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PREFACE

Dear colleagues,

In your hands is the Book of Abstracts of the 10th International Agricultural Symposium "AGROSYM 2019", which I hope you will find useful in your work. Almost 1000 contributions were received and around 900 accepted for oral or poster presentations. Symposium themes cover all branches of agriculture and are divided into six sections: 1) Plant production, 2) Plant protection and food safety, 3) Organic agriculture, 4) Environmental protection and natural resources management, 5) Animal husbandry, 6) Rural development and agro-economy, and 7) Forestry and agroforestry.

Technology and innovation have clearly been important in the development of agriculture, which is a prerequisite to achieve sustainable food security. Most of the important gains in agriculture have been achieved through selective breeding, domestication and the appropriate and timely delivery of water and other inputs (e.g. fertilizers). Technology has been particularly important for improving production in field crops. Today, it is obvious that conventional methods of agricultural production in addition to providing sufficient food and various other products (e.g. feed, fibre, fuel) have led to a number of negative environmental, social and economic impacts in rural areas. Agriculture, like any other user of natural resources, has many environmental impacts. Moreover, many agricultural practices carry high costs both to society and producers, and affect the long-term viability of agriculture. The negative impacts and externalities of agriculture raise serious questions about the long-term sustainability of high-input agriculture. One of the goals of the sustainable agriculture movement is to create farming systems that mitigate or eliminate environmental harms associated with industrial agriculture. Globally, consumers are sending clearer signals than ever before about what they want in their plates; higher quality as well as healthier, safer and testier agro-food products. Therefore, organic food is the fastest growing food sector.

AGROSYM 2019 should help, of course, to identify some measures by which we can decide on a course of action. Such evidence-based actions should foster transition towards sustainable, efficient, inclusive and smart agro-food systems. Furthermore, the results reported here will be also significant in the dissemination of knowledge to the wider audience about the importance of agriculture and food science, one of the most important strategic areas of many national research strategies. Finally, they should inform policies in agriculture, food, environment and rural development fields.

Full texts of the submitted communications will be available on the website (http://agrosym.ues.rs.ba). Each contribution included in the present Book of Abstracts was reviewed by referees.

Many thanks to all the authors, reviewers and colleagues for their help in editing the Book of Abstracts. Special thanks go to all co-organizers, organising partners and sponsors for their unselfish collaboration and comprehensive support.

East Sarajevo, 20th September 2019
Prof. dr Dusan Kovacevic
President of the Scientific Committee of AGROSYM 2019
Editor in Chief

CONTENT

KEYNOTE ABSTRACTS

THE IMPACT OF GENOME EDITING ON CROP IMPROVEMENT

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Abstract

Plant scientists are constantly striving to improve crop plants in ways that directly benefit consumers, farmers, and food processors. These efforts are guided by a need to address a set of fundamental problems, including a rapidly growing world population, a changing climate, an ongoing battle against pathogens and insects, worsening soils, the negative effects of agriculture on the environment, and the need for tastier and more nutritious foods. Researchers have used traditional plant breeding and transgenesis to address these issues, but both have significant disadvantages. Recently, genome editing has become reliable in plants, and this advance has the potential to dramatically speed research and crop improvement. Genome editing is a tool for making a specific genetic change at a targeted location in a genome. This technology, also called targeted mutagenesis, has been possible in bacteria, yeast, and mammalian systems for many years, but genome editing has only recently become efficient and widespread in plant research. The most wide-ranging breakthrough for genome editing in plant science came in 2013, when the highly versatile CRISPR/Cas9 genome-editing system was first applied to plants. This method involves the use of the Cas9 nuclease, which is targeted to a specific site in a genome by binding a guide RNA (gRNA). The gRNA has a specific 20 nt sequence within it that binds to complementary places in the genome. Once this binding occurs, Cas9 creates a double-stranded break at the binding site. While the normal DNA repair systems usually repair such breaks without fail, errors can occur, resulting in sequence insertions and deletions at the target site. Further modifications of the system allow for targeted insertions and deletions of various sizes, single base pair changes, allelic swaps, and even epigenetic changes. Here we will discuss the technology and how it can be used for plant improvement.

Key words: *Genome editing, crop plants.*

THE FAILURES OF GENETICALLY MODIFIED ORGANISMS (GMOS)

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Abstract

Genetically modified organisms (GMOs) have been contentious for more than three decades. Only 24 countries grow GMOs commercially. Four countries (USA, Canada, Brazil and Argentina) account for 85% of the global GMO hectares. Four crops (soy, corn, cotton and canola) account for 99% of GM hectares. Despite the veneer of social validity that regulators cast, the GMO sector has failed to gain a social licence. Where GM labelling is required, food manufacturers avoid GM ingredients. GMOs have failed to gain price parity with their non-GM counterparts, and they attract price penalties. Segregation of GMOs and non-GMOs has failed (with a tolerance of 0.9% GM contamination in so-called non-GM canola). GM has failed the coexistence test with a GMO growers contaminating neighbouring farms. GMOs are a biosecurity fail, with test plots of GM canola planted in the late 1990s still monitored two decades later for rogue canola plants. Most GMO crops are glyphosate dependent. Glyphosate is globally subject to massive litigation claims and awards, and is implicated in the causation of multiple cancers. Mechanisms for compensating farms contaminated by GMOs are lacking. The GMO industry has taken no responsibility for contaminations. GMOs are a threat to the organic sector and the maintenance of certification and price premiums. Most countries (88%) do not grow GMO crops. This paper considers the global experience of GMOs and the Australian experience as a microcosm of the global experience and as a case study.

Keywords: *Genetically engineered crops, GM canola, GM cotton, Marsh v Baxter, glyphosate.*

1. PLANT PRODUCTION

THE IRON, COPPER AND LEAD UPTAKE ABILITY OF PHRAGMITES AUSTRALIS SPECIES

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Abstract

The phytoremediation ability of the common reed (*Phragmites australis*) plant species was estimated using the bio-concentration factor (BCF). BCF can be defined as the plants' ability to uptake heavy metals from polluted sediments into the root tissues and was quantified as the ratio of metal concentrations in root tissues to sediments. Bioconcentration factor (BCF) provides information on the ability of a plant to absorb a metal from a substrate and accumulate it in its roots. BCFs of Fe, Cu and Pb elements in a treated soil by 100 and 200 mg/l of FeCl3, Pb (NO3) 2, CuSO4, were ≤ 1 (0.94 and 1.04 for iron, 0,19 and 0.57 for lead and 0.28 and 0.64 for copper, respectively) indicating a low accumulation (concentration) of these elements in the roots. These BCFs also remained lower than those obtained with the soil treated by ZnCl2 that were greater than 2 (2.54 and 2.88), indicating a very good accumulative capacity. At high concentration (500 mg / l), the all results obtained with the four elements studied (Zn, Cu, Fe and Pb) showed BCFs greater than 1 which were of the order of 3.93, 2.34, 1.24 and 1.21, respectively.

Keywords: *Phragmites australis, Common reed, Heavy metal, Bioconcentration, Phytoremediation.*

SECURING THE PRODUCTION OF DURUM WHEAT (TRITICUM DURUM DESF.) BY SUPPLEMENTARY IRRIGATION IN THE SEMI-ARID ZONE (SOUTH OF SETIF PROVINCE, ALGERIA): CASE OF THE BOUSSELEM VARIETY

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Abstract

The study was conducted on the experimental site of the SAGRODEV pilot farm in Sétif province during the 2012/2013 farming season. To quantify the beneficial effects of supplemental irrigation made at different phenological phases on the yield components of durum wheat (Triticum durum Desf.) Variety Boussalam the research was conducted under conditions of water restrictions. We did two field trials. The first treatment led to maximal evapotranspiration (ETM) during the entire vegetative cycle and the second led to rainwater (PL). In the first trial, 4 water-restricted treatments were conducted, where we simulated precipitation with water supplies in the form of supplementary irrigations to bring the soil back to its holding capacity at the beginning of each of 4 phenological phases of the development period corresponding to the phases (Germination-Tallage), (heading-heading) and (flowering-filling of the grain) according to the contributions (respectively 15mm, 30mm, 30mm, 20mm). The results show that supplementary irrigation significantly improves the number of plants / m2 (NP / m²), number of ears / m2 (NE / m²), thousand grain weight (PMG), grain yield (Rdtg) and stem height (HT), number of grains per ear (Ng / ear), grain yield (Rdtg) and straw yield (Rdtpai). These results show the productivity potential of the Boussalam variety, expressed under the supplementary irrigation which constitutes a factor of improvement of the yield.

Key words: *wheat, irrigation, case study, Algeria.*

MORPHOGENETIC REACTIONS OF *PIMPINELLA ANISUM* L. (MEDICINAL PLANT) UNDER IN VITRO CULTURE CONDITIONS

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Abstract

Pimpinella anisum (L.), is a medicinal umbellifera, condiment for its leaves and seeds. In Algeria, only a small population cultivates this plant in their gardens, otherwise, the seeds are coming from several countries (China, Egypt, Jordan) which are used in the daily recipes. Similarly, seed germination is asynchronous according to the germination tests carried out. Therefore, it is essential to study the behavior of this plant (seedlings, leafy fragments) under in vitro controlled experimental conditions. This technique could offer a juvenile plant material leading to the establishment of new plants. Morphological and morphogenetic reactions were recorded on the culture medium of Murashige and Skoog (1962) with different combination and different concentrations of growth regulators tested.

Key words: *Pimpinella anisum (L.); medicinal plant; seedling; germination; in vitro culture.*

ANALYSIS OF THE ADAPTATION OF WHEAT (*TRITICUM AESTIVUM* L.) TO DIFFERENT CLIMATIC ZONES

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Abstract

Our study aims to characterize some genotypes of common wheat (Triticum aestivum L.) by the use of molecular markers such as SSR (Simple Sequence Repeat) and STS (Sequence Tagged Site). All SSR and STS reactions were performed from the genomic DNA extracted from the genotypes. The polymorphism is revealed using markers, linked to traits of interest for soft wheat (dwarfism, resistance to brown and black rust). The results showed amplifications for the majority of genotypes concerning the genes Lr46, Lr34, Rht.

Key words: *Triticum aestivum L., Soft wheat, Molecular markers, Genes, Characterization, Amplifications.*

THE POTENTIAL APPLICATION OF *ARTEMISIA JUDAICA* L. (SSP.*SAHARIENSIS*) ESSENTIAL OILS AS ALTERNATIVE COSMETIC PRESERVATIVE

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Abstract

Artemisia judaica is called ‘‘Shih Sahrawi’’ or “Tiherdjeli” in traditional Algerian medicine. It is a perennial fragrant plant that grows widely in North African Desert Rivers beds and in south-western parts of the Middle East. It is commonly used by the local populations for the treatment of gastric disturbances, skin disorders, weak immune systems, for its cardiotonic, analgesic, antispasmodic and antimicrobial activity. In this study, we were interested in these of the essential oil from flowers of Algerian *Artemisia judaica* (AJEO) as natural cosmetic preservative using a challenge test. The essential oil was extracted by hydrodistillation and characterized GC/MS. Twenty-nine compounds which represented 93.2% of the total compositions of the oil were identified of which piperitone (71.1 %) was the dominant component. The antioxidant properties were estimated by two conventional methods, DPPH test and reducing power essay. The AJEO showed an antioxidant activity by an IC50 of 3.94 mg/ml (DPPH) and an EC50 of 0.125 mg/ml (reducing power). The antibacterial activity and the antibacterial efficacy of AJEO were evaluated against three contaminants of cosmetics and studied in a shampoo model during 28 days of incubation. All bacterial strains showed sensitivity against AJEO where the most sensitive was *S. aureus* (MIC of 0.68 mg/mL). AJEO revealed a decimal reduction equal or more than 1 which AJEO could inhibit the growth of bacteria in shampoo by challenge test during 28 days of incubation. In light of our results, we conclude that AJEO can be applied in cosmetics as antibacterial and antioxidant preservative.

Keywords: *Artemisia judaica (L.), Essential oils, Antioxidant, Antibacterial, Cosmetic preservative.*

ANATOMICAL AND HISTOCHEMICAL STUDYS ON YOUNG TWIGS OF *ARGANIA SPINOSA* (L.) SKEELS

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Abstract

Argania spinosa (L.) is the only species of the genus *Argania*. It is the most northerly representative of the Sapotaceae and is exclusively tropical. Argan is a forest species endemic to the Morocco-Algerian region. It is perfectly adapted to semi-arid and arid climates. Its socio-economic importance, beneficial contributions to soil fertility, and protective roles against erosion and desertification has made it a true phytoparadox. On the one hand, it is a multipurpose tree, all of whose components are usable and valuable sources of income and/or food. On the other hand, the commercial interests in this species at this time are focused primarily on its applications in the cosmetics industry and the production of argan oil. Despite the many uses of the argan tree mentioned above, little research has been conducted on its structure. For this reason, we investigated the anatomy and histochemistry of its cauline tissues in the present study to determine conservation measures for this species. The anatomical and histological study of the branch branches of the argan tree revealed that the structure has the characteristics typical of dicotyledonous woody plants. However, the argan tree has afunctional phellogen located in the outer cortical zone and pockets or secretory channels in the cortex and the pith. The histochemical study on the samples taken facilitated the observation that starch distribution differs with seasonal stage (development cycle) and tissues. This study also revealed significant parietal lignification of support tissues (woody rays, xylem and pericyclic fibers) and conduction tissues (xylem) and even the pith.

Key words: *Argania spinosa (L.), Twigs, Anatomy, Histochemistry.*

ANALYSIS OF THE AGRONOMIC PERFORMANCES OF SOME VARIETIES OF THE GENUS VICIA SP OF NORTH AFRICAN ORIGIN IN THE SEMI-ARID ZONE OF SETIF

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Abstract

In the semi-arid regions of Algeria, fallow is an important component of cereal / sheep production systems. The use of legumes, especially vetches, on these fallows should be able to improve the feeding of herds as part of sustainable development. This work is part of a Maghreb network of vetches improvement from Maghreb origins (Algeria, Morocco, Libya and Tunisia) during four years of study (2009/2010 - 2012/2013) at the level of the semi arid region of Setif. Indeed, multiannual tests for the evaluation and adaptation of different varieties of vetches is a very important step in plant breeding. This study deals with the agronomic performances of different varieties of vetches through the different phenological stages and the parameters of production in dry matter and in grains. The results obtained indicate a considerable variability between the different varieties tested and suggests possibilities of adaptation to the different production systems and climatic situations. Significant differences were found in dry matter and grain yields between different varieties of vetch, which is explained by the presence of a variety x year interaction. The Algerian varieties were more efficient in grain yield during the four years of study with averages of 14 qx / ha, while for the dry matter yield, the Moroccan variety in this case Yamama was the most significant with average yields of 18 qx / ha. Positive correlations between dry matter (r = 0.57) and seed (r = 0.76) yields with flowering show that late varieties are the most productive in forage and grain.

Key words: *Maghrebian network, vetch fodder, grain, semi arid, interannual variation.*

CAN USING NUMERICAL ANALYSIS OF IMAGE LEAF SENESCENCE HELP TO DURUM WHEAT SELECTION?

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Abstract

The high plateau of Algeria has a Mediterranean type climate and receives 250 to 500 mm rainfall, with about 70% occurring during the cold season from October to February. However, cereal crops suffer additional abiotic stresses such as winter-spring cold(due to altitude) and terminal heat (because of close proximity to the Saharan desert). The overall objective of this study was to investigate if leaf senescence can assist in breeding wheat for drought tolerance under such conditions. Specific objectives included (i) to investigate the relationship leaf senescence and grain yield under contrasting climatic conditions with special reference to drought (ii) . Senescence was also estimated by following the decrease in chlorophyll concentration, using a SPAD-502 portable chlorophyll meter which measures leaf transmittance at red (650 nm) and near infrared (940 nm) wavelengths. Measurements were done on the same leaf used for Numerical Image Analysis measurements, at five dates (148.4, 188.2, 271.0, 352.8 and 443.8°C from an thesis stage). Some durum wheat genotypes from ICARDA and CIMMYT are studied. Lower Grain Yield and higher senescence rates in season 1 compared to season 2 may be attributed to climatic conditions (rainfall and temperature). Sharp increase in temperature during grain filling stage in season 1 is likely to have accelerated senescence. Lower grain yield is probably the consequence of a lower grain setting caused by freezing at heading and drought and high temperatures around an thesis. Highly significant effects of genotype, season and genotype x season were found on leaf senescence.

Key Words: *Durum Wheat, Carbon Isotope Discrimination, Leaf Senescence, Algeria.*

TILLAGE OR NO TILLAGE: IMPACT ON FUNGAL ENDOPHYTES OF *Vicia sativa* L. UNDER A SEMI-ARID CLIMATE (ALGERIA)

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Abstract

The integration of legumes and no tillage practices, into cropping systems promotes the profitability and sustainability of agriculture and contributes to mitigating and adapting to climate change. This results in their effects to improve and rehabilitate the soil. The aim of this work is to see the diversity of fungal endophytes on the roots of *Vicia sativa* L. with a comparative effect of conventional tillage and no tillage. Sampling is carried out systematically in march 2018 at an I.T.G.G.C. experimental station in Setif region under a semi-arid climate. After extraction of the rhizospheric soil and the rhizoplan, superficial root sterilization has been performed to remove endophytes organisms, that remain in the rhizosphere. The fragments are seeded on PDA medium. The whole is incubated at room temperature. Preliminary results of microscopic identification revealed that endophyte taxa present in direct and conventional seeding included species of 13 genus. Direct seeding had a higher density of endophytes and the most dominant (with a frequency of 5 to 10%) are *Fusarium*, *Chaetomium* and *Cladosporium* species.

Keywords: *Fungal endophytes, no tillage, soil, legumes, Algeria.*

GENETIC STRUCTURE AND ORIGINS OF THE DATE PALM (*PHOENIX DACTYLIFERA* L.) IN ALGERIA

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Abstract

The domestication history of the date palm in the Middle East is now well-known, starting with fruit harvesting of wild types no later than the 6th millennium BC. The establishment of cultivation in southern Mesopotamia had occurred in the 5th millennium BC, and subsequently there had been spread of the technology of oasis agriculture around the Persian Gulf towards the end of the 4th Millennium BC. Compare to its Middle East history, there is almost no evidence of significantly ancient cultivation of the date palm in Sahara. Date palm (*Phoenix dactylifera* L.) is the mainstay of oasis agriculture in the Saharan region. It is cultivated in a large portion of the Mediterranean coastal area of the Sahara and in most isolated oases in the Algerian desert. Genetic diversity levels and population genetic structure were investigated through the genotyping of a collection of 481 date palm accessions ranging from Mauritania to Pakistan using a set of 18 simple sequence repeat (SSR). Our study on SSR nuclear genotyping has shown that there are distinct genetic pools in the western and eastern regions of the traditional cultivation belt of the date palm. The two primary gene pools (western and eastern) are most easily tracked, even in admixture contexts, by the maternally-inherited chloroplast genome. These genomes can be easily identified by genotyping of a dodeca nucleotide minisatellite locus situated in the *trnG-trnfM* intergenic spacer. The Occidental chlorotype is characterized by three repetitions of the 12 bp motif (type 3 chlorotype), while the Oriental chlorotype is of type 4. This polymorphism is the easiest access to the differentiation of the Occidental and Oriental chloroplast genomes, which is otherwise extensive. In Algeria, chloroplast diversity shows a very high proportion of the Eastern Chloroplast. The fraction is roughly 70% similar to Mauritania, much higher than neighboring countries Egypt, Tunisa and Morocco. However, not markednuclear admixture in Algeria between the western and eastern gene pools was observed. Algeria nuclear diversity was similar to the diversity found in the neighboring countries. Therefore, Algeria presents a striking diversity that remains largely un-explained.

Keywords: *Phoenix dactylifera, date palm, genetic diversity, chlorotype, microsatellite, chloroplast minisatellite.*

IS THERE A RELATION BETWEEN GERMINATION RATE AND SEED SIZE FOR CITRANGE TROYER?

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Abstract

Stocks (for graft) play a key role in the adaptation of fruit trees with soil conditions. The main goal of this research is the determination of the influence of seed size on the germination degree of a very used citrus stock called Citrange troyer (*Citrus sinensis* L. × *Poncirus trifoliata* Raf.). The seeds were harvested between 27 December 2012 and 23 January 2013, from trees of fourteen (14) years old located in Skikda (Algeria). They were treated with a fungicide before being sown. Besides, their dimensions were measured. The width of nucellar embryos varied between 2,03 and 2,81 mm, while their length was between 3,82 and 4,86 mm. For the zygotic embryos, their width fluctuated from 0,93 to 0,99 mm and their length from 1,25 to 1,73 mm. The germination rate did not exceed an average of 57,70 %. Moreover, the results showed no significant correlation between germination and seed size (*P* ranged from 0,176 to 0,868 and *P* was between 0,050 and 0,987). This result suggests that there are other factors having a direct impact on germination level. Therefore, it is recommended to carry out further studies to test the influence of potential factors.

Keywords: *seed morphology, citrus, Algeria, Citrange troyer.*

THE IMPACT OF SEED VOLUME ON GERMINATION LEVEL OF *CITRUS VOLKAMERIANA*

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Abstract

Citrus trees constitute an important fruit crop worldwide. The aim of this work is to study the relation between seed volume and germination degree of volkamer lemon (*Citrus volkameriana* Pasquale). In this context, we used local seeds of this stock, collected over six different dates (from 27/ 12/ 2012 until 05/ 02/ 2013). Calliper rule was used to measure the size of examined seeds. Then, these latter were sown in bags containing substrate consisting of a mixture of 1/3 of well decomposed manure, 1/3 of sand and 1/3 of fine soil. The zygotic embryos recorded a width of 0,62 – 0,82 mm, and a length of 1,11 – 1,31 mm. Besides, the results showed that the nucellar embryos had a length ranging from 3,09 to 4,13 mm and a width varying from 1,35 to 2,02 mm. Whereas, the germination percentages were between 84,61 and 100 %. On the other hand, the statistical analysis using SPSS (10th version) did not reveal any significant correlation between germination degree and seed size (*R*: -0,662 – 0,809 ; *P* : 0,051 – 0,483). This result suggests that there are factors, other than dimensions of embryos, which have a role in germination degree.

Keywords: *stock, nursery, seed performance, Citrus volkameriana*.

GENETIC DIVERSITY ANALYSIS BY THE MORPHOMETRIC TOOL OF SOME BARLEY (HORDUM VULGARE L.) ACCESSION COLLECTIONS FROM WESTERN ALGERIA

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Abstract

Landraces are still the backbone of agricultural systems in many developing countries, mainly in marginal environments and are characterized by high genetic heterogeneity, good adaptation to local environment conditions and by low productivity.Little is known about the diversity of barley in Algeria. An inventory has been conducted in western Algeria to collect local accessions of barley (Hordeum vulgare L.) for their morphological characterization. In this context, a collection of 34 traditional and new accessions of barley were investigated. Thirty agro-morphological traits were recorded based on Dill descriptors using 12 quantitative and 18 qualitative agro-morphological traits. The phenotypic diversity was determined by the Shannon-Weaver diversity index (H') at different levels (sample Totality, by type of barley and varietal name). The H' estimates showed a wide phenotypic variability for different traits with H' average of 0.74 and 0.53 from quantitative and qualitative characters, respectively. The results of the multiple correspondence analysis and hierarchical clustering showed a clear distinction between the different accessions. The results of this work revealed a great phenotypic diversity of barley accessions that only partially matcheds the names of varieties because of the existence of homonyms and synonyms in the names given by farmers. The information gathered from this study could be used in conventional breeding programs and in situ conservation of the diversity. This work is a continuity to the work done during the 2012-2013 as a companion for the study of some phenotypic traits of agronomic interest in the Wilaya (region) of Tlemcen and the analysis of the diversity of these varieties and the influence of the environment on their performance.

Keywords: *barley, Agro-morphological traits, Genetic diversity, Algeria.*

VIRTUAL CEREAL WATER IN ALGERIA: BLESSING OR CURSE?

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Abstract

This work attempts to understand and analyze the concept of virtual water, a newly introduced device used by developed countries to better refine the evolution of the water situation subject to these inter-country water transfers. However, the transfer of this invisible water hides underlying challenges of supporting and promoting the agricultural economies of exporting countries. The key argument put forward in this new concept of international trade is that of water productivity, particularly in cereal production. However, it is clearly still relatively lower in poor and less developed countries. The very ones that matter a lot and export very little. This is the Algerian case where cereal farming is basically rainfed. In this respect, the application of Ricardo's theory of comparative advantages, from which the concept of virtual water derives, is therefore an instrument of unilateral subjection. Because the virtual quantities of water imported with cereals do not really contribute to Algeria's water balance. This is only possible in the case of irrigated crops. It is therefore more sensible and advantageous to redouble efforts to increase yields and the current cereal area, by absorbing the enormous potential of fallow land and mastering the technical route. On the other hand, it is imperative to provide clear answers to this excessive consumption of cereals. In this way, the country hopes to free itself from massive wheat imports.

Keywords: *Virtual water, comparative advantage, productivity, cereals.*

GEOGRAPHICALLY DISTANT ORIGIN-VARIETY USE PERSPECTIVES

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Abstract

Barley, a versatile short-season crop, is among the most important feed-grains in Azerbaijan which widely used for stock feed, human food, malting, brewing and distilling. Barley grows best in cool ground-ideal temperatures hover right around freezing. In irrigated land barley yields 4-8 tons per ha and with rainfed it yields 1-4 tons per ha. Each year, ICARDA generates and introduces grouped "barley nurseries" purposefully to cooperated countries. ICARDA has the global mandate for barley, lentil and fababean and a regional mandate for chickpea, durum and bread wheat improvement within the Consultative Group of International Agricultural Research (CGIAR). ICARDA's crop improvement programs develop nurseries for a wide range of agricultural systems and distributes them worldwide upon request. All nurseries are developed, prepared and dispatched from the ICARDA's Headquarters in Lebanon, except winter barley and wheat from ICARDA, Turkey. ICARDA has collected different samples of cereals from all corners in the world and has developed a breeding nursery using those samples. Afterwards it distributes these breeds to all the cooperated countries. ICARDA hands over "barley nurseries" to Azerbaijan as well. Environmental adoptability of barley nurseries for Azerbaijan (Garabagh irrigation zone) were studied and more than 300 samples were evaluated and selected for low (LRA) and moderate rainfed (MRA) areas. As a result of test plots , 10 samples were selected. The plant height varied from 98 to 117 cm, productive tillers from 7 to 9 and 1000 kernel weight 49-53 gr, while at check (local barley variety Garabagh-7) these indicators changed in range of 115-120 cm, 6-7 productive tillers, and kernel weight 46-47 gr. Spike length changed in range of 6.5-11.0 cm, number of spikelet's 21-33, weight of spike 1.3-2.1 gr, number of seeds per spike 24-28, weight of seeds per spike 1.1-1.8 gr, while at check, these figures changed in range of 9.0-11.0 cm, 25-27, 1.3-1.5 gr, 23-25, and 1.1-1.3 gr, respectively. The high yield elements of barley samples are ultimately accompanied with the increase in the weight of 1000 kernel weight. These new samples are compatible to the environment in Garabagh zone of Azerbaijan because of their tolerance to climate, distinguishing characteristic for the region as well as their biotic and abiotic stress factors. The new samples are included in working collection

Keywords: *barley, samples, breeding, selection, productivity.*

EFFECT OF PRE-SOWING TREATMENT OF SEEDS WITH OZONE-AIR MIXTURE ON MAIZE PRODUCTIVITY

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Abstract

An important place in agro technology systems aimed for high yield obtain belongs to prepare of seeds for sowing. Depending on pre-sowing treatment of seeds with ozone-air mixture, yield structural elements of local maize varieties were studied. Field experiments were conducted in favorable conditions for cultivation of maize in Republic, on Zagataly (Regional Experimental Station) in two variants, the control variant seeds treated with Vitavax, and the experimental variant seeds treated with an ozone-air mixture at a regime of 5000 ppmxmin. It was revealed that in control variant, cob length varied within 22.0-28.0 cm, number of seed rows per cob 16.0-18.0, number of seeds per row 46.0-53.0, output of seeds from cob 78.0-84.0%, and in experimental variant these measurements were 21.9-27.8 cm, 16.0-18.0, 49.0-56.0 and 85.5-88.5%, respectively. 1000 kernel weight in control variant varied in range of 322-351 gr., productivity 49.8-53.8 c/ha, while in experimental variant they were 333-363 gr. and 56.2-59.4 c/ha, respectively. In control variant, cob length was longer, but due to the incomplete top, number of seeds per cob was not maximum possible, consequence of high temperature and lack of moisture accompanying the flowering and fertilization period. But in experimental variants cobs of the most studied varieties were almost fully completed, which could be explained by increased adaptability of plants due to stimulating effect of ozone on development from the early stages.

Keywords: *maize, pre-sowing treatment, ozone-air mixture.*

WHEAT PHYSIOLOGICAL TRAITS, GRAIN YIELD AND YIELD COMPONENTS UNDER DROUGHT STRESS

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Abstract

Wheat (*Triticum* L.) is one of the most important cereal crops in human nutrition. Two year (2013/14 and 2014/15) field experiments were carried out to study the effect of soil water deficit on physiological traits, grain yield and yield components of durum and bread wheat genotypes. Gas exchange parameters measured by using LI-COR 6400 XT Portable Photosynthesis System. Drought led to a decrease in the stomatal conductance, photosynthesis and transpiration rates. With the strengthening of drought intercellular CO_2 concentration increased, due to the decrease in mesophyll conductance. Mesophyll conductance played a dominant role in the regulation of photosynthesis rate. Positive correlation was found between the rate of photosynthesis and growth rate of genotypes. Genotypic differences was detected in the relative water content at the grian milky ripe stage. Drought led to reduction of Chl a, b and Car (x+c) contents. Leaf spesific mass was increased in response to water deficiency. Drought caused accelaration of dry matter translocation from leaves, stem and vegetative parts of spike into grains. Stem dry mass was reduced by 20-50% depending on the genotype from the stage of milk ripeness to wax ripeness. The smallest reduction was found in the tallest genotypes. Drought had a greater effect on grain yield and yield components of durum wheat than that bread wheat. Wheat traits- high potential productivity, high rate of photosynthesis, early crop growth rate till heading were related to drought tolerance of wheat. High number of spikes per unit area, biological yiled, harvest index are good criteria for wheat breeding in drought conditions.

Keywords: *Drought, Physiological traits, Photosynthesis, Wheat, Yield components.*

INFLUENCE OF AGROTECHNICAL MEASURES ON YIELD AND QUALITY OF GREEN ONION

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Abstract

Green onion has high nutritional values reflected in the high content of vitamin C and other bioactive substances, primarily essential oil with high antioxidant properties. This essential oil has a high phytochemical effect and is considered as one of powerful plant antibiotics. Due to its specific chemical composition, spring onion takes a special place in the diet of people, most specifically in the early spring when offer of fresh vegetables is limited. The aim of this research was to determine how production method, ie. adequately applied general and special agrotechnical measures influence the yield and the quality of green onion. The influence of various soil mulching materials (control variant, agro-textile, straw, combination of straw and agro-textile) and fertilizers (control plot without fertilization, NPK (N_{120},P_{100},K_{120}),NPK(N_{120},P_{100},K_{120}) + 30g phytofert 20:20:20/100m²/day, NPK (N_{120}, P_{100}, K_{120}) + 40g phytofert 4:10:40/100m²/day) were tested. The results indicated that the joint effects of mulch and fertilization were exerted through a positive effect on the yield of green onion. The use of agro-textile showed a statistically higher yield in plants fertilized with NPK + 40g phytofert (1,45 kg/m^2) compared to the control variant (1,06 kg/m^2). In addition, the use of straw contributed to statistically much higher yield in fertilized plants with NPK + 30g phytofert (1,53 kg/m^2) compared to the control variant (1,17 kg/m^2). Applied variants of mulch material had a positive influence on the content of vitamin C. The highest content of vitamin C was found in variants with straw mulching (13**,**41mg/100 g).The increased quantities of fertilizers did not positively affect the qualitative characteristics of green onion.

Keywords: *green onion, production method, yield, quality.*

THE IMPACT ON THE HYBRID AND THE WAY OF THE PLANTINGON THE VARIABILITY OF THE YIELD CORN SILAGE

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Abstract

Corn as one of the most important tiller culture has a substantial and almost irreplaceable role in the animal production. In addition to the use of corn in concentrated we traditionally have cultivate for the silage. Using corn silage provides quality meal for the ruminants, primarily milking cows. The goal of our research was to determined influence of hybrid (various FAO groups) and way of sowing (number of plantsha^{-1}) to the yield and variation of the yield corn silage in 2018. Sample was set in the mountain area of City Banja Luka (on Manjaca, 527 masl, N 44°39'57", E 17°00'24"). For this research, we used four Agrimax hybrid corn various FAO groups (Kalina - FAO 280, Zeros - FAO 360, Zona - FAO 420, Titos - FAO 580). Query variants of sowing (number of plants byha^{-1}) in this research were 73000, 78600 and 85200 plants byha^{-1}. All the variants of sowing on inerrably between the lines distance of 70 cm the depth of the sowing was 6-8 cm.The surface of every plot was 308 m^2. The yield of the silage was determined by weighing on the scale recalculated on yield by hectare. Weather conditions during vegetation were favorable,primarily growing and developing corn sub serve enough moisture.The highest average yield was 59,66t ha^{-1} and it was obtained by variants of sowing 78600 plants byha^{-1}. In this research, Hybrid Titos had the highest silage of 62,66 t ha^{-1} at the variant of sowing by 78600 plants onha^{-1}. Applying variants of sowing by 85200 plants byha^{-1}gave the smallest average yield of 50,33 t ha^{-1}.With the same variant of the sowing, Kalina gave the lowest yield of silage of 42,00 t ha^{-1}. The smallest variability yield had a hybrid Zeros, the average yield of this hybrid was 57,86 tha^{-1}. On the locality of conducted research, the best would be sowing of corn for production of silage use by 78600 plants byha^{-1}. Hybrid Titos - FAO 580gave the highest average yield by 60,52 t ha^{-1}. For the emergence of early autumn frosts and security to get to in the optimal phase forensile would be best for production of corn silage cultivate a hybrid Zeros FAO - 360, which were receive lower average yield for 2,66 t ha^{-1}in relation to hybrid Titos, but the production would be safer.

Keywords: *Corn, hybrid, plant number, yield, silage.*

VARIABILITY OF YIELD GREEN MASS AND HAY OF RED CLOVER

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Abstract

Over a two year period 2010 and 2011 vegetation season in three swath (the first and second year of life) on the plot Kosariste in Dobrnja on Manjaca, it has been studied by the variety of the yield, it has been studied by the variability of the green mass and a hay of the red clover. The experiment was set on 13rd of May 2010in four repetitions, and researches were carried out on four lines of red clover (DS-1, DS-2, DS-3 and DS-4) and four cultivars of red clover (Kolubara, Nike, Viola and Start). The goal of research was to determine the variability of the yield green mass andhay of red clover by swath and genotypes, and to determine the most productive swath and genotype for area of Manjaca. The highest averagegreen mass yield 39,46 t ha^{-1}andhay 8,87 t ha^{-1} were found in cultivar Kolubara, while the cultivarViolashowed the lowest average yield green mass of 29,38 t $ha^{-1}$and hay of 5,74 t ha^{-1}. The first swath of the first year gave the lowest yield 28,19 t ha^{-1} of green mass and 6,84 t ha^{-1} of hay. Yield of green mass and haystack in the first swath of the first year was satisfactory considering biology of this plant species that in the first year (if the sowing carried out in the spring time) gives low yield. Gaining relatively high yield in the first swath of the first year contributed to good security of the plant moisture. Red clover was the most productive in the second year, and the highest yield was obtained in the first swath, which was the case in this research in which the green mass yield in the first swath of the second year was 45,39 t ha^{-1} and of hay 8,65 t ha^{-1}. The greatest variable 40,49% was in the cultivar Start, for green mass yield, and smallest 11,48% in the cultivar Kolubara for yield of hay. If sowing of red clover is performed in spring period next to applying necessary agro technical measures achieving satisfactory yield is limited to the security of the plants moisture. The largest yield get in the first, swath second year, while the height of the yield in the second swath the second year frequently conditioned by weather conditions. The smallest yield of green mass and hay of red clover on Manjaca gave curltivars Viola and Start. Best results for the research parameters, they have been determined at the sort Kolubara. All four lines made high yields which was statistically significant no different in relation to the Kolubara and representative potential future of sorts a fit for cultivate in this area.

Keywords: *Red clover, yield, line, cultivar, Manjaca.*

ROYAL – A NEW VARIETY OF SPRING BARLEY

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Abstract

In addition to the winter wheat breeding in PI Agricultural institute of Republic of Srpska, Banja Luka, barley breeding (spring and winter) take a significant role and it is directed towards the creation of a new barley varieties that will have great genetic potential for stable yield and possibly a number of other good qualities, as well as higher tolerance toward biotic and abiotic factors. Result of long term experiment, during 2018 is confirmed by the recognition of one of the spring barley varieties, which, according to basic technological parameters, is classified in a group of beer barley, under the commercial name Royal. In the two-year trails under the Commission for recognition of Varieties of Republic of Serbia during 2017 and 2018, it was found that the variety previously named BL55-16 manifested different, uniformed and stable characteristics of a single variety and that, on average, for all sites and years of testing, it achieved the yield at the level of standard. But regarding technological characteristics, the variety previously named BL55-16 was better than standard. The newly recognized variety commercialy named Royal at the same time was the first recognized variety of spring beer barley in PI Agricultural institute of Republic of Srpska, Banja Luka. It is characterized by high genetic yield potential over 8.5 t ha^{-1}, high quality, primarily with protein content, greater extract content, slightly larger grain and a higher hectolitarian mass compared to the standard. During two year trails in all localities, variety Royal achieved average yield of 5780 kg ha^{-1} and variety NS Marko (standard) 5602 kg ha^{-1}. Among a number of localities, locality of Novi Sad was standing out as the most favourable environment for cultivation of this barley in 2017. In the most favourable environment variety Royal achieved a yield of 8974 kg ha^{-1} and variety NS Marko 8780 kg ha^{-1}. However, the highest average yield during both years of trails was achieved in the locality of Pancevo (7434 kg ha^{-1}).

Key words: *variety, barley, yield, quality.*

THE INFLUENCE OF AGRO-ECOLOGICAL CONDITIONS ON THE QUALITY OF FIELD PEA

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Abstract

Two forage pea varieties (Saša and NS Junior) and three grain varieties (NS Javor, Baccara and NS Dukat) of field pea were cultivated in 2016 and 2017. The research was conducted at the experimental field of the Agricultural Institute of Republic of Srpska in Banja Luka and in the experimental field of the Agricultural Faculty in East Sarajevo to determine the influence of agro-ecological conditions on the protein content, fat content and ash content of pea grains. The grain quality of the pea was significantly influenced by the locality, while the interaction of the variety/location and the year/location significantly influenced the ash content and the fat content and had a significant effect on the protein content of the pea grain. In the experiment conducted in Banja Luka, there was significantly higher content of protein (26.89%) , fat (2.468%) and ash (3.504%) in the pea grain, compared to the quality of the pea grain produced in East Sarajevo, where the content of protein was (24.88%), fats (2.312%) and ash (3.10%). The largest amount of protein and ash was found in the variety Saša, in the area of Banja Luka. These results can influence the improvement of breeding work at the Agricultural Institute of Republic of Srpska, stimulating the production of peas and increasing the area on which this crop will be grown. Special attention should be paid to hilly and mountainous areas where field peas can be important in providing sufficient quantities of plant proteins to feed domestic animals.

Keywords: *pea, locality, proteins, fats, ashes.*

INFLUENCE OF TEMPERATURE ON WHEAT SEED GERMINATION

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Abstract

In order to achieve high wheat yields, it is necessary to determine the optimal plant composition, which is achieved through the use of quality seeds. Seed quality is affected by germination, purity and absolute seed mass. Seed germination is a variable trait. Seed germination is determined by standard methods under optimal laboratory conditions. Seed germination by standard methods is not real germination, because under natural conditions and under the influence of external factors and hereditary and non-hereditary seed properties, germination is much smaller. Seed germination and development of wheat under natural conditions takes place at much lower temperatures and in the presence of pathogenic soil microorganisms. For this reason, laboratory tests were carried out to determine the germination of seeds of two wheat varieties. The experiments were set on soil taken from two localities (East Sarajevo and Bijeljina). In addition to the standard seed germination method, we also took a test at temperatures of 2°C, 8°C and 12°C, respectively, at temperatures that are characteristic for our winter wheat production areas, for the period from October to December. After 10 days of seed germination in the growth chambers, the temperature was increased to 25°C and seed germination was observed for the next 6 days. The Russian variety had a higher percentage of seed germination compared to the domestic variety. Wheat seed sown in the soil of the cultivar type (Bijeljina) had higher germination compared to the seed sown in the soil of the alluvial type (East Sarajevo). The lowest germination had the seeds germinated at 2°C for 10 days, and then at 25°C for 10 days, and the biggest germination had the seed germinated at 12°C for 10 days, and then at 25°C.

Keywords: *Wheat, variety, germination, locality, temperatures*.

RESPONSE OF SOME WHEAT GENOTYPES TO DROUGHT AT GERMINATION AND EARLY SEEDLING GROWTH

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Abstract

The aim of this study was to determine the most tolerant winter wheat varieties against osmotic stress at germination stage and early seedlings growth. The osmotic stress was simulated in controlled environmental conditions by adding different concentrations of mannitol solution to the growing media of five winter wheat variety. In all studied varieties the benchmark water potential in which they had germinated and had a good seedlings growth was of -0.3 MPa. Under the stronger stress, -0.6 MPa, all varieties showed reduction in all examined parameters. The variety Bosanka had the highest final germination and germination energy under mannitol. The parameters defining the development or percentage of strong seeds, coleoptile and root length, fresh and dry weight of root and coleoptile of a seed were more affected by water deficit stress than germination and germination energy. Biplot analysis showed that wheat cultivars grown under -0.6 MPa osmotic had higher values of root/coleoptile ratio in relation to control and -0.3 MPa treatment which was the most reliable for screening properties of the genotypes for drought resistance in seedling stage.

Key words*: Winter wheat (Triticum aestivum L.), tolerance, mannitol, biplot analysis.*

PHENOLOGICAL DEVELOPMENT OF WINTER BARLEY

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Abstract

Phenology of small cereals as a complex trait, which provides matching plant development with growing conditions, is important factor that influence plant adaptation to particular environment and finally yield. Scales of growth based on plant phenology and scales of development based on apical morphology are very precise, but relationships between them are not always clear. Some morphogenetic features of cereals growth can be predicted on the basis of leaf appearance. That means shoot apex development is coordinated with leaf appearance and total number of formed leaves. The objective of this research was to study relationships among apical development and plant phenology and the variability in phenological development of diverse winter barley cultivars under field conditions. The twelve barley cultivars differed in origin, pedigree and agronomic traits were used in this study over six growing seasons at the Novi Sad location (45°20'N, 15°51'E, altitude 86 m) and under rainfed conditions. Phyllochron approach was used as method to determination of beginning/finishing stages of development apex and the duration of the phases was converted to cumulated growing degree days (GDD). Spikelet initiation started at 2.5 Haun stage and finished at 7.1 Haun stage. Preanthesis phases (single ridge-SR, double ridge-DR, spikelet development-SD, heading-H, anthesis-A) and grain filling period (GFP) were under significant effect of genetic (G), environmental (E) and interaction factors (GxE). Of the total variation of DR phase 55.7% participated to GxY, 22.1% to E and 12.3% to G. Spikelet development were mainly under G and E control, 42% and 44%, respectively. Heritability was 0.57 and 0.95 for DR and SD, respectively. Across cultivars and environments from the total growing period 138 GDD belonged to sowing-first leaf period, 161 to SR, 326 to DR, 541 to SD, 254 to flag leaf-H, 142 to H-A and 732 to GF. Although the variability was found in the duration of the pre-anthesis phases and GF, especially in spikelet and flower development, among most of the phases a positive genotypic correlation was found.

Keywords: *Barley (Hordeum vulgare L.), spike development.*

INFLUENCE OF SUPERAPSORBENT „TVERDAYA VODA" ON MORPHOLOGICAL CHARACTERISTICS OF POTATO

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Abstract

In the experiments that were carried out in 2019 on two localities (East Sarajevo and Bijeljina), the influence of the application of superapsorbent "*Tverdaya Voda*" on the morphological properties of potatoes was examined. The control variant, superapsorbent "*Tverdaya Voda*", superapsorbent "*Tverdaya Voda*" enriched with growth stimulants, superapsorbent "*Tverdaya Voda*" enriched with microorganisms, superapsorbent "*Tverdaya Voda*" enriched with microelements and superapsorbent "*Tverdaya Voda*" enriched with growth stimulants, microorganisms and microelements in the amount of 20 kg ha^{-1}, were applied for this examinations. The morphological traits of potatoes that were monitored are: plant height (cm), number of offshoots, mass of plant (g) mass of leaves (g) mass of stalks (g), leaf area per plant (m^2). In comparison with the multiyear averages, the year 2019 is characterized by higher temperatures and higher precipitation. Temperatures were lower only in May at both localities, which significantly influenced the slower sprouting of potatoes in East Sarajevo. When we used superapsorbent "*Tverdaya Voda*" enriched with growth stimulators, microorganisms and microelements, plant height was 88 cm, number of trees was 6.38, plant weight was 896 grams, weight of leaves was 492.9 grams, weight of stem was 403.1 grams and assimilation surface 0.5529 m^2 per plant, while in variant without the use of superapsorbent "*Tverdaya Voda*" obtained results for plant height was 62.62 cm, number of trees was 3.38, weight of plant was 365.5 grams, weight of leaves was 215.3 grams, weight of stem was 150.2 grams and assimilation surface was 0.3401 m^2 per plant.

Keywords: *superapsorbent, potato, morphological properties, locality*.

THE INFLUENCE OF APSORBENT AND LAND ON GERMINATION AND GROWTH AND DEVELOPMENT OF PEA GRAINS

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Abstract

The pea germination process begins when the seeds absorb a certain amount of water relative to the seed mass. The lack of water in the germination phase inhibits the growth of plants and reduces the production of crops. The solution for the problem of moisture protection during vegetation, aims to create technologies for maximum savings and efficient water supply of plants. For influence testing of superapsorbent "*Tverdaya Voda*" on pea germination, we used control variant (A_0), superapsorbent "*Tverdaya Voda*" (A_1), superapsorbent "*Tverdaya Voda*" enriched with growth stimulator (A_2), superapsorbent "*Tverdaya Voda*" enriched with microorganisms (A_3), superapsorbent "*Tverdaya Voda*" enriched with microelements (A_4) and superapsorbent "*Tverdaya Voda*" enriched with growth stimulators, microorganisms and microelements (A_5), and land from two localities (East Sarajevo and Bijeljina). The experiment was made in the laboratory of the Faculty of Agriculture in East Sarajevo. The application of the apsorbent exposed a very significant influence on the characteristics of examined pea grain. For all examined characteristics, the best results had the use of superapsorbent " *Tverdaya Voda*" enriched with growth stimulators, microorganisms and microelements, control variant had the worst results. The application of this apsorbent had the best results at both localities for germination energy, germination, mass and length of the hypocotyls.

Keywords: *apsorbent, germination energy, germination, length and weight of the hypocotyl, length and mass of the root.*

YIELD OF SELECTED GENOTYPES OF SPRING PEAS (Pisum sativum L.) DEPENDING ON TOP DRESSING AND AGROECOLOGICAL CONDITIONS

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Abstract

In two years of research (2016-2017), five varieties of peas (NS Javor, Baccara, NS Dukat, NS Junior and Sasa) were examined at two localities: 1) locality in the territory of the city of East Sarajevo (experimental field of the Faculty of Agriculture in East Sarajevo), altitude of 550 m and 2) locality in the territory of the city of Banja Luka (experimental field of the Agricultural Institute of Republic of Srpska), altitude of 163 m. In order to determine optimal pea nutrition, three varieties of fertilizer were applied: control variant - without fertilizer use, basic fertilization with 350 kg ha^{-1} $N_8P_{24}K_{24}$ and basic fertilization with 350 kg ha^{-1} $N_8P_{24}K_{24}$ + top dressing 27 kg ha^{-1}N (KAN 27% N). The following yield components were determined: 1000 grains weight and the yield of pea grain. The average average 1000 grains weight was 194.4 g. The largest 1000 grains weight was found in the genotype NS Javor (232.09 g), and the smallest mass was found in the genotype NS Junior (139.57g). The average yield of pea grains, at the level of biennial experiments, was 4014.5 kg ha^{-1}. The grain yield was under significant influence of the genotype and varied within the limits of 2561.9kg ha^{-1} in the genotype NS Junior, which we consider to belong to a group of combined genotypes, while the highest yield was found in the protein pea genotype NS Javor (4666.5 kg ha^{-1}).

Key words: *peas, genotype, yield, 1000 grains weight, locality, fertilization.*

ASSESSMENT OF CLIMATE PLASTICITY AND QUALITY OF PLANT PROTEIN IN BULGARIAN SOYBEAN VARIETIES

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Abstract

Legumes are widespread around the world, providing more than 69% of the proteins, and 30% of the fats/oils needed for human diet. Grain legumes - pea, soybean and common bean are major sources of protein content ranging from 20% to 40% depending on genotype and environment. Important is the fact that legumes require minimal amounts of soil fertilizers because they possess the ability to absorb nitrogen through symbiotic interactions. This ability affirm them as the world's plant protein sources, providing sustainable agriculture. Climate specificity of Bulgaria could be described as a heavy continental, different from other parts of Europe. Scientific activities in research organizations are related to creating varieties adapted to the country-specific agro-climatic environment. The Bulgarian soybean varieties are created for the specific soil and climatic conditions of the country along with the developed agro-technologies. The promotion of Bulgarian soy varieties through the production of certified seed can be defined as a sustainable approach in Bulgarian agriculture as well as assessment of their nutritional value in the production of food and feed. The aim of the investigation, which encompasses soybean, is to affirm the utilization, production and importance of local varieties and to evaluate their value as a component of feed and food. Based on the collected results and data, the aim of the researchers is to convince farmers to increase the cultivation of Bulgarian soy varieties characterized with high plasticity to the climate specificity of Bulgaria.

Keywords: *Soybean, Bulgarian varieties, Climate plasticity, Nutritional value.*

ALLELOPATIC EFFECT OF SOME WEEDS ON SEED GERMINATION OF SORGHUM CROPS

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Abstract

Aim of this study was to evaluate the allelopathic effect of 5 invasive weeds (*Sorghum halepense* (L.) Pers., *Sonchus arvensis* L., *Cirsium arvense* (L.) Scop., *Xanthium strumarium* L., *Aristolochia clematitis* L.) in forage crops on two cultural *Sorghum* sp. (*Sorghum sudanense* (Piper) Stapf and *Sorghum vulgare* var. *technicum* (Körn.)). Ex-situ experiment was carried out as follows: 10 seeds of each test variety were put in Petri dishes between filter paper and the dried weed biomass extract was added at concentrations 0.1, 0.2, 0.4, 0.8, 1.6 and 3.2% w/v. Petri dishes were placed in a thermostat-operated device at a temperature of 22 ± 2°C for a seven-days period. Distilled water was used as a control. Number of germinated seeds, % of seed germination against the control, and weed inhibition rate (IR) were observed. Our study revealed that the alellopathic effect of the tested five invasive weeds on seed germination of *S. sudanense* and *S. vulgare* var. *technicum* varied according to the plant species (both weed and cultural) and the concentration applied. Most pronounced negative effect on the germination process of *S. sudanense* seeds have expressed the cold aqueous extracts from *Sonchus arvensis* L. and *Cirsium arvense* (L.) Scop. – IR varied from 4.67-5.0% up to 70.3% at the highest test concentrations ($p<0.05$). Maximal inhibition of seed germination of *S. vulgare* var. *technicum* in comparison with the control was found at 3.2% w/v extract of *Sorghum halepense* (L.) Pers. (IR=58.4%), followed by the two highest concentrations of *Xanthium strumarium* L. extract (IR=41.6-45.9%).

Keywords: *interaction, Sorghum sudanense, Sorghum vulgare var. technicum, Sorghum halepense, Sonchus arvensis, Cirsium arvense, Xanthium strumarium, Chenopodium album.*

ASSESMENT OF THE POSSIBILITIES FOR ALTERNATIVE WEED CONTROL IN SOYBEAN

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Abstract

The aim of the present study is to assess the possibilities for an alternative weed control in soybeans by using cover crops with proven allelopathic potential as oats and rye. The study was conducted in the period 2015-2017 on the Experimental Field of the Soybean Experimental Station in Pavlikeni (Bulgaria). Weed communities in the studied soybean agrophytocenosis ranged between 5 to 8 species and practically does not change under the influence of meteorological factors. Weeding was of a mixed type with a prevalence of one-year late spring weeds (58% - 92%), which were also identified as dominant weed species. The values of the diversity indices and distribution uniformity of the weed species are negligibly influenced by the dynamics of the weather conditions. It was found that under the specific conditions of the experiment, the survival capacity of the soybean plants to the technical maturation phase was in the range of 0.76 to 0.96. The ability to self-restore of soybean was relatively good (from 1.16 to 5.09) and a slight increase in the soybean population (from 0.15 to 1.63) was observed. The use of oats as an allelopathic active cover crop in soybean reduces the weed infestation rate from 33.6% to 67%, as well as the amount of fresh and dry biomass accumulated in the late spring weed group by 12% to 68%. The capping ability is the result of limiting the density of some annual weeds (*Amaranthus* spp., *Abutilion theophrasti* Medik., *Chenopodium album* L.), although compensatory processes in the population density of other weed species. The use of rye as an allelopathic active cover crop in soybean reduces the weed infestation from 49% to 63% with the increasing of the rye sowing rate when compared to the control ($p<0.05$).

Keywords: *Glycine max, Secale cereale, Avena sativa, Sorghum halepense, Amaranthus retroflexus L., Chenopodium album L., Setaria spp.*

UPTAKE OF PHOSPHORUS AND POTASSIUM IN SORGHUM PLANTS IN DEPENDENCE ON NUTRITIONAL LEVEL

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Abstract

A pot experiment was carried out to determine the uptake and distribution of phosphorus and potassium in sorghum plants depending on the level of mineral nutrition. The plants were grown on eight levels of nutrition – $N_0P_0K_0$, $N_0P_{200}K_{200}$, $N_{600}P_0K_0$, $N_{200}P_{200}K_{200}$, $N_{400}P_{200}K_{200}$, $N_{600}P_{200}K_{200}$, $N_{800}P_{200}K_{200}$, $N_{600}P_{400}K_{400}$. The different levels of nutrients were created by applying of NH_4NO_3, $Ca(H_2PO_4)_2$ and KCl dissolved in water. It was established that sorghum grown at N_{600} level in combination with elevated levels of phosphorus and potassium $P_{400}K_{400}$ had the highest concentration of phosphorus and potassium. Self-nitrogen fertilization $N_{600}P_0K_0$ lowered the concentration of the two elements in the grain to values close to the unfertilized control. The highest content of phosphorus 1.09 $g.pot^{-1}$ was obtained at $N_{600}P_{200}K_{200}$ level, which exceeded the control by 146.7%. Sorghum plants removed the most potassium in maturity at $N_{600}P_{200}K_{200}$ and $N_{600}P_{400}K_{400}$ levels. Self-nitrogen fertilization $N_{600}P_0K_0$ reduced the total phosphorus and potassium uptake of the above-ground parts compared to triple combinations $N_{600}P_{200}K_{200}$ and $N_{600}P_{400}K_{400}$. The phosphorus and potassium harvest indexes were higher in the control plants, at the lower levels of mineral nutrition ($N_{200}P_{200}K_{200}$ and $N_{400}P_{200}K_{200}$) and at the N_{600} level combined with higher $P_{400}K_{400}$ fertilization. Sorghum gown at $N_{600}P_0K_0$ had been shown to reduce the proportion of phosphorus and potassium absorbed in the sorghum grain. Compared to the control, the decrease was by 4.8% for phosphorus harvest index and by 10.0% for potassium harvest index. Sorghum plants grown at the higher $N_{800}P_{200}K_{200}$ level were characterized with the lowest phosphorous (65.2%) and potassium (17.0%) harvest index.

Keywords: *Phosphorus, Potassium, Uptake, Sorghum.*

TROPHIC STRUCTURE OF THE NEMATODE COMMUNITY IN MONOCULTURES OF CARROTS (*DAUCUS CAROTA SUBSP. SATIVUS*)

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Abstract

The carrot (*Daucus carota* L.) has been used as food since ancient times. Despite of the nutritional importance of carrots, their production in small farms is stagnant or declining. The main reason is the monoculture of the carrots, where the risk of attack and damage from pests is high. The carrots change their shape and appearance under the influence of a number of biotic stress factors such as bacteria, fungi and plant-parasitic nematodes which affect their quality. Plant-parasitic nematodes are long known to cause significant damage to carrots. The results of the present work have been obtained on the basis of conducted field and laboratory studies, as for the research were used agricultural areas in the region of Targovishte. The aim of the present work was to assess the phytosanitary status of the areas in the monocultures of carrots on the basis of the trophic structure of the nematode communities. A total of 11 genera of plant parasitic nematodes were found in the analyzed samples. The genus *Pratylenchus* was found in 92% of the samples tested. The genus *Meloidogyne* was found in 53% of the samples. In addition to plant parasitic nematodes, entomopathogenic nematodes of the genus *Steinernema*, omnivorous nematodes of the genus *Dorylaimus* and bacterial-feeding nematodes of the genus *Cephalobus* were also found. The knowledge of the trophic structure of nematode communities in monoculture is a key to deciding on a crop rotation that will effectively reduce plant-parasitic populations.

Key words: *carrots, nematodes, monoculture.*

THE ANNUAL ALFALFA MEDICAGO TRUNCATULA SPECIES BENEFITS UNDERSTANDING BIOLOGY OF CROP LEGUMES

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Abstract

M. truncatula lines with altered expression of a gene encoding transcription factor CCHC-Zn were analyzed in frame of the project "Transcriptional and metabolite analysis of genes involved in seed maturation and nodulation in legumes" funded by the National Science Fund. The primary function of these genes is related to regulation of transcription due to the fact that they have specific binding sites for nucleic acid /RNA or DNA/ or proteins. According to recent studies, the relationship between thefunction of this type of proteins and plant development especially the reproductive organs– flowers and seeds, has been demonstrated. *M. truncatula* lines with silences expression of the gene CCHC-Zn developed by RNAi technology show a clear phenotype associated with a drastic reduction of seed size. The project also includes elite varieties and lines of soybean, G. max developed in the Soybean experimental station, the town of Pavlikeni, Agricultural Academy. Nine cultivars and two lines with different degrees of maturity and seed size were grown under filed conditions. The relationship between the function of orthologous genes to *M. truncatula* CCHC-Zn gene and plant growth and seed size in soybean cultivars were studied. Additionally candidate genes interacting with transcription factors CCHC-Zn are object of our interest. The comparison between the profiles of amino and fatty acids of the RNAi *M. truncatula* lines and soybean cultivars was made.

Keywords: *annual alfalfa, crop legumes, transcription factors, seeds size.*

UPTAKE AND EXPENSE OF NITROGEN, PHOSPHORUS AND POTASSIUM IN GRAIN SORGHUM DEPENDS ON NITROGEN FERTILIZATION

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Abstract

The uptake and expense of nitrogen, phosphorus and potassium in grain sorghum was studied in a field experiment during the period 2017-2018. Hybrid EC Alize was grown under non-irrigated conditions. The applied nitrogen fertilization was in rates 0, 60, 120, 180, 240 and 300 kg N.ha^{-1}. It was established that application of N_{240} and N_{300} let to high average uptake of nitrogen (212.0 kg N.ha^{-1}) and phosphorus (125.2 kg P_2O_5.ha^{-1}) in maturity. The higher removal of 159.9 kg K_2O.ha^{-1} on average was observed at N_{180} rate. The expense of nitrogen for production of 1 t of grain increased in parallel with the nitrogen fertilization. The highest nitrogen expense of 39.7 - 45.3 kg N.t^{-1} grain was established when sorghum received 300 kg N.ha^{-1} and it exceeded the control by 38.8 in 2017 and by 53.6% in 2018. Sorghum plants used 15.5 - 16.6 kg P_2O_5 an average to form 1 t of grain and nitrogen fertilization in rates N_{60}-N_{300} slightly affected the phosphorus expense. Nitrogen fertilization proven increased the expense of potassium for production of 1 t of grain compared to N_0 control plants. The increase was by 8.3 - 20.0% in 2017 and by 8.0 - 34.0% in 2018. Sorghum plants expensed 23.2 - 24.2 kg K_2O on average to form 1 t of grain at nitrogen rates N_{180}-N_{300}. The strong positive correlation was established between nitrogen fertilization with N uptake (0.966**) and N expense (0.997**) and K uptake (0.820*) and K expense (0.870*).

Keywords: *Uptake, Expense, Nutrients, Grain sorghum.*

INFLUENCE OF INTERCROPPING MAIZE WITH CLIMBING BEAN ON FORAGE YIELD AND QUALITY

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Abstract

Maize forage is poor in protein content which shows its low quality and nutritive value. Regarding to high feed costs of protein supplementations, legumes can be used in livestock nutrition for their high protein content and, thus, providing cost savings. Since legumes have low dry matter yield, acceptable forage yield and quality can obtained from intercropping cereals and legumes compared with their sole crops. In this study, maize (*Zea mays* L.) and climbing bean (*Phaseolus vulgaris* L.) were intercropped in different sowing densities and their monocropping equivalents were tested to determine the best intercropping system on forage yield and quality. Maize was cultivated alone (75 000 plants ha^{-1}) and intercropped with bean as follows: 75 000 plants ha^{-1} of maize and 37 500 plants ha^{-1} of bean (MB_1), 75 000 plants ha^{-1} of maize and 50 000 plants ha^{-1} of bean (MB_2) and 75 000 plants ha^{-1} of maize and 75 000 plants ha^{-1} of bean (MB_3), in rows alternating with maize. The highest dry matter yield was produced by MB_3 (20.9 t ha^{-1}), and the lowest by maize (16.9 t ha^{-1}). All intercropped systems had higher crude protein contents, MB_1 (92 g kg^{-1} DM), MB_2 (99 g kg^{-1} DM) and MB_3 (110 g kg^{-1} DM), than the maize (77 g kg^{-1} DM). Intercropping of maize with bean reduced neutral and acid detergent fiber, resulting in increased forage digestibility. Therefore, maize intercropping with bean could substantially increase forage quantity and quality, and decrease requirements for protein supplements as compared with maize.

Keywords: *Intercropping, Maize, Climbing Bean, Yield, Quality.*

INFLUENCE OF INTERCROPPING MAIZE WITH COWPEA AND FERTILIZATION WITH CLINOPTILOLITE ON FORAGE YIELD AND QUALITY

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Abstract

Maize forage is poor in protein content which leads to low quality and nutritive value. Regarding the high feed costs of protein supplementations, legumes can be used in livestock nutrition for their high protein content, and thus, provide cost savings. In this study, maize (*Zea mays* L.) and cowpea (*Vigna unguiculata* L.) were intercropped in different sowing densities and fertilization with naturale zeolite clinoptilolite and their monocropping equivalents were tested to determine the best intercropping system on forage yield and quality. Maize was cultivated alone (75 000 plants ha^{-1}) and intercropped with cowpea as follows: 75 000 plants ha^{-1} of maize and 37 500 plants ha^{-1} of cowpea (MC_1), 75 000 plants ha^{-1} of maize and 50 000 plants ha^{-1} of cowpea (MC_2) and 75 000 plants ha^{-1} of maize and 75 000 plants ha^{-1} of cowpea (MC_3), in rows alternating with maize. The highest dry matter yield was produced by MC_3 (23.2 t ha^{-1}), and the lowest by maize monocrop (20.3 t ha^{-1}) in fertilization with clinoptilolite. All intercropped systems had higher crude protein contents, MC_1 (99 g kg^{-1} DM), MC_2 (106 g kg^{-1} DM) and MC_3 (114 g kg^{-1} DM), than the maize monocrop (82 g kg^{-1} DM) in fertilization with clinoptilolite. Intercropping of maize with cowpea and fertilization with clinoptilolite reduced neutral detergent fiber, resulting in increased forage digestibility. Therefore, maize intercropping with cowpea and fertilization with clinoptilolite could substantially increase forage quantity and quality, and decrease requirements for protein supplements as compared with maize monocrop.

Keywords: *Intercropping, Natural Zeolite Clinoptilolite, Maize, Cowpea, Yield, Quality.*

BAKING POTENTIAL OF TRITORDEUM IN WHEAT COMPOSITE FLOUR

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Abstract

The tritordeum as a wheat and wild Chilean barley cross represents one of human extension of the prime cereals portfolio, which has a potential to be used in baking industry in near future. Tritordeum flour was collected from six genotype lines in a three-crop year period, and commercial wheat flour (WF) was used as a base for bi-composite flour preparation (50:50 w/w). With respect to WF control, all tested tritordeum lines had comparable ash content, but about 39% higher protein content in average with significantly lower technological quality (Zeleny test 22-33 ml versus 45 ml for WF). Properties of non-fermented and fermented dough from pure tritordeum flours and their wheat composites (50:50) were tested by rheological tests employing amylograph and alveograph. Simulation of fermentation process on fermentograph, maturograph and oven rise recorder (OTG) demonstrated insignificantly both prolonged technological times, and elevated dough volumes. Laboratory baking trial as a direct proof of bread consumer's quality was also performed; for wheat-tritordeum composite bread, results revealed out significant approx. 15% increase in bun volumes. On the other hand, harvest year did not statistically influenced the final product quality (specific volumes 345-378 ml/100 g versus 301 ml/100 g). Gained data were explored in terms of tritordeum line and harvest year by multivariate method PCA – higher importance of the latter factor was confirmed. Summarising it can besaid that the alternative cereal could be considered for practical usage in food industry.

Keywords: *tritordeum, protein quality, wheat composite flour, rheological behaviour, leavened bread.*

USAGE OF MODIFIED CYTOKININS AS POTENT AGROCHEMICALS

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Abstract

Cytokinins (CK) as group of naturally occuring plant hormones are N^6 substituted derivatives of purine base adenine, responsible for many events in plant growth and development such as cell division, initiation of shoots, apical dominance and leaf senescence.[1,2] They are according to the substitution in the position N^6 of adenine scaffold divided into two main groups: isoprenoid (N^6- (Δ^2 – isopentenyl)adenine (2-iP), N^6- (Δ^3 – isopentenyl)adenine (3-iP), dihydrozeatin (DHZ), *cis*-zeatin (cZ), *trans*-zeatin (tZ)) and aromatic (kinetin (K), benzylaminopurine (BAP) and hydroxylated derivatives topolins (*o*T, *m*T, *p*T)).[3] For their positive effects on branching, delaying of senescence, nutrient remobilisation, flower and seed set control they became interesting substances in search for potential agrochemicals. From the 1970' of the last century exogenous application of cytokinins have been tested in field conditions to improve yield traits of world-wide important crops such as wheat, rice, maize, barley, and soybean. Despite the extensive testing, so far cytokinins haven't found their stable place among commercialized plant growth regulators, mainly due to the complexity of their effects. Here we report a brief overview of our results covering synthesis, pot and field experiments using cytokinin exogenous treatment applications in various field crops, vegetables, cotton and fruit trees. We present here a novel very potent derivative of N^6-benzyladenine, *2-chloro-6-(3-methoxybenzylamino)purine* (AUCYT START® CHEMAP AGRO Ltd.), which was applied in spring barley and winter wheat before, or at tillering stage. The effect on yield forming traits such as number of tillers, grains per ear, number of ears and the final yield was evaluated and compared after spraying of the both crops in different phenological stages.[4] Main effect was observed on increase of productive tillers and following increase of grain yield.

Key words: *cytokinins, plant hormones, benzylaminopurine derivatives, field experiments.*

THE MYCORRHIZAL EFFECT ON YOUNG PLANT PRODUCTION IN SELECTED VEGETABLE SPECIES

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Abstract

The study was conducted with the aim to evaluate the mycorrhizal effect on the morphology of the selected vegetable species (eggplant, hokkaido squash, chrysanthemum, iceberg lettuce and zucchini) and also to evaluate the mycorrhizal effect on the internal physiology of the selected vegetable species. The study was conducted in a greenhouse conditions at the Faculty of Horticulture, Mendel University in Brno, Czech Republic. Seeds were sown in trays with inoculated growing substrate. The experiment used the arbuscular mycorrhizal fungi inoculum and the non-inoculated control treatment. Morphological and internal physiological parameters of the vegetables were analysed. It was established for eggplant, iceberg lettuce, hokkaido squash, and chrysanthemum that the higher the level of inoculum applied, the higher the percentage of inoculation. The highest level of mycorrhiza inoculation (5%) of chrysanthemum recorded the highest stem diameter. The highest leaf area value was recorded on 3% inoculation of zucchini. Based on plant height, it was observed that there was no significant difference between the different levels of inoculum for chrysanthemum, eggplant and hokkaido crop. The trend 5%>3%>0% based on the recorded mean values was recorded on iceberg lettuce. 5% inoculation of chrysanthemum recorded the highest value based on leaf area. The highest chlorophyll content based on the mean values was recorded on 5% inoculation of zucchini whilst the least mean value was recorded on 3% inoculation of iceberg lettuce. It is concluded that the number of leaves as well as the leaf area affects chlorophyll content.

Keywords: *Glomus, Funneliformis, Solanum melongena, Lactuca sativa, Glebionis coronaria, Cucurbita pepo.*

STUDIES ON THE GENE ACTION OF WHEAT CROP UNDER DIFFERENT ENVIRONMENTAL CONDITIONS

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Abstract

This study was conducted at El-Gemmeiza Research Station, El-Gharbia Governorate, Egypt during the two successive growing seasons 2015/2016 and 2016/2017. The eight common wheat cultivars, *Triticum aestivum* L., Giza 171, Sids 1, Sids 13, Shandweel 1, Misr 1, Sakha 61, Sakha 94 and Gemmeiza 12 were crossed in a half diallel crosses to estimates heterosis and combining ability associated with grain yield and its component under the three sowing dates of 30th October (1st sowing date), 15th November (2nd sowing date, 1st December (3rd sowing date) and their combined analysis to determine the best parents and crosses with high grain yield. Also, the aim was to determine the best method of selection used in the segregation generation. The results indicated that mean squares due to sowing dates were highly significant for all traits studied indicating as expected that the differences between the three sowing dates were markedly differed. Mean squares due to genotypes, parents, crosses, parent vs. crosses and interactions between parents and crosses with sowing dates were found to be highly significant for all yields and some of its components traits at the three sowing dates as well as their combined analysis.Values of (D) were significantly smaller in magnitude than the respective (H_1) in all traits revealing that dominance type of gene action was the most prevalent genetic type. Comparing between the magnitude of additive and dominance components revealed that the dominance component was more important than additive components for all traits in the three sowing dates and combined analysis. This finding could be interestingfor breeders to use the hybrid vigor in F1 to introduce hybrids with highly gain yield. The broad sense heritability values were very high in all studied traits compared to narrow sense heritability and this may be due to the fact that the dominance variance had the large part in the total genetic variance. Therefore the bulk method of selection for these traits might be quite promising.

Key words: *genes, wheat, environment.*

RESPONSE OF MAIZE (*ZEA MAYS* L.) TO NITROGEN FERTILIZATION WITH AN FOLIAR SPRAY WITH UREA AND ZINC

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Abstract

This study was conducted over two growing seasons 2016 and 2017 at the Agricultural and Experiments Research Station at Giza, Faculty of Agriculture, Cairo University, Egypt to study the effect of soil application of nitrogen and foliar spray of urea and zinc sulphate on grain yield and its components of maize (*Zea mays* L..). The experimental design was randomized complete block having split plot arrangement with four replications. The main plots assigned for soil application of nitrogen levels and the sub plots consisted of urea and zinc spray. Both soil application of nitrogen fertilizer and foliar spray of urea and zinc significantly increased all studied characters (plant height, ear length and diameter, number of rows/ear, number of grain/ear, grain weight/ear, shilling percentage, 100-grain weight, grain yield and harvest index, except ear diameter and number of grains/ear) under foliar application, in both seasons. The highest values for the previous traits were either at 120 kg N/fed or spraying urea in both seasons. The interaction between the two studied factors had significant effect on ear diameter in the first season, grain weight/ear and grain yield in both seasons. The highest grain yield (3.8 and 3.9 t/fed was observed at 120 kg N/fed combined with urea, while the lowest yield (2.9 and 2.5t/fed) was recorded at 80 kg N/fed without spraying either urea or zinc in both seasons, respectively. It could be concluded that application of 120 kg N/fed and spraying of urea could produced the highest grain yield under the experimental site and the same conditions.

Key words: *corn, N levels as soil application, urea and Zn spray***.**

IN-DEPTH BRAIN PHOSPHOPROTEOME STUDY REVEALS NEUROBIOLOGICAL UNDERPINNINGS FOR FORAGER HONEYBEE WORKERS (*APIS MELLIFERA LIGUSTICA*)

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Abstract

The forager bees perform the foraging tasks outside the hive in order to enhance the honeybee coloney survival. There is a lack of knowledge about how the neurobiological activities via protein phosphorylation in the brains of forager honeybee workers align with their tasks performances. The phosphoproteome in the brains of forager honeybee workers was characterized using Ti^{4+}-IMAC phosphopeptide enrichment, shotgun proteome, label-free quantitation, and bioinformatics. The identified 916 phosphoproteins in the nurse bee brain were involved in a wide spectrum of biological functions, metabolic pathways and kinase activities, indicating their pivotal roles to drive the brain maintenance, the neurobiological activities, learning, memory, and the cognition of the forager bee brain during navigation autside the hive. The more strongly represented phosphoproteins in the forager brains were strongly involved in the biological pathways of phosphatidylinositol signaling system, inositol phosphate metabolism, phototransduction, glycerophospholipid metabolism, and Wnt signaling. The most enriched kinases in the nurse bee brain were CDK2_CDK3, p38, JNK, ACTR2_ACTR2B_TGFbR2, CK2, CLK, PKC, and PKA, suggesting their vital roles in brain maintenance, signal transduction, and the olfactory learning processes to enhance the foraging activities performance. This study is the first in-depth and comprehensive phosphoproteome report on forager honeybee worker brains and provides novel insights into the molecular details of phosphoproteins that employ protein function to the needs of forager honeybee workers. These data provide basis information for future research to better understand the neurobiological roles of targeted proteins in the forager bee brain.

Key Words: *Brain, Forager bees, Honeybee, Phosphoproteome.*

RELATIONSHIP BETWEEN PHOSPHORUS STATUS AND NITROGEN FIXATION BY COMMON BEANS (PHASEOLUS VULGARIS L.) UNDER DRIP IRRIGATION

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Abstract

The current study aims to examine the response of contrasted recombinant inbred lines of common bean to the application of phosphorus and to identify the bean recombinant inbred lines which were efficient in phosphorus utilization when dependent on nitrogen fixation as a source of nitrogen. The experiment was conducted at the experimental farm of Agricultural Research Station of the Nubaria district, Behera, Egypt, during the winter seasons of 2008–2009. Three levels of mineral phosphorus fertilizers were applied (0, 45 and 90 kg ha-1 phosphorus pentoxide). Nodulation, plant growth parameters, leaf area, soil Olsen phosphorus, pH, and phosphorus and nitrogen of shoots, nodules and seeds were measured. The results have shown that the recombinant inbred lines responded positively to P application levels. The best values were observed in recombinant inbred lines 75, 83 and 34. Vegetative growth parameters were significantly enhanced by increasing levels of phosphorus. The highest level of phosphorus, i.e., 90 kg ha-1 phosphorus pentoxide gave the optimal values of growth parameters for all common bean recombinant inbred lines while control plants obtained the lowest values. An increase of Olsen-P and a decrease of soil pH were also observed with increases in phosphorus. These results led to the conclusions that phosphorus applied to Nubaria soil: (1) improved the soil fertility; (2) enhanced the ability of root nodules of common bean recombinant inbred lines to fix atmospheric nitrogen; and (3) increased the release of hydrogen by roots, thus decreasing soil pH and reducing the immobilization of phosphorus in the soil solution and transforming it into available form for the plant.

Keywords *Drip irrigation, Nitrogen fixation, Phosphorus, Phaseolus vulgaris, Recombinant inbred lines, Sandy soil.*

MITIGATION OF SALINITY STRESS USING MAGNETICALLY TREATED WATER AND K-HUMATE ON SUNFLOWER PRODUCTIVITY

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Abstract

Salinity is considered the major environmental factor that prevents crops from realizing their full yield potential. Various efforts, from time to time, have been made to improve seed germination, plant growth and yield production under saline condition using multidimensional approaches. Use of magnetic technology in agriculture is considered one of non-conventional technology, economic, safe healthy, environmentally and promising to improve soil and water properties, which is reflected for improving crop and water productivity. A field trial using sunflower (*Helianthus annuus* L.; Var., Sakha-53) was conducted at Agricultural Experimental Station of Desert Research Centre, Ras Sidr province, South Sinai Governorate, Egypt during late summer season of 2017 to explore the role of combination of magnetically treated brackish-water and foliar application of microbial or commercial potassium-humates for alleviation water/soil salinity stresses on productivity of sunflower under gated pipe irrigation system. Results showed that irrigation sunflower plots with magnetically treated brackish-water and foliar application of microbial or commercial potassium-humates treatments surpassed significantly irrigation with brackish-water in all tested parameters. The percent of improvement reached to 9.67, 62.74 and 78.56% in seed oil, seed and oil yield (Kg fed^{-1}; fed=4200m^2), respectively regarding irrigation with magnetic-brackish water and foliar application with K-humate compared to control treatment. Improving sunflower productivity due to application of magnetic water-technology may be open door for modified field crops mapping under this region.

Keywords*:* *Sunflower yield, magnetic water, salinity stress, k-humate.*

PERFORMANCE OF SOME HERBICIDES ON WHEAT AND ASSOCIATED WEEDS

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Abstract

The effect of some weed control treatments (osprey, suffix, brominal, tribunil, arelon and untreated control) on the productivity of wheat and associated weeds were examined under the clay loam in texture at the Agricultural and Experiments Station at Giza, Faculty of Agriculture, Cairo University, Egypt during 2016/2017 seasons. The obtained results indicated that dry weight of broad-leaved and grasses weeds significantly was lower as well as grain and straw yields of wheat was significantly higher with application of herbicides compared to untreated control, where aerlon followed by osprey surpassed all herbicides in these respect in both seasons. Herbicides significantly increased weed control efficiency and then increased number of tillers and spikes/m^2, plant height, grain yield and straw yield of wheat. Therefore, we can concluded that either arelon or osprey herbicide may be successfully for controlling weeds and increasing wheat grain and straw yields under the experimental site and the same conditions.

Key words: *wheat, yield, weed control and herbicides.*

INFLUENCE OF BIOSTIMULANTS AND FOLIAR FERTILIZERS ON THE YIELD OF GARLIC

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Abstract

Garlic (*Allium sativum* L.) is a popular spice and medicinal plant worldwide. In Estonia, the interest in garlic production has increased during recent years and the local market is demanding larger amounts of garlic, mainly for fresh production. Therefore, increasing garlic yield and improving bulb quality are important aims for growers. This can be affected by different agrotechnical measures, like irrigation, plant protection and fertilization. The use of foliar fertilizers and biostimulants is also getting more popular. The aim of this study was to determine the effect of biostimulants on garlic yield formation. Field experiment was carried out with the winter garlic cultivar 'Ziemiai'. Garlic cloves were planted in field in October 2015. Total fertilization with mineral fertilizers during growing period was calculated as N 125 kg, P 40 kg and K 148 kg/ha. In the experiment, foliar fertilizers (Ekolist 12-4-7 and Sulfone 5-20-15) and 5 products containing amino acids (Raycat Growth, Aminocat, Ruter AA, Aton AZ and Prolis) were used. Foliar application of mentioned products was carried out three times in 14 days interval. Control plots were sprayed with water. After the harvest, garlic was dried and calibrated by the diameter in 4 groups. Each group was weighed separately and based on the results the total yield was calculated. The total yield ranged from 496 to 577 g/m^2. All biostimulants increased total yield, marketable yield and average bulb weight of garlic, but there was now difference among products.

Keywords: *amino acids, foliar application, marketable yield, bulb weight.*

META-ANALYSES OF SWEETPOTATO (*IPOMOEA BATATAS L. LAM*) STABILITY PERFORMANCE IN DIFFERENT AGRO-ECOLOGIES OF THE TIGRAY REGION, ETHIOPIA

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Abstract

The study aimed at evaluating the influence of environment on sweetpotato stability and identifying superior genotype(s) with high yield stability in the farmers' field conditions. Six sweetpotato genotypes were evaluated for two years in 'meher' season (July- December), 2014 and 2016; four of the six genotypes were assessed for three years in the 'meher' season, 2012, 2014, and 2016. Planting was done in three replications in RCBD in three unique agro-ecologies: Endayesus-dry highland, Fachagama-dry lowland, Rarhe-moist lowland. Genotypes genetic merits were predicted using BLUP. The AMMI and GGE were used to test the genotypes stability. The ANOVA for AMMI model showed high significant difference ($P<0.01$) for genotypes, environments, seasons, and the interactions. Environment (41.67%) and the genotype main effect (35.71%) contributed largely to the cumulative variance for three years testing of four genotypes and two years testing of six genotypes, respectively. Berkume (42.44 t/ha), Tulla (33.92 t/ha) and Kulfo (33.67 t/ha) were superior for total storage root tuber yield (TTRY).Both the AMMI and GGE biplot predicted Tulla and Kulfo as ideal genotypes with dynamic stability; Berkume with static stability to Rarhe. The environment main effect had significant influence in determining how genotypes expressed their genetic potentials and stability as shown by the AMMI model and GGE biplot. The AMMI model partitioned the studied agro-ecologies of the Tigray region into two mega sweetpotato growing environments; the dry high/lowland in one environment and the moist lowland in another, completely different, but with high potentials for sweetpotato production.

Key words: *Stability, Agro-ecologies, Yield, Sweetpotato, Superior.*

EFFECT OF INTERCROPPING MAIZE AND COMMON BEAN ON GRAIN YIELD OF COMPONENT CROPS AND LAND USE EFFICIENCY UNDER CONVENTIONAL AND CONSERVATION TILLAGE

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Abstract

Sustainable food production in Ethiopia is adversely affected by the degradation of the natural resources base. Reduced crop biomass, ground cover and root development contribute to greater soil erosion. Understanding the benefits of different crop management strategies to minimize soil degradation and other related problems is critical. Intercropping of maize with common bean under conservation tillage practices was evaluated in the period 2014- 2016 cropping season in selected areas of Southern Ethiopia. The experiment had five crop management practices: the farmers' practices (check); conservation tillage + maize/common bean intercrop, conservation tillage + sole maize; conservation tillage e + sole bean and conservation tillage + maize-common bean rotation. The experiments were laid in randomized complete block design in 10 by 10 plot size replicated three times considering farmers field as replication. Maize variety BH 540 and common bean variety Hawassa Dume were investigated. Highest maize yield (7833 and 7777kg ha^{-1}) was obtained from maize /bean rotation and conventional farmer practice during 2014 cropping season across locations. Maize intercropped with common bean under conservation tillage during 2015 resulted in 15 and 17% more grain yield of maize over that of the conventional and sole maize under conservation, respectively. Similarly, the highest LER of 1.90 and 1.71 was obtained from maize/common bean intercropping during 2015 and 2016, respectively. Moreover, the maize/common bean intercropping under conservation tillage provided 23 and 8% more net benefit over the conventional tillage during 2015 and 2016, respectively. The net benefit advantage of 28, 54 and 36% of the over the sole maize during 2014, 2015, and 2016 cropping seasons, respectively, was found in maize/common bean intercropping under conservation tillage plots. Thus, highest yield, diet diversity and economic benefit of the maize bean intercropping under conservation tillage over the conventionally tilled plots is an alternative option for resources in poor small holder farmers,ingeneral, and female farmers,in particular, who does not have oxen to till their land.

Key words: *conventional agriculture, conservation tillage, intercropping, land equivalent ratio, sole common bean, sole maize.*

STUDYING THE ACCLIMATIZATION AND AGRICULTURAL PECULIARITIES OF EARLY SPECIES OF TANGERINE INTRODUCED FROM JAPAN IN CONDITIONS OF ADJARA

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Abstract

In the Black Sea subtropical zone, the reservs to assimilate the new areas for the citriculture has been exhausted and further development of the sector is mainly possible with the introduction of modern technologies, while increasing the cost of the plant should be carried out by replacing biologically amortized plants by arranging sedimentation nurseries, raising soil fertility, timely conduct of agro-techniques and plant pest control measures and correctly organizational-practical issues.Since our region belongs to the extremely northern subtropical zone, it is necessary to select varieties that are suitable for our zones, which are distinguished by early ripening and high yield. In 2011, with the initiative of the Ministry of Agriculture of Adjara for solution of this problem, 11 varieties of tangerine were imported from Japan: Nichinani, Iura-Vase, Taguchi - Vase, Miagava - Vase, Kavada, Nankani-20, Ohotsu-Vase, Ueno-Vase, Aoshima, Okitsu-Vase, Mukaiama, which was planted in the Kobuleti municipality, the plants are planted with nutritional air of 4x2.5 meters, at 35-40 meters above sea level, the soil is red. We had ten plants in each variant that we have studied: - The formation of buds, the beginning and end of vegetation, the massive flowering, setting, the beginning of the ripening of the fruit and the full ripening, high yielding (piece, kg.), the average weight of one fruit (g.), the color of the fruit, the nature of the skin removal from the flesh, number of seals in flesh and organoleptic characteristics. We received fruit from different expositions of the plant and explored biochemical indicators at the University Laboratory. (*Tanaka T. 1958; R. Jabnidze 2018).* The novelty of the research is that we have examined the first phonological, agro-ecological and agro-technological characteristics of eleven varieties of introductive tangerins, from which only three varieties: Nichinani, Iura-Vase, Taguchi - Vase identified the best characteristics for our zone and were recommended to be a super early sorts, which are 40-45 days prior to the local in breeding. We recommend the cultivation of such plants by growing citrus areas and therefore productivity. The novelty of the research is also that the intensive technological complex also includes organizational and economic measures and economic issues that will be directed to improve organizational management and management of the sector (*Taylor O*., 2007; *Rezo Jabnidze*. 2004).

Keywords: *Citrus, fruit, subtropical, varieties, phenology, vegetative growth*.

INTERACTIONS OF CATCH CROPS AND THEIR INFLUENCE ON YIELD OF MAIZE AND WINTER WHEAT IN DIFFERENT CROP ROTATIONS

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Abstract

Catch crops (CCs) are cultivated between main crops to prevent nutrient losses and to increase soil fertility. Furthermore, they affect rooting and yield of main crops. In a long-term project, four different CCs (mustard, berseem clover, phacelia, black oat) and mixtures with 4 and 12 CCs (mix4, mix12) were included in humus degrading (HD) and humus accumulating (including N-fixing legumes, HA) crop rotations, followed by maize and winter wheat. Aboveground biomass of pairs of conjointly grown CCs and yield parameters of main crops were determined. Various synergistic effects occurred in CC pairs, displaying higher measured biomass of 50/50% mixtures than calculated of both single CCs, e.g. for mustard/phacelia and berseem clover (35/38 vs. 25/23 dt ha^{-1}, $p<0.05$). Berseem clover also caused higher amounts of total shoot biomass of the following maize than mustard or phacelia (180, vs. 154 / 150 dt ha^{-1} DM, $p<0.05$), whereas black oat promoted grain yield vs. all other single CCs ($p<0.05$). Grain yield of winter wheat in the second year after single CCs apparently was higher than after CC-mixtures (90 vs. 83 dt ha^{-1}, $p>0.05$) in HA rotations. Correlation of wheat grain density and grain weight turned out to be negative ($r = -0.43$) in case of preceding single CCs and positive ($r = 0.81$) in case of CC mixtures, indicating a higher grain filling ability in wheat after CC mixtures. The results show clear interactions and influence of different CCs on development and yield of main crops during the whole crop rotation.

Keywords: *Catch crop, dry matter, yield, maize, winter wheat*.

COMPARISON OF SPECIES COMPOSITION OF VASCULAR PLANTS IN AGROFORESTRY SYSTEM

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Abstract

Agroforestry systems combine two close areas of land use, namely agriculture and forestry. Agroforestry can provide certain ecological benefits, such as increased biodiversity, reduced soil erosion, increased land use efficiency and production, and increased carbon sequestration. The aim of this contribution is the evaluation of species composition of vascular plants in two woody strips on a field under organic farming. The experiment was established on two fields near to Starnberg (Germany) in 2014. In May 2019, the evaluation of the vegetation was carried out using phytosociological plots of size 4 m^2. The percent coverage was estimated in each plot. A total of 36 plant species belonging to 17 plant families occurred in the monitored area. Woody strips can provide shelter and food for animals, but they can also be a potential source for weeds spreading to the surrounding land. Our results show whether plants are able to spread to the surrounding land and whether they are able to affect the vegetation in agricultural lands.

Keywords: *short rotation coppice, agriculture, energy crops, phytosociological methods.*

SPIKE DEVELOPMENTAL STAGES AND ABA ROLE IN SPIKELET PRIMORDIA ABORTION CONTRIBUTE TO THE FINAL YIELD IN BARLEY (*HORDEUM VULGARE* L.)

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Abstract

Salinity is a significant environmental stress factor limiting crops productivity. Barley (*Hordeum vulgare* L.) has a natural tolerance to salinity stress, making it an interesting study object in stress biology research. In the present study, for the first time the effect of salinity stress on barley inflorescence developmental stages was investigated. Five spring barley genotypes irrigated with saline water (12.5 ds/m NaCl) were compared to controls treated with normal tap water. We measured abscisic acid (ABA) concentrations in the apical, central and basal sections of the immature inflorescence at green anther (GA) stage. The role of ABA in spikelet primordia development, atrophy and abortion and final yield was evaluated. A time course experiment starting from double ridge until green anther (GA) stages revealed that salinity reduced the length of spike developmental stages in all genotypes causing shortened of the plant life cycle. The shortened plant life cycle negatively affected plant height and number of tillers/plant. Salinity also affected spikelet primordia development. In both control and salinity treated plants apical spikelet abortion started in late awn primordium (AP) stage. However, under salinity treatment, significantly more spikelets were aborted, thus directly affecting plant yield potential. ABA, which plays a role in the spikelet/floret abortion process, was markedly elevated in the base and apex of salt treated spikes correlating with an increased spikelet abortion in these regions. Overall, salinity treatment reduced all plant and yield-related parameters investigated and turned some of the correlations among them from positive to negative or vice versa. Investigations of ABA role in floral development and phase duration of barley spike showed that, ABA regulates the spikelet/floret abortion process affecting the yield potential under salinity and control conditions.

Keywords: *Barley, salinity, ABA, spike development, primordia abortion, spikelet/floret abortion.*

META-ANALYSIS OF THE YIELD RESPONSE TO PHOSPHORUS FERTILIZATION BASED ON LONG-TERM FIELD EXPERIMENTS

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Abstract

Phosphorus (P) fertilizer recommendations in Germany and most other European countries are based on plant-available soil P contents and results from long-term field experiments. Site-specific conditions are often neglected, and consequently excessive P fertilizer rates have often been applied in the past decades. In this study, long-term field P fertilization experiments including relevant site and soil parameters were evaluated in order to analyze the yield response. The database comprises about 2000 datasets from 30 field experiments from Germany and Austria. Statistical evaluations using a classification and regression tree approach, and multiple linear regression analysis indicate that besides plant-available soil P content, soil texture and soil organic matter content have a large influence on the effectiveness of P fertilization. This study methodology can be a basis for modification and specification of existing P fertilization recommendations and thus contribute to mitigate environmental impacts of P fertilization.

Keywords: *CART, Crop yield, Fertilization, Phosphorus, Plant-available soil phosphorus.*

CROP ROTATION PRODUCTIVITY WITH CEREALS AND LEGUMES: A SHORT REVIEW

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Abstract

Crop rotation is considered to be an instrument of sustainable cropping system assisting in varying the set of soil nutrients. Thereby reducing the likelihood of soil erosion, building soil organic matter, increasing carbon sequestration, improving soil quality, water holding capacity, nutrient availability, soil structure and minimizing greenhouse gas emissions. Additionally, reducing the outbreak of pests, weeds and other diseases on the farmland, reducing the reliance on chemical fertilizers, minimizing agricultural crop production dangers and heighten crop yield in comparison with monoculture practices. Crop rotation is an agricultural practice of growing different or non-similar crops on the same farmland in different seasons. Also, this cropping system has the potential to increase the diversity of cropping systems, to maximize resiliency of the cereals-based system under variable weather conditions. Higher cereal yields have been gained by including legumes in the rotations. Legume crops could play an important role by delivering multiple services in line with sustainability principles. Crop type can impact soil temperature and water content by affecting shade intensity and evapotranspiration. Crop residues returned to the soil are the main input in maintaining soil organic carbon (SOC), which generally seems to increase with the diversified crop rotation compared to the mono-cropping. Especially, crop rotation and grazing system can affect crop residue mineralization, root and microbial respiration, so as to play a major role in regulating soil surface GHG emissions.

Keywords: *rotation, legumes, cereals, productivity.*

INTERCROPPING – MAY BE AN OLD PRACTICE BUT TIMELESS: A SHORT REVIEW

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Abstract

Intercropping is known as the achievement of a high and stable production that not only raises complementary products in the area but also reduces the harmful effects of diseases and pests, prevents pollution and results in effective use of resources. Intercropping is an agricultural practice of cultivating two or more crops in the same place of land at the same time which is commonly practiced in many parts of the world in order to increase the productivity per unit area of the land. The crops are not necessarily sown at the same time and their harvest time may be quite different, but they are simultaneously grown for significant growing periods. In this review study, we are informed about the use and importance of the intercropping system which is mainly based on very old ones and which is of great importance in recent years in agricultural production. There are several intercropping systems such as mixed, strip and row intercropping patterns. Supplemental effects in models of resource use should be taken into consideration so as to get better yield and quality in intercropping systems. Cereal/legume intercropping increased dry-matter production and grain yield more than their monocultures. The N transfer from legume to cereal increased the cropping system's yield and efficiency of N uses. The taller cereal reduces biological N fixation and yield of the associated legume. Also, intercropping can be a method of improving diversity in agricultural ecosystem. It provides farmers with the chance to simulate natures´ principle of diversity on their farms. Complementarities in models of resource use should be considered to get better productivity in intercropping systems.

Keywords: *intercropping, productivity, legumes, agricultural practice.*

THE FIRST RECORD OF *RATTUS NORVEGICUS* ON THE ISLAND OF CYPRUS AND THE EXPECTED EFFECT ON AGRICULTURE AND LOCAL BIOTA

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Abstract

The island of Cyprus - a centre of endemism and a biodiversity "hotspot" - is located in the Eastern part of the Mediterranean Basin, which comprises one of the largest groups of islands in the world. This island system has been early and widely colonized by the black rat *Rattus rattus* since their spread from the Indian Peninsula. This species is considered one of the most damaging alien invasive predator to have been introduced on more than 80% of the world's major islands and known to negatively affect island biota and agriculture. Although across the Mediterranean Sea the brown rat *R. norvegicus* is present along with the black rat, on the island of Cyprus there were only *R. rattus.* This study reports the first documented record of *R. norvegicus* on the island of Cyprus from two localities, the city of Geri and Neo Chorio near Kythrea. The species identification was first carried out by morphological analysis, and then confirmed by molecular evidences inferred by the analysis of mitochondrial DNA sequences. The implications of the discovery of this new alien invasive species on agriculture and the local biota of Cyprus are examined.

Keywards: *Rattus norvegicus, brown rat, agricultural damages, alien invasive species.*

MANAGEMENT AND CONSERVATION OF THEBARN OWLS ON CYPRUS FOR THE CONTROL OF RATS AND THE PROTECTION OF AGRICULTURE - A REVIEW

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Abstract

Cyprus is an island in the eastern Mediterranean basin, which has been early and widely colonized by black rats *R. rattus*, since their spread from the Indian Peninsula. This species is considered one of the most damaging alien predator to have been introduced on the island, having a negative effect on island biota and causing huge damages to agriculture, especially to carob (*Ceratonia siliqua*) plantations, almonds (*Prunus amygdalus*) and pomegranate (*Punica granatum*). Rats feed on carob pods and the bark, eventually killing the trees. A natural enemy of rats is the barn owl (*Tyto alba*). A recent study of the feeding habits of barn owls in Cyprus revealed that it comprised mainly of rodents (overall means 96.2 and 95.7% by number and biomass, respectively). Mice followed by rats were the most important prey. In areas with high mole crickets (*Gryllotalpa gryllotalpa*) populations, this is an important item in their diet too. Barn owls are a rare species with a restricted habitat, limited by the presence of suitable natural cavities/holes for nesting. To increase the available nesting habitat, the government of Cyprus begun a program for the instalment of nesting boxes in agricultural areas in 1990. During the last 20 years about 200 nesting boxes were constructed and installed in agricultural areas across Cyprus by the Game and Fauna Service and the Department of Agriculture. With the recent increase in the cultivation of carob trees, the Agricultural Research Institute, in cooperation of the University of Cyprus, is participating in the design and installment of new nesting boxes, to attract barn owls in the new plantations.

Keywords: *Barn owls, Tyto alba, rats Rattus rattus, Biological control of rats.*

EFFECT OF THE 1BL.1RS WHEAT-RYE CHROMOSOMAL TRANSLOCATION IN BREAD WHEAT CULTIVARS ON PHYSIOLOGICAL TRAITS

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Abstract

In order to study the effect of the 1BL.1RS wheat-rye chromosome translocation on yield and physiological traits, three Hellenic spring wheat varieties with (cvs. Acheron, Elissavet and Orfeas), six cultivars without the translocation (cvrs. Apollonia, Acheloos, Vergina, Doirani, Nestos and Strymonas) and the Russian cultivar KVZ/Cgn as a check, were evaluated for three successive years under low input conditions. Total chlorophyll content, chlorophyll fluorescence, CO2 assimilation rate, stomatal conductance, intercellular CO_2 concentration and transpiration rate were measured. Significant differences were recorded in yield and in two traits, i.e. total chlorophyll content and transpiration rate. Regarding yield, despite the existing variability between cultivars with and without the translocation, no effect of the translocation was noticed. The two cultivars with (Elissavet and Acheron) carrying the translocation performed almost equally with two of the top yielding varieties without the translocation (Apollonia, and Achellos). Also, the same two wheat cultivars without the translocation showed high total chlorophyll content but they did not differ significantly from cv. Elissavet one of the translocation carriers. No positive effect of the translocation was observed on transpiration rate with the top yielding cultivar Apollonia without the translocation differing significantly from the top yielding cultivar Elissavet with the translocation. When the studied physiological traits were compared to the yield of the corresponding cultivars it was concluded that the 1BL.1RS chromosome translocation did not give any significant advantage on the yield potential of the genotypes. Further research is needed under different environments to confirm the results of the present study.

Keywords: *Yield potential, Drought resistance, Chlorophyll content, Transpiration rate.*

SINGLE-PLANT SELECTION AT ULTRA-LOW DENSITY OF FIRST GENERATION LINES OF THREE BEAN CULTIVARS UNDER WATER STRESS

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Abstract

Nil-competition (ultra-low plant density) has been asserted to highlight individual genotypes of high yielding potential. This was tested preliminary on three determinate type bean varieties (*Phaseolus vulgaris* L.), two genetically non-uniform and with unstable yields Greek cultivars, Iro and Pirgetos and a "Great northern" type imported variety. Single-plant selection under ultra-low density (interplant distance of 100 cm) was performed in a honeycomb design experiment established during 2017 in the main farm of the University of Western Macedonia in Florina. Eighteen high yielding plants were selected and seed of each constituted a separate first generation line. In 2018, progeny evaluation was conducted in two R21 honeycomb design trials under normal and deficit irrigation treatments respectively. Compared to the original variety Iro, four of the high yielding progeny lines had higher yield plant^{-1} (by 20 to 39%) under water deficit with two being significantly different, where for the variety Pyrgetos only one first generation sister line significantly outperformed the original cultivar by 28%. Water stress affected significantly total chlorophyll content measured at 10 day intervals from start of flowering until physiological maturity with the best performing progeny lines showing higher chlorophyll concentrations especially during the seed filling stage. Significant differences between progeny lines and the original varieties were also shown on CO_2 assimilation rate under water deficit especially within the genotype Iro. Further research is needed so that any existing variation is beneficially exploited.

Keywords: *Ultra-low plant density, Water stress, Chlorophyll concentration, CO_2 assimilation rate.*

EFFECT OF THE 1BL.1RS WHEAT-RYE CHROMOSOMAL TRANSLOCATION ON YIELD POTENTIAL IN BREAD WHEAT

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Abstract

In order to investigate the effect of the 1BL.1RS wheat-rye chromosomal translocation on bread wheat yield, four commercial cultivars with and six without the translocation were evaluated in the field. Except yield three more agronomic traits were measured (days to heading, plant height and 1000 kernel weight). The experiments were established in two different locations (one cold and one dry), for three years at each location and consisted of four replications. Despite the differences observed between the genotypes, no advantage of the translocation was noticed: two cultivars, although not differing, one without (ranked first) and one with the translocation (ranked second) ware ranked in the two first places. Cultivar Kavkaz/Cgn, one of the donators of the translocation was ranked eighth and the fourth cultivar with the translocation was ranked last. That's why it was decided to study the genotypes in each separate location in order to find out whether there was any adaptation effect of the translocation. The results revealed that three of four cultivars with the translocation performed well in the cold environment and only one performed well in the dry area. However, one of the cultivars without the translocation exceeded in yield the aforementioned cultivars carrying the translocation. In the dry area, five of the non-translocated cultivars performed equally well with the translocated one. For this, someone could conclude that no obvious advantage of the presence of the translocation on yield was noticed. A similar view was recorded and in the other three traits Further research, involving more environments, using a more sophisticated analysis is needed to drive to more accurate conclusions.

Key words: *fixed model, analysis of variance, adaptation, yield, days to heading, plant height, 1000 grains weight.*

A MISUNDERSTANDING BUT VERY PROMISING CROP: LUPINS

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Abstract

Grain legumes, also called pulses, are crops of the botanical family *Fabaceae*.Genus *Lupinus*spp. isalso included in this family.There are over 150 different species of lupines. Some of them are ideally suited to agricultural production due to their nature as nitrogen fixing grain legumes that develop seeds with high protein and high energy contents, which can be grown effectively in northern and southern climates. There are three lupine species of agricultural significance at present: narrow-leafed (*L.angustifolius*), white (*L. albus*) and yellow (*L. luteus*).The inclusion of lupine in crop rotation positively influences biodiversity and soil fertility as the bacteria at the root of lupine symbiotically absorb nitrogen (N) from the air. Lupine plant residues provide the next culture with 32–96 kg N/ha, while the accumulation of nitrogen in lupine biomass ranges from 199–372 kg N/ha, 86% of which is the result of symbiotic fixation.Lupine can be grown on less fertile, acidic and sandy soils where other crops produce lower yield. This is also very important for crop rotation, especially in organic agricultural production, due to its positive impact on the yield of subsequent crops, mainly cereals.Lupine seeds are of low price and non-genetic modified ingredients that constitute of good protein sources (ca. 40%), fiber (ca. 28%), healthy fatty acids, vitamins, minerals and other metabolites with recognized antioxidant properties (e.g., polyphenols). Despite the low European production of grain legumes, European countries exhibit suitable soil-climatic conditions in order for this crop to be cultivated.Measures towards increasing their local production have already been purposed by the European Commission as a way of decreasing the external dependence on soybeans.

Keywords: *lupine, cultivation, animal feed, nutritional value.*

CULTIVATION PRACTICES EFFECT *CANNABIS SATIVA* YIELD

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Abstract

An industrial crop which can produce high yield of a quality fiber is *Cannabis sativa* subsp. *sativa*. For the purposes of the study, a field experiment was established at the Experimental Farm of the Technological Educational Institute of Thessaly in Greece (TEI; Larissa plain) in 2017, in order to determine height, dry biomass and fiber yield of *Cannabis sativa* subsp. *sativa* (cv. Fibranova). The effect of two different plant populations (P_1 = 160 plants/m^2 and P_2 = 80 plant/m^2), two irrigation levels (I_1 = 100 % ETo, I_2 = 60 % ETo) and two N-fertilization levels (F_1: 244, F_2: 184 kg ha^{-1}) were investigated. It was found that at harvest period the average plant height was 3.67 m, while the final plant height was significantly affected by irrigation input. Moreover, the average biomass dry yield and fiber yield may overcome 13t $ha^{-1}$and 4 t ha^{-1}, respectively. Dry biomass partitioning showed that 17% of total biomass was the dry yield of the leaves and the 83% the dry yield of the stems, while the 36-37% of the dry stem yield was the fiber dry yield. Therefore, it could be concluded that *Cannabis sativa* subsp. *sativa* (cv. Fibranova) is a very promising annual crop for fiber production in Greece and other areas of the Mediterranean region with similar environmental conditions, but further investigation is needed.

Keywords: *yield, plant density, fertigation, fiber.*

COMPARISON OF COMMON FERTILIZERS AND FERTILIZERS WITH NITRIFICATION INHIBITOR TO YIELD AND PROTEIN CONTENT ON TRITICUM DURUM

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Abstract

One of the most important winter cereals cultivated in Greece is *Triticum durum*. In this research we studied the effect of different fertilizer types containing nitrification inhibitor and conventional fertilizers at 4 different N-levels (0, 70, 140 and 210 kg ha^{-1})on two different durum wheat varieties at the Experimental Farm of the Technological Educational Institute of Thessaly in Greece (TEI; Larissa plain). The sowing of the crop took place on November 2018. Nitrification inhibitor ensured crops N-nutrition for longer period compared to conventional fertilizers and may lead to higher yields with higher protein content. There were not found any statistical significant differences on yield between the tested factors for both varieties but only numerically superiority of the fertilizers containing nitrification inhibitor. On the other hand, there were found statistically significant differences in protein and starch content for both varieties. It was found that the N-levels of 140 & 210 kg ha^{-1} produced seeds of higher protein content, ranging 15.87-16.03 and 15.48-16.20 %, for both varieties, respectively. Furthermore, protein and starch content have a linear relationship with nitrogen supply, where R^2 is very high (0.93 and 0.97), respectively.The above results were found through the first year of experimentation, and therefore safer conclusions expected to arise after the repetition of the experiments in the same place for a second and a third year.

Keywords: *Triticum, nitrification inhibitor, fertilizers, yield, Greece.*

TEMPERATURE EFFECT ON SEED GERMINATION RATESOFDIFFERENT WINTER LEGUMES AND SPRING CEREALS

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Abstract

The most crucial stage in the life cycle of cultivation is the seed germination as it significantly determines the evolution of the crop. Temperature is one of the most important factors affecting the vegetation. Therefore, a laboratory experiment was conducted to determine the vegetation rate of different varieties of three winter legumes (*Lupinus albus* L. vs Multitalia and Ultra, *Pisum arvense* vs. Arvica and Olympus, *Vicia faba* vs. Tanagra, Favino, Solon and Scuro di Torre Lama), 3 varieties of spring cereals (*Sorghum bicolor* vs EJ 7282, Skyscraper, Grain sorghum – Pacific Graze), and 2 varieties of a perennial cereal (Switchgrass – *Panicumvirgatum* vs. EC 1101 and EC 1102) at 9 different temperatures (24, 20, 16, 12, 10, 8, 6, 4, and 2^{o}C) in a constant parameter chamber (temperature). For each variety, 100 seeds were placed in 2,4 or 5 separate petri dishes depending on the size of the seed. Observations were taken each day for high temperatures and every second day for low temperatures. The hierarchy of the vegetation rate of the studied species was as follows: *Sorghum bicolor* EJ 7282 >*Sorghum skyscraper* >*Grain Sorghum*, *Panicum virgatum*: EC 1101 > EC 1102, *Lupinus albus*: Ultra > Multitalia, *Pisum arvense*: Arvica > Olympus and *Vicia faba*: Scuro di Torre Lama > Solon > Favino > Tanagra. The higher temperatures for the studied seed caused the germination in a shorter period, and as the temperature dropped, it took more days to reach the total vegetation rate. Finally, the speed of day-to-day germination between varieties and species was different.

Keywords: *germination rate, winter legumes, spring cereals, temperature.*

THE EFFECT OF DIFFERENT FOLIAR FERTILIZERS AND DOSAGES ON THE YIELD AND SEED QUALITY CHARACTERISTICS OF DURUM WHEAT

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Abstract

Durum wheat is one of the most common cereals which is widely grown and constitutes the cereal with the highest monetary yield. There are many studies where the different varieties are compared in case to find the better one with increased harvested yield and better seed quality. Therefore, it appears that the main objective of the investigation is to increase seed quality and seed yield. Furthermore, many chemical substances are sold stating that they can increase the final yield and the seed protein content. For the purposes of the study, a field experiment was established at the Experimental Farm of the Technological Educational Institute of Thessaly in Greece (TEI; Larissa plain) in 2018 (November), where the effects of three different foliar fertilizers in different dosages and their combination (10 different treatments in 3 replications) on final yield and seed quality characteristics were investigated. Few initial observations on the field resulted in more vivid plants with more intense colouring, which could lead to the expectation of higher harvested yield. There was not found any statistically significant difference on seed yield, where control reached almost the 4500 kg ha^{-1} and 6750 kg ha^{-1} for the 3rd treatment (highest). On the other hand, there was found statistically significant differences for the protein content with control reaching the 13.3% and the higher 17.37 reached at the 9th treatment. Due to the fact that the above results were found through the first year of experimentation, safer conclusions expected to arise after the repetition of the experiments in the same place for a second year.

Keywords: *Wheat, seed yield, protein, foliar fertilizers, cereals.*

GENOTYPE BY ENVIRONMENT INTERACTIONS ON NINE COTTON FIBER TRAITS

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Abstract

Genotype × Environment interactions for cotton fiber traits are of great importance affecting quality. The purpose of this study was to evaluate fiber quality traits across four diverse environments by Advanced Fiber Information System (AFIS) instrument. The five most cultivated commercial upland cotton cultivars were used and each cultivar was sown in 16 fields (80 fields in total for all cultivars). Four samples from each field were collected for analysis of nine fiber traits. Many fiber traits exhibited statistically significant differences for both factors environments and cultivars (genotypes), indicating differences in environmental conditions and cultivar behavior. Genotype × Environment interactions were not present except for two traits that were very close to 0.05 significance level. Finess showed the greatest mean squares, while in most cases, mean squares of the factor environment were greater than for genotypes (except for IFC and Finess, where genotypes contributed the most in total variability). Thrace followed by Macedonia, proved to be the best regions in Greece to cultivate cotton for all fiber traits, except for trait SFC (percent of short fibers by weight). Cultivar CELIA showed the best measurements for almost all fiber traits across all Greek regions.

Key words: *AFIS, quality, Greek regions.*

ASSESSING YIELD OF WINTER CEREALS UNDER EXTREME CONDITIONS IN GREECE

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Abstract

The purpose of the present research was to analyze yields of 24 different genetic materials (cultivars) of winter cereals under extreme conditions for years (2011 and 2012). For this to be done, seven breadwheat cultivars (Yecora E, Acheloos, Centauro, Nestos, Vergina, Irnerio, Yenerozo E.), five durum wheat cultivars **(**Fenix, Simeto, Bob, Mexicali 81, Athos), five barley cultivars **(**Cannon, Plaisant, Sonora, Zotis, Konstantinos) five triticale cultivars **(**Catria, Ariti, Niobi, Vrodi, Vrito) and two oat cultivars (Pallini, Flega) were used. The experimental design was a Randomized Complete Block (RCBD) with four replications. Bread wheat cultivars exhibited the greater mean values 4.3 Mg/Ha, exceeding the mean value of the Greek bread wheat cultivars. The best cultivar was Yenerozo E. Reversely to this, durum wheat cultivars exhibited low yields about 2.7 Mg/Ha, compared to 3 Mg/Ha of the Greek mean. The best cultivars were Finix, Mexicali 81 and Simeto. The yields for barley were also low, about 3.8 Mg/Ha, compared to 4 Mg/Ha of the Greek mean. The best barley cultivars were Zotis and Cannon. Triticale cultivars showed unexpectedly very low yields. Oat had also very low yields. A Genotype x Year interaction was found statistically significant, indicating different response of the cultivars in relation to the environmental conditions.

Key words: *Wheat, barley, oat, triticale.*

BEHAVIOR OF YOUNG CONSUMERS REGARDING FLAVORED WINES - CASE STUDY: RETSINA AND VERMOUTH

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Abstract

From ancient times flavored wines were utilized for medical and pharmaceutical purposes. Those drinks consist of a neutral wine or grape juice base with the addition of alcohol and a mixture of dry ingredients, such as aromatic herbs, roots and bark. One of the most popular Greek flavored wines is Retsina, which results by addition of Aleppo Pine resin in grape juice during alcoholic fermentation and gives a wine flavored by resin. "Retsina" is a wine of traditional appellation produced only in Greece, while some retsina wines produced in the Greek regions of Attiki, Viotia and Evia have additionally become entitled to bear a geographical indication of origin. Vermouths, also designated into the flavored wines, originate from the addition of herbs and spices in a base wine. Italy and France are famous producers of vermouths, however a few Greek companies also begun producing vermouths recently. Both retsina and vermouths are consumed by young people. Specifically, retsina is also named “drink of students” because of its low cost and easy combination to a variety of foods of Mediterranean cuisine. Vermouths, on the other hand, consist a very popular choice among young people, for an after-office drink or aperitivo. The purpose of this survey was to assess the knowledge and preferences of young consumers regarding flavored wines, in particular retsina and vermouth. The present study was conducted in the period January to May 2019 in the region of Thessaly (central Grece). For this reason, four hundred questionnaires were filled in by randomly selected individuals, who were asked to answer key questions about flavored wines. The results of the survey showed that 79.5% of the respondents consumed flavored wines without being aware of the fact (45.5%). Respondents' consumption is limited to less than one bottle per month. They prefer retsina over any other flavored wine (64.4%). They prefer domestically produced wines (53%), originating mainly from the Greek region of Thessaly (21.6%), because of their desire to support local businesses. The present study provides detailed statistical information on the behavior of young consumers regarding flavored wines in the Thessaly region.

Keywords: *flavored wines, vermouth, retsina, young consumers.*

AN OVERVIEW OF VITICULTURE AND WINE PRODUCTION IN GREEK REGION OF WESTERN MACEDONIA

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Abstract

The geographical boundaries of Western Macedonia enclose large mountain ranges and continental morphology, wildlife sanctuaries and protected areas, dense forests and abundant water resources with rich ecosystems. All the above compose a harmonious environment for viticulture. The largest vineyards are found in the region of Florina (Amynteo), followed by the region of Kozani (Velvento, Siatista, Servia), while the amount of vineyards in the regions of Grevena and Kastoria is smaller. The characteristic of viticulture in Western Macedonia is the wide range of microclimates in the vineyards, ranging from cold continental, with heavy snowfalls and relatively cool summers in the highlands (Florina and Amynteo Plateau, Upper Voio Kozani) to coastal Mediterranean with mild winters and temperate summers around the artificial Polyfytos lake. In most areas, northern dry winds blow almost all year round, contributing to a healthy and dry climate, which reduces the risk of developing fungal diseases. The main grape varieties cultivated in the region are Xinomavro (and its clones) and Moschomavro, while a wide range of other local varieties are also found, due to the topography and geographical isolation of certain areas. The diversity of grape varieties is complemented by international red and white varieties. More than twenty wineries were created in the past 25 years, producing quality wines, while according to EU legislation Amynteo became a Protected Designation of Origin' (PDO) zone and in five other areas wines with a PGI indication could be produced. Serious efforts have been made towards the increase in wine tourism in the area, therefore a wine route has been developed, namely "The Wine Route of the Lakes" as well as a Network of visiting cellars in Siatista. Data about the viticulture and wine production in the region are presented and the challenges of visibility, wine tourism and climate change are discussed.

Keywords: *western Macedonia, viticulture, wine production, grape varieties, climate.*

UTILIZATION OF QUALITY AND COLOR CHARACTERISTICS OF MAIZE AS TOOLS TO RESEARCH GENOTYPE BY ENVIRONMENT INTERACTION

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Abstract

Plant yield potential and stability of performance consist of two significant tools utilized by prognostic breeding methodology in the evaluation and selection of plants for high crop yield potential. The aim of this study was to utilize quality parameters of maize (*Zea mays* L.) seeds (protein, oil, moisture, pH, and ash contents) and color characteristics (L, a, b parameters) in order to investigate the presence of variation among selected open-pollinated lines with high yield potential. Six lines with hybrid Costanza as check were evaluated in RCB experiments, in two contrasting environments A and B, where. A: Florina, W. Macedonia and B: Trikala, Thessaly. Environment B is with about 4-10^{o}C higher temperatures than environment A, lower altitude by 585 m and diverse soil conditions. Two prognostic selection equations, the plant prognostic equation (A) and the line prognostic equation (B) were employed for the selection of superior plants and lines, starting the selection in the F_2 generation of the commercial maize hybrid Costanza and continued for four cycles. Six high-yielding open-pollinated lines were developed on the basis of the two prognostic equations, i.e. Eq. $A = (x / \bar{x}_r)^2 \cdot (\bar{x} / s)^2$ and Eq. $B = (\bar{x} / \bar{x}_t)^2 \cdot (\bar{x} / s)^2$ where x was the single-plant yield, $\bar{x}_r$ was the average yield of the surrounding plants within a moving ring of a chosen size, $\bar{x}_t$ was the overall experimental mean and $\bar{x}$ was the progeny line mean and standard deviation. For the determination of quality, characteristics in maize seeds classical methods of analysis were implemented, while color characteristics were measured instrumentally by colorimeter. The results of statistical analysis revealed significant differences between the genotypes regarding all parameters, the environment was showed to affect significantly all characteristics, while statistically significant Genotype by Environment Interaction occurred.

Keywords: *maize lines, prognostic equations, crop improvement, quality and color characteristics, genotype by environment interaction.*

ASSESSING STABILITY IN MAIZE

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Abstract

Commercial maize hybrids should incorporate high yield potential and stability across environments in order to be profitable for the farmers. A stable genotype must show almost no interactions with the environments where it is cultivated. The only effects acceptable in the field, are the favorable conditions in some environments that may increase yield above the level of expected performance. The purpose of the present research was to analyze yielding stability in maize, based on data from Randomized Complete Block designs conducted in two contrast environments: in Florina and Thessaloniki (Northern Greece). Ten commercial F1 maize hybrids were used: ZS-680, ZS-8720, ZS-650, ZS-600, ZS-500, ZS-700, Cresus, Jetta, Funo and ZP-704. Plots consisted of four rows 5m long, 0.75m apart, 20cm plant-to-plant spacing and four replications. Mean yield was estimated for each location and hybrid and stability index (a specific ratio of mean and standard deviation) was used to depict which commercial hybrids were more stable across the environments. Generally, there were differences in stability across environments and some hybrids showed stability in both Greek environments. ZS-700 generally showed the greatest values (83.43) followed by Cresus (54.29). In Florina, stability index values were generally greater than Thessaloniki, indicating a more stable performance in this specific environment. The more stable hybrids were ZS-700 and Cresus for Florina, and ZS-600 for Thessaloniki. Jetta showed satisfactory values in both environments, indicating a more balanced and stable performance across the two environments. These commercial hybrids could be recommended for cultivation in certain Greek regions. The stability index is a useful criterion for cultivar recommendation. From our dataset, Florina region contributed positively to stability performance.

Key words: *stability index, environment, performance.*

EFFECT OF DIFFERENT STORAGE TEMPERATURES ON PHYSICAL STATE AND SOME INNER CONTENTS OF SWEET POTATO (*IPOMOEA BATATAS* L.) BULBS

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Abstract

In China and African countries, the production of the root vegetables especially sweet potato is facing several factors concerning the environmental storage conditions and the need for increased shelf-life of the bulbs. In fact, the storage of the bulbs is considered as one of the critical points of the production of the sweet potato crop around the world. Some of the vintage goals of the Department of Vegetable and Mushroom Growing at the Szent Istvan University were to inspect the influence of storage temperature on the quality change of the stored sweet potato bulbs and detect the weight loss changes during cold and ambient storage. In addition, non-destructive texture measurement of the stored bulbs was carried out using the acoustic response technique. This experimental work consists of two parts: the first part stores the washed and the unwashed bulbs in cold storage at two different temperatures (6 °C and 10 °C) in relative humidity of 85-90 % and determines the weight loss during the storage for washed and unwashed bulbs. The second part is carried out at ambient storage conditions at 20-25 °C and relative humidity of 60-70 %. This experiment proceeds in controlled environmental conditions in laboratories of the Department of Postharvest Science and Sensory Evaluation at Szent Istvan University for cold storage period, while the ambient storage was carried out in the Department of Vegetable and Mushroom Growing lab. According to our results, as it was expected, the percentage of the weight loss during cold storage has increased in different ways. After removal to ambient conditions (shelf-life), mass loss and negative textural changes (softening) became more extent and rapid. However, it was different in case of the examined varieties as well.

Keywords: *Sweet potato, Ipomoea batatas, Washed bulbs, Cold storage, Ambient storage.*

EFFECTS OF A SUBSTRATE IMPROVEMENT AGENT ON THE VEGETATIVE GROWTH AND QUALITY OF VEGETABLE SEEDLINGS

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Abstract

Seedling production and the quality of vegetable growing is a determining factor of subsequent yield. Transplant use has further advantages, e.g. earlier yield, improved efficiency of seed germination, increased growth safety, uniformity, etc. Non-profit orientated farmers can also consider using transplants because of these reasons. By applying substrate-improvement agents, farmers have a chance to enhance the seedling productivity in hobby gardens and in commercial production as well. These agents can improve the water capacity and nutrient content of substrates, and it can simplify the use of the media. Multiple type substrates can decrease the amount of chemical fertilizers necessary in production. This research aimed to study the development of lettuce and tomato seedlings in organic substrate with an improvement agent (BRT® Evergreen – AE), and estimate the efficacy of different amounts of these additives in vegetable transplant growing. AE is a lightweight substrate additive. It was developed by BRT Ltd., with the purpose of increasing the water holding capacity and nutrient absorption of the growing media. Differences were found in the development of lettuce and tomato transplants. The additive in different doses increased the nitrogen, phosphorus and potassium uptake of the plants as well. Furthermore, the dry material, nitrogen and SPAD chlorophyll content showed expressive coherences too.

Keywords: *Tomato, Lettuce, Transplant, Seedling, Additive*

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DEVELOPMENT OF CHANGES OF LACTIC ACID AND COLOR CONTENT IN HARVEST SEASON FROM ELDERBERRY (SAMBUCUS NIGRA L.)

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Abstract

Elderberry (*Sambucus nigra L.*) can be used in many ways in the food industry due to its nutritional characteristics its organoleptic properties and its rich color content. Currently this plant is used as a natural coloring or coloring food (concentrate, powder) in the food industry. In recent years, the rise in lactic acid content has been a problem for both Hungarian producers and the industry, which has a negative impact on the quality of products. Lactic acid bacteria often appear in plantations, due to weather conditions, especially temperature and precipitation. However, this also affects the anthocyanin content. Many items are rejected on receipt of raw material due to excess lactic acid limit, which makes it difficult to process of elderberry for both producers and acquiring companies. In our research, we monitored the development of lactic acid and color content in the elderberry samples from the plantations of BOTÉSZ (Bodzatermesztők értékesítő Szövetkezete – Hungarian elderberry association) under the elderberry harvest season. In our investigation, we used a variety of color content and lactic acid measurements to select a method that can be routinely applied in industrial environments. Based on our results, we would like to develop recommendations for good harvest practices that are planned to be presented at BOTÉSZ members' meetings and conferences.

Keywords: *Elderberry, lactic acid, color content, BOTÉSZ.*

GENETIC DIVERSITY ANALYSIS IN INDIAN MUSTARD (*BRASSICA JUNCEA* L. CZERN & COSS)

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Abstract

Genetic diversity in thirty genotypes of Indian mustard was analyzed using Mahalanobis D^2 statistics for eleven yield and yield attributing traits during *Rabi*, 2016-17 at Banaras Hindu University, Varanasi. Thirty genotypes were grouped into eight clusters on the basis of D^2 statistics. Cluster II comprised maximum eleven genotypes; cluster I ten, cluster V three, cluster IV two and cluster III, VI, VII & VIII comprised single genotype. The intra cluster distance (12.70) was maximum in cluster V and cluster V with cluster VII had maximum inter cluster distance (105.80). Cluster VII had high mean for length of main raceme, number of siliqua per plant, seed yield per plant and yield per hectare. The cluster VI had lowest mean for plant height and highest mean for number of siliqua on main raceme. Selecting genotypes from divergent clusters and utilizing them in hybridization program is likely to produce desirable recombinants, and may lead to improvement in yield and quality traits.

Keywords: *Indian mustard, genetic diversity and D^2 statistics.*

RICE LOSSES CHARACTERISTICS IN VARIOUS HARVESTING METHODS

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Abstract

Grain loss is inevitable during harvesting operations and attempts are made to identify and minimize that. In this study, field performance of five different harvesting methods were assessed which included three indirect harvesting methods of (i) manual cutting + threshing by a tractor driven thresher (T_1), (ii) rice reaper + threshing by a tractor driven thresher (T_2), (iii) rice reaper + threshing by universal combine harvester equipped with pickup type header (T_3), and two direct harvesting methods of (iv) head-feed rice combine (T_4), and (v) whole-crop rice combine (T_5). The results revealed that the maximum and minimum effective field capacity related to whole-crop combine (0.361 hah^{-1}) and manual cutting (0.009 hah^{-1}), respectively. Quantitative losses (grain and panicle shattering) in harvesting and threshing obtained to be 2.58% and 2.33% in average on indirect harvesting (T_1, T_2 and T_3) and direct harvesting (T_4 and T_5), respectively which were not significant statistically. The average qualitative losses (broken, husked and cracked grains) were 2.30% for indirect harvesting and 0.61% for direct harvesting that showed a decline of 63.3% compared to indirect harvesting. Total harvesting losses were 5.07% for T_3 (maximum) and 2.74% for T_4 (minimum). The harvesting method affected the percentage of broken rice after milling significantly. The average broken rice for T_1, T_2 and T_3 was 23.72, 23.28 and 24.56% respectively which were significantly higher than T_4 (21.05%) and T_5 (20.87%). Also, in the view of loss reduction, applying rice combine harvesters had priority respect to indirect harvesting methods.

Key words: *rice harvesting, combine harvester, losses, milling*.

HARVEST TIME IMPACT ON SHATTERING HABIT AND MILLING QUALITY OF RICE CULTIVARS

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Abstract

During harvest season, grain shattering is an important trait which affects both yield and milling quality of rice crop. A two-year study was carried out in order to investigate the variation of grain shattering habit and head rice yield at different harvest times. The experiments were laid out in a factorial based on completely randomized design (CRD) with five replications in order to examine the effects of rice varieties (at three levels: Hashemi, Khazar, and Ghohar), harvest time (at five levels: 26, 28, 30, 32, and 34 days after 50% flowering), and grain position on the panicle (at three levels: upper, middle, and lower portions) on rice grain pedicel breaking tensile strength (BTS) and head rice yield (HRY). The results revealed that the highest and lowest BTS were associated with Hashemi and Ghohar with an average of 0.60 and 0.35 N, respectively. With delaying in harvesting, grain detaching force from the pedicel decreased by approximately 50% among the earliest and the latest harvest time. Because of the non-uniformity in grain maturity, there was a nearly 30% variation in BTS of the grain pedicel for upper and lower portions of a single panicle. For selected intervals, harvesting time had no significant effect on HRY by itself but interacted significantly with other parameters. Rice variety affected HRY ($p<0.01$), whereupon other variables could intensify its effect.

Keywords: *Rice, shattering habit, harvest time, breaking tensile strength, milling*.

ROOT UPTAKE AND TRANSLOCATION OF ZINC IN WHEAT-ZINC ENRICHED SEEDS AFFECTED BY HISTIDINE

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Abstract

The role of histidine (His) on Phytosiderophore release, root uptake and root to shoot transport of zinc (Zn) was investigated in zinc biofortified wheat seeds. Seedlings were grown in a modified Hoagland nutrient solution and exposed to 10µm of Zn and without of histidine (His) as control treatment, Zn (10) + His (50) and Zn(10) + His (100). In our study, the presence of vanadate (a metabolic inhibitor) resulted in a significant decrease of root Zn uptake, indicating that a part of Zn uptake by the plant root was energy-dependent. Changes in zinc element in roots and stems of plants, dry weight of root and shoot, total dry weight, hysteine amino acids were significant at 1% probability level.Apoplastic absorption in both types of cultivars was more than symplastic pathway. Results showed that the use of histidine amino acid increased the transfer of zinc element synaptic compared to control treatment, Further, addition of His significantly increased the Zn content in shoots and roots of wheat. This increase was far higher in wheat-rich wheat cultivars. Nevertheless, Active absorption of zinc by application of hysteine also increased. Regarding the role of zinc element in increasing photosynthesis, the highest dry weight of shoot and root of plants was recorded in hysteine amino acid treatments. Also, this increase was higher in the application of enriched seed treatment. As a final result, it may be argued that the use of amino acids as fertilizers or application of amino acids along with the use of zinc-containing fertilizers can help to overcome the problem of zinc deficiency in countries such as Iran that have severe zinc deficiency.

Key words: *Apoplastic, Dry Weight, Phytosiderophore, Symplastic and Zinc Biofortified Seed.*

EFFECTS OF SEED PRIMING WITH PACLOBUTRAZOL ON CHILLING TOLERANCE OF WHEAT GERMINATION AND SEEDLING GROWTH

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Abstract

In dry farming, as rainfall is uncertain and may delay until cold months, seed germination and seedling growth may be damaged frequently by chilling stress. Paclobutrazol (PBZ) is a growth regulator from triazoles group. The response of wheat, Azar 2 cultivar, seed priming with PBZ was investigated under chilling stress in two separate experiments, germination and seedling stage. Seeds primed with different concentrations of PBZ (including zero or hydropriming, 35, 70, 105 and 140 µm) with a group of non-primed seeds as control. Seeds were exposed to a set of 5, 15 and 25°C temperatures. At 5°C seed germination was reduced significantly compared to 25 and 15°C, but seed priming with PBZ and especially with 70 µm enhanced germination percent and rate. The highest seed germination percent was observed in 15°C and 70 µm PBZ. But, highest germination rate belonged to 25°C and 70 and 105 µm PBZ. In the second part, lower temperature did not only reduce the number of emerged seedlings, but reduced their leaf area and the number of emerged leaves. The highest chlorophyll content, soluble carbohydrates, leaf protein content were found in 25°C and 35 and 70 µM PBZ. Although in optimal temperature, 25°C, lower concentration of PBZ showed better performance, in chilling treatments higher concentrations such as 70 and 105 µm showed better reactions in wheat seedlings.

Keywords: *Chlorophyll content, Germination, Leaf area, Leaf length.*

THE EFFECT OF WATER HOLDING AND FOLIAR APPLICATION OF ZN AND MN ON ECO-PHYSIOLOGICAL CHARACTERISTICS OF THE NEW VARIETIES OF RAPE SEED (*BRASSICA NAPUS* L.)

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Abstract

Development of new canola (*Brassica napus* L.) varieties needs effective tools to monitor characteristic association in yield and its components. Water deficit stress and sufficient nutrition are the most important factors limiting yield production by changing the physiological processes of the plant. In order to study the responses of three winter canola cultivars to late season drought stress and foliar application of Mn and Zinc sulfate fertilizer on physiological, morphology characteristics and yield, a split factorial experiment was carried out in Randomized Complete Block Design with three replication in 2017-2018 at the Karaj province. Irrigation in two levels, normal and water holding at flowering stage to next, foliar application in four levels, sprayed with water (control), foliar application with zinc sulfate, foliar application with Mn sulfate, foliar application composition with zinc sulfate and Mn sulfate (each of them in a concentration of four per thousand) both in main plot and three cultivars included Nima (control) and two new lines KS7 and R15 in sob plot were done. Foliar application was applied during the stem elongation stage. When the 50% of pod appeared, the total chlorophyll and leaves carbohydrate solution content was measured as index of drought stress damage. The results showed that all characteristics were significantly influenced by water holding and foliar application. Due to water holding, increasing in soluble carbohydrates and reducing of the concentration of chlorophyll occurred. The yield components of canola?? because of irrigation disruption decreased leading to lower grain and rapeseed oil yield. In complete irrigation, foliar application of the two micro elements increased the studied traits. The results showed that water holding in flowering stage decreased the grain yield (42%), biological yield (40%), chlorophyll content (47%) and increased soluble carbohydrates (23%). Most of the seed oil content (41.5%), the weight of one thousand seeds (3.21 g) and biological yield (15675 $Kg.ha^{-1}$) were related to the main effect of zinc sulfate and Mn sulfate combination. Spraying plants with zinc sulfate and Mn sulfate improved oil content in drought stress condition in relation to spray by water (control). Among cultivars, Nima cv. had better performancesrelative to KS7 and R15 in normal irrigation. In water holding treatment, two cultivars R15 and Nima narrowly to each other had better performances relative to KS7. The water holding condition in late season may influence plant growth that can be attributed to the lose yield components. In water deficit condition, R15 can be recommended for semiarid regions due to maximum seed and oil yield among and non stress condition.

Keywords: *Canola, Micro Nutrition, Yield and component yield, Water deficit.*

EFFECTS OF MOTHER CORM WEIGHT AND NUTRIENT FOLIAR APPLICATION ON FLOWER AND CORM CHARACTERISTICS OF SPANISH AND IRANIAN SAFFRON (*CROCUS SATIVUS* L.)

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Abstract

The corm size, nutrient management and corm type are the most important factors affecting the quantitative and qualitative characteristics of saffron (*Crocus sativus* L.). In order to study the effect of mother corm size and nutrient foliar application on flower and corm characteristics of Spanish and Iranian Saffron landrace, an experiment was conducted with factorial arrangement based on randomized complete block design with three replications during two growing seasons (2013-14 and 2014-15) at Faculty of Agriculture, Ferdowsi University of Mashhad, Iran. The mother corms type in two levels (Iranian and Spanish corms), mother corm size in three levels (1-8 g, 8.1-15 g, and 15.1-23 g) and nutrient foliar application in two levels (control and sprayed leaves including K_2O: 25% and P_2O_5: 28%) were considered as experimental factors, respectively. The results showed that the effects of different mother corm size, corm type and nutrient foliar application on number of flowers, fresh flower and dry weight (stigma + style) were significant. The highest number of flowers (48.6 flower m^{-2}), fresh flower weight (24.3 gm^{-2}) and saffron (stigma + style) dry weight (0.25 g m^{-2}) were obtained in 15.1-23 g mother corm size, and the lowest were obtained in 8g > mother corms. In contrast, nutrient foliar application had not significant effect on total produced daughter corms. However, the highest number of flowers (43.7 flower m^{-2}), fresh flower weight (21.8 gm^{-2}) and dry saffron weight (0.23 g m^{-2}) were obtained from Iranian corms in the second year. Hence, the use of appropriate weight for planting Iranian mother's corms (over 15 g) with application of foliar application can be useful for increasing the performance of the flowers and saffron corms.

Keywords: *Corm size, Nutrient foliar application, Corm type, Saffron yield.*

ADVERSE EFFECT OF LATITUDE ON PHENOLIC ACIDS AND ALKALOIDS BIOSYNTHESIS IN *LITHOSPERMUM OFFICINALE*

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Abstract

Lithospermum officinale is a well-known member of Boraginaceae because of its polyphenolic content. Its extract (CAS 90063-58-4) is used for cosmetic purposes and the infusion of the leaves of *L. officinale* and its relative species *L. rudrale* has been suggested for treatment of thyroid disorders. However, the co-occurrence of pyrrolizidine alkaloids such as senecionine severely restricts its use in long-term treatments. Recently, we have showed that the biosynthesis of alkaloids is retarded in the cell culture of *L. officinale* under the applied conditions. Increasing the accumulation of secondary metabolites often occurs when plants are exposed to a wide range of biological and non-biological stresses. These metabolites play an important role in adapting plants to environmental conditions and overcoming to the stresses. This adaptation was partly created by forming a wide range of phenolic compound that shield against ultraviolet ray in plants. Latitude variations are one of the most significant biogeographic patterns on Earth. It has been shown that the content of phenolic compounds and alkaloids at high latitudes has high and low values than to similar species in lower latitude respectively and vice versa. In a parallel study on *L. officinale* plants collected from its various natural habitats in Iran, we found a meaningful correlation between the altitude, phenolic and total alkaloid content of *L. officinale*. These results disclosed the adverse effect of altitude on the biosynthesis of phenolic and alkaloids in this plant.

Keywords: *Lithospermum officinale, pyrrolizidine alkaloids, Latitude, Biosynthesis.*

NUTRITIONAL PROFILE OF MICROGREENS FROM UNCONVENTIONAL GENOTYPES

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Abstract

Microgreens are an emerging class of specialty crops with really intense flavours and colours. These are young plants harvested to the cotyledonary level that can be considered as "functional foods" because of their bioactive compounds and their micronutrients. The present study reports the nutritional characterization of microgreens obtained from unconventional genotypes rich in omega 3 fatty acids, like purslane (*Portulaca oleracea* L.), chia (*Salvia hispanica* L.), linen (*Linum usitatissimum* L.) and soy (*Glycine max* (L.) Merr.). Related to bioactive compounds, high levels were observed for carotenoids, mainly lutein, β-carotene, violaxanthin and neoxanthin, in all microgreens except for soy. On the other hand, soy microgreens showed very high amounts of glutathione (1020 μg g^{-1}) and ascorbic acid (1047 μg g^{-1}). Moreover, all the microgreens showed high contents of hydrophilic antioxidants. The fatty acid profile provided interesting results as regards the amount of α-linolenic acid (omega-3 fatty acid). Fifty grams of linen microgreens could contribute with about 150 mg of α-linolenic acid (having an adequate daily intake of 1.1 g, corresponding to 0.5% of total dietary energy for a male adult, according to EFSA guidelines).

Keywords: *nutrition, microgreens, genotypes.*

OUT OF LABS: ASSESSMENT OF HYDROXYTYROSOL DERIVATIVES IN EXTRA VIRGIN OLIVE OILS BY EXTRACTION WITH NATURAL DEEP EUTECTIC SOLVENTS AND SPECTROPHOTOMETRIC ANALYSIS

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Abstract

Phenolic compounds play a key role in health and sensory properties of olive oils, as well as in their oxidative stability and shelf-life. Phenyl-ethyl-alcohols (hydroxytyrosol and tyrosol) and their derivatives are a major class of olive oil phenolic compounds, related to health claims admitted by European Regulations. Their determination involves several analytical issues. Natural deep eutectic solvents (NADES) are a green, promising class of solvents with potential applications also in analytical chemistry. A NADES based on glucose and lactic acid was used to assess the content of hydroxytyrosol (OHtyr) and tyrosol (tyr) derivatives in extra virgin olive oils. A set of 163 extra virgin olive oil samples was submitted to HPLC analysis of phenolic compounds and to liquid/liquid extraction with a NADES based of lactic acid and glucose. UV spectra of NADES extracts were then acquired and statistical analysis was performed, using calibration and prediction sample sets, to relate spectral features to OHtyr and tyr derivatives content, with both regression and classification approaches. Robust models were obtained: for labelling purposes, oils could be labelled according to health claim limits with an error of 0.6% The proposed method resulted, therefore, in a fast, green and reliable tool to assess this relevant group of phenolic compounds.

Keywords: *Olive oils, phenolic compounds, hydroxytyrosol, green chemistry, natural deep eutectic solvents.*

MONITORING THE GROWTH AND QUALITY OF JAPANESE GREEN TEA BY UAV IMAGERY

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Abstract

The area of tea plantations in Shizuoka prefecture extends 17,100 ha (2017 statistics), with 141,500 t raw leaf production, i.e., ca. 40% share of the total tea production of Japan (2016 statistics). Optimum timing for tea harvesting has been determined by farmers from visual observations based on their experience and knowledge. The estimation of yield and growth diagnosis of a tea plantation with the prediction of chemical component in live tea leaves without any physical contact or destructive measurements are challenging. As previous studies have mentioned, remote sensing techniques to predict the growth status of crops in a farmland are important topic for promotion of precision agriculture. The vegetation activity index of spectral reflectance characteristic on a degree of absorbing in red and reflecting in near infrared wavelength ranges, has been used in various studies as an indicator for predicting growth of crops. We examined relations between some chemical components and 12 spectral difference indices using from green to near infrared wave length ranges, tested as indicators for estimating of the quality of live tea leaves. Images were taken at the study site by using a multi-spectral camera mounted on a UAV during the first-crop tea growing season. As results, the fact that NDVI value increases from April 29th to May 10th and NDVI value on the day before harvesting ranges between 0.6 and 0.7, the optimal harvesting timing can be estimated when the NDVI value of tea leaves become between 0.6 and 0.7. Some of the free amino acids, which are the quality indicators for tea quality, are discovered to have correlations between multispectral indices from drone images, i.e., positive correlation between the anine and NGreDI ($r = 0.54$, $p<0.01$), positive correlation between glutamic acid and NRreDI ($r = 0.6$, $p<0.01$), negative correlation ($r = - 0.73$, $p<0.01$) between aspartic acid and NDVI, and negative correlation between serine and NreRDI ($r = - 0.45$, $p<0.01$). Above results indicates that in-situ tea leaf components can be monitored in tact and widely by drone imagery.

Key words: *quality, green tea, Japan.*

EFFICACY OF MULTILAYER CROPPING ON FIG PRODUCTION IN ARID CONDITIONS OF KUWAIT

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Abstract

An intercropping experiment to assess the influence of intercropping on the growth and performance of figs in a multilayer system of planting was laid out in Randomized Block Design comprising of two treatments with six replications in two sites. The two treatments were fig plants intercropped with or without vegetables. The results of the study revealed that date palm +fig +vegetables multitier system exhibited better performance, which has been reflected in the significant ($p<0.05$) increase of the soil nutrients, growth parameters and fruit quantity and quality than the fig plants without vegetables. Based on these results, it could be concluded that intercropping technique in date palm plantations along with figs and vegetables resulted in maximizing the use of unit land.

Key words: *Inter-planting, irrigation, date palm, microclimate, vegetables.*

INFLUENCE OF FERTILISER NORMS AND TYPES ON TOTAL NITROGEN CONTENT IN REED CANARY GRASS DRY MATTER

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Abstract

Perennial grasses are essential for agricultural production sector in Latvia. Nature and extent of winter damage on grasslands highly depends upon the climatic conditions, moreover they have effect on both persistency and yield. Nitrogen is harvest-limiting element. Almost all investigations showed that, under optimal application of nitrogen fertilizers, harvest increases regardless varying and contrastive environmental conditions. Total nitrogen content in RCG (*Phalaris arundinacea* L.) dry matter varied between 0.77 and 2.27%, while the average indicators are recorded for RCG varieties ’Pedja’ (1.33%), ‘Bamse’ (1.35%) and ‘Marathon’ (1.33%). Application of higher fertiliser norms resulted in slight changes in total nitrogen content. Research aims at evaluating influence left by fertiliser norms and types on RCG dry matter.

Key words *Phalaris arundinacea* L., *fertiliser norms, nitrogen content , dry matter.*

CAPER PRODUCTION UNDER DIFFERENT IRRIGATION REGIMES IN THE NORTHERN BEKAA PLAIN IN LEBANON

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Abstract

The young flower buds of caper (*Capparis spinosa* L.) are greatly appreciated as a seasoning condiment and in traditional medicine. In Lebanon, caper is spontaneously widespread in degraded and arid soils. Cultivation of the crop is likely to play an important role for the socio-economic improvement of farmers and herders. The study conducted in Northern Bekaa, Lebanon, with an annual precipitation less than 200 mm, aimed to investigate the effect of different irrigation regimes and the complete drought on growth and flower buds production of *Capparis spinosa* L. Plants of Amara ecotype micro propagated at LARI were planted at a distance of 2 m between plants and 2 m between plant rows. Four irrigation treatments T1, T2, T3 and T4 were studied. The first treatment T1 (rainfed) has been used as a control. T2 (200 l/plant/season), T3 (360 l/plant/season), and finally T4 (720 l/plant/season). Results showed a significant difference between the total number of flower buds/plant among the different treatments ranging between 921.75 for T4 and 325.8 for T1.The mean weight of flower bud and the total weight of flower buds/plant revealed significant differences between T1 and the other three treatments. However these differences were not significant between T2, T3 and T4. The highest yield, 760 Kg/Ha was obtained under the treatment T4, followed by T3: 569 Kg/Ha, T2: 377 Kg/Ha and T1: 186 Kg/Ha. Obviously, T2 treatment showed a better performance in terms of Water Use Efficiency (WUE) with a value of 0.68 $kg.m^{-3}$ in respect to T3 (0.48$kg.m^{-3}$) and T4 (0.34$kg.m^{-3}$). Consequently, the growers of the Northern Bekaa plain could decide how to make a compromise between increasing caper yield and available irrigation water. Growing caper locally offers opportunity to increase economic benefit to Lebanon in semi-arid region.

Key words: *Caper flower buds, Semi-arid regions, Water Use Efficiency.*

THE POSSIBILITY OF THE USING SOME GENERA OF FUNGI AS A BIOLOGICAL CONTROL FOR ROOT- KNOT NEMATODES (*MELOIDOGYNE INCOGNITA*) IN LABORATORY AND GREEN HOUSE IN EL – BAIDA REGION – LIBYA

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Abstract

Five (5) fungi (*Arthobotrys* sp, *Aspergillus niger*, *Fusarium* sp, *Trichoderma* sp, *Paecilomyces* sp) were tested using their extracts on root-knot nematodes (*Meloidogyne incognita*). The data of results showed the significant effects of five fungi extracts on the juvenil 2 (J2) mortality compared with control. The most effective one on this stage was extract of *Arthobotrys* sp followed by *Trichoderma* sp (75%, 69% respectively). However, the extract of *Paecilomyces* sp was the highest in reducing eggs hatching (12%) compared with control (67%). When estimated the effect of thees fungi extracts on root-knot nematodes on Tomato c.v. Rio-Grand in green house,the results demonstrated that there was significant reduction in galls index, egg mass, number of eggs, number of females in roots, nematode in soil, final population and reproduction factor (Rf). Also these fungi extracts were more effective in reducing nematodes population rate with allow percent (15,23,23, 17, 15%) for *Arthobotrys* sp, *Aspergillus niger*, *Fusarium* sp, *Trichoderma* sp, *Paecilomyces* sp. compared with Vydatenematicide and control (14%, 62% respectively). Moreover, these tested fungi extracts had no side effect on growth rate of tomato plants and their efficiency in control of nematode was Approximately equal toVidatenematicide.

Key words: *Fungi, extracts, Nematodes, green hous, Libya.*

MONITORING AND EVALUATION OF IRRIGATED AGRICULTURE IN THE NORTHWESTERN REGION OF LIBYA

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Abstract

The present trend of continuously expanding irrigated agriculture under severely limited water resources and arid climatic conditions, as it is the case in most of the North African and Middle Eastern countries, has raised several questions related to its potential sustainability in achieving the desired objectives of economic efficiency, environmental integrity and social equity. An intensive investigation has been undertaken to assess the negative impacts of irrigated agriculture in the Northwestern region of Libya. A total irrigated area of 90 thousand hectares has been cultivated with more than 15 major crops with a total irrigation water demand of no less than 730 million cubic meters per year (m^3/y). The analysis of water samples and hydrological data collected from more than 90 wells representing the whole region clearly shows that groundwater resources are depleting at an alarming and increasing rate. The negative economic and environmental impacts of this excessive groundwater depletion have been reflected in severe water level and piezometric head declines, intensive and extensive irreversible seawater intrusions, deteriorating water quality, soil salinization, exposure to nitrate pollution and reduced crop productivity. To prevent any further deterioration, the gap between the renewable water supplies of 200 million m^3/y and the agricultural water demand of 730 million m^3/y must be closed through the diversion of no less than 500 million m^3/y from phase two of the Man-made River Project (MRP) at the cost of 0.34-0.83 US$/$m^3$. This water supply will have to be subsidized, however, since irrigated agriculture is unable to pay back even 10% of this cost. The other alternative is to limit the irrigation water demand to the renewable water supplies through the importation of virtual water, reducing the irrigated area and the cultivation of crops that have the highest economic crop water productivity values. The results of this investigation recommend that unless immediate measures are implemented with competent managerial skills, sustaining any reasonable level of irrigated agriculture in this region is unattainable.

Keywords: *Groundwater depletion, seawater intrusion, soil salinization, unsustainable irrigation.*

THE IMPACT OF LIGHT PENETRATION INTO CANOPY AND SEASONALITY ON PHOTOSYNTHETIC INDICES IN APPLE TREE LEAVES

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Abstract

The aim of this study was to analyse the impact of light penetration into canopy and the effect of distances between technological tools and seasonality on photosynthetic behaviour. Apple tree cultivar 'Auksis' was grafted onto super-dwarfing rootstock P22 and planted at different distances (from 0,25 m to 1 m in rows, while space between rows was 3 m). Photochemical reflectance and plant senescence reflectance indices were measured at two heights: 1.0 – 1.2 m above ground and 1.8 – 2.0 m above ground; specific leaf area, fresh and dry weight were evaluated from all the canopy. Strong positive correlations were determined between photochemical reflectance index and plant senescence reflectance index in higher and lower levels of the canopy. Strong negative correlations were determined between photochemical reflectance index and plant senescence reflectance index and between specific leaf area and dry and fresh mass ratio. Increasing density between apple trees from 1 m to 0.5 m led to increase in photochemical reflectance index and specific leaf area, but plant senescence reflectance index decreased. Meanwhile, seasonality had significant impact on specific leaf area formation and dry to fresh weight ratio. Dry and fresh weight ratio increased by 5% in autumn compared to summer. Our results indicated that with decreased light penetration into canopy photochemical reflectance index decreased, but plant senescence reflectance index increased. Moreover, in autumn, trees prepare for winter by storing more nutrients and leaves accumulate more dry mass.

Key words: *apple tree, seasonality, light penetration, planting density.*

STIMULATION OF SECONDARY METABOLITES BIOSYNTHESIS IN PLANTS BY COLD PLASMA AND ELECTROMAGNETIC FIELD

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Abstract

Seed treatment with non-thermal or cold plasma (CP) or electromagnetic field (EMF) improves agricultural performance of crops, leads to stimulation of germination, biomass production, and disease resistance. However, a detailed molecular mechanism of mentioned effects is still missing, preventing the possibility of controlled modulation of plant. Besides of improved adaptivity and higher yield of treated plants, the quality of plant production and the concentrations of valuable secondary metabolites can be increased by CP and EMF. We reported, for the first time, that seed treatment with physical stressors led to substantial increase in amounts of chemical constituents and antioxidant activity in leaves of medicinal plant *Echinacea purpurea*: the amount of cichoric acid increased up to 3.8-fold, amount of vitamin C – up to 1.9 fold, and radical scavenging activity - up to 2-fold. CP and EMF had strong stimulating effect on steviol glycosides (SGs), used as natural sweeteners, accumulation in *Stevia rebaudiana*. The concentration of rebaudioside A, the most preferable of SGs as sweetener without bitter aftertaste, was increased 1.5-fold and the concentration of stevioside, the second most abundant SG, was increased 7-11-fold depending on treatment duration. Seed treatment with CP induced substantial changes of the amount and ration of izoflavones formononetin and biochanin A (BA) in leaves of *Trifolium pratens*. Therefore, it can be concluded that short time pre-sowing treatment of seeds with CP and EMF can be a powerful tool for the enhancement of biosynthesis/accumulation of secondary metabolites in plants and can have an economic benefit.

Keywords: *Pre-sowing seed treatment, Cold plasma, Electromagnetic field, Plant improvement.*

ANALYSIS AND CHARACTERISTICS OF THE NEW VIRGINIA HYBRID LINES IN CMS FORM

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Abstract

V-88/09 CMS F1, V-120/15 CMS F1 and V-79/09 CMS F1 are male-sterile hybrid lines of Virginia tobacco created during 2009-2017 at the Scientific Tobacco Institute-Prilep by inter-varietal hybridization. Following the previously obtained data on their characteristics, they were included in the comparative trials carried out in the experimental field of Tobacco Institute –Prilepin 2012-2016. Foreign tobaccos were included in the trial as check varieties. Throughout this period, the lines V-88/09 CMS F_1, V-120/15CMS F_1 and V-79/09 CMS F_1showed better bio-morphological and production traits in comparison with the check varieties. It allowed them to overcame all other lines and varieties included in the trials. The time of flowering, the length of the growing period and the stalk height in these lines are characters typical of Virginia tobacco. Excellent results were obtained with regard to yield and quality (average price USA $ / kg) and to the gross income (USA $ / ha). In most of the traits, these lines exceeded the control varieties and achieved statistical significance level of 1% and 5%. The purpose of this paper is to inform the domestic and general public with the achievements in this area, in hope to raise their attention and interest. Data presented here shall recommend these lines to be enrolled in the National list of varieties.

Key words : *tobacco, Virginia, line, traits.*

EVALUATION OF ANDROGENIC COMPETENCE OF DIFFERENT PEPPER, TOMATO AND EGGPLANT GENOTYPES

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Abstract

The methods of biotechnology such as androgenesis introduce new possibilities for faster creation of new varieties or at least faster development of improved genotypes with desirable traits that can give an answer to new abiotic and biotic challenges in agricultural production. Androgenesis is a method that opens possibilities for development of haploids and spontaneous dihaploids plants via anther culture. *In vitro* anther culture utilized for gaining haploid/dihaploid plants serves as a tool for improvement of some solanaceous crops such as tomato, eggplant and pepper, but it always faces obstacles for high productivity of regenerants in those crops. In the present study, androgenic competence of 3 pepper genotypes (Edita, Bela Duga and Homera), 3 tomato genotypes (Bellfort, Rally and Policarpo) and 1 eggplant genotype (Domaci srednje dugi) were evaluated. The pepper anthers were cultured according to the method developed by Dumas de Valux *et al.* (1981), tomato anthers were cultivated according to Corral-Martínez *et al.* (2011), while eggplant anthers were cultivated according to Dumas de Valux and Chambonnet (1982). The experiment showed that androgenesis was successfully implemented only in pepper genotype Edita, whereas the eggplant genotype did not show any response to anther induction media. Cultivation of anthers from all tomato genotypes resulted only in callus formation. Our results are one more confirmation that androgenesis applied on pepper, tomato and eggplant has its limitations and the successfulness of androgenesis depends on many factors as growing conditions and donor plant age, donor plant genotype, microspore developmental stage, culture media and cultivation conditions.

Keywords: *Androgenesis, Anther culture, Capsicum annuum, Lycopersicon esculentum, Solanum melongena.*

IMPACT OF PASTERIZATION ON THE QUALITY OF POMEGRANATE JUICE FROM "HICAZ" VARIETY FROM THE REGION OF NORTH MACEDONIA

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Abstract

Originating from Iran and the surrounding area, pomegranates have been cultivated for thousands of years yet are still considered emerging crops although well noted for ancient uses and cultural importance. Pomegranates contain a number of functional compounds that are responsible for beneficial health properties. Polyphenolic compounds are primarily responsible for these benefits and include phenolic acids, flavonoids (e.g. anthocyanins), and tannins. These compounds have shown effects in many studies including those related to cardiovascular, anti-inflammatory, anticancer, and antidiabetic conditions. The object of our study was to investigate the impact of pasteurization on the quality of pomegranate juice from "Hicaz" variety from the region of North Macedonia. The pH value and total acidity of the juice were not affected by pasteurization. There was no significant differences between those two parameters in fresh and pasteurized juice. However, all other parameters were significantly affected. The level of citric acid was almost double in fresh juice from "Hicaz" variety of pomegranate (781 mg/L) in comparison with pasteurized juice (402 mg/L). The amount of total anthocyanins was higher in fresh juice (598 mg/L) in comparison to pasteurized juice (537 mg/L). In addition, total phenols were higher in fresh then pasteurized juice (3367 mg/L and 3196 mg/L respectively). Opposite to this tendency, the total catechins were higher in pasteurized (50.1 mg/L) than fresh juice (44.9 mg/L). The pasteurization strongly affected the color of juice. The intensity of the color, the hue and the yellow color were higher in fresh juice. Opposite, the red and blue colors were more intense in pasteurized juice. The results from our study lead us to conclusion that pasteurization influenced significantly the quality of pomegranate juices from "Hicaz" variety.

Key words: *pasteurization, organic acid, total phenolic compounds, anthocyanins, catechins.*

REVALUATION OF NATIVE CORN TO FACE ENVIRONMENTAL CHANGE

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Abstract

Each sowing with improved maize moves to the native maize (MN). Producers accept them for their good performance under favorable conditions, but this behavior in rainfall agriculture is not certain. It is known that the genetic diversity within the MN ensures a certain yield under droughts in Mexico, so the objective of this work is to analyze the flowering stage in blue MN (MNAz) under the rain variations and point out its advantages under that tension environmental. Three locations (Loc) were planted with MNAz of 14, 16 and 18 rows, in which the dynamics of flowering and yield were recorded. Within each corn, there were cobs of different rows, predominantly those of 16 in the three locations. In 2018, in the eastern region of Tlaxcala, Mexico, agriculture suffered losses due to droughts of 30 and 45 days, causing economic damage to the country. Under these conditions, in Loc1 the yield of MNAz1 was 4,431.4 kg/ha and in MNAz2 2,213.7 kg/ha; in Loc2 with MNR/N it was 3,911.8 kg/ha and in Loc3 with MNAz3 it was 1,076.5 kg/ha. The performance is explained by the dynamics of female flowering under drought, through characters of escape to drought. In Loc1 the prolificity index was 0.92 in MNAz1 and 0.64 in MNAz2; in Loc 2 of 1.2 and 0.54 in Loc3. The improved corn yields between 0.1 and 0.8 ton/ha locally, which stimulates the MN to improve.

Keywords: *Native blue corn, female flowering, rain, prolificity index.*

POTENTIAL OF RHIZOGENESS OF HARD WOOD CUTTINGS OF SOME UNIFOROUS FIGS VARIETIES (*FICUS CARICA* L.)

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Abstract

The paper presents the results of the exogenous application of various concentrations of indole-butyric acid (IBA) and alpha-naphthyl acetic acid (NAA) on a percentage of spinning in four fig species. The research was carried out in a protected area (plastic bottle) in Podgorica, in 2018. Various effects of the exogenous application of phytotohormones IBA (1000 and 2000 *ppm*) and NAA (1%) on the efficacy of rhizogenesis of cuttings of fig species, which can be fruited during the vegetation (Cuticle, Dryer, Zimnica, Sultan Selim), was noted. The lowest average spinning values were found in cuttings that were not treated with phytohormones (control) in all studied fig varieties and then with cuttings treated with NAA (1%). The best cropping of mature figs was recorded using IBA at a concentration of 2000 ppm and it was for all varieties of sight (85.80%), and the worst sprains were registered in cuttings not treated with phytohormon (68.50%). Among the examined fig varieties, in all applied treatments, the variety Rezavica was best sorbed (83.15%), and the Sultan Selim variety was the worst scouring (74.00%). The increase in the percentage of matured cuts was observed in all tested varieties, in proportion to the increase concentration of the IBA solution. The analysis of the variance and the LSD test showed statistically significant differences between the studied fig species, where the success of the rhizogenesis depended on the type and concentration of the phytohormones with which the cuttings were treated and the genotype of the variety. The use of the IBA solution (2000 *ppm*) proved to be the best in the process of rhizogenesis and as such can be recommended in the production of seedlings of figs on their own roots.

Key words: *fig, variety, cuttings, phytohormon, scarring.*

EFFECT OF WATER STRESS ON CLEMENTINE PRODUCTION AND QUALITY IN TRIFFA BASIN (MOROCCO)

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Abstract

The Triffa basin in Morocco, with a strong vocation for the production of Clémentine de Berkane, is affected from time to time with a significant water deficit. The future of Clementine cultivation under these conditions of water shortage is, therefore, dependent on the need to rationalize the use of water mobilized for irrigation. The objective of this trial was to evaluate the effect of moderate water stress on Clementine production. For this purpose, a comprehensive three-repetitive random unit test was installed in 2017. The irrigation variants considered were T0 (irrigation according to the producer's strategy generally based on an increase in daily doses), T100 (irrigation according to the climatic demand as defined by the Penman-Monteith method adjusted to the conditions of the crop), T80 (irrigation according to T100 reduced by 20%) and T60 (irrigation according to T100 reduced by 40%). Differentiation between irrigation variants occurred between fruit set and harvest. Water was supplied through drip irrigation on a daily basis. Controlled parameters were vegetative growth, yield, number of fruits per tree, fruit weight and diameter and fruit quality (% juice, ° Brix, total acidity and juice pH). The results showed that, on one hand, it was possible to reduce irrigation water consumption by 20% compared to climate demand without affecting the yield and main quality parameters of clementine and, on the other hand, it was not useful to increase the irrigation inputs as practiced through the T0 variant.

Keywords: *Clementine, Water stress, Yield, Fruit quality, Parameters.*

ESTIMATION OF HETEROSIS AND HERITABILITY OF SOME YIELD AND GROWTH CHARACTERS OF BREAD WHEAT (*Triticum aestivum L*) VARIETIES IN WUDIL, NIGERIAN SUDAN SAVANNAH

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Abstract

This Experiment was conducted at Kano University of Science and Technology Wudil, Gaya research farm under irrigated condition for two (2) consecutive cropping seasons to estimate the heterosis and heritability of five (5) different bread wheat varieties. The treatment consists of five (5) different bread wheat varieties namely, ATILLA (AT), BORLOUG (BO), SERI (SE), REYNA 28(RE) and PAVON (PA) and each treatment was replicated three times using randomized complete block design (RCBD) with space isolation. The mean average for plant height, number of tillers per plant, number of spike per plant, number of grain per spike, number of leaves per plant, length of the spike, length of the root, weight of grain and 1000 grain weight revealed highly significant difference among genotypes and crosses. The maximum heterosis and heritability were recorded in AT X SE (13.89cm) and RE X PA (97cm) for plant height, AT X RE (25.9) and BO X PA (90.0) for number of tillers per plant, BO X PA (29.86) and BO X PA (90.0) for number of spikes per plant, PA X RE (8.71) and BO X RE (95.7) for number of grains per spike, SE X RE (1.89cm) and BO X RE (96.7cm) for length of spike, BO XAT, BO X SE and AT X SE (11.11cm) and BO X SE (87.5cm) for length of roots, AT X SE (74.0g) and AT X RE (93.3g) for weight of grain per spike and BO X SE (9.16g) and BO X SE, AT SE (86.5g) respectively. It should be concluded the cross combination of BO X AT recorded a better agronomic performance and greater mean values, yield and weight and showed a significant positive heterosis and very high to moderately high heritability. Thus the hybrid combination could be recommended for yield improvement and biological production enhancement of wheat plant.

Key Words: *Heterosis, Heritability, Bread Wheat, Yield and Growth Characters.*

PHENOTYPIC AND MOLECULAR SCREENING OF FIVE CASSAVA (*Manihot esculenta* CRANTZ) POPULATIONS FOR RESISTANCE TO MOSAIC DISEASE

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Abstract

Five cassava populations developed at University of Ibadan, Nigeria in 2016 were screened for resistance to cassava mosaic disease (CMD) during the seedling evaluation trial at 1, 3 and 5 months after planting. Dry leaf samples of the genotypes were shipped to BecA-ILRI hub, Nairobi where they were screened for CMD2 gene conferring resistance to the disease in cassava using six molecular markers linked to the gene. The PCR products were prepared for capillary electrophoresis and microsatellite data analysis (allele sizing) of the output of capillary electrophoresis was carried out using GeneMapper® Software Version 4.1. The markers found to be polymorphic between the resistant and susceptible checks were used to select resistant genotypes. Correlation between the phenotypic and marker data was estimated. Based on CMD Severity Score, between 53 and 82% of the progenies were resistant across the five populations with an average of 70.5%. About 70% of the progenies were identified to be resistant to the disease across the five populations with a range of 62 to 80% using the marker data. The correlation coefficients between the marker data and CMDSS in the five cassava populations ranged between 0.2089 and 0.3326. With the marker data and CMDSS combined, 40 to 60% of the progenies in each population with an average of 52% were identified to be resistant to CMD. The resistant genotypes identified with potential for other desirable traits were selected for evaluation at advanced trial stage thereby shortening the period required for the breeding programme.

Keywords: *molecular markers, cassava mosaic disease, seedling trial stage, capillary electrophoresis, microsatellite data analysis.*

ACCESSING THE BENEFITS OF PRECISION AGRICULTURE IN SUB-SAHARAN AFRICA

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Abstract

The United Nations estimates that sub-Saharan Africa, with a population growth rate of over 2%, will be inhabited by over 2 billion people by 2050. Population increase over the years has not been marched by commensurate increase in food production in this region. This is mainly because farm holdings are small (usually less than 2 ha).Agriculture is mainly rain-fed, there is limited use of improved seeds and other inputs, there is reliance on traditional intelligence when deciding on timing for farm operations, and these are other constraints. Consequently, total agricultural imports have continued to rise. With the high level of poverty in the region, importation of agricultural commodities is definitely not sustainable. The enlargement of food production capacities will require the adoption of precision agricultural practices that are able to optimize the effectiveness of inputs, and guarantee sustainable management of natural resources. Although precision agriculture has been considered a high tech practice, there are associated low cost and low technological tools that can raise productivity and increase efficiencies at the smallholder farm levelin sub-Saharan Africa. The adoption of precision agricultural practices, however, has to be done within the context of the size of farm holdings, and the prevailing cropping systems. It should benefit farmers who, because of high cost and limited access to credit, make use of low levels of agricultural inputs. Precision agricultural practices which are informed by crop characteristics and need, soil characteristics, and climatological conditions, result in the efficient use of resources. Consequently, greater returns are likely with improved yields, while the farmlands will be sustainably cultivated with minimal degradation.

Keywords: *sub-Saharan Africa, rain-fed, precision agriculture, smallholder farm, food production.*

EXPLOITING THE NUTRITIONAL POTENTIAL OF MINOR FRUITS OF RAWALAKOT TO DIVERSIFY THE FOOD CHOICES OF INDIGENOUS COMMUNITIES

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Abstract

The world is suffering due to the double burden of malnutrition i.e., under-nutrition and over-nutrition which is increasing day by day. Lack of dietary diversity and changing climatic scenarios are paving the way for this severe problem. There could be many solutions to address this acute problem. However, using indigenous minor fruit species could be the cheapest and sustainable solution to tackle this issue locally as well as globally. To understand the existing barriers which are hindering to unlock the full potential of these fruits, the present study was designed. To explore the nutritional potential of some selected minor fruits such as quince, autumn olive, black raspberry and wild olive grown in Rawalakot, were collected and analysed. The selected fruits were analysed for their physical and nutritional composition in order to priorities their edibility for indigenous people. Various samples of selected fruits were collected from different villages of district Poonch. Data was analysed for physical parameters such as, fruit diameter, total weight of fruit, fruit colour, fruit firmness, chemical properties such as vitamin C, total soluble solids, total ash content, titratable acidity, pH and antioxidant properties such as total antioxidants and total phenolics. The results showed that there is a huge potential of these crops to be promoted for commercial scale cultivation. However, further efforts are required to establish certified nurseries, small scale value addition plants and a supply chain system for these fruits.

Keywords: *Indigenous fruits, hidden hunger, micronutrients, sustainable nutrition.*

INDOL-3-ACETIC ACID RESCUES PLANT GROWTH AND YIELD IN SALINITY STRESSED TOMATO (*LYCOPERSICON ESCULENTUM* L.)

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Abstract

Soil is a medium for plant growth, providing support, minerals and water to the plant for survival. Soil salinity declines availability of water to the plant, affects micro-organisms growth, and water drainage capacity of soil, which adversely affects plant growth and development. In present work the effect of Indol-3-acetic acid (IAA) on growth and yield in salinity stressed tomato (*Lycopersicon esculentum* L.) was studied. Salinity levels (0, 30 and 60 mM of NaCl) were applied to the soil and IAA concentrations (0, 100 and 200 ppm) were sprayed on the plants after ten days of salinity treatment. The statistical analysis showed that salt stress conditions adversely affected plant height, branches plant^{-1}, stem diameter, fruits plant^{-1}, fruit diameter, fruit length, total chlorophyll content, root length, root fresh weight, roots dry weight, and yield plant^{-1}, while IAA application to salinity stressed tomato plants rescued the plants and hasd significantly positive effect on growth and yield of tomato plants. In the light of above results, it is concluded that foliar application of IAA may rescue the salinity stressed tomato plants.

Key word: *Abiotic stress, NaCl, Salinity stressed Tomato plants, IAA.*

THE ROLE OF SUPPLEMENTARY IRRIGATION FOR FOOD PRODUCTION IN A SEMI-ARID COUNTRY PALESTINE

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Abstract

Palestine consists of the West Bank and the Gaza Strip. The proclaimed state of Palestine has a land area of 6,657 km³. Water is always considered as an essential factor of life and development in arid and semi-arid countries. In Palestine, the total per capita water consumption is 139 m³. The total available water for irrigation is 239 MCM which is responsible for irrigating only 330,000 dunums out of 2,314.000 dunums cultivated that can be irrigated if water is available, i.e. 5% of the total cultivated land. The average rainfall is 450 mm and unfortunately there is no any water harvesting structures i.e. dams. Most of this rainwater flows towards the Dead Sea or the Mediterranean Sea as waste. So, harvesting this water in individual farmer's land and using this water for supplementary irrigation to irrigate olive trees, almonds, grapes and cereals will be of a great impact on the Palestinian land for feed production. It should be noted that there are few farmers who practice supplementary irrigation for production of vegetables that are planted in summer as individual initiative. The quantity and quality of production that they have is extremely tangible. Since most of the land in Palestine is planted by olive, grape, and cereals, supplementary irrigation should be introduced and practiced where the production of wheat irrigated by by treated wastewater was three times that under rain fed planting. Reuse of treated wastewater for irrigation as supplementary irrigation will increase the irrigated area in Palestine and will replace the fresh water that can be used for domestic purposes.

Keywords*: Palestine, Irrigation, Economics, Supplementary, Irrigation, Food Production.*

BREEDING VEGETABLE ROOTSTOCKS TOWARD COPING WITH BIOTIC AND ABIOTIC STRESSES

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Abstract

In Palestine, cucumber (the second important vegetable crop after tomato), is usually grown sexually using their own seeds. Recently, its cultivation is facing some serious problems such as soil-borne diseases, salty soil conditions, drought, etc. To alleviate such problems, grafting is highly recommended. Toward this end, an experiment was conducted to study the effects of different squash rootstocks on growth, yield and quality of cucumber. Cucumber (var. Kareem) was grafted on four squash rootstocks (A-113, A-184, USA and Salah-2) using tube grafting technique (with 20 replicates), in addition to the control. The trial was set-up in a single-span greenhouse located at Hebron University campus, supported by drip irrigation system. All of the necessary cultural practices (irrigation, fertilization, spraying, ventilation, etc) were made. Different growth parameters, yield component and quality were regularly measured. In general, Rootstock A-148 presented significantly higher production (kg) and acceptable appearance (dark green color, symmetrical, regular), comparing to the other examined rootstocks and the control as well. Furthermore, Rootstock A-148 and the control (Kareem) presented earlier flowering and accordingly earlier production by 15 days compared to the other examined rootstocks. Dry weight of the total rooting system of A-113 rootstock was significantly higher than the other evaluated treatments, followed by USA and A-148, respectively. In contrast, the control revealed the lowest value. In conclusion, A-148 rootstock could be efficiently used as a promising rootstock for cucumber cultivation in Palestine.

Keywords: *Cucumber, breeding, grafting, biotic & abiotic stresses.*

FLORISTIC BIODIVERSITY AND PHYTOGEOGRAPHICAL STUDY IN FEW SITES OF GAZA STRIP, PALESTINE

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Abstract

The plant diversity in Gaza strip was analyzed at four different sites representing the major types of ecosystem. The research was based on studying the floral diversityin terms of biological spectrum (life form), growth habit form, bioclimatic (phytogeography), and family compositions. In terms of life form, Therophytes predominated our findings (64%), followed by Phanerophytes (13%) and Hemicrptophytes (12%) were the last. Regarding the growth habit, it was clear that the annual herbs were abundant scoring (65%), followed by perennials (14%), shrubs and subshrubs (9%), and trees (7%). According to Phytogeography and Chorophytes, the analysis showed that Mediterranean elements were dominant (30%), followed by M-I-T (Mediterranean and Irano-Turanian) with 19% of the results, and the Sahari-arabian (8%). Species belonging to 52 families were recorded within the stipulated period that was from November, 2014 until the end of November, 2015. The analysis showed that the Compositae was the most abundant family with 34 species, followed by Leguminosae including 26 species and Poaceae consisting of 19 species. The *Trifolium* genus was the most abundant one with 6 species followed by Erodium with 5 species. In this study, more than 15species were newly recorded, and were not mentioned in the previous, yet, similar studies. Also, several species were recorded in the aforementioned study and not recorded in the present study, simply due to the disturbance and in stability in the ecosystems in that area. Most of the recorded species in this study are native. Around 24 species belonging to 12 Families are recorded as introduced species.

Keywords: *life form, chorotypes, abundant, therophytes, shrubs.*

LACTUCA CRACOVIENSIS SAWICZ. – AN ETHNOBOTANICAL STUDY OF A NEGLECTED POLISH VEGETABLE

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Abstract

Asparagus lettuce is an unique vegetable among lettuces because of edible, thick, crunchy stem. Since many centuries, local landraces of asparagus lettuce were grown in Krakow's gardens under the name 'łoczyga krakowska' or 'głąbiki krakowskie' (*L. cracoviensis*). The aim of the study was to analyze ethnobotanical sources, namely the 16-19th century Polish botanical and horticultural literature to track the history of usage of lettuce species and cultivars as well as to explain the phenomenon of *L. cracoviensis* in Polish horticulture. The asparagus lettuce was traditionally grown in Krakow's region for many centuries, but this vegetable did not appear in leading botanical, pharmacological, and horticultural literature till the 19th century. It is puzzling because most of the authors of the 16-18th century books in the field were well-educated Krakow citizens, botanists, doctors, or editors. Florian Sawiczewski, professor of pharmacy and chemistry at the Jagiellonian University, made a scientific breakthrough, describing 'łoczyga krakowska' as L. *cracoviensis* - a species endemic for Krakow region. According to the modern taxonomy, *L. cracoviensis* Sawicz. is a synonym of *L. saligna* L. or *L. sativa* L. var. *angustana* L.H. Bailey. We can conclude that asparagus lettuce was introduced to Krakow, and gained significant economic importance because its culinary value fits well in Krakow culinary traditions. Lettuce stems were commonly fermented and eaten during spring/summer months when fermented cucumbers, very popular in Poland, were not available yet. Lettuce opium (*lactucarium*), sourced also from asparagus lettuce stem, was prescribed as a sedative and an analgesic. Up-to-date studies refer therapeutic activity to sesquiterpene lactones isolated from of asparagus lettuce roots and shoots show sedative activities. Local breeding had been conducted to create varieties of better utilitarian characteristics. In the 19th century, they were described as a separate species *L. cracoviensis* Sawicz., but now a native genome pool disappeared in a high degree.

Key words: *asparagus lettuce, endemic species, ethnobotany, genome pool, Krakow.*

APPLICATION OF NANOPARTICLES IN THE FERTILIZATION OF CROP PLANTS

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Abstract

The growing global population requires higher agricultural productivity. It is necessary to use new technologies that increase the profitability of production, while meeting the requirements of food safety and environmental protection. Nanotechnology in agriculture focuses mainly on treatments aimed at both, increasing yields and the quality of received food. The purpose of the study was to develop the new method of fertilizing crop plants with the use of nanoparticles. The laboratory investigations were provided on *Lolium perenne* L. with the use of iron nanoparticles in different concentrations. The influence of iron nanoparticles on plant growth was tested. The results of the study showed that plant fresh biomass increased after application of iron nanoparticles to soil. Moreover, the increase of plant shoots length of about 25-30% in relation to control treatment was also observed. The plant biomass and its biometric parameters were dependent on the iron nanoparticles concentration in soil. The study showed that iron nanoparticles might stimulate the plant growth desirable for agricultural productivity.

Keywords: *Plants fertilization, iron nanoparticles, Lolium perenne* L..

ASSESSMENT OF SAP FLOW TECHNIQUES AS AN AUTOMATED INDICATOR OF *VITIS VINIFERA* WATER STATUS IN THE PORTUGAL'S DOURO VALLEY

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Abstract

The Douro Demarcated Region, NE of Portugal is characterized climatically by low precipitation and high water losses due to evapotranspiration during the summer. In this sense, experiments were carried out to evaluate the effect of different water availability on the water status of grapevines and soils. In commercial vineyards, the 'Granier' thermal dissipation technique ('Moscatel-Galego-Branco' variety over 2008-09 growing seasons; 'Touriga-Nacional' variety in 2016) and the 'compensated heat-pulse' method ('Boal' variety in 2012) were used to continuously monitor sap flow within the xylem of mature vines. Weather variables, soil moisture and leaf water potentials were also measured. Clear relationships between sap flow and increased water availability, after rainfall and irrigation events, were shown. Additionally, relationships between stress indicators, such as predawn leaf water potential, were examined. Furthermore, variations of trunk and root sap flow (using 'compensated heat-pulse' method) were observed during nocturnal periods, and were associated with high vapour pressure deficits. Relative transpiration (calculated as the relationship between the sap flows of water stressed plants and irrigated vines) showed a closer relationship with predawn water potential compared to soil moisture, suggesting being a potential indicator of automated water availability. However, the requirement for a (well-watered) control plot limits its practical applicability.

Keywords: *Grapevine, Survival strategies, Water dynamics, Predawn leaf water potential.*

RELATIONSHIPS BETWEEN THE INFLUENCE FACTORS OF THE SOIL TILLAGE PROCESS

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Abstract

It is known that the soil tillage process for the sowing of the crops is one of the most important agricultural works involving both large energy consumption and high costs. The quality of seed-bed preparation influences the degree of germination and crop productivity. The soil tillage process is influenced by many factors. Usually, these factors are: pedological factors (soil texture, organic matter, clay mineralogy, soil structure, soil bulk density, moisture content, respectively: external friction, soil-metal adherence, soil cohesion, soil resistance to penetration), technological factors (forward speed, working depth, working width), and constructive factors (type of tool, geometry of tool, technical condition of tool, adjustment mode of tool). All these factors determine the mechanical energy necessary to effectuate the soil tillage process, energy which contain the following terms: energy required to cut the soil, energy required to overcome the external friction forces, energy required to move the soil, energy required to overcome the adhesion forces, energy required for displacement of the tools, and the energy required to overcome the inertia forces (if the speed of the agricultural machine is not constant). In this paper, more complex scheme of the soil tillage process and the relationships between the factors of influence are presented, with concrete application for the agricultural vibro-cultivator used in conservation tillage systems, which can make the preparation of the seed-bed for sowing in one pass with minimum consumption of energy, without causing the degradation of agricultural soil.

Keywords: *Agricultural machine, Tillage, Mathematical modeling, Vibro-cultivator.*

RESEARCH ON IMPROVING TOMATO GROWTH ON PERLITE SUBSTRATE BY HORSE URINE AND BENEFITS FOR PLANT RESISTANCE TO PATHOGENS

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Abstract

The purpose of the present research was to improve the growth of tomato plants cultivated on mattresses with perlite in greenhouse conditions using various dilutions of horse urine in nutrient solution and to increase plant resistance to pathogenic fungi mediated by the development of microbial antagonists. In the study it has been used a control variant (non-treated) and two experimental variants treated with concentrations of 4ml/l and 6ml/l horse urine. The most significant effect with the highest plants and early production was registered for the variant with 4ml/l horse urine. Microbial density in perlite estimated by plate dilution method revealed high counts of heterotrophic aerobic bacteria and microscopic fungi. Taxonomic identification carried out by morphologic criteria revealed 7 to 9 bacteria species dominated by the development of *Pseudomonas fluorescens* known as an efficient antagonist for plant potential pathogenic fungi, especially from genus *Fusarium* and 8 to 9 fungal species, generally ubiquitous (from genera *Penicillium, Acremonium, Aspergillus, Fusarium, Cladosporium*) and with high enzymatic abilities for degrading various sources of nutrients (especially cellulose). The variant with 4ml/l horse urine proved to induce the best growth of tomato plants and the most equilibrate bacterial and fungal microflora, able to sustain plant health by the biological control of pathogens mediated by antagonistic fluorescent pseudomonads and actinomycetes.

Keywords: *tomato, horse urine, plant growth, Pseudomonas fluorescens, microbial antagonists.*

STUDIES ON STABILITY OF GRAINS WEIGHT FROM PANICLE TO A COLLECTION OF OATS AUTUMN (*AVENA SATIVA* L.) GENOTYPES

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Abstract

The research tracked the behavior of the grain weights in the main panicle to a collection of autumn oat genotype. The purpose of the study was to assess the stability of this character under the influence of the climate conditions from the Western Plain of Romania. The studied collection comprised of 73 genotypes of different origins. Experimental data has been collected over three years. In statistical processing several methods of stability assessment, determining: the regression coefficients and stability, (Finlay-Wilkinson model), the variance of linear regression analysis (Hardwick-Wood model) and the variance heterogeneity (Muir model) were applied. The weight of grains in the principal panicle was influenced by the climatic conditions, the values differing from one year to another depending on genotype response. In the case of this character, 52.24% of the genotype x environment interaction was due to imperfect correlations, so that in appreciating its stability to study genotypes the results of both components could be used. Between the different models of stability assessment for this character, the studied material had a close concordance (very significant value for $\chi 2$ = 133.75). The estimates of used models, based on the ranks sum, showed that the highest stability of grain weight in the principal panicle occurred at: Carie, 4458, ARK 0151-61, 4480, Thonson genotypes. The analysis of the genotype x environment interaction revealed a high stability due to reduced interaction (less than 0.75% of total value) to: 4458, 4480, ARK-0151-61, Gerald genotypes. The studied collection includes valuable genotypes for breeding programs.

Key words: *autumn oats, stability, grains weight form panicle.*

GENETIC ANALYSIS OF CHLOROPHYLL CONTENT IN BARLEY (*HORDEUM VULGARE* L.)

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Abstract

The aim of this study is to develop a selection approach to improve the adaptability of barley (Hordeum vulgare L.) to unfavorable environmental conditions based on chlorophyll content. A semicomplete diallel cross, including four barley genotypes, was analyzed for estimating variance of genetic effects, combining ability and heritability. Diallel analysis was used to estimate the genetic action of chlorophyll content in barley and provided an opportunity to get a quick and comprehensive view of the genetic control of a set of parents in early generation.The results revealed that the highest values of "cis" and "trans" heterosis were recorded in hybrids of the Andrew x DH260/18 combination, followed by hybrids of the Andrew x Djerbel combination. The greatest potential for amelioration of chlorophyll content is represented by the Andrew x Adi,combination, which allows for the identification of approximately 7,93 % recombinant lines with a chlorophyll content of at least 40 SPAD units in downstream generations. Achieving this 95% selection threshold requires the choice of at least 36 lines and 84 lines for an accuracy of 99.9%. High values of erytability in the broad sense and low values of erytability in a narrow sense confirms that a considerable part of the variability of this indicator is due to the genotype, due to the involvement of major genes in the determinism of this character.

Key words: *barley, chlorophyll content, genetic analysis, diallèl cross.*

PRELIMINARY RESULTS ON USING CAPILLARY DYNAMOLYSIS IN ASSESSING THE EFFECT OF STRUCTURED WATER ON CUCUMBER PLANTS

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Abstract

Capillary dynamolysis or rising picture is a method widely utilized in EU countries, contributing to quality assessment of fresh foods, medicaments from medicinal plants, certification in biodynamic agriculture or to differentiation between various agricultural practices. A less studied aspect was its application to the assessment of plant quality and vitality under irrigation systems using different types of water. The aim of the present research was to use capillary dynamolysis as picture forming method for acquiring new images reflecting the vitality and biological quality of cucumber plants (*Cucumis sativus* L.) and to assess their usefulness in appreciating the effect of irrigation with structured water when compared with tap water under organic and chemical fertilization in greenhouse experiment. The results from biometric parameters measurements revealed that irrigation with structured water significantly increased plant height and fresh biomass accumulation as compared to tap water, the effect being more visible when associated with organic and especially chemical fertilization. Visual evaluation of the 6 paper images formed by capillary dynamolysis was carried out in the paper. Differences in the aspect of structural elements from both base, bowl and flag zone were observed with evidencing of a higher vital force and quality of plants by stronger, more intensely colored and better-defined images at variants with structured water. A similar pattern of image was recognized for organic fertilizers and for chemical fertilizers, too. Information derived from rising pictures analysis proved its usefulness in comparing the influence of irrigation water and fertilizing systems on quality of cucumber plants.

Keywords: *cucumber, structured water, capillary dynamolysis, biological quality, picture creating methods.*

MORPHOLOGICAL PROPERTIES OF DIRECTLY SOWED AND TRANSPLANTED SWEET CORN PLANTS CULTIVATED WITH COVERING TECHNOLOGIES

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Abstract

Aim of experiment set up in 2014 was, to investigate shortening of sweet corn growing period with application of some technological elements: propagation time, propagation method, floating row cover. The choosen variety was a conventional, very early ripening sweet corn hybrid, 'Spirit'. The following growing technologies were compared: 1. direct sowing of plants with floating row cover, early period, 2. plants transplantation with floating row cover, early period 3. plants transplantation with floating row cover, normal period and 4. direct sowing of plants without row cover, normal period (regarded as control). It was studied the influence of above mentioned technological elements on some important morphological properties of sweet corn plant: evolution of phenological phases, plant height, tassels length, ear weight, height of ear insertion.

Key words: *earliness, sweet corn, fleece covering*.

MICROMORPHOLOGICAL AND BIOCHEMICAL ASPECTS IN *MENTHA x PIPERITA* L. FOR INDUSTRIAL APPLICATIONS

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Abstract

Aromatic and medicinal plants are a natural source of volatile oils studied for the antimicrobial, insecticidal or antioxidant activity. The composition of volatile oils of the same species may vary depending on the geographical origin. The purpose of the present research was to acquire new Scanning Electron Microscopy (SEM) images on secreting tissues of *Mentha x piperita* L. plants (Romanian ecotype originated in Ulmeni, district Teleorman) and to identify the main organic compounds from biochemical composition of volatile oil, underlining their importance for utilization in pharmaceutical, alimentary or cosmetics industry. The study of secretory tissues was performed using electronic microscopy at the Research Center HORTINVEST, U.A.S.M.V. Bucharest. Separation and identification of the compounds in volatile oil was carried out by gas chromatography. NIST spectral library was utilized to identify the essential compounds and verified using Kovat's indices. Micromorphological and anatomic analysis of SEM images of leaf tissues revealed secretory structures represented by hairs with unicellular and multicellular glands. Chemical composition of volatile oil of the Romanian ecotype of *Mentha x piperita* L. included 23 compounds, most important proportion being recorded for the next compounds: alpha-terpinolene (29.80%), terpinen-4-ol (23.33%), gamma-terpinene (9.84%), alpha-terpinene (6.40%), sabinene (4.26%), cis-p-terpineol (3.97%). These volatile compounds, generally recognized as safe (GRAS), are known to confer the character of medicinal and aromatic plant and recommend its utilization in pharmaceutical industry, plant protection, food industry and perfumery.

Keywords: *Mentha, volatile oil, scanning electron microscopy, secreting tissue, chemical composition.*

THE USE OF WASTEWATER FROM THE RECIRCULATING AQUACULTURE SYSTEM FOR BASIL CULTIVATION AND ITS EFFECTS ON THE ESSENTIAL OIL COMPOSITION

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Abstract

The wastewater resulting from the recirculating aquaculture systems (RAS) is rich in nitrogen and phosphorus, which is why it could be used for plant cultivation, as a sustainable disposal management. The aim of this study was to test the effects of RAS wastewater on basil yield and essential oil quality. A green basil cultivar 'Genovese' was used for this study. Plants were divided into two groups, a control group watered with distilled water (50 ml H_2O / pot / day) and one treated with RAS wastewater (50 ml H_2O / pot / day). Chlorophyll content, plant height, lateral stems number, and the fresh biomass were assessed. The essential oil was also extracted and its composition determined by GC/FID and GC/MS techniques. The results showed that fresh biomass of basil was higher (+13%) under RAS wastewater treatment compared with control. The chlorophyll content was higher in the same group (+13%). Regarding the composition of the essential oil, 26 compounds were identified, including 8 monoterpenes, 16 sesquiterpenes and 2 phenylpropanoids. The main determined compounds were eucalyptol, β-linalool, eugenol, methyl eugenol, α-trans bergamotene, germacrene D. RAS wastewater treatment influenced the production of the main compounds as followes: -12% eucalyptol, +11% β-linalool, +1,5% eugenol, -1.9% methyl eugenol, -4.7% α-trans bergamotene and + 22% germacrene D, compared with control. This study demonstrates that the use of RAS wastewater can improve the fresh yield of basil and it can also stimulate the production of specific compounds in the essential oil.

Keywords: *Ocimum basilicum L., chlorophyll content, fresh mass, essential oils.*

IMPACT OF VIBRATORY TILLAGE ON SOIL LOOSENING

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Abstract

It is known that a better and less costlier solution for soil loosening is one of the most important topics for researchers and manufacturers, presenting a continuous challenge. This is because agricultural machines for deep soil loosening and seed bed preparation are the biggest consumers of energy in agriculture. Under the influence of natural and artificial compaction the volume of the soil is starting to reduce. The coefficient of external friction between soil and the active surface of the tool is reduced due to vibration of the working tools for soil tillage leads, depending on soil humidity and frequency of oscillatory motion. The nature of the effects of vibratory working tools on agricultural soil, materialized in great deep soil loosening, indicates the possibility of using the resonance phenomenon depending on the physico-mechanical properties and the angle of oscillation of the working tools, resulting also in the possibility of reducing energy consumption. The application of vibration sometimes allows the increase of the working speed, especially as a result of the reduced energy consumption required for the actual work. In the interaction between the soil and the tool, soil reaction and deformation mechanisms depend on the different design and geometry of the active tool, soil characteristics and soil-tool interrelations. This paper aims to evaluate the impact and furthermore the advantages of using vibratory cultivators with the possibilities of draft force reduction occurring when the system vibrates around its resonance frequency.

Keywords: *Agricultural soil, Vibratory tillage, Oscillation angle, Soil loosening.*

ECO-FRIENDLY WATER-RETAINING AGENTS AS THE BASIS FOR POTATO AGROTECHNOLOGY (BLACK-EARTH REGION, RUSSIA)

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Abstract

The sorbent, or water-retaining agent, we produced is based on the introduction of biodegradable units into the macrochain at the stage of synthesis of polymers. The sorbent granules, containing biodegradable fragments in the mesh structure, were obtained by radical polymerization in the redox environment. Bacillus sp/ microorganisms were introduced into the sorbent matrix. It also seems highly effective to use a whole complex of products for processing vegetable and animal raw materials containing starch, pectin, chitosan and other polymeric materials. They are both available and can be decomposed as the result of microbial activity into water, carbon dioxide and nitrogen derivatives. The purpose of this work was to study the effect of moisture-retaining materials on the yield of potato. The sorbent demonstrated the ability to absorb and retain moisture in the plant root area, which allowed an increase in the potato crop production. The data showed that due to the moisture retained inside the sorbent and the moisture released to the plants, it was possible to form an additional potato crop. If the sorbent is enriched with microbes Bacillus sp. and the dose of the sorbent is 20 kg / ha, it increases the yield production by 1.7. The difference of yield output in the pilot plots caused the extra water retention in the soil. The biological activity of the soil varied considerably at the experimental plots, and the figures for the catalase activity were by 1.1-1.5 higher than the control option. Thus, we could observe a tendency of the increase in its activity by the end of the vegetation season.

Keywords: *sorbent/water-retaining agent, humidity sorption, Bacillus sp, microbiological activity of the soil, barley production capacity.*

RESEARCH OF THE PRODUCTIVITY OF AGRICULTURAL CROPS WITH UNMANNED AERIAL VEHICLES

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Abstract

The results of the analytical review of the use of unmanned aerial vehicles (UAVs) in agricultural production are presented. They can be used as aerial robots that perform the function of aerial photography, transportation of technological components, such as plant protection products and perform other similar functions. On the aircraft some other functional equipment can be installed: thermal imagers, multispectral and IR cameras, etc. With the help of the data obtained from the UAV, it is possible to create an orthophotoplan or 3D model of the terrain, create a map of heights, determine the state of the field, crops and determine their vegetation indices NDVI. The multi-level classification of areas of application of UAVs in agricultural production is proposed. Classification involves the ordering of areas of application of UAV in agriculture depending on the composition in use. A conceptual model of a software package designed to obtain and process remote sensing data using UAVs in different parts of the spectrum has been developed. The software package is designed to obtain and process the results of monitoring and subsequent analysis of the totality of the calculated vegetation indices. The main research tasks solved by the develop d software, which determine its structure, are formulated. To predict the yield of different crops a method of applying the results of aerial photography in conjunction with experimental data on the biological development of crops has been developed. For the practical use of the developed methodology, a database for each culture is formed. The obtained results are used to construct regression and matrix mathematical models of the relationship of optical-spectral characteristics with the productivity of crops.

Keywords: *Agricultural crops, Productivity, Vegetation index, Monitoring, Unmanned aerial vehicles.*

BIOCHEMICAL CHARACTERISTICS OF MEDICINAL RAW MATERIALSOF MYRTUS COMMUNIS L. IN CONDITIONS OF THE SOUTHERN COAST OF THE CRIMEA

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Abstract

Myrtle (*Myrtus communis* L.) is an evergreen shrub (Myrtaceae) with a natural habitat in the Mediterranean region. In the Nikitsky Botanical Gardens (the Southern Coast of the Crimea) this culture is studied as a decorative, medicinal and essential oil plant. Myrtle leaves are medicinal raw materials. In the subtropical climate of the Mediterranean type the content of essential oil in myrtle leaves obtained by Clevenger's method (time extraction -1.5 hours) (method of Pharmacopoeia XIII) is 0.82-0.88% on a completely dry mass. Analysis of the component composition of the essential oil, investigated by GC on chromatograph firm Chromatek Crystal 5000 showed that this oil belongs to the 1.8-cineol chemotype: the relative content of 1.8-cineol is 22.05%. Myrtenyl acetate (10.17%), linalyl acetate (5.72%), D-limonene (7.34%), methylevgenol (1.14%) were also identified in the oil. Quantitative analysis of phenolic compounds carried out using HELC method on the chromatograph of Agilent Technologies (model 1100) found that the mass fraction of phenol phenolcarbonic acids (gallic and ellagic) is 3.3%, flavonoids (catechine and its derivatives, quercetine and glycosides of myricetine) - 87.3%. D-catechine, myricetine-3-O-rhamnoside and myricetine-3-O-galactoside are dominate among flavonoids. The mass fraction in the extract of D-catechine is 30.2%; myricetin-3-O-rhamnoside - 26.2%; myricetin-3-O-galactoside - 16.1%. The studies have shown that under the conditions of the Southern Coast of the Crimea common myrtle accumulates a significant amount of biologically active compounds, including essential oil of 1.8-cineol chemotype, flavonoids and phenolcarbonic acids, which allows us to talk about the prospects of using this culture as a source of valuable medicinal raw materials.

Keywords: *Myrtus communis* L., *medicinal raw materials, essential oil, 1.8-cineol, flavonoids.*

GENETIC DIVERSITY ANALYSIS OF SUGAR BEET PARENTAL LINES USING MOLECULAR MARKERS

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Abstract

The results of molecular evaluation of sugar beet lines using molecular markers are obtained. Molecular-genetic selection of sugar beet parental lines for hybridization has been performed. In this study diploid CMS lines and linesmultigerm pollinators were used. The genetic diversity of 12 sugar beet breeding lines assessed using 12 microsatellite (SSR) and 4 IRAP markers. The investigations of polymorphism of markers have resulted in selection of 2 pairs of molecular markers – Bvv 30 + Bvv 64 and Bvv 23 + Bvv 32 – as the most informative to reveal heterogeneity of starting material and effective to forecast heterosis. The PCR-analysis of sugar beet initial lines with these pairs of microsattelite primers has allowed determination of specific DNA-profiles for breeding material. Genetical distances have been determined, and the cluster analysis has been performed that allow differentiation of the studied varieties between clusters depending on genetical relationship. Parental forms are recommended for crosses in obtain highly productive hybrids. It has been revealed that crossbreeding of the lines being the most distantly related genetically plays an important part in exhibiting heterosis effect in hybrids. It is advisable to exclude hybrid combinations with genetical distance less than 1.41 from further studying in connection with low efficiency. The research findings are important for hybrid sugar beet breeding.

Keywords: *Sugar beet, PCR-analysis, microsattelite markers, IRAP markers, genetic distances, heterosis, polymorphis.*

SOWING QUALITIES AND YIELDING PROPERTIES OF SUDAN GRASS (*SORGHUM SUDANENSE*) DEPENDING ON FRACTIONATION OF SEEDS AND SEEDING RATE

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Abstract

Currently, fodder production is important in providing livestock feed and has a huge impact on agricultural production in the Russian Federation. To create a sustainable fodder base for meeting the needs of animal husbandry, an important forage crop is Sudan grass (*Sorghum sudanense*) – which is an annual plant. It has a high drought resistance, good aftermath, it is versatile to it, produces a high yield of forage with good fodder merits. Green crop reaches 35-40 tons per hectare (Shitikova, A.V., 2019). With proper cropping practices, it produces record yields among fodder annual grasses. Data on the optimal sowing rate during cultivation for feed and seeds vary from 0.5 to 5 million units per hectare (Shapsovich, S.N., 2013). In this regard, it is necessary to determine the optimal seeding rate for the Central Black Earth region. In addition, the lack of scientifically based recommendations on the preparation of seeds for sowing indicates the relevance of research aimed at improving the elements of agricultural technology of this crop. When conducting research on Sudan grass Voronezh 24, data were obtained on the dependence of the quantity of the green mass of Sudan grass, on the seeding rate and fractionation of seeds. In the conditions of the Central Black Earth region, seeds of the Sudanese grass of Voronezh 24 variety must be separated on an aerodynamic separator. For sowing, seeds of large fractions are use. The highest yield of green mass can be obtained by using the seeding rate of 2.5 million pcs / ha.

Keywords: *Sudan grass, annual grasses, seed fractionation, feed production, feeding animals.*

THE INFLUENCE OF CLIMATIC FACTORS ON THE REALIZATION OF POTENTIAL PRODUCTIVITY OF SPRING WHEAT

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Abstract

Climatic factors are decisive in the life cycle of plants. The humidity, air and soil temperatures have an indisputable influence on all vital processes of spring wheat, including formation of structural elements and realization of potential productivity. Russia's Far East is a region with difficult soil and climatic conditions: it is characterized by meadow-brown heavy loamy soils and monsoon climate with periods of drought on early stages of growing season and big amount of precipitation at the end of it. The purpose of research was to establish the influence of climatic conditions of the region on realization of potential productivity of spring wheat and formation of structural elements of yield. Large negative correlation between the sum of temperatures and productivity of wheat on early stages of growth was established (R=-0.9). At the same time moderate negative correlation was found between yield and the amount of precipitation in the beginning of plants life cycle (R=-0.58). Hydrothermal regime of the region during tillering had a great negative impact on the formation of productivity (R=-0.86), which indicates the importance of the weather conditions contribution on the initial phases of plant development. Likewise, were determined the contribution of 1000 seeds mass, number and mass of seeds per 1 spike to the level of productivity of spring wheat and the influence of climatic factors on them.

Keywords: *Spring wheat, Productivity, Structural elements, Correlation coefficient, Climatic factors.*

THE INFLUENCE OF CONTINUOUS ANTHROPOGENIC PRESSURE ON FERTILITY AND BIOLOGICAL ACTIVITY OF SOILS

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Abstract

The paper compares agrochemical and microbiological parameters of arable land (for more than 50 years involved in agricultural activity) and natural ecosystem never exposed to anthropogenic impact. The study was conducted during the growing season of 2018 on meadow brown soil of experimental field of Far Eastern Agricultural Research Institute, Russia (48°31'05.9"N 135°16'25.6"E). Indicators of soil fertility and biological activity were determined. Hydrolytic acidity and pH values were measured potentiometrically; aluminium content was measured colorimetrically with xylenol orange; organic matter (humus), humic and fulvic acids – according to the methodology of M.M. Kononova and N.P. Belchikova. The total number of CFU was determined by method of serial dilutions with consequent spread plating on agar media (nutrient agar, starch-ammonia agar). A rise in exchange acidity provided an increase in the aluminium content (Al^{3+}) in arable horizon. Intensive pressure on the soil of experimental plots led to a decrease in humus content compared to the soil of natural ecosystem by 2.69-1.68 times and to an increase in the acidity of the arable horizon by 1.4-1.1. Anthropogenic pressure had a negative effect on the number of microorganisms inhabiting the soil of agrocenoses: the content of nitrifiers was 50.2 million units / 1 g abs. dry soil in the meadow versus 11.66 million units / 1 g abs. dry soil of agrocosystem; the content of ammonifiers - 21.2 million units / 1 g abs. dry soil versus 3.14 million units / 1 g abs. dry soil respectively.

Keywords: *Agrocenosis, Nitrifiers, Ammonifiers, Anthropogenic transformation, Soil fertility.*

QUANTITATIVE PHENOTYPIC CHARACTERISTICS OF PARENT PLANTS OF SOYBEAN CULTIVAR BATYA

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Abstract

Soybean production contributes to the wide range of industries and is one of the main grain and oilseed crops in global agriculture. The task of increasing its production in Russia is of great importance. The paper analyzes the results of study of the productivity of soybean cultivar Batya plants, grown from seeds obtained from different nodes of the parent plant in Khabarovsk Kray (Russia's Far East). The yield of offspring, productivity of one plant, mass of 1000 seeds were considered. The following phenotypic characteristics were determined: plant height, number of nodes, number of productive nodes, number of pods, bottom pod attachment point. Parent plants of soybean cultivar "Batya" were characterized by high productive qualities. The average seed weight per plant was 11.7 grams, and the yield with the density of 50 plants m^{-2} was 4.67 tons ha^{-1}. With an average 1000 seeds mass of 163.8 grams, the largest mass of 1000 seeds was on 7-16 nodes, and the highest productivity was on 8-15 nodes. Studies have shown that soybean plants grown from the seeds of the lower layer of parent plants possessed the highest productive qualities. The average number of productive nodes on plants grown from lower layer seeds was 12.0, and the number of pods was 26.9. And, as a result, the average yield of plants grown from seeds of the lower layers was 4.86 tons per hectare, which is 0.67-0.7 tons per hectare higher than yield of plants grown from seeds of the middle and upper layers.

Keywords: *Soybean, Parent plants, Productivity, Plant node, Yield structure.*

PRODUCTIVITY AND BIOCHEMICAL COMPOSITION OF SOYBEAN GRAIN, DEPENDING ON THE MEANS OF PROTECTION

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Abstract

The study was conducted in 2015-2017 in order to obtain experimental data on the impact of soybean protection technologies on the productivity and biochemical composition of soybean grain. Biological and chemical agents (TMTD, Immunocitofit, Zircon, Bisolbifit, Extrasol, Nutri-Veit with water softener Spartan, liquid humic fertilizer Optimo) were studied for plant protection on the example of *Ivan Karamanov* soybean cultivar. The experimental plots were laid in cereal-soybean crop rotation on meadow-brown heavy loamy soil on the base of the Far Eastern Agricultural Research Institute (Khabarovsk, Russia). The application of pesticides and biological agents in soybean crops contributed to a statistically significant increase in soybean yield compared to control (without treatments): 1.2, 1.03 and 0.8 tons ha^{-1} on the plots where seeds and crops were treated by Zircon, Extrasol and TMTD with Optimo, respectively. The highest protein contents were observed on plots with the application of TMTD (35.75 %); TMTD with Optimo (35.72 %); Zircon (35.56 %); Extrasol (35.47 %). The largest fat content was in grain obtained from plots where seeds and crops were treated by Zircon (16.5 %).

Keywords: *Soybean, productivity, protein, fat, plant protection.*

FORMATION OF SPRING TRITICALE GRAIN YIELD IN CONDITIONS OF MONSOON CLIMATE

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Abstract

The Far Eastern region is characterized by difficult soil and weather conditions, which have no analogues in the Russian Federation and neighboring countries. Currently, only 18 cultivars of spring triticale have been entered into the State Register of Protected Breeding Achievements and Approved for Use in the Russian Federation, therefore the expansion of the cultivated biodiversity of this crop in the area of high risk farming is undoubtedly an urgent task. In this regard, the purpose of research is to study the formation of spring triticale productivity in a monsoon climate. Field experiments conducted in the 2015-2018 year period. The object of research is testing of 10 cultivars of spring triticale of various ecological and geographical origins. The soil of experimental fields is a meadow-brown podzolized-gley heavily loamy. It was revealed that in the conditions of a monsoon climate, the need for heat and moisture in certain periods of organogenesis in spring wheat and spring triticale are diametrically opposed. The correlation dependences between the grain yeld of triticale cultivars and the parameters of environmental factors are established: the sum of the temperatures of the surface air layer and the amount of precipitation. Under the conditions of a monsoon climate, productive and promising genetic sources and donors of various ecological and geographical origins were identified for their involvement in the breeding process in order to expand the biological diversity of grain crops and increase the efficiency of rational use of natural agro-resources.

Keywords: *Far East region, crop productivity, crop cultivars, Russia*.

FEATURES OF THE INFLUENCE OF CLIMATIC FACTORS ON THE CROP AND QUALITY OF GRAIN OF SPRING OATS

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Abstract

The soil and climatic resources of the Far East of Russia from all grain crops, to the maximum extent corresponds to the biological characteristics of oats. Right now soybean prevails in the structure of sown areas of this ecological zone (72%), while grain crops occupy only 17%, which leads to possible environmental disaster of the natural environment with constant monoculture growing. The purpose of this research is to study the influence of climatic factors on the yield and grain quality of spring oats. The soil of is a meadow-brown podzolized-gley heavily loamy. The standard – zoned cultivar of spring oats Express in this zone was used. According to the economically valuable characteristics, 10 cultivars were selected and analyzed. As a result of research, the correlation between grain quality of different cultivars, meteorological conditions of the growing season and main phenological phases was determined in order to improve the adaptability of oats to environmental conditions. Correlation analysis of the data obtained in the study showed the dependence of the protein content in the grain of the hydrothermal conditions of the growing season. It was revealed that in most of the studied cultivars protein content decreases, while overall grain yield increases, as evidenced by the correlation coefficient ($r = –0.99$). Most cultivars demonstrated a significant positive correlation between completeness and grain size ($r = 0.95$). Grain inner hull in oat cultivar samples is a genetically determined trait with an indirect contribution of environmental conditions.

Keywords: *Spring oat, grain yield, grain quality, correlation analysis, Russia.*

CHEMICAL COMPOSITION AND YIELD OF DILL AS AFFECTED BY METALURGICAL SLAG AND ORGANIC FERTILIZER APPLIANCE TO MARGINAL SOIL

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Abstract

Anethum graveolens L., commonly called dill, is frequently grown in herb, vegetable and flower gardens not only for harvest of its aromatic leaves and seeds, but also for ornamental display of its attractive foliage and flowers. It prefers well-drained sandy and medium loamy soils with pH in the range from 5.3 to 7.8 and highly acidic conditions could stunt its growth. Thus, a necessary lime should be applied. The aim of this study was to investigate the influence of an appliance of Ca - containing metallurgical slag from Steel factory from Smederevo, Republic of Serbia, on chemical composition of an aerial biomass of dill, through vegetative experiments performed in semi-controlled greenhouse conditions. The effects of metallurgical slag were compared to those of commercial lime material ($CaCO_3$) in combination without and with standard mineral and organic (NPK nutrient of animal origin) fertilizers. Lime material, along with metallurgical slag, particularly in combination with organic fertilizer, showed positive effects on elemental composition of dill and its yield. The contents of toxic heavy metals in herb comparing to non-fertilized treatment were not significantly increased and were within the permissible levels in plants in all the treatments in spite of their higher content in metallurgical slag. Based on the results obtained in present study, the studied metallurgical slag of the standardized chemical composition can be recommended for the wider practice toward improving the productivity of highly acid soils such as stagnosol.

Keywords: *Metallurgical slag, Commercial lime materials, Organic and mineral fertilizers, Stagnosol, Dill.*

CORRELATION BETWEEN PATHOGENICITY AND MYCOTOXIN SYNTHESIS OF *FUSARIUM GRAMINEARUM* ISOLATES ORIGINATING FROM BARLEY GRAIN

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Abstract

Barley yields are reduced by not only decrease in areas cultivated with this crop, but also by spike fusariosis. Due to this, barley production does not meet requirements of the feed and beer industry in Serbia. There are many data on pathogenicity of *Fusarium graminearum* isolates on wheat, but little work has been done to study both, isolate pathogenicity on barley and potentiality to synthesize mycotoxins. The objective of this study was to establish the correlation between pathogenicity of isolates originating from barley and their capability to synthesize deoxynivalenol (DON) and zearalenone (ZEA). Isolate pathogenicity was analyzed after Twenty two *F. graminearum* isolates, originating from barely grain and collected from different locations, were observed. Four-centimetre fragments of the initial seedling leaf were placed in Petri dishes previously overlaid with filter paper moistened with sterile water. Mid-leaf area was inoculated with 5µl conidial suspension with concentration of $1x10^5$ conidia/ml. After five days, lengths of spots developed on leaves were measured. The mycotoxicological analysis was performed after ELISA was used to determine mycotoxin concentrations according to the manufacturer's instructions (Tecna S.r.l., Italy). The interrelation of *F. graminearum* isolates with concentrations of mycotoxins DON and ZEA was established by the Pearson's coefficient of correlation. All analyzed isolates expressed pathogenicity on barley leaves. The spot size ranged from 2.06 to 37.19 mm. *F. graminearum* isolates synthesized both mycotoxins, DON and ZEA, in the concentration of 2.3-203.7 and 2.26-114.35 µg/kg, respectively. The correlation established between pathogenicity and concentration was statistically very significantly high in DON (r=0.65), while it was not statistically significant in ZEA (r=0.30).

Key words: *Fusarium graminearum, barley, deoxynivalenol, zearalenon.*

PRODUCTIVITY OF RED CLOVER-ITALIAN RYEGRASS MIXTURES ON ACIDIC SOIL DEPENDING OF THE LIMING

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Abstract

Grass-legume mixtures are important crops in the production of quality forage. Soil acidity is one of the factors which limits growth of many legumes and grasses. The aim of the study was to analyze the effect of liming (control – without CaO; 3t ha^{-1} CaO; 6t ha^{-1} CaO) an acid soil with a pH of 4.8, on the forage yield, hay yield, the proportion of red clover, Italian ryegrass and weed in the total hay yield. The experiment was performed in the period 2014-2016. The trial was set in a randomized block design with three replications and with a plot size of 5 m^2. Sowing was done on row spacing of 20 cm. In the first and third year of the cultivation, the analyzes were carried out on three and in the second year on two obtained cuts, due to drought. The total hay yield of grass-clover mixture for all of the three years in control was 36.0 t ha^{-1}, in the treatment with 3 t ha^{-1} of lime 39.607 t ha^{-1} and in the one with 6 t ha^{-1} of lime 37.279 t ha^{-1}. Soil liming had an impact on the forage and hay yield in the first cut in the second and third year of production. In drier periods of the year, soil liming influenced on the significant increase in the proportion of Italian ryegrass. However, in the wet times of the year, the stronger impact of soil liming was reported for the development of red clover, and at that time its proportion was higher.

Keywords: *forage yield, Italian ryegrass, liming, red clover, weed content.*

MOLECULAR CHARACTERISATION OF MAIZE HYBRIDS

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Abstract

Despite the huge diversity of maize germplasm, modern maize breeding programme and agricultural practices decrease the diversity of modern hybrids. Genetic characterization of maize hybrids allows knowledge of the genetic relationship among them, thus preventing the risk of increasing uniformity. Because of their high reproducibility, informativeness and easey application of microsatelites are the most frequently used molecular markers in maize genetic diversity studies. The aim of our work was to evaluate genetic diversity of maize hybrids by SSR markers and compare results with their pedigre information. Sixteen polymorphic SSR (*Simple Sequence Repeats*) markers were used to characterize 14 maize (*Zea mays* L.) hybrids belonging to different breeding programs and FAO groups (from 300 to 800). A total of 53 alleles were found, ranging from two to four alleles. Genetic similarities were calculated in NTSYSpc2 program package using Jaccard’s coefficient based on binary data (presence or absence of alleles). The highest value of genetic similarity was 0.80 between H1 and H2, while the lowest value (0.26) was found between H12 and H13. Cluster analysis was done by unweighted pair group method (UPGMA) on the basis of genetic similarity matrix. Dendrogram analysis grouped maize hybrids in one cluster (most of the analyzed genotypes), one smaller cluster and one branch. The results revealed genetic heterogeneity between analyzed maize hybrids.

Keywords: *maize hybrids, genetic similarity, SSR markers, Zea mays L.*

THE UTILITY OF AGRO-MORPHOLOGICAL DESCRIPTORS IN UNIFORMITY AND STABILITY DETERMINATION OF MAIZE INBREDS

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Abstract

Testing of maize inbred lines distinctness, uniformity and stability was done according to the UPOV (Union Internationale pour la Protection des Obtentions Végétales) markers. In this study, three-year field experiment was conducted according to Complete Randomized Block Design (RCBD), in two densities and sowing data, in two replications. Eleven visual (VG) assessed traits, eight measured (MS) morphological traits and eight yield components, as well as grain yield, were evaluated. For this purpose, previously applied Ultra Thin Isoelectric Focusing marked five inbred lines (L1 – L5) differing in genetic purity, to be evaluated in field experiment for uniformity and stability. According to visual assessment, all inbred lines observed exhibited maximum uniformity in anthocyanin coloration of glumes of cob. Poor uniformity was achieved by all inbreds evaluated for anthocyanin coloration of glume excluding base and color of dorsal side of grain. L1 inbred expressed the highest uniformity and stability for most of the traits. Both inbreds with low genetic purity (i.e. L4 and L5) showed trend of segregation for almost all the traits. Three-way Analyses of Variance (ANOVA) was used for agro-morphological data analyzing. The best performing line was L3, as the most stable and uniform. Compared to pure inbreds, results of ANOVA showed more pronounced variations in morphological traits within lines with low genetic purity. Testing of inbreds differing in genetic purity by UPOV descriptors confirmed, to a certain extent, the results considering genetic purity obtained by IEF testing.

Keywords: *Genetic purity, Isoelectric Focusing, UPOV descriptors, Zea mays* L.

VARIABILITY OF TILLERING IN WINTER WHEAT (Triticum aestivum L.)

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Abstract

Variability of length of spike and number of spikelets spike^{-1} have share in forming of grain yield of wheat. The aim of this study was estimation of variability of length of spike and number of spikelets spike^{-1} in 20 genetically divergent wheat cultivars grown in different environmental conditions. The experiment was set up as a randomised block design in three replications. Obtained results indicated differences in average values of length of spike and number of spikelets spike^{-1} among tested cultivars in both years of experiment. In average for all cultivars length of spike was higher in the second year than in first year of experiment. Also, average value of number of spikelets spike^{-1} was higher in second year at the analysed wheat cultivars. The wheat cultivar Dejana expressed the highest length of spike (12.50cm) in average in the second experimental year while the wheat cultivar Sumadinka had the least length of spike (8.91cm) in average in the first year. Based on the results was established, variability of wheat cultivars for the both analysed traits of spike, as well as, significant differences between the wheat cultivars according to length of spike and number of spikelets spike^{-1}, which are in dependence of genetic and environmental factors.

Keywords: *wheat, variability, spike length, spikelets, cultivars.*

INCREASE IN GROWTH AND YIELD OF SOYBEAN IN FIELD TRIAL BY IAA-PRODUCING MUTANT *BACILLUS* SP. CO-INOCULATED WITH *B. JAPONICUM*

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Abstract

Application of bioinoculants using plant growth promoting rhizobacteria (PGPR) as root-colonizing non-pathogenic bacteria and their metabolites can increase plant resistance to biotic and abiotic stress factors. Co-inoculation using bacteria belonging to *Bacillus* and *Bradyrhizobium* genera, as PGPR members, can lead to synergistic activity and improvement of growth, nodulation and yield of leguminous plants, as well as to better tolerance against drought as abiotic stress. Assessment of soybean (*Glycine max* L.) growth and yield enhancement by co-inoculation with *Bacillus* sp. and *Bradyrhizobium japonicum* was the aim of this study. The field trial was conducted in Vajska locality (Vojvodina, Serbia) during 2017 on 0.5 ha plot per treatment under low rainfall. Commercial fertilizer containing *B. japonicum* strain (Kf) was used as positive control, while negative control (K) was without any inoculation. *Bacillus* sp. strain Q10b (B), mutant for the production of growth stimulating IAA (indole acetic acid), and its extracellular metabolites (Em) in addition to *B. japonicum* strain 526 were used in field trial. *Bacillus* sp. strain Q10b, as induced mutant, produced eightfold higher amount of IAA than wild type strain Q10. The B, Em and Kf treatments significantly improved morphological parameters of plant growth at flowering and maturity stage comparing to K. The values of plant height, trifoliate leaf number, pod number per plant and SDW were higher for treatments B and Em than in Kf at the flowering stage, as well as grain mass per plant at the maturity stage. The seed yields of 1600 (K), 1800 (Kf), 2220 (B) and 2480 kg ha^{-1} (Em) were obtained, suggesting soybean exerted high response to IAA-producing mutant *Bacillus* sp. Q10b and its metabolites in the addition to *B. japonicum* strain.

Keywords: *Bacillus sp., B. japonicum, IAA, soybean, coinoculation.*

EFFECT OF DIFFERENT DOSES OF NITROGEN FERTILIZER AND VARIETY ON THE YIELD AND GRAIN QUALITY OF WINTER TRITICALE

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Abstract

The effect of different doses of nitrogen fertilizers and variety on the yield and grain quality of winter triticale is given in this paper. The study was carried out in the vicinity of Bijelo Polje (Montenegro) during three growing seasons (2009/12.). The research included five varieties of triticale (Odissey, Kg-20, Triumph, Rtanj and Tango) and five variants of fertilization: control (without fertilization), N_{60}, $N_{60}P_{80}K_{80}$, $N_{90}P_{80}K_{80}$ and $N_{120}P_{80}K_{80}$. The experiment was set up as randomized block system in three replications. The grain yield, hectoliter weight and 1000 grain mass were monitored. The results of the study showed that both the variety and the different amounts of nitrogen, in combination with phosphorus and potassium, had a significant impact on grain yield and its quality. The highest average grain yield and a 1000 grains mass had the variety Tango (5304.0 kg ha^{-1}) or 47.9 g, while the lowest values of these characteristics were noted in the variety Kg-20 (4366.2 kg ha^{-1} and 32.7 g). On average, for all tested varieties, the highest grain yield was obtained in fertilization with 120 kg ha^{-1} nitrogen, but it was significantly higher only in relation to the control and the variant of fertilization where the minimum nitrogen (60 kg ha^{-1}) was used. The highest average hectoliter weight had the variety Triumph (72.1 kg), and the lowest variety Kg-20 (66.5 kg). Also, it was noted that the use of fertilizers caused an increase in hectoliter weight in the tested varieties. The $N_{60}P_{80}K_{80}$ rate was found to be economically optimal for these varieties of winter triticale in this area.

Key words: *Triticale, Nitrogen, Variety, Yield.*

EFFICIENCY OF EQUIPMENT FOR CLEANING OF THE NATURAL RED CLOVER (*TRIFOLIUM PRATENSE* L.) SEEDS

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Abstract

The paper presents results of examination of various red clover seed lots of the process of cleaning on the seed processing equipment. The experiment was carried out at the seed processing center of the Institute for Forage Crops Kruševac. In the Republic of Serbia, among the perennial fodder leguminous plants, red clover (*Trifolium pratense* L.) occupies the second place immediately after the alfalfa. The seed for planting red clover crop must have high purity, germination and genetic value. These properties of red clover seeds are accomplished by processing, i.e. by removing all impurities and seeds of poorer quality. In order to achieve optimum results during seed processing, each seed lot needs to be carefully analyzed and the machines should be appropriately adjusted. The aim of the study was to show the effectiveness indicators of seed processing in the red clover seeds. The basic indicators of the efficiency of machines in seed processing were the quality and quantity of the seed obtained at the end of the seed processing. The relevant parameters that define the characteristics of seed processing machines were: pure seed (%), weed seed (%), seed of other crops (%), inert matter (%), amount of processed seed (kg), seed losses (%) and processing output (%). On the basis of the obtained results it is possible to select the appropriate equipment, as well as their correct adjustment in the seed processing, depending on the quantity and type of weeds and other ingredients found in the natural red clover seeds. Machines and devices used for seed processing were: intake pit with belt conveyor, belt conveyors, bucket elevators and the fine-cleaning machine. For the separation of weeds used a magnetic separator with rollers.

Keywords*: Relevant parameters, Machines, Red clover, Processing, Impurities.*

DYNAMICS OF FORMATION, GRAIN FILLING AND MATURATION OF SOME WINTER WHEAT CULTIVARS WITH DIFFERENT LENGTH OF VEGETATION

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Abstract

The processes of grain formation, filling and maturation, as well as timely harvesting constantly occupy attention of researchers, because the questions about the yield amounts, quality and harvest losses are closely connected with these processes. Field trial with two winter wheat cultivars was carried out at experimental station of Institute for field and vegetable crops on Rimski šančevi (Novi Sad, Serbia), with main goal to investigate biology and process of formation and maturation of grain, dynamics of yield formation and to determine the phase when the yields were the highest. We also determined the influence of temperatures on passing through a particular growth phase. The samples of plant material were taken in 10 terms according to following phases: I) the first half of grain formation, II) full formed grain, III) the first half of milk stage, IV) milk stage, V) the first half of waxy stage, VI) full waxy stage, VII) full maturity, VIII) 10 days after full maturity, IX) 15 days after full maturity and X) 20 days after full maturity. The maximum yield in cultivar Simonida was achieved at the end of waxy stage, while in NS 40S it was on the half of waxy stage. Differences between cultivars were significant in dynamics of dry matter accumulation, while differences between duration of vegetation were smaller. The yield was decreased in the period between waxy stage and full maturation in both cultivars. After full maturity, the yield continued to decrease, for 11% in Simonida and 28% in NS 40S.

Keywords: *Winter wheat, Biology of maturation, Harvest time.*

RESPONSE OF SUNFLOWER HYBRIDS TO STAND DENSITY

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Abstract

Stand density plays an important role in sunflower productivity. It is one of the basic yield components, which depends on the characteristics of hybrids and agroecological conditions of the growing region. This study investigated the influence of stand density on seed yield of six sunflower (*Helianthus annuus* L.) hybrids, created in the Institute of field and vegetable crops, Novi Sad, Serbia. In each of two years, six sunflower hybrids (NS Kruna, NS Horizont, NS Ronin, NS Romeo, NS Dukat, Sumo 1 PR) were sown in six stand densities (from 30000 to 80000 plants/ha with the increasing step of 10000). The trial was arranged as a randomized complete block design (RCBD) with three replications. Analysis of variance (ANOVA) showed that the main effects year (Y), hybrid (H), stand density (SD) and year × hybrid interaction were highly significant for seed yield. Seed yield was predominantly influenced by the hybrid (48.52%). Year contributed to this trait with 22.77% and stand density with 5.03%. Only interaction Y × H for seed yield was significant, indicating that six hybrids responded differently to varying production years. Seed yield was significantly higher in 2018 (3.86 t/ha) in relation to 2017 (3.46 t/ha).The significantly highest seed yield was stated in NS Ronin (4.01 t/ha) and NS Kruna (3.91) on the basis of average for all densities. Regarding stand density, seed yield ranged from 3.50 (SD1) to 3.76 t/ha (SD4). In average for two years the highest seed yield was achieved at 60000 plants/ha (SD4). This study showed that stand density had a significant effect on seed yield in sunflower hybrids.The results may be helpful in recommending optimal sunflower stand density in this region.

Keywords: *Main effects, Interaction, Seed yield, Stand density, Sunflower.*

SSR ANALYSIS OF MOLECULAR VARIANCE (AMOVA) FOR RED CLOVER GENOTYPES

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Abstract

Red clover (*Trifolium pratense* L.) is forage legume with multipurpose value and evaluation of its genetic diversity is fundamental for its breeding. Plant material in this investigation consisted of 46 red clover accessions that came from throughout the world and our experiment was evaluated based on a trial that was set up in a randomized block design with three replications according to the UPOV descriptor (2001). The traits of interest were following agronomical and quality properties: number of internodes (NOI), stem length (STL), yield of green mass (YGM), yield of dry matter (YDM), crude protein (CP), acid detergent fiber (ADF), neutral detergent fiber (NDF). In the evaluation of red clover genotypes that were grouped according to the agronomical and chemical traits, the genotypes were separated into four clusters. The determined sample segregation was tried to interconnect with DNA level variation. Analysis of molecular variance (AMOVA) based on 14 Simple sequence repeats (SSR) was performed to assess genetic variation within and between red clover populations that were previously clustered. AMOVA did not show statistically significant intergroup differentiation. The index of genetic differentiation (Φ_{ST}) among groups was also estimated using the AMOVA procedure and it revealed weak genetic differentiation between these four clusters. As in many other marker supported experiments, in this investigation, AMOVA showed that the larger proportion of variation resided within population level.

Keywords: *Agronomical and chemical traits, Red clover, Analysis of molecular variance (AMOVA).*

THE SIGNIFICANCE OF CLIMATE VARIABILITY ON THE PRODUCTION OF WHEAT AND RAPESEED IN SERBIA

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Abstract

Yields of wheat and rapeseed in the Republic of Serbia in the period 2011-2018 were analyzed on the basis of data on sown areas and yield taken from the Statistical Yearbook of the Republic of Serbia. The trends of planted areas and yields in the Republic of Serbia and by region of analyzed meteorological stations (Novi Sad, Kraljevo, Negotin, Valjevo, Vranje and Kragujevac) have been determined, in order to analyze the impact of climate on yields of crops. The average sown area of wheat in the period 2011-2018 was 558,823 ha, and of rapeseed 12,679 ha. A slightly better eight-year average yield of wheat was achieved in Region I (4.76 t ha^{-1}); while in Region II the yields were 3.5 t ha^{-1}. The average yield of rapeseed from one hectare of sown area on the basis of the eight-year production in Serbia was 4.27 t ha^{-1}.

Keywords: *climate, wheat, areas and yield, rapeseed.*

THE INFLUENCE OF PLANT CUTTING ON GRAIN YIELD TRAITS IN MAIZE

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Abstract

In this research an influence of the strong source restriction meaning cutting off the whole plants at the first internodes 5 (5DAPt), 10 (10DAPt) and 15 (15DAPt) days after pollination on grain yield and its corresponding traits in maize were tested. Control represented plants harvested at full maturity. Four inbred lines were used, two historical ones (Mo17 and B73) and two commercial ZP inbreds (ZPL and ZPB). The experiment was conducted at Zemun Polje, Serbia, in 2014 and 2015. The trait of particular importance was the number of kernels per ear and its average values were 37.73 at 5DAPt, 115.14 at 10DAPt and 175.20 at 15DAPt, being sufficient for planting next generation of breeding. According to the results obtained, ZPL represented an improved Lancaster line over Mo17 regarding drought tolerance, that could not be stated for ZPB over B73. Hybrid among these two lines is drought tolerant due to heterosis (epistatic effects) or dominant origin of ZPLs good response to drought stress. Values for seed set and eventually for grain yield per plant were 0.00 for line B73 at 5DAPt in 2015. An improved breeding scheme for increased drought tolerance could be proposed, namely self-pollination of border plants on high density sown selfing progenies or dihaploid (DH) lines, cutting off selfed plants at 15 DAP and evaluating their kernel properties. Open-pollinated progeny would serve to estimate other important traits for selection. From the chosen progenies kernels of selfed and cut-off plants should be used for the next generation of breeding.

Keywords: *drought, grain filling, Zea mays L.*

EFFECT OF GROWTH STAGE ON MINERAL CONCENTRATION IN THE TOP ALFALFA AND DRY MATTER YIELD

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Abstract

Mineral concentrations in forages vary greatly, and are affected by soil mineral level, soil pH, plant species, stage of maturity, and application of fertilizers or waste materials. Soil tests are not useful in determining some mineral levels and are only good at predicting growth responses from applied P and K when test levels are very low. Plant tissue test is very reliable for minerals regardless of growth stage, but is not as reliable in predicting P and K responses with alfalfa sampled from early bud to 1/10 bloom. The aim of this study was evaluating the nutrition status of the alfalfa regarding to the best results of alfalfa dry matter yield. The samples were collected at three stages of alfalfa growth: early bud, full bud and at the beginning of flowering - 10% of bloom. 40-60 stems including leaves were collected from at least 30 plants. The top third samples were discarded and dried. Top third samples were analyzed for nitrogen, phosphorus, potassium, calcium, magnesium, sodium, iron, zinc, mangan, boron and sulphur regarding to DMY (dry matter yield) of alfalfa at different stages of growth. Results of investigation showed that alfalfa top had sufficient amount of nitrogen, phosphorus, potassium, calcium, magnesium, sodium, iron, zinc, mangan, boron and sulphur in all stages of growth, but it was deficient in potassium at full bud stage and zinc at the begining of flowering.

Keywords: *alfalfa top, mineral concentration, dry matter yield.*

ESTIMATION OF YIELD STABILITY OF ZP MAIZE HYBRIDS USING DIFFERENT STATISTICAL MODELS

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Abstract

Eight ZP maize hybrids, belonging to FAO 300-400 maturity groups, were tested during the 2018. at six different environments in Serbia. All examined hybrids have been recently registered in Serbia. The aim of the study was to identify hybrids with the highest grain yield potential, as well as with high yield stability over different environments. The experiment was conducted according to Randomized Complete Block Design in three replications. For the estimation of yield stability, different statistical analysis were done: regression coefficient (bi), Shukla stability variance (ri^2), Wricke' secovalence(Wi) and cultivar superiority measure (Pi). Maize hybrids ZP 4540 and ZP 4077 showed the highest yield potential, but they also had high moisture content in harvest. Hybrid ZP 4567 had above average yield and also high stability, while hybrid ZP 3536 had average yield, good stability and the lowest moisture content in the harvest. Although hybrid ZP 4540 obtained the highest grain yield in trial, it performed unstable according to the results of stability analysis. Based on the results obtained in the experiment, hybrids ZP 4567 and ZP 3536 are recommended for further testing in 2019 and initial commercialization.

Key words: *grain yield potential, yield stability.*

SELECTION OF DIFFERENTIALLY EXPRESSED GENES IN *CENTAURIUM ERYTHRAEA* RAFN. DURING *IN VITRO* SOMATIC EMBRYOGENESIS

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Abstract

Centaurium erythraea Rafn. (Gentianaceae) represents a well-known medicinal plant rich in secondary metabolites and an appropriate model system for studying developmental biology due to its great developmental plasticity *in vitro*. One of the most unique manifestations of this characteristic in plants is somatic embryogenesis (SE), the development of embryos from somatic cells. SE initiation and progressing of the embryo through different developmental stages involves gene reprogramming and differential expression of numerous genes. Our current research focuses on characterizing novel SE-related genes in centaury tissues using next-generation RNA sequencing data and quantitative real-time PCR (qPCR). Six different centaury tissues, including embryogenic calli, globular and cotiledonary somatic embryos were subjected to ultra-high-throughput sequencing on an Illumina HiSeq 2500 platform, followed by *de novo* transcriptome assembly. FPKM (fragments per kilobase of exon model per million reads mapped) was used to evaluate *in silico* expression of functionally annotated transcripts. The generated transcriptome data were subsequently used for discovering genes with potential roles in centaury SE. Potential SE markers were excavated focusing on transcripts with greater than eight fold change in FPKM values in embryogenic tissues compared to non-embryogenic ones. Based on these criteria, twenty transcripts were chosen, four with completely unknown function. Expression analysis of selected genes was carried out by qPCR using specific primers in different embryogenic and non-embryogenic centaury tissues. Identified genes with differential expression during SE will be further characterized by overexpression and silencing in centaury.

Keywords: *somatic embryogenesis, marker genes, gene expression, RNAseq.*

Acknowledgments: This research was funded by the Ministry of Education, Science and Technological Development of the Republic of Serbia (Projects OI173024, III43010).

VARIABILITY OF QUALITY AND RHEOLOGICAL PROPERTIES IN WINTER WHEAT UNDER THE INFLUENCE OF ECOLOGICAL FACTORS

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Abstract

This research involved analyses of six genotypes of the winter bread wheat (Toplica, Takovčanka, Perfekta, Vizija, KG-56S, and Aleksandra) on the experimental field of Centre for Small Grains in Kragujevac during two growing seasons (2011/2012 and 2012/2013). The most important parameters of bread-making quality were analysed (wet gluten content and rheological flour and dough properties). Grain samples were milled using a Brabender Quadrumat Junior laboratory mill. The gluten content was determined by the standard method and rheological flour and dough properties by Brabender Farinograph. Wet gluten content of analyzed wheat genotypes varied depending on the genotype and the year. The cultivar Aleksandra had the highest value of wet gluten content in both years of investigation (35.48% and 39.03%). The analyses of variance showed highly significant differences of wet gluten content between cultivars, investigated years as well as their interaction. The lowest water absorption in the first year of study was found in Takovčanka cultivar (59.2%), while in the second year in Kg-56S (63.8%). The cultivar Vizija showed the highest water absorption in both years of studying (62.13% and 67.3%). According to the analysis of variance, highly significant differences for the water absorption were determined between genotypes, examined years and their interaction. Farinograph properties showed that flour of analyzed cultivars belonged to B_1 and C_1 quality groups in the first year, and B_1 and B_2 in the second year. The analysis of phenotypic variance indicated that the highest impact of variance for wet gluten content belonged to year, while for water absorption belonged to cultivar × year interaction.

Keywords: *wheat, quality, gluten, rheological properties.*

CHANGE IN ACIDITY AND MOBILE ALUMINIUM LEVELS IN FOREST, MEADOW AND ARABLE LAND PSEUDOGLEY SOILS

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Abstract

Acidic soils are present in over 60% of the total arable land in Central Serbia. On such land, agricultural production takes place under unfavorable conditions, where beside acidity, the high content of mobile aluminum limits the maximum genetic potential of new varieties and hybrids. Researches in this paper were carried out on pseudogley lands of Čačansko-kraljevačka basin with different purposes (meadow, forest and field vegetation). Within the forest vegetation we oppened 13 profiles 16 meadow profiles and 8 field profiles, where the content of the active and substitution acidity of the soil and the content of mobile aluminum were tested at the depth of humus-accumulative (Ah), eluvial-pseudogley (Eg) and iluvial (Btg) horizon. The results of the analyzes showed that the active acidity of the soil varied in the range of pH 4.45 to 6.10 in all open profiles, regardless of the manner of use. The state of substitution acidity of the examined pseudogleys in all three horizons (Ah, Eg and Btg) showed an acidic and highly acidic reaction, excluding the Ah and Eg horizons at the location of Jarčujak. The influence of the manner of use largely affected the substitution acidity, most notably in forest profiles. Of the 13 profiles, all showed an extremely acidic soil reaction (pH/KCl<4.5), only one profile in the Ah horizon had a pH/KCl value of 5.36. Under meadow and field vegetation, 87.5% of the profile showed a very acidic reaction in the Ah horizon, which pointed to the tendency of reduction with depth. The content of mobile Al in the soil showed a large interval of variation from 0.14 to 53.33 mg/100 g of soil, depending on the pH, location and manner of use.

Keywords: *Pseudogley, Soil profiles, Soil acidity, Mobile aluminium.*

IDENTIFICATION OF MOLECULAR MARKERS FOR FOREGROUND AND BACKGROUND SELECTION IN *Ga1-S* INCORPORATION INTO MAIZE LINES

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Abstract

Marker assisted selection (MAS) significantly increases efficiency of conventional breeding. Molecular markers are utilized as selection markers for target genes (foreground selection) and also for identification of the genotypes (progenies) with the highest proportion of recurrent parent's genome (background selection). Maize Research Institute "Zemun Polje" has a breeding program with the aim to create lines with incorporated incompatibility dominant gene *Gametophytic Factor 1-S (Ga1-S),* using the integrated conventional and molecular breeding approach. *Ga1-S* is the most described gene belonging to the group of genes specific to the pollen development, germination and pollen tube growth. The *Ga1-S* system is the most commonly used to prevent the pollination of sweetcorn, popcorn and white kerneld hybrids by standard maize. The objectives of this study were identification of gene-specific molecular marker for foreground selection, as well as the set of SSR markers polymorphic between parental lines to be used in background selection. Genetic variability between two donor and three recurrent parental inbred lines was analyzed with 42 SSRs distributed over the maize genom. Total number of alleles detected with 30 informative markers was 83, average being 2.77. The genetic similarity values calculated on Dice coefficient ranged from 0.47 to 0.71. Among 12 gene-specific markers tested on parental lines, two showed distinct polymorphism for *Ga1-S*. These markers will be used as foreground selection markers for the incorporation of *Ga1-S* into our inbred lines which will be used for the creation of white kernel hybrids.

Keywords: *Gametophytic Factor 1-S, Maize, Molecular markers, Foreground selection, Background selection.*

EFFECT OF DIFFERENT SEED TREATMENTS ON DORMANCY BREAKING AND GERMINATION OF ACER CAPILLIPES MAXIM.

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Abstract

Snake-bark maple is a small, deciduous tree that grows to 10 -15 m tall, with arching branching and a decorative bark and leaves. It is native in the mountain forests of Japan. Kyushu Maple is tolerant of frosts, smoke and urban sites. It is not invasive species and it should be planted in green spaces in Serbia, especially as an alternative to invasive plant species. For this reason, we decided to investigate possibility of rapid and easy generative propagation of this species which has endogenous seed dormancy. Seeds were collected in the Arboretum of Swedish University of Agricultural Sciences in Alnarp. During the experiment, the seeds were cold stratified in a perlite or in bags *without* a *substrate* for 15 and 30 days. Parameters of seed germination were determined according to ISTA rules. The better results were achieved with seeds cold stratified in a perlite, for the both treatments (15 or 30 days stratification). The highest germination rate and germination energy were achieved after 30 days, both were 94.0%.

Keywords: *Snake-bark maple, seed dormancy, cold stratification, generative propagation.*

THE INFLUENCE OF DIFFERENT TREATMENTS ON THE SEED GERMINATION OF COTONEASTER MULTIFLORUS BUNGE.

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Abstract

Cotoneaster multiflorus is deciduous large shrub, with long arching branches and very abundant white flowers followed by scarlet-red fruit. It is suitable for landscape use as an ornamental plant. It can grow on a clay soils, and it is considered as a drought tolerant species that make it better able to withstand *climate change*. Generative propagation of this species is difficult due to its combined embryo and seed coat dormancy. For that reason, the aim of this study was the establishing quick and effective method for generative propagation of selected elite genotypes of *C. multiflorus* that are growing in the Belgrade area. The seeds were collected in a public green spaces in Petlovo brdo, Belgrade, and after maceration, the effect of different treatments was evaluated. These treatments included the soaking seeds in *sulfuric acid* at 96 % for 60 or 90 minutes, 5 months of cold stratification at 3-5^{o}C in perlite or without substrate (naked stratification) and combinations of these treatments. The obtained results showed that *C. multiflorus requires the combination of sulfuric acid* pretreatment and a cold stratification *in a perlite for germination. The seeds treated by sulfuric acid followed by 5 months of naked stratification didn't germinate. The length of sulfuric acid treatment also influenced germination rate and better results were achieved with seeds that were soaked for 90 minutes in sulfuric acid. However, the maximum germination percentage obtained in this research was only 40%, and it is necessary* to perform additional research in order to improve germination.

Key words: *Many-flowered Cotoneaster, cold stratification, sulfuric acid, embryo dormancy.*

GERMINATION OF *CAPPARIS SPINOSA* L. SEEDS UNDER DIFFERENT DORMANCY BREAKING TREATMENTS

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Abstract

Capparis spinosa is *a spiny, evergreen shrub, that grows to 1 m tall, spreading by semi-prostrate branching to 2 - 3 m wide. It is native mostly to Mediterranean coastal regions, growing on sandy or rocky soils, stone walls and rock crevices. Its* unopened flower buds are edible and used as a flavouring in sauces or salads. Also, caper bush is an ornamental and drough tolerant species that is suitable for landscape use. Generative propagation of this species is difficult due to its seed coat dormancy, followed by embryo dormancy that develops after drying. The aim of this study was to investigate the effect of different seed treatments on dormancy breaking. The seeds collected in Perast, Montenegro, were stored for six months before setting the experiment. The treatments included: soaking seeds in *sulfuric acid* at 96 % for 15 or 30 minutes, *mechanical scarification*, hot water (40ºC) treatment, 3 months of cold stratification at 3-5^{o}C in perlite, treatment with 0.2% KNO_3. The obtained results showed that KNO_3 has negative impact on caper bush germination, and in all combined treatments, the germination rate was lower with the addition of KNO_3. The *mechanical scarification showed the best germination rate (36%), but it is necessary* to conduct the additional research in order to improve germination of dried caper bush seeds.

Key words: *Caper bush, stratification, sulfuric acid, embryo dormancy, scarification.*

THE EFFECTIVENESS OF SOIL TILLAGE SYSTEMS IN MAIZE CULTIVATION UNDER VARIABLE METEOROLOGICAL CONDITIONS OF CENTRAL SERBIA

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Abstract

Soil tillage system is a basic in maize crop production. Under variable climatic conditions and frequent occurrences of dry years, soil tillage adjusted to the soil type, agro-ecological conditions and the crop, can contribute to the achievement of the maximum yield potential. Systems of reduced tillage, particularly direct sowing, have been widely used in Europe. Under agro-ecological conditions of central Serbia, the highest maize yields have been achieved by using conventional soil tillage with 20-25-cm deep autumn ploughing and a single pass land preparation in spring as 10-12-cm shallow tillage. In the Maize Research Institute, Zemun Polje, the long-term experiment was conducted (2005-2016) in order to test the efficacy of zero-, reduced and conventional tillage together with the application of different rates of mineral fertilisers in maize cultivation. The experiment was performed under rainfed and irrigation conditions. The data were processed by four factorials ANOVA and differences were analysed by the LSD-test. Based on the precipitation sum in the investigated period, three years were extremely dry, four were moderately dry and five were favourable for maize production. Under irrigation conditions, the 12-year maize grain yield average was higher by 2.1 t ha^{-1} than under rainfed conditions. Under rainfed conditions, differences between conventional and reduced or zero-tillage were 1.7, and 1.3 t ha^{-1}, respectively, while under irrigated conditions conventional tillage was more productive by 1.4 t ha^{-1} than reduced and zero-tillage, respectively. In some dry years, such 2012, the maize grain yield was higher under conditions of reduced tillage than conventional tillage.

Key words: *Maize, Tillage system, Meteorological conditions, Yield.*

MINERAL COMPOSITION OF TWO PEPPER CULTIVARS (*CAPSICUM ANNUUM* L) FROM SERBIA AT THREE RIPENING STAGES

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Abstract

The aim of this study was to evaluate mineral composition of two commonly cultivated pepper varieties from Serbia (cultivars *Kalifornijska* and *Slonovo uvo*), at three ripening stages. Concentration of macro (K, Ca, Mg, Na) and micro elements (Zn, Fe, Mn, Cu, B, Cr, Mo, Se, Li, Al), and heavy metals (Pb, Hg, Cd, As, Ni) was determined, using AAS and ICP-MS, after microwave-assisted digestion. Relative standard deviations of AAS and ICP-MS measurements, for the most of analyzed elements, were between 0.08 - 9.28 %, indicating that precision was satisfactory. Potassium was the most abundant element in all samples, followed by Mg and Ca. Among the investigated micro elements the average content of zinc was the highest, followed by iron, for most of analyzed samples. Zinc and iron were followed by copper, manganese and boron. Semi-mature peppers of cultivar *Kalifornijska* were richer in K, Ca, Mg, Fe and Zn compared to other maturity stages. For cultivar *Slonovo uvo* results were different compared to cultivar *Kalifornijska*. The content of K and Ni increased with ripening of fruit, while the content of magnesium decreased with ripening of fruit, which was not case for cultivar *Kalifornijska*. The higher values of Mg, Fe, Zn; lower values of Ca and higher values of Cu in cultivar *Slonovo uvo* were reported by different authors for other pepper varieties.

Keywords: *pepper, mineral composition, maturity stage, AAS, ICP-MS.*

INFLUENCE OF CULTIVAR, MICROBIOLOGICAL FERTILIZERS AND GROWING SEASONS ON NITRATE CONTENT IN LETTUCE

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Abstract

Lettuce belongs to a group of leafy vegetable crops with special importance in human nutrition. Along with healthy compounds lettuce can accumulate nitrate in leaves. The purpose of this study was to examine the effects of genotype, microbiological fertilizers and season on plant weight and nitrate content in outer and inner leaves. Green cultivars (′Kiribati′, ′Aquino′, ′Aleppo′) were cultivated in a fertile soil in a greenhouse trial during three successive seasons. Microbiological fertilizers (EM Aktiv, Vital Tricho and combination of EM Aktiv and Vital Tricho) were applied in the soil before trials and foliar. In spring cultivar ′Aquino′ showed the highest head fresh weight (360.3 g). All microbiological fertilizers led to increased head fresh weight in ′Aquino′ during autumn trial. Mainly fresh weight was higher in spring and winter compared to autumn. Cultivar ′Aquino′ showed the highest nitrate content (985.4 mg/kg, autumn) in outer leaves with application of Vital Tricho. Opposite to that, the lowest nitrate content was found in inner leaves of cultivar ′Aleppo′ (35.4 mg/kg, spring) with combination of fertilizers. Generally, microbiological fertilizers significantly increased nitrate content in outer and decreased in inner leaves. In both leaves the lowest nitrate level was measured in spring season. During all trials nitrate content remained under allowed level of European Commission Regulation (563/2002) for protected lettuce.

Keywords: *Lettuce, Microbiological fertilizers, Season, Plant weight, Nitrate.*

VARIATION IN MORPHOLOGICAL AND CHEMICAL TRAITS IN RED AND YELLOW MINI WATERMELON

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Abstract

Watermelon is an annual vegetable crop from *Cucurbitaceae* family. Five mini watermelon cultivars (red-fleshed ′Faerie′ F1, ′Golden crown′ F1, ′Bonanza′ F1 and yellow-fleshed ′Sureness′ F1, ′Yellow baby′ F1) were grown in open field experiment from May to July 2018. Plants were grown on a fertile soil, covered with black mulch film, on a distance 75x120 cm. During vegetation period regular agricultural practices were applied (fertirrigation, weeding and preventive protection against diseases and pests). Fruits were harvested after 60 days from planting. The aim of this study was to examine morphological traits of five cultivars in full physiological maturity. Fruit weight ranged between 1.57-2.65 kg with the highest value in cultivar ′Sureness′. Number of fruits ranged from 20 (′Yellow baby′, ′Sureness′) to 35 (′Faerie′). Rind thickness ranged between 5.22-11.91 mm with the highest value in ′Yellow baby′. Total soluble solids ranged from 9.5-10.95 °Brix and randman between 37-49%. Among all cultivars, red-fleshed ′Bonanza′ showed the highest randman and total soluble solids (49% and 10.95 °Brix, respectively). Opposite to that, the lowest total soluble solids showed yellow-fleshed cultivars ′Sureness′ and ′Yellow baby′. Generally, yellow cultivars showed higher fruit weight and rind thickness, whereas red cultivars showed higher number of fruits per plant, total soluble solids and randman. The present study outlines that ′Bonanza′ and ′Faerie′ showed the highest quality (soluble solids content) among tested varieties.

Keywords: *Watermelon, Fruit weight, Rind thickness, Randman, Total soluble solids.*

EFFECT OF CULTIVAR AND YEAR ON YIELD AND GRAIN QUALITY OF TWO-ROW SPRING BARLEY

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Abstract

Grain yield and quality components were evaluated in four ('Novosadski 448', 'Novosadski 456', 'Dinarac' and 'Dunavac') two-row spring barley cultivars. Comparative studies were conducted during the 2008-2010 year period on the experimental field of the Small Grains Research Centre, Kragujevac. The experiment was laid out in a randomized block design with three replications on a Vertisol soil. At tillering, 50 kg ha^{-1} nitrogen was applied. Calcium ammonium nitrate (CAN) with a nitrogen content of 27% was used for top dressing. The cultivars showed significant differences in grain yield, thousand kernel weight and germination energy, and no substantial differences in protein contents. Grain yield was highest in cv. Dinarac and lowest in cv. Dunavac. The analysis of the effect of the cultivar-year interaction reveals a specific response of each cultivar to germination energy. All cultivars were found to have germination energy of above 90%. Environmental conditions had no significant effect on grain protein content. This suggests that all of the tested cultivars can serve as equally valuable raw materials in the brewing industry.

Keywords: *Spring barley, grain yield, thousand kernel weight, germination energy, protein content.*

GRAIN YIELD, YIELD COMPONENTS, MACRO AND MICROELEMENTS VARIATION ANALYSIS IN WHEAT GROWN ON SOLONETZ SOIL

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Abstract

There are more than 7.7 billion of humans at the moment. It seems unavoidable that, if it weren't any calamity, our population would be about to reaching 10 billion mouths by the mid-century. The crop production increment in developing countries relies on agricultural production intensification per area unit by 80% and the remainder on arable land expansion. Hence, the part of strategy is to seize the soil degradation and to enhance or restore productivity to degraded soils. Solonetz is a less productive alkaline soil, with high sodium content, covering about 2.1% of agricultural land in Serbia. Bread wheat, one of the main sources of plant generated energy for humans, is moderately tolerant to alkaline soil. Long term trials for studying the wheat reaction to solonetz growth conditions, has been established. The results of 11 wheat varieties and 1 triticale are given. Analyses of grain yield, its components, as well as macro and microelements storage in plants has been conducted. Varieties showed considerable variation in grain yield, plant height, spike length and weight, grain weight and number per spike. The content of selected elements (Ca, Cd, Co, Cr, Cu, K, Mg, Mn, Na, Ni, Pb, and Zn) varied in harvested plant material, as well. Pearson correlation coefficients were used to study interrelationship between observed sources of variation. Low positive correlation coefficients between grain yield and plant height were in consequence of the genetic variation generated in plant breeding program under similar selection criteria. The mutual influence within the yield components, the spike traits, was considerably higher. Away from K and Na, the variation of elements had weak to negligible influence on grain yield variation. Further analysis using ridge regression and cluster analysis showed more complex relationship..

Keywords: *wheat, yield, components, elements, solonetz.*

COMPARATION VEGETATION INDICES FROM DIFFERENT SENSORS FOR GRAIN YIELD TRAITS ASSESMENT IN MAIZE (*ZEA MAYS* L.)

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Abstract

Grain yield, as well as single yield related traits such as kernel-row number and the number of kernels per row are important traits for final grain yield of maize. The grain yield traits are influenced by several factors, either they are environmental or technological. However, methods to assess these traits are laborious and time consuming. Non-destructive and rapid estimation of canopy traits are important for predicting crop growth and managing nitrogen (N) application. Using in-season measurements of vegetation indices provided research opportunities in assessing grain yield and yield related traits, including response to abiotic and biotic stresses. Various sensors have been used to obtain the canopy spectral reflectance for crops grow monitoring. In this study the performance of two proximal sensors in field trails were investigated and compared. An active multispectral optical device named Plant-O-Meter (POM) and GreenSeeker handheld device were used to assess cultivar differences and parameters affected by different amounts of available nitrogen. In a field experiment, three high-yielding maize cultivars were grown with five different nitrogen (N) supplies of 0, 50, 100, 150 and 200 kg N ha^{-1}. Canopy reflectance of maize cultivars was measured between V5 to V8 growth stages. The results indicated thatmeasuring with the Plant-O-Meter device within this growth stage could provide early yield estimation and accurate plant canopy measurements comparable to the GreenSeeker measurements.

Keywords: *Proximal sensors, maize, yield estimation.*

THE EFFECT OF LIMING ON THE ALUMINIUM CONTENT IN A WHEAT ROOT

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Abstract

Numerous chemical factors limit normal growth of plants on acid soils. On soils with a pH ≤ 5.5, Al toxicity is a main stress factor for plants, and it is reflected through the inhibition of root growth, a numerous of damages above-ground plant organs, as well as on decreasing of solubility of important biogenic elements. Liming is one of the key measures that can maintain or increase the productivity of acidic soils. Research in the field trials, were conducted on soil type Dystric cambisol. The objective was to determine the reasonable amount of lime material required, in order to mobile Al content in the soil type Dystric cambisol to bring below the hazardous level. The aim was to determine the Al content in the roots of wheat plants, as well as plant's response to the reduction of content of this element in the soil. The three doses of hydrated lime (CaO x H_2O) have been applied in order to reduce acidity: the two were on the level of partial liming (1/3 Y_1 CaO and 1/2 Y_1 CaO), and the one as full liming (Y_1 CaO). Even in the partial liming, response of soil and wheat plants has been very strong. Compared to variants where no lime applied, by partial liming content of aluminum in the soil has been halved, and in the roots of wheat during the whole vegetation it has been multiply decreased.

Keywords: *liming, aluminium, Dystric cambisol, wheat, root.*

GENERAL COMBINING ABILITIES OF ELITE MAIZE INBRED LINES FOR YIELD AND IMPORTANT TRAITS

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Abstract

General combining abilities (GCA) is an important biometric parameter for maize that can be used to predict the contribution that the investigated genotype can give to its progeny. Six elite maize inbred lines, components of commercial hybrids and belonging to different heterotic groups were chosen for the trial. Field trials were set on three locations (Zemun Polje, Becej and Pancevo) during two years (2011 and 2012). GCA was calculated for eight different trait the most important being grain yield. Significant values of GCA for examined traits with positive and negative sign, were evaluated in both years of trials and differences were recorded both between different years and genotypes. GCA estimates for grain yield ranged from -0.870 t ha-1 for ZPL3 line in 2011, to 0.909 t ha-1 for ZPL6 inbred line. Significant values of GCA for plant height (cm) were evaluated for each inbred line except for ZPL1 in 2012 with ZPL 5 being the best general combiner for that trait in both years: 19.4 cm in 2011 and 18.55 cm in 2012. Traits that were in correlation exhibited GCA values of similar significance. Inbred ZPL6 had significant GCA values for most of the wanted traits and can be considered as such as a source of desirable alleles for maize breeding programs.

Key words: *maize, general combinig ability, GCA, grain yield, morphological traits.*

EFFECT OF DRYING ON THE CHANGE OF SUGAR CONTENT IN PLUM FRUITS

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Abstract

Drying is one of the oldest methods of preserving fruit. In the course of drying process, there is a change in some components of chemical composition to a degree depending on food type, its composition, and drying process itself. The testing was performed in three replications using plum fruits of the 'Čačanska Lepotica', 'Mildora', 'Čačanska Rodna' and 'Stanley' cultivars, at the optimum ripening stage required for drying, based on soluble solid contents. Drying was performed at the experimental dryer using the convective (streaming) drying process, at two constant air temperatures, 90 °C and 70 °C, until attaining 75% of total dry matter in the prunes. In addition to the control, the fruits were subjected to a pretreatment consisting of dipping in boiling water. This paper reviews the values of total sugars, invert sugars and sucrose in fruits of fresh and dried plums (calculated in grams per 100 grams of total dry matter), as well as the change of these parameters in prunes in relation to the fresh fruits (expressed in percentages). Drying temperature affected the change of total sugars, invert sugars and sucrose content in fruit of the tested plum cultivars. On the other side, dipping as an applied pretreatment had no effect on the change of these parameters except in the cultivar 'Čačanska Rodna', which dipped fruits are found to have higher decrease of sucrose compared with non-treated fruits. During drying, hydrolysis of sucrose occurred, manifesting in a dramatic decrease of its content in dried fruits, in relation to the starting raw material in all of the tested cultivars. Intensity of changes was conditioned by varietal characteristics.

Key words: *prune, drying temperature, dipping, invert sugar, sucrose.*

THE COMPOSITION OF POLLENIZERS FOR SWEET CHERRY (*Prunus avium* L.) CULTIVARS RELEASED IN THE REPUBLIC OF SERBIA

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Abstract

As the result of national breeding programmes, three sweet cherry cultivars have been named and released so far in the Republic of Serbia – 'Asenova Rana' and 'Čarna', developed by planned hybridization at Fruit Research Institute (FRI), Čačak, and 'Canetova', selected from natural cherry population at Faculty of Agriculture, University of Belgrade. In addition to the inadequate assortment structure, lacking in well-adapted domestic and introduced cultivars, sweet cherry production in Balkan region is generally accompanied by insufficient knowledge on gametophytic self-incompatibility, the fertilization relationship among the cultivars belonging to certain incompatibility groups, as well as phenological characteristics and synchronization during the flowering phenophase of the main cultivars and pollenizers. The assessment of an adequate pollenizer composition for 'Asenova Rana', 'Čarna' and 'Canetova' in this research is based on determined *S*-allele constitution, parameters of pollen tube growth *in vivo* in the pistils of these cultivars, and their perennial average flowering characteristics in relation to the introduced cultivars – potential pollenizers. The research was conducted in the main sweet cherry growing regions in the Republic of Serbia (West Serbia/Šumadija and region of Belgrade). It resulted in the development of a pollination scheme for in total 28 national and introduced cultivars, its application in the plant material production, and dissemination of quality national sweet cherry cultivars with adequate pollenizers. The results could also influence sweet cherry breeding work on development of genotypes with improved biological and productive characteristics, and application of modern molecular and reproductive biology methods in this research area.

Keywords: *sweet cherry, cultivars, S-allele constitution, flowering, pollination scheme.*

RESULTS OF TESTING THE SOWING AGGREGATES FOR PLANTING THE NARROW-ROW CROPS WITH CONVENTIONAL AND REDUCED TILLAGE

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Abstract

The main goal of sowing the narrow-row crops is to make the seed distribution even more uniform in the vegetation space. Specifies of sowing the narrow-row crops in interaction with the effects of sowing aggregate operations significantly influence the profitability of production, bearing in mind the fact that failures in the sowing process cannot later be corrected. The paper presents the results of testing the quality of work of various sowing aggregates on two tillage systems during sowing of narrow-row crops. The tests were carried out in the vicinity of Knjaževac, and the quality of sowing aggregates effects included the determination of the longitudinal, transverse and seed distribution along the depth of the seed bed in the sowing of winter wheat of the Sosthena variety on the reduced tillage of the Amazone D9 4000 Super sowing machine, and on the conventional tillage of the seedling machine OLT Gama 18. The obtained results showed that the planting aggregate Amazone D9 4000 Super performed better and achieved a more even seed arrangement. The highest content of grain in the transverse distribution of 67% was grouped at a group distance of 120.1 - 140 mm, while the longitudinal seed content of over 64% was in the group distance of 40.1-60 mm. The second tested aggregate obtained the uneven distribution of seeds, bearing in mind that in the group distribution 120.1 - 140 mm there were 45% of the grains, while in longitudinal 55% of the grains were within the group distance of 40.1 - 60 mm. Distribution of seed at depth with both sowing aggregates was moderately satisfactory.

Keywords: *Sowing aggregate, Quality, Seed, Distribution, Wheat.*

THE INFLUENCE OF THE BERRY SIZE ON THE SKIN ANTHOCYANINS CONTENT OF SOME BLACK WINE VARIETIES

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Abstract

The influence of the berry size on the skin anthocyanins content of the black wine grape varieties Cabernet sauvignon (clone 169), Merlot (clone 348) and Pinot noir (clone 115) was studied. Research was conducted in vineyard of Experimental estate "Radmilovac" and in the laboratory of Faculty of Agriculture, University of Belgrade. The aim of the research was the determination of an anthocyanin of malvidin-3-glucoside on the berry skin. For all three varieties, berries were separated into three categories: small, medium and large. Based on the results, the goal was to compare the berry skin anthocyanin content of different sizes of berries. Determination of fertility coefficients, yield indicators, analysis of the composition and structure of clusters and berries and the content of sugars and total acids were performed regularly. The obtained results on the content anthocyanin of malvidin-3-glucoside were expressed in mg/g skin fresh weight. Varieties Cabernet sauvignon and Pinot noir had an expected result, meaning that the highest anthocyanin content was recorded in the smallest berries (diameter < 7.5 mm). For the Merlot variety, the highest anthocyanin content was observed in the medium berries (diameter 7.6 – 10 mm). The lowest anthocyanin content in varieties Cabernet sauvignon and Merlot was obtained in the largest berries (diameter > 10.1 mm), which was the expected result, while in the Pinot noir variety the lowest anthocyanin content was registered in the medium category (diameter 7.6 – 10 mm). Variety Cabernet sauvignon (clone 169) showed the highest anthocyanins content (average 6.871 mg/g fresh skin weigh), followed by Merlot variety, clone 348 (average 4.61 mg/g fresh skin weigh), whereas the lowest anthocyanin content was observed in Pinot noir, clone 115 (average 4.05 mg/g fresh skin weigh).

Keywords: *variety, clone, berry, berry skin, anthocyanins.*

LENGTH OF THE ONE-YEAR-OLD BRANCHES AND CATKIN POSITION ON THEM AFFECT QUANTITY AND MORPHOLOGICAL CHARACTERISTICS OF STAMINATE FLOWERS IN WALNUT

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Abstract

The influence of the length of the one-year-old branches (under 5 cm, 13-17 cm and above 25 cm) and the catkin position on these branches (basal, middle and terminal) to the number of staminate flowers per catkin, the number of stamens per staminate flower and the number of stamens per catkin was studied. The number of staminate flowers per catkin amounted to 56-123 (average 95.4). From the base to the top of the branch, the number of staminate flowers per catkin increased. The highest average number of stamens per staminate flower was found in catkins on the branches 13-17 cm long (20.8), and the smallest in the branches under 5 cm long (17.8). In the catkins at the base of the branches, the staminate flowers contained the smallest number of the stamens (on average 17.8), while in the catkins in the middle and the terminal zones of the branches the staminate flowers contained an average of 19.4 and 19.9 stamens respectively. The number of stamens per catkin ranged from 1120 to 3075 (average 1825.6). The largest number of stamens per catkin was determined on the branches 13-17 cm long (2001.6), and the branches up to 5 cm in length had the fewest stamens per catkin (1617.4). From the top of the branch to its base, the average number of anthers per catkin decreased from 2084.5 to 1503.3.

Keywords: *Juglans regia, stamen, male inflorescence, plant reproduction.*

EFFECT OF GIBBERELLIC ACID (GA3) ON SEED GERMINATION AND SEEDLING GROWTH IN WALNUT (*JUGLANS REGIA* L.)

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Abstract

The hand cracked and uncracked seed of walnut cultivar 'Elit' was soaked in water (as control) and in solutions of GA3 having concentrations of 20 ppm and 200 ppm, for 24 and 96 hours. The seed treated with gyberellin had a significantly higher germination percentage (83.5-84.7%) than the water-treated seed (50.2%), but the concentration of GA3 did not significantly affect seed germination. The seed treated with gyberelin had significantly higher germination energy than the seed that was immersed in water. Cracking seed did not show a distinct positive effect to the germination. The length of shoots and the main roots of the three-week-old seedlings were significantly higher in the variant in which the seed was treated with gyberelin. The obtained results in this study provide a basis for defining an optimal pre-sowing treatment of walnut seed in order to shorten the period of seed stratification and improve seed germination and seedling growth.

Key words: *seed, growth, walnut.*

THE EFFECT OF TEMPERATURE ON POLLEN GERMINATION OF TWO WALNUT CULTIVARS

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Abstract

The research was carried out in 2014 and 2015. The influence of temperature (10°C, 15°C, 20°C, 25°C and 30°C) on pollen germination of two walnut cultivars (G139 and Elit) was examined. The cultivar and the temperature both showed a significant effect on pollen germination. Conversely, the year did not affect germination. The least germination of the pollen in both cultivars was at 10°C. The average pollen germination rates over the two years were 5% and 11.6% for the G139 and Elite cultivar, respectively. The highest pollen germination rates were at 25°C, with G139 cultivar having 34.1% and Elite 44.4% germinated pollen grains. The influence of temperature on pollen germination of the studied walnut cultivars is presented in the form of graphics of the fitted cubic functions, based on the average values over the two years of research. The results highlight the issue of the temperature impact on the walnut pollen germination, emphasizing that the minimum temperature for walnut pollen germination is not 14°C (as commonly accepted) and suggesting the possibility that there are genotypes of walnut whose pollen can germinate at temperatures lower than 10°.

Keywords: *Juglans regia, Geisenheim 139, Elit, minimal temperature, cubic function.*

IDENTIFICATION OF *S*-ALLELES IN SOME INDIGENOUS SWEET CHERRY GENOTYPES GROWN IN OHRID REGION

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Abstract

Sweet cherry (*Prunus avium* L.) is one of the major fruit species grown in the Ohrid region. The assortment is primarily based on the indigenous genotype of 'Ohridska Dolga Šiška', which is characterized by very useful biological and agronomic properties that provide high economic value, and which is surrounded with sporadic trees from the other local genotypes for which the growers believe that they are good pollenizers. As the origin of these old genotypes is uncertain, and cases of homonyms or synonyms might occur, a reliable identification is required. Since sweet cherry exhibits gametophytic self-incompatibility, controlled by the multi-allelic *S*-locus that prevents self-fertilisation, determination of *S*-alleles of indigenous genotypes is an important step in molecular characterization that is also of enormous significance for growers and breeders to choose appropriate pollenizers in the orchard aiming to the efficient production of fruits and planning crosses in developing new cultivars. The paper presents the results of identification of *S*-alleles and incompatibility group in eight Macedonian indigenous sweet cherry genotypes [four genotypes of 'Ohridska Dolga Šiška' (ODŠ), two genotypes of 'Ohridska Crvena Krcka' (OCK), 'Ohridska Brza' and 'Ohridska Crna'] collected in the Ohrid region. The use of the polymerase chain reaction (PCR) with consensus primers for the second introns (PaConsII-F and PaConsII-R) of *S-RNase* and allele-specific primers revealed the following *S*-allelic constitutions in the assessed genotypes: S_2S_4 ('OCK-1'), S_3S_9 ('Ohridska Brza'), S_3S_{12} ('ODŠ-O1', 'ODŠ-O2', 'ODŠ-S1' and 'ODŠ-S2') and S_4S_x ('OCK-2' and 'Ohridska Crna'). Based on the obtained *S*-allelic constitutions, the assessed genotypes have been assigned to incompatibility groups XIII, XVI and XXII.

Keywords: *Prunus avium, autochthonous genotype, S-allelic constitution, incompatibility group.*

YIELD AND CONTENT OF STARCH AND PROTEIN IN THE SEED OF THE QUINOA GENOTYPES PUNO AND TITICACA

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Abstract

Quinoa (*Chenopodium quinoa* Willd.) is considered as a very important agricultural crop due to its nutritional value and tolerance to different stress factors. The aim of this study was to investigate the differences in yield, the content of starch and protein in the seed of two introduced genotypes of quinoa (Puno and Titicaca) and the possibility of their cultivation in Serbian agroecological conditions. The experiment was carried out during the 2017 growing season in the rain-fed condition in Subotica, Republic of Serbia. The seeds were sowed in the first part of April. Sowing was done at a depth of 2 centimeters, the distance between the rows was 50 cm and between the plants in the row 5 cm. The crops were harvested in the first half of August when quinoa seeds were mature and the amount of moisture in seed was 12%. The harvest of Puno and Titicaca seeds was made by hand. The content of crude proteins was determined according to the Kjeldahl method, while for starch measurement the Ewers polarimetric method was used. Obtained results showed that the yield of plants Titicaca genotype (24.4 g/plant) was higher compared to the yield of plants Puno genotype (21.3 g/plant). Our results did not show significantly different values in protein content between the seeds of Puno (14.1%) and Titicaca (14.0%). Also, the seeds of Titicaca and Puno contained similar starch content (54.1 and 55.6%, respectively). These results indicate that both investigation genotypes can be grown in Serbian agroecological conditions.

Keywords: *Quinoa, yield, seed, starch, protein.*

SOIL PROPERTIES AND QUALITY GRASSLANDS OF THE MUNICIPALITY OF IVANJICA

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Abstract

In the total agricultural area of the Municipality of Ivanjica, natural grasslands predominate and they are present at about 64.3% of these surfaces. Depending on the way and intensity of the use in the soil, dynamic processes are taking place that lead to changes in structure, fertility, and microbiological activity. Microorganisms are key players in the cycling of organic matter and nutrients, their activity contributes to a wide variety of soil ecosystem functions, including and the emergence of soil structure. They are the most numerous group of organisms in overall metabolic activity of soil and represent good indicators of soil health, since they respond quickly to changes in soil ecosystem. The total number of microorganisms represents one of the indicators of the biogenicity of soil. Chemical composition of soil and the total microflora, as well as the floristic composition of 15 natural grasslands were determined. Examined soil samples had humus contents ranging from 1.43 to 4.85 % and acidic chemical reaction, except for one sample which pH was KCl 6.55. The total number of microorganisms ranged from 5.602 to 6.322 (log of number) of absolutely dry soil. The examined grasslands have different percentage of presence of grasses, leguminous and plants from other families.

Keywords: *total microflora, floristic composition, grasses, legumes.*

BOTANICAL COMPOSITION AND FORAGE QUALITY OF NATURAL GRASSLANDS OF PEŠTER HIGHLANDS

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Abstract

Improvement of animal feed production and animal husbandry, particularly beef and sheep production, is interrelated with natural and sown meadows and pastures in hilly - mountainous region. High quality of forage has positive effect on profitability of milk and meat production and it is prerequisite for improvement and reduction of costs in livestock production. Because of that, the main role of grassland is to ensure a supply of livestock production as a source of healthy and safe animal food and that way they have strong contribution to rural agricultural and economic development. Grasslands in this area are preserved from the use of large amounts of mineral fertilizers and chemicals for plant protection, because of what production of healthy and safely animal food, with minimal investments, is still possible. The presence of useful and high quality species in grasslands enables the production of high quality biomass. One of the possibilities for improving the quality of biomass is to increase the percentage of quality plant species in grasslands. For this reason, research was carried out on the territory of the Pešter highlands were is collected 61 samples from natural grasslands on altitude of 1200 to 1300 m and determined botanical composition and dry matter quality. Natural grasslands analyzed in these research had an unsatisfactory botanical composition and low quality of dry matter. From analyzed samples, 54.1% showed low dry matter quality with less than 8% of the crude protein content, 37.7% samples contained 8-11%, and 8.2% samples contained 11-14% of crude protein.

Key words: *natural grasslands, botanical composition, quality, crude protein content.*

PRECEDING CROPS AND PRODUCTIVITY OF CORN

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Abstract

Corn can be cultivated in different production systems, such as perennial monoculture, as well as in perennial crop rotation system, usually in wheat-corn cropping system. In order to provide control of weed and various diseases and pests, crop rotation is recommended, since 10% higher corn yields can be achieved. A field experiment was carried out in the agro ecological conditions of Šumadija (Rača Kragujevačka), on vertisol soil type. The preceding crops were alfalfa and corn, while the tested corn hybrid was PR 1214 AM. The results of the experiment showed that larger number of harvested plants and corncobs (35.3 and 33.3%), rows of kernels on the corncob (by 4.3%), as well as larger number of grains on the corncob (by 6.8%) were detected on the plots with corn as a preceding crop compared to the plots with alfalfa. Based on these results, it can be concluded that alfalfa does not have an advantage as a preceding crop for cultivating corn. These results can also be linked to the extremely dry season during the year that preceded the setting up of the experiment.

Keywords: *corn, productivity, preceding crops.*

NUTRITIVE CHARACTERISTICS AND ANTIOXIDANT ACTIVITY OF PSEUDOGRAINS

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Abstract

Amaranth (*Amaranthus sp.*, Amaranthaceae), quinoa (*Chenopodium quinoa,* Amaranthaceae) and canihua (*Chenopodium pallidicaule,* Amaranthaceae) are pseudograins originating from South America. They are widely used in the diet as well as chia seeds (*Salvia hispanica,* Lamiaceae) from South America and wheat (*Triticum aestivum*, Poaceae) and millet (*Panicum miliaceum*, Poaceae), characteristic for our climate. The aim of the study was to determine the nutritive characteristics, phenolic content and antioxidant activity of commercial samples of pseudograins (amaranth, quinoa and canihua) from our market, as well as a comparative analysis to chia seeds, common and khorasan wheat and millet. Basic nutritive value parameters and mineral contents were assessed for pseudograins and chia seeds. The content of total phenolic compounds (TPC) and total flavonoid compounds (TFC), antioxidant activity by DPPH and FRAP tests were determined for all samples. The results of the nutrient composition indicates that analyzed pseudograins are good sources of proteins (13.39%) and unlike chia seeds are characterized by relatively low fat content (5.97%). Analyzed pseudograins contain calcium, magnesium, zinc and iron in a significant amount. The highest TPC content was observed in chia seeds (395.7 mg GAE/100 g), following canihua (327.4 mg GAE/100 g), quinoa (161.9 mg GAE/100 g), common wheat (61.8 mg GAE/100 g), Khorasan wheat (51.1 mg GAE/100 g), while the lowest content was identified in millet (32.9 mg GAE/100 mg). TFC content was in a range from 0.001 % (common wheat, khorasan wheat) to 0.099 % (canihua). Antioxidant properties of pseudograins were lower compared to chia seeds, but similar to common wheat and khorasan wheat while even higher comparing to millet.

Keywords*: pseudograins, chia, millet, wheat, phenolic compounds, antioxidant activity.*

VARIABILITY OF CAROTENOIDS AND TOCOPHEROLS CONTENT IN MAIZE INBRED LINES

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Abstract

Maize assumes worldwide significance owing to its utilization as a human food and livestock feed. Besides high yield as the most important goal, production of hybrids with better nutritional properties is also of great importance. Developing maize varieties with improved grain quality traits can be achieved through breeding, which involve the use of natural genetic variation existing in the breeding pool. The aim of this study was determination of carotenoids and tocopherols content as well as insights into genetic diversity in set of maize inbred lines. Twenty-one maize inbred lines with different kernel type (dent, flint, sweet corn, popcorn) and kernel color (yellow and orange) were evaluated under RCB design with two replications in Zemun Polje during 2017 and 2018 and their seed carotenoid and tocopherol content were determined by high-performance liquid chromatography. Analyses of maize inbreds revealed wide genetic variation for lutein and zeaxanthin (14.94–39.21/14.30-38.19 μg/g), β-carotene (1.95–15.34/1.40-14.03 μg/g), α tocopherol (3.95-18.0/ 3.72-17.70 μg/g) and γ tocopherol (18.25-88.05/20.97-88.60 μg/g) in 2017 and 2018, respectively. The highest value of β-carotene had inbred line P21, L+Z one sweetcorn inbred line and α –tocopherol GR-9. Also, cluster analysis based on 21 SSR primers polymorphism was done. A total of 134 alleles were detected with average number of alleles 6.3. The dendrogram consisted of two clusters, each cluster was composed of several sub-clusters. Most sub-clusters comprised genotypes belonging to different kernel type/color groups. The line with high content of particularly micronutritients may be used in breeding program to improve nutritional value.

Keywords: *carotinoids, genetic diversity, maize, tocopherols.*

THE EFFECT OF CYTOPLASMATIC MALE STERILITY ON YIELD AND YIELD COMPONENTS OF MAIZE INBRED LINES

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Abstract

Initial studies related to cytoplasmic male sterility (CMS) were performed by Rhoeds in 1931. CMS is used in maize to enhance efficiency of seed production with simultaneous cost redaction. The majority of studies showed positive effects of CMS on maize grain yield. Grain yields recorded male sterile plants were higher by 5-10% than the ones in female fertile plants. Seven maize inbred lines of different origin and growing season were analysed. Each inbred was analysed in five variants: original inbred (N), CMS-C, RfC, CMS-S and RfS. The aim of this study was to compare grain yields and yield components of original inbreds and their CMS and Rf variants. The highest yields of observed inbreds (5.303 and 5.197 t/ha) were recorded in those with C and S cytoplasm, respectively. According to the LSD test, at significance levels of 0.05 and 0.01, the longest ears of 15.57, 15.56 and 15.46 cm were detected in inbreds with original, S and C cytoplasm, respectively. The highest kernel row number (12.98) at both significance levels was established in inbreds with C cytoplasm. The highest number of kernels per row (33.92) at both levels of significance was recorded in inbreds with S cytoplasm. The greatest kernel depth (0.8212 and 0.8196 cm) at both significance levels was established in inbreds with C and S cytoplasm, respectively. The greatest 1000-kernel weight at both levels of significance was detected in inbreds with normal cytoplasm. The highest number of kernels per m^2 (2716 and 2676) was recorded in inbreds with C and S cytoplasm, respectively.

Keywords: *maize, yield, male sterility, inbred lines.*

MINERAL ELEMENTS TRANSLOCATION AND RELATIVE YIELD AND YIELD COMPONENTS TOLERANCE IN WHEAT GROWN ON SOLONETZ SOIL

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Abstract

The Green Revolution had great, but ambiguous impact on food production. Though it has increased agricultural output dramatically, the loss of a third portion of arable land due to erosion or pollution has been going on, as well. Moreover, the similar selection preasure, as it seems, has led to nutritionally inferior crops, engendering malnutrition, and even a stand that we live in a toxic food culture. The narrowing of genetic variability, and industrialized, unsustainable food system, made a modern diet as a leading risk factor for diseaes development. Increased demand for nutrients and health-safe food in the situation of the exponential growth of human population represents a some of heavy challenges to agriculture. The utilization of less productive soil in wheat production, as well as, the studies of nutritional and toxic elements dynamics in vegetative and generative wheat plant parts is given in the article. The trial has been conducted on solonetz soil. The phenotypic varietal variation of the yield and yiels components (plant height, spike length and weight, grain weight and number per spike) in 11 bread wheat and the one triticale genotypes was followed, as well as, the source to sink dynamics of 13 selected elements (B, Ca, Cd, Co, Cr, Cu, K, Mg, Mn, Na, Ni, Pb, and Zn). The varietal ability to endure abiotic stress growth conditions of solonetz was estimated through the relative tolerance index obtained by comparing a phenotypic variability of particular trait for each genotype in sample with corresponding phenotype variation of two standards, wheat varieties Renesansa and Pobeda, grown in normal, intensive production conditions of the experimental fields of the Institute of Field and Vegetable Crops in Rimski Šančevi. Notable variation has been found and commented in the article.

Keywords: *wheat, solonetz, yield components, tolerance index, chemical elements.*

QUALITATIVE ANALYSIS OF SUNFLOWER SEEDING IN REDUCED SOIL TILLAGE USING PRECISION AGRICULTURE SYSTEM

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Abstract

Reduced tillage has impact on the economical agricultural production. The secondary effect is manifested through the effective implementation of the basic frameworks of sustainable agricultural production. Support to the above concept in the field is represented by applied precision farming systems in accordance with the principles of good agricultural practice. The entire agricultural production technology is supported by agricultural machinery, which exploitation is a pillar of sustainability. Using precision agriculture technologies, it opens up new opportunities in analyzing the quality of sowing of row crops. An analysis of sunflower seeding was performed. The random sample system extracted data from big data records collected from over 18 parcels and an area greater than 380 ha. The average seed population had a coefficient of variation from negative 23% to positive 60% in relation to the given seed rate. The average number of well-planted seeds (single seeded seed, ISO index) ranged from 86.6% to 94.6%. The average number of double seeds (ISO Multiple index) ranged from 1.7% to 8.6%, and the average number of blank places (ISO Miss Index) ranged from 1.4% to 7.1%. Due to the large deviation and the characteristic cyclic repetition of the error in a big data sample, it was concluded that the sowing did not meet the required planting quality standards. The cause of the unacceptable planting quality is caused by poor exploitation of the soil tillage machine. The advantage of using precision farming systems, acquisition and then Big Data analysis is significant from the aspect of profitability of agricultural production. The registered error at the beginning will ensure the quick and effective detection and removal of the cause.

Keywords: *planting, precision agriculture, reduced tillage, sunflower, big data*.

A PROTOCOL FOR *IN VITRO* PROPAGATION OF RED RASPBERRY

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Abstract

Considering the problems in raspberry production in Serbia, Fruit Research Institute, Čačak initiated controlled production of '*Meeker'* and '*Willamette'* planting material by micropropagation using nuclear stock produced according to the Certification scheme for *Rubus*. To develop a method for efficient *in vitro* propagation of these genotypes special attention has been devoted to optimization of initiation and acclimatization stages. Surface sterilization of initial explants included different combinations of disinfectants ($HgCl_2$ or commercial bleach solution each combined with ethanol) and their exposure time, that were applied during a four-month period (May–August) in 2018. The highest rate of initiation in *'Meeker'* (79.3%) was achieved with sterilisation in 70% ethanol (1 min) and 10% commercial bleach (20 min), while sterilisation in 70% ethanol (1 min) followed by 0.1% $HgCl_2$ (3 min) gave the best results in '*Willamette'* (38.1%). The most optimal months for establishment of aseptic culture were August in '*Meeker'* (54.3%) and July in '*Willamette'* (26.8%). After initiation, shoots were multiplied in five consecutive subcultures on MS medium of constant PGR composition. An increase in shoot formation capacity over repeated subcultures was observed, therefore, the highest multiplication index was noticed in the fifth subculture in both cultivars. *In vitro* rooted and unrooted shoots were planted in a sterile soil substrate and acclimatized under a misting system in a greenhouse. The most optimal months for acclimatization of rooted shoots were August for '*Willamette'* (99.6%) and July for '*Meeker'* (100%), and July for unrooted shoots of both cultivars (96.5% in '*Willamette'*; 98.3% in '*Meeker'*).

Key words: *Raspberry, Aseptic Culture, Acclimatization.*

GRAIN YIELD AND QUALITY OF WINTER WHEAT CULTIVARS

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Abstract

The experiment was established at the experimental field of the Small Grains Research Centre in Kragujevac (Serbia) during the two growing seasons. The objective of the research was to evaluate the effect of genotype and the environment on the grain yield of winter wheat cultivars (Takovčanka, Kruna, Planeta and Vizija). The following characteristics were analysed: grain yield, 1000 grain weight and test weight. The average grain yield of all cultivars in the 2010/11 growing season was significantly greater than in the 2009/10 year, mostly as the result of highly favourable weather conditions at major stages of plant development. Takovčanka and Kruna gave significantly higher grain yields in all years compared to Planeta. Averaged across years, significantly higher values for 1.000 grain weight were found in Planeta and test weight was found in Takovčanka. Different responses of cultivars to variable agroenvironmental conditions in terms of grain yield and 1.000 grain weight and test weight require the use of a number of cultivars in the crop structure.

Keywords: *cultivars, grain yield, wheat, quality characteristics.*

EFFECT OF YEAR AND FERTILIZATION ON WINTER BARLEY QUALITY

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Abstract

The experiment was established at the experimental field of the Small Grains Research Centre in Kragujevac (Serbia) during the two growing seasons. The objective of the research was to evaluate the effect of fertilization and the environment on the yield of winter barley. The following characteristics were analysed: grain yield, 1000 grain weight and test weight. The average grain yield and 1000 grain weight of all treatments in 2010/11 growing season was significantly greater than in 2009/10, mostly as the result of highly favourable weather conditions at major stages of plant development. The grain yield of the barley was significant lower in control (treatment without fertilizer). Barley yield was the highest in the NP_1K and NP_2K (4.199 and 4.290 t/ha) treatments. Variance analysis showed statistically very significant differences for grain yield, 1000 grain weight and test weight between the vegetation seasons and very significant differences for grain yield and 1000 grain weight between the effects of fertilization. Variance analysis showed very significant differences for 1000 grain weight between the interaction of the vegetation seasons and variants of fertilization.

Keywords: *barley, fertilization, nitrogen, yield.*

NUTRIENTS STATUS IN MAIZE GRAIN FROM SUSTAINABLE AGRICULTURE

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Abstract

Maize cultivation with application of proper organic and bio-fertilizers could increase nutritional value of crop grain and maintain soil fertility. The aim of the study was to examine variations in concentrations of phytate, soluble phenols, total glutathione (GSH), yellow pigment (YP), DPPH radical scavenging capacity (DPPH), Ca, Mg, Fe, Zn and Mn in maize hybrids with white, yellow and red colour grain, under the influence of bio-, organic fertilizer and urea in regard to control (without fertilization). Results indicated that phytate, DPPH, Ca, Mg and, Mn varied slightly (< 10%). Red grain maize was characterized with the highest concentrations of phenols, Ca, Mg, Fe, Zn, and DPPH. White grain maize, particularly in urea and bio-fertilizer treatment, accumulated higher GSH values, while red and especially yellow grain hybrid accumulated higher YP amount in urea treatment. Irrespective to lower variations in Mn concentration, higher values were determined in yellow hybrid. Organic fertilizer mainly induced increase in Mg bio-fertilizer which positively affected Fe accumulation, while urea caused higher Zn and Mn accumulation in maize grain. It could be concluded that yellow and particularly red grain hybrid enabled increased accumulation of mineral elements, together with higher DPPH values, mainly in treatments with organic fertilizer and urea giving it advantage in production of highly nutritious food.

Keywords: *Colored maize grain, Sustainable production, Mineral nutrients, Antioxidants.*

NITROGEN FERTILIZATION AND SOWING DENSITY INFLUENCE ON WINTER WHEAT YIELD AND YIELD COMPONENTS

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Abstract

Nitrogen management in winter wheat is one of the most studied agricultural practices. Optimization of nitrogen nutrition and sowing density requirements of specific winter wheat cultivar are major objectives for improvement of trade-offs between grain yield, environmental sustainability and maximum profitable production. Therefore, the aim of this study was to assess the effects of interaction between nitrogen fertilization and sowing density on grain yield and yield determinants of modern wheat cultivars. The trial consisted of five winter wheat cultivars, four top-dressing nitrogen doses and four sowing densities was carried out under rain-fed conditions at the experimental field of the Institute of Field and Vegetable Crops, Novi Sad, Serbia. The analysis of variance showed statistically significant effects of all three factors on studied traits, while significance of interactions between studied treatments varied among traits. On average, grain yield among cultivars varied from 8.64 to 9.69 t ha^{-1}. Generally, the highest grain yield was achieved under conditions of 100 kg N ha^{-1} treatment. By increasing N fertilization thousand grain weight decreased almost linearly, while maximum grain number per square meter was recorded with 100 and 150 kg N ha^{-1}. The highest yield and grain number per square meter were obtained under increased sowing densities (700 and 900 viable seeds m^{-2}), while the thousand grain weight had lower variation and the highest values were realized with 300 and 900 viable seeds m^{-2}. In conclusion, the presence of significant interaction between cultivars, N fertilization and sowing densities, indicated necessity to adjust different management practices to each cultivar in order to achieve highest grain yield potential.

Keywords: *Triticum aestivum L., nitrogen fertilization, sowing density, yield traits.*

DETERMINATION OF PHYSICAL AND CHEMICAL PARAMETERS OF SELECTED VARIETIES OF BUTTERNUT SQUASH *(CUCURBITA MOSCHATA* DUCH. EX POIR.)

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Abstract

Butternut squash *(Cucurbita moschata* Duch. ex Poir.) is an annual plant of the genus *Cucurbita*. Its fruits are one of the most important crop-plants in traditional agricultural systems in the world and a source of biologically active components. This vegetable has been less grown in Slovakia so far. The aim of the work was to evaluate the influence of genotype on the physical and chemical properties, including carotenoids, vitamin C, and mineral contents of butternut squash in the conventional growing system under the field conditions at Slovak University of Agriculture in Nitra in 2018. Six cultivars of butternut squash (Liscia, Serpentine, Orange, UG 205 F1, Matilda F1, Waltham) were examined in experiment. The physical parameter analysis showed that the average weight of fruit was from 1.59 to 2.25 kg. The edible part of fruit was from 0.52 to 0.75. The fruits of the Orange variety had very unbalanced size, what may have negative impact on the marketing, especially in large commercial chains. The tested varieties are an important source of mineral substances, especially potassium, magnesium and calcium. The total carotenoids content in the pulp of fresh fruits ranged from 3.80 to 8.42 mg.100 g^{-1} FW. Its highest value was determined in case of Orange variety. The vitamin C content ranged in interval from 5.50 to 12.00 mg.100 g^{-1} FW.

Keywords: *butternut squash, variety, minerals, carotenoids, vitamin C.*

GENOTYPE VARIABILITY OF OAT BY DIFFERENT PROTEIN SEPARATION METHODS

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Abstract

Cultivated oats are hexaploid cereals belonging to the genus *Avena sativa* L., which is found worldwide in almost all agricultural environments. Oats are distinct among cereals due to their considerably higher protein concentration. At the same time oats possess a protein quality of high nutritional value and a special protein composition. The oat seed storage proteins are mainly composed of two classes: the globulins and prolamins. Globulin is the major oat storage protein while prolamin, the predominant storage protein of most of other cereals, is present at a low level. Polymorphism in seed storage protein profiles of oats was found by two separation methods. Acid polyacrylamide gel electrophoresis (A-PAGE) was used for prolamins and Lab-on chip (LOC) capillary electrophoresis for the globulins polymorphism. Lab-on Chip capillary electrophoresis is a modern analytical technique. It has proved to be rapid, sensitive and automated, providing high resolution, separation and reproducibility. In Slovak registered hexaploid oat varieties eight of hulled (Atego, Prokop, Valentín, Vendelín, Viliam, Vit, Vojtech, Zvolen) and two of naked oat (Hronec, Važec) were determined. The dendrogram, which was constructed based on the genetic distance matrix showed that oat cultivars were grouped into two major clusters. The main clusters consist of five cultivars grouped into a separate sub-clusters. The cultivars Zvolen and Hronec are individually joined to sub-clusters. Genetic similarity coefficients resulted from comparisons by prolamin and globulin patterns among all 10 cultivar used showed that the genetic similarity ranged from 0.000 to 0.889.

Keywords: *Avena sativa L., storage proteins, A-PAGE, LOC.*

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EFFECT OF FOLIAR APPLICATION OF SELENIUM ON ITS UPTAKE AND YIELDS IN BASILS

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Abstract

Basil is one of the most used spices in Slovakia. Selenium is an essential element for normal growth and development of the organism and because Slovak soils are poor in this element, the various ways of this antioxidant increasing in the food chain has being sought. The aim of the work was to evaluate influence of selenium biofortification on selenium content of *Ocimum basilicum* - variety ´Dark Green´, which was, in conditions of the Slovakia, well known and wide spread grown, as well as on the opal basils (´Purple Ruffles´ and ´Red Rubin´) and on *Ocimum tenuiflorum* – Tulsi. The influence of fortification on the yields of basils was also tested. The selenium content and the yields of selected basils were compared in dependence on the selenium fertilization, two terms of harvest and morphological variability. Small-scale field experiment was carried out at the Department of Vegetable Production, Slovak University of Agriculture in Nitra, 2016. Selenium was applied foliar at a dose 50 g Se / ha in the form of sodium selenate. In two harvests the values of selenium built in plants and the economically interesting quantitative data – the yields per ha were evaluated. Statistical methods were used for statistical evaluation by the help of Statgraphics Centurion XVII (StatPoint Inc. USA), with multifactor analysis of variance (ANOVA) and LSD test. Foliar application of selenium had a positive effect of selenium content in case of all tested basils. The yields were also positively affected where values of fresh mass in selenised variants ranged from 1.43 (´Purple Ruffles´) to 13.71 t/ha (Tulsi).

Keywords: *basil, selenium, yields, fortification, fertilization.*

EFFECT OF CULTIVAR ON THE YIELD AND ANTIOXIDANT ACTIVITY OF OKRA (*ABELMOSCHUS ESCULENTUS* L. MOENCH) GROWN IN SLOVAK REPUBLIC

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Abstract

The okra (*Abelmoschus esculentus* L. Moench.) is less-known vegetable species in Slovak Republic. The goal of experiment was to evaluate the yield potential and antioxidant activity of okra grown in conditions of Slovak Republic. The field experiment was established at the Slovak University of Agriculture in Nitra in 2018. Within experiment, seven okra cultivars with different fruit color were tested (Cajun Delight F1, Clemson Spineless, Burgundy, Blondy, Baby Bubba, Jing Orange, Pure Luck F1). Okra seedlings (18 of each cultivar) were planting in spacing 0.60 x 0.40 m on 23th May 2018. The harvest of okra fruits was realized according to fruit production from 3rd July 2018 to 27th August 2018. The antioxidant activity was measured in fresh pulp and seeds of okra fruits by method of DPPH. The yield of okra fruits per plant were ranged from 293.2 (Burgundy) to 470.7 g (Clemson Spineless). The average weight of okra fruits was varied from 25.6 (Cajun Delight F1) to 36.1 g (Jing Orange). The okra yield per hectare, counted according to yield per plant, was ranged from 12.22 (Burgundy) to 19.61 t.ha^{-1} (Clemson Spineless). The antioxidant activity of okra fruit pulp was ranged from 77.9 (Clemson Spineless) to 84.2 %DPPH (Baby Bubba). The antioxidant activity of okra seeds was only slightly varied, concretely from 98.3 (Cajun Delight F1) to 99.0 %DPPH (Pure Luck F1). Obtained results indicate that okra can be considered as a crop with good yield potential in the Slovak Republic. The important factor, influencing on the yield and quality of okra, is its cultivar.

Keywords: *Okra, Cultivar, Yield, Antioxidant activity.*

NUTRITION VALUES OF HULLED AND NAKED OATS AND BAKING QUALITY OF WHEAT-OAT COMPOSITE FLOURS

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Abstract

Oat (*Avena* spp. L.) belongs to the family *Poaceae* and to the group of grasses (*Gramineae*). In human nutrition, it is mainly used for the content of food fiber, β-D-glucan, carbohydrates and proteins. These ingredients are considered health benefits with positive effects for the consumer. The objective of the submitted study was to realize complete characterization of different varieties of oat among the genus *Avena* to find natural sources of beneficial components of the seed (contents of proteins, dietary fibre, β-D-glucan, lipids, starch…) for their next use in the breeding programmes and application in the food industry. Other aim of this work was to determine the effect of oat flour addition at the level of 5, 10, l5, 20, 25 and 30% to wheat flour on baking quality and to determine optimal portion of oat flour to by acceptable by consumers. The study involved determination of protein content, starch content, lipids content, β-D-glucan content and total dietary fibre content in wheat flour and two chosen oat genotypes (Valentin-hulled and Detvan-naked). Effects of oat flour on the flour properties, the rheological properties of dough by farinograph, the quality of final products and their sensory evaluation were determined. Oat is beneficial in nutritional value especially in total dietary fibre, β-D-glucan and lipids content compared to wheat seeds. Addition of oat flour up to 20% to wheat flour is acceptable for technological quality, rheology properties of dough and final products in overall flavour, appearance and texture for consumers.

Keywords: *Oat, nutrition value, β-D-glucan, composite flour, baking quality.*

CHARACTERIZATION OF GENETIC MARKERS CORRELATED WITH BISCUIT QUALITY AND ITS APPLICATION IN MOLECULAR WHEAT BREEDING

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Abstract

In vitro haploid production followed by chromosome doubling greatly enhances the production of completely homozygous wheat lines in a single generation and increases the precision and efficiency of the selection process in wheat breeding. A doubled haploid (DH) production system for wheat using a microspore culture method produced seeds and subsequently regenerated haploid wheat plants derived from the F1 plants of two combinations of the candide winter wheat genotypes (Bagou/Hana and Bagou/Simona). High-molecular-weight glutenin subunits are major parts of wheat storage proteins, and play a significant role in determining wheat processing quality. HMW-GS are encoded by the complex Glu-1 loci located on the long arm of chromosomes from homeologous group 1 and are called *Glu-A1*, *Glu-B1* and *Glu-D1*. The regenerated DH lines having enough seed were selected to test their high molecular weight glutenin subunits (HMW-GS) using SDS-PAGE for identification of genes encoding high molecular weight (HMW) glutenin subunits *Ax0* at the *Glu-A1* locus, *Bx6.5*, *Bx7*, *Bx6*, *By7.5*, *By8* at the *Glu-B1* locus and *Dx5*, *Dx2*, *Dy10* and *Dy12* at the *Glu-1D* locus in wheat inbred lines. Based on HMW-GS profile analyses, the lines possessed new high molecular weight glutenin subunits *Bx6.5* and *By7.5* correlating with biscuit quality which were subsequently selected. We obtained four different combinations with new genes on chromosome 1B. This technique could thus complement the conventional breeding programs to accelerate the release of new varieties for biscuit quality. This work was supported by the Slovak Research and Development Agency under the contract no. APVV-17-0113 and contract no. SK-CN-2017-0012.

Keywords: *Triticum aestivum L., double haploid lines, glutenin, bisquit quality.*

EFFECT OF SELENIUM BIOFORTIFICATION IN BREAD MAKING WHEAT UNDER SEMIARID CONDITIONS

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Abstract

Selenium (Se) is an essential micronutrient and its adequate intake has beneficial effects in humans, such as prevention of several cancers, immune system benefits, and some protection against the aging process and cardiovascular diseases. Despite their importance, it is estimated that about 15% of the world´s population, including developed countries, may have an inadequate intake of Se. To prevent these deficiencies, agronomic biofortification or the process of increasing the Se concentration in the edible part of cultivated plants through fertilization has shown to be a very effective technique. To study the effect on grain production, the accumulation of Se as well as Ca, Fe and Mg on the grain and in the strawa field experiment was developed in 2017/18 in subdivided plots with four replicates on bread making wheat (*Triticum aestivum* L.) in which the application of 0 and 10 g Se ha^{-1} applied as Na_2SeO_4 was studied. Selenium application increased significantly both grain and straw Se concentrations, from 36.9 to 139.6 μg kg^{-1}in grain and from 36.4 to 95.3 μg Se kg^{-1} in straw, but the rest of studied nutrients were not significantly influenced. Grain yield, with 5160 kg ha^{-1}, higher than the mean because the higher rainfalls of 2017/2018, was also independent of the application of sodium selenate. So, the application of 10 g Se ha^{-1} is a very interesting technique to increase effectively Se without a negative effect neither in grain yield nor in Ca, Fe, Ma and Zn concentrations on bread making wheat.

Keywords: *Agronomic biofortification, Sodium selenate, Bread making wheat, Straw, Semiarid conditions.*

EFFECT OF SOIL AND FOLIAR ZINCBIOFORTIFICATION IN FIELD PEAS UNDER SEMIARID CONDITIONS

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Abstract

Zinc (Zn) is an essential mineral for animals and humans and a deficient intake is associated with severe health complications, including skin lesions, hindered physical growth, and immune system, combined with an increased risk of infections, neurological disorders or DNA damage. Despite its importance, it is estimated that approximately 30% of the world's population has an inadequate intake of Zn, including population in developed countries. To alleviate these deficiencies agronomic biofortification, defined as 'the process of increasing the bioavailable concentration of essential elements in the edible part of cultivated plants through fertilization' has been proved as an effective technique. To determine the effect on biomass and on the Zn, Ca, Fe and Mg concentrations in field peas (*Pisum sativum* L.) four different $ZnSO_4$-$7H_2O$ applications were studied: 0 kg (Control), soil application of 50 kg (Soil), foliar application of 8 kg (Foliar), and the combination of soil and foliar (Soil+Foliar). While soil Zn application in both, Soil and Soil+Foliar, significantly increased the biomass yield by an average of 27%, foliar Zn application increased Zn concentration with respect to Control, with 21.5 mg kg^{-1}, insufficient for adequate feeding of livestock species, up to 75.5 mg kg^{-1} and 65.5 mg kg^{-1}, in the Foliar and Soil+Foliar treatments, respectively. Zinc application did not influence Ca concentration, but reduced Fe and Mg concentrations, mainly foliar application. So, agronomic biofortification combining soil and foliar application seems to be a good strategy to alleviate Zn deficiency in livestock, and therefore to be introduced in the food chain.

Keywords: *Agronomic biofortification, Zinc sulphate, Field peas, Semiarid conditions.*

EFFECT OF DIFFERENT SIZES OF (PRE BASIC SEEDS) MINITUBER ON PLANT GROWTH AND SEED YIELD OF POTATO

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Abstract

Potato (*Solanum tuberosum*) is one of the major stable foods in the world. Worldwide, potato minitubers are used at initial stage of seed multiplication. Minitubers are the progeny tubers produced from *in-vitro* derived plantlets. Field performance of different size minituber can vary and it is important to plant optimum size minituber in order to get higher seed yield. Hence, a study was conducted at Agriculture Research and Development Centre, Sita-Eliya to investigate the effect of different sizes of potato minituber on yield and growth performance. Potato variety granola was used and four grades of potato minituber (<10 mm, 10-15 mm, 15-20 mm, >20 mm) were taken for the study. Plant emergence percentage, number of main stems and plant height were measured as growth parameters and there was no significant effect ($p<0.05$) observed in plant emergence with different sizes of mintubers. But, a significant influence on number of main stems due to different minituber size was recorded. Plant height was also, significantly affected by minituber size. Total yield was also, significantly affected by planted minituber size. But, seed tuber yield (28 - 55mm) was not significantly affected by different minituber sizes. It was found that mini tuber size >10 mm was most suitable for the field planting in order to obtain high seed yield.

Keywords: *Different size, Minituber, Potato.*

EFFECT OF SOME BOTANICAL OILS ON THE CONTROL OF THE COTTON JASSID*, JACOBIASCA LYBICA* (DE BERG)(HEMIPTERA: CICADELLIDAE) ON EGGPLANT AT GEZIRA AND KHARTOUM STATES, SUDAN

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Abstract

Eggplant, *Solanum melongena* L., is one of the major vegetable crops in the Sudan. Eggplant is infested by some species of insect pests. However, the cotton jassid (*Jacobiasca lybica*) is the major one. This study was conducted to investigate the effects of botanical oils, castor bean seed oil, cotton seed oil and sunflower seed oil on population of the cotton jassid on eggplant, cultivar Wizzo. Two field experiments were executed during season 2015/16 at two sites, the experimental farm in the Faculty of Agricultural Sciences, University of Gezira and Elalafoon at the eastern Bank of the Blue Nile, in Khartoum state. The experiments in both sites were arranged in Randomized Complete Block Design (RCBD) with four replications. The botanical seed oils at a concentration of 5% were applied at 7 days interval with four sprays. Post-treatment observations on number of jassid were taken after 2 days from the application. The results indicated that all oil treatments were apparently effective against the cotton Jassid compared to the untreated control. The study found that the cotton seed oil was more effective in reducing the number of Jassid on eggplant (64 insects/100 leaves) followed by sunflower seed oil (132 insects/100 leaves), castor bean seed oil (140 insects/100 leaves) and the untreated control (312 insects/ 100 leaves) at Wad Medani site while, at Khartoum Site the cotton seed oil recorded high reduction of jassid population (92 insects/100 leaves) followed by castor bean seed oil (140 insects/100 leaves), sunflower oil (208 insects/100 leaves) and the untreated control (608 insects/ 100 leaves). This study recommended that, cotton seed oil can be used to reduce the number of cotton jassid on the eggplant crop.

Keywords: *oil, cotton, eggplant, Sudan.*

THE ROLE OF MADS-BOX GENES IN THE DEVELOPMENT OF THE BARLEY INFLORESCENCE

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Abstract

Understanding flower development in monocots is important for plant breeders exploring changes to floral architecture in order to maximize crop yield. The regulation of flower structure is critical for improving global crops such as barley (*Hordeum vulgare)*, wheat (*Tricum aestivum)*, and rice (*Oryza sativa*). Many advances have been made about the understanding of flower development such as identification of the MADS-box proteins in the 1990's in *Arabidopsis thaliana*. MADS-box proteins are a family of transcription factors which have been proposed as a driving source in floral diversity. Characterized by a conserved 60 amino acid MADS-box motif, MADS-box proteins form multimeric complexes regulating floral gene expression by binding as dimers to DNA sequences termed 'CArG-boxes'. In *Arabidopsis thaliana*, MADS-box proteins have confirmed the floral quartet model proposed in 2001, which suggests that floral organ identity is specified by protein complexes of MIKC-type MADS-domain proteins. In the present study we used the barley genome to identify 14 MADS-box genes, which we sequenced across 36 flower mutant lines (7 deficiens, 7 semi-deficiens, 18 intermedium, and 2 Hex.v) as well as the 4 commercial cultivars they were produced from. We aim to correlate the floral structure of the mutants to mutations in their MADS-box genes to determine their role in barley spike (flower) architecture. We expect to find mutations in these MADS-box genes in sequenced spike mutant lines, where different phenotypes like deficiens, semi-deficiens, and intermediate would show how different mutations correlate to different spike phenotypes.

Keywords: *genes, barley, crop yield.*

PRESERVING THE SUSTAINABILITY OF FIELD CROP SYSTEMS: OVERVIEW OF 50 YEARS OF TRIALS IN SWITZERLAND

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Abstract

Preserving soil fertility is a major challenge for farms without livestock specialized in field crops. Several decades ago, several trials were set up at the Agroscope experimental station in Changins-Switzerland to study the long-term effects of different cultural practices on soil fertility and crop yields. This paper summarizes the main results obtained in these trials. In the conditions at Changins, organic amendments have been useful for stabilizing soil organic carbon content while only high manure inputs have enabled its significant increase. To preserve soil fertility, farm manures are difficult to replace. Without regular organic amendments, reducing tillage is generally not enough to maintain soil organic carbon content, but can slow its decrease. Crop rotation brings no advantages in terms of the soil's organic carbon content, but it enables higher yields to be achieved both over the short and long term. By combining a diversified crop rotation, reduced tillage and regular organic inputs, it is possible to maintain soil fertility and crop yields on the long term. Long-term trials are a particularly valuable tool for understanding, testing and modelling the impacts of different agricultural practices on the sustainability of field crop systems. In future, research projects will continue to aim to provide practical solutions that will safeguard the sustainable fertility of agricultural soils.

Key words: *soil fertility, organic amendment, soil tillage, crop rotation, crop yield.*

CLONAL PROPAGATION CAPACITY OF TWO NEW APPLE ROOTSTOCKS BY STOOLING

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Abstract

This investigation was carried out at General Commission for Scientific Agriculture Research – Pome and Grapevine Division in Sweida governorate (Syria), from 2013 to 2017, to evaluate the ability of two new local apple rootstocks (Sukari Alswieda 'S' and Skarji Alswieda 'H') to vegetative propagation in stool bed. The results showed that the second year of propagation significantly produced the highest number of rooted shoots (liners) from each rootstock (7 liners and 5 liners in 'S' and 'H' respectively). 'S' and 'H' rootstocks revealed significant difference in average produced liners. However, the length and diameter of liners from 'H' rootstock did not show significant difference among studied years, they were in average 59.1 cm and 6.1 mm respectively. While as, the highest length and diameter of liners from 'S' were in the third year (82.3 cm and 7.6 mm respectively). On the other hand, the two studied rootstocks produced liners with good and stable root system which differed in structure between them, that 'S' rootstock revealed coarse (woody) roots, while in 'H' rootstock the roots were hairy. The number of roots was in average 17 roots and 12 roots in the liners of 'S' and 'H' respectively. As well as. the average length of liners roots were 23.4 cm and 22.2 cm in 'S' and 'H' respectively. Consequently, the clonal propagation for the studied rootstocks in stool bed is a sufficient tool to produce liners similar to the plant parent and they are ready to be budded with cultivars scions.

Key words: *apple, rootstock, vegetative propagation, stool bed*.

INFLUENCE OF TWO APPLE ROOTSTOCKS ON LEAVES AND FRUITS MINERAL CONTENT OF STARKRIMSON CULTIVARUNDER RAINFED CONDITIONS

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Abstract

This investigation was conducted at Pome and Grapevine Division- Horticulture administration- GCSAR in Sweida governorate under rainfed conditions during 2014-2015 to study the influence of two apple rootstocks (*Malus domestica* and MM106 grafted by Starkrimson cultivar) on K, Ca and Mg mineral concentrations in leaves and fruits during the growth season. The results showed that *M. domestica* significantly revealed higher K concentration than MM106 rootstock of leaves and fruits in general, whereas MM106 revealed higher concentration of Ca in leaves and fruits. Mg concentration revealed discrepant rate among two rootstocks during the growth season. The highest leaves and fruits K concentration was in August in *M. domestica* (1.57%),while in MM106 rootstock (1.30%)it was in June. On the other hand, the highest leaves content of Ca was in October in two rootstocks which was below the sufficient range. Two rootstocks exposed the same rate of fruit Mg and Ca mineral concentrations which were decreased through the growth season. The K/Ca and K+Mg/Ca ratios in leaves and fruits "as an indicator for biter pit physiological disorder" were calculated for two rootstocks, which varied depending on growth stage analysis. Consequently, the results led to establishing an efficient strategy for fertilization management of apple orchards depending on the fertilizers requirements and nutrient accumulation track during growth season.

Key words: *apple, rootstock, Starkrimson, mineral concentrations*.

PISTACHIO KERNEL CONTENT OF MINERAL ELEMENTS, PROTEIN AND TOTAL OIL UNDER RAIN-FED CULTIVATION IN SYRIA

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Abstract

This investigation was conducted at Sweida Agricultural Research Center and farmers' fields at altitude of 900-1100 m above the sea to study the chemical content of 13 pistachio genotypes including kernel dry oil content, protein, micro and macro-elements. The results showed the precedence of Syrian genotypes concerning their content of dry oil (58.43%) in comparison with introduced genotypes (one Iranian and two Turkish genotypes). Protein content differed among all studied genotypes and it ranged between 15.18% - 29.59% indicating high nutritional values of local genotypes in parallel with introduced ones. Potassium content was virtually low (0.54-0.82%) in all genotypes, whereas phosphorus concentration was widely variable in the samples (0.3-0.64%). Indeed, nitrogen content in pistachio kernels was by some means in an intermediate level (2.942-5.192%). Micro-elements concentration was extremely low in pistachio kernels concerning several elements (Cu, Zn and Mn). Cupper level ranged 3.45-8.3 ppm. The genotype Ash.6"Iranian genotype" was recognized by its high level of zinc element comparing with all other studied genotypes (30.05 ppm). The content of Fe was at high concentrations in all samples (81.6- 191.5 ppm). The recent outcomes indicated a negligible content of calcium which was assigned to the low soil content. Mg content was likewise low in all studied genotypes (0.0179- 0.0994%). Hence, it is fundamental to project fertilization programs accompanied with proper irrigation regulations appropriate to different soil granular structures particularly concerning the content of Ca as a vital structural element.

Keywords: *Pistachio, proteins, dry oil, mineral elements.*

IMPACT OF CASHEW SEED STORAGE PERIOD AND SIZE ON GERMINATION AND SEEDLINGS GROWTH VIGOR IN SOUTH-EASTERN TANZANIA

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Abstract

The efficiency of cashew seeds germination and vegetative performance was studied at Tanzania Agriculture Research Institute-(TARI- Naliendele), in Mtwara, Tanzania. The variables of study were duration of cashew seeds storage and seeds sizes. Cashew seeds were harvested from polyclonal seed gardens owned by the research center.Seeds were sorted, graded at size basis, weighed and soaked for sowing. Using randomized complete block design obeying factorial approach, the experiment was laid with three replications. Analysis was done by using GenStat under Duncan Multiple Range Test (DMRT) on the seed germination.The observed growth parameters were: height (cm), number of leaves, leaf length (cm), leaf width (cm), leaf area (sq cm), leaf area index (LAI), canopy diameter (cm) and seedlings canopy ground area (sq cm). The findings indicated that, cashew seeds harvested in 2018 were the superior in both germination and growth vigor differing significantly ($p<0.05$), cashew seeds harvested in 2017 were weak and those harvested in 2016 were the worst where no seeds were able even to germinate. Cashew seed sizes had no significant difference in germination and growth vigor, although medium sized seeds generally indicated best results. Thus, it is recommendable to sow cashew seeds harvested at current season for sowing than those stored for more than a year and medium seeds should be the best for sowing. However, this study was implemented in only single season and site, hence this opened gap for further research.

Kew words: *Cashew, nuts sizes, storageperiod, cashew growth vigor.*

IN VITRO MYCORRHIZATION OF PYRUS COMMUNIS

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Abstract

Micropropagated pear rootstocks represent good planting material to establish new growing areas or replace old plantations. The plantlets are devoid of pathogens, but also of beneficial root inhabitants that may help plants with stand stresses. Mycorrhization of plantlets is usually conducted at the hardening/post-hardening phases. Only few studies have reported their application *in vitro*, and none has investigated the subsequent impact on *ex vitro* acclimatization. Here, we report, for the first time, the effects of *in vitro* mycorrhization of pear plantlets on survival rate, root length and root number following transfer to substrate. Pear plantlets were pre-mycorrhized *in vitro* by mean of the Mycelium Donor Plant system. Heavy *in vitro* root colonization of the pear plantlets was observed after three weeks. One and three months after transfer to a peat, coco peat and perlite substrate, the survival rates were higher than those of control plants grown on substrate without AMF. The mean root length and root number of the pre-mycorrhized plants after transplantation were greater than those of non-mycorrhized plantlets. Mycorrhized plants accumulated more P, Fe, Zn, and total N than control plants. *In vitro* mycorrhization under autotrophic culture conditions thus represents a promising tool for the pre-adaptation of micropropagated pear plantlets to *ex vitro* conditions.

Keywords: *Rhizophagus irregularis, pear, Mycelium donor plant (MDP), Acclimatization.*

EFFECTS OF LIGHT EMITTING DIODES AND *TRANS*-CINNAMIC ACID ON MICROPROPAGATION OF *PYRUS COMMUNIS*

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Abstract

Combinations of monochromatic blue (B), red (R) and far red (F) LED lights were compared with fluorescent (FL) light during micropropagation and rooting of a recalcitrant pear. During the micropropagation phase, R gave some particular advantages: maximal shoot length and leaf area were obtained. Under B, callus weight quadrupled compared to FL. Although FR was advantageous for shoot number, shoot quality was inferior because of hyperhydricity and a pale green colour as indicated by a low Chl a+b and carotenoid content. The smallest leaf area was detected under FL. BR showed significant improvements. Shoot cluster weight and ratio shoot weight/callus weight were maximal, as well as number of shoots and shoot length. Leaves were also dark green, showing a maximal Chl a+b and carotenoids content. Adventitious rooting of *in vitro* cultured pear plants was highly affected by different light spectra and the addition of a new rooting compound. Without this compound, limited rooting was observed under R, B and BR. In combination with this compound, 100 % rooting was achieved under R.

Keywords: *Pyrus communis, LED, cytokinins, auxins.*

IDENTIFICATION OF RESISTANCE SOURCES TO *SEPTORIA TRITICI* BLOTCH IN CROSSES OF TUNISIAN DURUM WHEAT GERMOPLASM

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Abstract

Septoria leaf blotch of wheat caused by *Zymoseptoria tritici* is currently a major disease in Tunisian durum wheat (*Triticum turgidum* subsp. *durum*) which caused serious yield losses. The widespread distribution of the early maturing semi-dwarf cultivars and changes in cultural practices has contributed to its increased incidence. Therefore, this study was undertaken to determine the mode of inheritance of Septoria leaf blotch resistance and possible associations between specific traits in a cross between two parents. A cross was made between high yielding susceptible cultivar Karim and the resistant genotype Maâli in order to evaluate the F_1, F_2, BC_1 and BC_2 generations for their reaction to STB during two growing seasons (2014-2015 and 2015-2016) under field conditions. The cultivars and derived populations were evaluated using the area under disease progress (AUDPC) and the agronomic parameters (Straw height (SH) and thousand Kernel Weight (TKW)). Significant differences among generations were found for all traits, and genetic analyses of those traits were performed. Preliminary results indicated that in both F_2 populations a 3:1 (resistant:susceptible) segregation was observed in the field at the seedling and adult stages, indicating that resistance could be controlled by a single dominant gene. This control was supported in adult plant stage by BC_1 and BC_2 populations segregating. This high level of resistance expressed by this generation suggests the presence of resistance genes within this accession and the ability of the resistant accession to show a low severity of the disease and an important grain yield. This data could provide evidence that genetic resistance to *Z. tritici* exists in durum wheat and have to be considered in breeding programs.

Key words: *Durum wheat, genetic resistance, grain yield, severity, Zymoseptoria tritici.*

BIODIVERSITY OF CHICKPEA: BLACK CHICKPEA

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Abstract

Sustainability of agriculture includes; conservation of natural resources in long term besides using agricultural technologies that are non-destructive to environment and living creatures. Providing diversity of products supplies protection of soil, using local seeds, decreasing of pesticide usage, information transfer to farmers about chemical fertilizers etc. components. Local plant species are developed by selection method in traditional agriculture that are well adapted to ecology, provides the cultural demands and traditions. Local seeds are one of the main sources for conventional agriculture and a great effort for social, environment, economic output amongst farmers over the World. Otherwise, expansion of industrial agriculture caused to pressure on conventional methods under narrow area and difficulty on product sales. Therefore, farmers prefer to growing the seeds which are desired by markets and it cause to a serious danger for distinction of the local seeds. Black chickpea is a kind of the chickpea, has a rich content of nutritional value and taste, contains more protein ratio and some other minerals than the common chickpeas. Ideal for losing weight due to higher fiber content, a good vegetable energy source, health care statues especially for diabetes and cholesterol, a well iron source, provides oxygen demand for body, higher antioxidant content. Present paper describes some features of a less known legume – black chickpea and offers some proposals about farming systems depending on biological diversity provides more employment, more food production, better quality, effective usage of the local facilities, food security, controlling of production costs, more income to families and prevention of migration.

Keywords: *Biosecurity, Climate change, Conservation, Sustainable agriculture.*

SUSTAINABLE SOIL USAGE: LEGUMES AND HEAVY METALS

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Abstract

Industrialization and increasing of population caused effects on the whole ecosystem and environmental problems especially for heavy metal pollution of air, water and soil. There is not a distinct definition of heavy metals in literature but known as more than 20 for atom number (such as; Ag, As, Cd, Cu, Fe, Hg, Ni, Pb, Zn) and they have versatile damages particularly on soil. Some of the heavy metals in nature join to food chain and presenting toxic effects even very small amounts. Most of the heavy metals accumulate on biological systems. Some are necessary for plant growing but more quantities than requirement are toxic. Furthermore, some of the hyper accumulator plants are used for medical and aromatic purposes. So, those kinds of plants should be studied for negative and positive sides as well. Cleaning of soil from heavy metals is called as phytoremediation and the topic is quite essential in the world. Researches on hyper accumulator plants that are able to accumulation of metals reported 400 plant species in total. These plants are gathered from the following plant families; *Asteraceae*, *Brassicaceae*, *Caryophyllaceae*, *Cyperaceae*, *Lamiaceae*, *Violaceae*, *Euphobiaceae*, *Poaceae* and *Fabaceae*. It is fair that; legumes (*Fabaceae*) are the main protein sources for both animal and human. On the other hand, these crops are known as "absolute crops" for rotation programs. Present paper focused on; heavy metals in soil, their accumulation by legumes and statues in legume based foods.

Keywords: *Healthy food, Hyper accumulation, Phytoremediation, Pulses, Sustainable agriculture.*

CLASSIFICATION OF BARLEY VARIETIES BY ARTIFICIAL NEURAL NETWORKS

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Abstract

In this study, an Artificial Neural Network (ANN) was developed in order to classify barley varieties. For this purpose, physical properties of barley varieties were determined and ANN techniques were used. The physical properties of 8 barley varieties grown in Turkey, namely thousand kernel weight, geometric mean diameter, sphericity, kernel volume, surface area, bulk density, true density, porosity and colour parameters of grain, were determined and it was found that these properties were statistically significant with respect to varieties. As ANN model, three models, N-l, N-2 and N-3 were constructed. The performances of these models were compared. It was determined that the best-fit model was N-1. In the N-1 model, the structure of the model was designed to be 11 input layers, 2 hidden layers and 1 output layer. Thousand kernel weight, geometric mean diameter, sphericity, kernel volume, surface area, bulk density, true density, porosity and colour parameters of grain were used as input parameter; and varieties as output parameter. R2, Root Mean Square Error and Mean Error for the N-l model were found as 99.99%, 0.00074 and 0.009%, respectively. All results obtained by the N-l model were observed to had been quite consistent with real data. By this model, it would be possible to construct automation systems for classification and cleaning in flourmills.

Keywords: *Physical properties, Artificial neural networks, Barley, Classification.*

OLIVE PRODUCTION AND TRAITS OF MAIN CULTIVARS GROWN IN SOUTHEAST ANATOLIAN PART OF TURKEY

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Abstract

Olive (*Olea europea, L.*) is grown in certain countries in the world. Turkey is the fourth country regarding production. Olives are grown for table consuming and olive oil. Main production country is Spain.Oil needs 186 billion tons in the World. The olive oil is produced in the quantity of approximately 3 billion tons. Olive oil consumption is important for cardiovascular system for our health. The highest olive oil consumption in the world is 12.8 kg per capita in Greece. Olive production in Turkey is 1300 000 tons,Mainly 190 000 tons for olive oil, Table olive is also diveded two. One of them black olive another ones is green olive which pickled. The yield is not enough due to lack of some technical applications such as irrigation, fertilization etc. The intensive producing provinces are Eagean, Mediterranean, Marmara, and Southeast part of Turkey. General common growing cultivars are: Gemlik, Halhalı, KilisYağlık, KanÇelebi, Kalembezi, NizipYağlık etc. However, each cultivar has negative and positive traits.

Keywords: *Olive cultivar, Southeast Anatolian Region, Turkey.*

THE TRAITS OF PISTACHIO ROOTSTOCKS AND THEIR IMPORTANCE

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Abstract

Rootstock is very important for fruit production. They effects some traits such as vigours, qulaity of fruits, yields, diseases, resistance for different soil types etc.Rootstocks are very important for pistachio nut production as well. Rootstocks may resistance on to biotic and abiotic stresses such as insect pests and diseases, low and high temperatures, drought, low soil moisture, salinity and its effects on the size of the tree size, alternate bearing, yield, quality, shell splitting and blank nut production, etc. There are 11 *Pistacia* species and hybrids in generally. But for *P. lentiscus*, almost all of the *Pistacia* species can be used as rootstock for *P. vera*. Mostly common Pistacia spp. are P. vera, P. khinjuk, P. atlantica, P. terebinthus, P. palestina etc. in Turkey. In Greece and Italy (Sicily) the use of *P. terebinthus* is also common. In North Africa *P. atlantica* is used. In California, although both *P. atlantica* and *P. terebinthus* were used in the early days of the pistachio industry, now *P. atlantica* is the preferred rootstock because of its greater success in budding and faster growth than *P. terebinthus.* However, since both species are very susceptible to *Verticillium* wilt, a new rootstock, *P. integerrima*, or UCB=1 (hybrid) are now recommended to growers because of its vigour and resistance to the disease.

Keywords: *Pistacia, Rootstock, pistachio, fruit.*

EFFECTS OF DIFFERENT SOIL TYPES ON SOME FRUIT PHYSICAL TRAITS OF 'KETEN GOMLEGI' PISTACHIO CULTIVAR

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Abstract

Pistachio is mainly grown at Southeast Anatolian part of Turkey. It is grown very bad soil conditions and non-irrigated areas. It is named rich plants for poor soils. In this research the plants which grown different three soil types. Soil samples were taken from 3 different regions of these three different types of soil (A Parcel: Deep Red Soil (Kepir), B Parcel: Konglomera type (Pur), C Parcel: Boz soil (Lime content high) in fall. According to obtained results, pH was determined between 7.68 to 7.86 and lime content were 18.46 % to 35.10. Organic matter was very low because of high temperature. The highest shell splitting were obtained from the trees grown A type soil conditions. Shell splitting rate is changed between 38.65% to 50.39%. The empty fruit rate is also changed according to soil types. Fully filled fruit rate was affected soil type as well.

Keywords: *Pistachio, soil types, splitting, empty fruits.*

ABSCISIC ACID AND IRRIGATION LEVELS EFFECTS ON MORPHOLOGICAL CHARACTERISTICS OF STRAWBERRY

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Abstract

The high value of strawberries creates potential for high rates of employment and farm income in Turkey. Optimizing water application and effective cultivation practices are of considerable importance in improving strawberry yield. In this study, the effects of four different irrigation regimes and Abscisic Acid application (ABA use and control) effects on the leaf area, plant dry matter and crown number of strawberry (*Fragaria* × *ananassa* cv. Rubygem) were evaluated under Spanish type high tunnels conditions. ABA was applied three times starting from March to May via foliar application as 20 μmol L^{-1}. From the initiation of the treatment to the end of the trial, a total of 552, 447, 342 and 237 mm of water were applied to treatments IR125, IR100, IR75 and IR50 respectively. The IR50 treatment caused a significant decline in morphological parameters, indicating that the amount of irrigation water did not meet the plant water requirement. The increased amount of irrigation water increased the leaf area, dry matter and the crown number significantly. Furthermore, the ABA application increased the leaf area by 15%, the plant dry matter 12% and crown number by 8%. Under water stress conditions (IR50), ABA significantly increased growth rate as well as increasing leaf area, plant dry matter and the crown number by 13%, 12% and 11%, respectively, when compared to the control plot. Consequently, in the protected cultivation, the IR125 irrigation level and the ABA application enhanced vegetative growth and in turn the total marketable fruit yield and its components.

Keywords: *Leaf area, Dry matter, Class A pan, High tunnel, Rubygem.*

POTENTIAL OF AQUEOUS EXTRACTS FROM SOME PLANTS FOR THE CONTROL OF PLANT PARASITIC NEMATODES, *HETERODERA AVENAE, PRATYLENCHUS THORNEI* AND *PRATYLENCHUS PENETRANS*

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Abstract

Cereal cyst nematodes and Root lesion nematodes are important plant parasitic nematodes in Turkey. Extracted solutions of some plants were evaluated for their potential on control of plant parasitic nematodes. In this study, different concentrations of the solution were extracted from 12 different dried plants and the solution were tested against the second stage juveniles of the plant parasitic nematode *Heterodera avenae, Pratylenchus thornei,* and *P. penetrans*. These plants were dried at 60 ^{o}C for 3 hours in drying oven, and then they were chopped up and replaced with water. In the experiments, concentrations of 1, 2.5, 5 and 10% were used for dried plant material and the measurements were performed on 6, 12 and 24 hours awaited concentrations. The most effective treatments on immobilized second-stage juvenile were observed on 24 hours awaited concentrations of the plants. Also, the best concentration is caused by the 10% concentration. The results suggest that the most effective of leaf powder extract of *Radix eremuri, Nerium oleander, Eucalyptus camaldulensis* could be potential nematicides against *H. avenae*, whereas *P. thornei* and *P. penetrans* were less affected by these plants when it was compared *H. avenae*. This experiments will be informative effect of plant extracts for field studies on Cereal Cyst and Root Lesion nematodes. This study was supported by Ç.Ü. BAP 11991.

Keywords: *Heterodera avenae, Pratylenchus thornei, P. penetrans, Aqueous extracts, Control of plant parasitic nematodes.*

DETECTING THE BERRY SIZE RESPONSES IN TWO STRAWBERRY CV. BY USING DIFFERENT IRRIGATION LEVELS AND BIO-ACTIVATOR

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Abstract

The Mediterranean region is one of the regions most affected by global warming. Therefore, optimizing applied irrigation levels and finding alternative cultivation practices are vital for the whole plant species including strawberry. In this study, the responses of different strawberry cultivars (*Fragaria ananassa Duch. cv. 'Rubygem' and 'Kabarla'*) to irrigation levels and bio-stimulant use were investigated by evaluating the berry size parameters (diameter, length and weight) under high tunnel conditions in this region throughout the growing season of 2016-2017. The amounts of irrigation water applied were 0.50 (IR 50), 0.75 (IR 75), 1.00 (IR 100) and 1.25 (IR 125) times the water surface evaporation. Application of IR 50 was found to be statistically different from the other 3 applications, which partaking in the same group with the lowest fruit diameter, length and weight values in both varieties. While it was determined that bio-activator applications did not provide significant increases in fruit diameter and weight values in *'Kabarla'*; in *'Rubygem'* cultivar fruit diameter was increased 4.7% and weight by 9.0%. It was also detected that bio-activator applications did not provide significant differences in fruit length in both varieties, and *'Rubygem'* produced wider, lengthier and heavier fruits than the *'Kabarla'*. In the light of this information, it can be stated that permanent damage in the diameter, length and weight of the fruits representing the quality are dependent on the level of water stress and strawberry varieties.

Keywords: *Water stress, Drought, Mediterranean region, Fruit weight, Fruit quality*.

ANTIBACTERIAL ACTIVITIES OF ESSENTIAL OILS ISOLATED FROM MEDICINAL PLANTS AGAINST SOFT ROT BACTERIAL DISEASE AGENTS OF POTATO

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Abstract

Various essential oils obtained from medicinal plant species have potential for use in alternative strategies against plant pathogen control. Essential oils of different medicinal plant species belonging to Lamiaceae, Lauraceae and Myrtaceaefamilies such as *Thymbra vulgaris* (Tsv), *Thymus serpyllum* (Tsrp), *Origanum onites* (Oo), *Lavandula stoechas* var. *stoechas* (Lss), *Rosmarinus officinalis* (Ro), *Salvia officinalis* (So), *Laurus nobilis* (Ln), *Eucalyptus camaldulensis* (Ec), *Eucalyptus globulus* (Eg) and *Myrtus communis* (Mc), were isolated by hydro-distillation. Ten different essential oils were screened for antibacterial activity against the soft rot bacterial disease agents of potato *Pectobacterium atrosepticum* and *Pectobacterium parmentieri*, using the paper disc method. Almost all essential oils showed a varying inhibitory effect against the both bacteria. The inhibition zones caused by each essential oils showed significantly differences depending on the different oils and bacterial isolates. Zone of inhibition caused by each essential oils on tested bacterial isolates varied between 7.1 to 41.6 mm. Plants belong to Lamiaceae family were found to be more efficient than those belonging to Lauraceae and Myrtaceae families. The essential oils of *O. onites*, *T. vulgaris* and *T. serpyllum* showed the highest antibacterial activities against all tested bacterial species. The highest bacterial growth inhibition for *P. atrosepticum* and *P. parmentieri* were recorded for *T. vulgaris* and *T. serpyllum* essential oils, respectively. The findings of the present study suggest that essential oils of *O. onites*, *T. vulgaris* and *T. serpyllum* have a potential to be used as antibacterial agents against soft rot bacterial disease agents.

Key words: *Antibacterial, Essential oil, seed-borne bacteria, potato, Pectobacterium.*

THE EFFECT OF DIFFERENT FERTILIZER APPLICATIONS ON PLANT DEVELOPMENT AND FLOWERING OF DEMRE PEPPER

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Abstract

In the study, Demre pepper varieties are used. This study was carried out in Physiology laboratory climate chamber of Van Yuzuncu Yil University, Faculty of Agriculture, Horticulture Department. The study was aimed effect on some kinds of quality criteria of some commercial fertilizer which have a big market share in the world and Turkey. To this end, nine different commercial fertilizer applications were made to the pepper plants. In addition, the group watered with distilled water only (control) and groups with only ½ second Hoagland nutrient solution of irrigation, fertilizer application constituted control of these commercial applications. The fertilization plan is made in accordance with the size of the company said. In this study, plant height, stem diameter, the first flowering date, number of flower, plant internodes length, number of stems, were examined. Except the distance between nodes, all other parameters in terms of plant growth BESTLINE fertilizer is noteworthy that receive the highest value.

Keywords: *Pepper, Number of flowers, Plant growth, Yield.*

EFFECT OF NITRIC OXIDE (NO) APPLICATION ON THE DEVELOPMENT OF PEPPER PLANT UNDER DROUGHT STRESS

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Abstract

The aim of the study is to determine the possible role of NO (nitric oxide) as a precursor molecule in some metabolic changes that occur under the effect of drought stress in plants and to try to determine its effects on plant growth. Demre pepper varieties were used as a test material. Tested plants in the controlled climate were cultured in cups containing Hoagland nutrient solution. For drought stress application, 10% polyethylene glycol (PEG 6000), which is equivalent to the osmotic potential of -0,40 MPa, was added to the nutrient solution. Different doses of sodium nitroprusside (SNP) and potassium salt (carboxy-PTIO) (SNP 0,01, SNP 1, SNP 100 and SNP 0,01 + cPTIO, SNP 1 + cPTIO, SNP 100+ cPTIO) were applied to the pepper seedling before drought stress was applied. On the 10th day of drought application, the root, stem and leaf weights, leaf counts and inter-node distances of the plants were examined as growth parameters. In terms of plant growth parameters, it was determined that the growth and growth of plants pretreated with 0.01 and 1 doses of SNP were better.

Keywords: *Capsicum annum, Carboxy-PTIO, Drought stress, Nitric oxide, Pepper, SNP.*

INVESTIGATION OF THE EFFECT OF CALCIUM APPLICATIONS ON PLANT DEVELOPMENT OF PEPPER PLANT IN SALT STRESS

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Abstract

Morphological effects of calcium (Ca) applied in different doses to pepper plant under salt stress were investigated in this study. The study was carried out under controlled conditions in 16/8 hour light / dark photoperiod, 25 oC and 70% humid climate room. Root weight, stem weight, leaf weight, number of leaves, plant height and total plant weight were measured. In addition, salt resistance scales of plants were determined. In the growth parameters, the 1st (150 ppm) and 2nd (200 ppm) doses of Ca applications showed the highest decrease compared to the control. As the dose increased, the values approached the control but started to decrease again at the 5th (350 ppm) dose of calcium. In the scale evaluation, which is a morphological observation, the most damaged plants were observed at the 1st (150 ppm), 2nd (200 ppm), 3rd (250 ppm) and 5th (350 ppm) doses of calcium, respectively, the least damage was the 4th (300 ppm) dose of calcium.

Keywords: *Pepper (Capsicum annum), Calcium, NaCl, Salt stress.*

IMPORTANCE OF HARVESTER FOR MEDICINAL AND AROMATIC PLANTS

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Abstract

The importance of medicinal and aromatic plants used in the fields of food, health and cosmetics is increasing day by day. It is known that medicinal and aromatic plants increase their problems with the increase of cultivation areas at the stages from production to harvest. In particularly, it is one of the most important issues to avoid the loss of product and quality losses in the harvest of these plants. With the increase in production areas, the mechanization of harvesting processes has brought the necessity to agenda. Although medicinal and aromatic plants have importance for farmers or users, still there is lack of research on harvesting machines which can be used to harvest these plants. In addition to short flowering periods, negative climatic conditions limit the harvest times in medicinal and aromatic plants. Because of the desire to harvest the flower or body part in the plants, there is a need for harvesting machines with different characteristics. For this purpose, different types of harvesting machines are used for less product losses and more economical harvesting of medicinal and aromatic plants. Particularly the harvesting machine parameters are emphasized on cutting of the desired parts of the plants and transporting them to the warehouse without being damaged. Combine harvester is one of the most protected strategies for sustainable harvesting.

Keywords: *Medicinal and aromatic plants, Harvesting, Harvester*.

ASSESSMENT OF CEREAL SPECIES BASED ON YIELD AND AGRO-PHYSIOLOGICAL PARAMETERS UNDER RAINFED CONDITION

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Abstract

Because of the various environment conditions yield, quality and other agro-physiological parameters in cereal species vary based on genotype, environment and its interaction. The experiment was carried out to assess bread wheat, durum wheat, barley and triticale cultivars for grain yield, agronomic parameters, physiological and quality parameters under rainfed conditions. In this experiment a total of 17 cultivars (5 bread wheat, 4 durum wheat, 4 barley, and 4 triticale) were evaluated during 2017-2018 growing season. The experiment was conducted in the randomized completely blocks design with four replications. Grain yield, days of heading, plant height, number of spike per square meter, aboveground biomass (NDVI), chlorophyll content (SPAD), canopy temperature, 1000-kernel weight, test weight, and protein ratio were investigated. Analysis of the variance revealed that there were significant differences among cereal species and cultivars for the parameters tasted. Mean grain yield for bread wheat was 6643 kg ha^{-1}, for barley 5588 kg ha^{-1}, for durum wheat 5193 kg ha^{-1} and for triticale 4914 kg ha^{-1}. According to results, bread wheat cultivars had higher grain yield and aboveground biomass, barley cultivars had higher number of tiller per square meters, and chlorophyll content. Triticale cultivars had higher plant height and barley had short plant height. Barley cultivars had higher 1000-kernel weight followed by bread wheat. Bread wheat had higher test weight and durum wheat had higher protein ratio. Result of the study showed that bread wheat had higher grain yield and desirable parameters tested than durum wheat, barley and triticale cultivars, so bread wheat has more advantageous than the other cereals crops.

Keywords: *Cereals species, cultivars, yield, agro-physiological traits.*

GENOTYPES ENVIRONMENT (GXE) INTERACTION AND ASSESSMENT OF BREAD WHEAT (*TRITICUM AESTIVUM* L.) GENOTYPES UNDER RAINFED CONDITION

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Abstract

Due to the various environment conditions yield and quality in bread wheat varies and GGE biplot analysis provides an easy and comprehensive solution to genotype by environment and it allows effective assessment of the genotypes and the target environments. In this experiment a total of 17 bread wheat genotypes were evaluated during 2008-2009 cycle at 4 environments under rainfed condition. The experiment was conducted in randomized completely block design with four replications. Grain yield, 1000-kernel weight, test weight, protein ratio, gluten value, gluten index, hardness and sedimentation were investigated. Mean grain yield across locations varied from 4742 kg ha^{-1} to 6601 kg ha^{-1}. Tekirdağ was the highest yielding location. Graphical result from PCI showed that the first principal component PC1, explained 42.85% of square interaction while the second principal component, PC2 explained 22.45% of square interaction. The result of PCA revealed that 2 principal components (PC1, PC2) contributed 65.30% of the total variability. The highest test weight and 1000-kernel weight were obtained in Tekirdağ location, protein ratio and gluten value in Edirne location. Cultivar Aldane was the best genotype as it was more stable than the other genotypes based on sedimentation value, hardness, protein ratio and gluten value. The results of the study revealed that there was considerable variation among locations that could be used in selection of bread wheat genotypes for the development of cultivars. Cultivar Aldane was very stable for quality parameters and could be used in a breeding program to obtain quality characters of the genotypes.

Keywords: *Bread wheat, genotypes, environment, quality, GxE interaction.*

DIE-BACK OF THE SIIRT CULTIVAR SEEDLINGS USED AS ROOTSTOCK FOR PISTACHIO TREES

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Abstract

Pistacia genus is a member of the *Anacardiaceae* family and consists of at least eleven species. Seven species, *Pistacia vera*, *P. terebinthus*, *P. khinjuk*, *P. atlantica*, *P. mutica*, *P. palaestina* and *P. lentiscus*, are present and distributed in different regions of Turkey. Except for *P. lentiscus*, which is in the shrub form and is a green plant, all other species grown in Turkey can be used as rootstock for pistachio trees. Nowadays, the main pistachio rootstock used in Turkey is *P. vera* cv. Siirt. The seedling of Siirt cultivar are widely used as a rootstock due to rapid growth, early reach to budding thickness and good budding take. These are desirable characteristics in the rootstock. However, in the last 2 years, it has been observed that the Siirt rootstocks start drying 2 months after the budding. The plants dry up to the ground level together with the bud shoots and form bottom shoots again from the bottom of rootstocks. It is considered that these plant dryings have been caused by high summer temperatures occurred in 2017 and 2018. When pistachio seedlings budded, strong pruning is done on the grafted plants in our region. In this case, the severely pruned plants are supposed to be unable to withstand the high temperatures and thus dried up. These dryings are less in seedlings that are not severely pruned during the budding.

Keywords: *Pistachio, Siirt cultivar, Rootstock, Die-back.*

DETERMINATION OF EFFECTS OF INFLORESCENCE THINNING ON YIELD, QUALITY AND ALTERNATE BEARING IN PISTACHIO TREES

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Abstract

Pistachio is one of the most important fruit species in our region and has an important potential for arid and semi-arid areas. Regular yield cannot be obtained from the pistachio trees due to alternate bearing. In the "on year" of pistachio trees, because of the large number of flower clusters that occur on annual branches, the cluster abscission occurs and 5-8 fruits remain on a cluster. In this way, the energy of 1-year branches is more spent on cluster skeletons and in these branches, both fruit bud abscissions which are the sources of the alternate bearing is severe and fruit quality is low. The aim of this study was to determine the effects of cluster thinning on growth, yield, quality and alternate bearing in the Uzun pistachio cultivar which is widely grown in our region. For this purpose, clusters were removed by hand before the flowering in pistachios and the effects of thinning on growth, yield, quality and alternate bearing were determined. Cluster thinning applications were made with 4 replications according to randomized blocks trial design and for this purpose 20 trees which were 20-25 years-old were selected. In these trees, 5 different clusters thinning were applied and they were: 1 clustering, 2 clustering, 3 clustering, 4 clustering, and control. Cluster thinning was applied to all branches of the trees. No thinning was done in the control. The thinning was done before the flowering. According to the results obtained from the study, the cluster thinning application increased the number of fruits in the cluster by 112%, yield increased by 39.5%, there was decrease in the flower bud abscission which was the source of alternate bearing, and there was increase in the shoot length by 71%. Also, the filled nut rate was increased by 9.76% in pistachios.

Keywords: *Pistachio, cluster thinning, yield, quality, alternate bearing.*

THE EFFECTS OF DIFFERENT FROST PROTECTANT COMPOUNDS ON THE SPRING FROST HARDINESS OF ALMONDS

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Abstract

This study was carried out to determine the effects of different frost protectant compound treatments on spring frost hardiness of Moncayo almond cultivar. The treatments were water spray (control), Cropaid (natural plant antifreeze), Bactocold (a microbial fertilizer containing a natural *Azospirillum brasilense* isolate), and Glacier (Cryoprotectant) applications. The first treatments were applied on the rest period of almond trees in winter, and second applications were done at the first bloom stage of flowering in spring at the same almond trees. The frost tests were applied in the laboratory at -3 °C and -5 °C for 2 hours. The spring frost hardiness order of compounds, from the most to least hardy, was as follows: Glacier, Bactocold Cropaid, and Control for -3 °C in flower and small fruits. On the other hand, in the frost test of -5 ° C, no flowers survived in all frost protection applications.

Keywords: *Almond, Spring Frost, Frost Protectant.*

EVALUATION OF DIFFERENT MECHANICAL HARVESTING SYSTEMS OF TABLE OLIVE (*OLEA EUROPAEA CV. GEMLIK*)

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Abstract

The trials were conducted in Gemlik olive variety (Olea europaea cv. Gemlik)'s orchard to determinate the harvesting performance of different harvesting methods namely limb shaker, hand picking and trunk shaker at different frequencies and compare these harvesting methods. Trunk shaker with eight different frequencies were operated. In the first and second year of the experiments at the optimum harvest time, fruit volume, fruit detachment force, fruit weight, the ratio of fruit detachment force to fruit weight were found to be 3.9-4.0 cm^3, 3.27-3.99 N, 4.23-4.28 g, 0.77-0.94 respectively. Best results were obtained by using the trunk shaker with low frequencies as TSM 22 Hz for 8 sec. Damage levels, harvesting efficiency, duration of operation per tree and work productivity of trunk shaker with 22 Hz were found as 2.86%-7.24%, 93.93%-92.92%, 2.51-2.81 min $tree^{-1}$ and 286.22-355.72 kg h^{-1} respectively in two-year trials.

Key words: *Trunk shaker; Vibration; Olive Harvesting, Harvest performance.*

THE EFFECT OF DROUGHT STRESS ON FRUIT AND SEED COLOR IN PUMPKIN (*CUCURBITA PEPO* L.) GENOTYPES

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Abstract

Due to climate change, today, many agricultural areas are affected by drought. It is known that drought has many effects on plants, morphologically, physiologically and phenologically. In the study, the effects of drought stress on the fruit and seed color of the pumpkin genotypes were investigated. For this purpose, in 2017 and 2018, 48 pumpkin genotypes, consisting of 44 inbred lines and 4 commercial varieties, were grown in irrigation and non-irrigation conditions. The study was conducted by using a randomized block design with three replicates. Each parcel has an area of 20 m^2 and consists of 40 pumpkin plant. In this study, drip irrigation system was used and irrigation was applied ten times with seven days interval. We recorded fruits and seed color values (L *, a *, b *) with Chroma Meter CR-400, every two years. As a result of the study, it was determined that drought did not effect on fruit color values of L * and b *, but it had a significant effect on fruit color value of a* in pumpkin genotypes. Therefore, as the drought increases, the fruit colors shifted from green to red. Moreover, pumpkin seed color, which has economic value, was not affected by drought. When examined on the basis of genotypes, drought has important effects on fruit and seed colors.

Keywords: *drought, pumpkin, fruit color, seed color.*

NITROGEN FIXATION IN LEGUMES AND CHANGES IN CLIMATE

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Abstract

Increase in the world population is directly related with requirement of fossil energy and production of fertilizer as well. The truth in this condition is economic difficulty and environmental damage. Intensive agriculture systems cause to huge amount of nitrogen fertilizer usage which led to concern on N cycle over the soil-water nitrate accumulation and nitrogen oxide in atmosphere. Change in climate over the world is an essential issue for humankind. Scientific researches on plant response to environmental factors are a topic which increasingly takes attention due to concern on resources of plants, biodiversity and global food security. Legume family known as eco-friend and health-care plants which are fundamental crops for sustainability besides presenting second major crop of agricultural importance over the world. Depending on environmental changes, response of legume nitrogen fixation varies by view of drought, salinity, heat stress, carbon dioxide concentration and soil acidity. Present paper describes the main environmental factors which are directly connected with climatic changes and their major effects on N_2 fixation and legume production worldwide. Additionally, suggestions for adaptation of symbiotic legumes to climatic variability on production quantity are given depending on recent studies by view of molecular and biotechnological efforts over the world. Therefore, aim of the paper is improvement of healthy food supply consider to sustainable agricultural system.

Keywords: *Eco friendly, Global warming, Grain legumes, Rhizobium, Sustainable agriculture.*

SUSTAINABLE PESTICIDE USAGE IN FARMING LEGUMES

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Abstract

Pesticides are used in agriculture commonly including insecticides, fungicides and herbicides. Today, almost a total of 900 pesticide products and 600 active pesticide ingredients accessible in the markets. Millions of tons of pesticides are used in agriculture while only 5% of them are selective which means rest of it (95%) stored in soil, non-targeted systems, mix to water and atmosphere as well. Plants that are exposed by pesticides response in various amounts depending on physicochemical features, genotype, soil and environmental conditions. Pesticide application can realized by roots and other upper organs of the plants. A part of the pesticides are reasonably persistent and non-biodegradable. Pesticides which are taken by plants can change the locations through xylem or phloem while only by phloem in roots. Their mobility affected from water solubility characteristics. Therefore, oxidation of pesticides is important for their activity. For all that, many of pesticides have long half-life and remains in plants. Legumes are the secondary important food for human following to grains. Yield and quality of legumes reduces owing to pesticides (aldrin, chlorpyrifos, chlordane etc.). Additionally, pesticides also have negative effects on symbiotic nitrogen fixation by affecting the rhizobium bacteria. Nevertheless, bacteria which have pesticide tolerant strains may grow under pesticide stress. As the main principle of sustainable agricultural systems, legumes are essential crops in rotation. Present paper describes effects of the pesticides which effects growing, yield, photosynthetic activity, nitrogen fixation and tolerance in legumes.

Keywords: *Agricultural pollution, Biodegradation, Pesticide effect, Sustainable agriculture, Toxicity.*

SOME FACTORS AFFECTING FLAX FIBER YIELD AND QUALITY

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Abstract

Flax (*Linumusitatissimum*) being an ancient crop, has performed a significant role throughout human history. The principal use of flax was industrial, manufacturing textiles from fiber, and paints and varnishes from oil. However, in the last decades decline in flax cultivation has been observed. Nevertheless, recently the renewed interest in flax products has been noticed. This is due to research findings suggesting that the flax raw material provides a variety of industrial and health benefits. Flax fiber gains more and more applications, like in the automobile and construction industries as a recyclable composite material. Recent studies have focused on improving quality and increasing the productivity of flax fiber.In this work, depending on previous studies different factors that influence the quality and yield of fiber flax are presented. These include sawing date, sawing rate, harvest time, and retting process. Several sawing dates influence fiber quality and yield. Deferent aspects of retting process, with an explanation of retting water quality are discussed. Harvest fiber flax at mid- stages of maturity significantly affects the fiber yield and quality.

Keywords: *Fiber flax, Fiber quality, Retting process, Sawing date, harvesting date.*

MECHANIZATION OF FIBER CROPS HARVESTING

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Abstract

The bast fiber crops are considered the major contributors among the productive fiber plants. The bast fibers are sclerenchyma fibers associated with the phloem of crops such as cotton, flax, hemp, kenaf, ramie, nettle, jute, etc. Generally, bast fibers are used for industrial applications in textile, construction, automotive, and other industries. Recently, bast fibers have become also important as renewable raw materials for the production of strong, lightweight composite materials. Although there has been a noticeable interest in bast fiber crops recently, there are gaps in harvesting technologies. When bast fiber crops are grown for textile fiber and other high-quality applications, the crop should be harvested when the fiber is at its highest quality. Since most of the fiber harvesters are modified harvesters of mowers or others, this means that there is still a need for harvesting technologies that reduce the cost of production and maintain the quality of the fiber. The aim of this paper is to present a review of the common systems of mechanical harvesting for bast fiber crops, with more attention to hemp (*Cannabis sativa* L.) and flax (*Linum usitatissimum* L.).

Keywords: *flax harvester, hemp harvester, mechanical harvesting systems.*

OBTAINING HAPLOID AND DIHAPLOID LINES IN EDIBLE SEED PUMPKIN (*CUCURBITA PEPO* L.)

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Abstract

Pumpkin (*Cucurbita pepo* L.) has different consumption shapes and it is consumed as appetizer, and therefore pumpkins are produced in Turkey. Pumpkin seed cultivation in Turkey tends to be widespread. Especially after 2000's, there has been an increase in both production area and production. According to the latest data, the production area is 65.000 hectares and the production amount is 41.000 tons (TUIK, 2017). There is a need of F1 pumpkin seed cultivars in Turkey. For this purpose, 77 genotypes were used as vegetational material in our study, haploid and doubled haploid lineswere aimed to be obtained. In this study, irradiated pollen technique was used. The ray doses used were 100 and 150 Gy. In the pollination studies 74 flowers were pollinated at a dose of 100 Gy, and 39 fruits were obtained with fruit set rate of 52.7%. The average fruit weight was between 405 g and 3760 g. Pollinated 70 flowers at a dose of 150 Gy, provided 35 fruits and fruit set rate was 50%. The average fruit weight was between 602 g and 4205 g. 9301 seeds and 244 embryos were obtained from 39 fruits at a dose of 100 Gy. The number of seeds per fruit was 238 and the number of embryos per fruit was 6.3. Of the 150 Gy doses, 8,774 seeds were counted in 35 fruits and 234 embryos were removed. The number of seeds per fruit was 250.7 and the number of embryos per fruit was 6.7. Of the 244 embryos obtained from 100 Gy ray doses, 136 were rooted, 54 of them were transformed into plants and transferred to external conditions, 44 of them was kept alive by being accustomed to external conditions. The plant conversion rate was 18.0%. Of the 234 embryos obtained from 150 Gy ray doses, 99 were rooted, 67 of them were transformed into plants and transferred to external conditions, 51 of them was kept alive by being accustomed to external conditions. The plant conversion rate was 21.8%. As a result, 478 embryos were obtained in total; 235 of them were rooted, 121 of them have been transformed into plants and adapted to external conditions, 95 of them was kept alive by being accustomed to external conditions, and plant conversion rate was 19.9%.We have observed 63 plants in the ploidy detection we have done so far, 3 plants from 100 Gy doses and 6 plants from 150 Gy doses were identified as haploid (n). In 6 plants, myxoploid (n + 2n) structure was observed.

Keywords: *Edible pumpkin seeds, Haploid, Dihaploid.*

BIODIVERSITY ON PASTURES: HUNTING AND SOCIO-ECONOMIC DIMENSIONS

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Abstract

Pastures are main living area of many living organisms and hunting as well. Environmental pollutions, intensive farming systems, urbanization and excessive usage of natural resources caused to significant negative effects on ecosystem even distinction of many species which gave rise to decrease in biodiversity. Wild species of both animals and plants absolutely depend on pastures while these areas are in danger by corruption of balance which is welded by human eventually while natural disasters and epidemic diseases have just a very few ratio. On the other hand, senseless utilization of the pastures likewise out of purpose, excessively irrigation, fertilization, pesticide application, pasturage, illegal hunting and/or on forbidden period, misidentification, extreme and unconscious collection from nature etc. significant mistakes caused to great negative threats on biodiversity on the pasture areas that are quite important side or direct effects on sustainability of ecosystem. Hunters usually do the activity because of the sporting activity, friendship, food, hobby and habit. Some of the hunters do not have license and have a little knowledge about sustainability components such as; birth season, number of kids, average life time, diet, limitation and techniques. It is fair that most of the interviews with hunters showed that the hunters love the animals very much and their associations realize many activities to increase to animal population. Finally, remediation of destruction on nature is extremely limited and impossible in some cases. Therefore, present paper focused on threats on biodiversity of hunting animals in pastures, its socio-economic perspectives and to make suggestions.

Keywords: *Bioresource, Extinction, Hunter, Sustainable environment, Wild life.*

EFFECTS OF SHOOT TIP SIZE ON VIRUS ELIMINATION IN GRAPES

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Abstract

In viticulture, the most important diseases caused by intercellular pathogens are viruses. Infected plants may show symptoms like weak growth, late bud break, decreased yield and quality, also plants died in a few years. Thus, before the establishment of vineyard plant materials must be free from viruses and the other diseases. There are some methods to clean viruses from plants. Meristem and shoot tip culture is one of them. Meristematic zone is usually free from disease factors. Smaller size than 0.1 mm explants referred as meristem culture. Practically 0.1-0.2 mm size explants are used. The smaller the explant the more success the elimination of pathogens. On the other hand smaller explant has less ability to survive. In this study we aimed to investigate the correlation between the explant size and the success of virus elimination. Superior seedless grape variety was used. Plants were tested prior to thermotherapy and *in vitro* culture and verified as infected by different viruses (GLRaV-1+3, GLRaV-4 Strains, GRSPaV). Different size of shoot tip explants (0.1-0.5-1-5-10 mm) were excised and cultured on MS medium supplemented with $1mgl^{-1}$ BA. After two months of regeneration samples were taken for virus analysis and the results were evaluated. Less or no virus infection were detected in smaller size explants.

Keywords: *Shoot tip, Explant size, Virus elimination, Grape.*

WATER-YIELD RELATIONSHIPS IN SILAGE MAIZE IRRIGATED WITH DIFFERENT LEVELS UNDER DIFFERENT SOIL TILLAGE PRACTICE CONDITIONS

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Abstract

Silage maize is an important plant in the Eastern Anatolia Region where it is grown in an increasingly rising rates to meet the need for animal green forage. Increased pressure on fresh water resources requires the implementation of different strategies for water saving in irrigated agriculture. Therefore, the effects of three different tillage methods (Conventional tillage, Reduced tillage and No–tillage) and four different irrigation levels (100%–control, and 75%, 50%, and 25% of the control) were investigated in a semi-arid region to determine the water-yield relationships of silage maize. Soil tillage methods and irrigation levels affected silage maize yield. Silage yield (71.4 t ha^{-1}) in no–tillage method with 245.6 mm water use was by 10.8% higher than conventional tillage method which consumed 5% more water. Linear changes were observed in water–yield relations. Considering soil tillage methods only, no–tillage method significantly increased the water use efficiency. In the no–tillage method irrigated with the irrigation levels of 100%, 75%, 50% and 25%, higher yields were obtained by 9.3%, 10.5%, 13.0% and 11.1%, respectively compared to the conventional tillage method. Therefore, it was determined that the highest proportion of increase in yield was realized in 50% water deficit.

Keywords: *Water deficit, Direct drilling, traditional soil tillage, reduced soil tillage, Silage maize.*

BIOCHEMICAL DIVERSITY OF UGANDAN CULTIVATED *COFFEA CANEPHORA* SENSORY ORGANOLEPTIC CUP ATTRIBUTES

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Abstract

This study differentiated Ugandan cultivated *Coffea canephora* organoleptic cup attributes as a way of profiling, determining market variability and identifying heterogeneous genotypes for crop improvement and conservation. Three expert Barristers from Uganda Coffee Development Authority (UCDA) evaluated 208 genotypes from 21 districts and two research institutes in 2012. Robusta cupping protocol was developed by mainly The Coffee Quality Institute of America, UCDA, Specialty Coffee Association of America. Cup quality biochemical flavours were subjectively detected, quantified and described based on experience on 1-10 point descriptive scale; 1= least perceived, 10= strongly perceived. Data was analyzed with EXCELSTAT version 2011.2.05 (Addinsoft), Paris, France. Results revealed significantly different evaluators' organoleptic cup trait rating, reflecting diverse cup preferences. Four multivariate groups that were significantly different for fragrance, aroma and flavour offered diverse cup tests to different markets. Cup balance contributed the highest regression coefficient (0.90) to overall assessment while fragrance/aroma had the least (0.22). Accession rating ≥ 75% for cup balance, flavour, mouthfeel, aftertaste, fragrance and aroma revealed Ugandan Robusta was of high quality with mild taste. 'Nganda' and 'erecta' high genotype cup acidity coupled with about 50% sweet accessions revealed genotypes with high sugars and cup acidity can be identified from landraces. Lack of genotypes with fine grade acidity and sweet cup further validated the characteristic reducing cup acidity and sweetness in Robusta coffee. Coffee types, soil texture, altitude and location influenced liqour attributes. Diverse flavours in Ugandan Robusta can be exploited to diversify markets, enhance quality and crop husbandry.

Keywords: *Robusta, liqour traits, environment factors.*

DIFFERENTIATION OF MAIZE LINES WITH HIGH CONTENT OF CAROTENOIDS USING PROTEIN AND DNA MARKERS

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Abstract

Wide natural variety of carotenoids, including vitamin A precursors, is characteristic of maize (Zea mays L.), which allows using it to combat vitamin A deficiency in the world. Previous studies have established the effectiveness of the use of functional DNA markers in the selection of maize lines with a high content of carotenoids in grain. However, not only improving grain quality but also creating highly productive hybrids competitive on the grain market is currently important. The purpose of our study was to determine the genetic diversity of maize lines using storage protein and DNA markers, as well as to find correlations of two marker systems with FAO characteristics. On the basis of maize lines selected for high content of carotenoids, the allelic state of six SSR markers (phi022, phi034, phi062, phi073, phi079, phi085), electrophoretic spectra of zein and their electrophoretic mobility have been determined. Cluster analysis of maize lines using electrophoretic spectra of zein yielded eight clusters. It was found that the minimum genetic distance was 4.24 and the maximum 7.48 Cluster analysis by the identified alleles for SSR markers allowed to form seven clusters according to the affinity of the lines. Range of changes in genetic distances was from 1.00. to 3.46 The analysis of genetic distance matrices, using the Mantel test, found a correlation between the marker systems under study (r = 0.184). A correlation between the studied marker systems and their relation to FAO characteristics was established. Therefore, in order to increase selection efficiency of maize, it is advisable to use an integrated approach to the evaluation of breeding genotypes involving protein and DNA markers.

Keywords: *storage proteins; SSR markers; cluster analysis; correlation.*

SPRING WHEAT VARIETIES WITH THE ENHANCED ABILITY TO GROW UNDER MINERAL DEFICIENCY IN SOILS AND INCREASED CONCENTRATION OF MINERALS IN GRAINS

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Abstract

There is a serious mineral deficiency particularly for Iron [Fe], Zink [Zn] and Copper [Cu] in human diet worldwide and in Ukraine too. Wheat grains satisfy daily calorie intake, they are inherently low in Fe and Zn, particularly when grown on Fe- and Zn-deficient soils. The range of variability for 24 spring wheat varieties in the extraction of minerals from the two different soils and their delivery to flag leaves, flowers and loading to grains has been established. Large variation of grain Zn concentration was observed in crop season Y2018, with a range from 24,59 to 65,66 ppm depending on the minerals bioavailability. In Y2017 Zn concentrations varied from 10,27 to 19,06 ppm. Fe concentrations in Y2017 crop season were in the range 27,94-59,18 ppm, in Y2018 grain Fe varied from 23,7 to 42,57 ppm. Differences in variability between *T. aestivum* and *T. turgidum* genotypes were observed, the studied durum wheat had higher concentrations and higher bioaccumulation characteristics in a both growing seasons. Grain Cu concentrations in Y2017 ranged from 1,88 to 3,94 ppm, in Y2018 – from 3,05 to 5,34 ppm. Wider variation in grain Cu concentrations was noted at high Cu environment. The correlation of grains number per spike, a spikelet number per spike, the weight of 1000 grains with the leaf, spike and grain Zn, Fe, Cu, Mn and Ni were estimated. According to the results, five most efficient wheat varieties could be considered as candidates for further classic and molecular breeding for the efficient nutrient quality of grains.

Keywords: *Spring wheat, Mineral deficiency, Zink, Iron, Copper.*

EVALUATION OF RAPE SEED GENETIC DIVERSITY AND CREATION OF DROUGHT-RESISTANT GENOTYPES USING *IN VITRO* CELL CULTURE

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Abstract

Rape seed (*Brassica napus* L.) is one of the major industrial high-yielding oilseed and fodder crops. Water deficit in the limits plants genetic potential in all agro-climatic zones of growing. One of the main ways to increase rape seed productivity is to create new hybrids with the optimal response to environmental changes. The efficiency of breeding is largely determined by the genetic diversity of plant breeding genotypes, which is accepted to be evaluated by morphological features in the process of state variety testing and by using DNA markers. The purpose of this study was to evaluate the genetic polymorphism of spring and winter rape seed varieties using morphological and DNA markers, followed by their use for obtaining drought-resistant lines with the aid of *in vitro* cell selection. The study involved varieties of winter and spring rape seed. Resulted from cluster analysis were two clusters formed by morphological features. According to the varietal distribution by SSR markers (Ra3-H09, Na12-A02, FITO-063, Na10-B07), three clusters were obtained. No correlation between the matrices of genetic distances by morphological features and the DNA markers under study was found; however, the distribution obtained by genetic distances allowed to detect the difference between the studied rape seed varieties. As a result of the mutagenic action (γ-irradiation in a dose of 40 Gy) on micro calluses of rape seed varieties, which significantly differed by morphological and DNA markers, and subsequent gradual cell selection *in vitro*, about 4% of the drought-resistant rape seed clones were selected. Thus, the obtained distribution of varieties by morphological traits and SSR markers ensures a reliable basis for identification of varietal differences in selection for drought-resistant rape seed.

Keywords: *SSR markers; morphological traits; cluster analysis; cell selection*.

BIOCHEMICAL STRESS MARKERS OF PLANTS IN CONDITIONS OF FOREST AND PARK ECOSYSTEMS

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Abstract

The secondary metabolism of plants is very sensitive to the environmental factors. In the processes of physiological adaptations of plants, an important role belongs to the phenolic compounds. The total content and the ratio of phenolic components depend on the nature of stress factors. Thus, the latter can be considered as stress markers and used in the phytoindication of the levels of anthropogenic transformation observed in the forest and park ecosystems. The biochemical markers were studied using the referent species *Acer platanoides* L., *Carpinus betulus* L. and *Sambucus nigra* L., sampled in the National Nature park "Holosiivskyi" (Kyiv, Ukraine). According to the phyto-chemical profiling and analysis of the total content of phenolic compounds in plant leaves, the synthesis of metabolites of that class is quite sensitive of the habitat conditions. For the studied species, the highest phenolic content was observed in leaves of plants growing on insignificant elevations and slopes. The content of phenolic compounds such as flavonoids and catechins decreased in plants growing on plots with relatively high level of recreation pressure. The content of phenolic compounds and anti-oxidants was comparatively high in *Carpinus betulus*. The plants of *Acer platanoides* and *Sambucus nigra* exhibited high sensitivity of several pathways of phenylpropanoid synthesis, resulting in certain phenolic components. The plants of *Acer platanoides* were significantly sensitive to the environmental factors. In their leaves, the concentration of phenolic compounds changed almost by half depending on the habitat conditions. In contrast, the leaves of *Sambucus nigra* plants varied more by their qualitative and quantitative composition of flavonoids. The chlorogenic acid, also, was shown to be highly informative, according to the analysis of principal components. That phenolic compound has high anti-oxidative potential. It lowers the pro-oxidative activity of free radicals in the plant tissues under oxidizing stress. Simultaneously, the chlorogenic acid increases the enzymatic activity of the anti-oxidant system. The ratio of chlorogenic acid to the total content of the identified phenolic compounds is a relative index of the plant's physiological state. Hence, the ratio value can be considered a biochemical marker of stress in the indicator plants. That is especially important if there are no visually obvious signs of damage or depression in plants.

Keywords: *forest ecosystem, marker, phytoindication, phenolic compound, stress.*

COMPARATIVE EFFECTS OF AGRICULTURAL POWDER LIME AND LIQUID LIME ON GROWTH OF MORINGA

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Abstract

Moringa is described as one of the world's most nutritious crops and has multiple uses. The plant can be cultivated in a wide range of soil types, but grows best in soils with slightly acidic to neutral pH. An experiment was conducted to compare effects of agricultural powder lime and liquid lime on growth of *Moringa oleifera.* The experiment was set up in the open fields at the Copperbelt Research Station in Mufulira district on the Copperbelt province of Zambia which soils were generally acidic. The experimental design was a completely randomized block design with 5 treatments replicated 3 times at a spacing of 3 × 3 m between plants. The treatments consisted of powder lime applied at a rate of 1000 kg/ha and 2000 kg/ha, and liquid lime applied at the rate of 6 litres per hectare and 12 litres per hectare. The data generated were analyzed using the ANOVA in Genstat Statistical software. Results indicated that the response of *moringa* to different rates of powder and liquid lime applications was significantly different among treatments. Growth of *moringa* was significantly increased ($P < 0.05$) with the application of Powder lime at a rate of 2000 kg/ha compared to the application of other treatments. Further studies are suggested to determine optimum application rate of liquid lime to enhance growth of *moringa* in acidic soils.

Key Words: *Powder lime, Liquid lime, Acidic soils.*

PARALLEL COORDINATE PLOT IN THE SELECTION OF SUPERIOR SOYBEAN GENOTYPES

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Abstract

Parallel coordinates plot (PCP) is an effective technique for presenting multivariate data, identifying clustering structures, and analyzing correlations between different variables. PCP represents opservations as a series of continuous lines that run through parallel axes, each representing a different variable, with each continuous line representing one genotype, while parallel axes represent agronomic traits. The aim of this paper was to use PCP to visualize 8 quantitative traits in 90 soybean genotypes from different maturity groups (MG) examined in two-year trials at two sites, to determine the grouping structure of genotypes and correlate traits and identify the genotypes with the highest number of agronomically significant traits. The structure of variation of traits in the genotypes of different maturity groups was generally similar in all maturity groups, except for MG III, where a specific model of variation emerged, due to the genotypic composition of this group (genotypes of the semi-dwarf growth type, determinant stem). In the MG 00 genotypes, a group of high protein content but low grain yield and oil content was observed. MG 0 identified high-yield genotypes as well as one high-protein and high-yield genotype at a time. In GZ I, two genotypes with the highest yield, high number of pods and grains and maximum 1000 grains weight were isolated. Within GZ II, genotypes of high oil content and grain yield above the group’s average were considered significant for further work. PCP has proven to be an effective method for identifying superior genotypes that can be used as parental components in soybean breeding.

Keywords: *soybean, quantitative traits, multivariate analysis, PCP.*

2. PLANT PROTECTION AND FOOD SAFETY

EFFICACY OF TOTAL HERBICIDES ON WEED CONTROL WITHIN ROWS IN APPLE ORCHARD

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Abstract

This study investigates the efficacy of total herbicides in apple orchard. The field experiment was conducted in 2017 in apple orchard on calcaric fluvisol soil in the municipality of Istog in Kosovo. The trial was set in a randomized block design with four replications and elementary plots of 10 m^2. All herbicides were applied when the weeds were 15-25 cm high, the number and structure of weeds and the efficacy of herbicides were estimated 30 days after herbicide application, by comparing sprayed plots and control plots (untreated). A total number of 19 weed species was documented. The dominant weed species in control plots were *Chenopodium album* 25.5 plants/m^2, *Capsella bursa-pastoris* 16.3 plants/m^2, *Amaranthus retroflexus* 11.3 plants/m^2, *Poa trivialis* and *Rumex crispus* 9.8 plants/m^2, *Sonchus arvensis* 9.5 plants/m^2 and *Chenopodium hybridum* 9.3 plants/m^2. The number of weed species in sprayed plots with herbicides ranged from 5-8. The most efficient herbicides proved to be glyphosate (Glyphogan) 480 SL 92.3%, followed by glyphosate (Touch-down) 91.6%, glyphosate (Nasa SL) 91.3%, glyphosate (Roundup 5) 90.6% and glufosinat-amonium (Basta) 89.7 %. Herbicides used showed impact on the reduction of weeds number and above dry biomass of weeds. Based on the results presented, we recommend the usage of herbicide glyphfosate in the study region for successful weed control.

Keywords: *Apple orchard, Efficacy, Herbicide, Weed species.*

LEAF MINER ON APPLE ORCHARDSMOTHS AND THEIR PARASITOIDS

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Abstract

Leaf miners moths are becoming a serious threat of nurseries and apple orchards in Albania. Natural enemies are considered one of the most important integrated pest management strategy for leaf miners moths. The aim of our work was to identify and monitor population dynamics of leaf miners and their natural enemies in apple orchard of Albania. Ten trees were randomly selected from pome fruit apple orchards in the District of Ndroq (Tirane). The sample unit was 10 leaves per tree. Samples were maintained in plastic bags and transported in the laboratory of Plant protection (Agricultural University of Tirana). The leaf miner species were identified by using laboratory techniques based on male genitalia. A identification key was used for leaf miner species, as well as for natural enemies. Six species of leaf miner moth were found and identified in apple orchard: *Phyllonorycter blancardella* (F.), *Phyllonorycter corylifoliella* (Hb.), *Phyllonorycter mespilella* (Hübner), *Phyllonorycter pomonella* (Zeller), *Leucoptera scitella* (Zeller), *Stigmella malella* (Stainton), *Lyonetia clerkella*, (Comst). Regarding parasitoids, the following 3 species were identified: *Sympiesissericeicornis* Nees., *Pediobius pyrgo* Walk., and *Apanteles circumscriptus* Nees, and 3 species of predators: *Coccinella septempunctata* (L), *Chrysopa carnea*, and *Chrysopa perla*.

Key words: *Leafminers, parasitoids, Phyllonorycter spp, Sympiesissericeicornis Nees., Pediobius pyrgo Walk.*

ANTI-OXYDANT ACTIVITY OF THE ESSENTIAL OIL OF CUMINUM CYMINUM

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Abstract

We evaluated the anti-oxydant activities of the essential oil of Cuminum cyminum against free radicals that are responsible for various serious human diseases. The measurement of the absorbance (or optical density OD) is carried out by spectrophotometry at 517 nm. At this wavelength, the radical is absorbed, but after its reduction by the antioxydant, the absorption decreases. We calculated the percentages of DPPH radical inhibitions that are represented as a function of the different concentrations. The anti-oxydant activity of the essential oil of caraway is expressed in IC50. These IC50's are determined graphically. The x-axis represents the concentration of the essential oil and the y-axis the percentage of inhibition. The IC50 value expresses the concentration of essential oil required to reduce 50% DPPH in solution. This essential oil has a capacity for reducing the free radical. The concentration required for the neutralization and stability of 50% of the DPPH concentration is 0.318 g / l. According to this result, it can be said that the essential oil of cumin has a very important antioxydant activity and superior to that of ascorbic acid and BHT.

Keywords: *oil, Cuminum, human diseases.*

ANTIFUNGAL ACTIVITY OF *MENTHA ROTUNDIFOLIA* ESSENTIAL OIL AGAINST *ALTERNARIA ALTERNATA*

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Abstract

The antifungal activity of *Mentha rotundifolia* essential oil, harvested in Setif (Algeria) was evaluated *in vitro* against a phytopathogenic fungus *Alternaria alternata*, causing damage on tomato. The molecular identification of the strain was based on a comparison (BLAST) of the sequences obtained against a database and was often supplemented by microscopic observations. After "SANGER" sequencing of the PCR products, the sequences were received in FASTA format. Analysis of the essential oil of *M. rotundifolia* by Gas Chromatography/Mass Spectrometry method (GC-MS) identified 14 compounds. The 3-Cyclopenten-1-one, 2-hydroxy-3- (3-methyl-2-butenyl) - was the major constituent of this oil with a rate of about 89.09%. For this activity, we adopted the technique of direct contact on agar. *A. alternata* continued to grow on oil-free media at 1% and 0.1% (fungistatic effect); also on media with an oil concentration of 0.01%. While the explants taken from petri dish concentration in essential oil is 2; 4 and 10% did not grow (fungicidal effect). The very interesting antifungal effect of *M. rotundifolia* essential oil indicates the potential of this plant species as a source of natural fungicidal material. The present study revealed that this mint exhibited antifungal effect against *A. alternata* which provided a scientific basis for the use of this species as a good source of antifungal compounds. This preliminary work could provide a basis for the determination of sufficient and effective concentrations for *in planta* studies for the biological control of natural active substances of *M. rotundifolia* against fungal diseases.

Key words: *Mentha rotundifolia, essential oil, Alternaria alternata, molecular identification, GC/MS.*

EVALUATION OF THE SUPERFICIAL CONTAMINATION OF SHEEP CARCASSES FROM TWO SLAUGHTERHOUSES AT ALGERIA

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Abstract

In Algeria, ovine meat is a major source of protein with around 20 000 000 of ovines. The slaughtering procedure is mainly artisanal. Red meat is a favorable environment for the development of a large number of bacterial species that may be responsible for the alteration of the meat or risk for the consumer. In this study, samples were taken from ovine carcasses in two slaughterhouses located at west of Algiers (Algeria). In each built, 40 stamped ovine carcasses randomly chosen were sampled. Sampling swab technique, validated by the standard ISO 17604 (ISO, 2003d) was chosen. It is a double swab with a wet swab and then a dry one on a surface of 100cm^2. For each carcass, we collected 4 anatomical sites likely to have the greatest prevalence of contamination: neck, end of the chest, flank and thigh. The amount of total aerobic mesophilic flora and of enterobacteriaceae was calculated on 80 carcasses. The results were evaluated regarding European regulation 2001/471/EC. For both slaughterhouses, the total aerobic mesophilic bacteria counts 4.84 log10 CFUs/cm^2 were close to the upper limit (5 log10 CFUs/cm^2). The Enterobacteriaceae counts for the two slaughterhouses were 4.38 log10 CFUs/cm^2 and 3.30 log10 CFUs/cm^2, respectively. These values were above the upper acceptable limit (2.5 log10 CFUs/cm^2). In conclusion, the ovine carcasses, in Algeria, seem to be heavily contaminated by bacteria constituting a risk of food poisoning. It is imperative to minimize microbial contamination making improvements concerning sanitation, facilities, equipment, operation and staff at the two slaughterhouses.

Keywords: *Slaughterhouse, carcasses, enterobacteriaceae, total aerobic mesophilic bacteria, contamination.*

FUNGI IN THE OVINE CARCASSES ENVIRONMENT IN THE SLAUGHTERHOUSE OF STAOUELI IN NORTH OF ALGERIA

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Abstract

Meat contamination is a major public health problem. This contamination is also a major cause of lower economic productivity. A large number of bacteria have been isolated on the surface of carcasses, but also yeasts and molds. The slaughterhouse is a major place for this contamination. The objective of our study was to evaluate the occurrence of these fungi in 4 anatomical sites (neck, shoulder, abdomen and thigh) of ovine carcasses slaughtered in slaughterhouse of Staoueli and to assess some risk factors: slaughter staff (left and right hand), slaughter equipment (knives, axes and rifles), infrastructure (floor, walls, faucets, hooks and air). For this purpose, 140 swabs were used. That is 80 samples taken from 20 ovine carcasses, 8 swabs were obtained on the hands of slaughter staff, 24 swabs were collected on slaughter equipment and 28 from infrastructure. Our results showed a high prevalence (77.14%) of fungi with a predominance of yeasts, and revealed the presence of 12 species of yeast and 5 species of mold with a strong frequency of *Candida* sp. (42.13 %) followed by *Trichosporon cutaneum* (20%), *Torulopsis* sp. (10.71%), *Rhodotorula glutinis* (7.85%), *Rhodotorula rubra* (7.14%), *Geotrichum candidum* (3.57%), *Cryptococcus albidus* (0.71 %), *Geotrichum capitatum* (0.71%) for yeast, and *Penicillum* sp.(34.48 %), *Penicillum commun* (27.68%), *Mucoral* (17.24%), *Cladosporium* sp. (13.79 %), *Aspergillus niger* (6.68%) for mold. These results suggest that the slaughterhouse constitutes one of the major critical points on the hygienic quality of meat and prove a disrespect of hygiene rules before, during and after slaughter.

Keywords: *Ovine carcasses, slaughterhouse, yeasts, molds, contamination.*

STUDY OF CYSTICERCOSIS AND TOXOPLASMOSIS IN THE OVINE CARCASSES IN ALGERIA

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Abstract

The present study was carried out in two slaughterhouses located in north of Algiers (Algeria) to determine the prevalence of cysticercosis and toxoplasmosis in the ovine carcasses slaughtered for human consumption. Cysticercosis was studied by macroscopic examination of 10696 sheep carcasses, while for toxoplasmosis we used two techniques: the E.L.I.S.A test in 580 sheep sera and the histopathological analysis on samples of the oesophagi and diaphragms of 335 sheep. At the inspection, 461 (4.31%) carcasses were infested by cysts of *Cysticercus* sp. 241 (2.25%) carcasses presented visceral vesicles of *Cysticercus tenuicollis* followed by muscle cysts of *Cysticercus* sp. with 220 (2.06%) carcasses. All the muscle cysts were calcified. Sex and age of animals were considered as risk factors associated with muscle cysts of *Cysticercus* sp. infection. The heart (51.82%) was the predilection site for muscle cysticercosis, followed by diaphragm (30.77%) and esophagus (17.41%), while the liver (57.71%) was the most infected by visceral vesicles of *C. tenuicollis* followed by omentum (42.29%). Histopathological analysis showed that only 2 sheep presented cysts of *T. gondii*. The E.L.I.S.A test revealed a prevalence of 8.28% (48/580) of sheep. All positive sheep were males. Seroprevalence for *T. gondii* increased with age, but the difference was not statistically significant. The seroprevalence was significantly higher in summer and in the center of Algeria. Thus, season and origin of animals were considered as risk factors associated with *T. gondii* infection. These results suggest that infection with *T. gondii* and *Cysticercus* sp. in sheep were present in the north of Algeria.

Keywords: *Cysticercus spp., Toxoplasma gondii, ovine, histology, ELISA.*

DISSEMINATION OF CTV IN THE AREA OF MITIDJA IN ALGERIA (2002/2012)

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Abstract

For over 40 years, the existence of viral diseases has been and still is among the factors which have promoted the decline of Citrus in Algeria .Since 1948, quick decline probably associated with the CTV has been reported in some commercial groves; particular attention was given to these declining trees. It seems that all the early cases of tristeza found in the citrus-growing areas of the Mediterranean Basin can be traced back to the introduction of infected budwood from abroad. All countries including Algeria, which have introduced the Meyer lemon variety, have also introduced tristeza. The tristeza has been reported for more than 50 years and cited by several authors .This situation remained stable until the 2000s, when the tristeza reappeared in the center of the country. Despite the efforts made by the concerned institutions (ITAFV, CNCC, INPV and the DPVCT), in terms of control, the disease is still there, it reappears in different areas of the Mitidja, since the 2000s to date. In this context, the evolution of this disease has been studied over more than ten years (2001, 2012), in the Mitidja area, and high percentages of infections have been recorded in the areas surveyed each year.

Keywords: *CTV, Algeria Mitidja, Dissemination.*

EFFECT OF TWO PROBIOTIC PRODUCTS ON PSEUDOMONAS AERUGINOSA, BACILLUS CEREUS AND ENTEROBACTER CLOACAE

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Abstract

Lactic acid bacteria are industrially important microorganisms which have been used in the fermentation and preservation of foods. They can produce antimicrobial substances including lactic acid and bacteriocins which have the ability to inhibit pathogenic bacteria. The objective of our research was to evaluate the *in vitro* inhibitory effect of these bacteria by studying the antagonistic effect of two freeze dried probiotic products: Super Diet (composed of *Lactobacillus helveticus*) and Beneflore (mixture of six lactic acid bacteria; *Lactobacillus acidophilus, Bifidobacterium* spp., *Streptococcus thermophilus, Lactobacillus casei, Lactobacillus bulgaricus, Bifidobacterium logum*) against purified and identified pathogenic bacterial strains (*Pseudomonas aeruginosa, Bacillus cereus* and *Enterobacter cloacae*) by disk diffusion method. Their interactions led to the appearance of zones of inhibition with a diameter of 03 mm for *Bacillus cereus,* 02 mm for *Pseudomonas aeruginosa* and 00 mm for *Enterobacter cloacae.* It can be deduced that gram-positive pathogenic bacteria are more sensitive to the effect of lactic acid strains. Also, our results showed that there was a synergistic action between antimicrobial protein substances and organic acids. Finally, these two probiotic lactic products have a bacteriostatic effect on the pathogenic bacteria. This reveals that the production of bacteriocins-like is the origin of this inhibition.

Key words: *Probiotic, Lactic acid bacteria, Pathogenic strains, Antagonistic effect, Bacteriocin-like.*

PHYTOCHEMICAL AND BIOLOGICAL SCREENING OF APIACEAE THAPSIA GARGANICA L.

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Abstract

Phytochemical screening of the crude ethanolic extracts of the aerial part (PA) and the subterranean part (PS) of the plant *Thapsia garganica* L. was carried out by TLC and GC/MS. The results of these phytochemical characterizations showed that the two parts (PA and PS) of the plant contain flavonoids, tannins, saponosides and alkaloids in the form of traces. The study showed that the plant did not contain anthocyanins and leucoanthocyanans. PA and PS are poor in coumarins and iridoids. Gallic tannins are present with significant intensity in both parts of the plant. Phytochemical tests showed the presence of glucosides. The CG-MS gave an idea about the composition of the crude extracts of this plant. Eight compounds were identified for the crude extract of PA and 5 compounds for the crude extract of PS. The major constituents for these extracts were: phytole, hexadecanoic acid, octadecanoic acid, hexadecanoic acid, erucylamide and 13-docosenoic acid amide erucamide. In order to highlight the bioinsecticide potential of the extracts of this plant, toxicity tests were carried out on the 5th instar larvae of the migratory locust by testing 5 doses for PS ranging from 100 to 3000 µg/larvae and 4 doses for AP ranging from 300 to 3000 µg/larvae. The results of the toxicity tests revealed an increase in mortality as a function of time. The ethanol extracts tested had good insecticidal activity with a dose-response relationship. The 100% mortality was obtained 4 h after treatment for PS and after 24 h for PA at the highest doses tested

Key words: *phytochemical screening, biological screening, Thapsia gargarina.*

MUTAGENESIS AND *IN VITRO* SELECTION FOR IMPROVEMENT OF DATE PALM CVDEGLETNOUR AGAINST BAYOUD DISEASE

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Abstract

In Algeria, Degletnour variety of date palm is one of the best quality but very sensitive of Bayoud disease. This vascular fusariosis is caused by *Fusariumoxysporum*f.sp*albedinis (F.o.a).* The best way to control this disease is the selection of resistant varieties. The induction of the resistance in sensitive variety is possible by radiomutagenesis technics. For this purpose, embryogenic callus of date palm cultivar Degletnourwereirradiatedat 20 Gy from a Cobalt ^{60} source. Leaves detached from 20 vitroplants regenerated from irradiated embryogenic callus were used to evaluate their resistance to *Fusarium*-wilt. Two concentrations namely, 25µg/ml and 50µg/ml of the fraction FII of toxin were used. Mutants previously tested using the toxin were inoculated with 100 ml of the suspension of conidia of the F.o.a at a concentration of 10^6sp/ml. 11 vitroplants which showed resistance to the parasite were transferred in the field infected by the disease to confirm their resistance to the bayoud disease and other agronomic traits.

Keywords: *dates, Algeria, disease.*

INFLUENCE OF FOOD ADDITIVES ON PROBIOTIC BACTERIA ISOLATED FROM FRESH BEE POLLEN

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Abstract

The aim of this work was to evaluate the effect food additives on the growth of some selected probiotics from fresh bee pollen. Lactic acid bacteria were isolated from samples of fresh pollen collected from four regions in Algeria. Physiological and biochemical identification tests and technological properties were used to characterize the selected isolated bacterial species. In this study, 37 strains of lactic acid bacteria were isolated from samples of fresh pollen. Only one strain *Lactobacillus plantarum* LB9 showed a strong acidifying power. Whereas, all strains were proteolytic, none were amylolytic and only five strains *Pediococcus pentosaceus* LB32, *Enterococcus faecalis* LB16, *Enterococcus faecalis* LB40, *Enterococcus faecalis* LB21 and *Lactobacillus casei* LB38 were lipolytic. Ten strains belonging to the species *Lactobacillus plantarum* were selected to evaluate their probiotic potential *in vitro*; all strains were able to maintain their viability after 3h exposure to pH3 and 4h in the presence of 0.3% of bile salts. However, only five could survive with losses in cell viability after 3h exposure to pH 2. Most strains showed a high hydrophobicity and autoaggregation ability. All strains were resistant to ciprofloxacin, tobramycin, nalidixic acid and colistin. 50% of the strains were susceptible to chloramphenicol, nitroxolin, penicillin G, cefoxitin, pristinomycin, cefexim and 80% were susceptible to streptomycin. No haemolysis was observed on blood agar. Probiotic strains of *Lactobacillus plantarum* LB15, *Lactobacillus plantarum* LB27, *Lactobacillus plantarum* LB8, *Lactobacillus plantarum* LB12 and *Lactobacillus plantarum* LB11 were selected to evaluate the effect of food additives used in the food industry on their growth and survival. Results obtained have shown that, sweeteners aspartame, acesulfame, additives, sucrose, NaCl, flavorings strawberry, peach and vanilla have no influence on the totality of probiotic species *Lactobacillus plantarum.*

Keywords: *Probiotic bacteria, bee pollen, food additives, lactic acid bacteria, Lactobacillus plantarum.*

ANTIMICROBIAL ACTIVITY OF PGPR ACTINOBACTERIA

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Abstract

Actinobacteria are filamentous bacteria, commonly found in nature and especially in the soil, and are the most prolific of all microorganisms as producers of bioactive molecules. They are responsible for 70% of natural antibiotics known in the world, 55% of which are produced by actinobacteria belonging to the genus *Streptomyces*. However, with the appearance of resistant pathogenic strains, several antibiotics have become little or no effective. One of the research strategies adopted for rare genera isolation, producers of new antibiotics, is the exploitation of particular ecosystems in order to isolate rare strains. In this investigation, we studied the antibacterial and antifungal activities of six actinobacterial strains, already isolated from the semi-arid rhizospheric soil of eastern Algeria. Different rhizospheres were explored. Among the six isolates, four belonged to the genus *Streptomyces* and two were assigned to the rare genus *Nocardiopsis*. In fact, the six strains were tested for their antifungal activity against seven phytopathogenic fungi. The six isolates were then tested against phytopathogenic bacteria. The results showed that among the six actinobacteria, five strains (Lac1, Lac3, Vic8, Pru14 and Pru16) inhibited all phytopathogenic fungi. Only isolate Pin10 was unable to inhibit *M. nivale*. The six antagonistic strains showed more or less important antibacterial activities. Thus, *S. griseus* Lac1 exhibited the best inhibitory activity. This study confirmed not only the antimicrobial activity of *Streptomyces* strains, but also revealed interesting antibacterial and antifungal activities of the two rare strains belonging to the genus *Nocardiopsis*.

Key words: *Antimicrobial activity, Streptomyces, Nocardiopsis.*

MINERAL NUTRITION AND LIPIDS IN CHENOPODIACEAE

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Abstract

The physiological adaptation of the Chenopodiaceae species is correlated with a physiological adaptation. Indeed, several species of this family are characterized by a C_4 photosynthetic pathway. The aim of this work was to evaluate the lipid structure of two plant species of the genus *Atriplex* (*halimus* and *canescens*) in order to elucidate the effect of mineral nutrition on lipid peroxidation. Thus, the effect of two concentrations of NaCl (100, 300 and 600 mMl^{-1}) was studied at the level of three organs (roots, stems and leaves) through the assay of malondialdehyde (MDA) which represented a bio marker of lipid destruction. The results showed variability in the accumulation of MDA indicatingthe variability of inter and intra specific responses. Nevertheless, the integrity of membrane lipidswas little affectedin both species and more in *Atriplex halimus L*.

Key words: *Mineral nutrition, membrane lipids, Malondialdehyde*.

EFFECTS OF DIFFERENT ACARICIDE TREATMENTS AGAINST *VARROA JACOBSONI*

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Abstract

The present work concerns the application of a treatment based on lemon essential oil (*Citrus limonum*) on the *Varroa Jacobsoni*, major enemies of the Tellian bee (*Apis mellifera intermissa*), to remedy this plague that affects our beekeeping and subsequently increase the yield of the bee product. Pre-treatment results revealed infestation rates in the experimental site ranged from 0.0067% to 10.64%, an average of 5.32%. This shows the heterogeneity of infestations in hives according to the density of bees. This constitutes a difficulty in monitoring the population dynamics of this parasite. After treatment, the acaricidal effect essential oil of *Citrus Limonum* is noted by a better mortality rate by D1 dose: 0.25% which corresponds to 32.56%. The chemical treatment with oxalic acid and apivar gave better results than the plant used.

Keywords: *Apiculture, Apis mellifera, bio-Acaricide, Citrus limonum, Essential oil, Varroa jacobson.*

INVESTIGATION OF THE PRESENCE OF CITRUS TRISTEZA VIRUS IN CITRUS ORCHARDS OF CHLEF AREA (ALGERIA)

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Abstract

An investigation of *citrus tristeza virus* (CTV), the most destructive disease affecting citrus fruit was carried out in citrus orchards in Chlef Governorate (Northern West of Algeria). Biological indexing and serological analysis (DAS-ELISA and DTBIA) revealed many positive cases of Tristeza. The most affected varieties by CTV in Chlef included sweet oranges and tangerine, the distribution map of the virus was established. Infected trees of different ages and origins were chosen in order to be sanitized and regenerated by a new *in vitro* technique such as somatic embryogenesis. The obtained plants were tested for assessing the elimination of the virus. In order to evaluate genetic stability of regenerants, DNA analyses were performed.

Key words: *Citrus, Tristeza, distribution,Chlef, sanitation.*

MOLECULAR STUDY OF C*ALLIPTAMUS BARBARUS* (COSTA 1836) (ORTHOPTERA: ACRIDIDAE, CALLIPTAMINAE). ARE THE BIOFORMS 2 SUBSPECIES OR A NEW SPECIES?

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Abstract

Calliptamus barbarus (Orthoptera: Acrididae) is the most polymorphic species within the genus *Calliptamus*. It shows a morphological polymorphism (three hind femoral spots, or only one hind femoral spot). Several studies have beenmade in order to distinguish the two forms: morphometry, number of ovarioles, sound production, protein and enzyme system. The aim of our work is to assess whether the two forms can be considered as different taxa and to perform amolecular phylogenetic study of two populations of *C. barbarus* collected from two different Algerian localities. After sampling, DNA isolation from the hind femora was performed using PCR. Two mitochondrial genes, cytochrome oxidase subunit 1 (COI) and 16S, were edited and aligned using different algorithm programs. No clear genetic differentiation was found between the samples with different morphologies. Additionally, the samples from Algeria did not form a monophyletic sister clade compared to the one formed by the sequences from GenBank from other geographical regions. Despite the morphological differences shown between the two populations, our molecular study indicates that there are no differences at a molecular level. We can conclude that the process of speciation in this species has not yet begun. In the meantime, we propose the subspecies systematic position for the 2 bioforms: *C. barbarous xerophilus* for the living form in semiarid region and *C. barbaruus litoralis* for that living form on the littoral.

Key words: *Calliptamus barbarus, form, femoral spot, phylogeography,COI.*

IS THERE A RELATIONSHIP BETWEEN MINERAL COMPOSITION OF CITRUS LEAVES AND INFESTATION BY APHIDS?

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Abstract

Spring and autumn flushes are generally the most infested periods by citrus aphids. Nevertheless, the role of the mineral composition of citrus leaves on aphids is not clear. Therefore, this paper aims to study the correlation between certain minerals and the infestation level of citrus cultivars. Aphid counting was carried out on 12 leaves for each of six varieties retained (clementine, lemon, grapefruit and three varieties of tangerine), during autumn (October 2014) and spring (April 2015) flushes. In addition, mineral contents of the leaves in Na, Ca, K, Li and P were measured for the same periods. The results showed that the infestation levels of the studied varieties were higher in the spring flush than in the autumn one. Moreover, analyzes of young leaves showed an important intraspecific and interspecific differences in the mineral composition between citrus varieties. The study of the relationship between degrees of aphid infestation and mineral content of the six examined cultivars showed no significant correlation, suggesting a marginal role of the five analyzed minerals in the relation citrus - aphid.

Keywords : *Citrus aphid, clementine, lemon, grapefruit, mandarin, flushes.*

INTERSPECIFIC IDENTIFICATION OF SOME APHID SPECIES BASED ON THE MITOCHONDRIAL CYTOCHROME OXIDASE I (mtCOI) PARTIAL GENE

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Abstract

Aphid species identification based on host plant and morphological traits is difficult for immature aphids, sometimes even for adult aphids and in other cases for biotypes that have no or very small differences in morphological characters. However, precise identification of aphids is necessary in agriculture because of differences between species and biotypes in virus transmission efficiency or insecticides susceptibility. Fortunately, since the development of molecular techniques, mitochondrial DNA sequences were used for species discrimination and even for intraspecific differentiation between populations. In this study we performed the cytochrome c oxidase subunit I (COI) mitochondrial barcode region on 17 *Aphis gossypii* and 13 *Aphis spiraecola* populations collected from citrus, hibiscus, zucchini, potato and pepper in addition to 03 samples of *Pterochloroides persicae* collected from peach tree. Sequence analysis of the partial mtCOI gene of 709 bp fragment for the three studied species showed the utility of mtCOI as species-distinguishing molecular marker that can be used as reliable species identification of aphid species. In contrast, intraspecific discrimination was not evidenced. The two species of Aphidinae subfamily were identified in a neighbor-joining tree. Mean intraspecific sequence divergence in Aphidinae subfamily was of 6.4%, ranging from 5.8% to 7%. However, the mean interspecific variation between subfamilies (Aphidinae and Lachnidae) was higher than 10% with a range of 9.4% to 10.6%. Intraspecific variations of *A. gossypii* and *A. spiraecola* populations were insignificant with a very low clonal diversity level that varied from 00% to 0.3% and from 00% to 0.9% respectively. This molecular test evidenced that the mtCOI partial gene is a powerful marker to solve the taxonomic ambiguities that the morphological identification cannot decipher.

Key words: *Aphids, Identification, mtCOI, Reliability, Molecular.*

STUDY OF THE SURVIVAL OF BACILLUS CEREUS IN LOW-ACID CANNED VEGETABLES

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Abstract

The species B. cereus is widely distributed in food products and is often the cause of food poisoning. Therefore, data on the ability of this microorganism to develop in low-acid canned products are of scientific and practical interest. The aim of the study was to determine the survival of *Bacillus cereus* in low-acid canned vegetables stored at different temperatures. The objects of the study were industrial samples of aseptic canned carrot puree (pH = 5.11, aw = 0.912) and sliced beets sterilized in vacuumized polymer bags (pH = 5.43, aw = 0.887). The *Bacillus cereus* 11778 strain was used. The listed products were contaminated with a daily culture of the test-strain, with a concentration of 104–105 CFU / ml, and incubated at 6 and 30°C for 26 days. Sampling of products was carried out every 3 days to identify viable microorganisms. The generally accepted methods of experimental microbiology were used. It was found that in the canned "Beet sliced" *B. cereus* died after 10 days of storing the product at a temperature of 30°C. At a storage temperature of the contaminated product equal to 6°C, the test-microorganism did not die during the whole experiment and was detected in the amount of tens CFU in 1 ml of the product. In aseptic canned carrot puree, regardless of storage temperature, *B. cereus* remained viable throughout the experiment, i. e. 26 days. The approximation of the obtained numerical values showed acceptable convergence of the curves with experimental data (R^2 = 0.9186 ÷ 0.985). Microscopic examination of Gram-stained *B. cereus* 11778 preparations isolated from contaminated samples of canned products during the experiment showed abundant sporulation of the test-strain. The research results can be used to predict the activity of *B. cereus* in canned vegetable products under various environmental conditions.

Keywords: *Canned vegetables, Bacillus cereus, Survival curves, Environmental conditions.*

YIELD AND THE QUALITY OF THE WEATH GRAIN IN A YEAR WITH EXTREME WEATHER CONDITIONS

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Abstract

The goal of this work was to determine the variability of yield and the quality in wheat grain in the hill-mountain area of the City of Banja Luka cultivated during the vegetation season 2016/17, season with adverse weather conditions. Field research was performed in Dobrnja on Manjaca. In this research three types of winter wheat triticum cultivars Jelena, triticale cultivar Oskar and rye cultivar Oktavija were included. The sown was made mechanical pneumatic wheat in sewing machine among the rare distance 12,5 cm and on depth 3-4 cm. All necessary agro technically measures characteristic of wheat seed grain production were performed. In lab conditions we examined parameters of seed quality. The biggest yield was at triticale 2,93t ha^{-1}, while the lowest was at 2,49t ha^{-1}. All three of the researched cereals satisfied legal parameters of quality prescribed currently by valid rule about putting the grain seeds in the traffic in Bosnia and Herzegovina. The seed of wheat was characterised by the biggest germination of 97,0% and the biggest mass of 1000 seeds 41,7 g. The smallest germination was at the seeds of ray 86,0%. At was defined the smallest mass of 1000 seeds, 39,4 g. But also a high germination of 95,0%. During the period of maturation and harvest,there was a small amount of rainfall, which resulted in getting yield with moisture content suitable for storage and seed processing of seeds. In conditions of Dobrnja on Manjaca of high quality grain are to be produced the contributions. For production benefits of quality seed material in the future period of seed production, primarily wheat and triticale should be realized at larger surfaces. Producing quality grain seeds would significantly satisfy part of the agricultural seed producers in the village area of the City Banja Luka. Agricultural producers would have the opportunity to supply the seeds of sorts which seeds are produced implemented in similar, partly almost identical conditions on their parcels.

Keywords: *Winter wheat, yield, and quality, germinate, mass 1000 seeds.*

EFFECT OF MODE PACKAGING AND STORAGE ON SENSORY PROPERTIES AND COLORS

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Abstract

The increased need for fresh vegetables has led to the application of new technologies for the preservation of quality during storage. Lettuce is a type of vegetable that is consumed often and in relatively large quantities**.** The objective was to determine the effect of storing and keeping sensory properties lettuce using packaging in normal atmosphere and modified atmosphere (MA). The research was done on one control group and two experimental groups. Control group was lettuce stored in normal atmosphere in the refrigerator and the experimental group ware stored in MA, (98% nitrogen and 2% oxygen). During 25-day storage period, the sensory properties and colour were evaluated using a spectrophotometer (CM-5, Konica Minolta). Colour was measured on the outer, middle and inner leaves of the lettuce and ribs, under storage conditions of relative humidity of 95% and temperature 4°C. The colour parameter L*, in a control group, changed from 61.92 at the beginning in 68,59 at the end of the experimental period. An increase in L* value in lettuce is a sign of a decrease in the intensity of the green color due to the appearance of yellow pigments. Sensory evaluation determined that there was a statistically significant difference ($p = 0.05$) in the overall impression in the MAP, normal atmosphere and control samples. MAP enables the preservation of quality of sensory properties for a longer period of time (5 days).

Key words: *Green lettuce, MAP, normal atmosphere, color change, sensory rating.*

LEGAL REQUIREMENTS FOR PREPARATION AND PRODUCTION OF FOOD IN BOSNIA AND HERZEGOVINA WITH SPECIAL REFERENCES ON THE ENTITY OF THE REPUBLIC OF SRPSKA

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Abstract

Consumers expect the food they consume to be safe and acceptable to use. Food-borne illnesses are uncomfortable, while in worst cases they may have a deadly outcome. Food-induced epidemics may have a negative impact on trade and tourism, which can lead to a decline in primary producer and processor income, then to an increase in unemployment and ultimately even court proceedings. The food safety area in Bosnia and Herzegovina is currently regulated by legal and by-law acts that are in line with the EU legislation and standards of Codex Alimentarius. In addition, at the level of the Entities of the Republic of Srpska, as well as the Entities of Federation of Bosnia and Herzegovina, there are food laws that are in line with existing state-level laws and EU regulations. The system of good manufacturing practice is implemented in the entire territory of Bosnia and Herzegovina, ie in the Republic of Srpska and the Federation of Bosnia and Herzegovina. These standards are very important in food production and manipulation, as they guarantee quality and safety. In the Republic of Srpska this segment is regulated by the law and the food regulations, which the manufacturers are obliged to implement. The essence of the concept of health security is contained in constant efforts and concrete planning activities to position, define and timely eliminate any dangerous phases or situations in the entire cycle of production of agricultural and food products. The standard has become necessary due to the significant increase in diseases caused by food contamination, both in developed countries and in developing countries. There is a large number of laws and regulations in the territory of Bosnia and Herzegovina that define food production and manipulation. Businesses are required to apply the HACCP standard, and a large number of manufacturers also have the ISO 22000 standard. The main objective of the paper is to define and monitor the application of the HACCP system and the ISO 22000 standard on the territory of Bosnia and Herzegovina, with particular emphasis on the Republic of Srpska entity. In addition, the paper presents a fragmented presentation of the above mentioned system and standards in relation to the European Union with the aim of establishing the position of Bosnia and Herzegovina in the application of the HACCP system and the ISO 22000 standard.

Key words: *consumer, producer, primary production, food regulations, standards.*

TESTING ANTIBACTERIAL ACTIVITIES OF *SEMPERVIVUM TECTORUM*

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Abstract

Since their discovery in the twentieth century synthetic antibacterial drugs, penicillin, streptomycin and, other antibiotics have significantly influenced the reduction of the risk of contagious diseases. On the other hand, bacterial infections (respiratory and urinary tract infections, meningitis, sexually transmitted infections) are increasingly frequent in recent years, mainly due to the resistance of bacteria to synthetic antimicrobial drugs. In recent decades, there is an increasing need for natural and non-toxic antimicrobial substances, which is conditioned by the more frequent development of microorganisms resistance to synthetic antimicrobial drugs. Natural preparations made from fresh plant material and biologically active compounds isolated from various plant species that have been used in folk medicine for centuries can represent valuable resources for the production of new natural remedies. The aim of this paper is to test the antibacterial activity of *Sempervivum tectorum* on the tested bacterial isolates : pure *Sempervivum tectorum* juice, then in combination with honey and the action of the honey itself and to determine the type of action. The results of the work have confirmed the antibacterial activity of *Sempervivum tectorum* on seven clinical isolates, with a growth inhibition zone from 9.00 mm to 24.33 mm. Also, the obtained results show that *Sempervivum tectorum* represents a potential source of new compounds with antibacterial activity.

Key words: *Sempervivum tectorum, antibacterial, natural preparations.*

ANTIBACTERIAL ACTIVITY OF PROPOLIS EXTRACTS FROM GREECE AND REPUBLIC OF SRPSKA(BOSNIA&HERZEGOVINA)

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Abstract

Propolis (bee glue) is a mixture of various amounts of wax and resin that honey bees collect from leaf buds or tree barks and bushes. Usually these are popular trees, ash tree, apple, birch, chestnut, etc. Bees disinfect and protect their hive against unwanted external influences, such as fungi, microorganisms, smaller animals (mice, worms, ants), but they also protect hives against cold, moisture and flows. Propolis is a complex content that result from mixing of natural plant derived and bee released elements and compounds. The proportion of the various materials found in the propolis that related to its place and time of collection but, in general, raw propolis is estimated to have a composition of around 50% of vegetable resins, 30% of wax, 10% essential oils, 5% pollen, and 5% of various organic compounds. Other materials and elements are: flavonoids, polyphenols, organic acids, terpenes, esters, polysaccharides, minerals, vitamins, aldehydes, coumarins and potentially presents of foreign side adjuvants. The chemical composition of propolis is variable and depends on the type of plant that is collected from. Propolis is lipophilic in nature, rigid, fragile and brittle material when cold; but when temperature rises, it becomes soft, pasty, gummy and adhesive properity and be sticky. Concentrations of certain ingredients depend on the origin and also of ecological and climatic factors. Significant active ingredients that may be present in propolis are: flavonoids, caffe-phenethylether acids, chlorodane diterpenes, especially artepheline C. Propolis acts anti-inflammatory (immunomodulatory and microbicidal). It is used in the treatment of infections, and prevents throat inflammation, paradentosis, etc. Today propolis is available on the market in a number of preparations, which can be in the form of capsules, drops, sprays, creams, powders and passtiles. Due to the content of proteins, amino acids, vitamins, minerals and flavonoids, it can be used as a supplement to the diet in small quantities and with other components. The aim of this study was to investigate the antibacterial effects of two samples of alcoholic solution of propolis originating from Greece and from Republic of Srpska and their effect on clinical isolates of Staphylococcus pseudintermedius (isolates from the nose, skin and ear of the dogs and rabbits) and to determine the type of action. The results of work confirmed the higher antibacterial activity of alcoholic solution of propolis originating from the Republic of Srpska with an inhibition zone of 10.66 mm to 23.33 mm, and the range of action for propolis solution originating from Greece was from 10.00 mm to 19.00 mm. Alcoholic propolis solution originating from Republica of Srpska showed greater bactericidal activity, while the propolis originated from Greeks have stronger bacteriostatic activity.

***Keywords**: propolis, antibacterial properties, application.*

RESULTS OF SPECIAL SURVEILLANCE PROGRAM FOR THE PRESENCE OF QUARANTINE PEST *XYLELLA FASTIDIOSA* (WELLS *ET AL.*) – PIERCE'S DISEASE IN REPUBLIC OF SRPSKA DURING 2015-2018

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Abstract

Considering that quarantine phytopathogenic bacteria *Xylella fastidiosa* Wells *et al*. occurring in several European countries and the pathogen on quarantine I A1 list in Bosnia and Herzegovina, surveillance program for the presence of quarantine pest *Xylella fastidiosa* (Wells *et al*.) – Pierce's disease was carried out in Republic of Srpska during 2015-2018. The program was approved and financed by Ministry of Agriculture, Forestry and Water Management of Republic of Srpska. Visual inspections and sampling of host plants was carried out in a number of registered nurseries and seedling production places, farms and gardens, as well as public areas in Republic of Srpska. Laboratory analyses were carried out in accordance with the EPPO diagnostic protocols: PM 7/24 (1): Bulletin 34, 187-192; PM 7/24 (2): Bulletin 46 (3), 463–500 and PM 7/24(3): Bulletin 48 (2), 175–218. These protocols included two laboratory tests based on a different principle: ELISA (Enzyme-Linked Immunosorbent assay) for the serological detection and a conventional PCR test (Polymerase Chain Reaction) for the molecular detection of *X. fastidiosa*. CTAB method was used for DNA extraction and set of primers RST31/RST33 was used for the detection of *X. fastidiosa*. The PCR products were separated on 1.5% agarose gel in 1 x TAE buffer. During 2015, 29 samples were analyzed, while 131 samples were analyzed during 2016. In 2017 and 2018, 40 samples were analyzed and there were 83 visual inspections. All tested samples were negative for presence of bacteria, but considering consequences if bacteria occurs, surveillance program would be continued in 2019.

Key words: *surveillance, Xylella fastidiosa, Republic of Srpska.*

LABORATORY GERMINATION AND EPIPHYTIC MYCOPHLORA OF VARIOUS GENOTYPES OF SORGHUM (*SORGHUM BICOLOR* (L.) MOENCH)

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Abstract

Seed quality is an indication of the suitability for sowing. The species composition of the seed mycophlora is an important factor for seed sowing qualities. This study aimed to determine the species composition of the epiphytic mycophlora developing on the seeds of different genotypes of sorghum and their influence on the sowing qualities of the seeds, in 2018. Seeds of 5 plants of each sorghum genotype were collected to determine the species composition of pathogens growing on their surface. The collected seeds were transported to the phytopathological laboratory of Shumen University and analyzed for the presence of epiphytic microflora on them, and to study their seed qualities - germination and germination energy. The seeds germination and the germination energy is determined in line with the standard methods. All genotypes under laboratory conditions showed germination above 85%. The identification of phytopathogens is performed by the wet chamber method, by microscopic diagnosis and using different methods of isolation. It was found that *Alternaria alternate* (Fr.) Keissl. Was the most common fungus growing on the surface of the seed among all 7 isolated species, referring to 6 genus: *Alternaria alternate; Alternaria solani*, *Fusarium moniliformae, Helminthosporium turcicum*, *Peronospora sorghu*, as well as the causative agents of the *Aspergillus* and *Mucor* species. This pathogen is capable of damaging seeds and sprouts, thereby aggravating the sowing properties of sorghum seeds. When introducing new species of agricultural cultures in specific region information on seeds germination, seed-borne diseases eventual manifestation and development is explicitly important. In this connection, the present research is directed towards the germination and germination energy of the seeds, as well as the mycoflora of different sorghum genotypes, cultivated in Shumen region.

Key words: *Sorghum, Epiphytic micophflora, Qualities of seeds, Alternaria alternate.*

EFFECT OF DIFFERENT THICKENING AGENTS ON FREEZE-THAW STABILITY OF FOOD SYSTEMS WITH MODIFIED MAIZE STARCH

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Abstract

The stability of food systems is an essential characteristic for determining the quality of products. Freeze–thaw stability is an important property that is used to evaluate the ability of starch to with stand undesirable physical changes occurring during freezing and thawing. We analyzed the effect of different thickening agents on freeze-thaw stability of food systems with modified maize starch. It was made four systems with modified maize starch and combinations of starch and guar gum, starch and xanthan gum, and starch and pectin. The choice of starch quantity and thickening agent originates from the initially uniform viscosity of the resulting systems. The received food systems were storage at 8±1 °C and -18±1 °C for four days. The structural-mechanical properties and stability of the investigated samples were analyzed. The addition of a thickening agent reduced the amount of the used starch and increased the stability of the systems. The sample with 0.09 % xanthan gum and 3 % starch had the best result in regard to shear-resistance, and the worst result was found in sample with 0.14 % pectin and 3 % starch, storage at 8±1 °C. However, the different storage type of the samples influenced on their stability and thixotropic properties, which can be an indicator of choosing the type of storage. It was measured the value of the separated liquid (in %) of the samples. The results shown that only the sample №1 (only with starch) had a separated liquid. Incorporation of a thickening agent is an indicator of increasing the retrograde stability of the starch.

Keywords: *Food systems, Thickening agents, Structural-mechanical properties, Freeze-thaw stability.*

PHYTOCHEMICAL CHARACTERISTICS OF DIFFERENT MALTS AND POSSIBILLITIES FOR THEIR APPLICATION IN FUNCTIONAL BEVERAGES

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Abstract

The development of new assortments of beverages with high biological value and functional effect on human health is a new trend in the industry. Therefore, malt, a major raw material in brewing, is of particular importance. Malt has a high biological value and some of its components (phenolic compounds, catechins, ferulic acid, and etc.) have a high antioxidant capacity. The aim of this study was to investigate the phenolic content and antioxidant capacity of 8 malt types (2 Pilsner, 2 Vienna, 2 Wheat, 1 Munich and 1 Pale ale) and wort produced from them. The total phenolic content, phenolic acid and flavonoid phenolic compounds were determined. The total phenolic content varied between 0.88 and 6.66 mg GAE/g dw for malt and 263.57 and 412.65 mg GAE/L for wort. The results for phenolic acids and flavonoid phenolic compounds were almost equal both for malt and wort. The antioxidant activity was determined by the radical scavenging assay (DPPH) and ferric reducing antioxidant power (FRAP). The DPPH radical scavenging activities varied from 1.21 to 9.31 μM TE/g dw for malt and 492.39-6105.68 μM TE/L for wort, respectively. The results from FRAP assay ranged from 1.35 to 28.56 μM TE/g dw for malt and between 192.08 and 473.76 μM TE/L for wort, respectively. The results obtained were used for a discussion on the possibilities for the production of wort-based functional beverages.

Keywords: *malt, phenolic compounds, antioxidant activity, functional beverages.*

BIOLOGY, ECOLOGY AND CONTROL OF THE PLUM SEED WASP [*EURYTOMA SCHREINERI* SCHREINER (HYMENOPTERA: EURYTOMIDAE)]

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Abstract

The plum seed wasp, *Eurytoma schreineri* Schr. is a new pest on plum trees in Bulgaria. It is a serious pest for plums in northeastern Bulgaria. This wasp attacks the fruits of various plum cultivars. Damage by *E. schreineri* on plums ranges from 26-92%. The damage percent depends upon bioecological conditions and on the susceptibility of the plum varieties. Late-flowering cultivars are the most sensitive, where the attack can reach up to 90-92% of Stanley cultivar. This is univoltine and overwinters as a fully developed larva within stones of the fallow fruit under the plum trees. During the spring, usually in early May, the adults go out of the fallen mummified fruits and after mating the females oviposit inside the newly formed plum fruit. The egg is inserted into the endosperm of the fruit before the formation of the stone. Incubation lasts about 20-22 days, and hatch begins about the time that the plum seed embryo becomes visible. Larva development is completed by the end of June or early July, then the larvae enter diapause and remain in this state for 1-3 winters. Locally penetrating insecticides, applied when the larvae begin to hatch, provide a significant degree of larval control.

Keywords: *Prunus domestica, plum tree wasp, Eurytoma schreineri, adult emergence, northeast Bulgaria.*

CHANGES IN GERMINATION AND PRIMARILY GROWTH OF THREE CULTIVARS OF FENNEL UNDER APPLICATION OF DIFFERENT DIATOMITE TREATMENTS

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Abstract

Fennel is a plant belonging to the *Apiacea* (*Umbelliferae*) family, and used by humans for a long time for medicinal purposes. In order to evaluate the influence of different materials on germination and seedling growth of three cultivars of fennel, an experiment was conducted in 2018. There cultivars of fennel were Isfahan, Yazd, and Shiraz in main plots, and three materials including 100% soil, 50% diatomite + 50% soil, and 100% diatomite in subplots, were analyzed in a split plot experiment based on a randomized complete block design (CRBD) with three replications. The highest total germination percentage, coefficient of velocity of germination, coleoptile length, fresh coleoptile weight and dry coleoptile weight was related to Isfahan. The maximum speed of germination, mean germination time, fresh length and dry leaf weight was achieved in Shiraz cultivar. The higher values of total germination percentage, speed of germination and mean germination time were related to 100% soil, while application of 50% of soil + 50% of diatomite had obtained the maximum values of radicle length, coleoptile length, fresh coleoptile weight, dry leaf weight and dry coleoptile weight. The maximum values of coefficient of velocity of germination and fresh leaf weight was achieved in application of 100% diatomite. It seems that application of 50% soil + 50% diatomite and Isfahan and Shiraz cultivars have a great potential of seed germination of seedling growth.

Keywords: *Fennel, Diatomite, Germination, Seedling Growth.*

ANISE SEED GERMINATION AND PRIMARILY GROWTH UNDER VARIOUS TREATMENTS OF GIBBERELLIC ACID, BENZYLADENINE AND KINETIN

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Abstract

Seed dormancy is one of the major problems in agricultural studies, especially for medical plants. Anise (*Pimpinella anisum L.*) is an important medical plant with dormant seed and it is established and distributed only in its natural habitats. In order to evaluate the effects of some pretreatment factors on primary growth and germination characteristics of Anise, an experiment was conducted as Factorial layout within completely randomized design with four replications. Pre-chilling treatments were 0, 15, 30 and 45 days treatments and hormone treatments were GA_3 (Gibberellic Acid), BA (Benzyladenine), KI (Kinetin), GA_3+BA, GA_3+KI, BA+KI, GA_3+BA+KI, KNO_3, H_2SO_4 and distilled water as a control treatment. Prechilling treatment effects on coleoptile and radicle length, seedling length, germination percentage, mean time for germination, germination rate and seed vigor index were meaningful. Different hormone treatments had significant influence on coleoptile and radicle length, seedling length, germination percentage, mean time germination, germination rate and seed vigor index. The highest germination percentage and germination rate was related to usage of BA+KI. The higher values for radicle length and uniformity of seed germination were achieved in application of BA and KI, respectively. Moreover, application of GA_3+BA+KI had obtained the highest seed vigor index. It seems that application of endogenous GA_3+KI and BA+KI concentration, which is provided mostly by chilling treatment, is the most effective factor for breaking the seed dormancy. On the basis of the results, usage of 45 days moist prechilling accompanied with application of GA_3+KI and BA+KI in Esfahan cultivar was appropriate.

Keywords: *Seed dormancy, Seed germination, Seedling growth, Anise.*

INTERCROPPING AND ORGANIC FERTILIZERS WITH COMPARATIVE ADVANTAGES IN SUSTAINABLE AGRICULTURE FOR MORE STABLE AGRICULTURAL SYSTEM

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Abstract

Sustainable agricultural system is the best way to provide needs of people today and future generations. In sustainable agricultural system, agricultural yields increase with intercropping due to higher growth rate, reduction of seeds, pests and diseases and more effective use of resources. Intercropping is a one of the most important way to increase diversity in an agricultural ecosystem. Intercropping has a long history. Intercropping systems could be more stable systems of agricultural practices than mono cropping. The most important advantages of intercropping are increasing production, greater use of environmental resources, significant reduction of pests, diseases and weeds damage, improve soil fertility and increase in nitrogen, stability and uniformity yield. Integrated use of synthetic and organic fertilizers may lead to development of sustainable crop production. This method also can increase the efficiency of chemical fertilizers and of course reduce their use. Green manures are legume crops like clover and others that are able to add nitrogen by fixation to the soil and then reduce the need for commercial nitrogen. Moreover, planting green manures is an effective means of adding nitrogen to the agricultural land. The biological nitrogen fixation is also play an important role in sustainable agricultural systems. In sustainable agricultural system, fertilizers, livestock manure and cover crops are important parameters in productive agricultural systems to have stable food. All in all, in sustainable agricultural system, intercropping included, fertilizers, livestock manure and cover crops are important parameters in productive agricultural systems to have stable food.

Keywords: *Intercropping, Chemical Fertilizer, Manure, Sustainable Agriculture, Stable System.*

INTERCROPPING ENHANCES CROP YIELDS AND DISEASES RESISTANCE VIA IMPROVING CROP NUTRITION

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Abstract

Intercropping has been considered as one of the important sustainable agricultural practices. Although there were many studies on yield advantage and controlling disease, there are few studies that focused on linking crop disease resistance with mineral nutrient improvement driven by interspecific interactions in intercropping. A 2-year field study was conducted to investigate the crop productivity and crop disease incidence in the intercropping under 4 nitrogen application rates (0, 80, 160, 240 kg N/ha) and 3 cropping patterns (millet monoculture, peanut monoculture, and millet/peanut intercropping) in Northeast China. The results showed that there was a significant yield advantage of the intercropping, with greater than one of land equivalent ratios (LERs) under all four N rates. The intercropping reduced the disease index of millet leaf blast by 40.1%-68.4% and peanut leaf spot by 21.4%-49.9% compared with the corresponding monoculture species. Ca, B, Si concentrations in leaves of intercropped millet were 12.6%-84.4%, 21.7%-107% ($P<0.05$) and 17.9%-42.8% ($P<0.05$) higher than those in monoculture millet. The Zn, Cu concentrations of peanut were 14.2%-27.8% ($P<0.05$) and 6.36%-24.5% higher in intercropping than those in monoculture. There were significantly negative correlations between the disease index and Ca ($Y=-15.3x+70.4$, $R^2=0.6882$), B ($Y=-242x+78.1$, $R^2=0.7859$) and Si ($Y=-3.43x+79.9$, $R^2=6488$) concentrations in leaves of millet. A similar relationship was observed between the disease index and Zn ($Y=-0.71x+30.8$, $R^2=0.5972$) and Cu ($Y=-1.22x+26.7$, $R^2=0.5865$) concentrations in peanut leaves. The disease resistance of millet and peanut may be attributed to crop health derived from the improvement of mineral nutrition driven by interspecific interactions. Our finding has potential importance in crop disease bio-control.

Keywords*: diseases, intercropping, millet, mineral nutrition, peanut.*

INTEGRATED PEST MANAGEMENT FOR TOMATO BY AUTONOMOUS ROBOT

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Abstract

Integrated Pest Management (IPM) is a holist approach that combines cultural, biological and chemical measures to manage pests that suits the farmers' current needs. The most important role in the prevention of economic losses is to obtain information about occurrence of individual pests not only within one greenhouse, but also within a farm operating with several greenhouses. One of the most widely used methods for sampling and monitoring of pests is still the yellow sticky trap. However, IPM strategy based on autonomous robots can provide more accurate information about incidence of individual pest. Such information then facilitates the decision in choosing a relevant strategy for the treatment of tomato plants. The most harmful pests on greenhouse tomato crops are polyphagous. The main polyphagous pests are the sweet potato whitefly, *Bemisia tabaci (Gennadius),* the greenhouse whitefly *Trialeurodes vaporariorum* (Westwood) and leaf miner *Tuta absoluta*. *T. absoluta* is currently one of the most dangerous worldwide pests of tomato. It is important for early pest detection to know pest lifecycle and traits of individual live stages. Individual differences between different pests are important for artificial intelligence algorithms in order to identify and classify every pest. Automation methods and precision farming solutions can benefit from IPM by improving monitoring or scouting and control practices. The early detection of pests or the initial presence of these bio-aggressors is a key-point for effective crop treatment to prevent infestation, and to minimize disease impact and the usage of biological and/or chemical agents, which is of extreme interest for the whole food chain.

Keywords: *IPM, Tomato, Greenhouse, Autonomous robot.*

EFFECTS OF ZINC OXIDE NANOPARTICLES ON *SOLANUM LYCOPERSICUM* L. AND VIABILITY OF *TENEBRIO MOLITOR* (TENEBRIONIDAE)

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Abstract

Recently, the number of greenhouse plants (cucumbers, strawberries, tomatoes) has grown. Pathogens become the main enemy in this system of cultivation. The main pests of tomato plants include insects. These pests cause fading of leaves and necrosis. Leaves become yellow, lose turgor and finally degraded. Moreover, some insects produce honeydew, which allows the development of fungal diseases. In view of the EU's rejection of the introduction of new genetic methods (CRISPR), it is necessary to look for new ways how to protect plants from pests and the associated sustainability, which is most important for agricultural production. The main objective of this work was to test nanocomposite materials and their toxicity for individual pathogens and the plant itself. In this work, we tested metal nanoparticles on the growth of *Solanum lycopersicum* L. and viability of model pathogen *Tenebrio molitor*. Basic biochemical analysis of stress markers was performed as part of NPs plant toxicity analysis. Mainly, the total content of carotenoids, polyphenols, flavonoids, chlorophylls, antioxidants was associated with abiotic stress. Samples were analyzed using ambient and chromatographic techniques with a mass detector, spectrophotometer with 96-well plate reader. During the experiment, we used a different concentration of Zinc oxide nanoparticles (ZnO NPs). Larvae *T. molitor* was sprayed with nanoparticles 3 times a week, and the greatest effect had the highest concentrations of ZnO NPs, where the mortality was 80%.

Keywords: *Tomato, Zinc-oxide, nanoparticles, Tenebrio molitor*.

MAXIMIZE UTILIZATION OF SAND SMELT FISH AND SOME FISH PROCESSING WASTES AS A SOURCE OF OMEGA-3-RICH OILS

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Abstract

Fish processing discards contain valuable nutrients such as proteins, lipids and minerals. The present study aimed to extract fish oil, as a source of omega-3 oils, from sand smelt fish and sardine, mackerel, bory wastes and compare their physicochemical properties, fatty acid composition, as well as their storage stability. The studied physicochemical properties were free fatty acids (FFA), peroxide value (PV), thiobarbituric acid reactive substances (TBARS), saponification value (SV) and iodine value (IV). The results of the fatty acid profiles showed that mackerel waste had the highest fat content (17.11± 0.10) while sand smelt fish had the lowest fat content (6.44± 0.14). The total mono unsaturated fatty acids (MUFA) of sardine, mackerel, bory wastes and sand smelt fish were 4.04%, 29.13%, 40.9% and 47.79% respectively. While the total PUFA of sardine, mackerel, bory wastes and sand smelt fish oils were, 51.46 %, 43.09 %, 26.5% and 31.07% respectively. The highest Eicosenoic acid (EPA) and Docosahexaenoic acid (DHA) values were found in Sardine oil (23.71 % & 18.6 respectively) and mackerel oil (16.27 % & 15.49 % respectively) of total fatty acids. The production of omega-rich oil from careless parts after fish processing have different neutraceutical applications in the specific food products. The maximum utilization of fish processing wastes can contribute to the eco-system (economy and ecology) balance.

Keywords*: Fish wastes, sardine, mackerel, fatty acid composition, omega-3.*

THE EFFECT OF IMIDACLOPRID AND NANO IMIDACLOPRID ON POTATO TUBER MOTH *PHTHORIMAEA OPERCULELLA* (LEPIDOPTERA: GELECHIIDAE)

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Abstract

Potato tuber *Phthorimaea operculella* (Lepidoptera: Gelechiidae) moth is one among the harmful and important serious pest on many economic crops in Egypt. *P. operculella* is a harmful insect pest causing a lot of damage of the potato crop. Imidacloprid play an important role in its pathogenicity in insect pests, it decreases the infestations of a lot of many harmful pests. Results showed that, the LC50 obtained 156 and 65 ppm after *P. operculella* treated with different concentrations of Imidacloprid and nano Imidacloprid . under field conditions when *P. operculella* treated with Imidacloprid and nano Imidacloprid , the number of eggs significantly 68±3.9 and 5±6.4 eggs/ female as compared to 267 ± 74.4 eggs /female in the control. The percentage of egg hatching , larval mortality, malformed pupae and malformed adults significantly decreased in case of Imidacloprid treatments and almost reduced after nano Imidacloprid treatments. The weight of potatoes significantly increased to 2467±45.43 and 2985±74.76 kg/ feddan as compared to 164±51.81 and 1210±40.59 kg/ feddan in the control during season 2016 1nd 2017 respectively. The usage of nano Imidacloprid decrease the infestations with *P. operculella* under laboratory and field conditions.

Key words. *Imidacloprid, Phthorimaea, control, nano.*

THE TOXIC EFFECT OF *BEAUVERIA BASSIANA* TOXIN ON POTATO TUBER MOTH *PHTHORIMAEA OPERCULELLA* (LEPIDOPTERA: GELECHIIDAE)

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Abstract

Potato tuber Phthorimaea operculella (Lepidoptera: Gelechiidae) moth is one among the harmful and important serious pest on many economic crops in Egypt. P. operculella is a harmful insect pest causing a lot of damage of the potato crop. Beauvericin play an important role in its pathogenicity in insect pests, it decreases the infestations of a lot of many harmful pests. Beauvericin Nanoparticles were synthesized by hydrolyzing titanium tetra isopropoxide in a mixture of 1:1 anhydrous ethanol and water. 9 ml of titanium tetra isopropoxide is mixed with 41mlof anhydrous ethanol (A). 1:1 ethanol and water mixture is prepared. When the Beauvericin tested against P. operculella larvae. Results showed that, the LC50 obtained 132 and 32 ppm after P. operculella treated with different concentrations of Beauvericin and nano Beauvericin . under field conditions when P. operculella treated with Beauvericin and nano Beauvericin , the number of eggs significantly 49±1.8 and 3±2. 7 eggs/ female as compared to 233 ± 34.2 eggs /female in the control. The percentage of egg hatching , larval mortality, malformed pupae and malformed adults significantly decreased in case of Beauvericin treatments and almost reduced after nano Beauvericin treatments. The weight of potatoes significantly increased to 2392±75.13and 2779±44.28 kg/ feddan as compared to 177±53.41 and 1210±40.59 kg/ feddan in the control during season 2016 1nd 2017 respectively.

Key words. *Beauvericin, Phthorimaea, control, nano.*

TOXICITY OF IMIDACLOPRID ON CABBAGE WHITE BUTTERFLY, *PIERIS RAPAE.*

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Abstract

Cabbage crop attack by the harmful pests *Pieris rapae* (Lepidoptera: Pieridae) *w*hich causing a lot of damage to devour cabbage crop varieties. imidacloprid is a perfect bioinsecticide. The usage of Imidacloprid and nano Imidacloprid test against *Pieris rapae* gave a promising data. Results showed that, the LC50 obtained 133 and 31 ppm after *Pieris rapae* treated with different concentrations of Imidacloprid and nano Imidacloprid. Also, under field conditions when *S. oleae* treated with the Imidacloprid and nano Imidacloprid, the number of eggs significantly 55±6.1 and **5**±7.2 eggs/ female as compared to 289±6.9 eggs /female in the control. The percentage of egg hatching, larval mortality, malformed pupae and malformed adults significantly decreased in case of Imidacloprid treatments and almost reduced after nano Imidacloprid treatments. The weight of cabbages fruits significantly increased to 2566 ± 43.01and 1210± 40.09 kg/ feddan as compared to 1780±55.43and 1200± 33.11 kg/ feddan in the control during season 2017 and 2018 respectively.

Key words. *Nano, Imidacloprid, Pieris rapae, control.*

THE IMPACT OF TEMPERATURE ON LIFE HISTORY TRAITS OF THE BIRD CHERRY-OAT APHID, *RHOPALOSIPHUM PADI* (HEMIPTERA: APHIDIDAE) REARED ON WHEAT SEEDLINGS

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Abstract

The impact of temperature and some life table parameters of *Rhopalosiphum padi* (Linnaeus, 1758) were investigated at 18, 20, 22 and 24°C constant temperatures. The development durations decreased as the temperature increased, recorded 8.36, 7.65, 6.8 and 5.19 days at 18, 20, 22 and 24°C, respectively. The temperature threshold for the development of first, second, third and fourth instars and overall nymphal stages were 4.53, 7.96, 10.02, 9.67 and 8.25°C, respectively. The thermal units required for each nymphal instar: first, second, third and fourth and overall nymphal stage were 27.78, 21.28, 16.39, 22.22 and 83.33 day-degrees, respectively. The average adult fecundity was as high as 91.74 and 73.25 offspring at 20 and 22°C, but dropped to 47.66 and 63.45 offspring at 18 and 24°C. However, the average (m_x) values per female/day were 2.24, 2.12, 1.93 and 1.01 offspring at 20, 24, 22 and 18°C, respectively. The highest net reproduction rates (R_0) were 61.46 and 54.42 at 20 and 22°C, and mean generation time (T) and population doubling time (DT) diminished as temperature increased. The intrinsic rate of increase (r_m= 0.3 and 0.25) and the finite rate of increase (λ= 1.36 and 1.29 nymphs/female/day) were greatest at 24 and 22°C, respectively. The results indicated clearly that temperatures from 20 to 24°C were in the favourable range for survival and reproduction of this serious pest.

Key words: *Rhopalosiphum padi, constant temperature, life table parameters.*

CONTROL TRIALS OF ANABOLIC HORMONE RESIDUES IN TISSUES OF WILD AND FARMED NILE TILAPIA IN EGYPT

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Abstract

Due to the excessive use of growth promoters in fish production and its possible hazards for humans, our study focusses on monitoring and control attempts regarding their residues in Nile tilapia fish. A total of eighty random samples of Nile tilapia were collected from different Nile canals and markets in El-Menofia governorate, Egypt, for estimation of Methyltestosterone (MT) and Trenbolone acetate (TB) residues by using enzyme-linked immune sorbent assay (ELISA). In the present study, the MT and TB hormone residues were in acceptable levels and without exceeding the maximum permissible limits MPLs (2ppb) of codex (2007) and European Commission "EC" (1999), respectively; except MT residues level in small size farmed tilapia; as 49 % of samples were unacceptable and exceeded MPLs of codex (2007). These results provided no proof for illegal hormones use but did not exclude the possible misuse of hormones. Routine monitoring of these hormones as a food quality and health control measure is needed. Application of various cooking methods (frying and grilling) on Nile tilapia of each category (n =3) exhibited that cooking methods positively reduced residues of MT and TB. The obtained results revealed that the most effective cooking methods for reducing the levels of such hormone residues were grilling (78.8% and 82.05% for MT and TB, respectively) followed by frying (34.8% and 53.85% for MT and TB, respectively).

Key words: *Nile tilapia, methyl testosterone, trenbolone acetate, frying, grilling.*

ANTIFUNGAL ACTIVITY OF *THUJA ORIENTALIS* AGAINST TRANSMITTED SEED-BORNE *ALTERNARIA ZINNIAE*, CAUSING LEAF SPOT DISEASE IN ZINNIA (*ZINNIA ELEGANS* L.)

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Abstract

Leaf spot disease of zinnia caused by seed-borne *Alternaria zinniae* is a serious problem around the world. In this study, four species of *Alternaria* as *A. alternata* (Fr.) Keissler, *A. solani* (Sorauer), *A. tenuissima* (Kunze) Wiltshire and *A. zinniae* M. B. Ellis were detected in seed samples of zinnia collected from the commercial lots in Egypt. In pot experiments, when seeds and seedlings of zinnia were inoculated with these species, only *A. zinniae* was the main causal pathogen of leaf spot. Moreover, it was frequently detected in all seed components of coat, cotyledon, and embryo. Disease severity (DS) % induced by all isolates of *A. zinniae* was highly related to growth stages of zinnia, where DS% increased with the development of plant age from 1- to 8- week old. Transmission of *A. zinniae* infected seed to seedling was at 51.25% (blotter method), whereas use seedling symptom test and test tube agar method exhibited infected seedling of 58.5 and 55.75%, respectively. In efficacy tests of extracts from different materials of thuja against *A. zinniae*performed *in vitro*, leaf methanol and water extracts were the most effective ones followed by seed methanol and water extracts, where they completely inhibited spore germination and mycelial growth at conc. of 5 and 7%, respectively. In field experiments conducted during 2016 and 2017, a highly significant reduction in the percent of leaf area infected with *A. zinnia* of zinnia occurred after seeds were treated by soaking in 3% leaf and 7% seed methanol extracts for 15 min before sowing. Growth of zinnia plant improved with the increase of root and shoots growth characteristics including also leaves and flowers. Hence, there is a scope to integrate thuja leaf and seed extracts as plant-derived agents for eco-friendly management of *A. zinniae* causing leaf spot of zinnia.

Key word: *Zinnia, Alternaria zinniae, seed transmission, control, extract, Thuja orientalis.*

THE AWARENESS OF HOUSEHOLD APPLE JUICE PRODUCERS ABOUT MYCOTOXIN PATULIN– A PILOT STUDY IN ESTONIA

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Abstract

Mycotoxin patulin is a toxic compound which is mainly produced by *Penicillium expansum*–a fungal organism causing blue mould rot in apples and pears. In EU, limits for patulin are fixed to of 50 µg/kg in fruit juices. Apple juice is produced in many households in Estonia from apples growing in home gardens. The aim of the study was to find out what knowledge people had about patulin and which procedures people practiced prior juice processing for decreasing the potential of mycotoxin contamination. The total of 110 household apple juice producers (40 males and 70 females) from North Estonia answered the questionnaire. The questionnaire consisted of both open-ended and closed- ended questions. The results showed that the main reason for domestic apple juice processing was that people considered it to be more health-beneficial than industrially processed juice; mainly because of the absence of preservatives. 76% of respondents did not know that apple juice may contain patulin. People were more aware about the threat of pesticide residues than about mycotoxins in apple juice. 49% of the respondents agreed that they use apples with little signs of spoilage for juice processing. 80% of the respondents washed apples before juice processing, but only 43% of domestic juice producers removed rotten parts from apples. Conclusively, domestic apple juice processors in Estonia have poor knowledge about mycotoxin patulin and about measures how to reduce potential contamination of apple products. Thus, more attention should be paid on educating people about natural food contaminants.

Keywords: *Penicillium expansum, blue mold rot, apple quality, food safety.*

MANAGEMENT OF YELLOW RUST ON WHEAT BY SOWING MIXTURES OF CULTIVARSWITH DIFFERENT RATIOS UNDER FIELD CONDITIONS

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Abstract

Yellow rust (YR), caused by *Puccinia striiformis* f. sp. *tritici* (*Pst*) is considered a major threat to wheat production worldwide. Culturing of single wheat cultivars often leads to disease epidemics. Therefore, sowing mixtures of wheat cultivars seems to be practical in yellow rust management. In 2017, a field experiment was carried out to test the effect of sowing seed mixtures of two cultivars, Julius (resistant) and Rumor (sensitive), at different ratios at the research station of the University of Hohenheim, Stuttgart, Germany. The cultivar mixtures were sown using seeds of Julius:Rumor with the following ratios (w:w); 00:100, 10:90, 25:75, 37.5: 62.5, 50:50, 75:25, 100:00, respectively. Artificial inoculation with *Pst* urediospores (10^9 spores/ml) was carried out during the elongation phase. YR scoring was done at weekly intervals according to the scale 0-100% for both severity andincidence of YR. In addition, the disease index for each treatment was calculated. Our results indicated that YR severity was 10%, 12.5%, 11.7% and 25% with corresponding disease indices of 3.7%, 4.2%, 2.7% and 12.5% for 25:75, 37.5:62.5, 50:50 and 00:100 cultivar mixtures, respectively. Disease severity and incidence were negatively correlated with yield, which recorded 3.6 t/ha for the 25:75 and 37.5:62.5 followed by 3.5 t/ha for 50:50 compared with the sensitive variety Rumor (3.0 t/ha) and the resistant variety Julius (3.1 t/ha). In conclusion, our results show the potential of sowing seed mixtures in reducing the damage of yellow rust and increasing the yield obtained by the mixtures compared to the susceptible cultivar.

Keywords: *Cultivar mixtures, Disease severity, Wheat, Yellow rust, urediospores.*

QUALITY AND SENSORY EVOLUTION OF RED WINES ORIGINATING FROM PROTECTED DESIGNATION OF ORIGIN (PDO) NAOUSSA ZONE

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Abstract

Naoussa region is one of the most significant wine PDO zones in Northern Greece. Xinomavro (or Xynomavro) (Vitis Vinifera L. cv.) is among the most important red cultivated varieties in Greece, contributing other than Naoussa to three additional PDO wines. Scientific research indicates that the variety expresses variable viticultural and wine behavior in the different ecosystems of the zone Naoussa. The aim of this study is to research the quality features and sensory characteristics of Naoussa wine produced in a certain winery by selected vines cultivated in Ramnista, Imathia area, at the heart of Naoussa region. For this purpose, ten different vintage, ranging from 1996 to 2017, of Naoussea dry red wine (100% Xinomavro grapes), matured in French oak barrels for twelve months, produced in Foundi Estate (Greece), were selected and were analyzed for color parameters, phenolic content (anthocyanins, total phenolic content, tannins), acidity and alcohol content. Moreover, wines were evaluated based on several sensory attributes (appearance, aroma, taste and aftertaste attributes). The present study tried to explore the evolution of quality and sensory characteristics of PDO Naoussa wines during ageing. Results and conclusions are presented and suggestions are provided.

Keywords: *PGO Naoussa, Xinomavro, wine, sensory evaluation.*

PHYSICOCHEMICAL AND MICROBIOLOGICAL QUALITY PARAMETERS OF COMMERCIAL SAMPLES OF CV.CHONDROLIA CHALKIDIKIS GREEN OLIVES PRODUCED IN SMALL ENTERPRISES AND COTTAGE INDUSTRIES

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Abstract

Cottage industries are small industries, ran by families or individuals at their own house, utilizing their own equipment for the production of food, such as cereal products, breads, pasta, sweets, fruit and vegetable products, vegetable products preserved with salt, vinegar and oil, table olives, olive pastes, pickles, sauces, dried products of vegetable origin of fruits and vegetables, dried fruits, pulses, aromatic plants, and products with honey. Table olives are one of the most significant products of these industries, especially since their production process leads to low –risk products (preserved in brine, contain lactic acid as a result of sugar fermentation). Cottage industries were established legally in Greece in 2015, while in 2017 was published the Good Practice Guide from the national food control body. The aim of the present study is to establish whether there is significant variation in the physicochemical and microbiological characteristics of table olives produced in cottage industries and small business enterprises and assess the microbiological and physicochemical quality of cottage-industries' products. In the present study, physicochemical parameters (size categorization, acidity content, visual defects, salt content in brine and in olive flesh), as well as microbiological parameters (Coliforms, E.coli, Yeasts and Moulds presence) were assessed using classical methods. Samples of table green olives (Cv. Chondrolia Chalkidikis) were obtained by cottage industries and small business in Chalkidiki and Magnisia regional units in Northern and Central Greece, respectively. Data showed a lack of significant variation in physicochemical parameters, as well as microbiological parameters among the samples, therefore concluding that commercial products of cottage industries, specifically table olives, are of similar quality to products produced in SME enterprises.

Keywords: *green olives, commercial olives, home-made olives, quality, Greece.*

IMPLEMENTATION OF BIODYNAMIC VITICULTURE IN GREECE: AN OVERVIEW AND KEY CHALLENGES

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Abstract

Sustainable grape production is increasing the past years worldwide, as well as in Greece, due to the realization of environmental impact occurring from the conventional forms of agriculture and the climate change phenomenon. The organic wine sector is well developed in Greece, however there's an increased interest of organic grape-producers in biodynamic viticulture from the recent years. There is also a lack of research-based publications on biodynamic practice in the country in general and its potential role in sustainable rural development. The aim of this research is to explore the state of biodynamic practice in Greek viticulture sector and to present the key challenges the country is facing. For the collection of information used in this study was applied a threefold approach: (I) literature review; (II) semi-structured interviews; and (III) winery visits (observation). Four wineries were visited and interviews with stakeholders were conducted. The main challenges facing the implementation of biodynamic practice and certification of the produced wines are the cost of application biodynamic preparations in large vineyards, the difficulty of production and handling biodynamic preparations by individual vine-growers, a lack of public awareness and recognition, and a lack of available market research. Greek vine-growers practice biodynamic viticulture in already certified as organic vineyards and they embrace fully the philosophy of environmental sustainability.

Keywords: *biodymanic, viticulture, wine, sustainable, Greece.*

CONSUMERS' BEHAVIOR TOWARDS ORGANIC WINE IN GREECE

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Abstract

Organic viticulture is the second most important form of organic farming in Greece, where its practice started on 1980s. Climate conditions and landscape are factors affecting favorably organic farming in the country, and the main characteristics of organic vineyards are its small size. The present paper reports the results of a quantitative survey, conducted through web during February 2019, and aiming at including the point of view of wine consumers in Greece regarding organic wine. The survey was implemented through a self-administered, online-based questionnaire. One hundred questionnaires were collected, mainly by young people, representing all regions of the country. Results indicated that 96% of the respondents were aware of organic wine and its sustainable production process, 62% of the respondents claimed to purchase organic wine, mainly from wine stores, or directly from the producers, while the main factors affecting preference for organic products are health protection, safety/quality and environment protection. An inhibiting factor for organic wine market was shown to be the limited marketing and distribution of these products in Greece, as well as higher prices. However, most of the respondents would be willing to pay up to five euro more in order to purchase an organic wine, in comparison to conventionally produced wines. Results of the survey after statistical analysis are presented, conclusions and suggestions are provided.

Keywords: *organic wine, consumers' perceived views, Greek market.*

COMPARING OF PREEMERGENT WEED CONTROL TECHNOLOGIES IN SOYBEAN (GLYCINE MAX)

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Abstract

Soybean is one of our most important protein crops, with worldwide production reaching 320 million tons. It is grown in Hungary at 60,000 ha in the southern part of the country. Its yield is currently around 180,000 tons. Currently it is forbidden to cultivate genetically modified soybean in Hungary, which is why Hungarian soy production has a great value. Current legislation does not allow all of the preemergence herbicides to be used, as well as the use of post-emergence herbicides. Soybean is a very bad weed supressant at the initial stage of development. During this period, herbicide control is warranted, for which at present there are not enough active substances available. The aim of our experiment was to investigate the effects of five preemergent herbicides on soy weeds in field trials. We also examined the phytotoxic effect of the herbicides on soy. The tested active ingredients were s-metolachlor, metobromuron, flumioxazine, metribuzin, and dimethenamid-p + s-metolachlor. The weeds in the experimental area were: *Echinochloa crus-galli, Datura stramonium, Chenopodium album, Ambrosia artemisiifolia, Hibiscus trionum, Sorghum halepense, Cirsium arvense.* During the evaluation, we examined the effect of each active substance on the weeds mentioned earlier. The active substances were classified according to official regulations based on herbicidal efficacy and phytotoxicity.

Keywords: *Soybean, weed control, preemergence, field experiment.*

DETERMINATION OF EYE IRRITATION POTENTIAL OF AGROCHEMICALS WITH 3D TISSUE MODEL

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Abstract

Draize rabbit eye test (OECD 405) is one of the most criticized *in vivo* methods, because of the lack of objective quantification within its grading system and the injuries inflicted on the test animals. However, several *in vitro* test methods have been validated in the last fifteen years, which can partly replace the *in vivo* eye irritation testing. Seven agrochemicals (Amistar Top, Movento, Folicur solo, Karate zeon 5 CS, Chess 50 WG, Ridomil Gold MZ 68 WG, Champion WG) were examined with EpiOcular™ model. The test items were applied to the surface of the cornea epithelial construct for a fixed period, and the tissue allowed to express the resulting damage after removal. The irritation potential of the test item may be predicted by measurement of its cytotoxic effect, as reflected in the MTT assay, on the EpiOcular™ tissue. The test item is identified according to UN GHS as Category 2 or Category 1 if the mean percent tissue viability after exposure and incubation is less than or equal (≤) 60% compared to the negative control. Depending on the regulatory framework in member countries, the test item is evaluated as "No Category" (UN GHS) if the mean percent tissue viability after exposure and incubation is more than (>) 60%. Concurrent positive and negative controls were included. Compared to the results with the available information about *in vivo* data of the tested agrochemicals, five test items are corresponded to them. However, two test items showed false positive result based on the results performed on experimental animals.

Keywords: *EpiOcular™ tissue, in vitro, eye irritation, cytotoxic effect.*

MODEL STUDY TO INVESTIGATE THE TOXIC INTERACTION BETWEEN GLYPHOSATE AND COPPER SULPHATE ON CHICKEN EMBRYOS

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Abstract

The toxic effects of the Taifun Forte herbicide (360 g/l glyphosate isopropylamine salt) applied alone or in combination with copper sulphate were studied on chicken embryos in the early phase of embryonic development. The test materials were injected in 0.1 ml volume into the air chamber of eggs on the first day of incubation. Subsequently, on the third day of incubation permanent preparations were made from the embryo in order to study the early developmental stage. Embryos fixed on slides and stained with osmium tetroxide solution were studied under light microscope. The embryonic mortality and the developmental anomalies was analysed statistically by Fisher test. According to the result of the statistical evaluation, the embryonic mortality was not influenced by the single treatment of copper sulphate. However, Taifun Forte and its combination with heavy metal significantly increased the early embryonic mortality. Developmental abnormalities were sporadically observed due to the single administration of copper sulphate. The incidence of it was increased due to the treatment with herbicide alone and in combination with copper sulphate. Based on the results, additive toxic interaction may occur between the copper sulphate and glyphosate that can highly reduce the viability of the embryos or can lead to extinction of wild birds in serious cases.

Keywords: *glyphosate, copper sulphate, interaction, embryonic mortality, chicken embryo.*

STUDIES ON DISSIPATION KINETICS AND RISK ASSESSMENT OF IMIDACLOPRID RESIDUES AND BIOEFFICACY OF SOME INSECTICIDES AGAINST HEMIPTERAN PEST IN OKRA

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Abstract

In the present study field investigations were carried out at Vegetable Research Centre, G.B. Pant University of Agriculture and Technology, Pantnagar during spring and rainy seasons ,2017. Three species of hemipteran insect pest *viz.*, leafhopper (*Amrasca biguttula biguttula),* Whitefly *(Bamisia tabaci),*Aphid *(Aphis gossypii)* were observed to attack the okra crop during both spring and rainy season 2017. Among all the insecticidal treatment , Imidacloprid 17.8 SL @ 100ml/ha followed by Acetamiprid 20 SP @ 75 gm/ha was found to be highly effective against aphid and leafhopper population and Thiamethoxam 25% WG @ 100 gm/ha was found to be most effective to suppress whitefly population. Yield was recorded maximum in Acetamiprid 20 SP@ 75gm/ha treated plots. Yield of okra in rainy season (15.17/ha) was more than spring season (13.04 T/ha). Seasonal incidence of all the pest under was studied from 13th standard meteorological week to 25th standard meteorological week of 2017. Maximum mean number of leafhopper (16.10 leafhopper/3 leaves) , whitefly (15.31 whiteflies/3 leaves) and aphid(31.52 aphids/3 leaves) was recorded during 20th SMW ,21st SMW and 21st SMW of 2017 respectively. Residues of imidacloprid was dissipated to more than 80 % after 3 days of spraying and it was found to be below detectable limit at 7 and 10 days. Half life period for imidacloprid at tarai region of north western Himalaya was estimated to be 2.094 days at recommended dose. As the RQ (Risk Quotient) value was found to be less than 1 after 3 day (0.85) so the waiting period of 3 days have been suggested in okra crop in agroclimatic region of *tarai*.

Keywords: *residues, insecticides, pests.*

INHIBITORY EFFECT OF EUCALYPTUS ESSENTIAL OIL TO CONTROL FUSARIUM WILT ON TOMATO PLANTS

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Abstract

Essential oils of medicinal plants are an attractive method for combating pests and plant diseases. The production of essential oils by plants is a protective mechanism against various pests and diseases, because most of these essential oils have antifungal and antimicrobial properties. The aim of this study was to investigate the inhibitory effect of eucalyptus essential oil to control fusarium wilt in tomato plants. First, eucalyptus essential oil was extracted by using water distillation. Then, its growth inhibitory effect on Tomato Fusarium Wilt was investigated by filter paper diffusion in different concentrations(25, 50, 100 and 200 µL). After that, the treated samples were incubated for 120 h at 26 °C and the diameter of the inhibition zone of the fungus was measured. All experiments were performed with 3 replications. The highest inhibitory effect on the disease was equal to 58.27% at a concentration of 200 µL. The results of this study showed that Eucalyptus essential oil could be a good candidate to control Fusarium Wilt in Tomato Plants.Due to the fact that the compounds in the essential oils act as synergists, there is little chance of resistance to these substances in fungi. In addition to the ability to control plant diseases, these essential oils can reduce costs and prevent environmental degradation.

Keywords: *Essential Oil, Eucalyptus, Fusarium Wilt, Tomato.*

POSTHARVEST BEST TEMPERATURE FOR DRYING IN HAZELNUT WITH AND WITHOUT SHELL

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Abstract

Hazelnut fruits have significant importance in terms of food and pharmaceutical industries and are consumed both raw and dry roasted. Drying is one of the most important phases of hazelnut processing and improves the quality of the final product. Therefore, in order to achieve the best drying temperature, an experiment based on the completely randomized design was carried out with two factors: drying temperature at three levels (40, 50 and 60℃) and two fruit types (with shell and without shell) with six treatments and three replications. After fruits drying some traits like time and energy needed for drying, taste test and also number of oil qualitative traits such as acidity, peroxide and protein content were measured and finally, temperature of 60℃ was recognized as the most effective one for hazelnut drying.

Keywords: *Hazelnut, Drying, Acidity, Protein, Peroxide, Taste test.*

CAN THE APPLICATION OF WHEAT-ENRICHED SEEDS BE EFFECTIVE IN SOLVING THE PROBLEM OF ZINC DEFICIENCY IN IRAN AND IN INCREASING THE NUTRITIONAL QUALITY OF THIS PLANT?

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Abstract

Today, just a lack of protein and energy are not considerd as malnutrition. Global approach to the problem of malnutrition has changed, so that in addition to protein and energy, a wide range of micronutrients deficiency, especially zinc, is also included to malnutrition. Efforts to increase zinc storage and improve the quality and quantity of yield in wheat grain is an important challenge in the world. Due to the importance of zinc deficiency in Iran and its negative impact on plant communities and humanitarian, current research was done. According to the results of previous research and after soil testing and selection of appropriate farm, this research was done in factorial experiment with completely randomized block design with three replications in the spring of 2014. The results of farm section showed that the parameters of the number of spike, number of grains per spike, grain yield, protein content, phytic acid, phytic acid molar ratio, phosphorus and zinc content. In conclusion it should be stated that in order to enrich the stability of the country in the fields of enriched seeds, soil application of zinc sulfate is recommended. It must be applied in the same way on a regular basis in the maternal fieldsand reusedin the main fields.This is among the recommendations of farming for cultivation in the country.

Key words: *Biofortified Varieties, Number of Grains per Spike, Phytic Acid, Yield and Zinc.*

EVALUATION OF QUANTITATIVE AND QUALITATIVE YIELD IN HYBRID AND OPEN-POLLINATED TOMATO CULTIVARS

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Abstract

In order to evaluate yield and fruit quality in 18 tomato cultivars, an experiment was conducted in a field in Mashhad, Iran. The experiment was carried out as Randomized Complete Block Design with 18 cultivars and three replications. Results in the first harvest indicated Processor 112 to had the highest fruit yield (70.62 ton/ha) significantly. Amongst the studied cultivars Pinkbal cultivar with the high vegetative growth showed the lowest fruit yield (9.7 ton/ha). In the second harvest, Shaper 527 with in determinate growth type demonstrated the highest yield (77.02 ton/ha), but Petopride5 and Early Orbana Y cultivars with determine growth type were the next rankings. GS 15, Early Orbana Y،Petoprid, Red diamond, Processor112, Shaper527 and Petopride5 showed the highest total yield respectively. Fruit brix was higher in Shaper520, Cal G N3, Petopride5, Tango, Petoearly CH (Control), Shiwa, Pink Stone, Processor 118 and Processor112, in comparison to other cultivars, but Perimo early and Red diamond cultivars had the lowest fruit brix. Also Early Orbana Y. F. and Tango showed the highest fruit pH, while Processor112 and GS15 cultivars were the least significant. Therefore recent cultivars are more suitable for processing industry and making the tomato paste in the factory.

Key words: *tomato, cultivars, yield, brix, fruit pH.*

EVALUATION OF SPRAY QUALITY USING WATER SENSITIVE PAPERS AND SIMULATED TREE CANOPY

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Abstract

There are many problems due to remaining of excessive pesticide residues on agricultural products and risk of environmental pollution. Therefore, it is necessary to use new methods to enhance the spraying technique and quality. In this research, the number of droplet and volume of consumed chemical were evaluated for two sprayers (turbine and lance-nozzle) and two sizes of peach tree (small and large) using water sensitive papers and simulated tree canopy. Droplet diameters was considered in four categories as 0-150, 150-300, 300-450 and >450 micro meter. Data were analyzed based on randomized completely design by factorial test at five replications. Results showed that type of sprayer, droplets diameter and their interactions have significant effect on canopy size but volume of chemical used in large tree canopy was 16.5% more than small tree canopy. Also, in air blast sprayer the volume of chemical was about 101% and the droplet number was 17% more than lance-nozzle sprayer. Mean comparison of data showed that there is a significant difference between number of droplets and volume of chemicals at different particle size, as the maximum number and the minimum volume was obtained at 0-150 micro meter. Mean of total droplet number with turbine sprayer at range of 150-450 micro meters was 42.2% that considers about 84.7% of chemical volume. For lance-nozzle sprayer, mean value of droplet number at the same range of diameter was about 49.9% as it considers 46% of chemical volume. In general when we use turbine sprayer, the consumption is about 50% less than lance-nozzle sprayer.

Keywords: *Spraying, water sensitive paper, air blast sprayer, spray droplet diameter.*

APPLICATION OF CHITOSAN-BASED COATING IN LEMON FRUIT CONSERVATION

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Abstract

The fruit character such as nutrition, favour, and firmness deteriorated during the process of storage and leads to the decay of the fruit. Lemon is one of the most important citrus fruit and is cultivated in many countries including Iran. The effects of chitosan-clay nano-composite coating on the quality properties of lemon fruit during storage were investigated. Chitosan-clay solution was prepared by composition %1 clay, %2 chitosan. The lemon fruit were dipped into the chitosan-clay composition and then dried at environment temperature. Experiments were carried out at four storage time with coated and uncoated samples. The physical, chemical and mechanical properties of lemon fruit were measured during storage. The results showed that the pH of lemon fruit juice increased significantly ($p<0.05$) for coated and uncoated samples. Coated samples had the lower TSS (Total Soluble Solid) and higher TA (Titratable Acid) rather than uncoated samples. The inner strength of coated samples was more because of the higher firmness and peel shear force and also the lower punch force. As a result, the coated fruits had more resistance to the applied force than uncoated fruits. Coating was more effective in maintaining lemon firmness at prolonged storage. Thus the coated samples had the most resistance to fungal disease. Finally, it should be indicated that resistance to fungal diseases, interior tissue strength and quality properties of fruit were increased by using the nano composite coating. Consequently, it reduced the percentage of weight loss and maintained the fruit quality longer.

Keywords: *Citrus, Lemon, Mechanical properties, Nano composite.*

THE ANTIBACTERIAL EFFECTS OF DIFFERENT PLANT ESSENTIAL OILS UNDER TIME AND TEMPERATURE ON GROWTH AND MORPHOLOGY (WITH TRANSMISSION ELECTRON MICROSCOPY) OF BACILLUS CEREUS IN A FOOD MODEL

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Abstract

Bacillus cereus is a spore-forming food-borne pathogen often associated with food products such as meat, vegetables, soup, rice, and milk and other dairy products. 1 - 20 % of total outbreaks of food intoxication in the world are caused by *Bacillus cereus*. There is an increasing interest in the use of plant-derived antimicrobial compounds as natural preservatives for food. The objective of this survey was evaluation of antibacterial effects of *Cinnamomum zeylanicum Nees.* and *Cuminum cyminum* and *Zataria multiflora Boiss*. essential oils (0, 5, 15, 30 and 45µl 100ml-1) that after steam-distillation and analyzing by GC/MS affected under (10 and 25°C) temperatures at 21 days' intervals on growth of *Bacillus cereus* ATCC11778(10^7*CFU ml-1*) in a food model (commercial barely soup). Also, morphology of bacterium was observed by TEM. Results with SPSS software (version:21) showed the logarithmic growth of bacterium decreased by increasing essential oil concentrations and also in 10°C in comparison with 25°C, respectively. Then the effect of these essential oils (450 µl/l) on morphology of *Bacillus cereus* was evaluated with TEM after processing and photographs explanation. We observed abnormality in bacterial division, cell deformity and depletion of cell content, release of cytoplasmic constituent. The findings of this study indicated the potential inhibitory effects of *Cinnamomum zeylanicum Nees*. and *Cuminum cyminum* and *Zataria multiflora Boiss*. essential oils on *Bacillus cereus* bacteria in commercial barley soup.

Keywords: *Plant Essential oils, Time, Temperature, Bacillus cereus, Transmission electron microscopy.*

UNDERSTANDING HOST-PATHOGEN PROTEIN-PROTEIN INTERACTIONS IN RICE BLAST PATHOSYSTEM

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Abstract

The *Magnaporthe oryzae*, causal agent of rice blast disease, is a major constraint to global food security. The importance of both rice and the rice blast disease provide an excellent foundation for dissecting the biochemical complexities of plant pathogen interactions. Plant disease control is an area where the field of proteomics interactions has the potential to make a significant and immediate impact through the identification of proteins involved in disease resistance. Genetic analyses of plant-pathogen interactions have revealed that resistance reactions are, in many cases, controlled by two dominant loci: avirulence gene in the pathogen and a corresponding resistance gene in the plant. The absence of either member of the gene pair results in the development of disease symptoms. In the rice blast pathosystem, the *Pi-ta* resistance gene in rice confers resistance to isolates of *M. oryzae* containing the corresponding avirulence gene *AVR-Pita*. The efficacy of the *Pi-ta* resistance gene has been challenged by spontaneous virulent mutants of *M. oryzae* which possess an apparent non-functional *AVR-Pita* allele. However, the exact nature of resistance and avirulence protein interactions still remains unresolved. In this study we used the yeast two hybrid system to detect the rice genes interacting with the rice blast genes. We generated a rice cDNA library, than screened this rice cDNA library across the rice blast protein, avr-pita. The protein sequence of positive interactors were deposited at National Center for Biotechnology Information (NCBI) (http://www.ncbi.nlm.nih.gov/) database and used for alignment with CLUSTALW 2.0.

Keywords: *Rice, Magnaporthe oryzae, Plant, Pathogen, Resistance.*

PREVENTIVE APPROACH FOR MICROBIAL CONTROL OF *CAPNODIS TENEBRIONIS* WITH ENTOMOPATHOGENIC FUNGI

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Abstract

Capnodis tenebrionis (L.) (Coleoptera: Buprestidae), the Mediterranean flat-headed root-borer, is an economically important pest on stone fruit trees (apricot, plum, cherry, peach and nectarine). Chemical pesticides and Entomopathogenic nematodes are used for the control of adults and boring larvae, respectively. Currently, there are no solutions for preventing the neonate larvae from infesting the roots. Previous studies demonstrated highly efficiency of Entomopathogenic fungi (EPFs) in attacking these neonate larvae. This study was aimed at assessing the persistence of EPF conidia over time and their efficacy as preventive treatment in the soil against neonate larvae of the pest. *Metarhizium brunneum,* local Israeli strain Mb7 expressing GFP (Green fluorescent protein), and *Beauveria bassiana*, strain GHA expressing GFP, were mass-produced on rice grains. The sporulated rice was mixed with the soil either 4 months or a week before releasing *Capnodis* neonate larvae on the soil of potted rootstock plants (677 almond×peach and 2729 plum). To monitor persistence, the soil and roots were sampled every four weeks and samples were observed under confocal microscopy to follow fungal development in the rhizosphere and in the soil. *Galleria* bait method was applied, too. Fungal development in the rhizosphere was observed 42 days post inoculation: conidia germinated on the root surface of almond×peach rootstock; conidia in the soil were viable, but did not germinate. Fungal persistence was found steady during the 42 days of the experiment. *Galleria* larvae exposed to soil previously treated with the fungi died within 7 days. Infestation rates by *Capnodis* larvae in the Mb7 treatment was significantly lower.

Key words: *Capnodis tenebrionis, Entomopathogenic fungi, Rootstock, Metarhizium brunneum.*

MONITORING THE SAFETY OF WILD -GROWING FRUITS FROM DIFFERENT REGIONS OF KAZAKHSTAN

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Abstract

The article presents the results of environmental monitoring of wild plant'sspecies that are growing in various regions of the Republic of Kazakhstan during 2015-2018.The aim of the research was to study the species diversity of fruit and berry crops of natural flora, contamination of theirberriesby heavy metals.The geobotanical characteristic of wild-growing species of fruit crops was compiled by the route survey method. In the laboratory species of wild-growing plants were identified and a list of species biodiversity were compiled.It is established that the composition of biological diversity includes 34 species of fruit and berry crops from 10 families.In laboratory conditions, the fruit crops contamination by heavy metals asPb, As, Cd, Zn, Cu, Mg has been studied.The completed studies on environmental safety are aimed at studying the gross concentrations of heavy metals in berries. The results of the study of fruits contamination by heavy metals showed that their existance was noted in all the selected samples.*Berberissibirica* Pall.accumulates increased concentrations of Pb (0, 042 mg / kg), *Ribesrubrum* L., *Fragariavesca* L., *Loniseraaltaica* Pall.- As(0.019-0.038 mg / kg); *Crataegus sanguine* Pall. -Cd (0.04 mg / kg).It is determind that the number of the accumulation of heavy metals in the examined fruits does not exceed the limits of permissible levels.The results of research characterize the wild berries of the regions of Kazakhstan as safe for widespread use in food and medicinal purposes.

Keywords: *ecology, natural flora, biodiversity, fruits, food security.*

PERFORMANCE OF SAFFRON ON DIFFERENT SOILS UNDER HOMOGENEOUS ENVIRONMENTAL CONDITION

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Abstract

Soil is the major factor determining saffron yield. Although saffron tolerates different soil types, some soils with specific characteristics perform better than others. This work was conducted to evaluate the performance of saffron crop on different soil types under homogeneous environmental conditions. Four soil types sampled from different regions were tested: Rendzic Leptosols, Anthropic Regosols, Hypercalcaric Fluvisol and Eutric Cambisols. Soil samples were put in large plastic pots (radius=0.22 m, height=0.44 m) and organized in complete block design with four replicates. Combined analysis for four years revealed significant differences between soil types regarding most yield parameters. Saffron corms performed better on calcareous clayey Rendzic Leptosols soil with respect to plant length (pl), flowers per plot, flowers percorm cluster, total stigmas fresh and dry weights, fresh and dry weight of single stigmas and total number of corms. Regarding qualitative yield parameters (Crocin, Picrocrocin and Safranal), the best results were obtained under the Hypercalcaric Fluvisol soil. A regression analysis was used to evaluate the performance of soil types on the number of flowers per mother corm through four years of the study. In this regard, a positive significant higher slope was obtained for Rendzic Leptosols ($y = 4.23x - 8514.3$, $R^2 = 0.69$, $p < .0001$). Quantitative yield attributes such number of flowers per corm cluster was significantly correlated with organic matter t ($r = .60$, $p = .016$) and calcium ($r = .52$, $p .041$) contents. Correlation analysis showed that the soil parameters most attributed to the saffron yield were organic matter, phosphorus, potassium and calcium. For soils with limiting factors (Eutric cambisols and anthropic regosols) further studies should focus on improving their performance under saffron crop.

Keywords: *Rendzic Leptosols, Anthropic Regosols ,Crocin, Corm cluster.*

THE EFFECT OF PLANT PROBIOTIC (SAPROPEL) ON GARDEN STRAWBERRIES AND ON SOIL MICROORGANIZMS

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Abstract

Many scientists say that sapropel accumulated in nature, or lake sludge, is unique and valuable sediment. Sapropel is a complex material of organic and mineral origin. Sapropel is found in many Lithuanian lakes. Due to the chemical and physical properties of sapropel, it is appropriate to use it as a fertilizer or probiotic for plants and soil improvement. The aim of the research work was to determine the influence of the complex of organic and mineral substances - the plant probiotic (based on sapropel) on strawberry yield, leaf area, leaf chlorophyll index as well as to determine its influence on the major quantities of soil elements, to evaluate the abundance of microorganisms and species composition in soil. Field experiment was conducted in garden from May 22 in 2017 and finished in 31 of August of 2018 in Lithuania. During the research period, the chlorophyll index of the garden strawberry was the highest at the beginning and end of the fruit fecundity, when the plant probiotic of 5 l m^{-2} was used. This level of probiotic increased the chlorophyll index by 6.0 and 81.0%. Increasing the probiotic content from 5 l m^{-2} to 10 l m^{-2} revealed a tendency of increasing leaf area. At the beginning of the strawberry fruit yield, using the plant probiotic 5 l m^{-2}, there was the highest average yield. After using the plant probiotic 5 l m^{-2} at the end of the fruit yield, the lowest average yield was achieved. The highest total amount of microorganisms was determined in the soil sample with probiotic additive 10 l m^{-2} and lowest was in the control.

Keywords: *garden strawberries, sapropel, yield, soil microorganisms.*

BIOCONTROL OF STRAWBERRY GREY MOLD USING PEPPER EXTRACTS

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Abstract

Grey mold is an important yield loss causing disease in strawberry around the world. The growing resistance of the pathogens requires the continuous formulation of new plant protection products and one of the natural resources of bioactive ingredients are plants. Black pepper and allspice (pimento) are commonly used spices for foods. However, they also have active substances which provide these spices and their fruits aromatic, taste or medicinal properties. This gives a potential for antifungal activity of the extracts of these spices. The aim of the research was to investigate the inhibition of *Botrytis cinerea* growth by black pepper (*Piper nigrum* L.) and allspice (*Pimenta dioica* L.) extracts. The research was carried out at LAMMC Institute of Horticulture, Lithuania. Extracts from dried fruits of spices were produced using subcritical CO_2 extraction. Firstly, inhibition of *B. cinerea* was examined by mixing different concentrations of investigated extracts with PDA and inoculating each plate with 6 mm diameter, 7-day old pathogen disc. Secondly, strawberry leaves were sterilized and placed in Petri dishes with filter paper and 5 ml of sterile water. Leaves were sprayed with mixtures of extracts with sterile distilled water. Then each strawberry leave was inoculated with 9 mm diameter, a 7-day old disc of *B. cinerea*. Both experiments were incubated separately at 22±2 ^{o}C in the dark and evaluated after 2, 4 and 7 days. The results showed that allspice extract demonstrated higher inhibition of *B. cinerea* than black pepper extract both on the PDA and on strawberry leaves.

Keywords: *inhibition, antifungal, allspice, pimento, black pepper*.

BROADLEAF WEED CONTROL IN GRAIN LEGUMES

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Abstract

Grain legumes produce high quality protein used for food and feed needs and their benefits are very well known. Despite of this, they are grown only on 1.5 % of the European arable land. Grain legumes are poor competitors to weeds and weed control is a challenge for the growers. The objective of this study was to evaluate the effect of pre- and post emergence herbicides on weeds in different legume containing cropping systems. Grain legumes – pea (*Pisum sativum* L.), bean (*Vicia faba* L.), lentil (*Lens culinaris* L.) and checkpea (*Cicer arietinum* L.) were treated with aclonifen, pendimethalin, prosulfocarb, aclonifen and clomazone + aclonifen at pre-emergence, while bentazone and MCPB were applied as post-emergence herbicides. The effect on number and mass of weeds in lentil stand was the lower as compared to that with the other grain legumes. The pea suppressed weeds on average by 68 % greater than the lentil. Pendimethalin was the best control option for *Lamium purpureum* L. and *Polygonum aviculare* L. annihilation. MCPB, aclonifen and bentazone provided the best control on *Brassica napus* L. All herbicides controlled less than 70 % of the *Chenopodium album* L. The exception was MCPB application. The foliar injury of lentil was noticed after bentazone usage, but for the checkpea this was true after treating the crop with MCPB. No any visible stress symptoms on grain legumes plants were registered after application of pendimethalin, aclonifen, prosulfokarb and aclonifen + clomazone.

Key words: *grain legumes, weed, herbicide, foliar injury.*

THE CONTRIBUTIONS OF PLANT-BASED ORGANIC MATERIALS TO THE PRODUCTIVITY OF SPRING CEREALS IN STOCKLESS ORGANIC CROPPING SYSTEMS

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Abstract

Legumes, plant-based materials and organic fertilizers are tools for supporting of nutrient cycling in stockless organic cropping systems. In order to exam the effect of plant-based materials and organic fertilizers on spring cereals productivity a few field studies were conducted on a loamy *Endocalcari-Ephypogleyic Cambisol* in Dotnuva (55˚24'N, 23˚50' E), and on clay loam *Endocalcaric Endogleyic Cambisol* at Joniškėlis (56º21'N, 24º10' E) in Lithuania. In the first presented study the aim was to assess how red clover and pea in combining with manure pellets can impact on spring cereals productivity. Grain yield and quality of spring wheat were affected by the using of manure pellets and biomass of incorporated red clover. Cattle manure pellets had a positive impact on subsequent spring barley yield. The second presented study is focused on incorporation of plant based material. The usage of plant-based organic materials (green, ensilaged, composted) and granulated cattle manure affected on spring cereals productivity. The yield of spring wheat grains was affected by application of the green biomass of red clover and granulated manure. The yield of subsequent spring barley grain was increased by the application of fermented red clover mass. During two years of plant-based organic materials exposure, most of the N yield was accumulated after application green or ensilage red clover biomass and granulated cattle manure. The productivity and the quality of spring cereals in stockless organic cropping systems can be improved by the use of red clover incorporation in combination with other management factors.

Keywords: *legumes, nitrogen yield, plant-based materials, spring cereals.*

APPLICATION OF BIOLOGICAL CONTROL IN REGULATION OF WESTERN FLOWER THRIPS (*FRANKLINIELLA OCCIDENTALIS* PERGANDE) POPULATION AT PEPPER IN PROTECTED AREA

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Abstract

Although chemical pesticides play a vital role in controlling the number of harmful insects, they also contribute to accelerated pollution of soil, air and water. Due to the frequent use, insects become resistant to active ingredients very quickly, they destroy the natural enemies of the pests, and have a harmful effect on humans. It is a method of controlling pests such as insects, mites, weeds and plant diseases using other organisms. It relies on predation, parasitism, herbivory, or other natural mechanisms. Accordingly, the application of biological protection, that is, the use of living organisms (predators and parasites) in plant protection programs in protected areas, takes on a larger scale worldwide, rather than the use of chemical pesticides. The aim of our research was determining the effectiveness of predatory mite *Amblyseius swirskii* (Mesostigmata: Phytoseiidae) and predatory bug *Orius laevigatus* (Hemiptera: Anthocoridae) on reducing the population of Western flower thrips (*Frankliniella occidentalis*). Experiment was set in greenhouses in Strumica region, in two localities (Prosenikovo and Dabile), during 2018, in a commercial pepper production. The results obtained correspond to our expectation in controlling the population of the trips. High efficiency of natural enemies has been established in controlling the number of thrips population in both localities. The efficiency at the locality Dabile was higher, due to the earlier introduction and the presence of a lower number of thrips. In the Prosenikovo locality, a lower nuance was observed, due to the later introduction and the presence of a higher number of thrips.

Keywords: *Pepper, Western flower thrips, Amblyseius swirskii, Orius laevigatus.*

EXAMINATION OF VITAMIN C IN FEED AND MILK

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Abstract

The exact quantification and concentration of vitamin C in fodder is of critical importance for the normal health of dairy cows that are susceptible to oxidative stress, just like humans. Studies have been carried out on vitamin C (ascorbic acid) of feed (alfalfa hay, concentrates for milk cows and wheat straw) from three farms in different regions used for feeding dairy cows and their milk. Based on the performed tests of the chemical composition of the feed, it was concluded that the total feed used was characterized by the best composition. The concentration of vitamin C was examined in extracts of feed and raw milk. Vitamin C was examined through colorimetric method, using a calibration curve of 2,4-dinitrophenylhydrazine and a spectrophotometer (Pharo 300-Merck spectroquant). The highest concentration of vitamin C was found in alfalfa hay, farm B (40.2 μg/ml), while in the raw milk it was mostly present in milk from farm A (2.8 μg/ml). From the above, it can be concluded that regardless of which farms the tested samples of feed and their milk are, higher values for the concentration of vitamin C are obtained in the samples of extracts of alfalfa hay. If we compare the vitamin C concentration in feed and milk, it is concluded that the raw milk values are much lower than the feed and even much lower than the pasteurized milk taken for standard (2.3 μg/ml).

Key words: *feed, alfalfa hay, concentrate, milk cows, vitamin C.*

COMPETITIVE ABILITY OF *ALSINE MEDIA* L. IN THE AUTUMN AND EARLY-SPRING SOWN CROPS

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Abstract

A. media conquers very fast any frigid, humid space before winter or spring crops can develop into competitive ones, because of its ability to yield enormous seed quantities under cool environment conditions. It is most frequent weed in various crops in temperate and subarctic conditions, where it is usually one of the first weeds to occur in spring. *A. media* is one of the most common weeds in winter and spring cereal habitats, the most frequent weed in winter oilseed and peas, highly competitive weed in establishing alfalfa, one of the prevailing weeds in strawberry, and one of the most ubiquitous weed species emergeing in sugar beet. It is a leading weed problem in vegetable production, in gardens and turf in nearly every state in temperate world. On the other hand, in correlative field experiments of weed competition and yield decreasing in various crops, *A. media* was found to be less competitive than *Avena fatua, Alopecurus myosuroides, Raphanus raphanistrum Polygonum persicaria, Chenopodium album*, *Galium aparine* and many other weeds. In trials in autumn and early-spring sown crops and established crop plants, such as established alfalfa, *A. media* was a weak competitor, although it occurs at high densities. The concrete competitive response and related yield reduction generated by *A. media* will rely upon a number of circumstances, such as time of emergence in affiliation to the crop. *A. media* demonstrates intense initial development and will generate considerable yield depletions when it appears simultaneously or before the crop. It is a remarkably flexible species, meaning that early formation and source taking will outcome in more competitive entities.

Keywords: *Alsine media, crops, weeds, competitor.*

EPIGENETIC HEREDITY MAY INFLUENCE THE WHEATPLANTS RESISTANCE TO HEAT AND FROST

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Abstract

Our researches aimed to investigate the possible implication the epigenetic phenomena in modification of the resistance of different wheat genotypes to heat and frost. The primary resistance of 12 wheat genotypes to high temperatures and frost was appreciated. One set of seeds was reproduced in the Kharkov region (Ukraine), and another - in the central area of the Republic of Moldova. Obtained results suggested that the conditions of seeds reproduction substantially influenced the distribution of wheat genotypes according their resistance to extreme temperatures. Of particular interest were the data that showed that the germination of seeds during incubation at 1 or 4°C was inversely proportional to their primary resistance to frost: seeds of genotypes with higher frost resistance germinated slower. Surprisingly, these results were consistent with the law of Bergonié and Tribondeau, according to which cells were most radiosensitive when actively proliferating, highly metabolic, undifferentiated, and well nourished. Plants obtained from the seeds treated before sowing with the solution of biostimulator *Reglalg* (a preparation that meets the requirements of organic agriculture) demonstrated increased resistance to heat and cold stress. This influence tended to remain functional during plants ontogenesis and also in the next generation, without supplementary treatment with biostimulant. These data demonstrate that epigenetic phenomena may be involved in determining winter wheat genotypes primary resistance to extreme temperatures.

Keywords: *winter wheat, biostimulator, epigenesis, stress tolerance.*

VEGETABLE OILS: DO THEY HAVE ANTIOXIDANT ACTIVITY?

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Abstract

The main aim of this paper is to start the discussion about the potential antioxidant activities of oil extracts and oils from various vegetable raw materials. Many publications reported that the seed oils and essential oils possess the high antioxidant activities. In our opinion it is not so. We want to share the results of own investigations and our view at this topic. We tested: a) oils extracts from seeds of apricot, grape, peach, pumpkin, fenugreek, white bryony, sea buckthorn and rosehip; b) walnut oils (eight samples of oil); c) essential oils from needles of juniper and pine. Antioxidant activities of oils and oil extracts were appreciated by two spectrophotometric methods: method based on model oxidation reaction of N,-diphenyl-n-phenylenediamine by azo-bis-(isobutyronitrile) as the initiator of free radicals; and procedure of DPPH free radicals scavenging. Trolox was used as standard antioxidant. Tested oil extracts from seeds did not show antioxidant capacities; on the contrary, they took part in reaction enhancing of free radical oxidation. Walnut oils demonstrated a neutral effect against free radicals. They did not enhance and did not reduce oxidative processes. Thus, the antioxidant capacities of walnut oils also were not identified. Freshly obtained essential oils from needles of juniper and pine possessed the antioxidant activity, which decreased by 2-8 times during one mount of storage. The oil extracts, vegetable and essential oils have others nutritional values and should not be considered as antioxidant. Moreover, to extend shelf-life they need to be fortified by antioxidants.

Keywords: *oil extract, vegetable, essential oil, antioxidant activity.*

FOOD SAFETY POLICY IN MONTENEGRO: CURRENT STATE OF PLAY

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Abstract

Food safety is pervaded in broad number of scientific disciplines and backed up with state and international policies in order to have social, reflected in public health, and economic sense, as essential prerequisite for food trade. Merging services responsible for food safety, veterinary and phytosanitary policies of Ministry of Health and Ministry of Agriculture and Rural Development in 2016 into a single government body, Administration for Food Safety, Veterinary and Phytosanitary Affairs, brought to a common approach to policies related to food safety, improvement and enforcement of food safety system in Montenegro. Improvement has been made in developing food safety policies, implementation of international regulations, and understanding obligations and requirements of farmers and producers. The coverage of consumers' understanding of government role in ensuring safe food improved significantly. However, the level of consumer interest and responsibility in emerging risks in food chain needs to continue to increase. Taking into account specifics of Montenegro as a small country and limited human resources, timed and effective networking of institutions is eliminatory for risk assessment and management process. Although food safety is the main responsibility of producer, Administration has the leading role and has to continue to strengthen and evolve, continuing to back up numerous small scale producers and awaiting accession to the European Union. Future policies should refine roles and accountabilities of all stakeholders in risk assessment and management process, based on multiple criteria used in decision making considering human, animal and environmental health in order to prioritize food safety issues.

Key words*: food safety, food safety policy, Montenegro.*

MYCOTOXINS OF *PENICILLIUM AURANTIOGRISEUM* AS POTENTIAL RESOURCE FOR CANCER THERAPY

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Abstract

For years, natural products have been used as treatment agents and have been helpful in the fight against cancer. Because of the side effects of chemotherapeutic drugs, the search for new natural and biologically active products remains a priority goal of cancer treatment with fewer side effects and / or with greater therapeutic efficacy. Molds of terrestrial and marine environments are the main sources of these effective compounds. Molds are a major source of natural products with antitumor activity. A number of these products were first discovered as antibiotics. The major contribution comes from alkaloids, taxoids and terpenoids. Despite its pathogenicity, *P. aurantiogriseum* could serve as biological control way against bacteria and fungi harmful to plants and agricultural products. It contains a large number of mycotoxins that could be used in the future for cancer treatment and have great potential for clinical research. The use of this species has not attracted attention in the pharmaceutical field and the identification of its mycotoxins with anticancer effect could lead to the new therapeutic targets. Given its importance and omnipresence, *P. aurantiogriseum* deserves a global study to value and better exploit it. This review will provide an overview of the use of *P. aurantiogriseum* mycotoxins in cancer studies, as well as the advantages and limitations of applying mycotoxins as a treatment tool.

Keywords: *Natural products; Cancer; Treatments; P. aurantiogriseum; mycotoxins.*

PROSPECTIONS FOR FOOD BASED LURES IN MASS TRAPPING OF *BACTROCERA DORSALIS* ON *CHRYSOPHYLLUM ALBIDUM* IN OSUN STATE, NIGERIA

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Abstract

The oriental fruit fly, *Bactrocera dorsalis* Hendel (Diptera: Tephritidae**)** is an invasive pest in many countries across the globe, including Nigeria. The potentials of three food-based lures in mass trapping of *B. dorsalis* on *Chrysophyllum albidum* were assessed during 2019 fruiting season in three selected villages in Osun state, Nigeria. The food lures included: pineapple juice, orange juice, banana juice, Methyl Eugenol (standard check) and control (water). The lures were baited with cypermethrin applied at 40ml/trap/week, while methyl eugenol was applied at 10 ml/trap/week. Data collected were subjected to ANOVA, and significant means were separated using Turkey's Honestly Significant Difference (THSD). The results showed that *B. dorsalis* was trapped on *C. albidum* in all the study sites. The number of *B. dorsalis* trapped was higher during the ripening period of *C. albidum* in all locations. The percentages of trapped flies after 10 weeks were 70.85% - 79.50% (Methyl Eugenol) >7.86% - 11.09% (Orange juice) > 8.95% - 11.05% (Pineapple juice)> 2.52% - 6.41% (Banana juice)> 0.60% - 1.09% (control) at the study sites. There were no significant differences ($P > 0.05$) on the density of *B. dorsalis* trapped in all locations. However, the densities of trapped *B. dorsalis* significantly ($P<0.05$) differed among the different treatments in all location. All the food-based lures significantly ($P<0.05$) trapped higher flies than control. The food-based lures tested had potential in trapping *B. dorsalis,* hence increased dosage and application frequency could be used to control *B. dorsalis* in homestead trees and home gardens.

Keywords: *Fruit fly, attractants, mass trapping, control, African star apple.*

BIOCONTROL POTENTIAL OF *TRICHODERMA HARZIANUM* AGAINST ROT CAUSING FUNGI OF WHITE YAM (*DIOSCOREA ROTUNDATA* POIR*)* TUBERS

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Abstract

Biological control potential of *Trichoderma harzianum* in the control of postharvest fungal pathogens of *Pepa* white yam tubers in storage was carried out for two years. Rotted *Ogoja* and *Pepa* white yam tubers were collected from farmers' barns in Zaki-Biam, Benue State, Nigeria. Pathogenicity tests conducted on healthy *Pepa* yam cultivars after fourteen days of inoculation revealed that the tubers were susceptible to *A. flavus, F. moniliforme* and *P. expansum*. Treatments comprised either inoculation of yam tubers with *A. flavus, F. moniliforme* and *P. expansum* alone or paired with *T. harzianum* as well as a control where the tubers were neither inoculated with antagonist nor with fungi pathogens and were stored for five months between December, 2015 and April 2016 and between December, 2016 and April, 2017. Results got in the first year of storage showed that tubers treated with fungi pathogens alone caused mean percentage rot of between 8.89% (*P. expansum*) and 20.00% (*A. flavus*) while those treated with *T. harzianum* alone produced only 2.22%. In the paired treatments, mean percentage rots were between 4.44% (*P. expansum* × *T. harzianum*) and 6.67% (*A. flavus* × *T. harzianum*). The findings in the second year revealed 13.33% (*P. expansum*), 22.22% (*A. flavus*) and 4.44% (*T. harzianum*) in the alone treatments while paired treatments produced mean rot of between 4.44% (*P. expansum* × *T. harzianum*) and 8.89% (*A. flavus* × *T. harzianum*). The results revealed that *P. expansum* was the most antagonized while *A. flavus* was the least inhibited. The findings revealed that *T. harzianum* (biological control agent) was more effective in inhibiting the growth of *A. flavus, F. moniliforme* and *P. expansum* in the first year of storage compared with the second year of storage. The antagonist therefore has biological potentials in controlling fungi pathogens of yam in storage.

Keywords: *Biocontrol, Trichoderma harzianum, Zaki-Biam, Pathogenicity Test, Aspergillus flavus.*

EVALUATING THE ANTIOXIDANT AND ANTIMICROBIAL POTENTIAL OF SEABUCKTHORN OIL

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Abstract

Development of wholesome and nutritious food products with less fat, suitable sensory attributes and optimum functional quality is a main industrial concern, in order to capture consumer's interest in healthy and functional foods. The main objective of this research was to incorporate the antioxidant properties of seabuckthorn oil in cookies and finally develop and characterize cookies. Seabuckthorn oil-in-water emulsion was prepared by using seabuckthorn (SBT) oil, whey protein isolate (WPI) as an emulsifier and gum Arabic as stabilizer. Afterwards, emulsion was subjected to homogenizer to enhance its stability. Emulsion used for cookies contained 23% seabuckthorn oil, 67% water, 7% whey protein isolate and 3% gum Arabic. Wheat flour was subjected to chemical (moisture, ash, fat, fibre, protein and NFE) according to methods described by AOAC (2000) and rheological test (farinograph). Cookies were prepared with different flour and seabuckthorn emulsion proportion. White flour used for preparation of cookies contained 7.51% moisture, 0.76% ash, 0.89% fat, 0.71% fibre and 12.91% protein. Cookies prepared form seabuckthorn oil-in-water emulsion was tested for different proximate attributes. Means for energy value of cookies was found highest in T_0 (296.09±5.34) while lowest in T_5 (274.38±4.28). The mean values for texture showed that cookies hardness ranged from 1.70±0.62 Kg to 1.650±0.83 Kg. Mean values for color varied from186.81±4.19CTn to 172.48±4.39CTn. Then cookies were stored for 6 weeks and subjected to sensory attributes (color of cookies, texture, flavour, taste) by the consumers during storage for its acceptability. Finally, the data obtained was analyzed statistically using CRD and factorial. The emulsion substitution allowed a saturated fat reduction of 23% by adding seabuckthorn oil-in-water emulsion resulted in cookies with acceptable sensory scores. These results showed that seabuckthorn extracts were effective against lipid oxidation and microbial growth.

Keywords: *sea buckthorn, emulsion, antioxidants, antimicrobial, cookies.*

FIRST REPORT OF *RHIZOCTONIA SOLANI* CAUSING ROOT ROT OF CHILLI IN PAKISTAN

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Abstract

Rhizoctonia solani is an important soil-borne fungal pathogen causing root rot of chilli with typical symptoms of seedling damping off, root rot and stem canker of young transplants. During the year 2016, symptoms of root rot were noted in chilli (*Capsicum annuum* L.) crop in Pothohar region of Pakistan. In some fields, approximately 31% of the plants were affected. Infection began when transplants were approximately 4-6 weeks old. Irregular, water-soaked brown lesions were observed on hypocotyl and root portions. Reddish-brown discoloration at the soil line level of the stem were observed in infected plants. Symptomatic tissue pieces (4-mm^3) were surface-sterilized with 0.1% NaOCl for 30 seconds, rinsed three times with sterile distilled water, blot dried, and incubated on potato dextrose agar (PDA) medium at 25°C. One day after incubation, mycelium on PDA was transferred to a fresh malt extract agar (MEA) plate and incubated at 25°C with a 12-h photoperiod. A total of 32 isolates examined morphologically exhibited eased plants on malt extract agar (MEA) medium light grey to brown coloration with plenty of mycelial growth and branched hyphae. A septum was always present in the branch of hyphae near the originating point with a slight constriction at the branch. All the isolates failed to produce conidia or conidiophores. Septal distance for each isolate varied from 66.7 to 150.3 μm (average 111.8 μm) while hyphal diameter ranged between 5.3 to 8.2 μm (average 6.4 μm). All isolates were multinucleate when subjected to DAPI (4′,6-diamidino-2-phenylindole) staining. Based on Restriction analysis ofPCR amplified ribosomal DNA with four discriminant enzymes (*MseI*, *AvaII*, *HincII* and *MunI*) and hyphal anastomosis interactions with known tester strains the fungus was characterized as *Rhizoctonia solani* Kühn AG-4 HG I, AG-2-1 and AG-6 with the frequency of 69, 18 and 13% respectively. Seeds of chilli (*cv*. Sanam) were planted in plastic cell trays (53.49 cm L x 26.82 cm W) having 32 cells/ tray. Each *R. solani* isolate was artificially inoculated 2 weeks after sowing with a set of control plants. Four weeks after inoculation, all inoculated plants showed lesions similar to those observed in the field while control plants remained symptomless. Fungus reisolated from artificially inoculated plants was confirmed as *R. solani*. To our knowledge, this is the first report of *R. solani* infection on chilli from Pakistan which will be useful to breeding programs working on varietal evaluation.

Keywords: *pests, root, chilli, Pakistan.*

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IN VITRO ANTIBACTERIAL EXPLORATION OF *SALIX ALBA* AGAINST GRAM-POSITIVE AND GRAM-NEGATIVE BACTERIAL STRAINS

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Abstract

Antibacterial properties of *Salix alba* L. were explored against seven selected bacterial strains. Methanolic extracts were prepared separately for both bark and leaves of the plant and used in different doses (100 mg/ml and 75 mg/ml) against seven Gram-positive and Gram-negative bacterial strains *Streptococcus pyrogenes, Staphylococcus aureus (1), Staphylococcus aureus (2), Shigella sonnei, Escherichia coli (1), Escherichia coli (2)* and *Neisseria gonorrhoeae*. The agar well diffusion method was used for the determinationof zone of inhibition against dreaded bacterial pathogens and was recorded after 24 hours and 48 hours. MIC and MBC of plant extracts were recorded by broth inoculation method. All bacterial pathogens were successfully inhibited while *Escherchial coli (1)* and *Shigella sonnei* were found potent against both leaves and stem bark methanolic extracts. Highest inhibition zone diameter 17.00±1.732 mm was recorded by *Salix alba* L. leaves extract at 100 mg/ml concentration against *Streptococcus pyrogenes*.*Staphylococcus aureus (1)* showed the highest percentage activity with 15.333±1.155 zone of inhibition against 11 mm zone of inhibition of gentamycin with Percentage Activity (PA) calculated 139%. *Staphylococcus aureus* was found to be less resistant with least MIC and MBC 0.585 mg/ml and 1.17 mg/ml respectively by leaves extract and 1.17 mg/ml and 2.34 mg/ml by bark extracts. Exploration of plant extracts as antimicrobial drugs can help to find new agents with potential activities against resistant pathogens to control prevailing diseases and to make the process of food preservation better.

Key words: *In vitro, bacteria.*

ROLE OF DIFFERENT INSECT VISITANTS TO SUNFLOWER (*HELIANTHUS ANNUUS* L.) YIELD, OIL CONTENT AND OTHER QUALITY ATTRIBUTES IN MARDAN DISTRICT OF KHYBER PAKHTUNKHWA-PAKISTAN

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Abstract

The current studies were carried out at Agricultural Research Farm, Abdul Wali Khan University, Mardan of Khyber Pakhtunkhwa during 2017. Objectives of the trial were to explore the role of different insect visitors towards yield, percent oil content and other quality associated with sunflower in Mardan region of Khyber Pakhtunkhwa. It was found that maximum seed production per hectare as well as percent oil content was obtained from sunflower plots kept under natural conditions, where pollinators species such as honey bees and other non-*Apis* visitants had access to sunflower blossoms. In contrast, sunflower plots covered with insect-proof bags gave minimum seed production and oil content, which was most probably because of bee visitors denied to forage on flowers of the crop. Results revealed that sunflower in blooming stage attracted large number of bee visitors that contributed significantly towards increment in yield, oil content and other quality parameters of sunflower.

Keywords: *Insect visitants, yield, oil content, sunflower, Mardan, Khyber Pakhtunkhwa.*

VARIABILITY AMONG *RALSTONIA SOLANACEARUM* STRAINS FROM DIFFERENT AGRO-ECOLOGICAL ZONES OF PAKISTAN

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Abstract

Bacterial wilt incited by the bacterium *Ralstonia solanacearum* is a serious threat to economically important solanaceous crops in Pakistan and the bacterium has shown great morphological, pathogenic and geneticdiversity in different regions of the world. As such information is lacking in Pakistan, therefore, in the present studies variations in hypersensitivity response, growth and virulence were observed among 114 strains of *Ralstonia solanacearum* collected from eight agro ecological zones of Pakistan. Of all 114 isolates of *R. solanacearum*, 88 showed positive HR and mucoid growth,while 26 isolates gave negative HR with non mucoid growth. Out of 114 strains of *R. solanacearum* consisting of biovar 3 and 4, 22.8% were found a virulent, 25% weakly virulent, 29.3% virulent and the remaining 21.9% were highly virulent. Among 92 *R. solanacearum* biovar 3 strains, 21.7% were identified as a virulent, 25% weakly virulent, 34.4% virulent and 22.8% were highly virulent in the eight agro ecological zones of the country. Similarly, out of 22 *R. solanacearum* biovar 4 strains, 27.3% were detected as avirulent, weakly virulent and virulent, while18.2% strains were found highly virulent. Relationship was also found between growth and virulence among the *R. solanacearum* strains of the isolates. The strains having non-mucoid growth were found avriulent while those with mucoid growth were weakly virulent to highly virulent. Similarly, strains showing positive HR were virulent, while those with negative HR were found as avirulent.

Key words: *bacteria, crop, Pakistan.*

BIOACTIVE PEPTIDES: A RECENT INNOVATION IN NUTRACEUTICAL

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Abstract

Nutrients having some physiological functions are attaining attention globally. Bioactive peptides have gained a potential place in functional food and nutraceutical. Bioactive peptides are the substances whit important biological functions in human body. Peptides from food proteins are important bioactives and have multifunctional health benefits. Bioactives have also immuno modulatory role affecting the gastro intestinal, endocrine, cardiovascular and central nervous systems. But still investigations are needed to rule out mechanism of action, gastrointestinal digestibility and absorption. Lactoferricin is bioactive peptide with anti-inflammatory effect especially in arthritis. Whet protein hydro lysate inhibits inflammatory mechanism in intestinal and respiratory cell. TGF-beta TGF T beta-10 and immunoglobulin are peptides from animal milk with immuno modulatory role affecting gastrointestinal system significantly. Ovotransferrin bioactive peptide derived from egg white suppress cytokine induced inflammatory protein. Protein hydro lysate prepared from fish and meat has anti-inflammatory and wound healing properties. Bioactive peptides are also derived from plant source. Bioactive peptides from corn and soybean protein hydro lysate reduce the lipid oxidation by 53% and 20% respectively. Soybean hydro lysate inhibits cytokine and chemokine expression and activates TGF-beta which plays anti-inflammatory role in breast cancer. Poly unsaturated fatty acid oxidation also creates problem even in gastrointestinal track. Bioactive peptides from salmon play potential role in oxidation of linoleic acid. Bioactive peptides by casein hydrolysis exhibits enhanced free radical scavenging and metal ion chelating activity. Safety limits and optimal dosage of bioactive peptides still need in vivo investigations.

Key words: *Bioactive peptides, Hydro lysate, Immuno modulation, Lipid oxidation, safety.*

ANTAGONISM OF SEVERAL FUNGAL SPECIES AGAINST *MACROPHOMINA PHASEOLINA* (TASSI) GOID, CAUSING CHARCOAL ROT OF MUNGBEAN

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Abstract

Macrophomina phaseolina (Tassi) Goid, is a devastating soil-borne fungal pathogen of various crops resulting in significant yield losses. In the present study, *M. phaseolina* was isolated from infected munbean root samples and molecular identification was made using sequence analysis of ITS regions and subsequent sequencing (accessions; MH371345, MH371315, MH371335 and MH371316) which had 99-100% identity with already reported sequences of *M. phaseolina*. Native strains of selected biological agents viz. *Trichoderma harzianum, Penicillium* spp., *Aspergillus niger,* and *A. flavus* were tested for their antagonistic potential against *M. phaseolina* (Tassi) Goid under lab and greenhouse conditions. Significant growth inhibition (71.6%) was produced by *Penicillium* spp. followed by *A. flavus* (64.6%), *T. harzianum* (Th2, Th3) 58% and 57.8% *in vitro* respectively. *A. niger* was found least effective among all the test isolates. Biocontrol agents exhibiting high efficacy were screened for plant growth promotion impact on five mungbean varieties viz., NM-98, AUM-19, AUM-38, AUM-6173 and MG-1 under greenhouse conditions. *T. Harzianum* and *Penicillium* spp. significantly suppressed the disease severity and produced a positive effect on seed germination, radical length, vigor index, and biomass. There is a need to explore the biocontrol potential of microbial agents thus, they can be used as an alternative to chemical formulations.

Keywords: *Antagonism, biocontrol, charcoal rot, Macrophomina phaseolina, mungbean.*

STERILANTS EFFECT AND MICRO-PROPAGATION OF TWO DIFFERENT CULTIVARS OF PEACH (*PRUNUS PERSICA)*

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Abstract

Conventional vegetative propagation methods of peach are generally time consuming and season bound with low multiplication rate. Surface sterilization is one of the critical steps in micro-propagation of peach because of giving quality planting materials for further process. Efficient protocol was established for sterilization and shoots multiplication of two peach cultivars i.e. Tarnab local and Swat local using shoot tips of healthy plants. Explants were cultured on B5 media after the treatment with 70% ethanol of different time exposure (1 and 5 minutes), while the same explants were treated with different concentration of $HgCl_2$ (0.1% and 0.2%) of different time exposure (3 and 5 minutes). Different concentrations of BAP (0, 0.5 mgL^{-1}, 1 mgL^{-1}, 0.5 mgL^{-1}+Gln 200 mgL^{-1}, 1 mgL^{-1}+Gln 400 mgL^{-1}) were used to identify its effect on the growth of peach cultivars. The experiments were designed on Completely Randomized Design (CRD). The highest explants contamination (100% and 90%) and least explants survival (0% and 10%) were recorded when explants were treated first with 70% ethanol for 5 min and then with $HgCl_2$ 0.2% for 5 min. The minimum explants contamination (23.3% and 20%) and maximum explants survival (76.6% and 86.6%) were recorded when explants were treated with ethanol 70% for 1 min and then with $HgCl_2$ 0.1% for 3 min. The highest percentage of shoots development was recorded on B5 media supplemented with BAP 1 mgL^{-1} + Glutamine 400 mgL^{-1}. The roots development was also observed when media was supplemented with BAP 0.5 mgL^{-1} + Glutamine 200 mgL^{-1}.

Keywords: *B5 medium, BAP concentrations, Ethanol, $HgCl_2$, Peach cultivars.*

RESISTANCE OF WHEAT GENOTYPES AND THEIR PRE-HARVEST ESTIMATED YIELD COMPARISON WITH ACTUAL YIELD UNDER YELLOW RUST EPIDEMIC

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Abstract

Yellow rust resistance assessment of sixteen genotypes and their pre-harvest estimated yield comparison with post-harvest actual yield were carried out under artificially induced epidemic conditions at Nuclear Institute for Food and Agriculture (NIFA), Peshawar, Pakistan. Three parameters of yellow rust resistance including Final Disease Severity (FDS), Average Coefficient of Infection (ACI) and Area Under Disease Progressive Curve (AUDPC) were recorded while pre-harvest yield of each genotype was estimated in standing crop using a standard method. Pre-harvest estimated yield of tested genotypes was also compared with post-harvest actual yield for validation of estimation method under local conditions. Results revealed that significant differences were observed among the tested genotypes based on the three disease parameters studied. Five genotypes were found resistant (i.e. NR-421, NR-409, NR-399, NR-400 and NARC-2011), seven moderately resistant (i.e. PR-103, WL-1896, DN-84, PR-104, Pirsabak-08, Bakhtawar-92 and Fakhr-e-Sarhad) while three displayed susceptibility (CT-09095, DN-93 and Morocco). An arithmetic difference was observed between pre-harvest estimated and post-harvest actual yields. However, this difference between both types of yields individually for all wheat genotypes remained statistically non-significant and was indicative of the effectiveness of yield estimation model used in this study. Further multi-locations and multi-years studies are required for resistance characterization and authentication of yield estimation method for future use.

Keywords: *Rust resistance, Wheat, Yield estimation & actual yield comparison.*

THE INNOVATIONS OF AGRICULTURAL ENGINEERS AND THEIR CONTRIBUTION TO SUSTAINABLE AGRICULTURAL DEVELOPMENT TO ACHIEVE FOOD SECURITY IN GAZA STRIP, PALESTINE

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Abstract

The agricultural sector is one of the most important productive sectors depending on the economic development in the various countries of the world. In Palestine, the agricultural sector is one of the most important economic sectors which constitute a main pillar in economic development in terms of its contribution to the GDP which reached 36% in 1993, its contribution to the employment of Palestinian labor.But, this situation has been reduced by many factors and influences to become its contribution to GDP 5.6% per year in 2016. These indicators have been accompanied by a decline in the concepts of the safe use of agricultural pesticides, especially in the Gaza Strip, which was accompanied by the unprecedented spread of cancer and deformities of embryos and inflammation and cirrhosis of liver and kidney failure, where a series of studies indicated that the excessive use of agricultural pesticides in the Gaza Strip has affected all especially in the health and environment sectors, where it caused severe damage to the health of the citizen and the farmers. Hence, the initiative to find alternatives to the use of agricultural pesticides is one of the priorities of agricultural engineers in the Gaza Strip. This paper presents one of the most important success stories related to sustainable development in the Gaza Strip, led by agricultural engineer Abdel Moneim Ahmed, who was directly related to the promotion of safe agriculture to overcome the health and environmental problems,and on the other hand, to provide a satisfactory economic return to farmers. The project was based on the idea of legalizing the use of agricultural pesticides and training farmers and agriculture engineers in the methods and techniques of applying safe agriculture, which about 200 engineers and farms benefited from. The idea was developed from an independent initiative based on the special potential to the relationship opened with many local and international institutions that had a positive role in helping him to develop his project. For the purposes of the financial and technical sustainability of the idea, a Facebook site was established under the name of "Safe Agriculture Association". It used many applied research programs and training of graduate agricultural engineers. It also contributed to the promotion of agricultural tourism through frequent visits by students of many schools, universities and kindergartens to his model farm. These visits have increased to more than 50 visits annually.

Keywords: *Economic development, Safe Planting, Pesticides, Sustainable Agriculture, biological control.*

EFFECTS OF MYCORRHIZAL FUNGI ON THE LEAF NUTRIENT, GROWTH AND HEALTHINESS OF TOMATO PLANTS

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Abstract

The objective of this study was to investigate the response on leaf nutrients content (K, Ca, Mg, N), growth and healthiness of tomato plants inoculated with Mycorrhizal Fungi (MF): *Claroideoglomus etunicatum* and *Rhizophagus intraradices*. The experiment was carried out in plastic tunnel as a two-factors experiment in a random block design with five replicates, in Grądy (Lublin province), Poland, for three years 2015-2017. Experimental treatments included plants inoculated with *C. etunicatum* (CE), plants inoculated with *R. intraradices* (RI), and plants without mycorrhizal inoculation as control (C). The mycorrhization of tomato roots with *C. etunicatum* and *R. intraradices* (CE, RI) increased Ca and K content ($g \cdot kg^{-1}$f.w.) in the leaves, although only Ca leaf content ($g \cdot kg^{-1}$f.w.) was a significant higher than in control. However, studied MF had no significantly effect on N concentration (%) and Mg content ($g \cdot kg^{-1}$f.w.) in tomato leaves. The length of tomato stems depended on cultivar and period of measurement, not on the MF application. By contrast, the MF inoculation had an effect on the length of tomato roots, especially for CE treatment, where roots were statistically longer compared to control. Similarly, the mycorrhization of tomato roots with CE and RI had significant impact on the growth of tomato leaves number per plant, as well as on the health status of tomato plants, where disease index (DI) of plants inoculated with MF was lower than in control. CE and RI treatment decreased yield of diseased fruits by 51% and 39.7% compared to controls, respectively. In general, our findings indicate that mycorrhizal inoculation of tomato can improve the growth and health status of plants in organic tomato production.

Keywords: *Claroideoglomusetunicatum, Rhizophagus intraradices, nutrition, disease index.*

INCIDENCE OF SEED-BORNE FUNGI ON TRADITIONAL CULTIVARS OF SOYBEAN (*GLICYNE MAX*) IN POLAND

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Abstract

Soybean (*Glycine max* L. Merrill) is one of the most valuable crops. Its seeds contain 42-45% valuable protein, 18-22% fat and 21% starch, which allow them to be used for food and animal feed production. It is a good source of vitamin B and contains valuable amino acids. The aim of the study was to assess the health status of seeds of five soybean cultivars grown in Poland in the region of Warmia and Mazury. The health assessment was carried out on anatomical parts of seeds (seed coat, cotyledons, embryonicaxis) of five soybean cultivars (Abelina, Aldana, Alligator, Merlin, Lissabon) using traditional (based on observation of fungal morphological structures under optical microscope) and molecular diagnostic methods (PCR and Real-time PCR based on DNA analyses). Anatomical parts of seeds were inhabited by saprotrophs of *Alternaria, Cladosporium, Penicillium* and *Rhizopus* genera. Among the pathogens, the presence of fungi of the genus *Fusarium* was found, which was isolated from the seeds of 4 tested cultivars (Abelina, Aldana, Alligator, Lissabon). However, in the seeds of Merlin cultivar no fungi of this genus was found. Molecular analyses (PCR and qPCR) concerning the identification of the *Fusarium* genus and their toxigenic potential, as well as *Penicillium verrucosum* and *Aspergillus ochraceus* synthesizing ochratoxin A, showed the presence of the fungi in the examined material.

Keywords: *soybean seeds, fungi, PCR.*

INFLUENCE OF CITRATES NANOPARTICLES ON MORPHOLOGICAL TRAITS OF BACTERIAL CELLS *PSEUDOMONAS SYRINGAE* PV. *ATROFACIENS*

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Abstract

The electron-microscope investigations have been shown disintegration the cell *wall Pseudomonas syringae* pv. *atrofaciens* with subsequent killing of bacterial cells under effected 1% solutions: citrates of nanoparticles Ag-Cu, the complex Co-Cu-Zn-Fe-Mn-Mo-Mg (Avatar-1) and iodine-selenium. In field conditions, it was found that during pre-sowing treatment of wheat seeds with 1% solutions of citrates of Ag-Cu nanoparticles, as well as the complex - Co; Cu; Zn; Fe; Mn; Mo; Mg (Avatar-1) and bio-drug iodine-selenium there was a significant inhibition of the development of basal glume rot of cereals for the artificial infection of *Pseudomonas syringae* pv. *atrofaciens*. Consequently, reduction of basal glume rot of cereals the typical symptoms and the percentage of isolated cell *Pseudomonas syringae* pv. *atrofaciens* D13 was detected on wheat plants at pre-sowing treatment of wheat seeds by experimental biocides, that have been attributable to explained by structural changes in the bacterial cells of the pathogen, which lead to a reduction of viable forms of bacteria due to damage of both, the cell wall and internal contents.

Keywords: *Wheat, bacterial diseases, Pseudomonas syringae, nanoparticles.*

BENEFICIAL EFFECT OF FERTILIZATION WITH MEAL FROM MEALWORM LARVAE ON THE CONDITION OF TWO PLANTS

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Abstract

The phytopathogenic fungi still are threat for people health and crop production. Nevertheless, intensification of agriculture has increased the use of chemicals in agricultural treatise, therefore looking for alternative solutions. In the industry (including environmental protection and animal nutrition) insects areinteresting because they are omnivorous and can be fed with waste, show rapid biomass growth and are a source of protein, fats and micronutrients equal to the model egg white protein. In this work, a lyophilisate meal was prepared from mealworm larvae (*Tenebrio molitor* L.) feeding on waste produced from the production of oatmeal, which was applied in soil in pots where spring wheat or peas were sown. Variants in three replications were incubated for 30 days, and then the rhizosphere was evaluated for fungi that infested plant seedlings, including the number of *Fusarium* phytopathogens. Based on the results, it was observed that the use of meal positively affected the rhizosphere significantly reducing the plurality of fungus toxins *Fusarium* spp. (producing DON), *Penicillium* spp. and *Aspergillus* spp. However, this was more evident in the case of wheat rhizosphere (highly significant differences) than peas (significant differences). In both plants after the use of flour, improved biometric parameters were observed. The height of the aboveground part increased by an average of 21%, while the roots increased by 15%, which confirms the usefulness of fertilizer flour from the mealworm larvae, while reducing the exposure of seedlings to fungal diseases.

Keywords: *fertilizer with insect, plant protection, environmental protection, health crop, seedling pathogens.*

CHEMICAL PROTECTION OF WINTER WHEAT and its ENVIRONMENTAL IMPACT IN DIFFERENT SOIL TILLAGE SYSTEMS

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Abstract

The aim of the study was to assess the environmental impact of chemical protection of winter wheat in three soil tillage systems: conventional tillage, reduced tillage and direct sowing. The study was conducted in 15 farms in the Wielkopolska region (Poland), in the years 2015-2017. The highest intensity of winter wheat protection, in terms of the number of chemical protection treatments was in the conventional tillage (4.1), followed by the reduced tillage and the direct sowing (3.4 and 3.1, respectively). The largest consumption of active substances was found in the reduced tillage system (2.16 kg a.s./ha). Smaller quantities of active substances were used in the conventional tillage (2.04 kg a.s./ha) and the direct sowing (1.43 kg a.s./ha). In the analyzed soil tillage systems, the costs of winter wheat protection per hectare ranged from 272 to 353 PLN/ha. The direct sowing was characterized by the lowest cost of plant protection products used. Among the analyzed tillage systems, the most negative values of the potential toxicity index had the reduced tillage and the conventional tillage (-68.1 and -55.5 points, respectively) which resulted from larger consumption of active substances with properties associated with higher environmental threats. In turn, less negative points had the direct sowing (-39.5 points). The environmental impact of chemical protection of winter wheat in the studied tillage systems was mainly related to a high risk of volatilisation of substances into the atmosphere, followed by surface water contamination and leaching into groundwater, while there was the lowest risk of bioaccumulation.

Keywords: *Plant protection products, Costs, Potential toxicity index, Soil tillage systems, Winter wheat.*

THE LEVEL OF WINTER WHEAT STEM BASE DISEASES IN THE DEPENDENCE ON THE INTENSITY OF PLANT PROTECTION

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Abstract

The aim of the study was to determine the health status of winter wheat, taking into account the severity of diseases of the stem base, depending on the intensity of plant protection during the growing season. The level of protection was expressed by the diverse selection of active substances and the doses of the applied plant protection products. The research was carried out at the Production and Experimental Plant in Bałcyny, where the health assessment of the winter wheat steam bases cultivar Julius was carried out. The evaluation was carried out in accordance with the EPPO methodology and the quantitative composition of microorganisms colonizing the stalk base was analyzed in laboratory conditions. On the basis of the research, it was found that the dominant diseases of the base of winter wheat were fusarium foot rot and eyespot Abandonment of plant protection during the 29-32 BBCH development phase resulted in an increase in the infection of winter wheat with pathogens of the disease complex. The use of active substances: prothioconazole, trifloxystrobin, fenpropimorph, epoxiconazole, metrafenone, bixafen and spiroxamine improved the health status of the steam base. Selected active substances stimulated the development of pathogens, others, even at low doses, inhibited their development. The mixture of prothioconazole, bixafen and spiroxamine had the highest effectiveness in limiting the foot rot diseases.

Keywords: *winter wheat, steam base, plant protection.*

THE INFLUENCE OF FORECROPS AND CATCH CROPS ON THE SPECIES COMPOSITION OF FUNGI IN THE SOIL AND ON THE HEALTHINESS OF OAT

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Abstract

The purpose of the study was to establish quantitative and qualitative composition of soil-borne fungi in the cultivation of oat, as well as to assess the healthiness of this cereal. The experiment considered spring barley and potato as forecrops and white mustard or lacy phacelia after spring barley as catch crops. The population of fungi having an antagonistic effect towards selected fungi pathogenic to cereal was determined. The healthiness of the stems of this cereal was also investigated. The most fungi were found in the cultivation of oat after spring barley, while the least after potato. The cultivation of oat after spring barley with the use of catch crops significantly influenced the reduction in the number of fungi obtained from the soil. Differences in the number of fungi in soil under oat cultivation after white mustard and after lacy phacelia were also noted. Among the species recognized as pathogenic for cereals, *Fusarium culmorum* and *F. equiseti* predominated. *Bipolaris sorokiniana* was also obtained, especially in the cultivation after spring barley. On the other hand, among the antagonistic species, *Clonostachys rosea, Trichoderma viride, T. koningii, T. harzianum* were most represented. The most favorable forecrop for oat was potato. The introduction of catch crops, especially white mustard, also positively influenced on the healthiness of oat. The average disease index for the tested oat cultivars grown after potato and after spring barley with white mustard as catch crop was 11.02 and 12.78, respectively, whereas after spring barley it was 21.75. The main cause of oat infection was *Fusarium* spp., regardless of the forecrop and catch crop.

Keywords: *oat, soil fungi, healthiness, forecrops, catch crops.*

REAL-TIME PCR METHOD FOR QUANTITATIVE EVALUATION OF ABUNDANCE CHITINOLYTIC BACTERIA USED IN BIOLOGICAL CONTROL

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Abstract

In recent years, interest in biological plant protection methods has increased. In order to biological control of fungal phytopathogens and harmful insects, can be applied biological plant protection agents containing microorganisms. A common strategy for beneficial bacteria (especially the genus of *Bacillus*) for controlling phytopathogens and insect is the ability to chitin degradation. Unfortunately, the effectiveness of bio-agents is related to the viability of beneficial bacteria, which depends on the type of cultivation, environmental conditions, as well as possibility of counterfeit biological agents traded. In order to validate the effectiveness of the chitinolytic bio-agents, microbial cultures can be prepared. Such media for the detection of chitinolitic bacteria are difficult to prepare and the range of bacteria that grow on these media is limited. In this work, commonly available primers Qchi-f 5'-GATATCGACTGGGAGTTCCC-3 'and Qchi-r 5'-CATAGAAGTCGTAGGTCATC-3' (225 base pairs) were used to detect the *Chit*A gene by means of a qualitative PCR reaction. They were adapted to develop a quantitative reaction PCR (qPCR, Real-Time PCR) in the Sybr Green method. The *Bacillus subtilis* strain 41Cable to colonize the western corn rootworm (*Diabrotica virgifera* and parasite on phytopathogenic fungi of the genus *Fusarium*, was used as the material. To create a standard curve, the *Chit*A gene amplification product was cloned into the pCR™ 2.1-TOPO™ plasmid (Invitrogen/Thermo Fisher Scientific). The curves were prepared in the range from $1 \cdot 10^9$ to $1 \cdot 10^3$ copies of genes. Genomic DNA from *Bacillus subtilis* strain 41C from 100 cells was used as a control. The reaction was performed using a mastermix Maxim Probe 2X (Thermo Fisher Scientific). The reaction efficiency was ranged from 96 to 99% (r^2 = 0.996-0.999), and the fluorescence signal from 100 *Bacillus subtilis* cells was confirmed. Based on the results, it was confirmed that the developed qPCR method is suitable for the quantitative assessment of bacteria carrying the *Chit*A gene responsible for the distribution of chitin.

Key words: *biocontrol, chitinase, qPCR, plant health.*

THE EFFECT OF RYE-RICH DIET ON THE LEVEL OF PROINFLAMMATORY CYTOKINES IN PIGS

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Abstract

The aim of the study was to investigate the influence of the diet supplemented with rye seeds on the level of proinflamatory cytokines in pigs. 32 growing pigs were divided into three groups: one control (C) fed with mixture of wheat and barley seeds (50:50), and two experimental (E1 and E2), fed with supplementation of different types of rye seeds in the diet. Namely, pigs from E1 group was fed with using wild type of rye in properly prepared feed of wheat, barley, rye in proportion of 20:20:60, respectively. The pigs from E2 group were fed with the same diet. However, instead of wild rye hybrid type of rye was used. The blood samples were taken from external jugular vein, centrifuged and serum samples were frozen until further use. ELISA kits were used for cytokine measurements (IL-1, IL-2, IL-6 and TNFα) in blood serum. The mean level of IL-1 in the blood serum of pigs from C group was 2613.06 ±178.7pg/ml, whereas in E1 and E2 groups reached 2956.64±183.63 and 1511,07±192.05pg/ml, respectively. The mean concentration of IL-2 in controls was 35.46±3.21 pg/ml which was similar to E1 values (32.31±6.23), but differed significantly from E2 (61.50±7.24). IL-6 mean level in C group was 871.15±160.31 and, in both E1 and E2 the stated values of IL-6 were lower. However, if compared the IL-6 concentration between E1 and E2 groups, the statistically significant difference was stated (718.05±63.44 versus 380.38±30.28pg/ml). Similarly, the concentration of TNFα in blood serum of E1 pigs reached significantly higher values in comparison to E2 (104.79±3.35 and 59.87±6.50pg/ml, respectively. Feeding a wild type rye seeds may increase the concentration of proinflammatory cytokines in the blood plasma of fattened pigs, whereas feeding with hybrid type of rye did not promote significant changes in the levels of investigated cytokines.

Key words: *pigs, rye, cytokines, inflammatory.*

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FOOD IRRADIATION AS A KEY TO REDUCE FOOD WASTE AND GUARANTEE FOOD SAFETY

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Abstract

Food waste is being in the focus of recent global policies, to tackle food scarcity and to overcome "nutritional poverty" in several countries. Otherwise, a global food market is being the key to make available several products to different populations. These vectors for food policy must be supported by several orientations, to attain their final objective: better and enough food for the world population. For that, different post-harvest processing technologies are making their fundamental contribute. Among that, the preservation of food by irradiation, a physical process that does not use chemicals, is making its way in several countries, to accept imported or exported products without pests (insects), without foodborne pathogens, and also to extend the shelf life of processed products, stopping enzymatic degradation and reducing microorganisms that contribute for food spoilage. We have been studying the effects of gamma and e-beam radiation for food preservation of several Mediterranean products, including chestnuts, mushrooms and aromatic plants, berries and tomatoes, using an experimental gamma chamber with ^{60}Co sources and an electron accelerator with the maximum energy of 10 MeV. And here we present these technologies, their limitations and advantages, the effects on relevant properties of food (*e.g.* color, texture, nutritional parameters), and question why food preservation by irradiation is underused, since its first use has more than 100 years and its first industrial application has more than 50 years.

Keywords: *Food technology; Food safety; Post-harvest technologies; Food irradiation.*

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PHYSICO-CHEMICAL AND MICROBIOLOGICAL ANALYSIS OF JUICE EXTRACTED FROM SWEET SORGHUM

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Abstract

Sorghum is the first grain where the genome has been wholly deciphered, which will give new directions of progress in improving the species in the years to come. Sweet sorghum is one of the four major groups of sorghum grown for its sweet strains. The importance of sorghum is reflected in studies of the structure, content of phenolic compounds and antifungal proteins in its kernels. The economic importance of sorghum is quite significant given that about 16% of the total cereal consumption in the world is represented by sorghum. Also, through the industrialization of sorghum, the following can be obtained: bioethanol, syrup, vinegar and food alcohol, cellulose and paper, acetic acid and ethylene, natural fibers, vegetable proteins, animal feed, etc. Currently there are high-performance equipment by default advanced technologies for extraction and processing of juice from sugar-bearing strains. The paper presents an analysis of juice from sweet sorghum strains, juice extracted with mechanical roller presses. The technological line for extracting raw juice from the fragmented strains of sweet sorghum ensures the storage, dosing and feeding of the raw material by means of the conveyors, squeezing the juice into the roller presses, evacuating the juice and bagasse in the means of transport. The characteristics of juice from sweet sorghum strains will be highlighted by physicochemical analysis: determination of sugar percentage, refractive index, dynamic viscosity, density, pH determination and microbiological analysis: total aerobic microbial count, yeasts and moulds, enterobacteriaceae, escherichia coli, coliforms bacteria, Cereus bacillus, Salmonella, Listeria monocytogenes.

Keywords: *Sweet sorghum, Juice, Mechanical presses, microbiological analysis, physicochemical analysis.*

ANALYSIS OF THE CONSTRUCTIVE FORM'S INFLUENCE ON THE BAFFLES AT THE LIQUID SLOSHING IN A PARTIALLY FILLED TANK VEHICLE FOR AGRI-FOOD PRODUCTS BY FEM MODELING

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Abstract

The transportation of the liquids agri-food cargo in bulk form over large distance is a high potential risk of catastrophic accidents, which can cause loss of human life, property damage and environmental hazards. This paper presents an analysis of the influence of the structural geometric shape of the baffles; on the dynamics of liquid sloshing inside a tanker with ellipsoidal cross-section, partially filled and to constant braking deceleration. The study tanker was modeled using Finite Element Method (FEM), used to storage and transport of agri-food liquids under atmospheric pressure like oil products, water, e.g. The FEM modeling was done with the ANSYS CFX program. The tanker consisted of three chambers separated by swash plates (baffles) with capacity cca.15m^3. Baffles divided tank volume into three approximately equal parts and due to single filling and emptying system it allowed liquid flowing between chambers. According to standard recommendations the baffles had a cross section of 75% of the section tank. The paper shows velocity distributions, sloshing stabilization, and contours of turbulent kinetic, which are of high importance in choosing the best design of baffles. Also, the analysis allows to determine pressure changes depending on excitation condition (acceleration value, direction, duration) and its influence on tank structure.

Keywords: *Tank vehicles, Constructive form a Baffle, Liquid sloshing, FEM, ANSYS-CFX*.

COMPARATIVE EVALUATION OF MOLECULAR METHODS USED FOR FUSARIUM STRAINS IDENTIFICATION IN THE WEST PART OF ROMANIA

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Abstract

In a top of the most devastating fungi all over the world the fourth and fifth positions are occupied by fungi from the Fusarium genus. They produce toxins which cause significant quantitative losses in many agricultural crops and introduce into the food chain some dangerous toxins which are a serious threatening to food safety. The main plants affected are cereals, which are actually the most important source of food for both humans and animals. Therefore the development of reliable, fast and cost effective methods for *Fusarium* strain identification based on gene/DNA fragments evaluation is of great importance. In our studies, after fungal isolation from wheat samples collected from different locations, the DNA was extracted and purified, followed by specific amplification (PCR) or sequencing. First, the primers which amplify specific genes for *F. graminearum, F..culmorum, F..proliferatum and F. verticilloides* were used in a qualitative PCR. Following amplification of DNA from 58 single spore colonies with the *F. graminearum* species-specific primer, 39 positive and 19 negative results were obtained. The amplifications with the other specific primers were not successfully. Therefore another identification method was necessary. According to the literature data for the unknown samples the elongation 1 factor (TEF) genes were amplified, sequenced and compared with the databases *Fusarium*-ID. Therefore the precise identification was possible. It has been shown that some negative samples for the *F. graminearum* - specific primers are still part of this specie, indicating the possibility of genetic polymorphisms that degrade the binding sites of some primers. For a safe and accurate identification the sequencing for specific genes is recommended.

Keywords: *Fusarium, strain identification, molecular methods, DNA sequencing.*

STUDY OF BIOLOGICAL EFFECTIVENESS AND DYNAMICS OF THE DESTRUCTION PREPARATIONS BASED ON NEONICOTINOIDS AND PYRETHROIDS ON CEREALS

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Abstract

Cereals are one of the most important crops grown for food, fodder and technical purposes. Stable obtaining high yields and grain quality is one of the most important tasks of agriculture. The purpose of this work is to present results on the biological effectiveness and safety of the use of insecticides for protection against a complex of piercing-sucking pests. Field experiment was conducted for two years. Pest management was carried out in accordance with the procedure on the day before spraying and on the 3rd, 7th and 14th days after spraying. The biological effectiveness of the pesticide was determined by reducing the number of pests with the correction for control and calculated according to the Henderson-Tilton formula. To study the dynamics of the decomposition of residual amounts of thiamethoxam and alpha-cypermethrin in 2016 and 2017, samples of plant material were sampled on the day of spraying with the pesticide and at 8, 15, 23, and 30 days after. The analysis of residual quantities of thiamethoxam was performed under laboratory conditions using high performance liquid chromatography, residual quantities of alpha-cypermethrin are analyzed by gas chromatography. The test pesticide showed high biological efficiency. Based on the results of the analyzes, it was established that the level of thiamethoxam and alpha-cypermethrin content in the crop did not exceed the maximum allowable levels.

Key words: *Cereals, Insecticide, Russian Federation, Neonicotinoids, Pyrethroids, Piercing-sucking pests.*

CORNERSTONE OF STRATEGY AIMED ON CREATION OF RESISTANT VARIANTS OF GARDEN CARROT (*DAUCUS CAROTA* L.) TO WHITE AND GRAY ROT PATHOGENS IN FGBNU FNCO

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Abstract

The storage period of garden carrot under Russia conditions lasts 210-250 days, and commercial product losses exceed 25-40%. In this period the root crops can be damaged by 75% pathogenic agents. Composition and ration of pathogens is variable and depends on year, carrot variety and place of growing. This impacts assessment objectiveness of individual and combined pathogens and effectiveness of search for resistance sources for immunity selection. Under Moscow region conditions the most damage is caused by storage rot of root crops, especially by low temperature sclerotial disease agents *Sclerotinia nivalis* and *S. sclerotiorum* (white rot) and *Botrytis cinerea* (gray rot) and rarer *Typhula ishikariensis* (Typhylal blight). Major challenge of collaborative studies of FNCO phytopathologists, geneticists and crop breeders is search for resistance sources and creation of resistant forms for garden carrot protection. Samples of various origins are annually put into operation. Wild species of *Daucus* L. are engaged, interspecies and interspecies hybridization, inbreeding are used. The resistance of initial samples and resultant progeny is evaluated at natural infectious background (field, storage facilities) under *in vitro* conditions by artificial inoculation with pure pathogen cultures. Selection for resistant variants is based on population and individual multistep evaluation during the vegetation period, after placement for storage, before the mother roots planting. This resulted in carrot varieties and hybrids with highly resistant roots (Margosha, Rif $F_{1,}$ Nadezhda F_1). The Institute is heavily involved in variety-improving selection of the key economic varieties for resistance to the most aggressive races of white and gray rot agents.

Keywords: *Daucus carota L., varieties, resistance, Sclerotinia, Botrytis.*

SELECTION PROSPECTS OF PHYSALIS ANGULATA IN MODERATE CLIMATE OF THE RF NON-CHERNOZEM BELT

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Abstract

Federal Scientific Vegetable Center (FNCO) of Russia devotes much attention to search of advantageous vegetable crops to offer as an alternative to farmers and market and to produce functional food products. These crops include ground cherry (*Physalis* L.) famous for a unique chemical composition with numerous biologically active compounds and valuable technological properties. In Russia *P. pubescens* L. has been widely commercialized. However, recently the interest deepened to vegetable physalis (*Physalis angulata* L.), an important agricultural species in some countries. This crop is distinguished by its winter hardiness, easy maintenance, and low vulnerability to pest and diseases. FNCO greatly facilitated the popularity and promotion of *Physalis angulata* L. varieties in the RF. Key selection areas of *P. angulata* L. are determined by demands of current market and consumers. For moderate climate of Russia this means early ripeness, synchronized harvest, high palatability and processability, high yield and storability, attractive appearance of the product. False dichotomous forking of stem of *Physalis angulata* L. is unique for this genus. Therefore, the breeding for even ripening involves selection of specimens showing determinate growth. FNCO created unique selection specimens of *Physalis angulata* L. using interspecies and intervarietal hybridization followed by individual selection, with vegetation period lasting 80-90 days compared to 105 days of Konditer variety. Average fruit weight of resultant specimens is 160-240g, this trait is stable over the years, with CV=5.15%. Promising specimens show determinate forking, high percentage of fruits ripening on plant (25.5%), and thus superior productivity compared to the standard.

Keywords: *Physalis angulata L., selection, varieties, productivity, hybridization.*

THE ECOLOGICAL FORMULATION OF A PESTICIDE MANUFACTURED BY JSC SCHELKOVO AGROHIM ON THE EXAMPLE OF THE HERBICIDE ZONTRAN CSC.

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Abstract

The results of studying the effectiveness of the herbicide Zontran CSC, containing the active substance metribuzin 250 g/l in a preparative form (formulation) named Colloidal Solution Concentrate (CSC) are presented. Experiments were carried out on soybean crops with mixed type of weeds: annual dicotyledonous and annual grasses. The biological effectiveness of Zontran CSC was compared with a product containing metribuzin 700 g/kg in a formulation wettable powder (WP). It was established that the pre-emergence application of Zontran CSC on soybean crops at a dose rate of 1.2 l/ha was comparable to the biological effect of the product, contenting metribuzin at 2.3 times more, but in the WP formulation. It was observed that Zontran CSC in comparison with the product containing a higher amount of metribuzin, but in the WP formulation, was at the level, and in some cases exceeded the biological effectiveness of this product. Thus, the formulation of the colloidal solution concentrate allowed, without loss of biological effectiveness and with obtaining reliable yield increases, to reduce the amount of metribuzin per unit of cultivated area, which makes the use of pesticide environmentally friendly, since minimizes its release into the environment.

Keywords: *Herbicides, metribuzin, colloidal solution concentrate, formulation, soy.*

STUDY OF BIOLOGICAL EFFECTIVENESS AND DYNAMICS OF THE DESTRUCTION PREPARATIONS BASED ON NEONICOTINOIDS AND PYRETHROIDS ON CEREALS

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Abstract

Grain crops are grown for food, forage and industrial purposes. The aim of agriculture is produce high yields of the best quality as economically as possible. The basic reason for grain crops low productivity is the wide spread of pests. For pest control use insecticides with various mechanisms of action. Neonicotinoids are effective for controlling populations of arthropods and indispensable when insects have resistance to other types of pesticides. Neonicotinoids bind to nicotinic acetylcholine receptors of a cell and trigger a response by that cell. While low to moderate activation of these receptors causes nervous stimulation, high levels overstimulate and block the receptors, causing paralysis and death. Pyrethroids also interact with the nervous system of an insect. They break the sodium ion exchange process, depolarizing the membrane and prolonging the opening of the sodium channels. High lipophilicity ensures instantaneous penetration of pyrethroids through insect covers, ensuring rapid effect. In the course of research there was biological efficacy and residues degradation dynamics of imidacloprid and thiamethoxam from the group of neonicotinoids and lambda-cyhalothrin and alpha-cypermethrin from the group of pyrethroids in cereal crops in the conditions of the Moscow Region of the Russian Federation. The results of our work were recommendations on the application of effective rates for the consumption of mixed preparations for the protection of crops and conclusions on the safety of the crop production.

Key words: *Cereals, Russian Federation, Yield, Neonicotinoids, Pyrethroids.*

EFFECTOR DIVERSITY OF *PHYTOPHTHORA INFESTANS* POPULATION IN EGYPT

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Abstract

One of the most important factors limiting potato production in Egypt is late blight disease caused by the oomycete pathogen *Phytophthora infestans*. The current study was conducted to understand the mechanisms of how *Phytophthora infestans* overcame resistance genes in potato. Eighteen Egyptian isolates were screened for the presence or absence of five effector genes which condition the susceptibility or resistance of hosts with known R-genes. Obtained results revealed that the Avr1 and Avr2 genes were absent in 13-A2 isolates. Unexpectedly, in one 13-A2 isolate (EG-96) the avr2 gene amplified and showed similarities to the avr2-like gene with many SNPs discriminating the two sequences. The Avr2-like was present in all tested isolates, but absent in reference isolate T30-4. The Avr3a was present in all tested isolates. Avr3a contained the homozygous EM or heterozygous EM/KI virulent forms in the tested isolates. The Avr4 locus was present in all tested isolates. Sources of allelic variance varied depending on the effector gene. In Avr1 and Avr2 there were mutation or deletion, in Avr2-like and Avr3a it was mutation and in Avr4 mutation or truncation of the resultant protein were observed. R2 was the most effective resistance gene in the Egyptian population because all tested isolates belonged to clonal lineage 23-A1 and had the avirulent form of Avr2.So, all potato cultivars which have R2 will be resistant. Such information on effector gene diversity is valuable for determining the most effective long-term strategies for resistance gene breeding and its deployment to maintain durability.

Keywords: *Potato, Late blight, Effectors, Resistance genes.*

CONTROL OF APHIDIDAE IN CHRYSANTHEMUM UNDER GREENHOUSE PRODUCTION

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Abstract

Significant pests on ornamental plants in the greenhouses are aphids (Aphididae), such as *Myzus persicae* which cause decreased growth, shriveling of the leaves and transmit plant viruses. The trials were conducted in 2018 by standard OEPP methods at locality Budisava (Vojvodina) in chrysanthemum crop (cultivar Multiflora) in the greenhouse. The pesticide preparations based on dimethoate (400 g a.i./L, SL) were applied at a concentration of 0.1%, bifenthrin 0.05% (100 g a.i./L, EC) and chlorpyrifos + bifenthrin (400 + 20 g a.i./L, EC) at a concentration of 0.1%. Pesticides were foliar applied, using a backpack sprayer with water consumption of 500 L/ha when chrysanthemums were in the flowering stage. The efficiency of the insecticide was calculated by Henderson & Tilton and the significance of differences was determined by ANOVA for a confidence interval of 95%. Before the treatment, the average number of aphids ranged from 133.7 to 161.7. Two days after the application of the insecticides, the number of *M. persicae* was significantly lower in comparison to the control, and the efficacy was 92.8-95.9%, while seven days after the treatment efficacy was 94.5-96.4%. Fifteen days after the application, the efficacy was still high in the range of 93.2-95%. Aphididae populations have shown high sensitivity to these insecticides but this certainly does not exclude the necessity of including them in the monitoring of susceptibility to the most commonly used insecticides, since aphids are capable of developing resistance rapidly.

Key words: *Flowers, greenhouse, Aphididae, insecticides.*

DIFFERENT ASPECTS OF NON-STANDARD FOLIAR FERTILIZERS BASED ON AMINO ACIDS, PHYTOHORMONES AND PLANT EXTRACTS

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Abstract

We studied different aspects of application of foliar non-standard fertilizers based on amino acids, phytohormones and plant extracts. The trials were carried out at the level of the seedlings, individual plants grown in semi-controled conditions and plants grown in the field. Various energetic and thermodynamic parameters were analyzed, then the chemical composition (mineral elements, different sugars, secondary metabolites, etc.), as well as parameters of plant growth and their yield, in order to better assess the impact of these fertilizers on crops. We found that on maize seedlings it works by changing the content of various elements, then the polyphenol profiles, as well as thermodynamic parameters, where this effect does not only depend on the dosage of the fertilizers, but also on the corn genotype. We also found that the fertilizers affect the energetic and thermodynamic parameters of individual maize plants, as well as the parameters of plant growth. The most significant and most diverse results were obtained by analyzing the yield and components of the yield of many different crops (crop, fruit, vegetable), as well as their chemical composition (mineral elements, different sugars, secondary metabolites, etc.) in terms of improving nutritive quality. It was noticed that these fertilizers greatly affect the content of microelements, starch and crude proteins in maize and barley, sugar and polyphenol content in various fruit trees, as well as in soybeans, in which we note that in certain agroecological situations these fertilizers have led to spectacular magnification yields of different crops, but there were also situations when they did not have any positive effect on crop yields, which will be discussed.

Keywords: *amino acids, BRs phytohormones, plant extracts, plant protection, resistance of plants to stress, biofortification.*

EFFECTS OF TEA WOOD ESSENTIAL OIL ON *TRIBOLIUM CONFUSUM* DU VAL. AND *ORYZAEPHILUS SURINAMENSIS* L.

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Abstract

Tribolium confusum Du Val. and *Oryzaephilus surinamensis* L. are important storage pests which cause a significant decrease in yield. For controlling storage pests, chemical pesticides have been used for years. However, their application can leave residues in food, have a negative influence on human or animal health and manifest high ecotoxicological influence on the environment. Therefore, there is a justifiable need for safe and eco-friendly measurements against these two storage pests. One of the ways is using essential oils or plant extracts. The aim of this study was to explore the contact, the contact – digestive and the repellent effects (Y tube olfactometer) of tea wood essential oil (*Melaleuca alternifolia*) on *T. confusum* and *O. surinamensis*, applied at concentrations of 0.5%, 1% and 2%. Methanol and water were used for the control treatment. The experiment was performed in four replications with 10 insects in each, at a temperature of 25±1˚C and 45–70% RH. Effects were determinated 24, 48 and 72h after the application. Tea wood essential oil caused the highest mortality of *T. confusum* (95%) in the concentration of 2% after 72h in contact test, while in the contact–digestive test, the mortality ranged from 22.5 to 80%. Essential oil of tea wood did not have such a good influence on *O. surinamensis*. The highest mortality of *O. surinamensis* was in contact-digestive test with efficiency of 52.5% after 72h, while in the contact test caused mortality in the range of 15-50%. Tea wood oil showed an excellent repellent activity to both species in concentration of 2%.

Keywords: *Tribolium confusum, Oryzaephilus surinamensis, tea wood, essential oil.*

ANALYSIS OF FUNGICIDES BOSCALID AND PYRACLOSTROBIN RESIDUES IN LETTUCE AND SPINACH

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Abstract

Bremia lactucae is an important lettuce pathogen which causes downy mildew. Chemical protection must be conducted with caution considering short vegetation of lettuce and its fresh use in diet. Lately, fungicides from the group of carboxamide (boscalid) and strobilurine fungicide pyraclostrobin are used for protection against this pathogen. In this study, analytical method for the simultaneous determination of boscalid and pyraclostrobin residues in lettuce was developed and validated. The method is based on QuEChERS extraction, followed by HPLC/DAD analysis. The best separation was achieved using Zorbax Eclipse XDB-C18 column, while elution was conducted by acetonitrile and water (75/25) at a flow rate of 0.55 ml/min. The detection wavelength was 210 nm. The retention times for boscalid and pyraclostrobin, were 1.492 and 2.211 min, respectively. The accuracy of the QuEChERS method was expressed as recovery at the levels 0.1, 1.0 and 2.5 mg/kg. The recovery values varied at 80–106%. In addition, the RSD obtained was 1.87–13.54%. Precision was evaluated trough repeatability of the peak areas and were 0.93 and 0.97%, while LOQ values were 0.1 mg/kg and 0.05 mg/kg, for boscalid and pyraclostrobin, respectively. The linearity of the detector responses of these compounds within the concentration range 0.1-10 μg/ml, were higher than 0.9995. Results are completely in accordance with SANTE guidelines. The obtained method was applied for the analysis of boscalid and pyraclostrobin residues in lettuce and spinach samples, collected on the market in Novi Sad. Obtained results showed that the contents of the analyzed fungicides were below MRLs.

Keywords: *Boscalid, Pyraclostrobin, Lettuce, Spinach, Residues.*

PHENOLIC COMPONENTS AND ANTIOXIDANT ACTIVITIES IN VARIOUS TYPES OF CARROT EXTRACTS

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Abstract

The objective of this study was to evaluate antioxidant activities of vegetable extracts *Dancus carota* L., grown in Serbia. Different experimental models have included the determination content of total phenolics, total flavonoids and antioxidant activities of extracts. From the same material, two extracts were obtained by various methods: maceration and ultrasonic extraction. The highest content of phenolic compounds was detected in *D. carota* L. 50.42 mg GAE/g, ultasonic extract. The lowest content of phenolic compounds shown *Dancus carota* L. macerat, 17.45 mg GAE/g. The obtained antioxidant activities are in correlation with the content of phenolic components. On the basis of the results obtained, extract of were found to serve as a potential source of natural antioxidants due to their marked activity. The obtained results may be useful in the evaluation of new dietary and food products.

Keywords: *D. carota L, maceration, ultrasonic extraction, phenolic compounds*.

ANTIMICROBIAL FEATURES OF ETHANOL EXTRACT MUSHROOM *CORIOLUS VERSICOLOR*

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Abstract

Polysaccharides *Coriolus versicolor* mushrooms isolated from the *Coriolus versicolor* COV-1 strain have an immunological effect on the human body and favorably influence the immune system of humans. Since ancient times, mushrooms were used in folk medicine, as evidenced by the records of Shen Nong from the East Han Han dynasty in China (100-200 BC) which mentioned the medicinal properties of mushrooms *Ganoderma lucidum*, *Dendropolyporus umbellatus* and *Tremella fuciformis*. Mushrooms represent a part of the tradition of East Asian countries, especially China, Japan, Korea, and the areas where the Slavs lived. Today, many pharmacological properties of mushrooms are known. Medicinal mushrooms are used to fight cancer in China, Russia, Japan, Korea, the United States and Canada. In this paper, a special review of the medicinal properties of mushroom *Coriolus versicolor* is given. This type of mushroom has been widely used exclusively for its medical properties, and is otherwise inviolable due to its rough and hard texture and bitter taste. Mushroom *Coriolus versicolor* is medicinal mushrooms, exhibits significant antitumor and immuno stimulatory properties. Active components are β-glucan proteins that exhibit antitumor, antiviral, antibacterial, antioxidant, and immuno modulatory properties, and ergosterol. Studies have shown that mycelium mushrooms *Coriolus versicolor* contain two of the most important bioactive components of PSK (polysaccharide krestine) and PSP (polysaccharide peptide). In addition to these two components, there is also a polysaccharide coriolane for which it has been proven to have a high antitumor effect. *Coriolus versicolor* is successfully used in infections and inflammation of the respiratory, urinary and digestive tracts, in the treatment of liver disease including hepatitis B and chronic active hepatitis. The most widely used is in raising the general immunity of the organism and the fight against tumors. Due to all of the above mentioned useful properties of this type of mushrooms, further research should be directed to the possibility of applying substances from these mushrooms in the treatment of some other diseases. Because of its solid fruiting body, it belongs to insect mushrooms. The antimicrobial properties of the *Coriolus versicolor* mushroom were determined by the MIC method. A series of solutions of this fungus in ethanol of various concentrations was made. The antimicrobial activity of the *Coriolus versicolor* mushroom solution of the ethanolic solution ranged from 10 mg ml-1 to 40 mg ml-1. The most pronounced antimicrobial activity showed an ethanolic solution of mushroom *Coriolus versicolor* in which 5% of the fruiting body of this mushroom was added.

Key words: *Coriolus versicolor, antimicrobial activity, MIC method.*

INFLUENCE OF BIOTIC STRESS ON TURKEY OAK SEEDLINGS IN ELEVATED CO_2 CONDITIONS

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Abstract

Expected climate changes, especially elevated CO_2 content can significantly disrupt the host-pathogen-herbivore relationship. Previous studies analyzed the influence of increased CO_2 content in relations between herbivores and their host plants, according to scenarios, which predict concentrations between 550 and 750 ppm in the future. This paper presents the results of influence of biotic stress, caused by inoculation with a root pathogen (*Phytophthora plurivora* T. Jung & T. I. Burgess) or gypsy moth (*Lymantria dispar* L.) herbivory, on the properties of Turkey oak (*Quercus cerris* L.) seedlings in elevated CO_2 conditions in extreme scenario, which predicts concentration of up to 1000 ppm in the future. For testing the influence of infection with *P. plurivora*, and feeding of gypsy moth larvae on the seedlings, analysis of covariance (ANCOVA) with plant status (exposure to infestation, feeding on the leaves or no biotic treatment) and environmental conditions (ambient or elevated CO_2 level) as independent variable and leaf mass, shoot mass and plant height as dependent variables, were used. Plants height before treatment was used as covariate. Fisher's least significant difference test was used to examine the differences in mean values of individual treatments. Biotic treatments (infestation and feeding on the leaves) significantly influenced the shoot mass and height of the seedlings, while the CO_2 concentration significantly influenced all the three observed plant properties. Interaction between biotic and environmental conditions showed no statistically significant influence on any of the analyzed properties. Plants height before treatment, used as a covariant in the analysis of variance, significantly influenced all of the analyzed properties.

Keywords: *gypsy moth, Phytophthora spp., Quercus cerris, elevated CO_2.*

INFLUENCE OF INOCULATION OF *Q. CERRIS* SEEDLINGS WITH A ROOT PATHOGEN *P. PLURIVORA* ON THE PERFORMANCE OF *L. DISPAR* LARVAE UNDER EXTREMELY ELEVATED CO_2 LEVEL CONDITIONS

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Abstract

A large number of organisms like pathogens and herbivores are related to different tree species. They could be often found together on the same plant host. The elevated CO_2 levels can also influence the changes in plant metabolism, which can influence the plant-herbivore relations caused by the pathogens. This paper presents the results of influence of biotic stress, caused by inoculation of Turkey oak (*Qercus cerris*) seedlings with root pathogen (*Phytophthora plurivora*), on the performance of the gypsy moth (*Lymantria dispar*) larvae in elevated CO_2 conditions in extreme scenario which predicts concentration of up to 1000 ppm in the future. Influence of inoculation of seedlings with a root pathogen on the performance of gypsy moth larvae was examined by analysis of covariance (ANCOVA) with plant status (exposure to inoculation, with or without biotic treatment) and environmental conditions (ambient or elevated CO_2 level) as independent variable, and growth rate (GR) and relative growth rate (RGR) as dependent variables. Plant height and larval weight before treatments were used as covariates. Fisher's least significant difference test was used to examine the differences in mean values of individual treatments. ANCOVA showed a statistically significant influence of CO_2 concentration on both parameters, GR and RGR of the larvae. Inoculation with the root pathogen and covariates (larval weight and plant height) as a source of variation, individually, did not influence the performance of the larvae statistically significantly. Interaction between the biotic and environmental conditions had a significant influence on the RGR, but not on the GR.

Keywords: *gypsy moth, root pathogen, Turkey oak, elevated CO_2, tree-trophic interactions.*

THE INFLUENCE OF ABIOTIC FACTORS IN DEVELOPMENT OF CODLING MOTH AND ITS NATURAL ENEMIES IN SOUTHERN SERBIA

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Abstract

The codling moth (*Cydia pomonella* L.) is the most economically significant pest found in apples, pears, quinces, peaches and walnuts in southern Serbia. The research was carried out with the aim to determine the presence of this species in the monocultural apple plantations, apple plantations with mixed varieties of apple trees, abandoned apple plantations and on apple trees that were part of the spontaneous flora. The monitoring was also carried out on the individual apple trees grown on infields, whereby some of them were chemically protected and others were not. The standard entomological methodology used for the research was divided into the field observation (pheromone traps, trunk bands made of corrugated cardboard, visual examination, the branch beating method, entomological isolators) and the laboratory growth (the growth of interwoven larvae, the growth of the collected plant organs with eggs hatched on them, taxidermy, labelling, determination and collecting of the material gathered in the field). The results of the research showed that the variability of abiotic factors affected the length of the codling moth's developmental phases. It also affected the numerousness of codling moths. These are the identified natural enemies of the codling moth: parasite species of codling moth from the Hymenoptera order (Ichneumonidae, Braconidae), species known as moth (Tortricidae) parasites from Hymenoptera and Diptera orders, predator species from the following orders: Dermaptera (Forficulidae), Neuroptera (Chrysopidae), Coleoptera (Coccinellidae) and Heteroptera (Miridae).

Key words: *Cydia pomonella L., abiotic factors, natural enemies, southern Serbia.*

PRESENCE OF DEOXYNIVALENOL IN BREAD IN SERBIA DURING 2018-2019

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Abstract

Deoxynivalenol (DON) is one of several mycotoxins produced by certain *Fusarium* species that frequently infect wheat, corn, rice, oats, barley and other grains in the field or during storage. DON affects animal and human health causing vomiting, acute temporary nausea, diarrhea, abdominal pain, headache, dizziness, and fever. The objective of this study was to evaluate the presence of deoxynivalenol (DON) in wheat flour bread. In this study, a total of 210 samples of wheat flour bread were collected in the period of 2018-2019. All samples were analyzed for DON by enzyme-linked immunosorbent assay. DON was detected in 47 out of 210 wheat flour bread samples (22.38%), at levels ranging from 81 to 214 μg/kg. The maximum contamination level of DON (214 μg/kg) in this study was found in wholemeal bread. These results suggest not very high percentage of contaminated samples. However, the level of contamination was higher in wholemeal bread than in white bread, which raises a risk for consumers of bread made of whole wheat flour.

Key words: *Deoxynivalenol, bread, ELISA.*

TOXIGENIC POTENTIAL OF *ASPERGILLUS PARASITICUS* ISOLATES ORIGINATING FROM MAIZE GRAIN IN SERBIA

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Abstract

Maize is one of the most susceptible crops to mycotoxins in the world. In relation to mycotoxins, the greatest attention has been paid to aflatoxins, because of their potential for carcinogenicity and other health issues in humans and animals. *Aspergillus flavus* and *A. parasiticus* produce aflatoxins in many economically significant crops in both, fields and storages. Since *A. parasiticus* isolates originating from Serbia caused significant direct losses as a result of maize grain infection and potential contamination with aflatoxins, it is necessary to establish their toxigenic potential. Aflatoxins were produced by almost all *A. parasiticus* strains. Obtained results indicate that there is a great diversity in the production of all individual aflatoxin. The concentrations of aflatoxin B1 were ranged from 33.05 to 7361.03 μg kg^{-1}, while the presence of aflatoxin G1 was in the range of 5.13-6666.12 μg kg^{-1}. The existence of atoxigenic isolates of this species can be significant for Serbia, as they have been increasingly applied as biocontrol agents for virulent strains of fungi. The use of these isolates as biological agent in plant protection should be estimated. Prevention is the most important and economically most beneficial practice in the decrease of fungal growth and mycotoxin production.

Key words: *A. parasiticus, toxigenic potential, aflatoxins, maize.*

EFFECTS OF ANTAGONISM AMONG SPECIES OF THE *GIBBERELLA FUJIKUROI* COMPLEX IN FUMONISIN SYNTHESIS

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Abstract

Some of the most important plant disease pathogens belong to the *Gibberella fujikuroi* species complex, due to both, their genetic diversity and mycotoxin synthesis. The objective of this study was to observe toxicological properties of representatives of this complex. Three isolates from each *G. fujikuroi* species complex (*Fusarium verticillioides*, *Fusarium proliferatum* and *Fusarium subglutinans*) were selected from the fungi collection of the Maize Research Institute. Each isolate was cultured singly and jointly with an isolate of other two species of this complex. Isolates were cultured in the thermostat at 25°C for seven days. The Enzyme-linked immunosorbent assay (ELISA) was used to observe the potential of fumonisin synthesis of these species when cultured singly and in the presence of another species in the same Petri dish. Values of synthesised fumonisin were similar in single cultures of *F. verticillioides* and *F. proliferatum* and in gregarious ones. In both cases, these values were high - *F. proliferatum* i.e. *F. verticillioides* synthesised fumonisin in concentrations above 60,000 i.e. 35-60,000 ppm, respectively. *F. subglutinans* singly cultured did not synthesise fumonisin, but cultured with another species of the *G. fujikuroi* complex it synthesised fumonisin in small concentrations. Gained results showed that certain species of the observed complex could change the potential of mycotoxin synthesis when cultured with another species. Hence, it is necessary to perform further studies for the purpose of practical application of these properties.

Key words: *antagonism, fumonisin, G. fujikuroi*.

CONTENT OF Cu, Zn, Co, Ni, Cr IN SOIL AND FRUITS OF APPLE AND PLUM

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Abstract

In plants, some metals play important role as micronutrient components, significant for growth in low concentrations. If present in higher concentrations than necessary, they can be phytotoxic and cause product contamination. Analysed soils are classified from clay loam to heavy clay, medium to high supply with soil basic fertility parameters, acid to neutral soil reaction. Analysing total content of Cu, Zn, Co, Ni, Cr in soils under apple and plum plantations, an averaged higher content of Cu (13,88 mg kg^{-1}), Zn (33,78 mg kg^{-1}), Co (22,05 mg kg^{-1}), Ni (52,38 mg kg^{-1}) has been measured under plum plantations and the content of Ni (9,55 mg kg^{-1}) under apple plantations. Results of the examination on the presence of the above elements in fruits have shown differences in relation to the content in the soil. Content of Cu, Zn, Co, Cr have had higher average values in fruits of apple and the Ni content has been higher in plums, with higher measured values in individual fruits of plum Cu 3,11 mg kg^{-1} of dry matter), Zn (4,08 mg kg^{-1} of dry matter), Ni (1,32 mg kg^{-1} of dry matter). Adoption of metal from the soil depends on the pH value of the soil, organic composition, the soil type and the concentration of metals in the soil itself. It also depends on the percentage of metal adoption through the plant root, water, metabolic capacity, ion absorption and other. Monitoring the content of metals in soil and fruits is significant in sustainable land use and health food safety.

Keywords: *Metals, Apple, Plum, Soil fertility, Health food safety.*

EFFICIENCY AND THE POSSIBILITY OF USING ZEOLITE AND APATITE IN PURIFYING WATER FOR IRRIGATION AND REMEDIATION OF CONTAMINATED SOIL

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Abstract

Knowledge of the mobility of heavy metals and radionuclides, such as Pb, Cd, Zn and U, represents one of the goals of protection, regulation, rational use and irrigation of agricultural soils from the aspect of safe food production. The aim of this work was investigation of efficiency of natural mineral materials based on zeolite and apatite from domestic deposits in the mobility of heavy metals and radionuclides in the waters and soils of the different physico-chemical characteristics (pseudogley and chernozem). The affinity, efficiency, zeolite adsorption mechanisms and apatite adsorption precipitation were determined in a constant-pressure column system at 300 mg l^{-1} for different pH values (5.00 and 7.00) of the basic contaminated solution (Pb, Cd, Zn, U) at time intervals of 30, 60, 90, 120, 180 minutes. In all experiments, significant changes in the pH of the filtrate occurred. The most significant changes in the pH of the filtrate, minimal fluctuations in the time interval, at pH = 5.00, recorded the basic solutions of Pb (7.69-7.87) and U (7.77-7.93) during leakage through the column with apatite, while slightly lower changes for Cd and Zn were observed. Changes also occurred in the column with the zeolite, but with a much lower intensity compared to the column of apatite, and with the trend of changes U> Pb> Cd> Zn. The trend of changes between apatite and zeolite also occurred in the basic contaminated solution with initial pH=7.00. Zeolite and apatite adsorption/precipitation processes successfully immobilized Pb at both tested pH values of stock solution. Our investigation showed that in colonies, apatite better immobilized U, zeolite is better for immobilization of the Cd, while for the Zn both materials showed a very similar affinity. Zeolite and apatite were added in amount of 20 gkg^{-1} soil to reduce the content of water-soluble and easily accessible forms of Pb, Cd and Zn in uncontaminated and contaminated soil.

Keywords*: soils, water for irrigation, zeolite, apatite, heavy metals.*

INFLUENCE OF MACERATION TIME OF GRAPE POMACE CABERNET SAUVIGNON ON EXTRACTION KINETICS OF SOME POLYPHENOLS AND ANTI-DPPH RADICAL ACTIVITY OF WINES

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Abstract

The influence of five different maceration times on extraction of some polyphenols and anti-DPPH radical activity of wine samples were investigated. In focus were: caffeic acid, syringic acid and *p*-coumaric acid. Grape variety Cabernet Sauvignon was harvested in the state of technological maturity. Phytosanitary state: 100% health, sugar in must 23% and total acid in must 6.8 g/l. Alcohol fermentation and maceration was carried out by microvinification method using the pigeagé system. Sulphur dioxide was added as $K_2S_2O_5$ (10g/100 kg crushed grapes), enzymatic preparation Caractére (Car) (Enartis, Italy) with pectolytic, hemicellulase and *ß*-glycosidase activity and wine yeast *Saccharomyces cerevisiae* (BDX, Lallemand, Canada) in the amount of 20g/hl. Liquid parts were separated from the start of fermentation (3, 5, 7, 14, 21 day, respectively), and fermented without contact with pomace (seeds and skin). Control sample obtained first day, without maceration. Determination of the amount of caffeic, syringic and *p*-coumaric acids was performed using Waters Acquity UPLC H-Class with mass detector. It was found that the dynamics of extraction during alcohol fermentation all three phenolic compounds take place exponentially. Maximal amount of extraction for caffeic acid was at 13th day (2.851 mg/l), for syringic acid was at 11th day (1.096 mg/l) and for *p*-coumaric acid at 12th (1.335 mg/l) day of maceration. For anti-DPPH radical activity, the highest potential (5.8%) was found for wine macerated 21day, and lowest (40.66%) was found for wine macerated 3 days. Addition of enzymes and longer maceration leads to better extraction of phenolic compounds and to higher antiradical activity.

Keywords: *Maceration time, Phenolic compounds, Extraction, Antiradical activity.*

PRESENCE OF VIRUSES IN THE POPULATION OF GRAPEVINE CULTIVAR "PROKUPAC" (*VITIS VINIFERA L.*) IN RASINA DISTRICT, SERBIA

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Abstract

Grapevine cultivar "Prokupac" is officially recognized as Serbian autochthonous variety, It has a long history, tracing to the Middle Ages. This cultivar is used to be the most widespread variety in this part of Balkans and best-rated domestic Serbian wine at international markets. Survey of virus infection incidence in grapevine nurseries, was conducted at 14 location of Rasina district (Republic of Serbia), during 2018. The survey was conducted by Agricultural Service Krusevac, as authorized institution with a professional capacity included into a national phytosanitary system, for implementation of the system of control of prevention of fruit tree and grapevines pathogens (including export and import). It also controls the presence of pathogens in main nurseries. Total number of 17 samples was tested on presence of four viruses using ELISA: *Grapevine fanleaf virus* (GFLV), *Grapevine leafroll-associated viruses 1*, *2* and *3* (GLRaV-1, GLRaV-2, GLRaV-3). The presence of GLRaV-1 was confirmed in one tested sample, and the presence of GLRaV-1, GLRaV-2, GLRaV-3 were also confirmed in one tested sample. Conducted investigation indicates deteriorated viral sanitary status of cultivar "Prokupac" and necessity for intensifying the clonal and sanitary selection program.

Key words: *Virus diseases, Prokupac, Autochthonous grapevine cultivar, ELISA.*

LOW TEMPERATURE TOLERANCE OF PLODIA INTERPUNCTELLA, SITOPHILUS ORYZAE AND SITOPHILUS ZEAMAIS, THE PREVAILENT PESTS OF STORED MAIZE IN SERBIA

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Abstract

Insect's bionomics and development are highly dependent on the environmental temperature. For centuries, this fact has been used for the control of storage pests. However, the temperature threshold depends on the species, life stage, acclimation and exposure period. This research assessed the effect of low temperatures and exposure period on the survival and development of *Plodia interpunctella* (larvae), *Sitophilus oryzae* and *S. zeamais* (adults), the prevalent maize pests in Serbia. Specimens were exposed to following temperatures: 4, - 4, -10, -15 and -18 °C, during 30, 60, 120 and 180 minutes. The mortality and recovery of insects at room temperature (26 ±2°C) after the exposure to low temperatures were recorded. The first effects were recorded at -4 °C when specimens of all three species were immobile after 180 min, but recovered after 30 min. Larvae of *P. interpunctella* (100%) were paralyzed after 30 min exposure at -10 °C, *S. oryzae* weevils after 60 min (85%) and *S. zeamais* after 120 min (98%) but all specimens became active after 30 min. When exposed to -15 °C for 30 min the total paralysis of both weevil species was recorded. 15% of *S. oryzae* recovered after 180 min and 75% of *S. zeamais* after 120 min. Only 4% of *P. interpunctella* larvae regained activity when exposed for 60 min at -15 °C, but died after 120 min of recovery. At -18 °C, all species were paralyzed after 30 min, while up to 40% of weevil specimens recovered. However, when exposed for 60 min, no recovery was recorded. Tested species were susceptible to low temperatures as follows: *S. oryzae* > *P. interpunctella* > *S. zeamais*. This indicates that temperatures and exposure period should be adjusted to the specific pest, while in combined infestations the temperature should be adjusted to the most tolerant one.

Keywords: *Storage pests, P. intepunctella, S. oryzae, S. zeamais, low temperature tolerance.*

INVESTIGATION OF THE OXIDATION PRODUCTS OF THE OILS OF THE LATEST NON-OILY SUNFLOWER HYBRID SEEDS

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Abstract

The oxidative stability of three different cold-pressed oils were studied by monitoring the content of oxidation products. Samples were tempered at 63±2°C for a period of 8 days and the peroxide (PV) and anisidine value (*p*-AnV) as well as the content of the conjugated dienes and trienes in the initial samples and after 4th and 8th day of the exposure to the test were determined. The best oxidative stability in the initial sample had the oil of hybrid NS-H-6304. The PV was 2.20±0.02 mmol kg-^{1}, while the *p*-AnV was 0.47±0.06. The worst oxidation characteristics in the initial sample had NS-H-6971 oil (PV=3.98±0.05 mmol kg^{-1}, *p*-AnV=1.52±0.34). After 8 days, the lowest PV was found in the sample NS-H-6971 (54.70±4.10 mmol kg^{-1}), while the highest value was obtained in the sample NS-H-6488 (72.88±6,07 mmol kg^{-1}). The lowest *p*-AnV after 8 days was 1.60±0.02 (NS-H-6488) while the highest value of 6.56±0.04 was found in the sample NS-H-6791.

Keywords: *Sunflower oil, non-oily hybrids, primary and secondary oxidation products.*

FUNGAL PATHOGENS OF BIRDSFOOT TREFOIL (*Lotus corniculatus* L.) IN SERBIA

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Abstract

Birdsfoot trefoil (*Lotus corniculatus* L.) is a species adapted to field conditions in the most important livestock production region in the all continents and constitutes a very valuable forage species. It has a high ability to utilize nutrients and has very modest demands on the conditions of its growth. The roots of birdsfoot trefoil are associated with bacteria that fix atmospheric nitrogen and, thusly, its populations increase the availability of nitrogen in the soil. This species often forms dense, fibrous root networks that reduce soil erosion. Isolation of the pathogen was done from the leaves and roots. Black leaf spots were observed on birdsfoot trefoil in field plots in Serbia. These spots were circular to irregular. Single lesions often coalesced to form larger lesions and became dark brown. On the roots systems of a large number of plants birdsfoot trefoil symptoms of light to dark brown necrosis and discoloration of conductive tissues were observed. There has not been a systematic research of birdsfoot trefoil mycoflora in Serbia. This research aims to present the results of preliminary research of mycopopulation of 12 different genotypes of birdsfoot trefoil. Total of 480 plant parts have been examined and 7 genera of fungi were isolated: *Alternaria*, *Fusarium*, *Phythophthora*, *Mucor*, *Sclerotinia*, *Bipolaris* and *Rhizoctonia*. Considering the importance of birdsfoot trefoil as a fodder crop in Serbia, the aim of this study was to identify phytopathogenic fungi as casual agents of diseases in birdsfoot trefoil for a clearer perception of problems (the extinction of plants, reducing yields, deterioration of the quality of feed and others) arising as a result of the presence of those fungi.

Key words : *birdsfoot trefoil, fungi, mycoflora.*

EFFECTS OF AN INSECTICIDE OF NATURAL ORIGIN ON LESSER GRAIN BORER (*RHYZOPERTHA DOMINICA* FABRICIOUS; COLEOPTERA: BOSTRICHIDAE) AND QUALITY OF STORED WHEAT GRAINS

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Abstract

Modern methods of protection of stored wheat grains from insect pests strive towards optimizing the use of different techniques and methods within integrated pest management (IPM) programmes. In this study, the potential of synthetic insecticide of the natural origin Abamectin on *Rhyzopertha dominica* F. in stored wheat was examined. The research was conducted in three rates/doses of the tested insecticide (0.25; 0.5 and 1.0 mg a.s. kg^{-1} of wheat) and the effects of its application, as well as the effects of infestation of *R. dominica* on certain physical and chemical traits of wheat grains were, also, examined. After 24 h of treated, 25 adults of *R. dominica* of both sexes were released into each vessel. Insect mortality was determined by manually removing from the infested wheat after 7, 14 and 21 days of exposure. Ten weeks after treatments, progeny emergence and progeny reduction were designated. Efficacy of Abamectin after 7 days of exposure in all applied dosages was low (< 56.5%). Abamectin efficacy was significantly increased after 14 days of exposure (ranged from 67.0%, 68.5% to 85.0%). Abamectin in all applied rates after 21days of treatment was highly active (100%). Ten weeks after grain treatment, all three dosages of examined insecticide were prevented progeny emergence. Amount of the damaged grains and dockage, as a nus-product of feeding of *R. dominica* larvae and adult, compared with untreated, infested sample was significantly smaller which represent positive aspect of Abamectin application. Application of Abamectin was contributed to the significant difference in moisture content, but did not change significantly protein and ash content, in comparison with control. Untreated grain samples, infested with *R. dominica*, in relation to the other tested samples, showed the biggest change in technological grain properties of examined species.

Keywords: *wheat, R. dominica, Abamectin, insecticidal activity, grain properties.*

SPINOSAD APPLICATION FOR PEST MANAGEMENT OF STORED WHEAT

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Abstract

In the condition of low insecticide efficacy, *Rhyzopertha dominica* F. can affect particular changes in physical and chemical grain composition, since the whole pest life-cycle is spent feeding on kernel endosperm. Therefore, this research aimed to determine the insecticidal activity of Spinosad, an insecticide a.s. of natural origin, on *R. dominica* mortality, progeny emergence and some wheat chemical traits (moisture, protein and ash content). Wheat samples were treated with Spinosad in amounts of 0.25; 0.5 and 1.0 mg a.s. kg^{-1} of wheat grain. After 24 h, 25 adults of *R. dominica* of both sexes were released into each vessel. Insect mortality was determined by manually removing from the infested wheat after 7 and 14 days of exposure. Ten weeks after treatments, progeny emergence and progeny reduction were designated. Spinosad application in the lowest dosage, after seven days of exposure, affected mortality from 94.5% to 100%. Spinosad applied at 1 mg kg^{-1} caused a 100% mortality. The mortality of *R. dominica* adults after 14 days exposure period was 100% after the application of the three doses. Ten weeks after grains treatment, all the Spinosad dosages prevented infestation. Spinosad application in all examined dosages did not lead to grain damage. Damaged grain and dust in Spinosad treated samples were not recorded, which represent the ideal small grain protection. There was no determined impact of examined insecticide on particular chemical traits. All established changes were due to the activity of *R. dominica*. Spinosad has been identified as a promising alternative to stored-grain protectants.

Keywords: *wheat, Rhyzopertha dominica* F.*, Spinosad, insecticidal activity, grain properties.*

THE EFFECTS OF WATER EXTRACTS OF *XERANTHEMUM CYLINDRACEUM* SIBTH. ET SM. ON SEED GERMINATION OF THREE WEED SPECIES

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Abstract

The present study focused on inhibitory effects of water extracts of flowers, leaves, stems and roots of *Xeranthemum cylindraceum* Sibth. et Sm. on the total germination percentage, germination rate and germination rate index of chickweed (*Stellaria media* [L.] Vill.), common ragweed (*Ambrosia artemisiifolia* L.) and velvetleaf (*Abutilon theophrasti* Medik.). Water extracts were made by soaking 10 g of plant biomass in 100 ml of distilled water on a shaker for 24 h. Batches of 50 (*A. artemisifolia* and *S. media*) or 30 (*A. theophrasti*) seeds were germinated in 0%, 10%, 20% and 50% extract solutions in three replicates. The extract of *X. cylindraceum* flower did not affect the germination percentage of test species but it did affect the germination rate and germination rate index of all three species. The highest concentration of leaf extract significantly reduced chickweed germination percentage, while it had no corresponding inhibitory activity on the other two species. Its 10% concentration even stimulated the germination of *A. theophrasti* seeds. Leaf extracts had inhibitory effects on the germination rate and germination rate index of all three species. Stem extract of *X. cylindraceum* had no effect on any germination parameter of common ragweed seeds. However, it had inhibitory effect on the germination rate and germination rate index of chickweed, and on germination rate of velvetleaf. Root extract acted inhibitory on all three germination parameters of chickweed seeds, and on the germination rate of velvetleaf. It had no inhibitory activity on the seeds of common rageweed. Based on available literature, the present study is the first to show that *Xeranthemum cylindraceum* has allelopathic properties.

Keywords: *alellopathy, Xeranthemum cylindraceum, water extracts, weed seeds, germination inhibition*.

FUNGAL BIOMASS AND MYCOTOXIN IN KERNELS OF *AVENA* L.

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Abstract

The fungal biomass (DNA) of *Fusarium culmorum* Sacc. (FC) and content of mycotoxin deoxynivalenol (DON) were determined in *Avena* spp. kernels. Kernels were harvested from panicles *A. strigosa, A. ludoviciana, A. byzantina, A. fatua, A. sativa* and *A. nuda* after artificial inoculation by fungi. The plants panicles were infected with FC by spray + polyethylene (PE) bag cover 48 hrs. method during flowering. Quantification of pathogen DNA in samples was carried out by Real-Time PCR method using ABI PRISM® 7000 machine in MicroAmp optical 96-well plates. A commercial competitive enzyme-linked immunosorbent assay (ELISA kit) was used to determine the DON concentration in samples. The lowest content of fungal DNA was found in kernels from *A. byzantina* (0.043 $ng.kg^{-1}$) and the highest content from tested genotypes was found in *A. sativa* (1.725 $ng.kg^{-1}$). A high positive correlation by Pearson ($r = 0.857$; $P = 0.000$) was found between fungal grain infection (FI = % DNA in kernels) and the content of DON. The cultivar PS-201 was the most affected (FI = 4.288%; DON = 37.2 $mg.kg^{-1}$) genotype. In contrast, the *A. byzantina* and one breeding line from *A. nuda* had the lowest FI and accumulated low DON content. The amount of fungal DNA in grain was used as an indicator of the infection degree and the content of DON in kernels showed the level of oat resistance to DON accumulation.

Keywords: *Avena spp., Fusarium culmorum, deoxynivalenol, fungal DNA.*

ESTIMATION OF POSTHARVEST LOSSES AND RENEWABLE ENERGY POTENTIAL OF DAMBULLA ECONOMIC CENTER, SRI LANKA

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Abstract

This study was conducted to quantify the postharvest losses and renewable energy potential of the Dambulla Economic Center (DEC), the focal point in fruit and vegetables (F&Vs) value chain in Sri Lanka. Postharvest losses of twelve vegetables and five fruit types having the highest annual sales in the DEC were assessed. The average loss of selected F&Vs at the DEC was estimated based on the data gathered from ten stalls for 18 months. The number of garbage lorries and tractors transporting waste from six waste dumping sites at the DEC and average weight of waste carrying by vehicles was recorded. Categories of waste generated were assessed using sort-and weigh methodology (Solid waste analysis D 5231-92, 2003). Causes for the post-harvest losses were studied, and the potential to generate biogas from the waste was calculated. Results indicated that the amount of daily waste at DEC was 10.8 tones where F&Vs contributed more than 99% of the waste. The amounts of losses were varying 1 - 5% where the highest values were observed for cucumber and pumpkin and the lowest for beetroot and pineapple. The composition of the waste at the DEC was nonfood wastage (10.9%), the debris of fruit and vegetables (10.2%), yellow pumpkin (10.2%), leafy vegetables (10.1%) and cucumber (7.8%). Wastage was mainly due to lack of demand by wholesalers for oversupply F&Vs (30.3%), pest damage (19.4%), diseases (18.1%), mechanical damages (16.7%) and poor product quality (15.4%). The potential capacity to generate biogas from the daily waste was estimated at DEC is 214 m^3. Results conclude that proper pre/postharvest agriculture practices are needed to obtain quality produces with high demand and there is a possibility to produce bio-energy using wasted F&Vs at DEC.

Keywords: *Postharvest losses, Renewable energy potential, Fruit and vegetable wastage.*

QUANTIFICATION OF EMBEDDED ENERGY OF SELECTED VEGETABLES IN THE FOOD VALUE CHAIN, SRI LANKA

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Abstract

Energy is embedded in all stages of vegetable value chain; production, distribution, wholesale, retail and consumer levels. Present study was aimed to quantify the embedded energy of selected twelve vegetables in Sri Lanka namely bean, tomato, carrot, leeks, cabbage, brinjal, okra, beetroot, capsicum, cucumber, pumpkin and radish from farm to plate using the process chain analysis on the basis of fossil fuel consumption. Data was gathered through a questionnaire based survey administered to farmers, vegetable collectors and whole-sellers at Dambulla Dedicated Economic Center (DEC), the focal point of fruits and vegetable value chain in Sri Lanka. Distributers and retailers of these vegetables and consumers were selected from Kurunegala district. The fuel consumption data to perform the mechanical tasks - land preparation, water pumping, pesticide application, harvesting and transportation were obtained to calculate the embedded energy. Embedded energy was calculated by multiplying the amount of fuel used and the calorific values of fuel type: diesel, gasoline LPG and kerosene. Results showed that energy was embedded in all the stages of the vegetables value chain including production, distribution (farm to DEC), wholesale, retail and consumer levels with different proportions. The maximum embedded energy was reported at the consumption stage where food was preparing (2352 kJ/kg). The order of embedded energy values along the chain were wholesale level (961 kJ/kg) >distribution level (735 kJ/kg) > retail level (454 kJ/kg) > production level (418 kJ/kg). The embedded energy of the selected vegetables were in the order of okra <capsicum<radish <tomato <brinjal<leeks<bean < cucumber <beetroot<cabbage<carrot <pumpkin.

Keywords: *Agricultural products, Embedded energy, Fossil fuels, Vegetable value chain.*

PESTICIDE RESIDUES IN COW MILK AND DAIRY PRODUCTS FROM THE MAJOR MILK PRODUCING AREA OF SRI LANKA

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Abstract

Nuwara Eliya district is the leading fresh milk producing area in Sri Lanka. In the district, pesticides are widely applied for intensive cultivation of vegetables which leads to contamination of water and material used to feed cows. Contamination and health risk hazards of organophosphorus pesticide residues in milk and dairy products originated in the district were studied. Identification and quantification of eleven commonly used pesticides in 50 milk samples and 12 dairy product samples were performed using standard analytical methods and GC-MS technique. Results revealed that fresh milk contained residues of Prothiofos (0.0568± 0.037 mg/ kg), Diazinon (0.0378±0.009 mg/ kg), Chlorpyrifos (0.0264±0.004 mg/ kg), Profenofos (0.196±0.099 mg/ kg), Fipronil (0.1906±0.188 mg/ kg), Phenthoate (0.1012±0.110 mg/ kg), Dimethoate (0.1196±0.201 mg/ kg) and Tebuconazole (0.062±0.069 mg/ kg) at higher levels than the recommended maximum residue levels (MRLs) of the World Health Organization. Sterilized milk (0.0115±0.000 mg/ kg) and fermented milk (0.022±0.004 mg/ kg) contained higher levels of Profenofos than the MRLs. Higher levels of Fipronil than MRLs were observed in pasteurized milk (0.086±0 mg/ kg) and fermented milk (0.014±0.000 mg/ kg) samples. Phenthoate at higher levels than MRL was reported in pasteurized milk (0.3645±0.402 mg/ kg), sterilized milk (0.1405±0.197 mg/ kg) and milk powder (0.0055±0.000 mg/ kg). Moreover, Dimethoate content in fermented milk (0.087±0.012 mg/ kg) was higher than the MRL. Routine monitoring of the above pollutants in food items including fresh milk and value added milk products is essential to prevent, control and reduce the pollution and to minimize the health risks to consumers.

Key words: *Pesticide residues, Cow milk, Dairy products, Health risk.*

ASSESSMENT OF CHEMICAL PROPERTIES OF FLOUR FROM FOUR ACCESSIONS OF HINGURALA (*DIOSCOREA ALATA*)

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Abstract

Starchy tubers and root crops are important subsidiary foods in tropical and sub-tropical countries. Four underutilized accessions of Hingurala (*Dioscorea alata*) namely Maha hingurala, Suta hingurala, Heen hingurala and Hingurala were quantitatively analyzed for their chemical properties with a view to identify the potential of using as a raw material in value addition. The flour of four accessions was analyzed for its proximate compositions, mineral contents, phytochemicals, polyphenolic contents, antioxidants and fatty acid profiles. The highest moisture, free fat and crude fiber contents reported in Hingurala were (72.31±4.89 %), (0.7824±0.072 %) and (2.86±0.433 %) respectively. The highest protein content was reported in Maha hingurala (7.380±0.51 %). The ash content was highest in the Heen hingurala (3.275±0.781 %). The highest Na, Fe, Mg, Cu, Zn and Mn contents were reported in Suta hingurala. Maha hingurala and Heen hingurala reported the highest K and Ca contents respectively. The results showed a range of other compounds such as saponins (2.77-5.94 %) and alkaloids (0.003-0.022 %). Maha hingurala showed significantly ($p<0.05$) higher contents of flavonoid (17.47 mg quercetin/ 100g), total phenolic (117.82 mg/ GAE/100g) and antioxidant (14,370.7±24.7 TEAC μmol/ g) than other accessions. The most abundant fatty acids were palmitic acid (31.2-40.4 %) and Linolelaidic acid (22.6-48.2 %) in all four accessions. This study revealed the food values of newly identified four Hingurala accessions in terms of their nutritional and chemical properties. The use of flour from Hingurala accessions as an important raw material in value addition has to be studied further.

Key words: *Dioscorea alata, Proximate composition, Phytochemicals, Antioxidants, Polyphenols.*

THE EFFICACY OF SOME FUNGICIDES, INSECTICIDES, ACARICIDES AND FOLIAR FERTILIZERS AGAINST TWO-SPOTTED SPIDER MITE TETRANYCHUS URTICAE KOCH

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Abstract

Two experiments (in vitro and in greenhouse) were carried out at Agricultural Scientific Research Centre in Lattakia (Syria) during 2014, to evaluate the efficacy of some fungicides, insecticides, acaricides and foliar fertilizers (methomyl, chlorpyriphos, flubendiamide, lufenuron, propamocarb hydrochloride, thiophanate-methyl, chlorothalonil, copper oxychloride, K2O35%+SO345%, abamectin) against two-spotted spider mite Tetranychus urticae Koch on common beans plants (Phaseolus vulgaris L.) which were artificially infected with sensitive strain of two-spotted spider mite reared in the laboratory. The effectiveness of pesticides and foliar fertilizer were tested at the recommended concentrations. Results showed that some evaluated pesticides effectively reduced two–spotted spider mite population comparing with acaricide Abamecten. The insecticides chlorpyriphos and methomyl showed high effectiveness (100% and 89.11% respectively), after 3 days of treatment under laboratory condition. Foliar fertilizer K2O35%+SO345%, had relatively good efficacy (74.68%) with no significant differences versus acaricid Abamectin after 3 days of treatment under the greenhouse condition. On the other hand, the effectiveness of the fungicide chlorothalonill was relatively low (31.53%), after 7 days of treatment in the laboratory.

Key words: *Two-spotted spider mite, Tetranychus urticae, Chemical pesticide.*

DISEASE INCIDENCE OF VICIA FABA-ASSOCIATED FUNGI AND THEIR PHYTOPATHOGENIC BEHAVIOR UNDER OSMOTIC AND MATRIC POTENTIAL STRESSES

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Abstract

Atmospheric and environmental changes appear and contribute to the creation of different stress conditions that threaten all type of living organisms.As a reaction for that, plants and microorganisms evolve themselves ina way to survive and resist. The fungus is a survival microorganism, with high tolerance and resistance under extreme conditions. Different abiotic factors could broaden the host range of pathogens with a creased chance of increasing its infections. The objective of this study was to determine the effect of osmotic (salt stress) and matric potential (drought stress) stresses on fungal growth in vitro and the disease incidence in *Vicia faba* plants by phytopathogenic fungi isolated from Tunisian agricultural fields. Firstly, we obtained a large diversity of phytopathogenic fungi threatening field faba bean plants from different climatic region from Tunisia and most frequently fungus (67%) was identify as genus of *Fusarium.* The effect of combined stress of biotic (phytopathogenic fungi) and abiotic (salt and drought stress) was experienced and analyzed by mixed model equations to produce best linear unbiased predictors (BLUPs), standard errors and sPLS data. Significant difference was observed and results showed an increase in fungal infection under some concentration for salt and drought stress in case of fungal strains belonging to *Gibberella avenacea* VFF6, *Rutstroemiaceae sp.* VFF7 and *Fusarium equiseti* VFF6. However, no significant difference was recorded for other fungal strains of *Fusarium equiseti* (VFF9, VFF12), and *Boeremia exigua* VFF4 when compared to treatments with or without abiotic stress application. However, in case of *Rhizopus oryzae* VFF1 and *Alternaria sp.* VFF5, a significant decrease in fungal infection was noticed under abiotic stress application.

Keywords*: Vicia faba, Fungi, Diversity, Phytopathogenicity, Osmotic stress, Matric potential stress.*

STUDY OF THE GROUND ARTHROPODS BIODIVERSITY IN OLIVE GROVES IN TWO DIFFERENT BIOTOPES OF THE SFAX REGION

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Abstract

The ground fauna that exists in Tunisian olive orchards is very rich, but little known and underestimated in terms of biological control potential. In fact, this fauna may include soil predators feeding on the pre-imaginal stages of *Bactrocera oleae* (Diptera, Tephritidae), which is the most damaging pest in olive orchards. In this context, the study objectives were to explore the composition of the ground-dwelling arthropods present in olive agro-ecosystems (conventional and organic) and to know more about the fauna diversity and its species richness. From May to October 2018, arthropods sampling was performed using 3 pitfall traps per hedge (*Casuarina*, *Cypress* and *Tamarix)*, and 12 pitfall traps per plot (extensive and intensive). The results showed that fauna density was surprisingly higher in the conventional biotope than in the organic one, with total captures of 3238 and 2352 specimens, respectively. In addition, there was a diversity of eight arthropod orders, with a predominance of Hymenoptera, Coleoptera and spiders in both hedges and plots. Furthermore, samples of soil-dwelling arthropods from *Casuarina* hedgerows were higher than those captured in the hedgerows of *Cypress* and *Tamarix*, with respective total captures of 1312, 305 and 168 specimens. Families of Formicidae (Hymenoptera), Tenebrionidae, Scarabeidae, Curculionidae and Dermestidae (Coleoptera) were the most abundant specimens in pitfall traps. Captures of Carabidae and Staphilinidae families were less important. All these results gave an idea about the soil-dwelling fauna diversity in olive groves and will allow us to explore the role of hedgerows in maintaining this biodiversity.

Keywords: *Ground arthropods, hedges, olive groves, biodiversity, Tunisia.*

ULTRASOUND PRETREATMENT APPROACH: MATHEMATICAL MODELING OF POTATO SLICES

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Abstract

Drying is one of the oldest methods used to protect agricultural products and extend their shelf life. Recently, consumer demands have shown a trend towards healthier and higher quality dry product consumption. For this purpose, chemical and physical pretreatments have been applied to the product before drying process in order to reduce drying time. Ultrasound technology is one of those pretreatment that are frequently examined in the literature. In this study, the effect of different time of ultrasound pretreatment (20 and 40 min) applied, slice thickness (2 and 4 mm) and temperature (60 and 70 °C) on the drying kinetics of potato were investigated, and ten different thin layer models were used to select the most suitable thin layer model. The results showed that the shortest drying time was found in potato samples in the experiment of 70°C-US40-2mm with 110 min, while the longest drying time was observed in potato samples in the experiment of 60°C-unpretreated-2mm with 250 min. The decrease in the drying time of the product was observed with the decrease in product thickness and the increase in the application time of the ultrasound. It was determined that the drying rate increased as the drying temperature increased. The best model was based on the highest R^2 and the lowest χ^2 and RMSE values. At the end of the calculations, it was found that the most suitable model for all drying conditions was the Midilli et al. model. Consequently, ultrasound technology can be a good alternative method in the drying industry with the energy efficiency and better quality product it provides.

Keywords: *Ultrasound Technology, Potato, Modeling, Slice Thickness.*

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DETERMINATION OF *LISTERIA MONOCYTOGENES* AND ANTIBIOTIC RESISTANCE PROFILES IN MODIFIED ATMOSPHERE PACKED GROUND AND CUBED BEEF SAMPLES

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Abstract

This study was conducted to determine the *Listeria monocytogenes* presence, serotypes and resistance against various antibiotics in modified atmosphere packaged (MAP) ground and cubed beef samples. Five of ground (5/50-10%) and 3 of cubed beef samples (3/50-6%) were identified as *L. monocytogenes* positive in MAP samples. Eleven *L. monocytogenes* isolates obtained from samples being investigated in term of *hlyA* gene by PCR method verified this gene (100%). One isolate against (9%) ampicillin, 2 isolates against (18.2%) chloramphenicol, 3 isolates against (27.2%) erythromycin, 4 isolates against (36.3%) oxytetracycline and 4 isolates against (36.3%) penicillin G, 6 isolates against (54.5%) tetracycline and 3 isolates against (27.2%) vancomycin were resistant in 11 *L. monocytogenes* isolates confirmed by PCR. The *L. monocytogenes* isolates were found to be resistant to one or more antibiotics in antibiotic-resistance test results. In conclusion, applying of national residue monitoring program by official authority for prevention of intensive antibiotic use in order to prevent the development of resistant strains to antibiotics has great importance.

Keywords: *Listeria monocytogenes, PCR, Antibiotic resistance, MAP*.

USAGE OF PARSLEY POWDER AS AN ALTERNATIVE CURING AGENT IN FERMENTED SUCUK PRODUCTION

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Abstract

Sucuk is one of the most consumed traditional Turkish meat products and is a dry, cured, fermented and produced from beef meat, animal fat, curing ingredients and various spices. Nitrate and nitrite, which are used as curing agents in the production of sucuk, are very effective in extending the shelf life of product and in the formation of characteristic color and flavor. However, nitrate and nitrite cause toxic effects on human health. The control and reduce of nitrate and nitrite content in cured meat products is very important for the quality of the products and food safety. On the other hand, nowadays, consumers demand foods that do not contain chemical additives so that current studies focus on the usage of plant-derived natural additives as alternative curing agent. In this study two different groups of fermented sucuk were produced containing C: 100 ppm sodium nitrite (control group) and P: 1.17% parsley powder (100 ppm nitrate equivalent). The effects of parsley powder as an alternative curing agent on residual nitrate and nitrite contents, lipid oxidation, pH values, color and sensory properties of fermented sucuk during storage at 4^{o}C for 45 days were investigated. After 30 days of storage, there was no nitrate in the P group. At the end of storage C and P group had 2.23 and 2.86 ppm sodium nitrite contents, respectively. C group had lower pH values (4.89-5.05) than P (5.16-5.29). Overall acceptability scores of the sucuks containing parsley powder were higher than control samples.

Keywords: *Alternative curing, Fermented sucuk, Parsley powder, Residual nitrate, Residual nitrite.*

EFFECTS OF PROBIOTICS TO SOME BIOLOGICAL CHARACTERISTICS OF *TRIBOLIUM CASTANEUM* HERBST (COLEOPTERAN: TENEBRIONIDAE)

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Abstract

The red flour beetle, *Tribolium castaneum* Herbst (Coleoptera: Tenebrionidae) is the most destructive pest of stored products worldwide. It is the worst pest of flour mills and warehouse as a cosmopolitan in distribution. It generally feeds on broken grains, leading to the creation of dust. Destructive stage is adult and larva. It is a tiny and low-maintenance beetle that has appeared as the most suitable insect model for developmental biology study and genetic functional analysis. Over the past two decades, probiotic bacteria have become increasingly popular as a result of the constantly expanding scientific evidence pointing to their beneficial effects on human health. Microorganisms, particularly bacteria, have beneficial or negative impacts on insect vital activity. *T. castaneum* was reared with wheat flour and yeast (95% flour and 5% yeast g/g) as nutrient medium in the laboratory. The larvae and adults were exposed to 6 different treatments (flour, flour + yeast, flour+ ½ capsule, flour+1 capsule, flour+2 capsules and flour+3 capsules probiotics). The probiotics used in practice were available commercially, including: *Lactobacillus acidophillus, L. rhamnosus, L. reuteri, Bifidobacterium bifidum, B. longum, B. breve* and *Streptococcus thermophiles*. The purpose of this research was to explore the impacts of probiotics on certain biological characteristics of the larvae and adults of *T castaneum*. As a result of this research; *T, castaneum* larvae and adults were administered with different doses of probiotics; weight gain, developmental time, egg production and mortality rates were evaluated**.**

Keywords: *Tribolium castaneum, probiotic, model organism, developmental biology.*

A NEW RECORD OF INSECT PEST SPECIES ASSOCIATED WITH APRICOT, *PRUNUS ARMENIACA* IN ISPARTA, TURKEY

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Abstract

Turkey is the world leader in apricot production and supplies 74% of the global dried-apricot market. Circa 19.2 million apricot trees sustain an average annual production of 750 000 tonnes of fresh fruit. *Oarius grisescens* Desbrochers des Loges, 1905 (Coleoptera: Curculionidae, Entiminae) was detected to be endemic in apricot orchards of Isparta, Turkey for the first time. *O. grisescens* is a polyphagous pest that feeds on plant leaves. The adults emerge in late September and keep active during the fall. *O. grisescens* was found feeding particularly on *Prunus armeniaca var. Roxana*. with the apricot flower midge, *Contarinia pruniflorum* Coutin & Rambier (Diptera: Cecidomyiidae). Numerous *O. grisescens* adults were found on tree trunks surrounded by the fiber-trap taken as a control measure. Research focusing on the biology of *O. Grisescens* is in progress seeking developing control meassures.

Key words: *Oarius grisescens* ,apricot, *Prunus armeniaca var. Roxana, Turkey.*

PLANT PARASITIC NEMATODES ASSOCIATED WITH CORN (*Zea mays* L.) GROWING AREAS IN DIYARBAKIR PROVINCE, TURKEY

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Abstract

In this study, plant parasitic nematode species in rhizosphere of Corn (*Zea mays* L.) growing areas in Diyarbakır province (Central, Bismil, Çınar, Ergani) were examined faunistically and taxonomically. When adult nematodes were more abundant, thirty one soil and plant root samples from corn growing areas were taken during June and September in 2012-2014 and nematode samples were extracted, prepared and identified. Nematode species were extracted by using "Petri dish" method. The slides were prepared according to the ring method. The taxonomical situations and synonyms of the genera that were determined at the end of the study were identified according to formula of Siddiqi. Plant parasitic nematode specimens found in this study were placed in superfamilies of Tylenchoidea, Dolichodoroidea, Anguinoidea, Aphelenchoidea and Hoplolaimoidea of Tylenchida and Aphelenchidaorders. Totally 21 species from corn growing areas were identified in Diyarbakır province. The most intensive species were *Aphelenchus avenae* Bastian, 1865; *Ditylenchus myceliophagus* Goodey, 1958; *Helicotylenchus dihystera* (Cobb, 1893) Sher, 1961; *Merlinius microdorus* (Geraert, 1966) Siddiqi, 1970 and *Pratylenchus zeae* Graham, 1951 in corn growing areas, respectively. No literature record of about the presence of plant parasitic nematodes has been determined in corn growing areas in Diyarbakır province before.

Keywords: *Plant parasitic nematodes, Corn, Tylenchida, Taxonomy, Helicotylenchus dihystera.*

PROBIOTIC CHARACTERIZATION OF ENTEROCOCCUS SPP. ISOLATED FROM ARTISANAL CHEESES IN TURKEY

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Abstract

The aim of this study was to investigate probiotic characteristics of selected *Enterococcus* spp. isolated from artisanal Tulum cheese which is produced from raw cows' milk and ripened during 6 months in Turkey. In this context, cell surface properties (hydrophobicity and autoaggregation), acid and bile tolerances, exopolysaccharide (EPS) production, hemolytic and antimicrobial activities, resistance against lysozyme and nine antibiotics, and simulated pancreatic and gastric juice tolerances were evaluated for 10 lactic acid bacteria (*Enterococcus faecium* strain 2014-VREF-41, *Enterococcus faecium* strain CAU2770, *Enterococcus faecium* strain CAU2901, *Enterococcus faecium* strain CAU3651, *Enterococcus faecium* strain CAU4595, *Enterococcus faecium* strain CAU4739, *Enterococcus faecium* strain CAU8746, *Enterococcus faecium* strain CSCWL1-4, *Enterococcus faecium* strain L175(LBF2)F04, *Enterococcus faecium* strain LOCK 0965). The percentages of hydrophobicities of 2014-VREF-41, CAU8746 and LOCK 0965 isolates toward hexadecane were 48.92, 79.70 and 40.51%, respectively. Generally, although the viability of all strains decreased with the increasing amount of bile rate, the survivability of strains was between 70-98% at 1% bile concentration. Furthermore, the isolates were resistant to simulated pancreatic juice. Besides it, the survival rate ranged from 42.51% to 66.99% after simulated gastric digestion and the most resistant strain against gastric juice was L175 (LBF2) F04. All strains showed γ-hemolytic activity. It was determined that all strains demonstrated antibacterial activity against *S. aureus* ATCC25923, while CAU2901, CAU3651, CAU4595, CAU8746 and CSCWL1-4 strains also showed antibacterial activity against *Listeria monocytogenes* ATCC7644. LOCK 0965 was found to be resistant to 6 (erythromycin, gentamicin, kanamycin, streptomycin, tetracycline, vancomycin) of 9 antibiotics.

Keywords: *Antibacterial activity, Enterococcus, Lactic acid bacteria, Probiotic.*

POSSIBILITIES OF USING KEFIR IN YAYIK BUTTER PRODUCTION

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Abstract

Fermented milks are known for their nutritive and therapeutic characteristics, hence having great consumption potential especially by health-conscious people. As a consequence, these fermented dairy products, such as kefir and yoghurt, have been the subject of several studies seeking to evaluate their functional properties related to the biological activity of microorganisms used in manufacturing. The microflora of the fermented products differs from each other. In yoghurt fermentation, process is carried out by two symbiotic bacteria, but in kefir more complex microflora takes part in. Lactic acid bacteria, acetic acid bacteria, lactose fermenting and non-lactose fermenting yeasts comprise kefir microflora. Intestinal microbial balance, antimicrobial, antitumor and anti-carcinogenic activity, enhanced lactose digestion mechanisms are depending on rich microflora of fermented dairy products. Yayık butter, traditionally produced by using yoghurt in Anatolia, has different sensory characteristics and storage stability due to the raw material used when compared to cream butter. In this study, possibility of producing Yayık butter from kefir and its properties are investigated and compared with traditional Yayık butter characteristics. Standardized milk up to 7% fat content is separated into two parts, inoculated by yoghurt and pure kefir cultures and incubated for 43°C for 3-4 h (up to pH: 4.6) and 22°C for 18 h, respectively. Finally kefir and yoghurt obtained are churned to get Yayık butter samples. Samples are analyzed in some of chemical attributes such as serum pH, titratable acidity, color, volatile compounds and sensory properties.

Keywords: *Yayık butter, Kefir, Yoghurt, Traditional dairy product, Sensory properties.*

MOLECULAR PHYLOGENY OF *FUSARIUM OXYSPORUM* SPECIES COMPLEX ISOLATED FROM EGGPLANT AND PEPPER IN TURKEY

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Abstract

Members of *Fusarium oxysporum* species complex (FOSC) are economically most important plant pathogenic fungi found in a large number of plants in different families, while individual strains have strong specificities for particular hosts. Fusarium wilt caused by *F. oxysporum* f. sp. *melongenae* (Fomg) and *F. oxysporum* f. sp. *capsici* (Foc) is a worldwide soil-borne disease that causes yield losses in eggplant and pepper (Solanaceae) growing regions of Turkey. The intra-species or inter-species genetic diversity and phylogenetic relationships in Fomg and Foc isolates obtained from Turkey were investigated by utilizing the sequence data obtained through the designed primers belonging to three protein coding gene regions; beta-tubulin (BT), calmodulin (CAL) and chitin synthase (CHS). Phylogenetic analyses were carried out with BT, CAL and CHS gene regions with a selected subset of Fomg and Foc, along with other non-host *F. oxysporum* and outgroup isolates. The clustering trees successfully separated the Fomg and Foc from the outgroup *Fusarium* isolates. On the other hand, sequence data for BT, CAL and CHS gene regions displayed limited variation among Fomg and Foc isolates and found inefficient to distinguish reliably among several *F. oxysporum* forma specialis (f. sp.) groups. The sequence variation on these 'housekeeping gene' regions in the core genome were not considered adequate to differentiate FOSC populations.

Keywords: *Fusarium wilt, phylogenetic analysis, beta-tubulin, calmodulin, chitin synthase.*

EFFECTS OF SPROUTED AND UN-SPROUTED CHICKPEA FLOUR ON SOURDOUGH FERMENTATION

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Abstract

Sourdough, which is generally fermented mixed of flour and water, is eventually obtained from a fermentation process performed by microbial ecosystem containing lactic acid bacteria and sometimes yeast communities. There are many studies, performed to investigate the effects of different additives having prebiotic properties to increase the growth of lactic acid bacteria in sourdough, of which vast majority has focused on inulin, fructo-oligosaccarides and galacto-oligosaccarides. The galacto-oligosaccharides (GOSs) are not affected by gastric acid and do not have a function as substrates for hydrolytic enzymes in the upper digestive tract, therefore they are important prebiotics stimulating the growth of lactic acid bacteria. GOSs naturally occur in legumes and chickpea is a common source of them. In this study, effects of sprouted and un-sprouted chickpea flour on sourdough fermentation were investigated. Three different groups of sourdoughs were produced including C: chickpea flour free (control group), SC: sprouted chickpea flour and USC: un-sprouted chickpea flour. pH, total titratable acidity and lactic acid bacteria count were determined during 0, 24 and 48 hours. The group of SC significantly ($p<0.05$) increased the mean count of lactic acid bacteria and mean total titratable acidity compared to control and USC. At the end of 48 hours, the group containing sprouted chickpea flour demonstrated the highest lactic acid bacteria count (9.42 log CFU/g) and total titratable acidity (1.85%). However, the group of C had the lowest mean pH value (pH 4.35).

Keywords: *Sourdough, Fermentation, Sprouted, Chickpea flour.*

EFFECT OF *XENORHABDUS* SPP. AND *PHOTORHABDUS* SPP. BACTERIAL METABOLITES AGAINST *TETRANYCHUS URTICAE* (ACARI: TETRANYCHIDAE) AND PREDATORY MITES

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Abstract

The effect of *Xenorhabdus* spp. and *Photorhabdus* spp. bacterial metabolites against different biological stages of *Tetranychus urticae* (Acari: Tetranychidae) and predatory mites *Phytoseiulus persimilis* and *Neoseiulus californicus* (Acari: Phytoseiidae) was investigated in laboratory conditions. The study was conducted in 25 ± 1 ^{o}C temperature, 70 ± 5% humidity and 16 h light conditions in a climate room. The results showed that the mortality rate of bacterial metabolites on *T. urticae* eggs, larvae, protonymphs, deutonymphs, adult males and adult females ranged between 2.5-4.5%, 46-98%, 31-96%, 42-92%, 92-100% and 46-93%, respectively at 7 days post-treatment. All of the tested bacterial metabolites presented a very low effect on *T. urticae* eggs and no statistical difference was found among the treatments. Similarly, *X. szentirmaii* and *X. nematophila* supernatants were not effective against eggs of predatory mites *P. persimilis* and *N. californicus* (ovicidal effect 0%-4.5%). The mortality rate of *X. szentirmaii* and *X. nematophila* on the larva, protonymph, deutonymph and adult of *P. persimilis* and *N. californicus* ranged between 18.5-23.0%, 28.5-32.0%, 28.0-29.5%, 30.0-39.5% at 7 days post-treatment. Due to the low effects on the predatory mites and the very high virulence on the pest *T. urticae*, the bacterial metabolites of *X. szentirmaii* and *X. nematophila* could be potentially used in the integrated management of *T. urticae.*

Keywords: *Phytoseiulus persimilis, Neoseiulus californicus, secondary metabolites, Tetranychus urticae, entomopathogenic nematodes.*

EFFECTS OF AGRICULTURAL PRACTICES ON STICKY TRAP CAPTURE RATES OF WHITEFLIES

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Abstract

Whiteflies are one of the most common sap sucking insect pests found in tomato growing greenhouses, worldwide. It is critical to monitor whitefly populations from very beginning in order to apply correct measures, in greenhouses treated either with traditional (spraying) and biological control methods.Yellow sticky traps are best and most common monitoring option since yellow color presents a strong attraction for whitefly adults and correctly reflects the underlying population found in the plants. On the other hand, greenhouses involves continuous human interaction for application of several different agricultural practices, across the season, including irrigation, pesticides and fertilizers from roots/leaves, and other applications to keep plant body in a certain form, ie, side-shoots pruning, fruit truss thinning, leaf removal, etc. In this study, all major agricultural practices were monitored weekly in a soilless tomato growing greenhouse, along with whitefly captures on the yellow sticky traps. Total of 44 sticky traps were used in ten thousand m^2 area. Monitoring started on March 22nd, 2019 and continued until end of the season. Counts of all individuals found on trap face and agricultural practices recorded in binary style were subjected to variance analysis to reveal statistical significance of the factors on trap catches. According to analysis results, root applications of insecticides lowered the number of trap catches (R^2_{adj}=0.083), as expected. On the other hand, hanging of plants on strings (R^2_{adj}=0.087), tross thinning (R^2_{adj}=0.022), sucker pruning (R^2_{adj}=0.051), harvest and packaging (R^2_{adj}=0.141) and leaf removal (R^2_{adj}=0.058) practices statistically significantly increased the trap catches.

Keywords: *Whitefly, Insect monitoring, Soilless agriculture.*

THE EFFECT OF SOME CHEMICAL ADDITIVES ON THE FOAMING PERFORMANCE OF THE PASTEURIZED LIQUID EGG WHITE

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Abstract

The foam stability of egg white changed between 46.7(0.5 mg/kg phospholipase at 24h) and 64.6 (0.5 mg/kg phospholipase.48 h). When tartaric acid was added to egg white in the rate of 5 %, an increasing in foam capacity and stability was observed. In the use of sodium acid pyrophosphate **(**SAPP), especially on performance effects, it was seen that the similar results to citric acid and tartaric acid were obtained. In control group 1., while the effect on foam capacity is 200 units, due to the fact that it was not been form cream of lump of dough. In group 2, whose contamination of egg yolk is low, it was seen that it was only 40 units. In the use of citric acid, that important effects on foam capacity can be provided on condition that the content of egg yolk is kept at a certain levels. In control group 1 having low contamination, while the effect on foam capacity is 200 units, due to the fact that it does not been form cream of lump of dough, in group 2, whose contamination of egg yolk is low, it was seen that it was only 40 units. In the rates of tryethyl citrate of 0.1 -1 ml/kg, in the studies on two different control group, in pH and brix, any variation was not observed. While foam capacity values change between 640 and 690, and in stability values ranged from 60.3 to 67.4. It is considered that the rate of maximum using was around 0.2 ml/kg. Triethyl citrate protects egg white against the detrimental effects of egg yolk.

Keywords: *Egg whites, foamming, food addivites, performance of egg white.*

EVALUATION OF THE DAMAGE RATES OF LEOPARD MOTH, *ZEUZERA PYRINA* L. (LEPIDOPTERA: COSSIDAE) ON DIFFERENT OLIVE VARIETIES IN TURKEY

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Abstract

The leopard moth, *Zeuzera pyrina* L. (Lep. Cossidae), is one of the significant pests of olive trees in Turkey. The leopard moth is a xylophagous species that attacks the shoots and branches of numerous fruit-bearing in larval states, and may cause the death of young trees or loss of the branches in old trees. The study was carried out to evaluate damage rates of the leopard moth in 'Gemlik', 'Ayvalık', 'Savrani' and 'Karamani' varieties of olive orchards in Antakya, Yayladağ, Belen and Altınözü districts of Hatay province of Turkey. Evaluation of the damage rates of the pest in each of the sampling orchard were done by counting numbers of the damaged branches and trunks of olives trees. As a result of investigation, the damage rates of this pest varied in each of the sampling varieties. The highest damage rates of the leopard moth were observed in 'Gemlik' with 90 percent, located in Antakya (Arpahan village) district, following 'Gemlik' with 40 percent, located in Yayladağ district. On the other hand, the damage rates of this pest were not observed at the 'Ayvalık', located in Belen district, 'Savrani' and 'Savrani' +'Karamani', located in Altınözü district of Hatay province in Turkey.

Key words: *Leopard moth, Zeuzera pyrina, olive trees, damages rates*.

POPULATION DENSITY AND DAMAGE RATES OF MEDITERRANEAN FRUIT FLY, *CERATITIS CAPITATA* (WIEDEMANN) (DIPTERA: TEPHRITIDAE) IN POMEGRANATE ORCHARDS IN TURKEY

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Abstract

The Mediterranean fruit fly (Medfly), *Ceratitis capitata* (Wiedemann) (Diptera: Tephritidae), is one of the important pests of pomegranate in Turkey. The studies were conducted in 2012 and 2014 to evaluate distribution, population density and damage rates of Medfly at pomegranate orchards in Hatay province of Turkey. The study was carried out using the Econex yellow traps and pheromones at six different pomegranate orchards which contain 'Hicaz' variety in 2012, and at four different pomegranate orchards two of which contain 'Hicaz' variety and the other two 'Katırbaşı' variety in 2014. The pheromone traps were weekly checked and captured Medfly adults were counted and then cleaned. Pheromones in the yellow traps were replaced with the new ones in every 90 days. During the harvest time, except from the pheromone trap hanging tree, 200 pomegranate fruits were randomly selected to evaluate the ratio of the damaged fruits in each of the orchards. The Medfly was found in all pomegranates orchards where the study was conducted. In 2012, a total of 2634 Medfly adults were caught by pheromone traps. The highest number of the Medfly were observed with 53.68 % in November. In 2014, a total of 1325 Medfly adults were caught by pheromone traps. The highest number of the Medfly were observed with 73.6 % in November. In 2012, the highest damage rates of Medfly were observed with 14 % at Orchard II (Hicaz). In 2014, the highest damage rates of Medfly were observed with 25 % at Orchard IV (Katırbaşı).

Key words: *Medfly, Ceratitis capitata, pomegranate, pheromone traps, damages rates.*

POPULATION DENSITY AND DAMAGE RATES OF PEACH TWIG BORER, *ANARSIA LINEATELLA* ZELLER (GELECHIIDAE: LEPIDOPTERA) ON EARLY APRICOT ORCHARDS IN TURKEY

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Abstract

Peach twig borer (PTB), *Anarsia lineatella* (Gelechiidae: Lepidoptera), is one of the important pests of apricot in Turkey. The study was conducted in 2013-2014 to determine the population density and damage rates of PTB in Anamur district of Mersin province. The study was conducted in five early apricot orchards of the villages Kalınören (Trintina), Ören (Trintina), Cerenler I (Nimfa), Cerenler II (Trintina) and İskele (Trintina) of Anamur. The peach twig borer of pheromone (E-5 Decenyl acetate 5,0 mg/capsul E5 Decenol 1,0 mg/capsul) was used in Econex polillero trap + DDVP impregnated tablet. The traps were hanged at South-East direction of the trees about 1.5-2 m above ground, checked weekly and the caught adults were counted and cleaned. Pheromones in the traps changed in every 40 days with the new ones. Randomly chosen 20 trees' twigs and fruits were checked, apart from the trap hanging trees, in order to determine the damage rates. A total of 46 PTB adults were caught by the pheromone traps in 2013. The first adults were caught on 14 April, and the highest number of catch was on 12 May. The highest number of PTB adults was in May with 67.4% followed by April with 32.6%. A total of 66 PTB adults were caught by the pheromone traps in 2014. The first adults were caught on 13 April, and the highest number of catch was on 11 May. The highest number of PTB adults was in May with 68.2% followed by in April with 31.8%. It was observed that PTB had one generation and the pest did not cause any significant damage on early apricot varieties.

Keywords: *Peach twig borer, Anarsia lineatella, Pheromone traps.*

EFFECTIVENESS OF VARIOUS ATTRACTANTS FOR OLIVE FRUIT FLY, *BACTROCERA OLEAE* (GMELIN) (DIPTERA: TEPHRITIDAE) IN OLIVE ORCHARDS IN TURKEY

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Abstract

The olive fruit fly, *Bactrocera oleae* (Gmelin.) (Diptera: Tephritidae), is a serious pest on olives in Turkey. The study was conducted in 2016 to determine effectiveness of different attractants for olive fruit fly, *Bactrocera oleae* (Gmelin.) (Diptera: Tephritidae) in Hatay province of Turkey. In 2016, three studies were conducted with ammonium carbonate (AC), Ammonium bicarbonate + Ammonium acetate (AB+AA), di-ammonium phosphate (DAP), Ammonium sulfate (AS) attractants and Spiroketal. In 2016, a homemade plastic wipes were prepared containing 25 ml concentration from mixed attractants. The Decis traps were used as traps hanged with homemade plastic wipes at 1-1,30 m above ground on the tree branches. Traps were arranged as 3 trees/trap. Three studies were conducted as the randomized complete blocks design with five replicates. In the first study, a total of 2489 olive fruit fly adults were caught by traps. In the second study, a total of 2929 olive fruit fly adults were caught by traps. In the third study, a total of 2804 olive fruit fly adults were caught by traps. The results of three studies indicated that the highest number of olive fruit fly adults (♀♂) were caught by DAP attractants traps, followed by AB+AA attractants traps.

Key words: *Olive fruit fly, Bactrocera oleae, attractants, Turkey.*

Acknowledgement: This project was supported by University of Hatay Mustafa Kemal of Scientific Research Projects (BAP) (project number: 16240).

CONTROL OF OLIVE MOTH, *PRAYS OLEAE* BERN. (LEPIDOPTERA: YPONOMEUTIDAE) WITH MASS TRAPPING IN ORGANIC OLIVE PRODUCTION

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Abstract

The study was carried out in 2017-2018 in order to evaluate the control of olive moth *Prays oleae* Bern. (Lepidoptera: Yponomeutidae) with mass trapping in organic olive production. Studies were carried out in organic olive orchards in Sarıbük (Saurani + Halhali + Haşebi varieties), Tokaçlı (Haşebi + Saurani varieties) and Türkmenmezrası (Karamani + Saurani varieties) villages in Altınözü district of Hatay province, Turkey, using delta traps with olive moth pheromone. Number of pheromone traps were 49 (2017) and 30 (2018) in Sarıbük village, 32 (2018) in Tokaçlı village and 25 (2018) in Türkmenmezrası. Number of adults caught was counted every other week in 2017, and weekly in 2018. Adults were cleaned and pheromone capsules were replaced with new ones in every fourty days. In 2017, 1219 olive moth adults were caught by 49 pheromone traps in Sarıbük village. The highest number of adults was caught on 6th June, it was observed that the population density decreased significantly in later samplings. In 2018, 14,393 olive moth adults were caught by 30 pheromone traps in Sarıbük village. The first adults were caught on 15th April and the highest number caught was on 13th May. It was observed that the population density decreased significantly in later samplings. In 2018, 37,953 olive moth adults were caught by 32 pheromone traps in Tokaçlı village. The first adults were caught on 29th March and the highest number caught was also on 29th March. It was observed that the population density decreased significantly in later samplings until 3rd May. For the same year, 45,354 olive moth adults were caught by 25 pheromone traps in Türkmenmezrası village. The first adults were caught on 29th March and the highest number caught was also on 29th March. It was observed that the population density decreased significantly in later samplings until 3rd May. There was not any injured olives in Sarıbük village for both of the years observed on 28th September 2017 and 04th August 2018. In 2018, damage rates were determined to be between 0.2-0.7 in Tokaçlı and between 0.4-1 in Türkmenmezrası, both observed on 19th July.

Key words: *Olive moth, Prays oleae, mass trapping, Turkey.*

MACRO AND MICRO ELEMENT CONTENTS OF SOME HERB AND CONDIMENTS

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Abstract

The study was conducted to investigate the macro and micro elements of several herbs and condiments. Mineral contents of samples were measured by Inductively Coupled Plasma Atomic Emission Spectrometry (ICP-AES). The macro elements of herbs and condiments were Ca (234-40059 mg/kg), Mg (649-7312 mg/kg), K (5788-37781 mg/kg), P (526-8412 mg/kg), and S (741-8117 mg/kg). The highest Ca, P and S contents were found in urtica, black cumin and ginger, respectively. Basil had the maximum Mg (7312 mg/kg) and K (37781 mg/kg) contents. The lowest Ca (234 mg/kg) and K (5788 mg/kg) amounts were determined in sesame, while the cinnamon, turmeric and sumac have the minimum Mg, P and S contents, respectively. The micro elements of samples were B (6.4-51.1 mg/kg), Cr (0.10-2.62 mg/kg), Cu (5.9-22.8 mg/kg), Fe (36-781 mg/kg), Mn (3.6-624.3 mg/kg), Ni (0.12-5.80 mg/kg) and Zn (5.0-62.1 mg/kg). The highest and lowest Fe contents were found in balm (781 mg/kg) and rose (36 mg/kg) samples, respectively. While Zn contents of samples change between 5.0 (rose) and 62.1 mg/kg (black cumin), Cu contents ranged from 5.9 (turmeric) to 22.8 mg/kg (basil). The Mn content of clove (624.3 mg/kg) was higher than other condiments. Additionally, rosemary and thyme contained higher B content, with the ranges of 48.1 mg/kg and 48.0 mg/kg, respectively. The study revealed that investigated edible condiments are good source of P, K, Ca, Mg and Fe. The urtica, senna and basil condiments are thought to be beneficial for bones and teeth due to their high Ca content. However, the clove, rosemary and thyme contain a high amount of Mn and B elements, so over-consumption of these herbs can create toxic effects.

Key words: *condiments, herbs, mineral, heavy metal, ICP-AES.*

DETECTION OF EXTENDED-SPECTRUM-BETA-LACTAMASE-PRODUCING *ENTEROBACTERIACEAE* FROM CHEESE SAMPLES

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Abstract

Enterobacteriaceae strains producing ESBL have been isolated from many foods, especially foods of animal origins which form a greater risk to consumers due to zoonotic character. In this study, it was aimed to determinate the prevalence of extended-spectrum beta lactamase (ESBL) producing *Enterobacteriaceae* in cheeses sold in local markets in Samsun. A total of 150 cheese samples (25 white cheese, 25 kashar cheese, 25 plaited cheese, 25 farmer's cheese, 25 kuymak cheese and 25 cottage cheese) were collected from the local markets established in Samsun center and were used as material. Samples were pre-enriched in EE Broth and then were streaked onto ESBL chromogenic agar. According to CLSI instructions, suspected colonies were analyzed for ESBL by the combined disc diffusion method. BD Phoenix system was used for bacterial identification. MIC values of obtained isolates to selected antibiotics were evaluated according to EUCAST criteria. 148 ESBL positive isolates were obtained from 34 samples (26.6%). Identification of 148 bacterial isolates were as follows: 79 *Escherichia coli* (54.5%), 39 *Klebsiella pneumoniae* (26.3%), 16 *Klebsiella oxytoca* (10.8%), 5 *Citrobacter youngae* (3.4%), 4 *Shigella bodii* (2.7%), 2 *Klebsiella ozaenae* (1.53%), 2 *Enterobacter cloacae* (1.53%) and 1 *Enterobacter aerogenes* (0.67%). It was concluded that chees sold in local markets was an important source of enteric bacteria that can produce ESBL. Therefore, chees can be considered as a potential source for spread of ESBL genes from foods to humans.

Keywords: *Antibiotic resistance, Enterobacteriaceae, ESBL, Cheese.*

OPTIMIZATION OF ENZYMATIC EXTRACTION CONDITION OF PECTIN FROM POMEGRANATE PEEL

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Abstract

Pectin is a linear polymer of 1, 4 α linked D-galacturonic acid units with varying degrees of methylation. It has been widely used in food, cosmetic and pharmaceutical industries. The most common method for the production of pectin is threating of the pectin sources with acidified water, followed by the coagulation with ethanol. However, this method is a time and energy consuming process and it requires corrosive chemicals. Lately, enzyme assisted extraction has been shown that it can be used for the production of pectin. Extraction of pectin from pomegranate peel was carried out with cellulose enzyme from *Aspergillus Niger* at 40 ^{o}C and pH 5. Extraction conditions were optimized in terms of the enzyme and substrate concentrations and extraction time (30, 60, 90 s), using response surface methodology. The optimum conditions were determined as 0.075 U/mL of enzyme concentration, 9.99 g pomegranate/100 mL of substrate concentration and 2.58 h of extraction time. Under the optimum extraction conditions, it was determined that pectin yield was 7.19% and the extracted pectin was high esterification grade pectin (58.25%). The structure of the extracted pectin was similar to that of commercial pectin based on the FTIR analysis. The result of this study showed that enzymatic extraction can be successfully used as an alternative pectin extraction method and the pomegranate peel could be to be used in the production of pectin.

Keywords: *Pectin, Enzyme, Extraction, Pomegranate, Cellulase.*

POPULATION GROWTH PERFORMANCE OF TYPHLODROMUS ATHIASAEURTICAE (ACARI: PHYTOSEIIDAE, TETRANYCHIDAE) AT DIFFERENT TEMPERATURES*

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Abstract

Population growth performance of the predatory mite *Typhlodromus athiasae* Porath and Swirski (Acari: Phytoseiidae) was evaluated at three constant temperatures (20, 25 and 30°C) under laboratory conditions providing 60±5% RH and a photoperiod of 16 L:8D. Like most ectothermic organisms, the developmental time of *T. athiasae* decreased at higher temperatures, and the developmental rate increased with the temperature. The developmental rate at different temperatures fit the linear equation. The life history raw data of the predator was analyzed based on the age-stage, two-sex life table theory, which took into account the stage differentiation, real survival, and the male population. The population parameters; intrinsic rate of increase (r), finite rate of increase (λ), net reproductive rate, (R_0) and mean generation time (T) were calculated, and then population growth of the predator was simulated at temperatures tested using data collected for development, survival and fecundity in the life table study. Results indicated that the net reproductive rate, intrinsic and finite rate of increase obtained at 25ºC and 30 ºC were similar, and the mean generation time was the shortest at 30°C. The fitness of the predator was the lowest at 20ºC at which the predator displayed the longest total pre-adult developmental time, the lowest fecundity, consequently the lowest population growth rate according to population simulation results.

Key words: *Typhlodromus athiasae, temperature, population parameters.*

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NUTRITIONAL CONTENT OF BEE BREAD (PERGA) FROM NEW DISCOVERED HONEYBEE PRODUCTS

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Abstract

The basic nutrient needs of honeybee (Apis mellifera L.) are nectar, pollen, and water. While nectar is the source of carbohydrates for honeybees, pollen is a source of protein, lipid and vitamins. The pollen collected by forager honeybees is brought to the hive by putting the honey bee secretions and pressing the pollen basket. Then, with the help of other young bees in the hive, beebread is poured into the honeycomb cells and covered with a small amount of honey and bees wax to prevent spoilage. This mixture is subject to chemical modification by the action of different enzymes, microorganisms, moisture and temperature (35-36 C). This chemically modified pollen is called "bee bread". Bee bread is consumed by adult bees and larvae as fed. The chemical structure of production of bee bread in Turkey was identified in this study. Chemical analyzes were performed according to the methods recommended by AOAC. Accordingly, the ash, protein, carbohydrate, dietary fiber, fat and energy content of bee bread were determined as 8.14g / 100 g, 13.56 g / 100 g (Nx6.25), 30.60 g / 100 g, 18.18 g / 100 g, 21.69 g / 100 g and 408 kcal / 100 g, respectively. There is a need for research on perga, which is rich in nutrients and has bioactive properties.

Key words: *Bee bread, perga, chemical analysis, nutritional content.*

COMPARISON OF THE BIOACTIVITY OF PROPOLIS EXTRACTED BY OLIVE OIL PRODUCED BY DIFFERENT PRODUCTION PROCESSES

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Abstract

Virgin olive oil is obtained from the fruits of the olive tree (*Olea europea*) by mechanical or other physical means, under conditions that do not cause any changes to the oil. Important factors in the production of good quality olive oil are the harvesting period, maturity of the fruit, the mode of harvesting (hand picking, nets, other means), storage of olives before processing, leaf removal, mode of crushing and kneading, and the system of extraction. Some oils, such as virgin olive oil, are used without further treatment, but most are refined in some measure before use. The refining processes remove undesirable materials, but may also remove valuable minor components which are antioxidants and vitamins such as carotenes and tocopherols. In this study, propolis was extracted with virgin, refined and riviera olive oils in different condensations. Then, the total phenolic, antioxidant and antiradical activities of these extracts were measured. Total phenolic content of the extracts ranged from 462.03-1780.49 mgGAE/100g, antioxidant activity 9.27-27.39 mgAAE/g and antiradical activity 57.52-83.32%. According to the results, the highest activity was observed in virgin olive oil extract.

Key words: *Propolis, olive oil extract, total phenolic content, antioxidant activity.*

BIOLOGICAL ACTIVITIES OF PLANT PHYTOCHEMICALS

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Abstract

Many different plants are used to treat various health problems by people in whole world. Bioactive compounds are produced and stored as secondary metabolites in plants that are called phytochemicals and they have beneficial effects on health when consumed. In addition, they also have an effective role in the formation of the color, smell and taste of the plants. As an alternative to the synthetic materials, the use of the phytochemicals to treat the many diseases have increased in recent years. Increasing in interest to use phytochemicals has developed a new market in food and non-food (medicine, cosmetics) areas. These compounds are one of the most potent antioxidants that terminate the free radical propagation in the biological systems, increase the body's defenses against oxidative damage as well as control the oxidative changes in food. Besides their antioxidant activities, they have also high antimicrobial activities. The antidiabetic activities of them to control blood sugar level have been reported in many studies. Their antiinflammatory activities and cytotoxic activities have been also observed at different levels in different studies. The studies have showed that the plant phytochemicals have high antimicrobial, antioxidant and cytotoxic activities and could potentially be used as an important source both in the food and non-food industries. In this study, biological activities such as antioxidant, antimicrobial, antifungal, antidiabetic, anti-inflammatory and anticancer properties of phytochemicals, naturally found in plant, were reviewed.

Key words: *Phytochemical, Bioactive property, Phenolic compound, Antioxidant.*

HAZARDS RELATED TO FOOD SAFETY

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Abstract

Today, it is clear that the concept of food production and food safety must be dealt with together. It is not possible to talk about a commercial success when food safety is not applied. Reliable food cannot be obtained at all stages of production unless necessary control measures are taken. In this case, public health hazards can enter the food chain from many different points and may adversely affect production. Therefore, the entry point or points of each hazard should be determined and necessary precautions should be taken at these points. Contagion occurring at one point in the food chain also affects the next stage of production. Thus, even if the other steps of the food chain are successful, the result is negative. What is the concept of food chain, which has an important place in food safety? 'Farm to table' 'or' 'from field to fork' expressed in the food chain until it covers all the processes available to consumers, starting from primary production. Chemical contaminants (industrial residues, remnants of pesticides, remnants of veterinary drugs), biological agents (bacteria, viruses, parasites) and physical contaminants (nails, glass pieces, stones, bristles, etc.) effect chain process negatively. It impairs food safety and endangers public health. In this review article, it is aimed to give information about the physical, chemical and biological hazards that threaten food safety.

Keywords: *Food Safety, Public Health, Physical Hazards, Chemical Hazards, Biological Hazards.*

THE EFFECTS OF PROBIOTICS ON PUBLIC HEALTH

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Abstract

In our intestines, only digestion and absorption is not realized. Furthermore, the microbial activity required for a healthy life is carried out by microorganisms in our gut. There are 10^{14} microorganisms of more than 500 different species in the gastrointestinal tract. In determining the composition of these microorganisms, the place of probiotics is very important. Microorganisms used as probiotics; *Lactobasillus* species, *Bifidobacterium* species, *Bacillus* species, *Pediococcus* species, *Streptococcus* species, *Bacteriodes* species, *Propionibacterium* species, *Leuconostoc* species, some molds and yeasts. The most commonly used microorganisms among these microorganisms are *Lactobasillus* species and *Bifidobacterium* species. These microorganisms were selected and characteristics such as being reliable, stable, colonizing the intestines, competing with carcinogenic and pathogenic bacteria, producing antimicrobial bacteria, being able to produce resistance to diseases, being resistant to antibiotics, staying alive and stable in storage conditions for a long time heve been studied. This review article aims to give information about the positive effects of probiotics on public health.

Keywords: *Probiotics, Public Health, Microorganisms.*

INFLUENCE OF ABIOTIC AND BIOTIC FACTORS ON PRODUCTIVITY OF TRANSGENIC SOYBEAN AND MOLECULAR PROPERTIES OF DISEASE PATHOGEN

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Abstract

For the first time in Ukraine, it has been shown that transgenic soybean cv. Grimo and Monro is affected by various pathogens, including viral diseases. Negative effect of the *Soybean mosaic virus* (SMV)-infection on the productivity and yield structure of soybean plants is proved. Also, significant role for the cultivation of transgenic soybeans (Kyiv and Poltava regions, Ukraine) is revealed for growth conditions. Cultivation of the cv. Monro in different weather and climatic conditions has shown that the growth limiting factor is moisture. In 2018, harvest of soybean cv. Monro in farm "Mriya" in Kyiv region was 3.1 t/ha, but in the farm "Mir" in Poltava region it was almost twice lower. We analyzed the coefficient of significance of deviations of the agrometeorological regime in 2018 comparing with the average perennial meteodata. It was 1.14 - 2.30 and demonstrated that the conditions in 2018 are very different comparing with the average perennial parameters and close to the rare. SMV named SGK-17 (Ac No MG940988), isolated from transgenic soybean plants cv. Monro from Kyiv region, was studied in the detail. Nucleotide and amino acid sequences of the SGK-17 coat protein gene region (430 nt) were compared with sequences of SMV isolates from different countries. SGK-17 has the highest identity level (97.9% nt and 97.2% aa) with isolates from China, Poland, Iran, USA, Ukraine and is belonging to the one cluster with them. Four unique aa substitutions in CP gene of SGK-17 are revealed, which can be involved in its ability to infect transgenic soybean.

Keywords: *transgenic soybean, soybean pathogens, sequencing, productivity, weather and climatic conditions.*

FIRST REPORT OF LEEK YELLOW STRIPE VIRUS ON ALLIUM SATIVUM L. IN UKRAINE

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Abstract

Garlic (*Allium sativum* L.) is a valuable crop, cultivated all over the world. Viral diseases of garlic are one of the factors that reduce quality of garlic yield. *Leek yellow stripe virus* belongs to genus *Potyvirus*, family *Potyviridae*, and garlic infected with LYSV is found in many places of garlic production. In 2018, we screened garlic-growing areas in different regions of Ukraine and collected plants with symptoms characteristic of viral infection: yellow striping and streaking, mosaic, spotting and plant growth retardation. DAS-ELISA with commercial diagnostic kit for LYSV (Adgia, USA) showed that 28% of collected plants were infected with LYSV. LYSV was detected in Vinnytsia region (Bershad district), Kyiv region (Boryspil district), and Poltava region (Semenivka district) in Ukraine, suggesting wide spread of the virus. According to available literature data, LYSV is often found in coinfection with OYDV. However, we found only 7% of plants to be mixed infected (LYSV+OYDV). Subsequent transmission electron microscopy revealed viral particles of 720-800 nm in length and 16 nm in diameter as characteristic for *Potyvirus* representatives. Further, LYSV infection was also confirmed by RT-PCR with coat protein gene-specific primers generating LYSV cDNA of expected length (~409 bp). This is the first report of LYSV-infected garlic plants in Ukraine that proves LYSV is widely spread in Ukraine.

Keywords: *leek yellow stripe virus, onion yellow dwarf virus, garlic, potyvirus, Ukraine.*

DISTRIBUTION AND TRANSMISSION OF PLUM POX VIRUS IN UKRAINE

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Abstract

The most sensitive viral disease of the stone crops is Sharka, the causative agent of which is the plum pox virus (PPV, Plum Pox virus). PPV worldwide has a quarantine status. PPV is widespread in many regions of Ukraine and poses a serious problem to horticulture stone crops of our country. The purpose of our research was to analyze the distribution and the harmfulness of this pathogen, to describe the ways of transmission, to carry out research on the identification of aphids that were carriers of the disease and to characterize its molecular features and strains diversity in the territory of Ukraine. The samples were visually selected from the central and northern regions of Ukraine. Modern methods of molecular diagnostics were used such as: polymerase chain reaction with reverse transcription, sequencing. The phylogenetic analysis confirmed the identity of the strains and helped us made a comparative characterization of the samples to the already known strains. Depending on the strain, different kinds and varieties of plants could be damaged and crop losses could significantly vary. Therefore, it is important to determine the diversity of PPV strains and their similarities with other isolates. The result revealed high level of damage to stone crops in the territory of Ukraine, especially in Odessa and the Kiev region. Harmfulness and distribution of this disease increases every year. These researches are needed to find ways to fight this pathogen and stop the spread of a dangerous virus in Ukraine.

Keywords: *Plum pox virus, distribution, strain diversity, PCR, phylogenetic analysis, Ukraine.*

THE AGRO-FOOD EXPORT TRENDS IN UKRAINE: FOCUS ON GRAIN CROP MARKET

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Abstract

The analysis of agro-food export trends in Ukraine on the example of grain crop market during 2010-2018 was done. According to study data the share of grain exports as raw materials among all agro-food products increased from 24.83% in 2010 to 38.90% in 2018. The share of flour-grinding products and ready-made grain products in total agro-food export was almost unchange able (increase from 0.81% to 0.94% and from 2.6% to 1.4% respectively). The amount of flour-grinding products and ready-made grain products export was in 100-200 times less than the amount of grain export as raw material. Our data showed that export revenue from sale of grain crop and flour-grinding grain products were positively correlated with export amount ($r=0,8097$ and $0,8648$ respectively, $p<0.01$). By contrast, the relation between export price and export revenue was not significant ($r=-0,0868$ and $-0,3694$ respectively). At the same time, export revenue from the sale of ready-made grain products had a significant impact both on export price and export amount, which confirmed positive association between evaluated parameters ($r=0,9621$ and $0,9504$ respectively, $p<0.01$). This fact confirmed the possibility of increasing the currency revenue from ready-made grain products export compared to the grain export as raw materials. In addition to direct positive impact on the economics, an increase of processing grain crop export should have a number of accompanying positive effects.

Keywords: *Grain, Flour-grinding products, Ready-made grain products, Raw orientation export, Export amount, Export price, Added value.*

EFFECT OF SALICYLIC ACID APPLICATION ON PHENYLALANINE AMMONIA-LYASE (PAL) ACTIVITY AND TOTAL PHENOLIC CONTENT IN WHEAT (*TRITICUM AESTIVUM* L.,) AND BUCKWHEAT (*FAGOPYRUM ESCULENTUM* MOENCH) PLANTS UNDER CADMIUM STRESS

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Abstract

Salicylic acid (SA) is an imperative endogenous plant hormone. It is considered as one of the most important signaling molecule involved in both abiotic and biotic stress tolerance. Application of optimal concentrations (0,05 mM) of SA enhances plants tolerance to cadmium stress by modulating levels of several metabolites including components of antioxidative defense, osmolytes, secondary metabolites, and metal-chelating compounds. When SA and Cd were applied simultaneously, the damage was less pronounced than without SA. Salicylic acid treatment itself also caused the oxidative stress, but decreased the phenylalanine ammonia-lyase activity, regulating phenolic synthesis. Thys, when the SA treatment was used prior the Cd stress, it prevented the damaging heavy metal effect.

Keyworlds: *phenylalanine ammonia-lyase (PAL), phenolic compounds, salicylic acid, cadmium chloride.*

CRITICAL TIME FOR WEED REMOVAL IN SOYBEAN AS INFLUENCED BY PRE-EMERGENCE HERBCIDES

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Abstract

By definition, the critical timing for weed removal (CTWR) is the maximum amount of time early season weed competition can be tolerated by the crop before the crop becomes subject to an irrevocable yield reduction. The concept of CTWR has been shown to be useful tool for determining the timing of weed control operations in agronomic crops. However, it has been speculated that CTWR can be influenced by the production practices. Therefore, field experiments were conducted in 2015 and 2016 at Concord, Nebraska, to evaluate the CTWR in soybean, as influenced by pre-emergence (PRE) herbicides. The studies were laid out in a split-plot arrangement with herbicide regime as the main plot and weed removal timing as the subplot. The herbicide regimes included; without PRE-herbicide and premix of saflufenacil plus imazethapyr at the rate of 280 g ai ha^{-1} or 420 g ai ha^{-1}. The weed removal timings were at V1, V3, V6, R2 and R5 soybean stages, as well as weed free and weedy season-long control. The CTWR was based on 5% acceptable yield loss. CTWR started at V1 soybean stage (21 days after emergence (DAE)) without PRE herbicide, while the application of PRE-herbicide delayed the CTWR to V5 soybean stage (34 DAE) in 2015 and to R1 soybean stage (46 DAE) in 2016. These results suggested that the use of PRE-herbicide in soybeans could delay the need for post-emergence weed control by 2 to 5 weeks.

Keywords: *Weeds, Pre-emergence, Post-emergence, critical, time.*

AMARANTH GRAIN AS ENRICHING INGREDIENT FOR BAKERY TECHNOLOGY

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Abstract

Specialized and functional food technology development is able to smooth out a problem of essential elements deficit in populations diets. Bakery products is traditional for Russia – majority of people consume it every day, so its suitable product for enriching. For mass products enrichment it's often to use non-traditional, but perspective raw materials, which an amaranth is. Amaranth is rich with protein, minerals, vitamins, dietary fiber, squalene and other nutrients. At the same time, amaranth varieties are significantly differentiated in composition and properties. The purpose of the first stage of the study was comparing the composition of amaranth as a factor determining the indicators of the purpose of its processed products. 8 grades of amaranth grain were analyzed. According to the results of research, it is recommended to use Universal variety amaranth grain as enriching raw ingredients of multifunctional action. However, the adjustment of the food products composition, including bakery products through the introduction of enriching ingredients often leads to a change in the traditional consumer properties of products - the shape, condition of porosity, color, taste and other organoleptic indicators. In this connection, as the second stage of research using flour from extruded amaranth was determining of some indicators - autolytic activity and acidity of dough. Results of study showed indicators increasing with makeweight of amaranth flour. 30% of additive non-traditional flour provides abnormal value of dough acidity, therefore that amount is critical.

Keywords: *amaranth, extrudate, enrichment, acidity, autolytic activity.*

3. ORGANIC AGRICULTURE

BREEDING INSECTS FOR AGRICULTURAL PURPOSES

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Abstract

Insects occupy a prominent place in the ecosystem. They clean, recycle and fertilize the soil and are indispensable in the food chain, being the main source of food for many animal species.Our study, aiming to use mixed insects as a natural pesticide and natural fertilizer, consisted of breeding a necrophagous flies until they were killed in a healthy and controlled environment. The dried maggots were then mixed to produce a flour that would be added to the plants as natural fertilizers to test the different growth and yield parameters in terms of yield. The results obtained showed that the insect-based flour added to the plants, improved their production potential, namely biomass yield and grain yield as well as certain components of yield.

Keywords: *Necrophagous flies, maggots, breeding, fertilizer, agricultural yield.*

BREEDING OF WHEAT VARIETIES WITH HIGH BREADMAKING QUALITY IN A DROUGHT STRESS CONDITION

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Abstract

The article provides scientific researches on breeding materials obtained from CIMMYT and ICARDA joint programs and local bread wheat varieties. The effects of the structural elements of spike in the conditions of drought stress, the effect on the accumulation of protein, productivity, also the relation of these parameters to the 1000 kernel weight and the height of the plants have studied. During the study, it was revealed that the productivity of bread wheat varieties varied between 327,2-510,0 g/m^2. The productivity of most of the bread wheat varieties mentioned above exceeded the standard of Azamatli-95. The amount of protein in the bread wheat varieties ranged from 13.8 to 14.8%. For bread wheat varieties, the maximum content of protein is higher at Gunashly (14.4%), Pirshahin (local -14.5%), and the minimum at RBWON SAA-75-13,8%, 130№120-13.9% varieties. The yield of protein per hectare at bread wheat varieties varied from 467,9-703,8 kg/ha. At studied wheat varieties between protein content and protein yield per hectare (r = -0.499 *), and productivity (r = -0.475 *) negative, productivity and protein yield per hectare (r = 0.995 **) positive correllation have revealed. Thus, on the base of all above mentioned including yield, protein content, spike structure analysis, technological quality, recommendations made to use of selected accessions for creation of high productive, high quality, resistant to a drought, and disease varieties.

Keywords: *bread wheat, productivity, spike structural indicators, drought stress.*

QUALITY AND TECHNOLOGICAL QUALITY INDICATORS OF BREAD WHEAT VARIETIES CULTIVATED IN SHEKI REGION OF AZERBAIJAN REPUBLIC

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Abstract

The article deals with quality and technological quality indicators of bread wheat varieties cultivated in Sheki BS. In bread wheat varieties 1000 kernel weight, gluten, gluten quality, sedimentation, protein, moisture, test weight, and vitreousness were studied. In researched Ugur varieties the 1000 kernel weight was high (48.0g) and on Sheki-1 was low (32.0g). Vitreousness was showed 16.0-100%. As we know, the quality of baking depends on the amount and quality of the gluten, according to the amount of gluten content, Matin, Beyaz, Sheki-1, Ugur varieties had excellent grades (36.0-37.2%).In the Azeri, Shafag-2, Fatima, Murov-2, Aran varieties classes I (32.0-35.2%), in the Azamatli-95, Markhal, Nurlu-99 varieties (28.4%-30.4%) classes II, in the Gyrmyzy gul-1, Yegane, Parvin, Mahmud-80, Zirva-85 varieties (23.2-26.0%) class III and in the Aghali variety (17.6%) class IV showed a result. The gluten quality was poor in Aghali, Gyrmyzy gul-1, Mahmud-80, Azamatli-95, Zirva-85, Fatima, Nurlu-99, Aran, Gobustan and the other varieties (91.4-111.7). The sedimentation content was high in Ugur variety (42.0ml) and lower in Aghali (15.0ml). According to the protein content, Matin, Fatima, Beyaz, Saba, Ugur varieties (13.7-13.8%) were highest and the lowest was Aghali (9.6%). Test weight was high in Mahmud-80, Matin, Zirva-85, Murov-2, Aran varieties (793-808g/l). The amounts of moisture content were closer to each other (11.5-12.3%). As a result of the researches, it is possible to give recommendations to the breeders for the selection of high-yield, high quality, drought-resistant, technologically-quali-fied varieties by selection of selected species, depending on the amount of protein, technological quality and biotic and abiotic factors of nature.

Keywords*: variety, protein, gluten, moisture.*

EFFECT OF HARMFUL AGENT ON PRODUCTION, INCOME AND BIODIVERSITY OF SHRIMP FARMING IN BANGLADESH

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Abstract

Shrimp is one of the leading exportable seafood products from where Bangladesh earns about UD$ 500 million yearly contributing 3.78% to the GDP. Shrimp farmers follow the traditional and extensive farming practices and the average productionis 275 kg/ha which is the lowest compared to other shrimp producing countries aroundthe world. Reasons of this low production are lack of better technology, dearth of quality seed and feed, and effect of shrimp disease. Small-scale organic shrimp farming practice introduced recently, has shown better production and profitability in four coastal subdistricts (Upazila) of Sathkira district in the southwest part of the country. Three different farming practices were studied: (I) organic (II) traditional and (III) extensive or control farming where farmers were interviewed to collect different data. The data showed that organic farmers'production was10.64% higher than of the traditional farmers and 20.84% higher than in extensive or control farming systems. Cost-benefit analysis showed that organic farming was more profitable compared to other practices because of low input cost and premium price received for organic shrimp. Percentage of gross sale of organic cultured shrimp was 10% higher than traditional and 19.37% higher than control or extensive shrimp farming. It was also found that the organic production (kg/ha) was little bit higher than the control and the traditional farming practices. On the other hand, traditional farming production cost was higher than the organic and control production. Considering the biodiversity conservation, organic farming is more ecofriendly culture system than control and the traditional practices.

Key word: *Harmful agent, Production, Income, Biodiversity conservation, Shrimp farming practice, Bangladesh.*

NUTRIENTS IN SWEET POTATO (*IPOMOEA BATATAS*) AND LOCAL POTATO VARIETIES

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Abstract

Sweet potato (*Ipomoea batatas*) has recently appeared on the Bosnian-Herzegovinian market, from imports. According to the available data, the production of sweet potatoes is being handled by a small number of individual producers, mainly for meeting their own needs. In the organic garden of the non-governmental organization SENSE from Banja Luka, sweet potatoes have been grown for several years, with propagation material purchased in Slovenia. On a representative sample from this garden, the basic morphometric characteristics of storage roots and their flesh were analyzed. Parameters L*, a* and b* of the flesh color were observed in the first 24 hours after cutting, with measurements after 1, 2, 3, 4, 5 and 24 hours. Chemical analysis of storage roots included: determination of dry matter, total mineral matter (ash), total acidity, total and direct reducing sugars, starch content, crude cellulose, total fats and crude protein, as well as mineral constituents: Ca, Cd, Cr, Cu, Fe, K, Mg, Mn, Na, Ni, Pb, Se and Zn. The content of certain mineral substances were also analyzed through the prism of official RDA (Recommended Dietary Allowances) tables in B&H. The obtained results were compared with the results of identical analyzes on potato samples taken from three localities in B & H: Glamoč, Lijevčepolje and Vrbanja. The results of the study showed that sweet potato color parameters differ significantly from all three potato varieties. Sweet potato contained less starch, cellulose and protein, and more sugar, fat and ash compared to all three potato varieties. Sweet potato was superior in terms of ash content *i.e*. total mineral matter,especially predominating in the content of Ca and Na, and also Cu and Zn.

Key words: ***s****weet potato, potato, flesh color, chemical composition, RDA values*.

KNOWLEDGE OF THE ECOMOMIC EFFECT OF BIOLOGICAL METHODS APPLICATION IN AGRICULTURE

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Abstract

During the past few decades investigations have been conducted on the impact of different biological methods on yields, production quality and early maturity in agriculture. The benefits of their application have been established. From a theoretical point of view, the isolated established economic effect of a factor would be confirmed if there is no a deficit of resources. The effect of the application of biologically active substances may be economically beneficial for one agricultural holding and proven as useless for another farm. The economic efficiency of the various factors must be assessed in the context of the whole set of conditions under which an agricultural enterprise operates. The aim of this study is to test the mathematical model for assessment of the economic effect of biological methods application in optimizing the structure of production. The elaboration of the production structure is one of the most important and complex agro-economic tasks in the management of the farm. The assessment of the economic effectiveness of the different biological methods will be done through an optimization model to improve the farm production structure. The results of the preliminary studies show that in assessing the impact of biological substances it is necessary to take into account not only the increase in profitability and the profit per unit area of agricultural crops, but also whether the profit of the holding has increased as a whole.

Keywords: *knowledge, agriculture, economic effect, biological methods, optimizing of production structure.*

EFFECT OF APPLICATION OF MICROBIAL FERTILIZERS ON NUTRIENT STATUS OF VIRGINIA TOBACCO

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Abstract

The effects of different microbial fertilizers (containing arbuscular mycorrhizal fungi *Glomus* spp., soil microscopic fungi *Trichoderma* spp. and plant growth-promoting bacteria *Bacillus* spp.) on soil properties and concentration of macro- and micronutrients in Virginia tobacco were studied in field experiment set on Cleyic-Chromic Luvisol in 2018. Three microbial products used were: Europlus® (Italy), Micotric L® (Italy) and Rhizo-Vam Basic® (Germany). The experimental design was a randomized complete block replicated three times. It was found that soil properties and plant nutrient levels were influenced by the use of microbial products. A comparison of unfertilized treatment indicated that with the exception of manganese and zinc, concentrations of macro- and microelements in Virginia tobacco leaves were significantly increased by the application of Europlus. The Mn and Zn concentrations were significantly higher by Rhizo-Vam Basic addition. There was a positive effect of Micotric L application on concentrations of nitrogen, potassium, calcium, magnesium and manganese in leaves, but differences with non-fertilized treatment were not significant. The results showed that microbial fertilizers used in this experiment could have a positive effect on the soil, the plants, and therefore the environment. Additional research is necessary in order to have better understanding of plant-soil-microorganisms interactions and these microbial products to be ecologically acceptable alternative to chemical fertilizers.

Keywords*: Microbial fertilizers, Tobacco, Soil, Macronutrients, Micronutrients.*

EVALUATION OF GARDEN PEA GENOTYPES FOR THEIR NODULATION CAPACITY AND GRAIN CONTENT OF ZN, FE AND MN

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Abstract

The purpose of this study was to assess the initial material of garden pea for some important characteristics, determining nodulation ability as well as for increased content of Zn, Fe and Mn in grains. Open field and pot experiments were conducted at Maritsa Vegetable Crops Research Institute in Plovdiv, Bulgaria during the period 2018–2019. In open field conditions the nodulation (%) and specific nodulation ability were assessed in ten genotypes at the beginning of the flowering stage (10 plants per accession). In pot experiment six pea genotypes were inoculated with arbuscular mycorrhizal fungi (AMF) (mainly Glomus species) using two commercial products Rizovam Basic (RHIZO-MIC UG, DE) and Funky Fungi BAC (BAC B.K., Netherlands). At the beginning of the flowering stage the nodulation (%) and specific nodulation ability were assessed in 10 plants/accession. In technological maturity, the content of Zn, Fe and Mn in green grains of the field grown plants was quantified by ICP-OES after microwave mineralization. The results showed that the highest nodulation and specific nodulation ability were achieved in variety Plovdiv in field conditions. In the pot experiment, the two AMF products had more effectiveness on variety Marsy for nodulation. No significant differences were established between genotypes for Fe grain content. However, four genotypes were distinguished with higher Mn content and three genotypes – with higher Zn content in their grains. In this study, the observed genetic variability in nodulation and the grain content of certain micronutrients enabled the selection of initial material for further breeding of high nodulating and bio-fortified pea varieties.

Key words*: Pisum sativum, microelements, nodulation, specific nodulating ability.*

Acknowledgements: This study was supported by the National Science Fund of Bulgaria, Ministry of Education and Science - Project: KP-06-H26/12 (Fundamental Research Competition – 2018).

MICROORGANISMS AT THE RHIZOSPHERE OF GARDEN PEAS VARIETIES AFTER INOCULATION WITH ARBUSCULAR MYCORRHIZAL FUNGI

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Abstract

The study was conducted at condition pots experiments, with six genotypes garden peas - "regular" and "afila". Arbuscular mycorrhizal fungi (AMF) were introduced into the soil substrate, when seeding the peas, in the form of two commercial microbial products: mono-mycorrhizal, containing spores only of species *Glomus intraradices* and poly-mycorrhizal, containing spores of the species - *Entrophosphora colombiana, G. etunicatum, G. clarum* and *G. intraradices.* The population densities of four main to soil fertility trophic groups of microorganisms related to mineralization processes of organic matter in the soil were determined. The degree of colonization with AMF of plant roots was, also, determined. A statistically significant decrease in population densities of microscopic fungi and of actinomycetes after inoculation with AMF was established. Trends depending on the variety, in the groups of microorganisms involved in the processes of transformation of nitrogen compounds into the soil were observed. Strongly proven influence of the "variety" factor at the group of mineral $NH4^+$ nitrogen assimilating microorganisms was found. The differences were not statistically proven at the ammonifing microorganisms.The two studied microbial products statistically significantly increased the degree of colonization with AMF of roots. Correlations between the degree of root colonization with AMF and the population density of the individual trophic groups of soil microorganisms were established. The study was supported by the National Science Fund of Bulgaria - Project: KP-06-H26/12.

Keywords: *Soil microorganisms, Arbuscular mycorrhizal fungi, Genotypes garden peas.*

USE OF THREE ESSENTIAL OILS AS SEED TREATMENTS AGAINST SEED-BORNE FUNGI OF RICE (*ORYZA SATIVA* L.) UNDER FIELD CONDITIONS

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Abstract

Three essential oils (EO) extracted from *Cymbopogon citratus*, *Ocimum gratissimum* and *Thymus vulgaris* were tested for their ability to control seed-borne infection of *Alternaria padwickii*, *Bipolaris oryzae* and *Fusarium moniliforme* in naturally infected seeds. Seven rice cultivars were tested and the EO, applied as slurry, controlled the seed infection at a range of 48% to 100% and reduced brown spot disease index up to 52%. The three EO also increased the germination capacity of the treated seeds with 5 to 13% and emergence up to 15%. On-farm evaluation conducted in Cameroon indicated that these treatments have shown harmless effects on the different parameters evaluated. Positive effects have been recorded with statistical significance at 95% level of confidence. Reduction of disease incidence has been recorded as a result of seed treatment with essential oils when compared to the non-treated control. Important increases have been noted in the yield of rice up to 36%.

Keywords*: essential oils, field trial, rice, seed-borne fungi, seed treatment*.

INTERCROPPING ENHANCES PRODUCTIVITY AND SUSTAINABILITY OF AGROECOSYSTEMS

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Abstract

Intercropping advantages are mainly derived from interspecific interactions, including above- and below-ground complementarity, competition and facilitation. There were lots of researches on interspecific interactions on above-ground parts, but relatively limited on below-ground interactions between intercropped species. The aim of the study was to examine role of interspecific root-root interactions in overyielding and efficient nutrient utilization of intercropping. Both field and greenhouse experiments were conducted to determine yield and nutrient acquisition advantages by adding sparingly soluble and organic Pinto soils, interspecific root-root interactions by root barrier, N complementarity by natural or enriched isotope abundance methods. Soil fertility parameters were determined in long-term field experiments. There are significant productivity advantages of intercropping in various legumes/cereals and cereals/cereals intercropping. One-thirds to 100 percentage of intercropping advantages are contributed to root-root interactions. There are two main mechanisms underlying the interspecific root-root interactions, facilitation and complementarity. The interspecific facilitation is that some crop species mobilize unavailable forms of one or more limiting soil nutrients (such as phosphorus, iron and zinc), and improve phosphorus, iron or zinc nutrition for themselves and neighboring non-mobilizing species by releasing acid phosphatases, protons and/or carboxylates, and phytosiderophores into the rhizosphere, respectively. When intercropped with legumes, cereals usually have more roots competitive to soil mineral nitrogen leading to reduction in soil mineral nitrogen, which facilitates to nodulation and biological N_2 fixation of associated legumes. The root-root interactions maintain soil fertility on a relative fertile soil and enhances soil fertility on a poor soil under continuous overyielding. Our results highlight that interspecific root-root interactions below-ground play an important role not only in overyielding and nutrient acquisition, but also maintaining or enhancing sustainability of agriculture. The mechanisms underlying the root-root interactions include interspecific facilitation on sparingly-soluble soil nutrients and complementary utilization of soil and atmosphere nitrogen in legumes-based intercropping.

Key words: *Below-ground parts, Intercropping, Interspecific Interactions, Nutrient utilization, Soil fertility.*

INFLUENCE OF SEEDING RATE ON COMMON VETCH-WHEAT FODDER CROP MIXTURE PERFORMANCE UNDER ORGANIC MANAGEMENT

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Abstract

Common vetch (*Vicia sativa* L.) originates from southern Europe and is also widespread in the Mediterranean region of Croatia. Due to the economic and ecological dimensions of growth, it is valuable to ascertain whether the application of seed inoculants or growth bio stimulators can enable ecological management of this crop in mixture with wheat (*Triticum aestivum* L.). Research was conducted through field experiment set up on agricultural area near city of Zadar, Dalmatia, during the vegetative seasons 2016/17 and 2017/18. The effect of different common vetch *cv*. Poppelsdorf sowing rates (40, 60, 80, 100 grains/m²) in mixture with wheat *cv*. Valerius (200 grains/m²), on fodder yield was evaluated through 3 treatments (control without fertilization, seed inoculation with strain *Rhizobium leguminosarum* bc *Viciae* 1001 and Bio-algeen growth bio stimulator application). The highest dry matter yield (DMY) determined on control was achieved in both years with 100 grains/m², 7,98 t ha^{-1} in 2016/17 and 8,82 t ha^{-1} in 2017/18, ($P<0.05$). The highest DMY determined with growth stimulator application was in both years significantly highest ($P<0,05$) with 100 grains/m², 9,24 t ha^{-1} in 2016/17 and 10,29 t ha^{-1} in 2017/18, respectively. The DMY determined with *Rhizobium leguminosarum* bc *Viciae* 1001 seed inoculation treatment in both years was not significantly different between 80 and 100 grains/m², although those 2 higher rates had significantly higher yield ($P<0,05$), compared to 2 lower seeding rates (40 and 60 grains/m²). The highest DMY and the biggest potential for ecological management in both years was shown by applying seed inoculation with *Rhizobium leguminosarum* bc *Viciae* 1001 (11,34 t ha^{-1} in 2016/17 and 10,71 t ha^{-1} in 2017/18).

Keywords: *Common vetch-wheat, seeding rate, ecological management, Mediterranean.*

USE OF FLOWERING STRIPS IN ECOLOGIC FARMING SYSTEMS

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Abstract

This work is focused on the actual issue of decreasing biodiversity and increasing problems with pests. These problems are one of the impacts of monocultural growing systems and disappearance of natural structures in agricultural landscape. Introduction of such structures, for example flower strips, is one of the options that can support and increase biodiversity and abundance of beneficial organisms in agroecosystems. An experiment was focused on the beneficial organisms appearance in flowering strips compared to the control zone. The next part was assessing the effect of the irrigation and ranking of the flowering period. The trial was established and evaluated during 2014 and in 2018 on the ecological farming area of Faculty of Horticulture in Lednice na Morave. It was obvious that flowering strips had positive impact on some families and orders of beneficial organisms. Chosen mixture of plants contained flowers continuously blooming during the season. Irrigation had effect on appearance of several plants species, weed development and also there were variations in abundance of beneficial insects. A gradual reduction of the coverage of each species and at the same time the reducing number of flowering species was found in the mixture during 2018. It is apparent that the seed mixture may no longer adequately fulfil the ecosystem service and therefore it would be advisable to restore the mixture.

Key words: *biodiversity, beneficial organisms, plant mixture, flowering period.*

ORGANIC AGRICULTURE FOR SUSTAINABLE PRODUCTION OF SOME PROMISING HALOPYTIC PLANTS IN SALINE ENVIRONMENT

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Abstract

Applying organic farming systems in biosaline agriculture, is unconventional approach for sustainable using of marginal soil (salt affected soils with poor drainage) and desert land for planting non-traditional halophyticcrops such as *Leptochloa fusca, Kochia indica, Sporobolus virginicus, Atriplex nummularia* and *Spartina patens* irrigated with saline water. These plants are highly salt tolerant C_4 halophytic forage plants grown well in coastal salt marsh. It has a special place in newly emerging farming systems, especially in coastal areas and where fresh water resources are not available or in short supply. We can call it environmentally smart crops because they ensure food and feed security, contribute to energy security, guarantee environmental sustainability, and tolerate the negative impacts of climate change. Organic agriculture is the most important and widely practiced agro-ecological farming system. It is claimed to be the most sustainable approach and long term adaptation strategy. It emphasizes recycling techniques and low external input and high output strategies. It is based on enhancing soil fertility and diversity at all levels and makes soils less susceptible to erosion. It is also reported to be climate change resilience farming system as it promotes the proper management of soil, water, biodiversity and local knowledge and provide producers with ecologically sound management decisions. To achieve the aforementioned objectives, a field experiment was carried out at the Model Farm of National Research Centre, El Tour, South Sinai to study the impact of biofertilizer inoculation with either vesicular-arbuscular mycorrhizas, *Azotobacter chroococcum* or soil yeast (*Rhodotorula glutinis*) alone or in combination with organic fertilizer (chicken residues) on some growth characters, photosynthetic pigments content, crude protein content and some physiological aspects as well as nutritive values of five halophytic plant species (*Leptochloa fusca, Kochia indica, Sporobolus virginicus, Atriplex nummularia* and *Spartina patens*). Our results showed that combined application of organic and biofertilizer treatment enhanced all the previous character as compared with control treatment (mineral fertilization).

Key words: *Organic agriculture, Halophytic plants, Saline environment.*

EFFECT OF SPRAYING SULPHUR, MAGNESIUM, ZINC AND, ON FRUITING OF SUPERIOR SEEDLESS GRAPEVINES

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Abstract

During 2017 and 2018 seasons, Superior seedless grapevines received four concentrations of boric acid. (17% B) namely a1) 0.0%, a2) 0.025 % , a3) 0.05 % and a4) 0.1% and eight treatments from single and combined applications of sulphur, magnesium and zinc. The main target of this investigation was studying the effect of spraying sulphur, magnesium, zinc and boron on some vegetative growth characters, as well as physical and chemical characters of Superior seedless grapevines. Selecting the best combination of these essential nutrients responsible for overcoming the problems of small berries and shot berries accompanied with improving yield quantitatively and qualitatively was also considered. From economical point of view, it is recommended to spray Superior grapevines with a mixture containing sulphurat 0.1%, magnesium sulphateat 0.5 %, chelated –Zn at 0.01 % and boric acid at 0.05 % four times before bloom, just after berry setting and at two weeks intervals for improving growth, vine nutritional status, yield and quality of the berries in addition to produce filled and low shot berry clusters. This recommendation was true under experimental and resembling conditions.

Key words: *Shot Berries, Superior Grapevines, Magnesium, Zinc, Sulphur, Boron.*

BLUEBERRY CULTIVATION IN PEAT SOIL: EFFECT OF ORGANIC FERTILIZERS ON PLANT PRODUCTIVITY AND FRUIT QUALITY

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Abstract

Blueberries (*Vaccinium* spp.) are calcifuge plants preferring the soil rich in organic matter. Therefore, there is an increasing interest in the environmentally friendly cultivation potential of these plants in peat soils with low pH. The aim of this study was to determine the influence of two commercial organic fertilizers on the plant productivity and chemical composition of blueberry fruit in peat soil under organic farming system. The 6-year old blueberry plantation is located in a harvested (milled) peat field. Till 1989 this area was used for industrial peat production. The soil of the experimental area belongs to the soils subgroup *Fibri–Dystric Histosol* (*Drainic)*, the peat layer was more than 1 m thick, the organic matter content was >70%, and the pH_{KCl} was < 3. Five half-highbush blueberry *Vaccinium corymbosum* × *V. angustifolium* clones (new Estonian breeds) were used in the trial (20/00, 10/13, 7/03, 23/00, 10/00). Organic fertilizers Monterra 4-2-8 and Monterra 9-1-4 were applied with the rate 100 g/plant. Higher K-content in the fertilizer Monterra 4-2-8 increased the yield and the content of total phenolics, anthocyanins and soluble solids and decreased organic acids content in fruits. The SPAD (portable chlorophyll meter) value of the Monterra 9-1-4 treatment was significantly greater than the Monterra 4-2-8 treatment. Fertilization treatments did not influence the vegetative growth parameters of plants, fruit weight and ascorbic acid content. Fertilizers did not affect soil pH within six years.

Keywords: *Organic farming, pH, phenolic, vitamin C.*

EFFECTS OF COMPOST APPLICATION RATES AND MULCH THICKNESS ON SOIL PHYSICOCHEMICAL PROPERTIES OF SALT AFFECTED SOIL OF DUGDA DISTRICT OF ORAMIA REGEON (ETHIOPIA)

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Abstract

Studies were conducted as on-farm trials at Dugda District of Oromia region to evaluate the effect of different compost application rates (0, 2, 4 and 6 ton/ha) and mulch thickness (0 cm/ha, 5 cm/ha, 10 cm/ha, and 15 cm/ha) on soil physicochemical properties and crop performance in terms of yield of Solanum *lycopersicom. L Production*. The experiment was conducted in factorial experiment arranged in a randomized complete block design with three replications. Results showed that, Mg, Om%, CEC, Ec (ds)/m, Na, and Available (Av.P) ppm were significantly ($p<0.01$) affected by the interaction effects of compost application rates and mulch thicknesses. However, pH, TN%, OC%, and Ca were significantly ($p<0.01$) affected by the main effects of compost application rate. Marketable fruit yield was significantly affected by the level of compost and its interaction with mulches. The optimum fruit yield was 37.23t/ha found from 6t/ha compost rate and 10cm mulch thickness applied plot.Yield obtained from the treatment combination of 6 ton/ha compost rate and 10 cm mulch thickness was argonomically and economically profitable by 15.56% for farmers.

Key words: *salt affectes soil, soil amendment, soil properties, yield.*

CORRELLATION BETWEEN MULCHING, MYCORRHIZA FUNGI, AND OTHER PARAMETERS IN LETTUCE IN TWO FARMING SYSTEMS

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Abstract

The most important soilborne fungi are mycorrhizal fungi, including Arbuscular mycorrhiza. Their importance is that they create a symbiotic relationship with the roots, therefore helping the plant to absorb nutrients and water. Recently, more research has been done on their use in agriculture, with more promising results. Our experiment took place parallel in Szent István University, experimental fields of conventional and organic farming system, Budapest, Hungary. Control, alfalfa and rye straw mulch treatments were prepared. We investigated the correlation between mulching, mycorrhizal colonization, morphological and inner content parameters of lettuce. In addition, the effect of the two kind of cultivation methods on mycorrhizal colonization was Lettuce is one of the leaf vegetables grown worldwide in the largest area, and the importance of an environmentally conscious lifestyle is becoming more and more important, and as a result the role of organic farming has become more valuable. Alternative methods are applied to the occurring problems (pests, diseases) in organic farming. One of these methods is mulching, which has positive effects, such as: weed control, regulation of soil water balance, fertilizing effect and soil life stimulation. studied. Results showed several correlations between the different parameters. Mulching and farming system affected the quality of lettuce and mycorrhizal colonization of roots. Also, colonization affected the phosphorus uptake of the plants. However, due to the method of conventional cultivation, these differences were less remarkable. Altogether, more environmentally friendly cultivation has a positive effect on the amount of mycorrhizal fungi.

Keywords: *mycorrhiza, lettuce, inner content, organic farming, conventional farming.*

PHOTOSYNTHESIS RESPONSES TO VARIOUS FERTILIZER TREATMENTS IN PEPPERMINT GROWN UNDER WATER DEFICIT STRESS

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Abstract

The severe decline of rainfall over the last decades along with overuse of chemical fertilizer is a major cause of soil fertility loss. The current study was conducted under open condition to examine the effect of vermicompost and urea fertilizer under drought stress condition on some photosynthetic parameters of peppermint. The experiment was designed as factorial based on completely randomized design with three replications in 2016. Different irrigation levels consisted of 75 (control, I_3), 60 (I_2) and 45% (I_1) of field capacity. Different proportions of vermicompost and urea consisted of control (F_1), 100% vermicompost (F_2), 75% vermi+25% urea (F_3), 50% vermi+50% urea (F_4), 50% vermi+75% urea (F_5) and 100% urea (F_6). Results for interaction indicated a significant reduction in photosynthetic pigments and gas exchange traits except Cartenoids and intercellular CO_2. Fourty and 55% irrigation significantly decreased the content of stomatal conductance. In contrast, intercellular CO_2 increased when plant was under stress condition. The highest amount of chl a was in interaction of I_3 and F_2 treatment. The peak of chl b was in I_3 treatment interaction with F_6. Drought stress significantly reduced the ratio of a/b chl and the major a/b ratio was achieved in I_3 and F_3 treatment. It was found that the highest contain of cartenoids was obtained when drought stress was treated. Generally, the amount of photo and transpiration rates were higher in normal irrigation than in drought stress. The peak of these traits was observed in F_5 and F_6 treatments, respectively.

Keywords: *Drought, Mentha Piperita, Photosynthetic Pigments, Photosynthetic rate, stomatal conductance.*

INVESTIGATION ON THE EFFECTS OF THE COVER CROP, CUMIN (*CUMINUM CYMINUM*), ON SOME AGRONOMIC AND QUALITATIVE TRAITS OF SAFFRON

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Abstract

As well as the expansion of land use due to the short period of saffron growth, its intercropping can also enhance yields and agronomic traits, which usually happens through weed control, shading, and reduction of soil temperature and growth climate. Therefore, the effects of cumin seed rates in an intercropping on quantitative and qualitative characteristics of saffron were studied in a Randomized Complete Block Design (RCBD) with three replications in Zaveh, Torbat-E Heydariyeh, Iran, during 2016-17.Treatments included five levels of cumin seed proportions (25, 50, 75 and 100% of the optimum density). The results of the study indicated the significant effect of cumin seed rates on all the measured traits of saffron except the number of flowers, replacement corms (daughter corms) and leaves, as well as safranal value. The minimum (8.03 kg/ha) and maximum (14.88 kg/ha) weight of dry stigma was associated with the ratios of 100 and 25% of cuminseed, respectively. Any increase in the ratioof cumin seed by over 25% reduced the amount of other quantitative traits. The cumin seed ratio showed significant effects on the number of umbels per plant, the number of seeds per plant, and seed yield. Since the increase in the number of seeds per plant as a result of low ratios of cumin seed cannot compensate for the reduction of plants, therefore, lower yields would be attained. Totally, increasing shading and less competition, due to lower ratios of seed, improves physical, chemical and biological conditions of the soil, and helps to save more water. Such conditions improve the traits of corm, flower, and photosynthetic area, and so results in an economical saffron yield.

Keywords: *Saffron, Cumin, Cover crop, Yield, Qualitative Traits.*

ISOLATION, IDENTIFICATION AND PERFORMANCE OF PHOSPHATE-SOLUBILIZING BACTERIA FROM WARM-WATER FISH POND IN IRAN

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Abstract

As a critical nutrient, phosphorus plays an important role in controlling primary productivity in warm-water fishponds. Concentration of water-soluble phosphate is often very low, since a large portion of soluble phosphate in fish ponds often bonds and forms insoluble complexes with calcium (Ca^{2+}) and magnesium (Mg^{2+}) in calcareous soils and with iron (Fe^{3+}) and aluminum (Al^{3+}) in acidic soils. Application of phosphate solubilizing bacteria (PSB) is one of the most important new approaches for increasing water-soluble phosphate that are consistent with the principles of sustainable aquaculture. For this purpose, sediment sampling from 30 warm-water fishponds in Mazandaran province was carried out. A total of 64 PSB strains were isolated using National Botanical Research Institute medium (NBRIP) that contained tricalcium phosphate (TCP). In this study, 11 stronger PSBs, identified by 16s rRNA gene sequence, showed good ability in solubilizing TCP, including *Acinetobacter lactucae* ($Persian_{11}$), *Pseudomonas frederiksbergensis* ($Persian_7$, $Persian_8$ and $Persian_9$), *Pseudomonas deceptionensis* ($Persian_9$), *Pseudomonas kilonensis* ($Persian_6$), *Pseudomonas putida* ($Persian_3$), *Pseudomonas taiwanensis* ($Persian_1$ and $Persian_2$) and *Pseudomonas umsongensis* ($Persian_4$ and $Persian_5$). Based on the ability to dissolve TCP in liquid medium as well as growth in the range of environmental parameters of warm-water fishponds (temperature, pH and salinity), the $Persian_{10}$ was selected as the strongest PSB strain, with an ability to release 80.52 mg/l of phosphorus. According to the results of this study, the $Persian_{10}$ strain can be used as an effective bio-fertilizer in warm-water fishponds.

Keywords: *Phosphate solubilizing Bacteria, Bio-fertilizer, Fishpond, Sustainable aquaculture, Sediment.*

ORGANIC BEEKEEPING DEVELOPMENT IN LATVIA

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Abstract

Organic farming as the more sustainable agriculture system shows considerable growth on the global and EU level, including Latvia. The paper discusses the achievements of organic beekeeping, as well as perspectives and some threats. The aim of the paper is twofold: 1) to assess organic beekeeping (i.e., production of bee products and related services), as well as the latest development trends and issues of the sector; 2) to evaluate the role and impact of RDP 2017-2020 measures on the development of the sector. Beekeeping is an important sector, which produce more than 27% from total honey production in 2017. The paper discusses achievements of organic beekeeping, as well as perspectives and some threats. The aim of the paper is twofold: 1) to assess the role of organic beekeeping (i.e., production of bee products and related services), as well as the latest development trends and issues of sector; 2) to evaluate the role and impact of CAP or RDP 2017-2020 measures on the further development of the sector. Beekeeping is an important organic sector, which produce more than 27% of honey from total national production in 2017. There is growing trend to diversify of or bee products and related services (i.e., heritage or agritourism, apitherapy etc.). Various activities, cooperation and collaboration forms support the distribution channels of organic bee products and services, and boost the added value and beekeepers' income. The main threat of further development of organic beekeeping is as follows: reduction of biodiversity (i.e., agrobiodiversity), increasing monoculture (i.e., rape) and usage of pesticides.

Keywords: *Organic beekeeping, Bee products, Latvia.*

ORGANIC FARMING IN LITHUANIA – THE FUTURE OF THE CAP IN ENVIRONMENT PROTECTION

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Abstract

The greater attention in EU countries has to be paid to the aspects of environment protection (sustainable management of natural resources, the preservation of biodiversity, environment and ecosystems), as well as to the use of environment-friendly "green technologies" which help to reduce the influence of climate change. In this area results of organic farming in period 2010-2018 would be presented. Therefore, the organic production method plays a dual role in society: it creates a specific market that responds to consumer demand for organic products, as well as benefiting society, contributing to environmental protection and animal welfare and rural development. From 2015, the number of organic farms decreases by about half in a year, but the total area of organic production is increasing. This shows the tendency of farm consolidation in 2015. 220 163 ha, 2 672 farms were certified and 244 354 ha and 2 425 farms were certified last year in 2018. So, in 4 years, 247 farms have left organic production. Still, small farms employing up to 30 hectares are very large - 830, although their total cultivated area is only 12,000 ha. In recent years, the structure of organic crops has changed.Ten years ago, cereal crops accounted for about 70 percent. The area is now only about 40 percent as much as perennial grasses. This means that more closed-loop farms have come to ecology. Last year 1,069 livestock farms were certified. They contain 14,485 dairy cows, 11,307 cows, 432 bulls, 31,770 cattle, 442 horses, 1,060 goats, 24,209 sheep, 142 pigs, 1,176 cattle. Every year, the number of organic birds is growing - 16,719 last year, of which 12,950 are laying hens. 1,019 bee families have been certified. Changes in Lithuanian regarding organic farming will be presented in oral poster.

Keywords: *Common agriculture policy, organic farming, Lithuania.*

INFLUENCE OF ORGANIC AND MINERAL FERTILIZERS ON THE AGROCHEMICAL PROPERTIES OF SOIL IN ORGANIC VEGETABLE FARMS

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Abstract

The inversigations were carried out in Lithuania, at Vytautas Magnus University's Agricultural Academy Test Station in loam *Calc (ar) i-Epihypogleyic Luvisol - LVg-p-w-cc* neutral, average humus, phosphorus and potassium soil. The investigation has been carried out with organically grown carrots and naturally occurring mineral phosphorus and potassium fertilizers, certified in organic farming system, such as: phosphorite powder, Patenkali, and organic fertilizers (cattle manure compost and vermicompost). The aim of the study was to investigate the influence of natural mineral and organic fertilizers on the agrochemical properties of the soil in the system of organic gardening. The amount of organic carbon and humus, mobile potassium, phosphorus and total nitrogen decreased in unfertilized soil. The soil natural fertility decreased, it was degraded. The use of phosphorus fertilizers increased the amount of mobile phosphorus in the soil, while fertilizing with potassium, the amount of mobile potassium increased the amount of mobile potassium, mobile phosphorus and organic carbon and humus decreased accordingly. The natural mixture of phosphorus and potassium fertilizers solved the problem of the decrease of mobile phosphorus and potassium in the soil, but the tendency of the decrease of humus in the soil remained. Organic fertilizers increased organic carbon and humus in the soil. The content of phosphorus and potassium in organic fertilizers was insufficient to ensure the accumulation of phosphorus and potassium in the soil. Fertilization by cattle manure vermicompost and compost had the greatest impact on the accumulation of organic carbon and humus in the soil. Vermicompost was more effective than compost.

Keywords: *organic gardening, carrots, fertilizers, soil agrochemical properties.*

EFFECT OF DIFFERENT ECOLOGICAL ENVIRONMENTS ON ORGANIC CULTIVATED BUCKWHEAT GENOTYPES

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Abstract

This study examined the yield of 11 buckwheat genotypes in the municipality of Bijelo Polje, Montenegro. Investigations were carried out in micro experiments at two localities (Laholo and Pašića Polje) in 2015 and 2016. The cultivation of buckwheat on both experiments was according to the ecological principles. The experiments were conducted in two different locations (altitude difference 220 m) in four repetitions. The genotype of "Godijevo" was used as a standard variety. The yield, plant height and weight of 1000 grains (TGW) were tested. The following parameters were computed: the average value (x), the standard deviation (SD), the coefficient of variation (CV), and three factors analysis of variance (ANOVA). The yields for all genotypes were higher at the locality "Laholo" at 830 m a.s.l. The average height of the plants had higher values on the locality of "Pašića Polje" (610 m a.s.l.). The results of yield in this study (organic production) were lower than the average values for buckwheat in these areas (conventional production). The average yield, for two years, of all 11 varieties on the experiment of "Pašića Polje" was 604.0 kg ha^{-1}, and 666.0 kg ha^{-1} at "Laholo" locality. The highest yield at the locality "Pašica Polje" had variety France (726.13 kg ha^{-1}), while on the locality "Laholo" the best yield was in variety Buckwheat 2 (760.87 kg ha^{-1}). The highest average TGW had Heljda 1 variety (26.45 g). Analysis of variance showed very significant differences of yield, TGW and plant height between genotypes, years and locations.

Keywords: *buckwheat, genotype, yield, locality.*

CONSUMERS' PREFERENCE AND WILLINGNESS TO PAY FOR ORGANIC AMARANTH AND TOMATO IN NIGERIA: CHOICE EXPERIMENT APPROACH

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Abstract

In Nigeria, increasing high demand for amaranthus hybidius and tomatoes coupled with the susceptibility of these vegetables to location and cultivar-specific pests and diseases motivate farmers' heavy and often unguided reliance on synthetic pesticides. Considering consumers' preference and Willingness to Pay (WTP) for organic vegetables in south-western Nigeria, empirical evidences to drive development of organic agriculture remain sparse. Using discrete choice experiment, taste parameters and heterogeneities were estimated from 6,669 observations generated from a random sample of 247 households within Akure metropolis, Ondo State. Four specifications of generalized multinomial logit and mixed logit models were estimated. Price, chemical reduction, taste, freshness and NAFDAC-certification attributes were consistently revealed as strong predictors of consumers' choice of organic amaranth. Preference for organic tomato was predicted by price, chemical reduction taste, complete and partial freshness. Also, respondents were willing to pay a premium for chemical reduction 1.45 times their WTP for NAFDAC certification; 2.9 times that for taste and 1.74 times and 3.1 times the WTPs for partial freshness and complete freshness attributes. We suggest policies that raise consumers' awareness of organic food, include standardization of organic agricultural production in curricula of NAFDAC and revive the moribund organic fertilizer plant in the study area.

Keywords: *Consumers' preference, choice Experiment, Multinomial logit, Freshness, Nigeria.*

UTILIZATION OF SUMMER GAP WITH INTEGRATION OF BIOCHAR AND LEGUMES AS SUSTAINABLE TOOLS FOR IMPROVING CROP PRODUCTIVITY AND SOIL FERTILITY

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Abstract

To reduce reliance on scientific fertilizers due to rapid increase of fertilizer prices and environmental constraint it necessary to improve crop productivity and soil fertility on sustainable basses. Utilization of summer gap through biochar and legumes have pleasant effects on improving crop productivity and soil fertility on long term basses. Two years field experiments were conducted on wheat and maize crops with summer gap utilization with legumes and biochar at research farm of agronomy, the University of Agriculture Peshawar during 2011-2013. Wheat-maize-wheat cropping system was followed with the adjustment of legumes in summer gap (land available after wheat harvest till maize sowing). Legumes i.e. mungbean, cowpea and Sesbania with a fallow were adjusted in the summer gap with and without biochar application. Biochar was included at the rate of 0 and 50 t ha^{-1} with four N levels of 0, 90, 120, 150 and 0, 60, 90, 120 kg ha^{-1} to subsequent maize and wheat crops, respectively. In legumes experiment, biochar increased fresh and dry fodder yield in cowpea and Sesbania, grain and biological yields in mungbean. In maize experiments, biochar improved grain yield. Nitrogen application increased grain and biological yields. In wheat experiments, increase in nitrogen level enhanced biological and grain yields. It can be concluded that use of biochar and legumes in summer gap improve overall farm productivity and soil fertility on sustainable basses.

Keywords: *Biochar, legumes, sustainability, soil fertility and cropping system.*

AGRICULTURAL UTILISATION OF BIOWASTES AND BIODEGRADABLE WASTES

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Abstract

Due to rapid urbanisation and an increasing global population huge amounts of diverse wastes are produced. In this group a particularly important role is played by biowastes and biodegradable wastes. Presently in most European countries landfill disposal of these substances is banned, which makes them a potentially very attractive alternative for organic agriculture, after appropriate preparation such as stabilisation and/or composting. It is well known that the chemical composition of individual waste groups varies and consequently it will influence their agricultural quality. Therefore this study is focused on the verification of the above assumption. For this purpose 3 different composts (prepared from sewage sludge, garden and park wastes and a mixture of kitchen and garden wastes) and 2 municipal sewage sludge samples originating from one small and one bigger municipal wastewater treatment plant were evaluated in terms of their chemical properties (contents of macro- and micronutrients, the quality and quantity of humic compounds). Additionally, phytotoxicity of the composts and sewage sludges was analysed using phytotests. The study clearly demonstrated that the sewage sludges, independently of their origin, were more abundant in most macronutrients (e.g. C, N, P, S, Mg and Na) and micronutrients (Fe, Zn, Cu, Ni) in comparison to composts. At the same time it should be underlined that regardless of compost compositions they were richer in organic matter and Ca, K and Mn contents. Moreover, the composts were characterised by more favourable properties of humic substances and their influence on plants manifested in phytotests was more advantageous than that of the sewage sludges. The obtained showed both the analysed composts and sewage sludge to be promising organic substances as potential substitutes of mineral fertilisers according to the principles of sustainable agriculture, which becomes the predominant trend in agronomy.

Keywords: *Compost, Biowaste, Sewage sludge, Nutrients, Humic compounds.*

ORGANIC AGRICULTURE IN CENTER REGION OF PORTUGAL: THE BEIRA LITORAL AND LIS VALLEY DISTRICT CASE STUDY

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Abstract

The aims of this study are to analyze the agricultural structure and to typify organic farmers in Center Region. The methodology included interviews with farmers and field visits to confirm the regional database. The first region to be analyzed was Beira Litoral and then, based on the results obtained, surveys were carried in the Lis Valley for a more delimited analysis and with the objective of evaluating the predisposition for agricultural system change. This work revealed elements that have enabled researchers to develop organic agriculture, to overcome the obstacles faced by farmers, to help boosting chain elements' confidence and reducing confusion between different farming practices. In the Lis Valley subregion, the improvement of the agricultural system was considered to allow more efficient production, while saving resources; also, the improvement of the agri-environmental system would allow the conversion to organic agriculture. The conversion is not achieved solely by means of a holistic approach, and it is necessary to use both personal communication and social groups in each region to show farmers the importance and the benefits that may result from this change. According to the evidence available, providing farmers with credible information is essential to increase their confidence in organic farming. Trust in organic farming also depends on farmers' confidence. It is necessary to work on creating adequate training for their needs and to provide accurate and real information on the difficulties and benefits of organic agriculture.

Keywords: *Organic farmer, Portuguese Center Region, Lis Valley irrigation district.*

THE USE OF FUNGI OF THE GENUS TRICHODERMA TO REDUCE THE INFECTIOUS BACKGROUND OF THE SOIL

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Abstract

Fungi of the genus *Trichoderma* and preparations based on them have long been used as effective antagonists to suppress a wide spectrum of phytopathogenic microflora and to induce soil improvement. The effect of seven strains of fungus of the genus *Trichoderma*, isolated from the soils of different climate zones, were studied for 1) their ability to inhibit the growth and activity of pathogens, 2) their effect on the biodiversity of the soil microbiota and the increase in associative nitrogen fixation, and 3) their stimulation of growth and development of *Brassica oleracea*. It has been shown that *Trichoderma* strains isolated from the soil of agrophytocenoses, where organic fertilizers have been used for a long time, have the greatest impact in suppressing the growth and development of pathogenic microflora. These strains differ from those that are isolated from badlands due to a steady nitrogen-fixing effect and the high destruction rate of plant residues. They are characterized by a low growth rate and insignificant sporulation when compared to other strains of the same kind. However, a positive impact has been noted in the increase of the number of non-pathogenic soil microflora, and the approximation of this indicator on fertile soils. This would suggest that the search and selection of products for the development of biological preparation, potentially effective for organic farming and bio- vegetable production, should be carried out in resistant agrophytocenosis soils, as they accumulate a genetic memory for maintaining the sustainability of the soil ecosystem and for the conservation of biodiversity.

Keywords: *Trichoderma, soil fertility, organic agriculture.*

SOME ASPECTS OF THE ORGANIC FOOD MARKET IN SERBIA

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Abstract

The paper aims at analyzing organic food market in Serbia with a particular focus on structural characteristics on production units and organic food distribution channels. Secondary data were collected mainly from Serbia Organica's database and includes 102 registered domestic producers/processors. Our research showed that the organic market in Serbia was still immature, as it was not well-organized and the products were not readily available on the market. The overall market share for organic food was extremely low as well as share of utilized area under organic production in total agricultural land. Research results indicate that the majority of farms are small, with fruit growing being the most prevalent activity. Majority of producers sold their products to wholesalers and to processing companies. The size of farm is not the main obstacle for further development of the organic food market since there is no statistically significant correlation between distribution channels and the utilized land for organic production. Despite that, the sector showed positive tendencies - domestic growers were increasingly turning to certified organic farming systems; large retails chains upped their offer of organic imported products; a large companies getting involved in primary agricultural production on larger land areas; and promotion of organic products was intensified in the past years. Taking into consideration that the majority of organic producers in Serbia are small farmers, in order to increase the supply, an improved framework for business development should be applied. In order to develop the local organic market, a complex measures must be adopted.

Key words: *Distribution channels, organic agriculture, organic market, Serbia*.

DEPENDENCE OF GRAIN YIELD OF SPELT ON LOCALITIES AND DIFFERENT TYPES OF FERTILIZER

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Abstract

Investigations of organic technology for spelt in the different regions were carried out by placing the field experiment using the random block system method, in three repetitions, during 2010/11. and 2011/12. year, at the experimental school of the Faculty of Agriculture in Belgrade, in the village Jasenica near the town of Valjevo and on Zlatar, Radijevici village. As a material was used late varieties of spelt (Nirvana), selected at the Institute of Field and Vegetable Crops in Novi Sad. In order to increase the fertility of the soil, or increase the content of nutrients, and above all phosphorus that was deficient, commercial organic fertilizer was used in the form of granules under the trade name "Biohumus Royal offert". The second treatment was the use of zeolite and hydrogel soil conditioners (Aqua Vitadi Natura d.o.o), which is also ploughed down in autumn, with the aim of keeping moisture, preventing nutrient losses and, consequently, positively affecting useful microorganisms, as well as stabilizing heavy metals in the soil. The third variant was the combined application of organic fertilizer and soil conditioner. Also, it was used microbiological fertilizers "Uniker" and "Slavol" and their combination with organic fertilizer and soil conditioners. Statistical analysis of data for grain yield was performed using analysis of variance for one factorial experiment and for individual comparisons; we used the least significant difference (LSD test). The results of the study showed that the grain yield of spelt cultivated in the organic production system in the differents region of Serbia was statistically varied depending on the fertilizer variant. The average yield of grain of spelt was 4954 in first, 3093 in second and 2241 kg ha^{-1} in third locality. The best result was achieved by combined use of zeolite and biohumus, where the average two-year yield of spelt grain was 3550 kg ha^{-1}. It is interesting to note that yields (4377, 2756 and 2216 kg ha^{-1}) were obtained on the control treatment without the use of fertilizers, is not much lower than the yield in fertilizing variants, because crop rotation effect in first and the soil has not been used for agriculture production for a long time in other localities, retained favourable fertility characteristics and enabled the plants to increase productivity. This fact is very important because in Serbia there are a lot of those lands, which can be used for organic production, especially low-input crops, such as a spelt.

Key words: *growing technology, organic fertilizer, soil conditioner, spelt, yield.*

PHENOLIC ACIDS PROFILE OF ORGANICALLY GROWN EMMER AND SPELT

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Abstract

Ancient wheats, that have remained unchanged over the last hundred years, are gaining interest since several studies suggested that they present healthier nutritional profile than modern wheats. The most common forms of phenolic compounds in wheat are presented by phenolic acids, one of the major and most complex groups of phytochemicals in cereal grains. Phenolic acids are often scarce in commercial wheat flours, because they predominantly occur in the bran, i.e. the aleurone layer and outermost pericarp, which are usually eliminated during milling. Little information is available on phenolic acids composition and concentration in different *Triticum* species, as well as on possible environmental effects. The aim of this study was to explore differences in the phenolic acids content of different *Triticum* species with focus on their free and bound fractions, and their changes caused by different climate conditions. Content of biologically active compounds determined as free, bound and total phenolic acids, did not differ significantly between spelt and emmer. Dominant compound was ferulic acid, which accounted for 72.5% of free and 94.9% of bound forms of phenolic acids, with no significant difference between species. Differences in the content of other determined phenolic acids were significant in both, free and bound (except caffeic acid) forms among *Triticum* species. Spelt was characterized with significantly higher concentration of *p* - hydroxybenzoic, salicylic and syringic acid, while, on the contrary, emmer achieved higher concentration of *p* – coumaric and sinapic acids.

Keywords: *Spelt, emmer, phenolic acids.*

ANTHILL SOIL UTILIZATION IN MAIZE CROPPING SYSTEMS: AN ENDOGENOUS SOIL FERTILITY MANAGEMENT PRACTICE BY SMALLHOLDERS IN ZAMBIA

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Abstract

We surveyed two districts of Zambia, namely, Choma and Pemba. The overall objective of the study was to get farmer perceptions of anthill soil utilization practices for key information that would contribute towards the development of anthill soil based research agenda. The study employed both qualitative and quantitative methods approach to collect data from the respondents that included farmers and key informants who had the knowledge about anthill soils in crop production. Qualitative data were analyzed using triangulation method and Computer Assisted Qualitative Data Analysis Software (CAQDAS), Nvivo version 10, while data generated from quantitative interviews with a Smart phone Application (Open Data Kit) were analyzed using Statistical Package for Social Sciences (SPSS). Results revealed that the major key hurdles to the application of anthill soil lay in biophysical, technological, land, institutional and agro-climatic constraints. Broadly, farmers reported decreasing in soil fertility (69.74 %), limited farm products (69.23 %), security of land tenure (48.21 %), limited access to research and extension services (54.62 %) and finance (66.41 %) as major constraints confronted on their farms coupled with poor rainfall patterns (94.62 %). We, therefore, advocate for strengthened social networks of the smallholder farmers for them to have access to information on the efficient approach of utilizing anthill soil technology. Enhancing institutional linkages between research and extension is critical for information dissemination which would aid in decision making as to when farm operations would be carried out for improved agriculture production and productivity.

Keywords: *Anthill soil, Practice, Smallholder farmers, technology, Zambia.*

THE INFLUENCE OF MULTIPLE MIXED INFECTIONS IN AGARICUS BISPORUS

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Abstract

Bacterial diseases are a huge concern for mushrooms farmers and cause huge economic losses to the industry every year. Mycoplasmosis is a new hreat currently faced by other industry worldwide. Mycoplasma is a wall-less bacterium. Mycoplasmosis is an genetic transmitted. Commonly used methods for diagnosis of Mycoplasma include isolation and identification of bacteria, several serological tests and molecular techniques. The review summarized the pathogenesis of Mycoplasma, associated risk factors, diagnostic tools and control measures. Best measures to control Mycoplasmosis include biosecurity, hygiene, good management, monitoring and removal of infected fruit bodies and farmer awareness. To reduce the risk of transmission of disease to other populations, there should be continued monitoring of flocks for Mycoplasma. For the presence of mycoplasma, we tested the roofing primer. We have found that mycoplasmal symptoms in the event of infection of the casing soil correlated with data on the isolation and identification of the disease. Pathogen: bacteria from the genus Pseudomonas causes mycoplasmosis on fungi. We have diagnosed their inherent symptoms: the acquisition of young gray-colored fruit bodies, premature disclosure. The presence of exudates in the samples also testifies to the mycoplasmal nature. The champignons affected by Mycogon formed exudates, this was observed in 36% of the samples studied. We have optimized microbiological methods for the detection of mycoplasma infections of a particular fungal culture. We are applied the method of antisera. Samples of Mycogon and mummification were highly sensitive to antibiotics Coprinus and Bacterial mildew were sensitive; bacterial lesions of the substrate. We carried out the initial screening of champignon samples in greenhouse conditions for mycoplasma infection. We studied the prevalence of mycoplasma champignon diseases in conditions of farms of the Kiyv region (Ukraine). We have studied influence of multiple mixed infections in Agaricus bisporus.

Key words: *multiple mixed infections, mushroom.*

4. ENVIRONMENT PROTECTION AND NATURAL RESOURCES MANAGEMENT

THE USE OF PHYTOREMEDIATION FOR THE INDUSTRIAL WASTEWATER TREATMENT

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Abstract

The environment is a key element of survival, but it is dangerously affected by human activities and especially industrialization. The ecosystems are relatively degraded, the aquatic environments are soiled, the waste is poorly recycled and wastewater is used without any prior treatment. This last use poses a serious environmental problem because of the pollutants contained in the wastewater, such as toxic substances, pathogens and organic and inorganic pollutants. Currently, chemical pollution is a major concern for serious risks it can cause and among the most dangerous chemical pollutants are heavy metals. These elements are toxic to humans, animals and plants because they are non-degradable, persistent and difficult to remove once incorporated into the environment. Also, Nitrogen pollution imbalances the water nutrient balance causing an aquatic environment modification and rendering it anoxic. In the context of environment protection and preservation, studies have been carried out and techniques have been adopted to eliminate the various pollutants and to clean up contaminated ecosystems. Phyto-purification "The use of plants and their associated micro-organisms in root systems for environmental remediation", presents a noninvasive, a cost-effective and an efficient technology. Macrophytes showed great plasticity of structures, morphology and behavior in aquatic systems. They are, therefore, used for the decontamination of polluted aquatic ecosystems. The main objective of this study was to evaluate and assess the efficiency of planted filters with Macrophyteson their ability to remove chemical pollutantspresent in industrial wastewater including nitrogen and heavy metals. Results obtained confirmed the interest of using the planted filters in the framework of industrial wastewater treatment.

Keywords: *Environment, Chemical pollution, Phyto-purification, Macrophytes, Industrial wastewater.*

STUDY OF MELLIFEROUS PLANTS VISITED BY THE WORKER HONEYBEE, *APIS MELLIFERA* INTERMISSA IN BOUMERDES, ALGERIA.

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Abstract

This work allows to establish a list of melliferous plants visited by the worker bee, *Apis mellifera intermissa* in Boumerdes through melissopalynological analysis. Eight samples of honey were collected in summer from different regions of Boumerdes: Mizrana (H1), Tizéruine (H 2), Tagdempt (H 3), Sherraba (H 4), Baghlia (H 5), Boudouaou (H 6), Sidi Daoud (H 7) and Si Mustapha (H 8). For the analysis, we adopted the classical method of Louveaux *et al*., (1978). The results obtained showed that the melissopalynological analysis indicated the pollen grains of *Eucalyptus* were numerous as more than 45% of the pollen in six (6) of the eight samples of Boumerdes (H1, H2, H3, H4, H7 and H8)). The pollen of *Hedysarum coronarium* was dominant in the sample H5 (67.60%). In seven samples honey recognized multifloral by beekeepers, Eucalyptus and *Citrus* taxa were respectively super represented and underrepresented in the honey H7 (87.46%) and H6 (19.80%). Thus, the number of taxa listed in the honeys studied varies from 14 to 19. The total number of pollen grains counted for the 8 samples varied from 646 to 3 580.

Keywords: *Honey, melliferous plants, melissopalynology, Boumerdes.*

FIRST COPROLOGICAL MENTION OF SOME CARNIVOROUS MAMMALS, ESPECIALLY THE STRIPED HYENA *HYAENA HYAENA* IN CHREA NATIONAL PARK (ALGERIA)

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Abstract

This work took place in the Chrea National Park, located 50 km southwest of Algiers and classified as a biosphere reserve in 2002, through UNESCO's program. The coprological study was carried out by analyzing the excrement of three carnivorous mammals, namely the red fox *Vulpes vulpes*, the African wolf *Canis lupus* and, for the first time in Algeria, the Striped hyena *Hyaena hyaena*. The collection of dung was made in several stations: Oued el marja, Tiberkent, Bni-selmen, Tamesguida. The dung was harvested from February until the end of May 2018. The monitoring of the striped hyena, the Aafrican wolf and the Red Fox wasdone mainly by their distinct presence indices. In total, we collected 48 faecal samples over the entire territory of the study area. The samples were measured, weighed, and decorticated for prey identification and for parasitological analyzes. The coprological study and the parasitological diagnosis made it possible to reveal and quantify the presence of helminth eggs and oocysts of coccidia or even protozoan cysts in the excrements of the three wild mammals. A total of five (05) genera of parasitic species were found in the mound of the striped hyena, seven (07) in the red fox and seven (07) in the common jackal so the results showed that the nematodes were the most present in all three mammals with Ankylostoma sp., Toxocaracanis, Strongylus sp. The study of the diet made it possible to identify items such as vertebrates, invertebrates, fruits, including waste found in feces (paper, glass scrap, etc.), which were for the most part anthropic origin. The results are expressed as a function of the relative abundance of each item.

Key words : *Mammals, coprology, parasites, Chrea, excrement.*

ENTOMOFAUNA BIODIVERSITY OF A CITRUS ORCHARD IN EUCALYPTUS (ALGERIA)

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Abstract

Orchards minimally processed with surrounding hedges form a significant source of biodiversity. These orchards are an entire ecosystem, home to a rich insect fauna associated with the presence of a large diversity of plant species. The values of the richness and diversity rise when the intensity of the chemical protection is reduced emphasizing the importance of such orchards in the conservation of biodiversity. To show the interest hedges fauna perspective, we conducted a study in an orange grove located ?Eucalyptus surrounded by hedges and windbreaks consisting of several plant species. With the sweep net there were the invertebrate fauna of the herbaceous and after a year of inventory there were 3.179 individuals distributed among 148 species grouped into five classes and 16 fauna orders. Hymenoptera and Diptera were represented with 38 species (AR% = 25.3%), followed by Coleoptera with 25 species (AR% = 17.3%), Homoptera dominated in the workforce with 731 individuals (AR% = 32.1%). The Shannon-Weaver index calculated reflects a great diversity of population sampled equal to 4.2 bits. The equitability is 0.7, showing a strong trend of balance between the numbers of species present.

Keywords: *biodiversity, a citrus orchard, reaps net, hedges, Eucalyptus, Algiers.*

SOIL FERTILITY MANAGEMENT IN THE OASES OF THE NORTHERN SAHARA OF ALGERIA

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Abstract

Can oasis agriculture characterized by its often fragile ecosystems in the middle of the desert, but with proven potentialities through generations, persist in a market economy? One of the objectives to be achieved in this respect is the profitability of the agriculture in these systems. The satisfaction of the nutritional needs of the plants, cultivated in association in the oasian farms, as well as the enhancement of their soils' characteristics, are intimately related to the practice of the organic and mineral amendments, conciliating in the same time the imperative of profitability on one part and the ecological aspects in these fragile areas on the other part, especially since the latter are considerably amplified by the fragility and complexity specific to oasian systems (permanently irrigation, drainage, soil salinity, etc). An inventory and analysis was established on oasian farmers' practices concerning organic amendments by local products and mineral inputs in the oasian production systems in the Ghardaïa region in the Algerian northern Sahara, showing a diversity of these practices, both conservative and non-conservative of the soil fertility on the relation to the available resources, deployed strategies and the margins of improvement. Positive trend is observed among oasian farmers to valorise animal and vegetable biomass produced on their farms and in the same time reduce their dependence on mineral fertilizers which prices have become exorbitant and not adapted to the physicochemical and biological characteristics of their soils.

Keywords: *Soil fertility, Oasian system, amendments, Algeria, farmers practices.*

LINYPHIIDAE SPIDER (ARANEAE, ARTHROPODS) AS INDICATOR IN BELEZMA NATIONAL PARK

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Abstract

Spiders are one of important abundant invertebratesin both natural and cultivated environment.In aforest, they occupy a different habitat and microhabitat from little layer to canopies and several types of vegetation. They are also considered as indicators of environmental quality. Linyphiidae are araneomorphae spiders, predators occupying different plant formation such as forest. During a period of eight months, several stations were chosen in Belezma Mountain belonging to national park with the same name. Cedar forest and lawn are chosen to harvest spider. Pitfall traps were used to collect the spider and ten pitfall traps were operative during the study. The pitfalls were PET plastic bottles (diameter 8 cm, height 18 cm). The top of the bottle was cut-off andused as a funnel for the pitfall. They were monthly emptied and refilled with a formalin solution (4%), with some detergent to reduce surface tension, as fixative. A total of 394 spiders were collected, out of which 147 belonging to Linyphiidae. They belonged to 8 genera and 17 species**.** Cedar forests are richer and more diverse, where 11 species were found only in those plots. Three species were harvested only in lawns (*Tenuiphantes tenuis, Mecopistes monticola* and *Trichopterna sp.)* and eight in both ecosystems The study shows a difference between stations and type of vegetation. Also, the presence of some spider species at specific plot is demonstrated.

Key word: *Linyphidae, Belezma, spider, Cedar forest, indication.*

IMPACT OF O*LEA EUROPAEA* SUBSP *EUROPAEA* VAR *SYLVESTRIS* ON ABUNDANCE AND DISTRIBUTION OF SOIL INVERTEBRATES IN NORTH ALGERIA

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Abstract

The biological diversity of an ecosystem is a good indicator of its quality and its capacity to resist deterioration due to the external factors. The biodiversity conservation is a key element of environmental protection. The aim of this work was to evaluate the physical, chemical and biological characteristics of soils under oléastre in Kabylian region Algeria. We sampled soil of seven shrubs on four levels. The physical and chemical soil parameters as well as the enumeration of the soil fauna according to Berelèse-Tullgren method on four levels were measured. Soil was a cambisol (W.R.B. 1998). To do so, soils as well as soil invertebrates were analysed. The soil was silty loam and with sandy texture, with a slightly acidic to neutral pH, with low rates of organic carbon by means against the levels of available phosphorus are very low. This count allowed us to examine six orders of animals, springtails, beetles, annelids, nematodes, centipedes and beetles larvae. This work showed that the environmental conditions, in particular soil characteristics, had an important impact on the presence and/or absence of certain soil invertebrates. The main result of this work lies on the hierarchization of factors driving invertebrate communities in Kabylian soils. However, the composition of soil fauna should be considered for rehabilitation. The results presented in this study are valid for this region only. To make a more general statement about the results, this type of studies needs to be applied to different soils, orchards and other climates in Northern Africa.

Keywords: *Olea europaea subsp europaea var sylvestris, invertebrates, carbon, soil quality.*

MORPHOLOGICAL CHARACTERIZATION OF LOCAL CATTLE POPULATION IN WILAYA OF TLEMCEN, ALGERIA

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Abstract

A morphological characterization and a study of the typology of the local cattle breeding were carried out in the Wilaya of Tlemcen (Algeria), in view of a contribution to a better knowledge of the local cattle genetic resources which remainedlittle studied until now.Body measurements were carried out at the level of local populations (Tlemcenian breed). This study dealt with 10 quantitative variables and two qualitative variables. The data collected were subjected to an analysis of variance (comparison of means). Analysis of main components CPA were performed on phenotypic characteristics. This very important preliminary work deserves to be pursued by a molecular characterization of more populations and a larger geographical area.

Keywords: *Genetic resources, Population, Characterization, Morphology, Tlemcen, Algerian.*

SOIL AGRONOMICAL PROPRIETIES UNDER TREATED WASTEWATER IRRIGATION AND SLUDGE AMENDMENT

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Abstract

We evaluated the agronomic proprieties and contamination hazards of loam to clay–loam soils from Boumerdes, north region of Algeria. Agronomical pertinent parameters, concentration and metals and their speciation were determined by soils, treated wastewater (TWW) and sewage sludge (SS). In treated soils, we observed a slight increase in pH, an increase in the cation exchange capacity, and no change of either salinity or electrical conductivity. Sodium absorption ratio and exchangeable sodium percentage remained satisfactory, below 13 and 15, respectively, with no infiltration problems. The soil organic matter (SOM) increased in all SS-amended and/or TWW irrigated soils, the increase being higher in SS-amended soils. The SOM kept a satisfactory C/N ratio. Both SS amendment and TWW irrigation brought high amounts of nutrients in the considered soils and increased the nutrients disponibility, especially regarding K and P, as shown by the nutrient concentrations in the soil water extracts. The pH increase did not seem to be a problem for the bioavailability of micronutrient. The SS and TWW application improve the agronomical soil proprieties.

Keywords: *Treated wastewater, sewage sludge, nutrients.*

MORPHOLOGICAL CHARACTERIZATION OF THE LOCALGOAT POPULATIONIN THE PROVINCE OF TLEMCEN, ALGERIA

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Abstract

In Algeria, goat farming is one of the most traditional agricultural activities associated with sheep farming. Knowledge of the production potential of our goat populations is insufficient both in terms of their characteristics and their performance. in view of a contribution to a better knowledge of the local goat genetic resources, Body measurements were carried outin30 goats (f) and 08 goats (M)in the state of Tlemcenin the west of Algeria . This study covers 19 quantitative variables, Body length (LC), ear length (LO), pelvis width (LB),chest width (LP), Width to Bones (LI), height at withers (HG), Height to back (HD), height to sacrum (HS), Chest depth (PP)flank depth (PF), anterior barrel Tower (TCA). neck lengths (LCo), head length (LT), hair length (LPL), Abdominal circumference (TAB), (LT) pelvis lenght (LnB), neck length (LCo) chest circumference (PT), the data collected were subjected to a descriptive analyzes. The means, standard deviations, minimums, maximums, and variances of body measurements of the goat population in both sexes shows significant differences between the two sex in some characters and non-significant differences between the two sex. sexes in other characters. The statistical analysis gave an idea about the resources and the variability in local population.

Keyword: *Genetic resources, Population, Characterization, Morphology, Tlemcen, Algerian.*

THE IRON, COPPER AND LEAD UPTAKE ABILITY OF *PHRAGMITES AUSTRALIS* SPECIES

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Abstract

The phytoremediation ability of the common reed (*Phragmites australis*) plant species was estimated using the bio-concentration factor (BCF). BCF can be defined as the plants' ability to uptake heavy metals from polluted sediments into the root tissues and is quantified as the ratio of metals concentrations in root tissues to sediments. Bioconcentration factor (BCF) provides information on the ability of a plant to absorb a metal from a substrate and accumulate it in its roots. BCFs of Fe, Cu and Pb elements in a treated soil by 100 and 200 mg/l of FeCl3, Pb (NO3) 2, CuSO4, are ≤ 1 (0.94 and 1.04 for iron, 0,19 and 0.57 for lead and 0.28 and 0.64 for copper respectively) indicated a low accumulation (concentration) of these elements in the roots. These BCFs also remained lower than those obtained with the soil treated by ZnCl2 that were greater than 2 (2.54 and 2.88), indicating a very good accumulative capacity. At high concentration (500 mg/l), the results obtained with the four elements studied (Zn, Cu, Fe and Pb) all showed BCFs greater than 1 which were of the order of 3.93, 2.34, 1.24 and 1.21, respectively.

Keywords: *Phragmites australis, Common reed, Heavy metal, Bioconcentration, Phytoremediation.*

PREDICTING THE IMPACT OF CLIMATE CHANGE ON YIELD AND WATER REQUIREMENT OF RAINFED CROPS IN SETIF REGION (ALGERIA)

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Abstract

Algeria is highly vulnerable to climate change impacts, due to its arid and semi-arid climate.If climate change makes Setif high plains region drier or warmer, pressure on rainfed agricultural would intensify. The first aim of this study is to show future climate changes in Setif region under A2 and B2 SRES scenarios, across three time slices (2025, 2050, and 2075) by using MAGICC-SCENGEN model. The second objective is to assess the impact of climate changeon yield and water requirement of three main rainfed crops (winter wheat, barley and olive) by using CROPWAT model. The projection of the four General Circulation Models (GCMs) showed that average temperature will increase by 0.73°C to 3.42°C, and the precipitation will decrease by 1% to 52,7%, across the three future periods under the two SRES scenarios. Winter wheat and olive yields are expected to decrease under the three types of soils (heavy, medium and light). However, barley yield is expected to reduce under light soil only. Crop water requirements and irrigation water requirements are expected to increase under the two scenarios and across the three future periods.

Keywords: *climate change, yield, water requirement, rainfed crops, Setif region.*

THE INFLUENCE OF SEED SIZE ON GERMINATION DEGREE OF A CITRUS STOCK

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Abstract

Determination of seed characteristics influencing the germination degree is an important factor in plant production. The objective of the present study is to know the relation between germination level and seed size for Citrange Carrizo (*Poncirus trifoliata* (L.) Rafinesque x *Citrus sinensis* (L.) Osbeck). Seeds were collected during a period of one month, from an orchard situated in the ITAF Institute (Techical Institute of Fruit Trees of Emjez Edchiche) in Skikda province (East Algeria). Their size was calculated using calliper rule. Afterwards, they were sown in plastic bags under greenhouse conditions. In general, the nucellar embryos were 1,84 - 2,61 mm wide, and 4,64 - 4,99 mm long. While, the zygotic embryos had a width of 0,79 - 1,01 mm, and a length of 1,39 – 1,83 mm. on the other hand, the germination rate was 65,38 % in maximum. In addition, the statistical analysis did not show any positive or negative correlations between germination degree and the size of seeds (*R* ranged from -0,706 and 0,753 and *P* was between 0,310 and 0,987). Thus, it will be useful to test the impact of other factors such as the seed composition, depth of sowing, date of sowing, …etc.

Keywords: *seed morphological characteristics, plant production, citrus stock, East Algeria.*

EFFECT OF CO-COMPOSTED CHARCOAL FROM GASIFIER PLANTS ON PLANT GROWTH, NUTRIENT UPTAKE AND SOIL FERTILITY

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Abstract

Biomass gasification plants generate energy from woody materials. During the production process, charcoal is produced. Charcoal is a carbon rich material out of woody material with a high potential for different applications. In this study, the usage of charcoal as a soil amendment is tested. In the experiments the influence of charcoal on plant growth and nutrient availability should be determined. Therefore a laboratory experiment and a trial under field conditions were performed. In both experiments the plant growth testing was performed according to DIN ISO 11269-2 and OECD guidelines. In a first step organic material (landscape care material) was composted with three different amounts of charcoal (5 % (v/v), 10 % (v/v), 25 % (v/v)). As a reference, the organic material was composted without adding charcoal. Under field conditions 2 t of compost was applied on each testing area, which had a length of 12.5 m and a width of 6 m. Silage maize was chosen as crop plant for cultivation. Soil samples, which were taken with an interval of two weeks during the experiment, were analyzed for nitrogen, nitrate, ammonium, potassium and phosphorus. After harvesting, the fresh and dry mass, as well as the nutrient uptake of the plants, were measured. First results showed significant positive effects on plant growth in the laboratory. In contrast no significant influence due to plant growth could be observed in the field. Indeed the influence of charcoal on the availability of potassium was significant. Also an effect on nitrogen compounds could be observed. Even if charcoal is not able to improve the plant growth or nutrient uptake significantly, it could become a leading part for carbon sequestration and further climate protection.

Keywords: *charcoal, composting, plant growth, soil fertility.*

LONG TERM IMPACTS OF REPEATED FIRE USE ON GRAZING LAND IN THE *CHIQUITANO* DRY FOREST. EXPERIMENTAL RESULTS FROM OBSERVATIONAL SATELLITE DATA USING STATISTICAL MATCHING TECHNIQUES.

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Abstract

The Chiquitano Dry Forest is a unique biome, the largest and best conserved dry forest at the global level, placed in the earth of South America. Being semi deciduous it is especially vulnerable to fires during the dry winters. Traditional agricultural practices of grassland management increase the risk of wild fires, while contributing to loss of habitat and biodiversity. The use of fire is still frequent and common as a manner to control forest regrowth and keep the land under agricultural usage. Over the past 20 years a large part of the Tucabaca protected area, in Bolivia, has been burned at least once. Even more noticeably, Tucabaca's buffer zone has been subjected to forest and prairie fires. Over the past two decades, soils used for cattle grazing have lost crude protein productivity (nitrogen content at the leaf level) due to land mismanagement, namely: the severity and frequency of burning. Introduced pastures, as well as natural grassland, are best managed under a careful planned rotational scheme. Evidence building requires robust time series, and for that purpose an area under traditional management has been identified and the impact of the use of fire analyzed over two decades of continued grazing use. Burning organic matter makes minerals and other nutrients available for the next grass growth, but repeated and severe burning have a detrimental impact on grass nutritional quality in the long run. This paper presents the results of a longitudinal study of managed grassland in the heart of the Chiquitano Dry Forest, in one of the most dynamic areas for expansion of grazing grassland at the expenses of forest. Harnessing the power of new technology for land monitoring can provide innovative tools for land management and sustainable food production. The same tools used to monitor historical changes in land use and fire induced damages can help monitoring quality and quantity of pastures, to support and foster sustainable practices such as rotational grazing. Tools developed within the framework of precision agriculture have been adapted to manage grazing land. IT make possible to run the equivalent of field experiments spanning over several decades within days, opening new possibilities to sustainably increase food production while reducing the impact on natural resources, with a growing role for big data and precision agriculture.

Key words: *satellite monitoring, wildfire, matching, experimental design.*

Fe, Cu AND Zn PRESENCE IN THE SOIL AT DIFFERENT LOCATIONS IN HERZEGOVINA REGION (BOSNIA AND HERZEGOVINA)

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Abstract

The aim of this research was to determine the quality of the soil and Fe, Cu and Zn content by the help of physico-chemical analysis at different areas of Herzegovina region (Bosnia and Herzegovina). The increased presence of the investigated elements has negative influence and the accumulation of it in the cultivated cultures is directly brought into the chain of nutrition, which results in their accumulation in the human organism as the final consumer. The research was carried out at three sites of Mostar, and from each of them, samples were taken from two different depths, from 0 to 30 cm and from 30 to 60 cm. The highest presence of Fe was found at the Salakovac site (42.447,11 mg/kg), where an increase of 37% was observed at the first depth, up to 42% at the second depth of testing, compared to MAC. Cu was above the limit values only at the site of Vrapcici, while Zn was measured in the highest values at the Salakovac site, at the first depth of the test (177,36 mg/kg). It can be concluded by comparing localities that Dubrava site is unloaded with the content of the examined elements, and it is considered acceptable for the cultivation of various herbal crops without fear for the health of final users. On location Salakovac recorded increased values of Fe in both depth testing, as well as increased concentration Zn on the first depth. This can cause long-term negative effects on the plants, but also human health. The Soil at the Vrapcici site contained higher concentrations above the permissible values of all tested elements which is the most polluted of these three explored sites. It can be said that represent great risk to human and animal health that consume the cultures cultivated on this land.

Keywords: *iron, copper, zinc, soil, MAC.*

THE IMPACT OF INCREASING VOLUME APPLICATIONS OF MINERAL FERTILIZERON VARIABILITY OF THE NATURAL MEADOWS YIELDS TYPE OF AGROSTIETUM VULGARIS

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Abstract

Production of cumbrously forage is one of the prerequisites for successful and profitable animal production. Beside the silage and concentrated nutritional nourishment of ruminant, an important role has been played by hay. The goal of our research was to determine raising application impact quantity of mineral fertilizer NPK 15:15:15 and nitrogen fertilizer 27% on the yield green masses and the hay of natural meadow agrostietum vulgaris in the vegetation season 2018. The experiment with three repetitions was set in Dobrnja on Manjaca, territory of the City of Banja Luka. Space between treatments and repetition is treated with total herbicide of the way setting of sample on the day setting of experiment. Mineral applications treatments were: a) 100 kg ha^{-1} nitrogen fertilizer, b) 200 kg ha^{-1} nitrogen fertilizer, c) 300 kg ha^{-1} nitrogen fertilizer, d) 100 kg ha^{-1} NPK 15:15:15, e) 200 kg ha^{-1} NPK 15:15:15, f) 300 kg ha^{-1} NPK 15:15:15, h) control without soil fertilizing. Yields of the green mass and the hay were determined weighing and recalculating on the yield of t ha^{-1}. From the cutting green mass samples were taken for determining hay yield. Hay yield was established from relation weight-on the green in the dry masses. We determined statistically significant variability for green mass yield and hay between applied treatments. The largest yield green mass and hay was received on 300 kg ha^{-1} NPK 15:15:15 application, where there was average yield of hay of 4,84t ha^{-1}. Significantly lower green mass and hay was obtained at the control variant. The average yield of the hay of control variant was lower by 1,92t ha^{-1}compared to300 kg ha^{-1} NPK 15:15:15 application of the fertilizer. During the vegetation, there were favourable weather conditions, firstly enough moisture, which partially contributed to the high yield of the green mass of hay. In years with absence of downfall can be expected by lower yield in relation to obtain in this work. Mineral fertilizer applications, primarily larger quantities of NPK 15:15:15 give the positive effects on the productivity on the green mass yield and hay on natural meadow agrostietum vulgaris.

Keywords: *natural meadow, mineral fertilizer, yield, green mass, hay.*

INTENSITY OF OOGENESIS AND SPERMATOGENESIS IN RAINBOW TROUT (*Oncorhynchus mykiss Wabaum, 1792)* IN VARIOUS MICROENVIRONMENTAL CONDITIONS

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Abstract

Aquaculture in the world and in Bosnia and Herzegovina is the fastest growing food production sector. The high nutritional value of fish meat, which is also rich in proteins, high-value fats, minerals and vitamins, is also a challenge in respect to a more intensive production of salmonid species in Bosnia and Herzegovina and in the Balkans. As the production is closely tied to the reproductive abilities of fish and animal population as a whole, our research studies compared the intensity of oogenesis and spermatogenesis in rainbow trout in various rearing environments, with a special emphasis on water temperature and oxygen saturation at the time of fishing. The research is one of the guidelines of how to intensify the production of rainbow trout while providing the most favorable living conditions and a faster growth of fish population, contributing to the faster production and market placement without undermining the fundamental postulates of the natural environment.

Key words: *rainbow trout, oogenesis, spermatogenesis, microenvironment conditions.*

DIVERSITY AND DISTRIBUTION OF THE SPECIES OF GENUS *AMARANTHUS* L. 1753 IN VOJVODINA (SERBIA)

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Abstract

The subject of research was diversity and distribution of the species of genus *Amaranthus* in Vojvodina. Genus *Amaranthus* is represented in Europe by 12 introduced and naturalized species, whereas *A. caudatus* is planted as ornamental and it sometimes occurs spontaneously. Other species are weeds or ruderal and common on territory of the northern and central Europe (Aellen and Akeroyd, 1993). In the Serbian flora this genus includes nine species of which all originated from America (Slavnić, 1972). Because of its foreign origin, the absence of predators and adaptive strategies, species of genus *Amaranthus* can easily expand their range in Vojvodina. Based on data from literature and herbarium collections ten species, two subspecies and one hybrid were recorded in Vojvodina. The nomenclature data collected from the literature and herbarium were systematized and harmonized with data provided by Flora Europaea (Aellen and Akeroyd, 1993). Data on general distribution and distribution in Serbia are given according to Flora of Serbia (Slavnic, 1972) and List of invasive species in Vojvodina (IASV, 2017). Data of distributuion in Europe are given by Flora Europaea (Aellen and Akeroyd, 1993) and List invasive species in Vojvodina (IASV, 2019). Floral elements are given to Gajic i Soó (Gajic, 1980; Soó, 1970). Analyzed data covered the period of 80 years, and obtained localities are grouped by regions: Backa, Banat and Srem. Ranges of taxa are shown in UTM maps (Universal Transverse Mercator) of Vojvodina, extent of 10x10 km (Walter and Straka, 1970).

Key words: *ruderal flora, weeds, distribution, Amaranthus.*

HABITAT TYPES OF EUROPEAN IMPORTANCE ON THE JAHORINA MOUNTAIN (BOSNIA AND HERZEGOVINA)

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Abstract

The paper presents types of habitats of Jahorina Mountain which are of European importance. The review is made on the basis of studies of flora and vegetation and the Guide of the types of habitats according to the EU Habitats Directive. Research was carried out in the period of 2015-2016. Taking plant material and making phytocoenological recordings were done at different habitats. Identification of species was based on floristic literature. Phytocoenologically recordings were made by the method Braun-Blanquet. During the research the following habitats have been isolated: 4060 - Alpine and Boreal heaths, 6230 - Species-rich Nardus grasslands, on silicious substrates in mountain areas (and submountain areas in Continental Europe), 6410 - Molinia meadows on calcareous, peaty or clayey-silt-laden soils (*Molinion caeruleae*), 6430 - Hydrophilous tall herb fringe communities of plains and of the montane to alpine levels, 6510 - Lowland hay meadows (*Alopecurus pratensis*, *Sanguisorba officinalis*), 6520 - Mountain hay meadows, 7110 - Active raised bogs, 7120 - Degraded raised bogs still capable of natural regeneration, 7220 - Petrifying springs with tufa formation (Cratoneurion), 9140 - Medio-European subalpine beech woods with Acer and *Rumex arifolius*, 9410 - Acidophilous Picea forests of the montane to alpine levels (*Vaccinio-Piceetea*). The aim of the paper is to present a habitat in Jahorina that is significant for Bosnia and Herzegovina and the European Union.

Key words: *habitat, Natura 2000, Jahorina*.

YIELD OF GRASSLAND BIOMASS IN SECOND SWATH AND IMPACT OF APPLIED MEASURES ON CHEMICAL REACTION OF REKULTISOL

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Abstract

The research of biological phases of soil reclamation by seeding the grassland has been conducted on the Deposol at internal disposal area for overburden from Raskovac open pit in Stanari coal mine (Republic of Srpska, Bosnia and Herzegovina). The aim of this survey refers to implementation of biological phase of reclamation on yield biomass (green mass) in second swath and improvement of technogenic soil fertility, type Rekultisol. The survey task refers to measurement of impact of fertilization and liming on yield of biomass grassland and chemical properties of forming Rekultisol. The survey was expended through three-year period (2011–2013). Three grass-leguminous mixtures and one grass mixture were studied; altogether four treatments of various doses of mineral fertilizer and lime. The research covered the selection of treatment with the most productive green mass and impact of chemical reaction of Rekultisol. Statistical analysis of measuring quantitative properties of vegetable mass was conducted by method of ANOVA, 3x4x4. The sandy-loam Deposol at the beginning of research had unfavorable physical and chemical properties. The applied treatments and interactions born impact on measuring quantitative properties of researched mixtures and chemical properties of Rekultisol. The TDS-1 mixture had the biggest green mass production (3,6 t/ha) in 2011. The TDS-3 mixture had the biggest green mass production in 2012 (6,9 t/ha) and 2013 (7,2 t/ha). The application of liming caused the increase of pH of Rekultisol. The biological reclamation in researched agro-ecological conditions was successfully conducted by seeding grasslands, raising selected species in grass-leguminous mixtures and application of optimal agromeliorative measures.

Key words: *open pit, soil reclamation, grass-leguminous mixture, Stanari*.

RESULTS OF PRELIMINARY HERPETOLOGICAL RESEARCH OF "NEVESINJSKO POLJE" WIDER AREA IN BOSNIA AND HERZEGOVINA

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Abstract

Nevesinjsko polje is an upper karst field in eastern Herzegovina. Characterized by high biodiversity, this karst field represents unrepeatable geomorphological and ecological unit. This area is specific primarily due to diverse climates that can be found in the region, then diversity of geomorphologic phenomena and soil types. All these factors indicate a presence of a rich and diverse herpetofauna that has not been researched in the past.In this preliminary herpetological research that was focused on specific geographical points in Nevesinjsko polje we have recorded 1 species of turtles, 8 species of lizards and 5 species of snakes. This research aims to confirm presence of specific species, and set the scope for further research in this area.

Keywords: *Nevesinjsko polje, karst field, herpetofauna, Reptilia, turtles, lizards, snakes.*

INFLUENCE OF SOIL MOISTURE REGIME ON ALLUVIAL FOREST HABITAT

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Abstract

At the mouth of the Tamis into the Danube there is a complex of alluvial forests that represents a separate ecological unit within the GJ „Donje Potamišje“. In unchanged natural conditions, there were favorable ecological conditions for the development of forest vegetation, defined by the periodically high water levels of the Danube and Tamis, as well as moistening of groundwater. The construction of HPP "Djerdap" changes the regime of the Danube and Tamis waters, which implies the process of degradation of land and vegetation, that is, the formation of ponds and wetlands on the entire surface of the forest management unit. By raising the embankment towards the Danube and Tamis, as well as by building ameliorative canals and evacuating excess water, more favorable ecological conditions for the development of forest vegetation were created. In addition, the area, called "Gradska Suma", is used as a source for the city's water supply, which affects groundwater levels, whose impact on forest vegetation should not be neglected.

Keywords*:* *hygrophilic forests, habitat, ecological unit, water regime, forest and swamp ecosystems, forest management class, levees, melioration.*

OCCURRENCE AND DISTRIBUTION OF INVASIVE WEED SPECIES *AMORPHA FRUTICOSA* L. AND *REYNOUTRIA JAPONICA* HOUTT. IN THE AREA OF MUNICIPALITY SRBAC (BOSNIA AND HERZEGOVINA)

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Abstract

Due to the rapid expansion over large areas and the establishment of different habitat types, numerous introduced or non-native plant species have been given the status of invasive weed species. Highly competitive, comparing to native plant species, they usually grow in almost mono-dominant community. Typical examples are *Amorpha fruticosa* L. and *Reynoutria japonica* Houtt., which present one of the significant threats to native biological, ecological and landscape diversity. Considering that both invasive weed species caused obvious damage in different habitat types of Entity of Republic of Srpska (Bosnia and Herzegovina) in the past few years, the main goal of this study was to examine the current situation in the area of municipality Srbac. Distribution and abundance parameters were done for 24 *Amorpha* and *Reynoutria* stands based on Blanque Braun (1964) method and FITO GIS software. Assessment of their occurrence and distribution was taken along the river Sava, from municipality Srbac toward municipality Derventa, along the roads in the urban areas, between the settlements in ruderal and less arable land, on the edges of farmland, in ditches and on the edges of forests. Considering the research results during 2018, based on the determined areal distribution, the current status of land cover and dominance of Japanese knotweed and false indigo-bush in the area, and the fact that these two mono-dominatn types have already formed large communities in a number of habitats in the area, it can be concluded that these invasive weed species represent a real threat to native plant species, endangering the different types of habitats in the area of municipality Srbac.

Key words: *A. fruticosa, R. japonica, occurrence, distribution, municipality Srbac.*

FLOOD REGULATION ECOSYSTEM SERVICES RECOGNIZED BY DISTRICT FOREST MANAGEMENT IN BULGARIA

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Abstract

The peculiarities of Bulgarian geographical space in the context of climate change and increasing vulnerability of water and soil resources are essential challenge in long-term forestry strategic planning. The study presents particular results from the identification of "flood regulation ecosystem services", which are used in the preparation of the pilot District Management Plans for the forest territories in Bulgaria (Smolyan, Dobrich, Montana). These documents underpin the management of "public ecosystem benefits" from forests. The aim of the study is to develop a unified methodology for: identification of ecosystem services, introduction of paid use for "public ecosystem benefits" from certain forest territories, and delineation of zones for „protection from urbanization". The applied approach is specifically oriented towards the Bulgarian methodological requirements for functional zoning of the forest territories and aims to ensure the logical link "structure-functions-benefits", which is considered here obligatory for such procedure. In order to identify the forest territories that have flood regulation functions, a total of 12 indicator groups have been created. The survey has been conducted on the basis of up-to-date forest inventory and through implementation of the EC methodological framework (MAES, 2013; CICES, 2018) for mapping and assessment of ecosystem services, adapted to the requirements of the Forestry Law and the longstanding Bulgarian experience in this sector.

Keywords: *forest ecosystem services, flood regulation, paid use of ecosystem services, zones for„protection from urbanization", forest management.*

NATIONAL RESEARCH PROGRAM "ENVIRONMENTAL PROTECTION AND REDUCTION OF ADVERSE EVENTS AND NATURAL DISASTERS' RISKS"

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Abstract

The main goal of this presentation is acquaint the scientific community and the public outside Bulgaria with the National Research Program "Environmental Protection and Reduction of Adverse Events and Natural Disasters' Risks" (2018-2023). The overall objective of the program entails implementation of fundamental and applied research to ensure a sustainable, favorable, and safer living environment for the population of the Republic of Bulgaria. *Expected applied results*: (i) Assessment and mapping of the geospatial-temporal distribution of adverse events and natural disasters' risks; (ii) Developing systems for predicting adverse and catastrophic phenomena; (iii) Creation and development of early warning systems for natural disasters; (iv) Establishment of early warning systems for changes in the ecosystems with risks of deterioration in the quality of the environment or loss of important bio-resources and other ecosystem services; (v) Building decisions and actions support systems in case of catastrophic events and disasters; (vi) Formulation of strategic measures to reduce emissions of harmful substances in the atmosphere with the goal of reduction of the health risk and adverse impacts on the ecosystems. *Expected fundamental results:* (i) Generation and transfer of new knowledge about processes and interactions in the atmosphere, hydrosphere, lithosphere and biosphere from local to national scale, their impact on quality of life, health risks, and ecosystems condition; (ii) Deeper understanding of the interactions between phenomena and processes of different scales; (iii) Investigation of the main mechanisms and pathways for forming the characteristics of the atmosphere, the hydrosphere and the lithosphere, and, respectively their impacts on the various natural disasters.

Key words*:* *climate, water, urban environment, natural risks and hazards, ecosystems.*

LAND USE AND PLANT BIODIVERSITY IN TWO REGIONS OF BULGARIA

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Abstract

Plant species diversity in the agricultural and managed forests depends strongly on the land use type and management practices applied. We present results of a two-year assessment of plant diversity in different types of agricultural and forestry territories, ranging from cereal fields to fruit orchards and from coppice forests to protected territories. The two-year studies took place in two regions in Bulgaria – the first one was in the Thracian plain between Plovdiv and Pazardzhik, and the second one – Western Stara planina and the adjacent territories. A structural analysis of plant diversity was performed in experimental plots, representing more than 30 land use types. The results revealed that character of plant diversity depends on numerous factors; however, the most important being the land use type. Thorough analysis of the floristic elements and biological types was performed. The results are discussed in the light of nature conservation and sustainable use of plant resources.

Keywords: *Sustainable agriculture, Biodiversity, Flora, Phytogeographic elements.*

Acknowledgments: The financial support provided by the Bulgarian National Science Fund, Project "BIOGEA" is very much appreciated.

RESOURCE ASSESSMENT OF ADONIS VERNALIS IN REPRESENTATIVE NATURAL LOCALITIES IN WESTERN BULGARIA

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Abstract

Genus *Adonis* comprises 32 species distributed in Europe and Asia. *Adonis vernalis* commonly called Pheasant's eye is a valuable medicinal plant characterized by high content of cardiac glycosides. Due to its toxicity, nowadays it is not among the most popular medicinal plants but is used frequently as homoeopathic remedy. *A. vernalis* grows on open limestone habitats with steppe character. Its distribution in Bulgaria is scattered in the northern and western parts of the country. It is an important part of the natural habitats of European importance included in the network Natura 2000: 40A0 Subcontinental Peri-Pannonic Scrub and 6210 Semi-natural dry grasslands (Festuco-Brometalia). Resource assessment was performed in natural localities situated in three floristic regions: Sredna gora, Znepole region and Sofia region. Floristic composition is rich and is typical for the calcareous sites. The predominant species are *Dichanthium ischaemum, Satureja montana, Amygdalus nana, Rosa spinosissima, Veronica austriaca, Syringa vulgaris, Pulsatilla montana, Inula oculus-christi,* but also some rare and endemic species occur: *Anacamptis pyramidalis, Ophrys cornuta, Gymnadenia conopsea, Anthylis aurea, Edraianthus serbicus*. The projective cover of *A. vernalis* is 15 – 20% and the population status of the species is stable. The resources were assessed and the estimated yield was 18 g/m^2. Continuous monitoring on the population status will provide valuable information for its sustainable use and conservation.

Keywords: medicinal plants, western Bulgaria.

HYDROMETEOROLOGICAL DROUGHT HAZARD AND VULNERABILITY ASSESSMENT FOR NORTHERN BULGARIA[1]

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Abstract

In the recent years, threats of natural origin, including those associated with the drought are topics arising interest in representatives of local authorities, government, scientific communities and residents of cities and villages. Drought is usually very unpredictable due to its slow nature of development. A significant part of the economy of Northern Bulgaria is agriculture, which increases the need for careful water management and planning. The objective of this study was to identify the drought hazard with regard to its spatial extends, frequency and severity and to assess the vulnerability to drought in Northern Bulgaria at the regional scale. The standardized precipitation index (SPI) and Streamflow Drought Index (SDI) at 6 and 12-month time step for the period 1961–2012 were used to obtain Drought Hazard Index (DHI). In order to assess drought vulnerability Drought Vulnerability Index (DVI) was calculated based on the following parameters: population density, municipal water use, industrial water use, agricultural water use, cereal cultivated areas and average annual yield. The results of the study show low DHI values and homogeneous distribution of drought hazard in the north part of Bulgaria. However, the drought vulnerability in the investigated area is very high due to the higher consumption of water by industry, municipal water supply and extensive agricultural lands. The results of present work bring to the understanding of drought hazard and drought vulnerability and can be considered as a first step in the development of risk-based drought management plans.

Keywords: *Drought, hazard, vulnerability, water use, agriculture.*

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DISTRIBUTION OF *DERMANYSSUS GALLINAE* (MESOSTIGMATA: DERMANYSSIDAE) IN NESTS OF PASSERINE SPECIES

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Abstract

The poultry red mite, *Dermanyssus gallinae* (De Geer, 1778), is a haematophagous ectoparasite in a wide range of wild and domestic bird species and some species of mammals and has a cosmopolite distribution. Infestation with it can cause decrease in egg production, anemia, and even mortality among fledglings as well as adult birds, and it can also transmit many diseases as a vector for bacteria and viruses, which determines its veterinary, medical and economically importance. It is one of the most important ectoparasites of the poultry houses. The research was conducted in the period between 2012 and 2015 in the Kamchia Mountain (Northeastern Bulgaria), an area characterized by high concentration of birds with conservation significance. A total of 2483 specimens of *D. gallinae* were found in nests of semi-collared flycatcher (*Ficedula semitorquata*), great tit (*Parus major*) and eurasian blue tit (*Cyanistes caeruleus*). The species was present in 44.96% of investigated nests. The abundance of *D. gallinae* demonstrated significant variability in the examined bird species and in the studied four years. It was greatest in the nests of *F. semitorquata* in 2015 and in the nests of *C. caeruleus* in 2013. In the nests of *Parus major* in all the studied years the species had constant and lower density.

Keywords: *mite, abundance, birds' nests, annual dynamic.*

CHEMICAL COMPOSITION OF CARDOON (*CYNARA CARDUNCULUS* L.) GROWN IN SOUTH BULGARIA

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Abstract

Comparative research has been conducted to allow us to determine the content of macro- and microelements in the vegetative and reproductive organs of *Cynara cardunculus* L. and quality of *Cynara cardunculus* L. oil. The experiment was performed on an agricultural field near Plovdiv (South Bulgaria). The contents of macro- and microelements in plant materials (roots, stems, leaves, seeds) and oils were determined. The oils were extracted using a Soxhlet apparatus from seeds of *Cynara cardunculus* L. The quantitative measurements were carried out with inductively-coupled plasma (ICP). Oil fatty acids characterization for unsaturated and saturated acids was performed by gas chromatography. The cardoon shows adaptability to local conditions and can be grown in southern Bulgaria and used for oil production. All plant parts of the cardoon are a rich source of macro and microelements and exhibit high nutritional value. The distribution of macro and microelements in the cardoon organs is selective, specific for the individual elements. Cd, Cu and Fe are accumulated in the roots, K - in the stems, Pb and Ca - in the leaves, and Zn, Mn, Mg and P - in the seeds. Cardoon seeds were a rich source of macro- and microelements (K, P, Mg, Ca, Fe, and Zn). Cardoon oil was abundant in unsaturated fatty acids (linoleic (61.67%%) and oleic acids (22.82%)), followed by palmitic acid (10.50%) and stearic acid (3.29%). Cardoon oil has a P/S index higher than 1 (4.2), which indicates that oil can have a good effect on human health and are oils suitable for consumption. Cardoon oil is a rich source of polyunsaturated linoleic fatty acid with potentially beneficial therapeutic activity.

Keywords: *Cardoon, fatty acid composition, micro and macroelements oil, Bulgaria.*

RURAL AND URBAN PUBLIC PERCEPTION OF THE LINKAGE BETWEEN CAPITAL, WELL-BEING, WELFARE ECONOMICS FOR SUSTAINABILITY AND IMPROVED LIVELIHOODS IN KIVU PROVINCES, EASTERN DR CONGO

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Abstract

Human wellbeing depends on various factors including the access to social capital, economic capital, cultural capital and natural capital. Given the high dependency to natural resources, human happiness is tributary of every part such a capital. The ability to integrate all types of capital may significantly improve human wellbeing in a given country such as DRCongo. The measurement of natural capital and its management during the economic development process are important aspects of the capital approach to sustainable development. Using a semi-structured questionnaire, a study survey was conducted to explore whether natural capital per capita was correlated with life satisfaction of rural communities from mountain areas of Kivu provinces, eastern DR Congo. Multiple and bivariate models were applied with the aim of identifying key drivers among major determinants of life satisfaction or happiness (social capital, annual income, unemployment, inflation, market price of goods and services,…). The results indicated positive relationships between natural/social capital and life satisfaction. There was a gender response. Social capital was more positively linked to life satisfaction for women, whereas natural capital was more associated with satisfaction of men. It was concluded that welfare economics of sustainability of rural people should take into account various aspects of well-being measures in order to be able to provide appropriate suggestions to policy makers in favor for rural communities.

Keywords: *Life Satisfaction, Well-Being, Natural Capital, Sustainable Development, Welfare Economics.*

DRIVERS OF CHANGE OF THE SOCIO-CULTURAL VALUES OF ECOSYSTEMS SERVICES & WELL-BEING OF RURAL COMMUNITIES IN SOUTH-KIVU PROVINCE, EASTERN DR CONGO

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Abstract

Ecosystem services are valued differently by stakeholders of different socio-cultural back grounds in Sub-Sahara Africa. Ecosystem services are generally assessed in a given area in order to determine their relevance to well-being of local population. A study survey was conducted in the Ruzizi plan watershed region, South-Kivu Province, eastern DR Congo during year for two consecutive years (2017-2018) for the values of ecosystem services as perceived by stakeholders as well highlighting current and future drivers of changes of these ecosystem services and the impacts of changes on well-being of rural people. Data was collect through conducting literature review, conducting field-ecological observations and through conducting semi-structured interviews. The results indicated that Ruzizi plain watershed deliver a large variety of ecosystem services. However, the diversity of ecosystem services delivered by different Ruzizi plain landscape habitats were perceived in different ways by both directly and indirectly dependent on provisioning ecosystem services. International NGOs, local development professionals and visitors (including tourists) had different views of the value of ecosystem services delivered by the different types of mosaic landscape habitats (vegetation cover). Overall, provisioning services related to traditional practices were perceived as highly important and highly vulnerable by farmers than by conservation-development actors and political leaders. Also, there was contrasting perceptions of drivers of change for most ecosystem services as well as the resultant well-being. It was therefore recommended that socio-cultural and economic valuation of ecological services in order to find appropriate landscape habitat (ecosystem) managements strategies to increase the community resilience while enhancing spatiotemporal effective delivery ecosystems services for the wellbeing of communities may require a very good mapping of different actors and identify those actually likely willing to be involved in environmentally-friendly farming practices for the good of communities.

Keywords: *Economic value, Ecosystem services, Livelihoods, Kivu, DR Congo.*

THE CURRENT NECESSITY OF INTEGRATING ENVIRONMENTAL, SCIENTIFIC AND TECHNOLOGICAL INFORMATION DURING DECISION-MAKING TO BETTER ACHIEVE SUSTAINABLE DEVELOPMENT, SOCIAL TRANSFORMATION AND PROSPERITY OF DR CONGO

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Abstract

Achievement sustainable development and prosperity in DR Congo require new approaches, such as bridging environmental conservation and decision-making. This require that top policy-makers access to right technological and scientific information as well as working with right local human resources. Without being able to combine political attributes with scientific information while setting governance regimes, it may be not possible to achieve transformation and prosperity or eradicate corruption and poverty even when the country is rich in natural resources. The development crisis in DR Congo is more a human resource crisis. It appear currently very necessary to bridge academics and non-academics, conservation and development targets, and theory and practice. Such bridging approach should be implemented by empowering local and provincial institutions, enhancing capacity of local and regional stakeholders through a recognition and validation of local knowledge systems and the creation and consumption of knowledge networks, understanding better linkage between social and natural landscape capital, understanding better the exact type of history, contexts, their evolution drivers, as well as capturing better the roles of economic and market forces in shaping opportunities for using market-based incentives to promote and conciliate conservation and development in line with the governance process. It is very necessary to rewrite and propose to the current top leader a new governance conceptual framework based on connecting key pillars of natural resource characteristics, interactions of social actors, governance and participation, politics, technological-industrial scientific knowledge (education-research), information exchange, cooperation-collaboration with external actors, and cultural-socio-economic issues that support spaces for both conflicts and synergies between conservation and development goals. The relevance of fostering for informed dialogue, trust and social learning to promote sustainability is suggested. Maintaining the Environmental quality as well educating population about environmental concerns may result into improving the governance and well being of communities.

Key words: *Complex social-ecological systems, Environmental quality, Economic incentives, New governance framework, DR Congo.*

THE POTENTIAL ROLE OF SMALL-SCALE GARDENS AND GREEN PLACES IN MITIGATING CLIMATE CHANGE NEGATIVE IMPACTS IN URBAN SOCIETIES, KIVU PROVINCE, EASTERN DR CONGO

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Abstract

Worldwide, urban woodlots, forests, agroforestry, parks found in the vicinity of cities serve as areas for recreation and entertainment, as well as space for biodiversity to compensate for the built parts of the city. Iin DR Congo, there are no policies for promoting such infrastructures, yet they are vital for the sustainability of urban environments. In Bukavu town for example, at every rainy day, it is easy to see too much water running in the town with channels being overflowed, creating several flood places here and there. Overflow of water is key source of landslides and building destruction in slopped areas. Urban gardens create opportunities for leisure and recreation and thereby promote health and well-being, as well as a sense of place, cultural identity, and social cohesion – important factors for societies to adapt to change. The amount and quality of environmental services that can be provided to population depends of the size and the number of green places and urban gardens. These may be natural-based solutions to mitigate climatic change impacts in urban areas. However, most urban citizens in DR Congo are either not aware or neglect such issues in the design of buildings. One way to increase the attention of urbandwellers towards greening taste on their compounds is economic evaluation of ecological services as benefits provided by urban environment. It is recommend that urban gardens and trees/green spaces can be considered in future urban planning for their high potential to contribute to the achievement of urban sustainability for city communities.

Keywords: *Urban Green Spaces, Climate change adaptation, Ecosystem services, Nature-based solutions recommended, DR Congo.*

CLIMATE-SMART AGRICULTURE OPPORTUNITIES TO MANAGE CLIMATE VARIABILITY-RELATED RISKS IN MOUNTAIN ZONES OF SOUTH-KIVU PROVINCE, EASTERN DR CONGO

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Abstract

Workshops and interviews with various stakeholders were conducted in 2018 in South-Kivu province to identify and describe best-bet technologies appropriated for different ecological zones of the Province. Findings of the study showed that most farmers adopted sustainable land management practice the most common being agro-forestry, terraces, rotation system, cover crop and mulching. Stakeholders (67.54%) indicted that climate-smart agriculture innovations having high chance of being adopted by farmers included: conservation of natural resources (keeping wild 30% farmland), and related environmental-friendly farming practices such as cereals-legume intercropping, ecological sound crop rotations, mixture of improved crop varieties, use of animal manure and organic matter from composts, use of contours and alley cropping for soil and water conservation…), the use of high yielding, pests/disease tolerant crop genotypes, the establishment of meteorological services in rural areas, the creation of TV/Radio talks on climate change issue, the promotion by the government of land-use policy, the creation of agricultural banks, agroecology and agroforestry, ecological engineering approach for landscape management, water harvesting techniques, soil erosion control and land degradation mitigation measures, facilitating local innovation and technological development mechanism, the re-creation of effective national agricultural and environmental services with extension workers actually based in rural areas. It is expected that these climate smart technologies/ services can be used as a stepping up approach to sustainably improving farm productivity while contributing to mitigation. However, financial commitments from government, central, provincial, territorial and development agencies will be crucial for effective adoption of climate smart agriculture technologies in eastern DR Congo.

Keywords: *Climate change and variability, Climate smart genotypes, Kivu Provinces, eastern DR Congo.*

INTEGRATING SOCIO-ECOLOGICAL RESILIENCE WITH WATER RESOURCES MANAGEMENT TO PROMOTE ECO-HEALTH AND HUMAN WELL-BEING IN THE KIVU PROVINCES, EASTERN DR CONGO

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Abstract

There exist wide perceptions of environmental change affecting mountain zones of eastern DR Congo. Environmental collapse is felt as imminent due to exponential increase in pressure on the natural resources driven by rapid population growth and deepening poverty. This study focused on the integration of ecohealth and watershed management approaches with the objective of managing watersheds for the improvement of human health and well-being in South-Kivu province, eastern DR Congo. In this study watersheds are considered as units for management of complex relationships. In eastern DR Congo, there are complex reciprocal interactions among ecosystems, society, and health being the resultant of the integration of the ecohealth approach with watershed-based water resources management in rural landscapes. Cross sectional survey design was adapted with a view of improving the promotion and adoption of sustainable watershed and land management practices in different ecological zones both in upper and lower catchments. Data was collected using both primary and secondary sources. Using key management concepts such as resilience, such approaches can help reduce vulnerability to natural hazards, maintain ecological flows of water and the provision of other ecological services, and promote long-term sustainability of coupled human and natural systems in rural areas. This paper generated empirical evidence likely to be used and inform policy and decision making processes at all levels on the importance of integrating environmental considerations into economic planning and policies with a view to influencing attitude and behavioural change, with special reference to community participation in natural resource management in watersheds.

Key- words: *Ecohealth, Health promotion, Watershed management, DRCongo.*

HUMAN BEHAVIOR AND ENVIRONMENTAL SUSTAINABILITY CHALLENGES IN MOUNTAIN ZONES OF KIVU PROVINCES, EASTERN DR CONGO

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Abstract

Environmental sustainability is a key issue for human societies throughout the 21st century world. In DR Congo many human communities are strongly dependent on natural ecosystem services such as arable land, water resources, fish stocks, and various forest products. Many environmental problems in eastern DR Congo, basically are social and behavioral problems. In eastern DR Congo, biodiversity is decreasing because of bad farming practices/methods such as pesticide application, logging and deforestation for creation of new mining sites within the forest landscapes. Urbanization is stimulated by decreased possibilities of economic security in rural areas. Driving forces of global environmental change that can be easily detected in eastern DR Congo include: human population pressure, dissemination of bad and not appropriated technologies, culture erosion/dilution, and lack of public awareness about environmental issues, civil wars and poor/bad governance. This paper call for setting-up good research and policy support concerning environmental sustainability at different scale levels in eastern DR Congo. Currently, conflicts over natural resources and environmental conditions are threatening peace and stability among nations and may do so increasingly in the near future. To ensure environmental security and sustainability, the overall policy goal certainly should be to reverse the trend of gradual rising environmental deterioration, locally as well as globally. Some key aspirations include: safeguarding the availability of basic resources, protecting human health from environmentally risky conditions, ensuring sufficient quality of human living environments, protecting natural areas with their wildlife and promoting greater harmony between humanity and nature.

Keywords: *Environmental sustainability, Environmental concern awareness, Environment degradation, DR Congo.*

EFFECT OF WATER QUALITY, ENVIRONMENTAL SANITATION AND HYGIENE PRACTICES ON HEALTH OF CHILDREN ATTENDING SCHOOLS IN SLUM AREAS OF BUKAVU TOWN, SOUTH-KIVU PROVINCE, EASTERN OF DR CONGO

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Abstract

The study survey was carried out among the slum areas-based 15 schools found in Bagira, Kadutu and Kasha health zones in Bukavu town during the period of 2016-2018. In the majority of school visited, the majority (80%) of the population used tube well water for drinking, and for cleaning school compounds and toilets. Pipped water was absent in 50% of school visited. The dust bin facility was the most neglected sector in these slum schools. School gardens and greening compounds were only present on 25% of school visited. Solid waste management and drainage system were totally unsatisfactory in 60% of schools visited Majority (61%) of the children did not ware sandal while going to latrine and did not cut finger nail/hair regularly (72%). Most of the slum dwellers (45.5%) did not use cover for safety of the prepared food for the children. It was observed that there was presence of flies in the food preparation areas. Most of school workers and teachers were not concerned about the need of regular cleaningof toilets (2-3 times/ day). Findings of the study showed that 30% of children were underweight, 37% children were stunted and 24% children were wasted. Water quality, environmental sanitation and hygiene practices were poor and positively related ($r=0.45$., $P<0.001$) with health status of school children. The water quality, environmental sanitation and hygiene practices were found to have significant impact ($P<00.5$) on the health of school going children of these slum areas of Bukavu town.

Key words: *Environmental sanitation, Water quality, Slum-based schools, DR Congo.*

EFFECTS OF ENVIRONMENTAL DEGRADATION AND NATURAL HAZARDS (FLOODS, LANDSLIDES, SOIL-WATER EROSION) ON FISHERIES RESOURCES IN WESTERN PART OF LAKE KIVU SHORES, EASTERN DR CONGO

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Abstract

These days, fishermen keep complaining about declining yields (harvests), economic returns, fish stock collapse, fish biodiversity erosion. However, fisherman have very little time to think of main causes. There exist some unfriendly farming activities (tree cutting for charcoal making) that were carried out on hilly and sloppy lands. Consequently, the degradation of vegetation habitat found in the margins of the Lake could be linked to the reduction in fish capture. In addition, there is absence of policies being implemented to regulate fishery on Lake Kivu. Natural hazards such as seismic/volcanic activities and the temporary presence of gas in some areas are also contributing to the destruction of Lake Margins. Yet, such habitats play role in increasing the fish stocks as breeding sites for many fish species. River pollution, perennial erosion and permanent flooding problems in some sites need to be well controlled on Lake Kivu. These problems are quite serious issues that have great potential to reduce fisheries yield in Lake Kivu. The flooding and soil erosion or tributary river pollution with heavy discharge of sediments are associated with heavy ecological and socio-economic consequences fundamentally including reduced capture fisheries, reduced natural fish yield in the wild. These results may result in high food insecurity of fishermen and to serious socio-economic challenges for communities depending on fishery in the margins. The future well-being of the population depends upon wiser balance between exploitation and conservation of natural resources in order to achieve appropriate sustainable production systems that avoid environmental degradation.

Keywords: *Flooding and Soil Erosion, Fisheries resources, Lake Kivu margins & Shores, DR Congo.*

FARMERS' PERCEPTION OF CLIMATE CHANGE IMPACTS, ENVIRONMENTAL DEGRADATION, NATURAL HAZARDS, LOCAL ADAPTATION AND APPROPRIATED MITIGATION MEASURES IN KALEHE TERRITORY, SOUTH-KIVU PROVINCE, EASTERN DR CONGO

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Abstract

Climate change is expected to have a significant impact including increases in average temperature and rainfall patterns in DRCongo. A survey was conducted in south-Kivu to identify perception of farmers about climate change and Natural hazards. The results indicated a high site-variability in knowledge, indication, impact and adaptation to climate change ($p<0.05$) .Most respondents (87.56%) recommended that climate-smart genotypes (tolerant/resistant varieties of crops) should be explored in order to increase resilience against negative impacts due to climatic variability. Some farmers (34.65%) argued that television, radio and newspapers should be used as a tool to disseminate weather information to the larger community about the current and predicted state of the climate change/ variability and also available adaptation practices and mitigation measures. Data indicated that rural poor need more support from the government, NGOs, and the private sector to enable them to move beyond short-term coping measures in response to climate shocks and to invest in long-term, anticipatory strategies that enhance resilience to climate change through the accumulation of assets, livelihood diversification, and the adoption of agricultural technologies that allow for increased productivity and profitability. There was a paucity of information about plans to address flood risks, landslides and soil erosion. Respondents stated that rainfall intensity, volume and spells were expected to increase across the country in the future. Respondents emphasized the greater investments in rural and agricultural development to support the ability of households to make strategic, long-term decisions that affect their future well-being.

Keywords: *Climate change, Adaptation, Mitigation, Environnemental variability, DR Congo.*

DRIVERS OF ECOSYSTEM SERVICES AND HUMAN WELL-BEING DECLINE IN RUZIZI RIVER PLAIN WATERSHED, SOUTH-KIVU PROVINCE, EASTERN DR CONGO

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Abstract

This study aimed at identifying also how human population pressure may be a more pre-eminent stressor than climatic variability in rural areas of South-Kivu province. For two consecutive years, meetings were organized and workshop participant identified the critical provisioning and cultural ecosystem services. Grazing landscape habitats were felt to contribute to about 30.81% of ecosystem services and goods while 40.43% of ecosystem services were identified to be born, localized and delivered from crop landscapes. Freshwater (rivers, lakes, streams) was credited with about 15.81% of ecosystem services and goods. There was no project involved in payment for ecosystem services although rewardable activities. The primary drivers of decline of ecosystem services were pointed by stakeholders as human population growth, insecurity, climate change and absence of governance at all levels. Climate impacts were predicted to continue causing reduction in harvestable provisioning services in future. *Eucalyptus* plantation was identified as a good adaptation practice because the trees could moderate climatic events and reduce on the speed of aridity. Also improved garden and agricultural productivity and insecurity control were the highest ranked management strategies by stakeholders (65.56%). While asked to estimate the rate of decline of ecosystem services, most (70%) felt that they had reduced by 61.39% as compared to the situation 10-20 years ago. Stakeholders felt that, in the future, climate change and insecurity, uncontrolled population growth and bag governance will continue to erode the capacity of communities and ecosystems to cope with potentially extreme climate impacts. These interlinked issues are undermining communities' capacity to cope with potential future shocks such as droughts, inundation, landslides, fishery collapses, crop yield failures, livestock deaths, erosion of local biodiversity. In the absence of more detailed scientific data, such information is clearly vital for conserving biodiversity and ecosystem services in Ruzizi plain for food security and sustainable development.

Keywords: *Drivers, Climate change, Ecosystem services, Livelihoods, Well-being, Ruzizi Plain, Kivu, DR Congo.*

CADMIUM IN AGRICULTURAL SOILS ON LIMESTONES IN DALMATIA, CROATIA

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Abstract

The goals of this paper were to determine concentration of cadmium in agricultural soils on limestones in Dalmatia, Croatia and compare it with soil guideline values (SGV) set up in Croatian regulation on the protection of agricultural land (NN 9/14) and some EU countries. In a total, 22 topsoil samples (0-25 cm) were taken in the olive groves and vineyards located in the vicinity of city of Primošten and on the island of Brač and Šolta and analysed for pH, soil organic carbon (SOC) content, P_2O_5 and K_2O, particle size distribution and Cd concentration. The cadmium was extracted with aqua regia and determined by inductively coupled plasma - optical emission spectrometry (ICP-OES). The Cd concentration ranged from 0.68 to 2.89 mg kg^{-1}. The median value of 1.80 mg kg^{-1} was ten times greater than the median value of European agricultural soils established in GEMAS project. The maximum concentrations of Cd in soil samples of Primošten, Brač and Šolta were 2.27, 2.89 and 2.55 mg kg^{-1} respectively. In 9 of 22 soil samples (41%), the concentrations of the cadmium exceeded the maximum admissible concentration (MAC) value of 2.0 mg kg^{-1} given in mentioned Croatian regulation. Obtained anomalous Cd concentrations imply the need for establishing the origin of Cd in these soils, as well as spatial distribution of areas with elevated levels of Cd in soils.

Keywords: *agricultural soil, cadmium, soil guideline values.*

EVALUATION OF FLOWER BEDS WITH PERENNIALS IN THE CITY DISTRICT NOVI ZAGREB - EAST

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Abstract

Flower beds are one of the most visible elements of public green areas. Regardless of their importance, there is little research of flower beds as an individual element in space. Flower beds with perennials are extremely important in urban environments because they contribute to biodiversity, but also reduce maintenance costs compared to seasonal flower beds. The aim of this research was to determine the existence of flower beds with perennials, the presence of floral species, to detect problems related to species selection and maintenance. Out of 96 explored flower beds with perennials within the research area, eight flower beds were not found (none exist). Almost 90% of flower beds were combined with roses or seasonal plants which were probably planted by citizens even though the public areas were maintained by the municipal utility company. The most common flowers were roses (37%), irises (29%) and yuccas (20%). The results showed that all flower beds were not present and that most of the existing beds should be maintained and better designed in terms of respecting environmental conditions in the selection of floral species.

Keywords: *evaluation, perennials, flower beds, maintenance, Zagreb.*

WATER PUMPING PERFORMANCE FOR ROOF CULTIVATIONS UNITS USING THREE SMALL AC/DC SOLAR PV WATER PUMPING SYSTEMS

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Abstract

The most vital usage of solar pumping systems is to irrigate the agricultural lands to assist farmers rather than using electric or fuel system that takesplenty of time, high cost, effort and much losses. The performance evaluation of mini water pumps power-driven by small solar photovoltaic (PV) panel (40 Watt) was investigated to supply the needed water for irrigating roof cultivation units. The experiments were carried out at Faculty of Agriculture, Zagazig University, Zagazig, Sharkia Governorate, Egypt (Latitude 30.5o – Longitude 31.5o) at winter and summer seasons in 2018. Two solar pumping systems were evaluated; DC solar PV water pumping system (DC-SPVWPS) and AC solar PV water pumping system (AC-SPVWPS) under different operating parameters of pumps power (5, 12 and 22 W), solar radiation hours during daylight (9:00 to 15:00) and pumping heads (0 ,0.5, 1 and 1.5 m). All parameters were evaluated by determinations of pumping discharge, hydraulic energy, pump efficiency and cost. The obtained results revealed that the discharges and pumping efficiencies of AC-SPVWPS were higher than DC-SPVWPS. The optimum pumping heads at optimum discharges were investigated. Pumping costs of one cubic meter of water using AC-SPVWPS were higher than DC-SPVWPS. From results, it isimportant to point out to the need for use the small size of the solar PV power system due to efficient supplying of irrigation water for roof cultivation units.

Key words*: PV, DC solar PV water pumping system (DC-SPVWPS), AC solar PV water pumping water (AC-SPVWPS), Discharge, Hydraulic energy, Pump efficiency, Cost.*

BEE FORAGE DIVERSITY IN ETHIOPIAN VEGETATION AND ACHIEVEMENTS IN ETHIOPIA

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Abstract

The high biodiversity of the country is attributed to its wide ranges of altitude and great geographical diversity. This has resulted in the existence of the diverse floral resources of which majority of them are honeybee flora. In this paper bee forage identification and documentation were made to determine types of bee plants, flowering period and food source offered by the plants. Moreover melissopalynological analysis of honey from different regions of Ethiopia was analyzed for determination of major and minor honey source plants. Accordingly, over 1500 plant speciesbelonging to 105 plant families were identified. The growth form analysis of bee forage utilized by honeybees comprised of 41.6% herb, 28.7% shrubs, 21.7% trees and 8% climbers. The majority of bee plant species flowered from September to November and April to May resulting in two major honey flow periods in the country. Melissopalynological analysis of the honey samples indicated that *Schefflera abyssinica, Croton macrostachyus, Syzygium guineense, Vernonia amygdalina* and *Coffea arabica* contributed for 80%, 64%, 86%, 77% and 75% of the total pollen count respectively and they are dominant honey source plants from southwest and southeastern part of the country, while *Becium grandiflorum, Hypoestes forskalii, Leucas abyssinica* and *Acacia* spp. accounting for 71%, 75.1%, 62% and 70.5%, respectively are dominant plants from northern Ethiopia. On the other hand *Eucalyptus globulus* and *Guizotia scabra* honey were from central Ethiopia, contributing to 94% of the pollen count. Deforestation and Agricultural land expansion and climate change are the major causes for shrinkage of bee flora and affecting phenological pattern of bee forages. Thus in situ conservation and raising and planting of seedlings of bee forages should be promoted for sustainable honey production.

Keywords: *Bee forages, Pollen, honey flow, pollination.*

ETHNOBOTANICAL STUDY OF MEDICINAL PLANTS USED TO TREAT HUMAN AILMENT IN GUDURU DISTRICT OF OROMIA REGIONAL STATE, ETHIOPIA

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Abstract

This research was carried out to document ethnobotanical data and threats affecting medicinal plants. Semi-structured interviews, questionnaires, face to face discussion, and field visit were employed to gather the required data. A total of 92 informants - 21 key and 71 randomly selected informants), of which 48 males and 44 females were used. The study documented 57 plants species belonging to 55 genera and 41 families. Out of these famlies, Asteraceae were represented by 4 species (7.123%), followed by Euphorbiaceae, Fabaceae and Rutaceae represented by 3 species each. The majority of the species 40 (70%) was gathered from natural habitats while 26% was cultivated and 4% collected from both habitats. The most widely utilized plants are: trees 19 (33.3%) species, followed by shrubs 18 (31.6%) species, herbs 16 (28.07%) species, and climbers with 3 (5.3%) species. The society also frequently uses plant parts such as fresh plant materials (68%) and leaves (33%). The most widely used route of medicine application was oral (58%), dermal (23%) and nasal (10.5%). The remaining remedies were taken with some other additives and solvents like water, butter, milk as well as honey. Traditional medicines were prepared by pounding (33.3%), and crushing (24.6%). Carduus schimper and Ocimum forskolei was medicinal plants with higher informant consensus. The disease classes with highest ICF rate (0.93) were fibril illness. The result reveals that there is high preference for Ficus vasta for healing Hemorrhoid disease whereas Cissus cactiformis was used for treatment of Rabies by traditional medicine practitioner. Ekebergia capensis was the highest multipurpose tree species.

Key words: *Ethnobotany, Guduru district, traditional practitioner, medicinal plants, ailment.*

MECHANISMS FOR SUCCESSFUL BIOLOGICAL RESTORATION OF THE THREATENED *JUNIPERUS PROCERA*(CUPRESSACEAE) ON DEGRADED LANDSCAPE, ETHIOPIA

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Abstract

Juniperus procera Hochst.ex. Endl. (Cupressaceae) is world largest juniper, but is currently threatened due to multiple anthropogenic factors. This paper describes mechanisms for the successful biological restoration of African pencilcedar in a degraded landscape that had been depleted of organic matter and essential nutrient elements as a consequence of relentless deforestation, soil erosion, unsustainable farming and overgrazing. We used stecklings (= planting materials derived from rooted cuttings) of *J. procera*, and deployed *Acacia abyssinica* Hochst. exBenth. (Fabaceae) to serve as a putativefoster tree. The study was conducted for a period of 7 years, with major soil fertility indicators determined at years 0, 3 and 7. We found that mean height, crown length, crown diameter, branch length, and branch numbers of *J. procera* trees grown in association with *A. abyssinica* were significantly ($p = 0.001$) higher than those grown without the putative foster tree. Mean plant-available P (15 ± 2.1 ppm) and soil N-content ($0.42 \pm 0.04\%$) were approximately 3- and 2-fold higher, respectively, in the *A. abyssinica*-treated plots than in the non-treated ones. Similarly, the levels of exchangeable cations and soil organic carbon were twice higher in the*A. abyssinica*-treated plots than in the non-treated ones. Cation exchange capacity improved with restoration time, both in the 0–15 and 15–30 cm soil profiles, but the extent of improvement was significantly ($p = 0.001$) higher in the 0–15 cm soil profile of the *A. abyssinica*-treated plots than in the non-treated ones. We conclude that successful restoration of *Juniperusprocera* in degraded landscapes and across the species' range of habitats is feasible provided that strong and well-fortified stecklings are established along with the N_2-fixing, fast-growing and drought-tolerant *Acacia abyssinica.*

Keywords: *Center for Indigenous Trees, Highlands, Mountainous region, Soil fertility, Tulu–Korma, Stecklings.*

SWOT ANALYSIS OF FOREIGN AGROBUSINESS INVESTMENT THROUGH THE INDUSTRIAL PALM OIL SECTOR

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Abstract

The foreign agribusiness investment and the private and public partnership is prioritized and have been increasing for the last fifteen years. In fact, the large-scale commercial land acquisitions are put in a context of « expanding economic relations between Africa and the rest of the World ». The foreign investment in some African countries have considerably increased through the economic liberalization, globalization of transport and communications, and global demand. This investment focus on extractive industries and agriculture especially the agro-industrial sector. One of them is the palm oil sector; this rise of oil palm plantations is explained by the high yield per hectare, the low cost of production, and the good technological quality According to Gatti R.C. and *al.*, the massive use of palm oil products and its potential impact on forest resources have attracted worldwide attention. The consequence on human health of daily palm oil intake are still debated. This paper opposes the point of view of both, the industrial and the Non-Governmental Organization (NGO) governance. Since shortly multi-actors international initiative, the sustainable palm oil certification and promotion, as introduced by the WWF accounts on the social and environmental aspects, as stipulated RSPO standard in 2018. This paper aims to compare the vision of each actor and the position of the certification concerning the social, environmental and nutritional aspects.

Keywords: *Swot analysis, Agribusiness, investment, palm oil.*

CALIBRATION OF SALTMED MODEL FOR INDUSTRIAL TOMATO CULTIVATION IN CENTRAL GREECE USING A DRIP IRRIGATION SYSTEM

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Abstract

Irrigation plays a key role in increasing agricultural productivity. Irrigated agriculture uses about 70% of global fresh water consumption. The continuing increase in world population and fresh water demands, along with the climate change effects are further threat for limited fresh water resources especially in arid and semi-arid regions. Models can be very useful tools in agricultural water management. They can help in irrigation scheduling and crop water requirements calculation and also to predict yields and soil salinization. Most of the existing models are designed for a specific irrigation system and are single-process oriented, such as models for water and solute movement, infiltration, leaching or water uptake by plant roots or a combination of them. SALTMED model has been developed for generic applications. In this research, the SALTMED model was calibrated using data from an industrial tomato cultivated field in Larissa region, central Greece, irrigated with fresh water at different water levels, using a drip irrigation system, corresponding to 100%, 80% and 60% of ET_c (deficit irrigation). The model successfully illustrated the effect of the irrigation application on soil moisture distribution and crop yield.

Keywords: *SALTMED model, Fresh water, Trickle irrigation, Soil moisture profile, Crop yield.*

LIFEGrIn: GREENING OUR CITIES FOR MORE RESILIENT LIVES

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Abstract

Cities already face harsh climate, due to obvious anthropogenic impacts, responsible for the alteration of both natural surface and atmospheric conditions. These impacts range from microscale to macroscale. Urban open spaces in cities should be considered as vital elements of the urban landscape/ecosystem with specific environmental contribution to climate change mitigation and adaptation. The LIFE GrIn project aims to incorporate the climate change adaptation and mitigation perspectives and green infrastructure management and conservation in local governance in cities, through the establishment of an integrated policy framework focusing on Urban Green Areas (UGAs). LIFE GrIn will utilize all available tools and indicators at European level to assist in strategic planning and management of UGAs in the context of climate change adaptation and mitigation. The program started at 2018 and has a 3.5 year - duration. Six different partners are participating from Greece. Scientific Coordinator for the project implementation is the HAO DEMETER-Institute of Mediterranean & Forest Ecosystems and other partners are the Environmental Management Company - Homeotech Co, the Central Union of Hellenic Municipalities, the Greek Municipalities of Amarousion and Heraklion and the Hellenic Ministry of Environment and Energy. The LIFE GrIn project conclusively will change the way of perception and management of urban green spaces, to make our lives and cities more resilient to climate changes.

Keywords: *Urban green spaces, Cities, Climate adaptation, Management of UGAs.*

LOCATION, EVALUATION AND REPRODUCTION OF LOCAL VARIETIES OF FRUIT TREES IN NORTHERN GREECE AND EPIRUS: PROGRAM PRESENTATION

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Abstract

The exploitation of local varieties of fruit trees can be an important tool for the development of Greek agricultural production due to the high percentage of available mountainous and semi-mountainous land. These varieties mainly concern very old trees, that are adapted to the specific local conditions, require minimal inputs and, in many cases, have local cultural importance. The aim of the project is to identify such local varieties in abandoned orchards in Northern Greece and Epirus, their evaluation and pilot reproduction. In total, 8 mountainous areas of research have been delimited, covering an area of approximately 735,000 ha. The location concerns fruit trees belonging to Families of Rosaceae (genus Pyrus, Prunus, Malus, Cydonia), Moraceae (genus Ficus), Juglandaceae (genus Juglans) and Lythraceae (genus Punica). In order to achieve the above purpose, a review on the available literature was carried out. Moreover, monitoring visits in the areas concerned took place and questionnaires were answered by the elderly inhabitants. A database with on-line connection was created for input of the primary data and characteristics of each identified variety (according to UPOV specifications) from the field. About 50 varieties with 2-3 representative individual plants were selected. The 150 trees were mapped, grown in situ, identified with DNA analysis, and evaluated for qualitative and quantitative characteristics, compared to known commercial varieties. Twenty best-graded varieties would be propagated by stem cuttings to produce about 250 plantlets from each variety. The first phase of the survey over a 10-month period, involved the localization of many valuable varieties in almost all areas of research, including 20 Pyrus, 35 Prunus, 15 Malus, 15 Cydonia, 8 Ficus, 13 Juglans and 6 Punica trees. The DNA identification and the evaluation of the selected trees will be carried out in the near future.

Keywords: *Local varieties, Abandoned orchards, On-line survey, Greece.*

DISPERSION AND BIOACCUMULATION OF HEAVY METALS IN PLANTS AT THE BASIN OF WEST MACEDONIA LIGNITE CENTER, GREECE

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Abstract

Lignite used in thermoelectric factories contains a number of trace elements which are dispersed in the environment during coal combustion. In this scientific research a comparative investigation has been carried out concerning the bioaccumulation of seven heavy metals (Cr, Mn, Fe, Ni, Cu, Cd and Pb) in trees, mosses and lichens from the northwest part of Greece, where the facilities of West Macedonia Lignite Center (WMLC) are located. In that direction, 71 soil samples and 92 samples of plant organisms were collected and utilized. In essence, the heavy metals concentrations were determined in all samples and then the calculation of the soil to plant Transfer Factors was conducted. The results revealed a discernible loading in some tree species, which however, did not exceed the legally established limits. On the contrary, mosses and lichens displayed much higher transfer factors, confirming their ability to bio accumulate air pollutants. Another conclusion is that chromium, manganese, iron, nickel, cadmium and lead compared to unpolluted areas are systematically increasing in tree leaves in the vicinity of WMLC. This fact cannot be attributed to soil uptake, given that soil parameters in the study area immobilize most of the heavy metals. The most reliable explanation for their origin is the flying ash of CPPs, which is rich in more of the metals in question.

Keywords: *Fly ash of lignite, Heavy metals, Bioaccumulation, Lichens and Mosses.*

INVESTIGATION OF NUTRITIONAL PARAMETERS IN STORAGE OF SEA BUCKTHORN (*HIPPOPHAE RHAMNOIDES L.*) JUICE

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Abstract

Sea buckthorn juice is one of the imperative product obtained from the sea buckthorn berries, is now commercially very important. The juice provides a nutritious beverage, high in suspended solids, and very high in vitamins especially in vitamin C and carotenoids. Comparative studies on the effect of preservatives and storage on overall quality of sea buckthorn berry blended juice were carried out. Juices were prepared from juice of sea buckthorn and pomace of sea buckthorn by mixing their pomace in 9.95:0.05 (0.5%), 9.9:0.1 (1%) and 9.8:0.2 (2%). All the samples were packed in 210 ml transparent glass bottles and stored at ambient temperature for six months. At each sample was analyzed for total polyphenol content (TPC), total antioxidant activity (TAA) and color measurement at zero storage and at interval of 2 months up to six months. During storage TAA of each sample decreased after 2 months from 7.56% to 33.1%. After 4 months TAA decreased from 11.6% to 39.2% and in half a year, TAA also fell from 19.33% to 47.5% compared with the initial months. After 2 months TPC too decreased from 0.9% to 10.9%, after 4 months each sample decreased from 12% to 27.8% and after half year TAA also fell from 21% to 44% compared with the initial months. TAA and TPC result of the control samples were higher than each month. The presence of valuable chemical and nutritionally important constituents in sea buckthorn juice, and from the scientific knowledge of their importance, it is clear that sea buckthorn juice is one of the most important sources of these materials, and can be use as alternative nutritional sources in the commercial market. We need to experiment with antioxidant details.

Keywords: *Sea buckthorn, pomace, antioxidant, FRAP, polyphenol content.*

CHANGES IN SOIL PROPERTIES IN URBAN ENVIRONMENT

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Abstract

In our research, the characteristics of soils were investigated in the peripheries and urban lands of Debrecen. Debrecen is located on the border of Hajdúság and Nyírség landscape units. The various landscape features affect also the soil conditions, therefore in the sand areas of Nyírség mostly Arenosols can be found. On the loess plains, including Hajdúság, Chernozem is the most frequent soil type. Through the centuries, the natural deposits have been overlain by younger anthropogenic sediments, and today the original soil surface can be found at a depth of 2-3 m in the city centre. The artefacts, grain size, $CaCO_3$, humus content and pH of 25 soil profiles were measured. After the complete exploration, the amount of Cr, Cu, Ni, Ba, Al, Fe and Mn were determined. Based on the parameters examined, it was demonstrated that human activities had impact on the soils. It was most evident in the presence of substances of anthropogenic origin, high $CaCO_3$ content, pH-shift into the alkaline range and in the irregular run of the humus content segment. According to the Joint Decision No. 6/2009. (IV. 14), soils in Debrecen exceeded the permitted levels for Cu, Ni, Ba. We also showed that there were significant differences in examined properties between urban area and periphery. In summary, since the anthropogenic impact on soil is decreasing from city centre to suburban area, therefore undisturbed chernozems and sandy soils can be found in the outskirts of Debrecen.

Keywords: *urban soil, soil properties, heavy metal, contamination, anthropogenic effect.*

AN INVESTIGATION ON BEHAVIOR AND SUSTAINABILITY OF LANDSLIDES BASED ON FRACTAL DIMENSION (CASE STUDY: DAMAVAND WATERSHED)

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Abstract

Among different types of natural hazards, landslide is the most dangerous and damaging one and has increased with the development of human activities within natural systems. This type of mass movement has affected several countries and many regions in the world. Due to geological and topographic conditions this phenomenon is widespread in Iran. Therefore; different measurements have implemented to manage it. First step of landslide management is determination of its stability. In order to determine landslide stability, a wide variety of methods and findings are used by experts. Finding a method which needs limited data, has economic and temporal justification and also appropriate accuracy and proficiency are always concerns for landslide experts. Fractal geometry as one of the most important branches of Mathematics in twenty first century has been applied in different branches of sciences and engineering by the researchers. In this research, FRACEK Software has been used for calculation of fractal dimension (D) and determining the stability of landslides in Damavand basin. After field visits and also application of Google Earth, 397 landslides were identified in the study area. For verification of the landslides, 41 landslides in 4 regions have been compared with their position in the map. Then in 4 landslides (Mosha, Ira, Rudehen and Aslan), field data collecting have carried out for the purpose of calculation of Factor of Safety. Required data includes: Soil cohesion parameter (C), soil bulk density (γ), slope percentage (θ), soil internal friction angle (φ), mass height (h) and mass width (b). Fractal dimension (D) is calculated for all 397 landslides. The results demonstrated that % 88.42 of the total number of landslides have a D more than 1.3 and only % 11.58 of the landslides have a D less than 1.3. According to Wu et al (2009), if D is more than 1.3 the landslide is unstable, otherwise it will be considered stable. According to the results, in the study area, there are 351 non-stable and 46 stable landslides. According to the calculations of factor of safety, Mosha, Ira and Rudehen are non-stable, while Aslan is stable. Also this is concluded that Aslan is stable according to fractal analysis while three others are unstable. The results of this research illustrated that there is no significant difference between the outcomes of fractal dimension analysis and factor of safety analysis. But it must be considered that factor of safety analysis is a cost and time consuming process, in the other hand fractal based analysis, is rapid, easy and just needs software. Therefore; it is recommended that fractal dimension should be used for investigating landslide stability.

Keywords: *Landslide, fractal, Damavand, factor of safety.*

EVALUATION OF GROUND-BASED SURFACE SOLAR RADIATION DATA VERSUS SATELLITE PRODUCTS (CASE STUDY: IRAN)

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Abstract

Global Surface solar radiation (SSR) is one of the key parameters in climate and agricultural studies and is an important component of land-surface energy models. Due to limitations in ground-based measurements, SSR is currently estimated by various empirical radiation methods which are solely valid for specific climates and locations. This work is aimed to evaluate SSR, derived from three satellite-based radiation products over Iran from 2012 to 2015on a daily basis. The satellite products have been developed by Clouds and the Earth's Radiant Energy System (CERES) and two datasets of CLARA and SARAH from Satellite Application Facility on Climate Monitoring (CM SAF). The results of validation of SSR estimation by all three products at all stations showed all three products are able to estimate the SSR in Iran with insignificant differences. Among them, SARAH shows the highest performance (R^2 = 0.93 and a RMSE of 22.36 W/m^2) in comparison with CLARA (R^2= 0.91; RMSE=24.39 W/m^2) and CERES (R^2= 0.92; RMSE= 25.23). Evaluation of satellite-based products in monthly and seasonal scales shows that satellite products underestimate the SSR in winter and spring. This bias is likely due to the increase in cloudiness and aerosol concentration induces in those seasons. Due to the good performance of the aforementioned satellite products (especially SARAH), it is possible to use these data in estimating SSR in places where the ground measurements are not available.

Keywords: *Surface solar radiation, Assessment, Satellite-based products, Iran.*

COMBINATION OF BIOLOGICAL FERTILIZERS WITH NITROGEN AND PHOSPHORUS FERTILIZERS TO REDUCE THE USE OF CHEMICAL FERTILIZERS IN SUGAR BEET

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Abstract

In order to reduce the use of nitrogen and phosphorus fertilizers in sugar beet cultivation, an experiment was conducted in a complete randomized block design with four replications during 2017 in Iran. The treatments were: 1- control (without any fertilizer), 2-use of chemical fertilizers with 100% fertilizer recommendation (based on the results of soil degradation, fertilizer of urea 240 kg / ha and triple super phosphate fertilizer 180 kg / ha was consumed), 3- use of chemical fertilizers with 75% fertilizer recommendation + Phosphonitrocara, 4- use of chemical fertilizers with 50% fertilizer recommendation + Phosphonitrocara, 5- use of chemical fertilizers with 25% fertilizer recommendation + Phosphonitrocara, 6- use of chemical fertilizers with 75% fertilizer recommendation + Nitrozist + Phosphozist, 7- use of chemical fertilizers with 50% fertilizer recommendation + Nitrozist + Phosphozist, 8- use of chemical fertilizers with 25% fertilizer recommendation + Nitrozist + Phosphozist. Phosphonitrocara contains *Bacillus coagulans*, *Azotobacter chroococcum* and *Azospirillum lipoferum*. Nitrozist is a bio-fertilizer which has been composed of Azotobacteria and Phosphozist is a bio-fertilizer that composed of phosphobacteria. The results of the experiment showed that the highest amount of root impurities, especially nitrogen, was caused by use of chemical fertilizers with 100% fertilizer recommendation, while the combined use of chemical fertilizers with 50% fertilizer recommendation with biological fertilizers(Phosphonitrocara or Nitrozist + Phosphozist) significantly reduced root impurities and increased sugar production.

Key Words: *Sustainable Agriculture, Sugar production, human health, Root impurities.*

DEVELOPING THE SOFTWARE FOR SPATIO-TEMPORAL ANALYSES OF VEGETATION INDICES: CASE STUDY OF ARSANJAN COUNY, FARS, IRAN

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Abstract

For storing, retrieving and fast processing of the environmental-related data and remotely sensed images of iran, land information observers company (lioc) in conjunction with the atmospheric and oceanic research center (aorc), shiraz university, iran, have constructed a database containing some spatiotemporal data of climatology, hydrology and agriculture over the country. Interactive computational and graphical-based lioc software has been developed for searching database, processing the acquired data and visualizing the results. As an example, we utilized this software to examine historical changes in the vegetation indices over 2100 hectares of agricultural areas of arsanjan county, fars province, iran. The modis-based images of the normalized difference vegetation index (ndvi) and enhanced vegetation index (evi) that constitute a part of the database were selected as the variables. Historical variations of these indices for april of all years between 2000 and 2018 were then examined. Among huge volume of various stored data in the database, and without using other software, the loic software efficiently recognized, clipped and processed all images that were associated to this particular area. The obtained images and statistics revealed that spatially averaged value of ndvi (evi) increased from 0.5 (0.39) in 2000 to 0.66 (0.52) in 2007. However, the index value experienced a negative trend after 2007 so that it dropped to 0.37 (0.29) in 2018. The results also proved that the lioc software is sufficiently able to search, find and analyze various environmental and agricultural-related data stored in the constructed database.

Keywords: *lioc, software, ndvi, iran, arsanjan.*

RICE AGENTS' PERCEPTIONS TOWARDS ENVIRONMENTALLY SOUND AGRICULTURE IN GUILAN PROVINCE, IRAN

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Abstract

The purpose of this study was to investigate rice agents' perception towards Environmentally Sound Agriculture (ESA) in Guilan province, north Iran. The descriptive–correlation method was used in this study. The statistical population of this study consisted of all the rice agents in Guilan (N=176). The sample size consists of 90 respondents, selected by random sampling method. Data were collected by the questionnaires and the validity of it was confirmed by a panel of experts. The reliability was confirmed by a pilot study where Cronbach's alpha coefficient was 0.942. Descriptive statistics and inferential statistics $SPSS_{v19}$, $LISREL_{8.80}$ were applied to data analysis. The results showed that there were no significant relationship between the environmental attitude and age, work experience and level of education at 0.05 levels. The results of confirmatory factor analysis revealed that economic factors, the most meaningful relationship with the ESA and social factors were placed in the next ranks, respectively. Rice agents in Guilan province can play important role in paddy farmers tending to environmentally sound, therefore, agricultural organization (Jihad-e-Keshavarzi) by training and promotion rice agent's skills can improved rice sustainable farming.

Keywords: *Environmentally Sound Agriculture, Behaviour, Developing Factor, Environmental Attitude.*

SOY-BASED VEGAN BURGER: FROM WASTE TO PRODUCTION

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Abstract

Soy press cake (okara) is a by-product of cold press oil production, which is applied as feed or waste, whereas, it still has protein, which could be applied for human nutrition, leading to reduction of the overall waste in vegetable product processing. Around 8.77 million tons of soybeans were produced in the European countries in 2014. Around 50 % of all soy based food products is okara, which is underutilized and disposed as low-quality feed or waste. The aim of this research was vegetable waste reduction by utilizing fermented okara for developing vegan burger products with sensory properties similar to meat products. The thermal treatment of okara samples was done by applying pasteurization and sterilization methods. Okara samples were fermented by specific Lactobacillus strains. After fermentation, vegan burgers were produced based on fermented okara. Chemical composition results indicated that okara was a suitable protein and fiber source and had essential amino acids. Microbiological results approved significant increase in the amount of Lactic acid bacteria in all fermented okara samples, which could have positive effects on flavor, texture and nutritional value of veg-burger. The sensory evaluation highlighted more acceptable sensory properties of veg-burgers fermented by two specific Lactobacillus strains than other strains. This research demonstrated the potential of Lactic acid bacteria fermentation by applying *Lactobacillus plantarum* and *Lactobacillus brevis* and pasteurization treatment to convert okara, commonly considered as feed or waste, into nutritive improver of vegan-burger; meeting nutritional and sensory requests of modern consumer.

Keywords: *Vegetable waste, soy press-cake, Vegan burger, Lactobacillus strains.*

BIODIESEL SYNTHESIS FROM KITCHEN WASTE OIL USING NATURAL CATALYST

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Abstract

Biodiesel is considered as one of the most alternative fuel for diesel engines and it is nontoxic, renewable and biodegradable. Biodiesel can be produced from fresh and/or waste oils. An effective way to reduce the cost of biodiesel production is to use waste oil. One of the main concerns of researchers in converting waste oil into biodiesel is as to what kind of catalyst can have maximum efficiency and, at the same time, have a minimum destructive environmental impact. Egg shell is one of the most important and proper natural catalysts that can have such ability. In this research, used egg shell was used as a natural catalyst in biodiesel production. To convert eggshells into a natural catalyst and perform the calcination process, five different temperatures (400, 600, 800, 1200 and 1400ºC) were used. The use of a natural catalyst in the transesterification reaction requires high temperatures and pressures. The effects of reaction temperature, catalyst content, and reaction time were analyzed on the biodiesel efficiency. The purest biodiesel was synthesized at the sintering temperature of 1200ºC using 7% catalyst, reaction temperature of 120ºC, reaction time of 45 min. The analysis showed that the most parameters including carbon content, viscosity, water content, and methyl ester purity (%) were performed in reasonable level by using of egg shell as a naturally catalyst.

Keywords: *Biodiesel, Eggshell, Natural catalyst, Waste oil.*

SUSTAINABILITY DRIVEN MODERNIZATION IN IRRIGATED AGRICULTURE

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Abstract

Human actions have always been focused on the adaptability with the environmental limitations and improving developments on that pathway. The basins of attractions now are shifted from the environment as finite to the socio-ecological resilience in first place and to the nexus between water and food, as a pre-condition for social justice, human well-being, economic development, and sustainability. The water-food nexus is central to the sustainable development. The inextricable linkages between these critical domains require a suitably integrated approaches and new strategies to attain their goals. To this aim, several countries embarked in the re-modernization of the irrigation schemes, foreseeing their on-demand operation. In the case of Tunisia, the re-modernized schemes are facing the challenge of the inadequacy of the service reported by the users threating their livelihood. The main objective of this study is to assess the correlation between the flexibility of the services provided under uncertainties, and mainstream the findings into the modernization program with view of increasing the resilience of the irrigation community.

Keywords: *Socio-ecological resilience, water-food nexus, Agricultural modernization, Sustainability, Land water air energy and the associated living system.*

AGRICULTURE AND LAND USE: CONTEXT ANALYSIS AND FUTURE PERSPECTIVES FROM THE MEDITERRANEAN TO THE APULIA REGION

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Abstract

Land use patterns have, over the centuries, reflected the continuous interaction between human activities and natural environment, and have resulted in significant environmental impacts and its consequences, both positive and negative on the well-being of human groups. The scarcity of resources, land and water, represents a great social challenge, especially in a context of climate change and food insecurity. These challenges are particularly significant for the Mediterranean, a region characterized by dynamic population and high density, with strong constraints on land and water resources. The Mediterranean has a long history of land use and represents one of the richest areas in terms of biodiversity; because of its cultural and environmental characteristics and its long history, the Mediterranean basin hosts a variety of land use systems of varying intensity and levels, ranging from intensive systems to traditional "mosaic" ones. These traditional mosaic systems are associated with high biodiversity values and landscapes particularly vulnerable to global changes, which see their survival threatened not only in terms of food supply, but also with respect to a number of ecosystem services linked to the multifunctional dimension of agriculture. In this context, starting from the report on land use in Italy, the contribution aims to provide a broad and precise picture of its current patterns at different levels, up to the Apulian regional scale. Agriculture itself, to which the delicate issue of land use is necessarily linked, today represents a fundamental strategic sector for the Mediterranean countries, whose centrality in Euro-Mediterranean regional cooperation requires an in depth reflection and analysis.

Keywords: *Land use, Mediterranean, Multifunctional agriculture, Ecosystem services, Biodiversity.*

RECYCLING OF PACKAGING MATERIALS TO OBTAIN AN OENOLOGICAL ADJUVANT

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Abstract

Circular economy is aimed to create a *zero-waste* system by the reduction of wastes and their exploitation by turning them into by-products to be used as inputs for new production processes. In this perspective, packaging materials (glass and aluminium) were used to synthetize zeolitic materials to be evaluated for oenological application. A potassium (Zeo-K) and a sodium (Zeo-Na) zeolitic material (Zeo-K and Zeo-Na) were obtained, containing 16% and 30% of crystalline materials respectively. Both materials were then tested as oenological adjuvants, evaluating their ability to remove riboflavin from wines. Riboflavin is responsible of a photoxidation process leading to the onset of the light-struck taste in wines. Preliminary experiments were performed using a model wine solution, enriched with 300 μg L^{-1} of riboflavin. Each zeolite was added to the riboflavin-enriched solution at the concentrations of 1 g L^{-1} (Zeo-K1, Zeo-Na1) and 10 g L^{-1} (Zeo-K10, Zeo-Na10). For comparison, two bentonites were also tested at the concentration of 1 g L^{-1}. A control without either zeolites or bentonites was also run. The obtained results showed that riboflavin concentration remained unvaried in the control, whereas it decreased from 4% (Zeo-K1) to 37% (Zeo-Na10) in the treatments. Both zeolitic materials appeared less efficient than bentonites at the same concentration. Nevertheless, synthesizing zeolites with higher crystallinity is likely to lead to materials with higher efficiency, almost comparable to bentonites. Efforts are being undertaken to produce more effective zeolites from waste materials for oenological applications and to evaluate possible secondary effects on wine properties.

Keywords: *Circular economy, packaging materials, zeolites, wine, riboflavin, light-struck taste.*

CHRONOSEQUENCE OF NATURAL REGENERATION IN ABANDONED MINING SITES IN THE AMAZON RAINFOREST OF MADRE DE DIOS, PERU

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Abstract

Gold extraction via small scale mining in the Amazon rainforest of Peru has become one of the greatest threats to deforestation and land degradation in the Amazon, especially in the Madre de Dios region which is one of the last biggest remnants of continuous tropical rainforest in the world. Restoration of these degraded ecosystems have become a priority in the last decade but without concrete actions, however, few research has been conducted in response to these restoration activities nor natural regeneration. The significance of this research was to study a chronosequence of natural regeneration in two active gold-mining sites in Madre de Dios-Peru (Paolita-PA; Santa Rita-ST) and how the nearby remnant forest contribute to natural regeneration. Sites were chosen depending on its management and the proximity to nearby remnant forest. Floristic composition of natural regeneration following abandonment of mining activities was studied by establishing a total of 12 plots (20x50m each), 6 with an abandonment period of 2 to 16 years and 6 were considered as reference forest. A total of 753 individuals from 44 families and 144 species were identified. To analyze biodiversity and similarity composition, Shannon and Jaccard indexes were used, respectively. The results showed that the abundance of species (Shannon) was higher in Paolita than in the Santa Rita mining site. From Jaccard's similarity index each mining site was analyzed in clusters finding that in Paolita, nearby remnant forest might not have a great influence over natural regeneration when compared with Santa Rita site which showed similarity between remnant forest, but instead the time of abandonment, availability of nutrients and forest fragmentation might be the cause of the recovery of degraded forest.

Keywords: *Chronosequence, Natural regeneration, Gold mining, Amazon rainforest, Peru.*

MITIGATING CLIMATE CHANGE INDUCED DROUGHT IN HARVESTING AND WATER USE EFFICIENCIES– A CASE OF AGRICULTUREIN MIGORI COUNTY (KENYA)

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Nairobi Story from Migoricounty

Abstract

The effect of climate change is observed in increasing dry spells, infrequent precipitation and temperature rise. There is more pronounced warming at higher altitudes resulting in a shorter winter and earlier snowmelt. As snow is the main source of soil moisture in the high mountains, this changes has adversely impacted soil-moisture, and less moisture has led to a poor crop performance. In Migori, region in Kenya, farmers faced challenges of low quality and productivity of apples mainly due to a severe shortage of soil moisture during the apples critical growth period. The survival chances of transplanted young saplings also affect orchard establishment. To tackle this issue, SNV facilitated an innovative process that brought together farmers, businesses, government and civil society organizations to develop and refine a climate-smart solution. Using a multi-stakeholder approach, the idea of snow-harvesting was piloted and refined. Combined with efficient water-use practices and financing mechanism, the solution was a success. In this session, a representative will explain the technical aspects of innovation along with SNV's process developing and refining the solution, and how an inclusive approach that ensures buy-in from all involved stakeholders can be used to overcome other development challenges.

Francis Keya from AAHRED a member of adaptation.

Key words: *climate change, drought, water, Kenya.*

GENETIC DIVERSITY STUDIES OF LATVIAN *VACCINIUM MYRTILLUS* L. POPULATIONS FOR *IN SITU* CONSERVATION

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Abstract

Plants and berries of bilberries (*Vaccinium myrtillus* L.) are traditionally used in many nations as a local medicine as well as edible plants. They are an important feed source for wild animals and birds. *In situ* conservation is an important component for the conservation of crop wild relatives (CWR) and wild harvested plants (WHP). Research on population structure and genetic diversity is important and is required for the development and implementation of *in situ* conservation strategies as well as being useful for ecosystem services management. The aim of this study was to test EST-SSR markers for bilberry genotyping and determine genetic diversity in different forest types – *Vacciniosa, Myrtillosa, Hylocomiosa* as well as compare populations from various regions of Latvia. Our results indicated that there was a small genetic differentiation between bilberries grown in different forest types (0-2%); most of the variation was found within individuals. Analysing populations in different regions of Latvia, 5% of the genetic variation was found among populations. Analysis using the STRUCTURE software package showed that there were no isolated populations or distinct groups. There was a positive correlation between geographic and genetic distances, indicating that the analysed populations differentiation can be explained by isolation-by-distance, without additional dispersal barriers.

Key words: *Vaccinium myrtillus*, *genetic diversity*, *in situ conservation.*

MORPHOLOGICAL CHARACTERISATION OF OREGANO (*ORIGANUM VULGARE* L.) ACCESSIONS GROWN IN LATVIA

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Abstract

Wild populations of oregano (*Origanum vulgare* L.) are too few in Latvia. It is necessary to cultivate this species for keeping the biodiversity of local nature. The purpose of this research was to characterise the local genetic resources of oregano by morphological features. In the period of years 2012 – 2018, 44 oregano accessions from an *ex situ* collection of spice- and medicinal plants of the Laboratory of Cultivated Plants and Apilogy (Jelgava, Strazdu iela 1) were explored using international Draft Descriptor List. The collection was founded in 2011, planted in 4 rows, each accession in 10 repetitions. The results showed that oregano accessions differ morphologically. The variability between accessions was significant ($p<0.05$), but between samples of each accession – non-significant ($p>0.05$). It is important to research the correlation among the morphological parameters, meteorological conditions and biochemical properties of essential oils in oregano samples to select the most productive accessions for the cultivation in the agrocenosis.

Keywords: *Origanum vulgare* L. *descriptor, morphology.*

CLIMATE CHANGE ADAPTATION OPTIONS IN LATVIA'S AGRICULTURE

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Abstract

Environmental impacts of agriculture under a changing climate are considered more and more important. To avoid or at least reduce the negative effects and exploit possible positive effects of climate change, adaptation strategies and measures should be developed and implemented. Adapting agriculture to climate change has linkages with other policy areas, including water management, economic policies, climate change mitigation policies, as well as infrastructure, health, and other sectors and policies that foster sustainable development and increase resilience of communities as a whole. There are various widely accepted and evidence based effective climate change adaptation options proposed by scholars and experts for agriculture sector. Most important of them, for example, are the following: agricultural input efficiency; improving (i.e., less energy-intensive) farming; reducing N surplus and N use efficiency via fertilizer usage; crop and soil management strategies' change, such as tillage practices, permanent crops; crop rotations and use of cover crops or catch crops, organic farming, green manuring; as well as reducing and/or completely removing agrochemicals; carbon sequestration and improve soil physical, chemical and biological properties. Furthermore, implementation of agro-ecological and conservation agriculture principles that affect biodiversity conservation (agrobiodiversity; i.e., crop genetic diversity) and supports many ecosystem services. Adaptation measures include technological advancements, adaptive farming practices, etc. The paper presents results of current situation's evaluation, analysing above-mentioned measures implementation status, as well as provides proposals for implementation of most promising adaptation measures in Latvia's agriculture. Moreover, necessary policy decisions and public financial support (i.e., RDP 2014-2020, RDP post 2020) are indicated.

Keywords: *adaptation, climate change, agriculture, Latvia.*

BROWNFIELDS AS ENVIRONMENTAL QUALITY INDICATOR: CASE OF LATVIA

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Abstract

The background of investigation is the growing importance of the global economy, which shows that one of the basic natural resources - intensity of land use - is increasing. Often it is the cause of land degradation processes. Expressions of brownfields are diverse, and their elimination and gradual prevention is the first prerequisite for the sustainable use of land resources and development of each territory. Earlier studies in Latvia show that degraded land does not have one significant feature which would allow to determinate it as a "typical" brownfield. Sustainable land management is a key factor in the rational use of land resources, including the reduction of land degradation and putting in order of degraded territories. Improvement, maximal and efficient engagement of brownfields in economic activity is one of the key challenges for sustainable resource use that makes significant contribution to regional development. Determination of brownfields is essential part of territorial and land use planning which is strongly related to the implementation of sustainable development programmes and planning of further actions in all municipalities. The reuse of brownfields has significant impact on sustainable development as meets all objectives: improving the economy, improving social cohesion and the environment. The objective of investigation is on the basis of special literature to develop scientifically based proposals for possible solutions in regeneration of brownfields and its benefits for development and sustainable use of resources, transformation of brownfields into recreational areas, as well as further use of brownfields in cities and rural areas.

Keywords: *Degraded territory, brownfield, land resources, regeneration, sustainable development.*

INFLUENCE OF INTENSIVE AND SUSTAINABLE FARMING SYSTEMS ON NITROGEN AND CARBON CYCLES IN LITHUANIAN PEATLAND

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Abstract

Intensive agriculture generates high productivity of agricultural products, which reduces food shortages, and more people have food. However, there are also negative consequences: soil degradation or natural pollution. After Lithuania joined the European Union, many farmers moved from sustainable farming to intensive farming, and the number of intensive farming in peatlands, which makes 9% in Lithuania, increased. Peatlands are soils that are composed mainly of organic materials. Therefore, it was decided to research the impact of intensive and sustainable farming in peatland. For this, 3 peatlands using intensive and sustainable farming were selected at different locations in Lithuania. To carry out the experiment, a total of 16 pitches were selected - 6 pitches in the southern part of Lithuania (E24041'; N54020'), 6 pitches in eastern Lithuania (E24058'; N55013') and 4 pitches in western Lithuania (E21098'; N55014'). The experiment was carried out in 2016-2018. The research showed that organic matter (OM) amount decreased in all investigated fields, where intensive farming was used, in three-year period from 1% to 5%. However, the amount of mineral nitrogen (N_{min}) was higher compared to the sustainable farming. In sustainable farming it was 98 ± 42mg kg^{-1}, while in an intensive it was 128 ± 35mg kg^{-1}. This means that intensive farming stimulates the reduction of carbon in the soil and an increase in N_{min}, which can lead to the leaching of nitrates into deeper soil layers and pollute groundwater.

Keywords: *Peatland, Carbon, Nitrogen, Lithuania.*

LITHUANIAN COMPOST QUALITY: PHYSICAL CHARACTERISTICS, NUTRIENT CONTENT, HEAVY METALS AND ORGANIC POLLUTANTS

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Abstract

The increasing amount of waste causes the problem of waste disposal, therefore, there is an on-going search for ways to reduce the negative impacts of accumulated waste. The regional waste management centres established in Lithuania implement Directive 2008/98/EC of the European Union, which provides for the reduction of biodegradable waste going to landfills. Each such centre is equipped with composting sites, which compost both tree leaves fallen in autumn and other types of biodegradable waste collected from streets and individual urban residents. Sewage sludge and mixed biodegradable municipal wastes are composted in many regions of Lithuania. Composting is an alternative way of managing biodegradable waste [1, 2]. During composting, biodegradable waste is affected by microorganisms and decomposed, thus a new valuable product – compost – is obtained. High quality compost is a valuable fertiliser and soil improver. The incorporation of compost into the soil improves its structure, sorption properties, enriches it with the nutrients and helps to fight against soil organic matter degradation [3]. Therefore, as this type of organic fertiliser is gaining popularity, it is particularly important to ascertain both positive and negative effects of it on the environment, soil and plants. Compost can be a source of pollution with heavy metals, persistent organic pollutants and microorganisms [4, 5]. The aim of this study was to investigate the quality of composts produced in Lithuania. Physical characteristics, nutrient, heavy metals and organic pollutants contents were determined in green waste, sewage sludge, mixed municipal waste and mixed municipal waste composts after mechanical biological treatment.

Keywords: *compost, quality, characteristics.*

THE INFLUENCE OF GRANULATED ASH ON SOIL AND PLANTS

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Abstract

Constantly expanding the biofuel boiler network in Lithuania there are large amounts of ash from this fuel that are not rationally used and accumulate as waste. Biofuel ash is alkaline waste (pH ~ 13). It is therefore very useful to use it where there are acidic soils (pH <5.5). Ash contains a lot of nutrients (K, P, Ca, Mg), which are necessary for plants and soil. Biofuel ash can be used as agriculture fertilizer. The environment benefits when less waste ends up in landfill sites and nutrients are returned to the environment from which they came. The objective of the present study was to produce granulated biofuel ashes. To investigate their chemical composition, structure of granulated, strengths, to assess their quality and the impact the soil and plants. For the experiment, we used three different ash variants of granulated biofuel, where the ash content in the granule was 30%, 50% and 70%. The XRD patterns attributed to calcium hydroxide, calcium carbonate and quartz were identified in all granulated biofuel ash samples. The main difference between the samples was the intensity of the calcium carbonate peaks, which decreased with increasing granule size. Biofuel ash is generally used for fertilization because of its very long-lasting fertilizing effect. The granules should be hard enough to promote gradual and slow dissolution of nutrients to the forest soil during several years. On the other hand, too high compressive strength may also be problematic since it can retard and possibly prevent the leaching of nutrients.

Keywords: *Biofuel ash, Granulated ash, Fertilizer, Nutrients.*

RECLAMATION PROCESS OF DEGRADATION LAKES RESERVOIRS

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Abstract

The negative impact on the status of surface water bodies of the Baltic Sea and Baltic Sea region is caused by both diffuse pollution, which is essentially due to the pollution load caused by agricultural activities, as well as concentrated pollution, which results in an urgent problem - pollution with biogenic materials. By reducing pollution from agriculture, ensuring adequate domestic and individual wastewater management, lakes may require additional means to achieve their good status: to apply biological methods to improve water bodies (macrophytes, duckweeds). Hydrochemicals are increasingly being promoted in the world to reduce eutrophication of water bodies by using a method of chemical bonding/precipitation of excess phosphorus without removing the accumulated sludge. However, there is a strong public resistance. Based on the studies conducted in 2014-2018, only 20% of the studied lakes (total of 40 lakes studied) do not meet the criteria for good ecological status according to the phosphorus concentration in water. At lakes Lateženis and Luksnėnai the concentration of P_b shows indicator values of a bad ecological class, at lakes Draudeniai, Paežeriai and Mastis these indicator values are classified as being of a very bad class, while at the lake Talkša and in ponds Bubliai and Stepanioniai indicator values are classified as being of the average ecological class. Only significant amounts of phosphorus concentrations were found in the sludge of lakes Mastis and Draudeniai, but both of these lakes are shallow (average depth is 2.6 and 1.5 m, respectively), therefore the chemical phosphorus binding method cannot be applied. In the analysis of phosphorus concentrations in the sludge of other lakes, it was found that the highest concentrations of P_b were at lakes Spira, Kiementa, Antakmenas, Gauštvinis, Veisiejas and in the pond Vaitiekūnai. The average depth of these lakes is also low, but none of them has a bad status according to P_b. Laboratory studies of additional phosphorus release from sludge sediments have shown that no release occurs and the main source of pollution is still significant diffuse pollution. In this situation, the chemical treatment of lakes analyzed in this study cannot be justified.

Keywords: *Water quality, Phosphorus concentrations, Ecological status, Lakes.*

TREATMENT OF THE ROOT VEGETABLES WASH WATER IN LITHUANIA

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Abstract

Increasing supply of the washed and „ready to eat“ vegetables to the market causes issues of the huge volumes of fresh water used and large quantities of wastewater generated in the processing that requires special treatment for the vegetable producers. In Lithuania, farmers, who engage in washing vegetables, face the problems of wastewater treatment, wastewater storage and utilization. Wastewater released to the environment from their farms would meet hygiene and environmental protection criteria. Four typical farms were chosen that represent different root vegetables, such as carrots and beetroots, and use different washing and wastewater treatment systems. Wash water of the carrots was more contaminated than that of beetroots, especially after polishing and processing. All farms transferred the wash water used to the settling ponds or settling tank. Settled water continuously was used for the first wash. Drinking water from well was used for the final wash of vegetables. As a certain amount of excess water consistently generate, it was stored in the ponds. Excess water and sediments were spread out on the fields periodically according to legislations. Wastewater of one carrots washing farm was treated in the system of surface flow constructed wetland and two biological ponds. As vegetables producing farms are located in rural areas, natural treatment methods are suitable for treatment of their wash water. Natural treatment systems are relatively inexpensive and need low-maintenance option compared with technical treatment systems. The results of research show that such natural wastewater treatment system is suitable for farms in Lithuania, that wash and produce root vegetables, but before releasing wastewater to the environment, it has to be settled.

Keywords: *Root vegetables, Wash water, Treatment.*

DYNAMICS OF THE SOIL MOISTURE POTENTIAL AND TEMPERATURE IN THE PODSOLIC SOIL

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Abstract

Temperature is an important thermodynamic parameter and functionally related to soil water potential and dramatically affecting it. All types of decrease in potential of moisture occur in connection with increase in moisture content. Increase of its content comes in connection with an atmospheric precipitation and by way of pulling up the moisture from underlying layers. Dynamics of potential and temperature at various levels of a soil profile revealed. The influence of soil temperature in the range of soil moisture is high positive values on the dynamics of soil water potential. Dynamics of the soil moisture potential and temperature in a layer of the soil were analysed in various levels of a soil profile: 0.05-0.12 m. 0.3-0.37 m., 0.5-0.57 m., 0.7-0.77 m. Results showed all types of decrease in the potential of moisture (sluggish and fast, slight, and essential) occurred in connection with increase in moisture content. Increase in its contents comes in connection with an atmospheric precipitation and a way of pulling up of moisture from underlying layers. Decrease in the potential of moisture (at constant humidity) at temperature increase, is explained by increase of mobility and activity of moisture. Daily changes of the potential of moisture are small and are in limits of 1-3 kPa. Daily changes of temperature of the soil decrease both from top to down a soil profile, and within a day with cooling of free air: 1.5^{o}C in top and 0.4-0.3^{o}C in soil sublayers.

Keywords: *Temperature, Moisture, Precipitation, Potential, Soil.*

CLIMATE CHANGE CHALLENGES FOR AGRICULTURE IN LITHUANIA

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Abstract

Climate change affects many economic sectors, and agriculture is one of the most directly dependent on climatic factors. Lithuania historically is an agricultural country: agricultural land (% of land area) was reported near 48 % and the value of agricultural production amounted to EUR 2.63 billion in 2017. The average temperature in Lithuania in July is about 17°C, while in winter it is about −5°C. Global warming expected to lead to a more vigorous hydrological cycle, including more total rainfall and more frequent high intensity rainfall events. The average annual precipitation in Lithuania is 670 mm, but its distribution throughout the country is uneven, ranging from 500 to 900 mm. However, the latter is faced with increased droughts. The article analyses changes in precipitation and temperature in the last 30 years in central Lithuania and their impact on agriculture. Selyaninov Hydrothermal Coefficient used for identifying droughts during the active vegetation period, based on the water balance equation. While analysing the data of 1978–2018 in the researched territory, it is determined that the lowest quantity of precipitation was in spring (22%) and the highest quantity of precipitation was in summer (about 35%) and autumn (25%). During the research period, the biggest challenge is rainfall disbalance: the drought one year, and floods in others. These challenges particularly affect agriculture, especially increasing climate anomalies in the past decade.

Keywords: *Agriculture, Climate, Lithuania, Precipitation, Temperature.*

SOY-BASED VEGAN BURGER: FROM WASTE TO PRODUCTION

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Abstract

Soy press cake (okara) is a by-product of cold press oil production, which is applied as feed or waste, whereas, it still has protein, which could be applied for human nutrition, leading to reduction of the overall waste in vegetable product processing. Around 8.77 million tons of soybeans were produced in the European countries in 2014. Around 50 % of all soy based food products is okara, which is underutilized and disposed as low-quality feed or waste. The aim of this research was vegetable waste reduction by utilizing fermented okara for developing vegan burger products with sensory properties similar to meat products. The thermal treatment of okara samples was done by applying pasteurization and sterilization methods. Okara samples were fermented by specific Lactobacillus strains. After fermentation, vegan burgers were produced based on fermented okara. Chemical composition results indicated that okara was a suitable protein and fiber source and had essential amino acids. Microbiological results approved significant increase in the amount of Lactic acid bacteria in all fermented okara samples, which could have positive effects on flavor, texture and nutritional value of veg-burger. The sensory evaluation highlighted more acceptable sensory properties of veg-burgers fermented by two specific Lactobacillus strains than other strains. This research demonstrated the potential of Lactic acid bacteria fermentation by applying *Lactobacillus plantarum* and *Lactobacillus brevis* and pasteurization treatment to convert okara, commonly considered as feed or waste, into nutritive improver of vegan-burger; meeting nutritional and sensory requests of modern consumer.

Keywords: *Vegetable waste, soy press-cake, Vegan burger, Lactobacillus strains.*

THE EFFECTS OF“CLEAN FEEDING”MANAGEMENT FOR DAIRY ANIMALS RADIOACTIVITY IN MILK IN NORTH MACEDONIA 30 YEARS AFTER THE CHERNOBYL REACTOR ACCIDENT

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Abstract

One of the important assignments of the veterinary activity is a veterinary-sanitary supervision of the production and sale of milk and dairy products, whose main goal is to provide biologically good milk and dairy products from healthy animals. In practice, we have many methods of milk and dairy products control, especially methods of radiation-hygienic diagnostics, therefore the control and monitoring of radioactive elements in milk are fundamental for maintenance of the human health. The goal of this research was focused on determining the activity concentrations of ^{40}K and ^{137}Cs in milk samples (sheep, cow, goat milk) from the Republic of Macedonia and on the basis of the results, the risk of radiation among the population could be estimated. An instrument-gamma spectrometer (Canbera Packard) with a high-purity Germanium detector and a GENIE 2000 program were used for the measurement of the samples. On the basis of the performed tests, the data showed that the average activity value of ^{40}K was within the range of 29.06 Bq kg-1 to 43.66 Bq kg-1. The activity of ^{137}Cs was below the detection limit in all tested milk types. This shows that there is no radiation risk for the population i.e. the security limits have not been exceeded, highlighting the insignificant radiation hazard that arises from radionuclides that are naturally or artificially present in the animal feed, which reaches the human through the food chain.

Key words: *clean feeding, dairy animals, radioactivity in milk, gamma spectrometry*.

CHEMICAL COMPOSITION OF FLOODPLAIN SOILS OF THE LOWER DNIESTER RIVER

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Abstract

The chemical composition of the floodplain soils are caused by erosion-accumulative activity of the river and the nature of the basin soil cover. As a result of biogenic accumulation in the uppermost horizon of the soil, in addition to organic matter, a number of chemical elements are concentrated. The Dniester floodplain accounts for more than 50 thousand hectares. With a relatively low content of organic matter, the Dniester floodplain soils differ in significant humus reserves, which is associated with a large capacity of humiferous horizons in both modern and buried soils. In the 0-10 cm soil layer, the humus content is about 2.0%; in the 20-40 cm - 3.0%, with a gradual decrease to 0.5% at a depth of 185 cm. The soils of the Dniester floodplain are carbonate. The carbonate content (up to 7.5%) is inversely related to the amount of clay particles (<0.001 mm). The largest amount of SiO_2 is 56-81%. Alluvial silty-loamy riverbed soil contains 62.6-81.4% of SiO_2 in the layer with the highest silt content. Despite the light soil composition, the total P_2O_5 content is relatively high - up to 0.23%. The distribution of Na_2O is more uniform in soil - 0.8%. The soils are a high content of CaO (4-6%) and MgO (2.0-2.4%). Compared to the soils of the terraces, the floodplain soils contain a significant large number of nutrients - K_2O and P_2O_5.

Keywords: *Chemical composition, Dniester River, Floodplain soils, Moldova.*

THE USE OF BITUMINARIA BITUMINOSA AS AN ALTERNATIVE FOR THE RESTORATION OF PASTORAL LANDS IN THE MIDDLE ATLAS OF MOROCCO

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Abstract

In Morocco, rangeland practice refers to traditional concepts of extensive livestock farming and collective use of pastoral resources. Indeed, rangelands are the main source of animal feed in Morocco. Currently, pastoralism is the centre of many issues, the main one is the enhanced degradation of rangelands incumbent firstly to various human activities, and secondly, the recurrence of drought periods inherent in climate changes. This results in a significant decrease of biomass, genetic erosion, edaphic desertification, as well as many socio-economic and environmental consequences. The main objective of this study is to contribute to the rehabilitation of degraded sylvopastoral sites in the Central Middle Atlas through the use of a *Bituminaria bituminosa.* This Mediterranean multipurpose shrub legume has great potential in terms of biomass production and nutritive value provided to the livestock and also for the improvement of soil fertility. The characterisation of the nutritional value of this plant is performed by analysing the chemical composition of the plant part used by the animals. The results obtained show that this plant contains 35.39% of cell walls (NDF), 28.40% of lignocellulose (ADF) and 19.34% of lignin (ADL). The in vitro digestibility of organic matter is of 87.75%. These chemical analyses highlight the good energy value of *Bituminaria bituminosa* which may be a promising socio-ecological alternative for forage production and the rehabilitation of degraded silvopastoral areas in the region.

Key words: *Bituminaria bituminosa, Pastoralism, Middle Atlas, Leguminous shrub, Digestibility.*

ASSESSMENT OF CLIMATE CHANGE ADAPTATION STRATEGIES USED BY CASSAVA-BASED FARMERS IN SOUTHERN NIGERIA

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Abstract

The study focused on the assessment of climate change adaptation strategies used by cassava-based farmers in Southern Nigeria. Some climate change adaptation strategies used by farmers may not be cost-effective, efficient and sustainable. Specifically, the study describes the socioeconomic characteristics of the cassava-based farmers, ascertain the perception of the cassava-based farmers to climate change, identify the adaptations options used by the farmers, estimate and assess the cost-benefits of the climate change adaptation strategies used, determine the factors influencing the use of viability climate change adaptation strategies as well as the constraints in assessing climate change adaptation strategies used by the cassava-based farmers in the study area. Data were collected through the administration of questionnaire to 300 cassava-based farmers. Data were also collected through interview schedule and Focus Group Discussion. The collected data will be analysed using descriptive statistics, Benefit-cost analysis, Net Present Value, Factor analysis as well as Logit Regression Model. The project is funded by AIMS-NEI. Results are expected to show the socio-economic characteristics of the farmers as well as their perception to climate change, identify the climate change adaptation strategies used, reveal the cost benefits analysis hence assess the viability of the climate change adaptation options used by the cassava-based farmers in the study area and identify the constraints in assessment of climate change adaptation strategies in the study area. Conclusion and policy recommendations will be made based on the findings which should enhance food security in the study area.

Keywords: *Assessment, Climate change, adaptation strategies, cassava-based farmers.*

POTENTIALS OF PRODUCED WATER *BACILLUS SP.* FOR PHA PRODUCTION AND PLANT GROWTH PROMOTION

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Abstract

Produced Water (PW) is the major waste water stream of petroleum industry. This produced water, due to its unique chemical composition, supports many hydrocarbon-degrading microorganisms. The presence of high carbon content and low nitrogen content indicated that produced water was an ideal environment for many bacterial species that produce polyhydroxyalkanoates (PHA), an intracellular storage polymer. The main purpose of this study was to isolate bacterial strains that can produce large amounts of PHA on different carbon sources. While *Bacillus* sp. producing PHA used for Plant microbe interaction studies carried out with wheat crop.Produced water sample was collected from Potwar oil fields in sterilized bottles and stored at 4^{o}C. Sample was appropriately analyzed for many parameters including temperature, pH, odor, texture and color. Isolation of bacterial strains was performed according to serial dilution method. Isolated strains were screened for PHA production by using PHA detection media supplemented with Nile blue. Plant growth promotion experiment was done on PHA producing *Bacillus* sp. with wheat crop (*Triticum aestivum*).The use of glucose as sole carbon source resulted in highest production of PHA (43%), after 24 hours cultivation by *Bacillus sp.*(MH142143). It showed significant results in bioremediation of hydrocarbons. Maximum germination of 93% was observed in wheat seedlings when supplemented with*Bacillus sp.* with marked increase of 72.87cm in wheat seedling length in lab scale experiment. Results of this study helps in the elimination of hydrocarbon from produced water by *Bacillus sp.* and make it suitable for agriculture.

Key words: *Produce water, Bacillus, Triticum aestivum, polyhydroxyalkanoates, Plant microbe interaction.*

WATER CHALLANGES AND PERSPECTIVES OF DATE PALM TREE SECTOR IN JERICHO AREA/OCCUPIED PALESTINIAN TERRITORIES (OPT)

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Abstract

Palestinian farmers have started cultivation of Date Palm trees since early nineties of the last century. This sector has an increasing export value of 21 million USD/year, and provides currently 0.5 million working days, 1/3 by women. The management of this sector depends firstly on the precise number of cultivated trees. Aerial photographs with 10 cm resolution (2018 version), 4 -Band, and colored are used to determine number and age categories. Currently, 162,858 trees are growing, 30% are younger than 2 years, 49% between 2 and 5 years, and 21% is above 5 years. Within few years, most of trees exceed 5 years, irrigation water requirements will not be less than 21 MCM/a in case minimum water and soil salinity take place. Groundwater with salinity ranging between 4000 and 7000 μS/cm is the main source, where aquifer recharge is limited to 12 MCM/a. The deficit water requirement is covered by over abstraction. The sustainability of this sector depends on how farmer adapts new technology such as sub-surface irrigation, combined with new sources such as transfer 10 MCM from Al Fashkha spring, located 8 km to south at the Dead Sea shoreline, transfer 2 MCM of treated waste water from Al Bereh Wastewater treatment plant.

Keywords*: Date Palm, Jordan Valley, Water.*

ASSESSMENT OF CLIMATE CHANGE IMPACT AND SEAWATER INTRUSION ON THE AGRICULTURAL WATER DEMAND INGAZA STRIP

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Abstract

This study investigated the expected change of the crop water requirement due to possible impact of climate change and seawater intrusion in Gaza Strip [GS]. The elaborations were performed in ArcGIS through the integration of climate data, agricultural classification and water quality maps. Crop evapotranspiration, Net Irrigation Requirements [NIR] and Leaching Requirement [LR] were estimated following the standard FAO methodology. The analysis considered the baseline of (1990-2010) and the climate data projection (2025-2035) corresponding to the A1B scenario. The water quality data were obtained from on field measurements and a groundwater quality model. The present annual ET_O estimated using PM method is 1330 mm, while in 2030 it is expected to increase by 12% to 1490 mm. The significant predicted change in reference evapotranspiration besides the slightly predicted decreasing in annual effective precipitation, caused a significant increasing in the annual net irrigation requirements by 14% for the total cultivated crops. Regarding to salinity impact, the leaching requirements were calculated, whereas the overall leaching requirements increased by 58% from 7.68 to 12.11 Mm^3/year. The adaptation scenario is adopted to keep the cropping pattern and water inputs as today and to increase the irrigation efficiency for each crop in the future. It is in agreement with the overall tendency of policy makers and farmers since both are aware that there is a room for the improvement of irrigation efficiency in Gaza Strip.

Keywords: *Salinity, Leaching Requirement, Crop Water Requirement, Irrigation Efficiency, GIS.*

RISK FACTORS ASSOCIATED WITH DIARRHEAL DISEASES AMONG UNDER-FIVE CHILDREN IN GAZA STRIP: SOCIOECONOMIC AND ENVIRONMENTAL ASPECTS

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Abstract

This study lights the relationship between the climate change and the diarrhea among the children under five years. A case-control study was used and face to face interviews were done with 195 mothers. Logistic regression was used to assess the association between the socioeconomic factors, water resources, water usage, health behavior and the dichotomous dependent variable. The children under one year were more sensitive to diarrhea than the other childrenolder than one year and under five (OR=2, P= .005). The risk factors helping increase in the prevalence of the diarrhea disease in the children under five years were: low family income (OR=5.4, P=.002), father unemployment (OR=3.169, P=.02), low mother education (OR=3.8, P=.000) and the high crowding (OR=18.49, P=0000). The children in the householdsusing the municipal water as drinking water were more susceptible to diarrhea than the children in the households using the vended water and bottled or filtered water (OR=.06, P=000; OR=4.378, P=.02) respectively. The cooking with municipal water presented a higher risk than cooking with other water (OR=4.747, P=.000). The longer storage period was an important determinant in the prevalence of diarrhea (OR=2.16,P=.01).Keeping the remaining water and filling a new water in the storage tank could prevail diarrhea (OR=18.852, P=.000), the cycle of storage tank period (OR=4.62,P=0.14.) The lack of access to water was risk factor in the study (OR=2.72, P=0.009). Bad sanitation can help in the diarrhea disease prevalence (OR=5.818, P=0.000). The hygiene practices were very important determinants in the prevention of diarrhea. Our results showed that the diarrhea was in the childrens' mothers who did not wash the hands before preparing the food or feeding their children (OR=3.958, P=3.958). The feeding bottle was a source of worry, where the childrenusing the feeding bottles were at risk more than those not using bottles (OR=2.119, P= 0.048).Those who did not boil the bottle were at risk more than those who did (OR= 2.844, P=0.001).The children sucking their fingers were at risk of diarrhea disease more than those who did not(OR=3.345, P= 0.000). The bacterial contamination (total coliform, fecal coliform) was a determinant of diarrhea disease (OR=2.196, P= 0.017; OR= 2.413, P= 0.016)

Keywords: *diarrhea, factor risk, breast feeding, climate change.*

GAS SENSORS APPLICATION FOR THE DETECTION OF VARROA DESTRUCTOR IN HONEYBEE COLONIES

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Abstract

In modern times the Western honey bee (*Apis mellifera*) plays a role in a range of human activities, including nutrition, medicine, and agriculture. Its most vital activity for humans is pollination. In Europe, 84% of all crops that have been studied benefits from insect pollination. Unfortunately, honey bees are subject to a number of pests, infections, diseases and disorders. The early diagnostics, particularly in case of infectious diseases, can prevent the losses of bee colonies across wide areas. For that reason, an essential part of the contemporary beekeeping is the inspection for bee diseases and parasites. Usually, it is based on close examination of brood or testing of adult bees. However, apiary inspectors and beekeepers are not always well prepared. Other, reliable sources of information are needed. Many circumstances indicate that monitoring of parameters characterizing physical and chemical conditions inside hives may be used for the characterization of honey bee colony health. Currently, chemical sensors draw attention in many fields of applications. Chemiresistors, based on the semiconducting metal oxides constitute one of the most popular and promising groups of gas sensors. These devices offer high sensitivity in detecting very low concentrations (at level of ppm or even ppb) of a wide range of gaseous chemical compounds, small weight and size, durability, low cost, easy use, on-line operation. Our studies show that upon infestation of bee colonies with varrosis the beehive atmosphere is changed in a way which affects the responses of semiconductor gas sensors. The characteristic features of sensors responses may be utilized as the basis of *Varroa destructor* infestation rate determination with the use of appropriate pattern recognition techniques.

Keywords: *honeybee, Varroa destructor, gas sensor, detection.*

THE MEASURES OF THE COMMON AGRICULTURAL POLICY AS A TOOL FOR THE IMPLEMENTATION OF SUSTAINABLE DEVELOPMENT IN POLAND

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Abstract

The sustainable development policy is a response to the sectoral approach to environmental protection. The essence of the concept of social and economic sustainability is to ensure a lasting improvement in the quality of life of contemporary and future generations, which is connected with the permanent linking of ecology with the improvement of the quality and environment of human life. One of the factors of effective greening the economy is to create conditions and instruments that ensure the implementation of priorities and compliance with economic and ecological criteria. The aim of the study was to analyze the spatial diversity of two aid measures under the CAP of environmental programs and land afforestation. Subsidies aimed at improving the natural environment by preserving valuable habitats, promoting the sustainable management system, shaping landscape structure as a result of afforestation in rural areas. The research concerns the years 2004 - 2017, since the first such payments to farms in Poland until. The data was obtained from the Agency for Restructuring and Modernization of Agriculture (ARMA), for poviat offices in Poland. The points of reference of targeted analysis were: soil quality indicators, the share of protected areas, the course of ecological corridors and environmental priority zones. It has been shown that spatial differentiation of pro-ecological activity farms is not always correlated with the needs of the natural environment in this regard and depends also on other factors.

Keywords: *Sustainable development, Agri-environmental programs, Afforestation, Rural areas, Poland.*

THE HOUSEHOLDS BIO-WASTE MANAGEMENT ON THE EXAMPLE OF THE MALOPOLSKA REGION

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Abstract

An aim of this article is to assess the process of biological waste management from households in Małopolska voivodship. Households are a source of waste biomass, which can be used, inter alia, as a raw material for energy and for agricultural purposes. The use of this biomass is part of the implementation of sustainable development goals, which tools are the bioeconomy and the circular economy. Households are a source of two types of waste biomass: food waste and sewage. Food waste is a particular problem, as 9 mln tons of food is being wasted in Poland and about third part is being wasted by the consumers. To examine Malopolska inhabitants regarding their attitude towards the food waste and waste segregation we run a survey. The results of this research revealed that Malopolska did not differ from the consumers of other developed countries. As many as 57% of respondents declared that they were throwing away bread; 54.5% vegetables and fruit. There were noted some differences of consumers behaviour, depending on the population groups of women and men as well as residents of villages and cities. Regarding the segregation of a waste, only 21.6% of respondents confirmed that they always segregated the waste. Among conscientiously segregating, there were more women than men and more inhabitants of rural areas then small towns. The second source of biomass generated by households is a sewage. The processing of the sewage and its purification by the Wastewater Treatment Plants is a source sewage bio-sludge. It is a problematic material, but can be potentially valuable due to the high phosphors content. However, in Małopolska, the infrastructure for using the biomass is developing, but not fast enough in a context of constantly growing amount of waste and not in a direction of achieving maximum value from the biomass.

Keywords: *food waste, bioeconomy, biowaste, Malopolska Voivodship.*

COST AND ENVIRONMENTAL EFFICIENCY IN MEASURING THE ECO-EFFICIENCY PERFORMANCE OF WINTER TRITICALE PRODUCTION

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Abstract

Important issue in a sustainable production is a concept of eco-efficiency. Excessive application of agricultural inputs in fodder cereals production may affect both their economic performance and put an excessive pressure on the environment. The aim of the work was to estimate the eco-efficiency of winter triticale production by assessing the cost efficiency of applied inputs and the environmental efficiency. The research was carried out in a group of different types of farms located in two regions of Poland (Lubelskie and Wielkopolska), in the years 2017-2018. For efficiency measurement, the non-parametric Data Envelopment Analysis was implemented. The introduced model was focused on the input oriented efficiency that reflects the ability of using minimal amounts of inputs to obtain a given amount of output. Farms specialized in the milk farming reached the highest value of cost efficiency, while field crops farms displayed the full environmental efficiency. Cost efficiency of winter triticale production was higher in farms of lower economic size. Farms with higher environmental efficiencies were concentrated in groups of middle economic size. The results obtained suggest that the strategies of increasing the cost and environmental efficiencies of winter triticale production should be individualized dependent on the farming type and the economic size of farm. By applying DEA approach to the eco-efficiency analysis of winter triticale production, farms obtain an important source of information on an extent of indispensable changes with respect to improvement in cost efficiency and mitigation of their negative environmental effects.

Keywords: *Eco-efficiency, Cost efficiency, Environmental efficiency, Data envelopment analysis, Winter triticale.*

LIFE CYCLE ASSESSMENT AND LIFE CYCLE COSTING OF WINTER WHEAT PRODUCTION IN DIFFERENT SOIL TILLAGE SYSTEMS

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Abstract

The aim of the study was to assess the environmental impact and costs of winter wheat production in different soil tillage systems. The materials used for the analysis were data from 15 farms, located in the Wielkopolska region (Poland). The winter wheat production in three soil tillage systems: conventional tillage, reduced tillage and direct sowing during the period 2015-2017 was analyzed. The life cycle assessment (LCA) and life cycle costing (LCC) methods were applied in order to evaluate both the environmental and economic aspects for life cycle of the studied production system. The study was carried out in from "cradle-to-farm gate", i.e. from the manufacturing of means of agricultural production through to the process of crop cultivation and harvesting. The functional unit considered was one hectare of winter wheat cultivation. The economic cost at each stage of life cycle of winter wheat production was calculated. Average aggregated cost of production related to the functional unit of 1 hectare was 2778 PLN, with the highest value of 3107 PLN was found in the reduced tillage. Pre-production phases linked with the direct inputs levels contributed mostly to a high overall cost of winter wheat production in the analyzed tillage systems. Among the technological processes of plant cultivation, costs and environmental effects in soil cultivation were largest in the conventional tillage system mainly due to a higher fuel consumption and more intensive use of agricultural machinery in comparison to systems of reduced tillage and direct sowing.

Keywords: *Environmental impact, Life cycle assessment, Life cycle costing, Soil tillage systems, Winter wheat.*

Acknowledgments: The study was carried out within the frame of the research project funded by the National Science Centre, Poland. Project No. 2015/19/N/HS4/03031. Project title: Environmental life cycle assessment and life cycle costing of grain crop production in different soil tillage systems.

IONIC LIQUIDS AS NEW ANTIBACTERIAL COMPOUNDS TO FIGHT PSEUDOMONAS AERUGINOSA

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Abstract

Pseudomonas aeruginosa is an opportunistic human pathogen that is able to infect humans suffering from skin burn, cystic fibrosis, or who have a compromised immune system. It is a life-threatening bacteria, which is multi-drug resistant and able to adapt very quickly to changing environmental conditions, e.g., switching its source of carbon for energy. Ionic liquids (ILs) are salts with low melting temperature (<100 °C), high thermal stability and negligible vapor pressure. Typical ionic liquids consist of an organic cation and inorganic or organic anion. As many as 10^{18}ILs with different architectures and properties can be designed, e.g., greatly varying their polarity and interfacial activity. We can, therefore, tune the chemical and physical properties of ILs to reach a desired biological effect. This enables making ILs preferentially interacting with and toxic to bacterial cells. In order to test the antimicrobial activity of twelve ILs, four different strains of *P. aeruginosa* were used, based on their etiology. We investigate the MIC (minimal inhibitory concentration) and MBC (minimal bactericidal concentration) values, enzyme activity, total protein profiling using 1-D SDS PAGE electrophoresis and life/dead staining using fluorescent microscopy. Different results were obtained depending on the combination of ionic liquid and strain. Some of the tested strains were more vulnerable than others, which might be a result of their adaptation process or metabolism.

Keywords: *Pseudomonas aeruginosa, ionic liquids, antibacterial activity, toxicity.*

Acknowledgments: The research was financed by a grant funded by the National Science Centre, Poland no. 2017/27/N/NZ1/00950.

METAGENOMIC APPROACH TO ANALYZE ENVIRONMENTAL BIOFILM COMMUNITIES

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Abstract

Microorganisms, especially bacteria are able to grow as planktonic (free-living) cells or as a multicellular prokaryotic organism, referred as a biofilm. Biofilm in its structure is very complex and sophisticated. As the biofilm is developing, bacteria are able to switch their metabolism and adapt to their function, e.g. attachment. Furthermore, they produce extracellular polymeric substances (EPS) that protect them from the extreme environmental conditions, making them less sensitive for low pH, low temperature or UV radiation. Thus, environmental biofilm are extraordinary structures that need to be investigated as a complex, not only biologically but also with using high-resolution electron microscopy and geological approach. Such multidisciplinary analyses would allow examining not only microorganisms that create biofilms but also the environment they live in. In our studies we investigated two different biofilm samples collected from the closed mines in Sudety Mountains, South-West part of Poland. The biofilm from the polymetallic mine (pH = 1.0) and As-Au deposit (pH = 7.0) were investigated in order to image the structure, see the geological background of these areas and most of all to investigate microorganisms population able to live in such environments. Our results revealed very complex structures of biofilms and a big number (as for such environment) of bacteria able to live there. Thus, in our opinion, all environmental biofilms have to be treated as multicellular prokaryotic organisms connected and investigated with their environment.

Keywords: *biofilm, metagenomic, extreme environment.*

LAND SUITABILITY ANALYSIS FOR EMERGING FRUIT CROPS IN CENTRAL PORTUGAL USING GIS

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Abstract

Fruit production represents an important component of agricultural production in Portugal with a positive impact on the economy, especially in rural areas. In recent years there has been an increase of investment in so called emerging crops. It is agreed that the choice of uses best suited to soil and climate conditions, complemented by socio-economic criteria, promotes the sustainable use of rural areas. The objective of this study is to determine the suitability for the cultivation of emerging fruit crops in the Beira Baixa region, based on the analysis of the soil and climate limiting factors. For this purpose, the biophysical criteria determining the cultivation of pistachio tree (*Pistacia vera* L.), strawberry tree (*Arbutus unedo* L.), almond tree (*Prunus dulcis* (Mill.) DA Webb) and walnut tree (*Juglans regia* L.) were processed using a Geographic Information System. The analysis was performed by the Analytical Hierarchy Process (AHP). After divide the problem into hierarchical levels of decision making, a pairwise comparison of criteria was performed to evaluate the weights of these criteria, based on a scale of importance. The process was completed by validating the consistency of these operations. The AHP was adequate in the evaluation of the fruit tree species suitability, since it allowed the integration of the several criteria studied, being a useful tool, which allows the decision making and the resolution of problems. It is therefore essential to be aware of the suitability and resilience of new crops in order to meet the need to adapt to climate change.

Keywords: *Multicriteria evaluation, Land use suitability, Fruit cultivation, Analytic Hierarchy Process, GIS.*

SUSTAINABILITY OF RICE PRODUCTION SYSTEMS: AGRO-ECONOMIC ANALYSIS OF *BAIXO MONDEGO* AND *LIS* IRRIGATION DISTRICTS, PORTUGAL

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Abstract

Rice crop has an important economic and social value in Portugal, being cultivated under continuous flooding irrigation. Despite the technological advances achieved in the last decades in Portugal, such as the common use of laser precise land leveling, the problems of water management are yet frequent. To cope with the global changes and the raising social pressure to reduce water consumption and the environmental negative impacts, there is an emergent consensus to improve water saving methods and technologies, for water use efficiency and the safeguard environmental quality. A research project into solving this problem is underway. It deals with the evaluation of water saving solutions, and the assessment of agro-economic sustainability. The case studies here reported refer to Lower Mondego Valley and *Lis* Valley Irrigation District, located on Center of Portugal. These perimeters have a Mediterranean Temperate climate, with critical issues such as water scarcity, soil salinization risks, and economic sustainability. The applied methodologies consider: I) Monitoring of the water irrigation use of on-farm systems, both the traditional practices and the newly water saving techniques; II) Evaluation the effect of water saving technologies on cropping system operation; III) Development of performance indicators, to allow the comparison with other regions. The evaluation of the sustainability of rice production will use several data sources with *stakeholders* support, including data collection in field parcels, irrigation district records of crop performance, farmers' questionnaires and interviews, social acceptability, and environmental issues. This communication will present the preliminary results of referred research project, particularly farmers' socioeconomic data.

Keywords: *Rice sustainability, Rice continuous flooding, Rice water saving, Lower Mondego Valley, Lis Valley.*

FOOD WASTE IN PORTUGAL– A PUBLIC POLICY WITH THE COMMITMENT OF ALL SOCIETY

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Abstract

It is estimated that 30% of the world's useful agricultural area, equivalent to 300 kilos of food lost per inhabitant and corresponding to an economic cost of 750,000 million dollars, is wasted annually. On the other hand, in Europe there is an unacceptable direct relationship between economic development and the level of food waste where 89 million tons of food end up in the trash, in a scenario shared by different developed countries outside the European Union. In this context it is important to define and maximize strategies for reducing food waste, which is a global, social, civic, economic, technological, scientific and human commitment. Any strategy to be implemented will have to include different variables. In a reflected proposal, 5 intervention axes are to be considered: to carry out studies to know how much, how, where and why of food waste; disseminate and promote good practices and awareness raising actions; analyse and review normative aspects; encourage the design and development of new technologies; collaborate with the agents and organizations involved in this field. Considering these variables, in Portugal, in the past year of 2014, through a formal commitment "Combating Food Waste, a commitment of all", a common strategy was defined for all agents of the food chain who were actively involved in an organized, structured and coordinated way, committing to change attitude, working procedures and management systems.

Key words: *Portugal, food waste, strategy, good practices.*

REHABILITATION OF MINING AREAS THROUGH INTEGRATED GREEN BIOTECHNOLOGY APPROACH: THE CASE OF *LABLAB PURPUREUS* (L.) SWEET

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Abstract

It is estimated that there will be 9.1 billion people in 2050. As a result, food demand will increase and to answer the growing number of consumers, production has also to increase mostly by area expansion which reflects on the loss of biodiversity and the rise in greenhouse gas emissions (GGE). Yet, both land and water resources, the basis of our food production, are limited and already under heavy stress, thus it is imperative that the agricultural production has to become more productive, but also sustainable. One possible solution could be the recovery of marginal lands, such as salt and drought prone lands, or even abandoned mining areas. The latter is still controversial, however, one as to acknowledge that the rise in population also reflects in the demand of living standards improvement and urbanization that ultimately leads to a surge in demand and market potential of mining and quarrying market. Mining activities result in soil degradation and contamination as well as ecosystem disruption. Moreover, soils from mining areas are rich in potentially hazardous elements (PHE) that cannot be degraded, thus recently, there has been an effort to create sustainable ecotechnologies to rehabilitate these areas and create conditions for agriculture activities while protecting the food-chain. Phytostabilization is a rehabilitation ecotechnology based on pedo-engineering in which technosols are built from organic and mine wastes as for example gossan. The effectiveness of technosols in improving the physico-chemical characteristics of mining wastes and in the decrease of their leachates have been widely proven. It was with this in mind that we conducted a study using a wide-tolerant abiotic stress multifunctional (forage, pulse, pod, ornamental, medicinal) legume, *Lablab purpureus* (L.) Sweet to evaluate the potential of food production from these marginal areas.

Keywords: *Lablab purpureus, Tecnosolos, marginal lands, rehabilitation.*

FOOD SECURITY IN QATAR: THE BLOCKADE OF 2017 AS AN OPPORTUNITY TOWARDS A PRODUCTIVE AND SUSTAINABLE LOCAL FOOD PRODUCTION

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Abstract

Food insecurity concerns are as old as humanity. Food security exists when all population, at all times, has access to sufficient, safe and nutritious food. It is built on four pillars, namely food availability, food access, food utilisation, and stability. While it is widely admitted that food security increases with economic development, also rich countries in the Near East and North Africa (NENA) region, such as Qatar, face specific challenges. Therefore, this review paper analyses the state, determinants and perspectives of food security in Qatar. Since 2007-2008 global food crisis, Qatar's food security has been an ongoing challenge as the growing population is making significant pressure on the government. Based on its fiscal strength, the Qatari government adopted three important strategies: increasing local production, foreign agro-investments and long-term arrangements for food imports. As a result, in 2018, Qatar was ranked first in the Arab world and 22nd globally in the Global Food Security Index. However, denied food supplies from Saudi Arabia following the blockade in June 2017 exposed the high dependence of Qatar on imports, limits of import-based food policies and the need to increase the local production. Since then the Qatari agriculture sector has been under growing pressure to increase the local food production and to realize the highest possible level of self-sufficiency. However, agriculture is limited by several natural conditions, such as scarce water resources and poor soils, and aquifers have been heavily exploited above the average natural recharge. In addition, local food production is limited by some structural factors such as low use of modern agricultural techniques and equipment, and the poor sectoral coordination and integration within the governmental institutions. The paper makes the case for promoting a productive and sustainable agriculture, with high resources use efficiency, to increase food security in Qatar.

Keywords: *food security, food self-sufficiency, blockade of 2017, sustainable agriculture, Qatar.*

LANDSCAPE-ADAPTIVE METHODS FOR CROPING FODDER CROPS IN THE NORTH-EAST OF RUSSIA

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Abstract

Severe agroclimatic conditions and the presence of permafrost adversely affect the development of fodder production, the cultivation of annual grasses (vetch and oat mix). Low land productivity is conditioned by the low sum of active temperatures (above 5 ° C) less than 1700-1800, the high acidity of soils (Ph 3.5-4.7), the slow destruction of organics, and low microbiological activity. In such conditions, increased "northern" doses of mineral fertilizers (up to 200-250 kg / ha) and lime are used. The remoteness of the territory determines the large material expenditures for the delivery of mineral fertilizers, lime and seeds of annual grasses. An alternative creation of long-term meadow land from local perennial grasses is proposed. The results of long-term studies of the dynamics of post-agrogenic landscapes indicate the formation of the meadows with the dominance of local grasses, wheat grasses and pine purple grass on the arable land due to residual soil fertility for more than 10 years. For cold and waterlogged, often gleyed soils of the North, a new northern type of soil resting has been tested for a long time. It includes the creation of furrows by the plow at certain intervals with the soil layers between the furrows. It allows to increase the temperature by 1.5-2.0 times and reduce soil moisture by creating a wash water regime. The soils after such resting are characterized by a high content of all forms of potassium, nitrogen and phosphorus, as well as an improved composition of humus, a narrowing of C / N, an increase in the proportion of humic acids associated with calcium. High efficiency of the development of local herbs is conditioned by the pilot production tests of ash and slag waste from thermal power plants as an ameliorant. Application of small doses of mineral additives to the soil increases the yield of herbs up to 25-30%.

Key words: *low productivity, annual herbs, long-term meadows, northern fallow, ash and slag waste.*

RESULTS OF TESTING THE SOWING AGGREGATES FOR PLANTING THE NARROW-ROW CROPS WITH CONVENTIONAL AND REDUCED TILLAGE

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Abstract

The main goal of sowing the narrow-row crops is to make the seed distribution even more uniform in the vegetation space. Specifities of sowing the narrow-row crops in interaction with the effects of sowing aggregate operations significantly influence the profitability of production, bearing in mind the fact that failures in the sowing process cannot be corrected later. The paper presents the results of testing the quality of the work of various sowing aggregates on two tillage systems during sowing of narrow-row crops. The tests were carried out in the vicinity of Knjazevac, and the quality of sowing aggregates effects included the determination of the longitudinal, transverse and seed distribution along the depth of the seed bed in the sowing of winter wheat of the Sosthena variety on the reduced tillage of the Amazone D9 4000 Super sowing machine, and on the conventional tillage of the seedling machine OLT Gama 18. The obtained results show that the planting aggregate Amazone D9 4000 Super worked better and achieved a more even seed arrangement. The highest content of grain in the transverse distribution of 67% was grouped at a group distance of 121-140 mm, while the longitudinal seed content of over 64% was in the group distance of 41-60 mm. The second tested aggregate obtained the uneven distribution of seeds, bearing in mind that in the group distribution 121-140 mm were 43% of the grains, while in longitudinal,n 55% of the grain was within the group distance of 41-60 mm. Distribution of seed at depth with both sowing aggregates was moderately satisfactory.

Keywords: *Sowing aggregate, quality, seed, distribution, wheat.*

CHALLENGES IN ASESSING EFFICIENT MANAGEMENT OF NATURAL WETLANDS AND NATURE PROTECTED AREAS

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Abstract

According to relevant sources, the Ramsar convention on wetlands lists more than 2.200 internationally important wetlands, protected areas, flood retentions, nature reserves, etc. They cover nearly 200 millions of hectares on our planet. In Serbia, there are 10 Ramsar areas covering 64.000 ha. The Djerdap National Park (63.000 ha) is 11th candidate to be included into Ramsar list. Besides natural, there are few constructed wetlands in Vojvodina Province in northern Serbia, aimed to purify sanitation waters from small villages. Recent reports have indicated miss-functioning of several natural and one constructed wetland due to their degradation of either (or both) grey or green components. Status of wetlands and other protected areas in Serbia are discussed with regard to (1) possibilities and willingness of society to manage existing wetlands in sustainable way; (2) flood risk prevention actions while maximizing benefits for biodiversity conservation; and (3) changes in private land use which require public participation through motivation meetings and related actions, participatory decision making and joint effort in implementing decisions made. Serbia is aware of the fact that integrative water management and involvement of stakeholders from different sectors is needed to assure restoration of national floodplains and combining classical and green infrastructure (e.g. natural retention measures such as wetlands). Multi-criteria approaches and supporting tools in multi-persons decision-making environments offer many possibilities to 'attack' inherent planning, design and management problems. Spatial multi-criteria analysis supported by GIS tools (maps) can help to assess efficiency of natural wetlands by parallel analysis of relevant qualitative and quantitative factors. Prioritization of wetlands to be restored can be performed in a group setting, while communication of participants can be easier if the results are made transparent through visualization.

Keywords: *Wetlands, Protected areas, Decision making, Stakeholders involvement, Serbia.*

IMPACT OF GRAZING ON SOIL ORGANIC MATTER AND PHYSICAL PROPERTIES OF A FLUVISOL IN NORTWEST SERBIA

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Abstract

The effects of long-term (>20 yr) grazing on the selected physical properties of a non carbonated silty-clay Fluvisols were studied in the region of the Kolubara Valley, Northwest Serbia. Two adjacent land-use types (native deciduous forest and natural pasture soils converted from forests for more than 20 years) were chosen for the study. Disturbed and undisturbed soil samples were collected from three sites at each of the two different land-use types from the depths of 0–15, 15–30 and 30–45 cm. In relation to the soil under native forest, soil organic matter content, total porosity and air-filled porosity were significantly reduced after long-term of grazing. The bulk density (0.99–1.48 g cm^{-3}) and the saturated hydraulic conductivity ($6.9 \cdot 10^{-2}$–$3.2 \cdot 10^{-4}$ cm s^{-1}) were significantly lower in forest compared to the adjacent pasture (ex-forest) soil (1.49–1.55 g cm^{-3} and $3.4 \cdot 10^{-4}$–$5.5 \cdot 10^{-4}$ cm s^{-1}, respectively). In addition, forest had significantly lower dry mean weight diameter (7.0–9.2 mm) and greater wet mean weight diameter (2.0–2.6 mm) for 0–45 cm depth compared with the pasture (8.8–9.4 mm and 1.8–2.3 mm, respectively). The decrease of soil organic matter content and reduction in aggregate stability under long-term grazing rendered the soil more susceptible to compaction. In conclusion, the results of this study indicate that removal of permanent vegetation in the conversion process from forest areas to pasture land may lead to loss of soil productivity and serious soil degradation. Obviously, there is a need for greater attention to developing sustainable land use practices in management of these ecosystems to prevent further degradation of pasture soils in the region.

Keywords: *Pasture, Trampling, Soil structure, Hydraulic conductivity, Total and air-filled porosity.*

CONTENT OF NITROGEN IN AGROCULTURAL SOIL ON THE TERRITORY OF THE MUNICIPALITIES AND THE TOWN OF NIŠ (SERBIA)

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Abstract

Soil nitrogen (N) is important macronutrient for plant growth and productivity. The aim of this paper was to examine the overload of the soil with easily available nitrogen on the territory of the Nis city (Serbia) in 2015 and 2016. Totally 6523 samples from 1219 farms were collected (4669 samples from 862 farms in 2015 and 1854 samples from 357 farms in 2016). The analysis showed that the soil of this area is medium provided with nitrogen. In 2015: 82% of samples belonged to the class of medium supplied and 13.8% were class of rich soil with nitrogen, while in 2016: 89,1% samples belonged to the class of medium supplied and 9,1% were class of rich soil with nitrogen. The percentage of nitrogen was determined from the percentage of humus, while the humus content was determined using the Tyurin method. Soil samples were taken from a depth of 0-30 cm in field crops and vegetables, and 0-60 cm in orchards and vineyards. According to the results of the research, the soil on the territory of the city of Nis is moderate-supplied by nitrogen. Certainly, it is highly recommendable to analyze the soil in order to be informed about the content of nitrogen which is necessary to all producers. Research data processing was performed by using a mathematical-statistical method in the computer program SPSS – Trial version (Statistical Package for the Social Sciences).

Keywords: *Nitrogen, Soil, Serbia.*

AGRICULTURE AND CLIMATE CHANGE IN THE REPUBLIC OF SERBIA

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Abstract

Climate change is one of the greatest global challenges of our time. The consequences of this change are potentially so far-reaching and serious that every country must do its part to help stabilise our planet's climate. In the area of agricultural production, which accounts for about 10% of the total gross domestic product of the Republic of Serbia, the entire national economy is very sensitive to all factors that affect agriculture. There is no doubt that climate change will affect the quality and quantity of yields of major crops in Serbia, as well as the variability of yield which will be more pronounced each year. According to climate change scenarios, which predict a further rise in greenhouse gas (GHG) concentrations, we can expect more frequent occurrences of extreme weather conditions, drought and then reduction of the amount of summer precipitation in particular, the increased number of dry days and days with extreme temperatures in the individual sub-periods of vegetation (high spring and summer temperatures), warmer winters with a lower number of frostless days. Therefore, intensive studies are conducted and introduced in preventive and alternative ways in the production process to combat extreme weather conditions. Through customed agricultural techniques and the application of complex agro-technical measures, it is possible to mitigate, though not completely exclude the negative impacts of climate change on the yield of cultivated plants.

Keywords: *climate change, GHG, agriculture, adaptation measure, Serbia.*

ANALYSIS OF DROUGHT IN NEGOTIN LOWLAND FROM THE ASPECT OF PLANT PRODUCTION

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Abstract

The research covered drought analysis in Negotin lowland from plant production issues point of view. Monthly data for the period 1961-2010 from the weather station Negotin were used for the study. Data were analyzed in two sections; first thirty and the last twenty years. Mean air temperature, precipitation, potential evapotranspiration, number of ice days and number of tropical days were processed. For the drought indices, the Standardized Precipitation Index (SPI-6) for September 30, the Walter diagram, the De Martonne index, the Climatic precipitation deficiency and the Aridity index were used. In comparison of the second with the first period, an increase in mean air temperature (1°C for annual temperature and 1.2°C for growing season) and decrease in precipitation (4% for both annual and growing season) were observed. The average climatic precipitation deficit was 375mm, without any significant difference between two periods of research. The average number of tropical days was significantly higher (>50%) in the second study period compared to the first, while the average number of ice days did not show a significant difference. SPI-6 for 30th September indicate 6 dry growing season during the first thirty and 4 in the other twenty years of research period. Aridity index showed a higher frequency of occurrence of semi-arid growing season in the second period of research (every other year) than in the first period (every third year). The Walter diagram and the De Martonne-index pointed to the emergence of drought and the need for irrigation during July, August and September. The forecast indicated further increase in air temperature and decrease in precipitation for the analyzed area. The study conclusion is that in order to secure agricultural production, efforts must be made to find solutions for increasing of the irrigated surfaces in this area.

Keywords: *drought, drought indices, lowland, Negotin, Serbia.*

MERCURY CONTENT IN AGRICULTURAL SOILS AND FIELD CROPS OF CENTRAL SERBIA

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Abstract

Mercury (Hg) is a heavy metal, designated as a pollutant in the environment, due to its harmful effects on biota. Mercury pollution is a significant global concern, not only due to its increased levels in the environment, but also due to its toxic effect on human health across the food chain. The aim of this study was to determine the content of Hg in agricultural soils and main field crops. Total number of 84 bulked soil samples were taken (0-30 cm depth) from agricultural land. At the same plots, 84 plant crops (11 species – used as food and feed) were taken during the vegetation season 2018. The samples were analyzed for total Hg content using Direct Mercury Analyzer DMA 80 Milestone. The obtained results of Hg content in soil were within interval 0.003-0.37 mg kg^{-1}. The average concentration of Hg was 0.08, with median 0.06±0.06 mg kg^{-1}. Obtained values of Hg in soils were below maximum allowable concentration (MAC) and this interval is complied with the most cited range in soils up to 1 mg kg^{-1} without known nearby contamination sources. It was found that Hg content is positively correlated with pH value, slit soil fraction, and $CaCO_3$. The obtained results of Hg content in plant – field crops, were within interval 0.0001-0.9087 μg kg^{-1}. Obtained maximum value is still far lower than MACs for feed and food. According to the average Hg content in plant species, obtained results were classified from highest to lowest, respectively: bean, alfalfa, maize, soybean, rapeseed, sunflower, barley, pepper, wheat, rye and tomato.

Keywords: *Mercury, Hg, Soil, Heavy metals, Field crops.*

VARIATION OF SOIL STRUCTURE IN THE FOOT AND TOE SLOPES OF MT. VUKAN, EAST-CENTRAL SERBIA

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Abstract

This paper presents the variation of soil structure along the foot and toe slopes of Mt. Vukan, East-Central Serbia. The analysis of aggregate size distribution and structure indices were conducted by means of soil units, characteristic soil horizons and elevation differences along the study area. Soils of Great Field located at different elevations were found to have significant variation in ASD and soil structure indices. Topsoil horizon of Eutric Cambisols have higher MWD after dry sieving, but at the same time it has the highest variation in MWD after wet sieving, indicating low water stability, which is opposite to the coefficient of aggregability. We share an opinion that change in MWD better depicts soils structure stability to water. The results of correlation analysis indicated that clay content is correlated more to structure indices compared with SOM content. SOM is significantly correlated with ASD and soil structure indices only in Calcomelansols, whereas the significant correlation of clay content and soil structure is more evident in Eutric Cambisols and Non-calcaric Chernozems, compared with other soil units. Soil structure variation along the lowest chain of Catena might be strong, and that it has to be analyzed from the point of view of soil unit and their corresponding soil horizons.

Keywords: *Soil structure, aggregate stability, aggregate size distribution, structure indices.*

GEOGRAPHICAL ORIGIN OF INVASIVE PLANT SPECIES IN THE WORLD AND SERBIA

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Abstract

Invasive species are regarded as one of the biggest biodiversity threat on the planet. Globaly considered and having in mind the organisms of all the taxonomical categories, the highest number of invasive species is of Euro Asian and South American origin. However, analyzing the content of invasive flora in different regions, different species presentation, due to specific geographical origin, can be noticed because of the climate characteristics of each region. Although plant species of Old World are regarded competitively superior in relation to plant species of the New World, percentage predominance of European species is recorded only in the parts of the world with similar climate characteristics, such as the parts of North America. Among invasive plant species in Serbia, the most dominant are those of North American (approx. 67%) and Asian origin (approx. 24%). South American origin has been found in about 9% invasive plant species, European in about 6%, African in about 4%, while 3% of invasive species are hybrids. Those species with native distribution in more than one continent are assigned to each of the continents. Although North American species, on the global level, do not definitely belong to species groups with the biggest invasive potential, they are predominant according to their presentation among invasive species in Serbia. It can be explained by climate similarity of the parts of North America and Serbia, phylogenetic distance of North American and Serbian flora and economic-trade connections of Europe (therefore Serbia, too) with North America.

Keywords: *Invasive plant species, Geographical origin, Serbia*.

PHOSPHORUS, POTASSIUM AND NITROGEN ABUNDANCE IN SOIL OF DOLJEVAC MUNICIPALITY

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Abstract

Phosphorus, potassium and nitrogen are major macronutrients for plants which means that plants are using them in large amounts for their growth and survival. Due to their importance, those three are classified as necessary macroelements. The aim of this paper is to present soil condition of Doljevac municipality in Serbia regarding abundance of those macronutrients. The collecting of samples and testing was carried out in 2016. Precisely 116 samples were taken from 10 different villages of this municipality. The contents of readily available potassium and phosphorus were tested using the Egner-Riehm method, AL-method. The content of total amount of nitrogen was analysed using Kjeldahl method. The data processing was carried out in the IBM SPSS Statistics – Version 20 (trial version). It was found that 42,2% of the phosphorus samples belong to a class of soil badly supplied with readily available phosphorus while only 22,4% of samples were in class of well supplied or rich soil. On the other hand, the majority of samples (79,3%) were classified as well supplied and only 1,7% as badly supplied soil. Regarding nitrogen, almost all samples were classified as moderate supplied soil (>0,20% N) with 91,4% of total amount of samples.

Keywords: *phosphorus, potassium, nitrogen, Doljevac municipality, soil.*

ABUNDANCE OF POTASSIUM AND PHOSPHORUS IN AGRICULTURAL SOIL OF THE MUNICIPALITIES AND THE CITY OF NIŠ

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Abstract

Biogenic elements constitute a group of elements necessary for all living organisms. Among them, phosphorus and potassium take an extremely important place. This paper presents the results of readily available potassium (K_2O) and phosphorus (P_2O_5) contents in the soil of all five municipalities of the city of Niš (Serbia) in 2015. Samples were taken from the following municipalities of the town of Niš: Crveni Krst (181.5 km^2), Medijana (16 km^2) Pantelej (141 km^2) Palilula (117.37 km^2) and Niška Banja (141.1 km^2). The contents of readily available potassium and phosphorus were tested using the Egner-Riehm method, AL-method. The obtained data were processed in a IBM SPSS Statistics – version 20. The concentration of available forms of potassium and phosphorus was expressed in P_2O_5 or K_2O 100 g^{-1}. It was found that 63% of the potassium samples belonged to a class of soil abundant in potassium, while only 1.6% of the samples belong to a class of soil poor in potassium. The phosphorus content in the soil of Niš showed that 37.7% of the samples belong to a class of soil with medium abundance in phosphorus, 27.8% belonged to the soil abundant in phosphorus, and 34.5% belonged to the soil poor in phosphorus. The average pH in H_2O of the examined territory was 6.48.

Keywords: *available, potassium, phosphorus, soil, Niš.*

POSSIBILITY AND EFFECTIVENESS OF MICRO-ORGANISMS IN PURIFICATION OF WASTE WATER, LAGUNA AND WATERWAY

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Abstract

The quality of life on Earth in the future will largely depend on the amount of safe water. Any use of water from numerous sources for different purposes, leads to negative changes in its physical, chemical and biological characteristics, resulting in the formation of wastewater in many forms, as industrial, communal, agricultural or rain. This type of water should be collected, and purified using efficient and economical cost-effective technology, or otherwise pose a serious environmental problem. In order to stop this trend, a large number of countries are undertaking extensive measures and invests large resources in order to stop water pollution and return pure, unpolluted water to nature. In this paper, possible biological procedures for purification of the Ada Huja Lagoon Belgrade, using microorganisms from the genus *Bacillus*, are presented. The Laguna Ada Huja is the recipient of all the listed types of wastewater and as such represents a serious environmental problem. The experiment was performed in laboratory controlled conditions using two different doses of microorganisms. Measurements of essential parameters (pH value, Ammonium ion, Nitrites, Nitrates, Consumption of $KMnO_4$, Chemical consumption of oxygen, Biochemical consumption of oxygen (BPK), Total organic carbon (TOC)) were performed for 1, 15 and 60 days from wastewater treatment. It has been found that proposed technology, a mixture of heterotrophic, aerobic and optional anaerobic microorganisms produces extracellular enzymes for increased degradation of organic compounds in aforementioned environmental conditions. The use of these microorganisms leads to a decrease of the wastewater BOD/COD content, in addition, it reduces the amount of waste suspensions, reduces the filamentous bacterial reduction of the sludge population, and improves the characteristic of deposits, and therefore wastewater meets the regulated boundaries of the outflows and discharges into the watercourses.

Keywords: *wastewater treatment, lagoons, channels, environmental protection, microorganisms.*

HARMONIZATION OF RELATIONS BETWEEN URBAN AREAS, AGROCOMPLEX AND FOREST BIOCENOSIS IN THE MANAGEMENT FUNCTION

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Abstract

Existent trends in the use of renewable natural resources call into question the self-regulatory abilities of biocenoses to adapt to dramatic climatic and other changes. Activities on the development of rural economy through diversification and development of economic activities in rural areas, intensifying the process of urbanization, generate phenomena that directly threaten not only ambient values, but also nature as a whole. Opportunities and needs that were compatible a hundred years ago are now often in contrast, which is particularly reflected in the relationship between the needs of urban complexes for food, drinking water and air. By harmonizing the relationship between urban units, agrocomplex and forest biocenoses, it is possible to provide development that does not endanger the future generations of meeting needs, and meeting the needs of the present generations. Protecting and improving the state of forests, using existing potentials and their functions, such as raising new forests in order to achieve optimal forestry, spatial distribution and structure of the forest fund is a legal obligation. The law provides a basis for the sustainability of forest management and sustainable forest management. In this regard, from the point of view of area management, the imperative task is to harmonize ecosystems in the boundary areas (ecotons) that are located between different ecosystems. The equilibrium between the two ecosystems is unstable. Small changes in one ecosystem can significantly affect the survival of the second ecosystem, especially when it comes to forest ecosystems in relation to urban areas and agricultural complexes. The aim of this paper is to point out the possible negative consequences and possible solutions on the example of a tourist place based on the principles that the economic interest is equal to the ecological interest.

Keywords: *Renewable natural resources, Forests, Area management, Harmonization.*

THE CONCENTRATIONS OF HEAVY METALS IN THE LIVER AND MUSCLE TISSUE OF THREE KINDS OF FISH DURING FIVE YEAR PERIOD

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Abstract

Fish, as the top of the trophic pyramid of aquatic ecosystems, are one of the most sensitive bioindicators for the presence of heavy metals in the aquatic ecosystems that inhabit them. During 2013 and 2018, the concentrations of cadmium (Cd), lead (Pb), mercury (Hg) and zinc (Zn) in the muscle tissue and liver of selected fish species from different trophic levels were sampled in the Zapadna Morava River. The aim of this paper was to obtain a more complete insight into the level of accumulation of heavy metals in the organism of fish, especially fish meat as an edible part that should satisfy the health safety for human consumption. Investigations of the concentration of the presence of heavy metals from *Carassius auratus*, *Abramis brama* and *Squalius cephalus* have revealed various bioaccumulation of heavy metals. Among the examined fish, the highest accumulation of heavy metals was found in *Abramis brama*, *Carassius auratus* and *Squalius cephalus*, respectively. In all fish for all four investigated heavy metals, higher concentrations were detected in the liver and less in fish muscle. Bioaccumulation of heavy metals had the following trend: Zn > Pb > Cd > Hg. The determined concentrations of the analyzed heavy metals in the fish muscle were within the permitted limits of the MDK of the national legislation of the Republic of Serbia. Meat of investigated fish species is health-safe and hygienically correct for use in human nutrition. The relatively low content of tested heavy metals in fish meat indicates that in this aquatic ecosystem during the five year period there was no significant pollution with these heavy metals.

Keywords: *Heavy metals, Bioaccumulation, Freshwater fish, Zapadna Morava River.*

BUILDING FRAMEWORK FOR TRANSITION TO 'ONE WATER'PARADIGM IN SERBIA

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Abstract

EU legislation requires that agglomeration over 2,000 inhabitants must have wastewater treatment plant. There are more than 400 such settlements in Serbia, less than 5% treating wastewater. Treatment of wastewater in Serbia cause sometimes severe environmental problems. The National Waste Management Strategy points out alarming situation and defines plan for investment in building of many treatment plants. However, financial sources are limited and Strategy does not define transparent and justified methods how to perform prioritization and determination on where investments should be placed. On the other hand, frequent summer water shortages and reductions in water supply to the customers led to the conclusion that both management and public attitude towards water resources should be changed towards one of recommended and proven approaches for water saving known as 'one water' paradigm. We see its implementation in Serbia as a good practice, because related legislation is still in development phase and almost all most common water reuse types (agriculture, industrial, environmental purposes, urban use) can be publicly accepted and applied in Serbia. Knowing that, structured decision-making framework for prioritizing the investment options according to water reuse potential is proposed. Expectedly, it will help investors and policy makers in deriving and implementing more sustainable decisions, especially those related to water reuse potential. Although water reuse is complex, expensive and difficult for implementation, it is unavoidable necessity in reality characterized by population growth, climate change, increased demand of customers in different sectors and environmental protection requirements. Embedding the water reuse potential of any particular site in the country into a decision-making framework in search for most important investment sites is foreseen as socially and technically reasonable environment ensuring sustainable solutions for water savings. Applicability of the results and public acceptance are connected with the transparency of the process and especially with developing and adopting the supporting legislative.

Keywords: *Wastewater treatment, One water paradigm, Decision making, Investment, Serbia.*

CLIMATE INFORMATION USE BEHAVIOUR OF FARMERS WITH SPECIAL REFERENCE TO CLIMATE INFORMATION SYSTEMS IN SRI LANKA

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Abstract

Sri Lankan Climate Change adaptation is supported by two main climate information systems. The local traditional weather forecasts are dependent on the observations of the people. The other, modern weather forecasts provide scientific weather information to the farmers. The climate information seeking is considered as a behavioural trait. There are no studies conducted in Sri Lanka to identify the climate information seeking behaviour. In this regard, a study was carried out with randomly selected 900 farmers from six districts in Sri Lanka in 2016. A pretested structured questionnaire was administered to collect data. The theory of planned behaviour was used to build two Structural Equation Models (SEM) with respect to particular two information systems. For the both SEMs, the use of information was considered as the behaviour while subjective norm, perceived behaviour control, attitude and intention were considered as the behaviour specific beliefs. The structural validity of the questions and sample adequacy were separately checked for both SEM models. Results of both SEM models showed significant relationships for (1) attitude and intention (2) attitude and behaviour (3) subjective norm and intention (4) perceived behavioural control and intention (5) intention and behaviour as at $p<0.05$. The results of this study revealed that the behavioural beliefs were important to determine the use of the existing two climate information systems. Therefore, the correct intervention is required to change and improve the existing behaviour albeliefs when promoting suitable climate information systems which are specifically designed to cater the future climate turbulences.

Keywords: *Sri Lankan Climate Information use, Climate Information seeking, Climate information systems.*

IMPROVING SEED TREATMENT METHODS: A KEY FACTOR TO REDUCE THE RISK IN HONEY BEES AND OTHER POLLINATORS TO MAINTAIN BIODIVERSITY

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Abstract

Bee, this small little insect that works so tirelessly and quietly around us, certainly is one of the reasons, if not a main reason, for the possibility of human development on earth. Without them, the development of life on earth, as we know it now, would have been much different and the conditions for human development may not have existed. Bees and other pollinators have a great importance in maintaining the biodiversity in almost all environments. Pollinators support the reproduction of nearly 85% of the world's flowering plants. However, these important species are endangered through the use of pesticides. In late April 2008, dust drift containing insecticide resulted in the largest bee poisoning in Germany in the last 30 years. The reason for these incidents was the contamination of flowering bee forage plants with dust particles abraded from maize seeds treated with the neonicotinoid insecticide Clothianidin recorded in the Upper Rhine. Thus, highly specialist techniques should be used when treating seeds with Plant Protection Products to avoid such problem. The aim was to improve the seed treatment methodology to reduce the drift generated from seeds by drilling and hence saving of bees and other pollinators as well as reducing the risk of people handling the treated seeds during the sowing activities and people located in the vicinity of the sowing site. The current study investigated the amount of drift generated from seeds of two varieties of cotton using two formulation of the neonicotinoid insecticide imadocloprid through measuring the fine dust particles from various treatments using the Heubach methods, whereas a Heubach Dustmeter was used. The increase in percentages of drift generated through Heubach Meter through tested formulation of imadocloprid relative to the control treatment was found to be in the range of 336-378% and 221-287 for the Water dispersible powder formulation (WS) for Hamid and Barakat cotton varieties, respectively. For the Flowable Concentrate (FS) formulation the percentage increase in the drift over the control was ranging 82-95% and 15-445 for Hamid and Barakat varieties, respectively. The Heubach values were higher in case of WS formulations. They were ranging between 13.5 – 24.5 for Hamid variety and 23.3-25.4 for Barakat variety. The values for the FS formulation ranged between 7-8.8 and 2.64-14.7 for Hamid and Barakat, respectively. The pesticide residues measured were found to be more for WS formulation compared to FS formulation for both tested varieties. The results of the study indicated, in general, that the Flowable concentrate formulation for seed treatment was better than the Water dispersible powder formulation in reducing the drift generated from pesticide treated seeds and could play important role in improving seed dressing technology to save various pollinators.

Keywords: *Seed treatment, pollinators, Honey bees, biodiversity, insecticides.*

EFFECTIVENESS OF PLANT GROWTH PROMOTING RHIZOBACTERIA IN IMROVING THE PHYTOREMEDIATION POTENTIAL OF *LATHYRUS SATIVUS*

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Abstract

Heavy metals pollution has become one of the most severe environmental problems today causing damage to water, air, and soil due to their stability and non-degradable properties which poses a potential risk to human health. Bearing in mind the importance of the phytoremediation approach, in the present work, we selected *Lathyrus sativus* because of its fast growth and high tolerance to stressful conditions. The bacterial strains used in this work were isolated from root nodules of *L. sativus* cultivated in contaminated soils, and were selected for their resistance to lead, their efficiency and ability to produce plant growth promoting substances such as indole acetic acid, siderophore and HCN, and their potential for Pb-bioaccumulation and phosphate solubilization. A pot experiment demonstrated that bacterial combination significantly improved *L. sativus* shoot and root biomass as well as lead uptake under 0.5 mM Pb. We also found that PGPR inoculation helped in reduction of oxidative damage and enhanced the antioxidant enzymes activities, phenolic compound biosynthesis, proline and soluble sugars contents. *L. sativus* plants were cultivated in a vineyard in northern Tunisia. This site contains high proportions of Pb and Cd. Plants inoculation with *R. leguminosarum*, *P. fluorescens*, *Luteibacter* sp and *Variovorax* sp resulted in an increase in growth parameters and high metals accumulation. The rhizosphere of inoculated plants showed reduction in metal availability, increases in soil nitrogen content and phosphorus availability. Selected inoculum was able to maintain an efficient symbiosis with *L. sativus* plants in contaminated Pb-soils, improving plant performance under those conditions, which was likely to be due to a combination of biochemical and physiological changes caused by the intimate relation between PGPRs and plant. The enhanced Pb uptake by bacterial inoculated *L. sativus* plants might be of interest for phytoremediation purposes.

Keywords*: L. sativus, Phytoremediation, Pb, PGPR, Association.*

DIVERSITY AND SPECIFICITY OF BIOTA IN TUNISIAN ARTIFICIAL RESERVOIRS IN A MANAGEMENT CONTEXT

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Abstract

Due to the scarcity of water and for efficient use, many reservoirs, hillside dams and hillside lakes have been built mobilizing more than 90% of surface waters. These man made environment have biological potential that deserves to be better well known, monitored, exploited and managed. This review attempts to collect information on some dam reservoirs biodiversity in Tunisia from bibliographic studies for sustainable management. Investigations conducted in some Tunisian reservoirs revealed the presence of 185 phytoplanktonic species. Cyanobacteria branch was the most diversified with 52 species, some of which are potentially toxic and can be considered as a nuisance for water usages like drinking water, irrigation, fish farming or recreation. The Autochtonous tunisian freshwater fish biodiversity is low and limited to five families: Anguillidae, Cyprinidae Cyprinidontidae, Gobidae and Pœciliidae. Autochthonous marine fish species (Mullets) as well as freshwater fish species native from Eastern Europe and Western Asia have been introduced in few reservoirs for the diversification of livestock and the promotion of inland fishing. The avifauna of reservoirs in Tunisia is quite diversified. Some have a special status and are considered vulnerable to endangered species. Most of the reservoirs in Tunisia are poor in both submerged and emerged macrophytes which may affect diversity and abundance of water birds. The environmental and ecological conditions in these reservoirs seem to favor the growth of species belonging to different biological compartments but resource management is not sufficiently efficient.

Keywords: *Reservoirs, Biodiversity, Management, Tunisia*.

EFFECTS OF GREEN SILVER NANOPARTICLES ON COMMON BEAN (*PHASEOLUS VULGARIS*) CROP

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Abstract

In the present study, we performed the green synthesis of silver nanoparticles (AgNPs) using aqueous leaf extracts of the following species: *Melia azedarach*, *Eucalyptus gomphocephala* and *Ruta chalepensis*. The effects of these extracts and their corresponding AgNPs were investigated on the following parameters in common bean (*Phaseolus vulgaris*): i: germination parameters (germination percentage and radical length); ii: growth parameters (leaf number, shoot and root length, fresh and dry weight); iii: yield parameters (number, weight, length and diameter of the pods); iv: biochemical parameters (total sugar, chlorophyll a and b and carotenoids). Six applications of 15 ml/day were considered for 10 days: three with leaf extracts and three with respective AgNPs at 20 ppm concentrations. Application of deionized water was considered as control. The measurements of growth and biochemical parameters were carried out at day 70 after planting. Results showed that AgNPs biosynthesized from *E. gomphocephala* and *R. chalepensis* leaf extracts improved growth parameters, as well as rates of chlorophyll a and b and carotenoids. Whereas AgNPs biosynthesized from *M. azedarach* leaf extract caused a decrease in all the parameters, except pod sizes, which increased. Regarding the leaf extracts' effect, the highest values of all the parameters were obtained by the application of *M. azedarach* leaf extract. The other leaf extracts registered a negative effect on growth parameters, which was more pronounced with *E. gomphocephala* extract. This study demonstrated that biosynthesis of AgNPs is cost effective, environmentally friendly and may be considered as an efficient tool for agronomy.

Keywords: *Leaf extracts, Green synthesis, Silver nanoparticles, Phaseolus vulgaris, growth parameters.*

EFFECTS OF DRAINAGE AND RUNOFF ON THE PRODUCTIVITY OF THE LAGOON OF GHAR El MELH (TUNISIA)

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Abstract

The Ghar El Melh lagoon, Ramsar site and Ramsar City (Tunisia), is a coastal quaternary lagoon edified by the flood and sediments discharge of Mejerdah River and the marine swell. This lagoon maintains hydrological exchanges with the inland waters issues through river and channels, and the marine water across an evolving inlet. The aim of this work focused on how the inland water arrival, strongly linked to the agricultural activities and rainfall regime, may affect the fisheries productivity of the lagoon. In fact from the inland side, 2 rivers and 2 channels discharged into the lagoon the drainage water of more than 2280 ha of irrigated areas. The lagoon communicates with the sea through a naturel outlet of 70 m large and around 0.8 m depth. The yearly balance of water exchange revealed that the lagoon received 4.5 mm^3 of runoff water and 5.7 mm^3 of agriculture drainage waters. The daily tidal exchanges amounted to 3.1 mm^3, ensuring a water renewal time of 8.2 days. These inputs varied strongly with the rain season and the tidal range. The fisheries of the lagoon were directly regulated according to this hydrodynamic characteristics and balance: fish recruitment, trophic and genetic migrations etc. Thus the annual production of fish, dominated by European eels and mullets, seemed to fluctuate according to the years: 64 ± 22 tons per year during the period 2008-2017, the eels production was 8 times greater with runoff and drainage spill (24.10 ± 15.19 ton/year) (Kruskal-Wallis test: $p < 0.001$). However, that was not the case for mullet. The organic and mineral load of these waters may be directly implicated in the irregularity of catches, knowing that the total nitrogen can reach 2.67g/m^3 in the drainage waters.

Keywords: *coastal lagoon, rainfall, water exchanges, fisheries, Tunisia*.

SOIL PROPERTIES OF NON-USED AREA BETWEEN NUSAYBIN AND SYRIA

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Abstract

This study was conducted in the soil taken from the deminded field among Nusaybin/Mardin and the border of the Syria between the years of 2012 -2013. With this study, the pyhsical and chemical features of the soils engaged in conventional farming methods for years and not cultivated agricultural field after 1950s were examined. For that purpose, from the field where agricultural studies were performed, 12 sum disturbed soil temples were taken from the different 4 spots and 3 depths (0-20, 20-40, 40-60 cm) and from the field that mine was removed, 36 sum disturbed soil temples also were taken from the different 12 spots and 3 depths in the area cleaned (0-20, 20-40, and 40-60 cm). These 48 samples were analyzed. In the fields taken from this area, pH, EC, organic matter, the capacity of field, wilting point, useful water, texture, lime, penetration resistance, the stability of aggregate and density were analyzed. Also, the amount of useful water was found by calculating from these analyses. The important differences between ph, EC and lime were not observed between cultivated and not cultivated fields. These rates were found 7.8, 0.8, 18% respectively on the cultivated fields while these rates were found 7.8, 0.7, and 19% respectively in the demined fields. While the capacity of the fields was found as 32%, wilting point was found as 22%, and useful water substance was found as 9% in the cultivated fields, the capacity of the fields was found as 28% wilting point was found as 22% and useful water substance was found as 9% on the uncultivated field. Penetration resistance was found as 3168-3632 kPa in the cultivated fields. However, penetration resistance was found as 4900-6878 kPa in the uncultivated field.

Key words: *Land mine soils, soils of SE Turkey, arid soils, the physical properties of the soil.*

CHANGES AT AGRICULTURE FROM GOBEKLITEPE ARCHAEOLOGICAL SITE IN THE SOUTHEASTERN ANATOLIA REGION OF TURKEY TO TODAY

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Abstract

Göbeklitepe is one of the most impressive findings of recent years. Göbeklitepe represents excavations, magnificent temples, obelisks measuring 7 meters in length, sculptures and reliefs, and an excavation site that displays the finds that will affect visitors. The fact it is 12000 years old means a very old tradition. It is not known how the agriculture was developed there, it is known that wild grains were stored. It is believed that this transition has taken so long and that a mixed diet is maintained. Independent agriculture was developed in different regions of the world. Urfa was identified as the first culture of red wheat with DNA tests in Karacadag. Göbeklitepe may be related to the beginning of agriculture. If we take a look at our land today, which is important in these days, mankind in the world is making heart, robot, blood, but cannot make a gram of soil. In the world where human beings live, one centimeter of soil consists of three hundred years to a thousand years work by nature, and an inch of earth is formed every five hundred years on average. So earth is a very precious asset. So we have to know the value. While the agricultural land assets of our country were 28.05 Million hectares in 1983, due to excessive irrigation, souring, concreting, erosion and stubble incineration, it was 26.60 Million hectares in 2005, 24.39 Million hectares in 2010 and 24.39 Million hectares in 2015. It can be seen that it has decreased by 23.80 million ha.

Keywords: *Göbeklitepe, agriculture history, GAP.*

DETERMINATION AND MAPPING OF PARAMETERS IN SURUC PLAIN BEFORE İRRIGATION

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Abstract

This study aims to show the changes that will take place on spots where irrigation areas will be settled within the "GAP Suruç Irrigation Project" by using (CBS) geographical Information System. This study is based on Land and Laboratory studies. As a part of Land studies, with the help of GPS,70 soil examples with 0-30 cm depth were taken to the laboratory from precise points of the map. These soil examples were analyzed for both physical and chemical findings and results were transferred to electronic platform. On electronic platform, with the help of PC, analyzes were combined, enriched, images were uploaded and map overlay technique used. When we evaluate the results of the analysis made, we observe that it is necessary to take high-resolution micro elements between pH 7.20-7.53 of oxidant and it is 0.01d/m-0.07dS m, values and it is only in the class of additive. Lime values, we can see that the average ratio of lime is 29.7%, the value of agricultural material is between 0.14-2.17 and it is inadequate to be 1.10 and it is insufficient, physical properties, the texture values are heavy and clayey. If this is done and it is parallel to the values of volume weight, the field capacity and the fading points add value, keep, manage, adapt to climate, harmonious and controlled, artificial irrigation, organic matter, possibility of being low aggregate stability are observed in low values throughout the plain ,the average value of 45.64% and the chemically evaluated value. As a result, this study will help to find out the changes of expected soil features within Suruç Irrigation Project.

Keywords: *Suruç, Gap, Gps, Mapping, Suruç Irrigation Project.*

DROUGHT ANALYSIS FOR GEDIZ BASIN USING STANDARDIZED PRECIPITATION EVAPOTRANSPIRATION INDEX (SPEI)

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Abstract

Drought has increased considerably in recent years in Turkey. Especially in Central Anatolia and West Anatolia there is a significant lack of rainfall. Global warming combined with the lack of rainfall influence agricultural production and constitute an important obstacle to supplying the water required for drinking-use. In order to fulfill hydraulic structures goals, hydrological, hydraulic and structural phases must be designed correctly. Therefore, it is extremely important to examine the changes of the sources feeding these structures over time. The methods that take into account only the precipitation of the indices used to indicate drought do not fully explain the drought. In this study, drought of Gediz River Basin located in West Anatolia was evaluated with Standard Precipitation Evapotranspiration Index (SPEI). Monthly precipitation, maximum and minimum temperature, average relative humidity, solar radiation and wind speeds were used as data set based on observations of 59 years between 1960 and 2018 obtained from 10 meteorological stations in the basin. SPEI continuity graphs were created for Gediz Basin in 1, 3, 6, 9 and 12 months and it was observed that there were droughts between various years. As a result, it is believed that Gediz Basin will suffer from water shortages in the coming years and urgent measures should be taken.

Keywords: *Drought, Gediz Basin, Standardized Precipitation Evapotranspiration Index.*

SUSTAINABILITY ASSESSMENT OF AGRICULTURAL ACTIVITIES IN EDIRNE, TURKEY

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Abstract

This study covers analysis of the sustainability state of agricultural activities (crop growing and husbandry) in Edirne, Turkey through a thermodynamic sustainability assessment technique, emergy analysis. Solar energy is the driving force behind all the transformations on the Earth. By taking solar energy as the basis and classifying energy and material flows as renewable, non-renewable and purchased from economy, emergy defines metrics to evaluate the sustainability of a system such as renewability, environmental loading. This study focuses on the sustainability assessment of major crops (sunflower, silage, wheat, rice) grown and animal breeding integrated with or without agriculture. For sunflower renewability values are 2.6, 4.4, 17.0 % respectively. The system using chemical fertilizers and irrigation has the lowest renewability and highest environmental loading and crop yield. Use of cow dung as the only fertilizer makes the most renewable system with lowest environmental loading but lowest crop yield. Renewability values for wheat are 6.5, 12.0, 15,6 %. Same tendencies for sunflower are valid for wheat, being irrigation and use of organic fertilizer important parameters. Being an industrial crop, rice has the lowest renewability (3.0 and 1,6%) and highest environmental loading among all crops due to high fertilizer use, irrigation water and diesel consumption. Lastly, silage is a common animal feed crop with renewability of 1.1, 10.0, 22.1 %. Least renewable system has the highest product yield and environmental loading. Irrigation and chemical fertilizer use increases environmental impact while organic fertilizer use increases system sustainability. Fodder is the major input for husbandry. Farmer grown fodder which is fertilized by animal dung increases the sustainability of a husbandry system. Our renewability values for animal breeding activities are found to be 11.2, 8.7 and 0.95 %.

Keywords: *Emergy analysis, environmental sustainability, agriculture integrated husbandry.*

DETERMINATION OF THE EFFECT OF BIOCHAR AND OLIVE MILL WASTE APPLICATIONS ON SOIL FERTILITY

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Abstract

In this study, as one of the agricultural wastes, two different forms of olive waste were applied to the soil and their effects on the soil fertility parameters were examined. Olive mill waste and biochar were used in the study. Biochar was obtained from the slow pyrolysis (500-600ºC) of olive mill waste. These wastes were applied to the soil at doses of 0, 0.5, 1.0, 1.5 t da^{-1}. At the end of the study, it was determined that olive mill wastes and biochar applications had no negative effect on the physical and chemical properties of the soil, but on the contrary, the applications enriched the soil in terms of organic matter, macro (especially total N) and micronutrient concentrations. In the study, significant increases were seen in the values of soil reaction (pH) and cation exchange capacity (CEC) by the applications. In addition, it was determined that the applications caused an increase in soil aggregate stability and soil aggregate size distribution values and soil moisture content, and prevented compression in soil by decreasing bulk density values. When most of the soil fertility parameters were examined, there was no significant difference in effect on soil fertility characteristics between 1.5 and 1.0 t da^{-1} application levels of both materials. Therefore, the 1.0 t da^{-1} application level is considered to be sufficient to improve the physical and chemical properties of soils. Evaluating from a general perspective, it can be claimed that both olive mill waste and biochar applications improve soil quality.

Keywords: *Biochar, Organic matter, Soil fertility, Olive mill waste.*

SALINITY MAPPING AND ASSASSING LEACHING EFFICIENCY BY MEANS OF EM38: A CASE STUDY OF A GOLF COURSE IN USA-CALIFORNIA-DOVE CANYON

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Abstract

The aim of the study was mapping salinity distribution of Dove Canyon golf course in US-California, Orange County-Dove Canyon City by means of EM38 sensors. Calibration points, calibration equation and salinity maps were set by means of ESAP software. This study was carried out both at field and laboratory. The readings were done by means of two EM38 instruments positioned vertically and horizontally in order to determine salinity level and to set the salinity maps of the golf course. Thus both vertical (EMv) and horizontal (EMh) readings were carried out at the same time. The temporal and spatial data were collected by means of a data logger and GPS instrument. After the readings at the field, calibration point coordinates were determined by means of ESAP software and calibration points were found by means of a navigator. Soils samples were taken from 0-15, 15-30, 30-45 ve 45-60 cm depths for each calibration points. At the laboratory, saturation percentage, moisture content, EC and pH at saturation extract were determined. Via calibration equation and ESAP software, salinity maps were set. Leaching requirement was determined by means of nearest meteorological station data (CIMIS) and performed by means of sprinkling irrigation equipment. In the golf course, treated municipal waste water was utilized as irrigation and leaching water. Salinity maps were composed at 16th fairway for pre and past leaching. In addition, low water content and spatial variability of the texture adversely affected the readings. Although, pre and past leaching surveys suggested a 30% decrease in salinity, especially the leaching at 0-15 cm was found very low comparing the water applied.

Key words: *EM38, ESAP, salinity mapping, leaching, golf course.*

THE EFFECTS OF SALINITY AND DROUGHT LEVELS OF TWO DIFFERENT PEPPER GENOTYPES

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Abstract

The aim of the study was to determine the effects of salinity and drought on hybrid (Demre) and traditional (Ilıcı) pepper genotypes with three replications, fully randomized factorial design. Irrigation water salinities were 0.25, 2, 4 and 6 dS/m. Irrigation water applied for drought experiment were 100, 75 and 50 percent of water requirements. Irrigation water EC for drought experiment was 0.25 dS/m. For both experiments water requirements were determined by weighting each pot. In order to reach required salinity levels NaCl, $CaCl_2$, $NaSO_4$ and $MgSO_4$ salt was utilized. For the salinity experiment, irrigation was initiated when the available water depleted to 30%. Throughout the experiment, water requirement, drainage water EC, yield, water use efficiency and spectrometer measurement were done. Increasing irrigation water salinities lead to decrease water requirements for both genotypes. Accordingly, the yields of both genotypes were effected by both salinity levels and water stress levels in different magnitudes. The highest yield was observed traditional genotype at control level but under highest stress condition hybrid (Demre) had the highest yield. The regression of yield and leaf chlorophyll index was as high as 0.86.

Keywords: *Pepper, salinity, drought, chlorophyll index, irrigation.*

INVESTIGATION OF THE EFFECTS OF DIFFERENT BARN PLANNING SYSTEMS ON WASTE CHARACTERISTICS – CASE STUDY OF TURKEY

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Abstract

Determining the daily amount of manure produced and characteristics of manure are important issues in designing the livestock waste management systems. In this study, the amounts of solid and liquid manure from 140 barns were measured daily for a period of two years. Total nitrogen, total phosphorus, unit volume weight, moisture content and total solids parameters were determined by the standard methods on waste samples taken each 15 days from barns. According to the results, 28.0 kg ± 4.2 kg/day of solid manure and 10.2 ± 1.08 kg/day liquid manure were obtained as average from the live weight of 452 kg of cattle. The total amount of waste derived from cattle was on average 38.4 kg/day. This value was calculated as 35.0 kg/day in tie-stall systems, 33.0 kg/day in free-stall systems, 36.3 kg/day in closed and loose housing system, 32.4/day kg in closed and grid-based systems, 42.1 kg/day in semi-open system and 39.8 kg/day in open systems. According to the calculations, solid waste was obtained from 6.7% of barns, semi-solid waste from 73.3% of barns and liquid waste from 20% of barns. These changes are seen in barn to barn were found statistically significant ($P<0.01$). Total nitrogen ratio, total phosphorus ratio, unit volume weight, total solids and moisture content varied in the range of orderly 5.0% - 1.9%, 5.6% - 2.3%, 888 kg / m^3 - 1286 kg/m^3, 53.0% - 1.7% and also 98.3% -% 47.0. These changes in different planning systems were found statistically significant ($P<0.01$). It was determined that solid waste was obtained from open systems, liquid waste from closed - free-stall system and closed -grid-based systems and semi-solid waste from closed-tie-stall systems, loose housing systems and semi-open systems. Briefly, it can be concluded that the different planning systems have important effects on amount of waste produced, waste characteristics and waste management system design.

Keywords: *Cattle, Manure, Moisture, Nitrogen, Phosphorus, Total solids, Waste amount.*

ESTIMATION OF CLIMATE CHANGE IMPACTS ON EVAPOTRANSPIRATION BY USING DIFFERENT METHODS

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Abstract

In recent years, environmental issues have come to the fore with their effects. Two of these important environmental issues are climate change and the water problems. Especially, the impact of climate change on water resources has been increasingly attracting attention as an important environmental issue. Therefore, the effects of climate change on water resources are needed to be known to manage water-related issues in the future. In this context, with this study, the impacts of climate change on evapotranspiration, which is one of the important components of water resources as a loss, were analyzed by using 18 different evapotranspiration equations (temperature-based, radiation-based, and mass transfer-based) for the three cities of Thrace part (Edirne, Kırklareli, Tekirdağ) of Turkey. The past situation was investigated by using actual data obtained from meteorological stations for the period of 1975-2010. The future projection was estimated for the period of 2015-2040 by using ECHAM-5 model data in the framework of the A1B scenario. As a result of the study, in the framework of 18 methods, it was estimated that evapotranspiration would increase in the Thrace part of Turkey from 13 to 17% as an average in the future.

Key words: *Climate change effects, evapotranspiration, evaporation, water resources.*

ALTERNATIVE PECTIN PRODUCTION METHODS AND SOURCES

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Abstract

Pectin is a polysaccharide, found in the cell wall of high plants that imparts flexibility and mechanical strength to plants by interacting with other cell wall elements. It is widely used in the food, cosmetic and pharmaceutical industries, as thickener, texturizing, emulsifying, stabilizing and gelling agent. The most commonly used method for pectin production is the acid extraction method. Due to the low extraction efficiency with limited yield, many methods have been developed such as enzyme, microwave and ultrasound-assisted extractions and subcritical water extraction. Pectin is commercially produced from mainly citrus peels followed by apple pomace, sunflower head and sugar beet pulps and the properties of the pectin depend on the source that are isolated from. Finding alternative sources methods are necessary that can compete with the production cost and properties of the commercial pectin sources. In this study, alternative pectin production methods, pectin sources and possibilities for the industrial use of the pectin produced with them were reviewed.

Keywords: *Extraction methods, Pectin sources, Food waste, Pectin properties.*

THE POTENTIAL OF EXOPOLYSACCHARIDE AND PECTIN PRODUCTION FROM TOMATO WASTES

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Abstract

Tomato is the most consumed vegetable in the world and in Turkey. The amount of its production in Turkey was 12 150 000 tons in 2018, ranking the country as the ***world third*** largest producer of tomato. It is consumed in diverse ways, such as fresh vegetable, pastes, sauces and drinks. There are large amounts of tomato wastes in the form of seeds and skins resulting from the tomato processing. This study focused on the bacterial cellulose (BC) and pectin production potencies from the tomato skins. For the BC production, tomato skins were hydrolyzed and directly supplied to *K. hansenii* GA2016 as sole carbon and nutrient sources, and the produced BC was purified and dried. Pectin extraction from tomato skins was performed with citric acid, at 80°C and 60 minutes and the extracted pectin was purified and dried. Production yield of bacterial cellulose and pectin were found as 3.29% and 4.02% (w/w), respectively. The water-holding capacity and thermal stability of BC were found to be higher than bacterial cellulose from Hestrin–Schramm medium (HSBC) while its average fiber diameter was thinner than HSBC. Utilization of the tomato skins for the BC and pectin productions could lower the production cost and increase the market share of BC and pectins among the polysaccharides.

Keywords: *Tomato wastes, Bacterial cellulose, Pectin, Skin, Utilization.*

THE PLACE OF GREEN PRODUCTION IN ENVIRONMENTAL PROTECTION AND NATURAL RESOURCE MANAGEMENT

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Abstract

The rapid increase of the population every day, it also increases production with consumption. Recycling and green production concepts gained importance as a result of the negative consequences of the wastes released to the environment during the production in the soil, water and air. With the implementation of these concepts, waste from the environment has been reduced with the recycling of waste, on the other hand, natural resources are preserved. at this point, there is a social responsibility for both producers and consumers. Reducing the damage to the environment as much as possible in production, the use of renewable resources in production rather than natural resources is a major task for producers; consumers also prefer to use environmentally friendly green products while consuming. This choice forces manufacturers to produce green. In this study, studies on green production related to environmental protection and non-consumption of natural resources were evaluated. In addition, the contribution of the sample companies that match the green production to the environment, natural resources and the country's economy has been examined.

Keywords: *Green Production, Environmental Protection, Eco-Friendly Product, Natural Resources.*

USE OF MICROALGAE CULTIVATION IN DAIRY WASTEWATER TREATMENT

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Abstract

Microalgae-based wastewater treatment systems have a great deal of interest in recent years with diverse advantages. Microalgae require large amounts of nitrogen and phosphorus for their growth. These microorganisms with high photosynthetic efficiency rapidly adapt and grow quickly in different types of wastewaters. Algae are successfully cultivated on brewery, aquaculture, animal manure and meat processing industries' wastewater for biomass production. Dairy wastewater also can be used as culture media for microalgae due to rich nutrient content in decreasing COD and nutrient load of effluents. Dairy wastewater is characterized by having high Biological Oxygen Demand (BOD) and Chemical Oxygen Demand (COD). Milk solids, fats and grease, lactose, detergents and sanitizing agents exist in dairy effluents. pH varies from 4.7-11 whereas the concentration of suspended solids varies in the range of 0.024–4.5 g/L. Total nitrogen and total phosphorus contents are 14-830 mg/L and 9-280 mg/L, respectively. It also contains metals like Na, Cl, K, Ca, Mg, Fe, Co, Ni, Mn, etc. Use of microalgae for removal of nutrients from dairy wastewater is considered as a promising and cost effective method. Soluble components of wastewater (carbon, nitrogen and phosphate) are used in microalgae cultivation and removed from wastewater as microalgae biomass. Phosphorus and nitrogen, heavy metals, pesticides, organic and inorganic toxins can be removed from the wastewater by accumulating in their cells or using in their growth. Algal biomass obtained can be used as a resource for animal feed and in biofuel production.

Keywords: *Dairy wastewater, Wastewater treatment, Microalgae, Biomass.*

ROOT DISTRIBUTION OF DRIP IRRIGATED CITRUS TREES PLANTED ON RIDGE

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Abstract

This study investigated the effects of drip irrigation on citrus root distribution that were planted on ridge system. The study was conducted in a farm in Zagarlı village of Adana in Turkey. The trees were planted in 3 m intrarow and 7 m row. The orchard size was 364 da and the trees were 6 years old. Root samples selected randomly from trees representing the orchard by the lateral side (L50, L100) and non-lateral side (Ln50, Ln100) of the tree from 4 different points and four different depths. According to the research findings Nova (*Citrus reticulate Blanco*), Okitsu (*Citrus unshiu Marc*), Valencia (*Citrus X sinensis*), the density of plant roots was found to be decreasing as the horizon deepens and away from the tree trunk. Furthermore, the root distribution on the lateral side was observed to be more uniformed and ampled than the non-lateral lines. It was observed that the root density on the lateral side was higher and uniformed more than on the non-lateral side.

Key Word: *Root distribution, orchard, planting on ridge.*

DEVELOPMENT OF E-LEARNING PLATFORM FOR THE SAFE USE OF PLANT PROTECTION MACHINERY AND PESTICIDES

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Abstract

When pesticide applications used for plant protection in agriculture are not suitable for their technique and taking safety measures, it causes health and safety problems for operators using plant protection machines, other agricultural workers, farmers and farmers' families posing significant risks to environmental and food safety. Chemicals that are used extensively in agricultural activities should be applied by people who have received adequate training and have the necessary knowledge and skills due to these reasons. This is also a requirement for safe and sustainable agriculture. In this context, it can be said that proper and correct use of the machines used in pesticide applications, and proper adjustment and maintenance of the machines, have the preventive effects of pesticides. In this study, an electronic learning platform which is developed within the scope of Integrated Management of Pesticides and Liable Exposure with Machinery Executing Needed Treatments" project shortly named IMPLEMENT project has been introduced. The target audience, which is expected to use the electronic learning platform, is a very large audience, such as farmers, farmers' unions, agricultural consultants, agricultural faculty members and students, agricultural engineers, plant protection machine manufacturers and non-governmental organizations. The platform includes 6 training units and training videos on the subject and access to the site is available at www.implement.farm. After passing the tests at the end of each stage, users who have completed the training are given a training certificate through the system. It is expected that the e-learning platform will be the source of training on the safe use of pesticides and machinery used for this purpose in agriculture.

Keywords: *Health and safety in agriculture, Sprayers, Pesticide, Environment, Training.*

CRITIQUING NATURAL RESOURCE RESEARCH IN SILOS-LESSONS FROM RURAL MINING COMMUNITIES IN GHANA

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Abstract

In 2017, the Government of Ghana placed a ban on small-scale mining activities across the country. The devastating impact of small scale mining was evident — degrading soils, deforestation, polluted waters, conversion of agricultural lands into mining sites, and deteriorating rural agrarian economies. In 2018, the ban was lifted. However, the impact remains indelible and seemingly irreversibleand the degrading trend still persist. This raises a series of operational, scholastic and political questions. What did the government miss? What is the invisible hand operating within the nexus of mining and natural resources in rural areas? I investigate these questions from a political ecology lens. It employs ethnographic method as the methodological approach to reveal latent and nuanced ways of resource use, access, distribution and governance. The study further adopts a waterscape conceptual framework to examine micro-politics, community resistance and mobilisation strategies towards resource dispossession and accumulation. Preliminary results reveal that mining impact on ecosystems is complex and wicked occurring at various scales of reference- ecological systems, micro, meso- and macro institutional scales. I observed that political discourses around resource degradation play a role in intensifying rural inequalities. Moreover, whilst the effect of appropriation is evident in communities' livelihood and way of living, micro and macro political machinations have further alienated and marginalised groups such as poorer household and women. The study makes a tremendous contribution to the emerging work on the political ecology of natural resource management in West Africa and goes a step further by adopting a systemic approach.

Key words: natural resource, mining, Ghana.

SIMPLIFIED EVAPOTRANSPIRATION MEASUREMENTS USING THE SURFACE RENEWAL METHOD OVER DIFFERENT AGRICULTURAL CROPS

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Abstract

Simple micrometeorological ground measurements, with strong theoretical background, can provide information on actual crop evapotranspiration to support irrigation decisions toward better agricultural water management. Several experiments were conducted over different field crops and orchards (in Arkansas and California) to pursue affordable evapotranspiration measurements. Latent heat flux, as an energy equivalent to evapotranspiration, was derived from the surface energy balance in order to reduce complexity of the measurement setting. The comparison of the estimated evapotranspiration to the direct eddy covariance measurements (where the gas analyzers were available) resulted in high agreement between the two methods ($R^2 \sim 0.90$). The results are presented for cotton and rice fields, as well as for sweet cherry, pistachio and citrus production orchards. The main goal of this multi-year research over different crop architectures is the possibility of independent application of the surface renewal method. We used several approaches, including the recent self-calibrating techniques, to address questions on the main advantages and limitations of the surface renewal application in place of eddy covariance. Our initial results show some overestimation of the surface renewal results in sensible heat flux compared to eddy covariance measurements. Given the difference in the magnitude of the turbulent fluxes in the irrigated agriculture, potential uncertainty in sensible heat flux measurements translates in lesser uncertainty in latent heat flux and therefore evapotranspiration estimates. While the surface renewal method can be applied over different landscapes, the irrigated agriculture would benefit the most, especially for production-scale crops in water-limited areas.

Key words: *evapotranspiration, water management, eddy covariance, surface renewal, irrigated agriculture.*

RISK ELEMENT ACCUMULATION IN COLEOPTERA ORGANISMS AS AFFECTED BY THE SOIL CONTAMINATION LEVEL

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Abstract

The risk element accumulation ability of epigeic organisms, insects from family Coleoptera, was determined and related to soil risk element content and bioaccessibility. The study was conducted in the mining and smelting district of Příbram, Czech Republic, which was characterized by extremely high aged-pollution in the soils, especially As, Pb, Zn, Cd. Four sampling sites differing in their element contents were selected and composite samples of Coleoptera individuals were sampled. The results indicated the ability of Coleoptera organisms to accumulate risk elements. In soil containing up to 841 mg As kg^{-1}, 84.6 mg Cd kg^{-1}, 4250 mg Pb kg^{-1}, and 8542 mg Zn kg^{-1}, contents in insect bodies reached 239 mg As kg^{-1} As, 24.2 mg Cd kg^{-1}, 70.4 mg Pb kg^{-1}, and 335 mg Zn kg^{-1}. Increasing element content in Coleoptera bodies with increasing soil element content was observed only in the case of Cd. However, the results indicated increasing bioaccumulation factors (BAF) values with decreasing soil element levels, indicating limited uptake of elements by the organisms living in contact with extremely contaminated soil. Two possible explanations are: I) species living in areas with long-term contamination are adapted to these concentrations and they have evolved mechanisms to avoid accumulation of risk elements, limiting their exposure relative to species living in less contaminated areas; II) the community of insect species was modified due to the long-term environmental contamination and only species with limited ability to take up risk elements were able to tolerate the risk element contents in the soil.

Keywords: *Soil, Risk elements, Anthropogenic contamination, Coleoptera.*

5. ANIMAL HUSBANDRY

ASSESSMENT OF GENETİC DİVERSİTY OF TURKİSH AND ALGERİAN NATİVE SHEEP BREEDS

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Abstract

Genetic diversity studies in domestic animals aim at evaluating genetic variation within and across breeds mainly for conservation and breeding purposes. The present study was conducted to investigate the genetic diversity of native sheep breeds reared in Turkey and Algeria. A total of 240 animals representing eight native sheep breeds raised in Algeria (Hamra, Ouled Djellal, Sidaou and Tazegzawt) and Turkey (Akkaraman, South Karaman, Karacabey Merino and Kıvırcık) were genotyped with fourteen microsatellite markers. A total of 340 alleles were detected. A mean number of alleles (Na), effective alleles (Ne) and polymorphic information content (PIC) were found to be 24.29, 10.99 and 0.90, respectively. The mean of the expected (He) and observed heterozygosity (Ho) values for all studied locus were 0.76 and 0.90, respectively. All F_{IS} value, also known as inbreeding coefficient were obtained as positive except OarCP34 locus. The genetic diversity parameters such as Na, Ho and He obtained from the studied Algerian sheep breeds were higher than the Turkish native sheep breeds. The mean global coefficient of gene differentiation (G_{ST}) showed that approximately 94.0% of the genetic variation was within-population and 6.0% was across the populations. The private alleles observed in the studied sheep breeds were highest (17) in the Ouled Djellal sheep breed, with a total of 66 private alleles. However, only 14 of it had a frequency higher than 5%. From these obtained results, the Algerian sheep breeds show a slight superiority over those of Turkish sheep breeds. Between-other, the dendrogram that the Algerian sheep breeds were completely separated from the Turkish sheep breeds and the Bayesian approach indicated that the most suitable group number was 4 (K=4).

Keywords: *Polymorphism, native sheep breeds, Turkey, Algeria, Microsatellite.*

STILLBIRTH IN RABBITS OF ALGERIAN SYNTHETIC LINE

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Abstract

In Algeria, the creation of the synthetic line of rabbits by cross-breeding between rabbits of the Algerian local population and the French strain INRA266 improved the body weight at slaughter, carcass traits and the litter size at birth by + 28%. However, increased litter size in this line was associated with a high percentage of stillbirth (+20%). This work was undertaken in order to identify the main causes of stillbirth in rabbits of Algerian synthetic line. This study was conducted at the rabbitry unit of the University of Blida. In this study, we proceeded to the necropsy of 185 stillborn kids from 95 females. The dead kits were immediately recovered, identify and weighted after birth. An external observation was firstly made and the shape of kids, color, cannibalism and abnormalities were noted on all kids. After dissection, different organs were observed (digestive tract, presence of milk in the stomach, liver, kidney and brown adipose tissue). The results of this study have shown that the litter size at birth was 8.8 kids and the percentage of still birth was 22% in the rabbits of synthetic line. In our experimental conditions, higher percentage of stillbirth was related to asphyxia during parturition (45%). In other side, the percentages of stillbirth related to death before partition and *in utero* infection were 11% and 18% respectively. Finally, lower percentage of stillbirth was related to starvation, anemia and cannibalism. In conclusion, the main cause of stillbirth in rabbits of Algerian synthetic line was asphyxia which could be related to the higher temperature at parturition.

Keywords: *diagnostic, necropsy, rabbit, stillborn.*

EFFECT OF GENOTYPE ON MEAT AND CARCASS TRAITS IN RABBITS

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Abstract

The aim of this work was to study the carcass traits and meat quality in rabbits of synthetic line and local population. In total, 70 rabbits (35 per group) were slaughtered at the age of 91d.). Slaughter yield and carcass quality measurements were performed for each group without prior fasting. Muscular pH of *Longissimus dorsi* and *Biceps femoris* were measured and the chemical composition of meat in the right hind leg was determined. The hot and cold carcasses from the synthetic line were heavier than those from the local population (+15%, P<0.0001). No differences were found in the dressing out percentage, liver and scapular fat weights. However, the synthetic line exhibited higher perirenal fat weight than the local population (25 g *vs.* 21 g P<0.001). The genotype did not influence pH measured in the *Longissimus dorsi* or *Biceps femoris.* Moisture and fat contents were higher in the synthetic line than in the local population (+9% and +35% respectively, P<.0001). However, crude protein was lower in the synthetic line (22% *vs.* 19%, P=0.0002). In conclusion, similar dressing out percentage was found between both groups, however, rabbits from the local population showed the best meat quality (low in fat and rich in protein).

Keywords: *carcass, chemical composition, dressing out percentage, meat, rabbit.*

EFFECT OF FETAL SEX ON THE CORPORAL DEVELOPMENT AND AMNIOTIC LIQUID HORMONES CONCENTRATION IN RABBITS

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Abstract

In mammals, the intra uterine position (PIU) affects the fetal body development, behavior, physiology and morphology in adulthood. However, the majority of studies investigating the effects of PIU have been performed on mice, rats and pigs. This work aimed to study the effects of PIU on fetal development, placentas and the concentration of steroid hormones (testosterone and 1-β/estradiol) in amniotic fluid in rabbits. A total of 40 synthetic and uni/ovariectomized rabbits were raised and sacrificed on the 25th day of gestation. The fetuses and their placentas were recovered, the number of blood vessels arriving at each implantation site was counted and the fetal development was measured. The fetuses were classified according to their ERAP in 3 categories: fetus positioned between two males (2 M), two females (0 M), or a male and a female (1 M). The levels of testosterone and 1-β/estradiol were measured by RIA in the amniotic fluid of each category of fetus. The fetuses implanted in oviductal position showed a better weight unlike those implanted in the median position (+ 5%, $p < 0.05$). Similarly, fetal organ weights, vital space, amniotic fluid volume, and fetal placental weights were better in the oviductal position. The effect of fetal vascularization was highly significant on all parameters measured in favor of fetuses receiving a number of blood vessels ≥6. Whatever the sex, the 2M fetuses showed high concentrations of testosterone (+ 20%, $p < 0.05$), but similar to 1-β/estradiol. In contrast, 0M fetuses had elevated 1-β/estradiol values compared to other fetal categories. No relationship was noted between the plasma steroid hormone concentrations of the female and those of the amniotic fluid of the fetus.

Keywords: *fetus, intra uterine position, rabbit, testosterone.*

STUDY OF MILK PRODUCTION AND ITS FACTORS OF VARIATION IN RABBITS OF ALGERIAN SYNTHETIC LINE

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Abstract

The aim of this work was to study the rabbits of synthetic line, the milk production and its main factors of variation. The experiment was carried out at the rabbitry of the Technical Institute of Animal Breeding, Algiers. In total, 75 nulliparous rabbit does were used in this experiment. The females were first mated at 18 weeks of age and at 10 days after parturition there after. The milk production was recorded during the first three parties. Average milk production between 0 and 21 days was 105g and increased from the 1st to the 3rd week. The milk production was affected by the parity of the females. Indeed, the females at the 3rd parity showed a higher milk production (+10% and +10 compared to the females in the 1st and 2nd parity). We did not find significant difference between the milk production recorded in summer and autumn (98 *vs*. 109; $p>0.05$). However, winter was associated with a higher milk production compared to the other seasons (124g; $p<0.05$). Finally, the milk production was affected by the size of suckling litter and the females with 7 suckled kids showed a higher milk production (131g). In conclusion, the milk production of the rabbit of the Algerian synthetic line is low compared to that reported in the European selected lines and breeds of rabbits.

Keyword: *Algeria, litter size, milk, rabbits, season.*

EFFECT OF THE PROTEIN/ENERGY RATIO OF THE FOOD ON GROWTH PERFORMANCE AND CARCASS YIELD IN RABBITS OF LOCAL POPULATION

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Abstract

In order to evaluate the effect of the protein/energy ratio (P/E) of the feed on zootechnical performances, and carcass yield, 60 rabbits aged of 42 days and with initial weight of 735 ± 27.6 g were placed in individual cages (10 rabbits per 6 repetitions). The rabbits were fed with 6 different P/E ratios, iso-cellulosic containing different protein and energy levels: 0.67 (19.7% of Crude proteins (CP) and 2927 Kcal/kg DM), 0.68 (19.39% of CP and 2830 Kcal/kg DM), 0.70 (20.46% of CP and 2914 Kcal/kg DM), 0.72 (20.44% of CP and 2825 Kcal/kg DM) , 0.73 (21.19% of CP and 2898 Kcal/kg DM) and 0.89 (25.34% of CP and 2841 Kcal/kg DM). Growth performances were measured from 42 to 91 days of age and also carcass yield at slaughter in 60 rabbits (10 rabbits/group). The results showed that the rabbits of group P/E 0.89 had low final weight and weight gain. Also, the feed intake of rabbits of group P/E 0.89 was lower ($p<0.05$) compared to group P/E 0.72 and P/E 0.73 (-11.20% and -12.63% respectively). The digestible energy intake per day was greater ($p<0.05$) with the P/E 0.67 compared to group P/E 0.68 and 0.89 respectively (+16.73% and +15.11%, $p<0.05$). On the contrary, the animals of group P/E 0.68 had a reduced protein intake in comparison with the group P/E 0.67, P/E 0.73 and P/E 0.89 (18.62 g /d *vs*. 21.99g/d, 22.54g/d and 24.7g/d; $p<0.05$). Nevertheless, the feed conversion ratio was similar between groups. The carcass yield of the animals of group P/E 0.89 was lower compared to the studied groups. In conclusion, increasing the P/E ratio results in low intake leading to low weight and weight gain and lower slaughtering performance.

Key words: *Energy, protein, local rabbit, growth, carcass yield.*

STUDY OF KIDS WEIGHT AT BIRTH AND ITS FACTORS OF VARIATION IN RABBITS OF ALGERIAN SYNTHETIC LINE

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Abstract

The purpose of this work was to study the weight at birth and its main factors of variation in rabbits of Algerian synthetic line. In total, 60 nulliparous rabbit does were used in this experiment. The females belonged to the 10th generation of selection on litter size at birth and weight at 77 days. The females were first mated at 5 months of age and 12 days after parturition thereafter. The litter size at birth, weight of litter and individual weight of kids were recorded for the first three parities.Litter size at birth in the synthetic line was 8.77 kids. The weight of kids at birth was affected by the parity of the female. The multiparous rabbit does showed a higher weight of kids at birth (+15% compared to the primiparous and 9% compared to the nulliparous). The physiological statute of the females also affected the body weight of their kids, and non-lactating females presented higher weight of kids (51 *vs*. 59g). We did not find a significant difference between spring and autumn for individual weight of kids (54 *vs*. 52g). However, summer was associated with significant lower weight of kids (45g; $p<0.05$). The stillbirth rate was higher in the category of kids with body weight ranged from 20 to 40g.

Keywords: *body weight, rabbits, litter size, stillbirth.*

CHARACTERIZATION OF THE REPRODUCTIVE PERFORMANCES IN RABBITS OF ALGERIAN SYNTHETIC LINE

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Abstract

The aim of this work is to characterize litter size at birth and its factors of variation (parity and season), in rabbits of Algerian synthetic line, at the 11th generation of selection on prolificacy at birth and weight at 77 days of age. This study was conducted at the rabbity of the University of Saad Dahleb Blida, Algeria. A total of 72 nulliparous females of Algerian synthetic line aged between 6 and 7 months were followed during their first 3 parities. The females were housed in individual cages and were fed a commercial pelleted diet *ad libitum*. The females were first mated at 18 weeks and at 10 days after parturition thereafter. The zootechnical performances of the females were recorded (the number of total born, born alive and stillborn). The results of this study showed that the litter size was 8.25 total born and 7.63 born alive. The stillbirth rate and the percentage of dead rabbits were 0.61% rabbits and 7.37%, respectively. Moreover, in the conditions of this work, the litter size increased significantly with the number of the parity of the females. Multiparous females showed a higher litter size compared to nulliparous females (9 *vs*. 8.40, $p<0.05$) and primiparous females (9 *vs*. 7.49; $p>0.05$). Finally, all the parameters measured in this study did not vary significantly according to the two studied seasons (summer and autumn).

Keywords: *crossbreeding, rabbit, prolificacy, stillbirth, genetic improvement.*

EFFECT OF OMEGA 3 ON THE REPRODUCTIVE PERFORMANCE OF THE ALGERIAN SYNTHETIC RABBIT IN ARTIFICIAL INSEMINATION

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Abstract

In the present work of the pubescent and immature rabbit does of the Algerian synthetic strain (ITELV 2006), the animals received a supplement of omega 3 of animal origin (fish oil) or vegetable origin (linseed) for 3 months (2 months before AI and 1 month during pregnancy). The females were followed until parturition in order to study the effect of omega 3 on their reproductive performance (fertility, prolificacy and stillbirth). Comparison of data between the six lots (Control puberts (CP), Control peripubertal (CPE), Linen grains pubertal (LGP), Linen grains peripubertal (LGPE), Fish oil puberts (FOP) and Fish oil peripubertal (FOPE)) for parameters of born deaths (BD), fertility and stillbirth rates showed no significant difference ($P>0.05$). Whereas for total births (TB), live births (LB) and weaner births (WB), the differences are significant ($P<0.05$). A very marked improvement in prolificity has been achieved by the incorporation of fish oil and flaxseed into the feed of the rabbits. In fact, the females of these two lots recorded the highest values (10.37 TB, 9.87LB, 9.3 WB and 10.44 TB, 9.77LB, 8.77WB respectively for FOPE and LGPE), as opposed to the unpunished rabbits of the control lot which gave the lowest numbers (7.14TB, 6.57LB and 6.57WB).

Keywords: *Fish oil, linseed, fertility, prolificacy, stillbirth.*

IDENTIFICATION OF PARASITIC SPECIES AFFECTING THE RABBIT RAISED UNDER DIFFERENT BREEDING CONDITIONS: STUDY OF INTESTINAL PARASITES

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Abstract

This research project aims to study the impact of rabbit breeding type and animal type on the presence and frequency of intestinal parasites in rabbits and to examine the variability of these frequencies among females. Two farms were chosen, the first is of the rational type (raising of Tikobaine, Tizi-ouzou, Algeria) and the second of the farm type (raising of Tizi-Rached-TiziOuzou). The parasitological diagnosis, which consisted of coprological analyzes, was carried out in the laboratory of the MouloudMammeri University of Tizi-Ouzou. It revealed and quantified the presence of helminth eggs and coccidia, in the dung and intestinal contents of the rabbit. A total of three species of parasites have been identified, namely: *Passalurus ambiguus*, *Eimeria sp* and *Strongyloides sp*. Their frequencies vary according to the type of breeding, type of animals and depending on the sample. Fattening rabbits have been reported to be most infested compared to breeding rabbits. At the end, we can say that the *Oryctolagus cuniculus* rabbit is a real reservoir of many parasitic species.

Key words: *intestinal parasites, coprology, Oryctolagus cuniculus, farmer farming, rational breeding.*

EFFECT OF SPERM STORAGE TIME AND TEMPERATURE ON SEMEN QUALITY IN THE RABBIT LINE ITELV 2006

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Abstract

The present study aims to study the effect of storage time and temperature on the semen quality of adult rabbits of the same age of the ITELV 2006 strain. In order to achieve our goal, 04 experiments are conducted to evaluate the semen quality of 10 adult rabbits. The semen samples are mixed the individual's ejaculation analysis and divided into fractions, and then diluted in a Tris diluent. They are then kept at four different temperatures for 96 hours. Samples are taken after 24, 48, 72 and 96 h. The experiment is repeated 4 times during 1 month at a rate of once a week. The microscopic parameters of ejaculation are evaluated before and after the preservation process. The results of the analysis showed that the percentage of motility and vitality of spermatozoa in fresh semen is 82.86% ± 7.82, 73.69% ± 1.29 respectively. For the conserved semen and for the same parameters, a decrease in the motility and vitality values is observed with the conservation time ($p<0.05$). For the storage temperature, the semen kept at 15 ° C for 24h has the best values compared to other temperatures (61.75% ± 2.05 and 66.5% ± 1.12 respectively for motility and vitality, $p<0.05$). We record a zero motility and vitality for the semen kept at 4 ° C from 72h.

Key words: *spermatozoa, refrigeration, Tris-based extender, vitality, motility.*

CHARACTERIZATION OF THE ALGERIAN SYNTHETIC LINE OF RABBITS

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Abstract

In order to develop rabbit meat production in Algeria, a synthetic rabbit line was created in 2003 by cross-breeding females from the local population with males from the French INRA 2666 strain. This new synthetic line has a 20% more litter size than the local Algerian population. Several studies have been performed to assess the reproduction performance of the synthetic line. However, there are no studies about its carcass traits or meat quality. The objective of this work was to study the slaughter traits and meat quality in rabbits of local Algerian population and a synthetic line. In total, 120 weaned rabbits were used (60 per group). At slaughter, carcass traits and meat quality were measured. No differences were found between the two groups in dressing out percentage, muscular pH, weight of liver or scapular fat. Hot and cold carcass weights were higher in the synthetic line then in the local population. Wider intestinal villi was found in the synthetic line (+20%, $p<0.0001$) allowing better absorption surface in this line. The synthetic line also showed higher fat content (3.41% vs. 2.22%, $p<0.0001$) in the meat and lower protein content (22.02% vs. 18.98%, $p=0.0002$). In conclusion, the synthetic line showed better carcass traits and better intestinal absorption surface.

Keywords: *carcass, growth, meat, rabbits, Algeria.*

STUDY OF REPRODUCTIVE PERFORMANCES AND EARLY EMBRYO DEVELOPMENT IN RABBITS OF ALGERIAN SYNTHETIC LINE

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Abstract

The objective of our work was to study the litter size and its main factors of variation as well as the early embryonic development (48h and 72h *postcoïtum*) in rabbits of the Algerian synthetic line. In total, 67 nulliparous females were used for the study of the zootechnical performances and 40 multiparous females, for the study of the early embryonic development. The zootechnical performances were measured on 6 parities. The females used for the study of the embryonic development were mated then sacrificed at 48h or 72h *postcoïtum*. The ovulation rate and total number of embryos collected were 13 corpora lutea and 11 embryos respectively. The percentage of normal embryos, fertilization rate and early embryonic survival were 85, 87 and 75% respectively. Early embryonic development in females of the synthetic line at 48h or 72h was late. In addition, litter size at birth was 8.8 kids (7.8 and 0.96 live and dead kids respectively). Stillbirth was 12%, while that between birth and weaning was 23%. Finally, the number of weaned rabbits per litter was 6.07. In conclusion, the rabbits of the synthetic line presented zootechnical performances quite comparable to those found in the literature. However, the early embryonic development evaluated at 48h or 72h was late.

Keywords: *crossbreeding, embryo, litter size, rabbits.*

STUDY OF THE IMPACT OF SOME FACTORS ON THE VARIATION OF THE BUTYROUS AND PROTEIN CONTENT OF COWS MILK IN TWO FARMS IN THE CENTRAL REGION OF NORTHERN ALGERIA

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Abstract

In order to study the factors influencing the change in the physico-chemical quality of *postpartum* cows milk, 52 dairy females of Montbéliarde and Prim'Holstien breed at different lactation numbers were collected during the first two months of lactation at two farms located in the central region of northern Algeria (provinces of Algiers and Médéa). The data obtained were processed by EXCEL for the calculation of means and standard deviations and the SPSS software for the study of correlations between dietary intake, milk production level and butterfat content (BC) and protein levels (PL). A significant decrease in these rates was observed during 60 days *postpartum*.It was related to the increase in the level of milk production during this period (correlation coefficients were -0.91 and -0.77 with the BC and PL respectively). In addition, primiparous presented lower rates than multiparous. On the other hand, the average butterfat content was comparable between two farms (41 *vs*. 39 g/l), whereas a difference of 5 g/l was noted for the PL (24 *vs*. 29 g/l). The proportion of the concentrate in the rations also played an important role in the variation of the useful matters of milk. Rations with high energy intake improved PL of milk at 1 month of lactation (r = 0.95), but also BC at 2nd month of lactation (r = 0.98).

Key words: *Algeria, dairy cow, fat content milk, protein content.*

CHARACTERIZATION AND IDENTIFICATION OF CERTAIN GOAT BREEDS IN EASTERN ALGERIA

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Abstract

The goat species is endowed with multiple qualities of production including dairy without it being demanding in terms of food or maintenance. The goat herd in Algeria consists of a mixture of local breeds (Arabia, M'zab, Kabyle and Makatia) and imported breeds (Alpine, Saanen and Murciano-Granadina). The production potential of our goat population is insufficient both in terms of their characteristics and their performance, particularly regarding: diet, the ability of young people, resistance to certain diseases and climatic and food adversities, and reproductive performance of males. In this context the present work aims at genetic evaluation of the current diversity of goat herds in eastern Algeria (identification and characterization of local breeds and creation of a network of breeders). To carry out this work, we must first develop a questionnaire to understand the functioning and progress of the goat rearing systems of the regions studied, then make the morphometric measurement of the individuals belonging to the local goat population with blood samples for DNA extraction and characterization of genes of interest. The expected results of this approach can be summed up in two axes: the detection of new breeds from statistical analyzes of phenotypic characters and the detection of new zootechnical interest genes with the influence of the environment on their expressions.

Key words: *Goat, Breeds, Genetic diversity, Genes of interest, DNA.*

NUTRITIONAL VALUE OF GRASSLAND MEADOW GRASS GRAZED BY DAIRY COWS

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Abstract

The chemical composition of forages and food is the first essential step to valorize animal feed, it allows us to estimate the food value of food. The present study focused on determining the chemical composition of grass grazed during the spring of 2018 by dairy cows at the beginning of the 2nd cycle (grass 1) and at the end of the 2nd cycle (grass 2). The dosage of this herb indicates the following levels respectively: green dry matter (GDM): 18,14 and 21,66%; mineral substances (SM): 10,45 and 10; Crude fiber (CF): 26,53 and 24,24 and total nitrogenous matter (TNM): 14,52 and 16,61% DM. From these analyzes, we were able to deduce the nutritional value of these samples by using the PrivAlim software: the energy value expressed in milk feed unit (MFU): 0.84 and 0,90, in feed unit meat (Meat UF): 0,78 and 0,86/ Kg DM and the nitrogen value represented by digestible proteins in the intestine (g of PDI): when the limiting factor is nitrogen, the DPIN value is 97 and 112 g, and if the limiting factor is energy, the DPIE value is 96 and 103 g/kg DM.

Key words: *grazed grass, chemical composition, energy value, nitrogen value.*

STUDIES OF FACTORS INFLUENCING THE GROWTH OF OULED DJELLAL LAMBS IN THE SEMI-ARID REGION (EASTERN ALGERIA)

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Abstract

The ovine herd in Algeria is made up of several breeds of which the *Ouled Djellal* breed is numerically the most important of the national herd, it represents about 50% of this herd. This breed is exploited fundamentally for meat production. Also, this sheep breed suffers from a lack of study done for it. The present work aims to determine the factors influencing the growth of Ouled Djellal lambs bred in the semi-arid region (eastern Algeria). The studied animal material consists of 665 sheep, including 318 ewes, 20 rams and 327 lambs. This flock was divided into three lots according to the method of reproduction applied: Lot I, in controlled reproduction, consisted of 124 ewes distributed randomly in 15 groups of 9 to 10 ewes with one ram each; Lot II, conducted in artificial insemination (AI) and constituted of 150 ewes; the third batch (lot III), consisted of 44 ewes conducted in natural struggle with 15 rams.The results obtained in this study show that lambs have an average weight of 3.25 kg at birth, 13.46 kg at weaning (90 days) and 23.22 kg at 180 days. The average daily gain from 0 to 180 days is 112.53 g/d.Also, the results obtained clearly indicate that birth month and birthing factors significantly influence ($P < 0.01$) on lamb weights and thus their average daily earnings (ADG). The mode of reproduction had a very significant influence ($P < 0.01$) on the weights of lambs at different ages as well as their weight gains ($P < 0.01$). So the control mode is a very important source of variation for these variables.So to obtain high weights, we must synchronize the herds to have lambing during the most favorable months.

Keywords: *Sheep, Ouled Djellal ewes, lamb weights, Algeria*.

MORPHOMETRIC CHARACTERIZATION OF THE EQUINE BARBE BREED IN ALGERIA

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Abstract

The Barbe horse occupies a prominent place in the history, culture and tradition of Algeria, and it is at the base of the evolution of the main equine breeds in Maghreb. Nineteen (19) measurements were made on 58 pure and presumed Barbe horses (uncertain origins), all aged three years and over. From these, six body indices were calculated and live weight estimated. The cephalic profile survey was also performed. Statistical analyzes were carried out on these difference measurements by software R 2.15.2 and XLSTAT2016. The statistical tests used were of the descriptive and analytical type including, among others, the calculation of mean standard deviation, principal component analysis (PCA) and ascending hierarchical classification (CAH). We also estimated genetic diversity by Shanon and Weaver index. They found that the Algerian Barbe horse was a eumetric, mediolinear horse with a body index of 0.955, (squared horse), with a median size of (152.5) cm, a chest of (175.5) cm and a posterior (19.8) cm and anterior (20.6) cm canon. It has a slightly hooked convex cephalic profile and a predominantly chestnut robe. Its characteristics make the horse Barbe of Algeria conform to the standard as defined by the world organization of the horse Barbe.

Keywords: *Algeria, Barbe horse, mensuration, conformation, statistical analyzes.*

MORPHOMETRIC CHARACTERIZATION AND TYPOLOGY OF DONKEY FARMING (EQUUS ASINUS) IN THE WILAYA OF TLEMCEN

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Abstract

Due to the absence of the ethnic data and studies of racial characterizations of this species in Algeria, which is an endangered species, we contributed to the phenotypical study of donkey population in the area of Tlemcen. A man power of 61 adult asses, distributed on the level of two areas from where 11 body measurements and 06 phenotypical characters were retained for this study. Measurements LTC, HG, TP, LH, LE, PC, LoT, LoO, LQ, LaT and TM were 157,26±12,88; 116,16±7,23; 124,26±7,03; 37,15±3,21; 27,07±3,27; 17,50±1,86; 52,39±4,06; 30,15±2,19; 41,42±5,76; 23,01±2,06 and 46,24±4,16 cm, respectively. The sex did not present any significant effect on studied body measurements ($p>0,05$). A factorial analysis of the multiple correspondences was carried out on the phenotypical characteristics, and it revealed two principal components which constituted 47,62% and 41,39% of total inertia, percentages respectively related to the color of the dress, the head, the members, the hairs, the muzzle and the belly. This analysis made it possible to establish remarkable phenotypical differences which had implications to be taken into account in the program of characterization and conservation of the species.

Key words: *Donkey, Populations, Body measurements, Phenotype, Characterization, Algeria.*

EFFECT OF DIFFERENT DIETARY PROTEIN CONTENT ON PRODUCTION PARAMETERS OF CROSS-BRED FATTENING LAMBS

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Abstract

The aim of the study was to examine the effect of different dietary protein content on the production parameters of cross-bred fattening lambs. The study was conducted on 20 cross-bred lambs from different Pramenka types, divided in two groups. The lambs were at the age of 55 - 60 days, and the fattening period lasted five weeks. The first group of lambs were fed with a mixture of cereals and sunflower meal that contained 12.26% of crude protein, while the second group was fed with a concentrate mixture with crude protein level of 14.69%. During the fattening period the lambs from both groups were fed with hay ad libitum. Fresh water was offered with no restriction during the study. Lambs were weighed at the starting and at the end of every week of the study, and the results were statistically analyzed. The body weight gain was determined within the both groups according to age of lambs during fattening. At the end of fattening period higher average weight and weight gain with no significance ($p>0.05$) were observed in lambs fed with a mixture of cereals and sunflower meal. However, similar values were determined for feed to gain ratio in both groups of lambs. The obtained results indicated that the cross-bred fattening lambs fed with a mixture of cereals and sunflower meal had achieved better, but not significantly better production parameters that may have economical benefit for lamb meat production.

Key words: *lamb, feed mixture, production parameters, fattening.*

THE INFLUENCE OF MILK TYPE ON THE PROTEOLYSIS OF WHITE-BRINED CHEESE MANUFACTURED FROM HIGH-HEAT-TREATED MILK PRETREATED WITH CHYMOSIN

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Abstract

White cheese in brine is widely consumed in southeastern European countries. A specific aspect of this type of cheese is that maturation occurs in salt brine, usually for one or two months. Today, it is commonly made from thermally-treated cow or sheep milk and to a lesser extent from goat milk. However, in the last 15 years, due to its nutritive and health benefits, there has been an increased interest in goat milk production and its conversion into high-valuable products, such as cheese. Usually white-brined cheese production uses a mild heat treatment. In the past 20 years, a higher thermal treatment of milk (above 70°C) has been recognized as a method for improving the yield and nutritive characteristics of cheeses through the formation of so-called micellar whey protein-casein complexes and their incorporation into the gel matrix. We investigated the effect of milk type on the proteolysis of white-brined cheeses prepared from high-heat-treated (90°C, 10 min) cow and goat milk, pretreated with chymosin at a low temperature (4°C). The cheeses produced showed a high content of denatured whey proteins and slower proteolysis than cheeses prepared from commonly treated milk. However, these characteristics depend on the type of milk. Ripened cow milk cheese had higher values of water-soluble nitrogen content and nitrogen soluble in 12% trichloroacetic acid, but similar values of nitrogen soluble in 5% phosphotungstic acid were observed in ripened cheeses. The suggested procedure can be useful for production of nutritive valuable cheese. Further investigations are needed.

Key words: *White-brined cheeses, hymozin pretreatment, high-heat treatment, proteolysis.*

FUNCTIONALITY OF TRADITIONAL SERBIAN WHITE-BRINED CHEESES

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Abstract

This paper is an overview of functional characteristics of traditional Serbian white-brined cheeses. It covers fatty acid profiles, mineral content profiles, antioxidant properties (total antioxidant capacity, reducing power, Fe^{2+}-chelating properties before and after *in vitro* digestion) and ACE-inhibitor activity (before and after *in vitro* digestion) of four Serbian traditional white-brined cheeses: Zlatar cheese, Sjenica cheese, Svrljig cheese and Homolje cheese prepared from different types of milk. Fatty acid and mineral content profiles of traditional cheeses were different in qualitative and quantitative sense. Sjenica cow cheeses had the most favorable health indices related to fatty acid composition, including atherogenicity index (1,89), thrombogenicity index (1,37) and desirable fatty acid ratio (46,34%). This type of cheese also hads the highest level of Ca, P, K, Mg, Zn, Cu. Due to different content and composition of proteins, low molecular weight peptides and free amino acids traditional cheeses had different antioxidant properties and ACI-inhibitor activity. Homolje cheese prepared from sheep and cow milk had the smallest values of total antioxidant capacity, whereas Svrljig cheese was the most efficient for radical scavenging. The best ACE-inhibitory activity had Zlatar cow milk cheese, whereas the lowest ACE-inhibiting potential had Sjenica sheep milk cheese. These data clearly indicate that traditional white cheeses may have significant health promoting effects through good balance of fatty acids, favorable mineral composition, maintenance of antioxidant defense systems by scavenging free radicals which induce oxidative damage to biomolecules causing ageing, cancer, heart diseases, stroke and arteriosclerosis.

Key words: *White-brined cheeses, fatty acids, mineral content, antioxidant properties, ACE-inhibitor activity.*

IMPROVING REPRODUCTIVE PERFORMANCES IN PRIMIPAROUS AND MULTIPAROUS COWS

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Abstract

Main goal in cattle reproduction is to achieve high fertility with economical justification for duration of open days or intercalving period. This period in optimal conditions should last 12-13 months, which in return gives best milk production in lactation year. Utilisation of biotechnological measures in control of reproductive functions, it is possible to increase reproductive performances in dairy cows. Induction and synchronisation of estrus usualy require utilisation of hormones for control of ovarian activity and to reduce unsuccessful artificial inseminations. Final goal is to reduce open days/service period to prevent or reduce financial losses. Our study has included 187 cows. Anamnestic data have been taken from reproductive/health card. Before hormonal treatment, all cows had clinical examination of reproductive system. First group had primiparous and multiparous cows which have received prostaglandin F2α in period 40-80 days postpartum, while second group had primiparous and multiparous cows which have received GnRH in period 10-14 days postpartum. Status of ovaries, uterus and pregnancy, have been done with manual and sonographic transrectal examination, while progesterone levels have been assessed using RIA method. Prostaglandin F2α application to multiparous cows, had reduced open days period for 20 days, but same application to primiparous cows had increased open days duration for 30 days. Treatment of multiparous cows with GnRH had signifficant shortening of open days period for 90 days, but same treatment in primiparous cows had reduced percent of conception. Our study has shown that optimum of reproductive performances could be achieved with application of GnRH hormone soon after parturition and timely application of prostaglandin F2α after 40 days postpartum, when histological regeneration of uterine endometrium is complete.

Keywords: *primiparous, multiparous, cow, hormone, reproduction, service period.*

THE EFFECT OF AGE OF PARENT YOUNG BROILER ON THE EFFICIENCY OF INCUBATION OF CHICKENS

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Abstract

By establishing reproductive-production characteristics of broiler parent hybrids Cobb 500 the research has been conducted on one parent flock during the period of 38 weeks of production. During the research, special attention was given to breeding eggs incubation and diurnal chicken production. The main goal of this paperwork was establishing the impact of broiler parents' age on chicken effective incubation. During the production cycle in 3 periods (AP_{23}, AP_{31}, AP_{42}) the following was observed: the breeding egg mass on deposition, the breeding egg mass on shuffling, diurnal chicken mass, length of diurnal chickens, and chicken to egg ration. According to the tested periods, broilers' parent in the largest number of cases had the best reproduction-production values during the middle of production cycle (AP_{31}), in relation to the first and third testing period (AP_{23}, AP_{42}). Broiler parents' age influenced the incubation values of the eggs and one-day chicks. The average mass of fresh layed eggs was the biggest in the tested period (AP_{31}) - 69.32 g, while the biggest mass of the eggs on transshipment was in the third tested period (AP_{42}) -60.44 g. The incubational values of one-day chicks during the incubation were increased along with the broilers parents' age which had the consequence that mass and weight of chick were the biggest in 3rd tested period (AP_{42}) where average mass was 42.41 grams, and length 16.80 cm. Chick share had its specific variations according to other characteristics. The biggest average share of the chick in the egg mass was in the 23rd week, or in the first testing period and it was 69.91%. The differences in the examined traits were considered significant at levels *P<0.05; **P<0.01. The differences in the examined traits were considered significant at levels *P<0.05; **P<0.01.

Keywords: *age, parent flock, Cobb 500, incubation properties.*

HEMATOLOGICAL AND SERUM BIOCHEMICAL PROFILE IN EAST BALKAN PIGS AT DIFFERENT AGE AND SEASONS

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Abstract

Twelve hematological and fifteen serum biochemical parameters were determined in indigenous East Balkan pigs at different ages and two seasons. The experiment was carried out in the Scientific Centre of Agriculture- Sredets aiming to characterize the health status of the animals when reared organically. Blood samples were taken from pre-weaned piglets (n=10), growers (n=10) and sows (n=10) in spring and summer. The results were analysed through two way ANOVA to assess the influence of the age, season and their interaction on the hematological and serum biochemical profile of the animals. Both age and season interacted significantly in regard to the red blood cells count (RBC) ($P<0.001$), hemoglobin (HGB) ($P<0.001$) and hematocrit (HCT) ($P<0.01$), as well as in the most biochemical parameters including creatinine($P<0.001$), total protein (TP) ($P<0.001$), albumin (ALB) ($P<0.001$), alanine aminotransferase (ALT) ($P<0.001$), aspartate aminotransferase (AST) ($P<0.01$), uric acid (UA) ($P<0.01$), Mg ($P<0.001$), triglycerides (TG) ($P<0.05$) and cholesterol ($P<0.01$). Regardless of the season, the white blood cells (WBC) including lymphocytes and granulocytes, as well as platelets (PLT)decreased with age, while mean corpuscular volume (MCV) increased.The content of glucose, urea, gamma-glutamil transferase (GGT), alkaline phosphatase (ALP), Ca and P which displayed maximal values in pre-weaned pigs ($P<0.05$) compared to the other age groups ($P<0.05$). The season affected the number of lymphocytes ($P<0.01$), their percent ($P<0.001$), mean corpuscular hemoglobin (MCH) andmean corpuscular hemoglobin concentration (MCHC) ($P<0.001$), as well as the concentration of GGT ($P<0.001$) which increased during summer,and also granulocytes ($P<0.01$), their percentage ($P<0.001$), PLT ($P<0.05$), glucose, urea, ALP, Ca ($P<0.001$) and P ($P<0.01$) whichwere higher in spring.

Keywords: *Hematological and serum biochemical parameters, Pigs, East Balkan breed, Age, Seasons.*

CHARACTERISTICS OF BASIC BEHAVIOURAL FEATURES OF 'HORNLESS HEREFORD' LACTATING COWS RAISED ON A NATURAL GRASSLAND

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Abstract

A study was conducted on the main elements of the behaviour of lactating beef cows of 'Hornless Hereford' breed with their calves at the age 5-6 months on a natural pasture in the region of Troyan, Bulgaria. The pasture is situated at 386 m above sea level on a flat terrain with a local grassland. The meteorological indicators characteristic of the late spring were recorded. The behavioural reactions were examined by chronometry, such as: grazing, having a rest, lying and ruminating, moving, water intake, defecation, nursing of calves. It was found that cows were grazing from 5.36 to 5.51 hours on average during the experiment and the calves were suckling 4-6 times a day and 2 times at night, respectively. The time used for grazing is comparable to that recorded under other climatic conditions, grazing composition and meat cattle breeds. The physiological state, the climate elements, the alimentary conditions and the raising system had an impact on the behavioural reactions of lactating beef cattle. Animals tested were characterized by imitating behaviour.

Keywords: *Pasture, cows, behaviour, 'Hornless Hereford', grassland.*

RELATIONSHIPS BETWEEN SOMATIC CELL COUNT AND SELECTED QUALITATIVE PARAMETERS OF SHEEP MILK

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Abstract

The aim of the study was to evaluate relationships between somatic cell count (SCC) and selected qualitative parameters of sheep milk (contents of fat (F), total protein (TP), casein (Cas) and lactose (L), pH, titratable acidity (TA) and clotting time (CT)). Determination of daily milk yield (DMY) and effect of the stage of lactation (SL) on selected parameters were also an integral part of the study. The study was carried out under operating conditions at a specialized sheep organic farm. Eighteen ewes of Lacaune breed were involved in the experiment. The SCCs insignificantly grew as lactation advanced, nevertheless, both mean counts (from 88 to 130 x 10^3/mL) and their counts in individual samples (from 36 to 420 x 10^3/mL) were relatively low during lactation. The SL also had no significant effect on pH and TA. On the other hand, the SL had a significant effect on all other monitored parameters. The SCC had a positive significant correlation with contents of F, TP and Cas. In contrast, between SCC and content of lactose a negative significant correlation was found. Many studies show that the content of lactose can be reduced with mastitis and SCC increase. However, in our opinion a negative significant correlation between SCC and lactose content was not affected by intramammary infection, because in all cases the SCCs were lower than the thresholds for subclinical mastitis in sheep. Our opinion also largely supports the fact, that all correlations between SCC and pH, TA, CT and DMY were insignificant.

Keywords: *Sheep milk, Somatic cell count, Milk composition, Milk acidity, Clotting time.*

EFFECT OF SEX ON GROWTH OF ABERDEEN ANGUS CALVES

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Abstract

The aim of the experiment was to evaluate growth ability of Aberdeen angus calves breed in organic farming system in the area of White Carpats (southeastern part of Czech Republic). Total number of animals used in experiment was 181 – 82 bulls and 99 heifers. Evaluation of growth ability was made according to methodology of Czech Beef Breeders Association. Average birth weight of calves was 37 ± 3.18 kg. Bulls had significantly ($p<0.01$) higher birth weight (39 ±3.72 kg), than heifers (36 ± 2.53 kg). In the age of 120 days there was significant difference ($p<0.01$) between gender at the range of 14 kg in favor of bulls (187 ± 30.42 kg). In the age of 210 days differences between sexes deepened even more. Average weight of bulls was 280 kg and of heifers was 257 kg. Same growth trend was also maintained at the age of 365 days, when difference ($p<0.01$) between bulls and heifers was 79 kg. Mean value of daily gain of bulls, from birth to 365 days, was 1424 $g.day^{-1}$, of heifers was 943 $g.day^{-1}$. In the age of 210 days hip height was also measured. Between gender there were no significant ($p>0.01$) differences.

Keywords: *Aberdeen Angus, growth of calves, bulls, heifers.*

UTILIZATION OF *ATRIPLEX LEUCOCLADA* BOISS *AND NOAEA MUCRONATA* FORSSK.) ASCH. & SCHWEINF. IN DAIRY GOATS DIET

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Abstract

In this study, two species of desert plants which are eaten by goats have been identified as *Atriplex leucoclada* Boiss and *Noaea mucronata* (Forssk.) Asch. & Schweinf., selected for their use in goat feeding and preferring and then later analyzed for their nutritional parameters. To study the effect of using these plants in feeding goats, three basal diets (T1, T2, and T3) were formulated using concentrate feed mixture and rice straw as roughage. The three diets differed in concentrate of roughage (C:R) ratio, where it was 25:75, 50:50 and 75:25 for T1, T2, and T3, respectively. Using *in vitro* technique, each experimental diet of T1, T2, and T3 was immediately incubated following addition either 2.5, 5, 7.5 or 10 /kg dry matter (DM) of *A. leucoclada* and 2, 4, 6 or 8 g/kg DM of *N. mucronata*. Results obtained showed that a significant increase in both rumen DM and OM disappearance (IVDMD and TVOMD) occurred when the different levels of such tested plants were added to the diet. Moreover, the levels of 10/g of *A. leucoclada* and 15/g of *N. mucronata* tested per kg DM diet had the superiority to improve both dry and organic matter disappearance in the rumen.These findings indicate that such desert plants can be used successfully in feeding ruminant and for improving disappearance of DM and OM in the rumen.

Keywords: *Goat, Feeding, Atriplex leucoclada, Noaea mucronata, Dry matter, Organic matter.*

COMPARATIVE STUDY OF SOME ANESTHETIC PROTOCOLS IN THE SURGICAL TREATMENT OF PATHOLOGY OF STOMACH

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Abstract

The realization of this study was carried out during the period September 2013 - April 2019 at veterinary hospital Pet Life, at the clinic of Faculty of Veterinary Medicine, as well as in some of the veterinary clinics in the district of Tirana. This study consisted in the use of some protocols of some parenteral anesthetic drugs used for induction and maintenance of anesthesia during the surgical interventions. These drugs are currently present in the pharmaceutical market of Tirana. They have been used in dogs of different ages, breeds and weights, for the surgical treatment of gastric surgical pathologies and stomach diagnostic manipulations as endoscopy. These medications include the use of some preanesthetic substances and some injecting general anesthetics in the form of various anesthetic protocols. The compilation of these anesthetic protocols was made to evaluate the best anesthetic effect and the fewest side effects of each protocol to determine the most successful protocol for general anesthesia with base anesthetic like Ketamine as well as comparing it with Ket-A - Xyl. Prior to defining the general anesthesia protocols in the patients was checked the primary condition, age, cardiovascular system, respiratory, renal, hepatic system was first evaluated for each patient. Selected dogs were divided into 5 large groups where each of these groups was applied a combination of general anesthetic injectable substances according to the following protocols. Protocol no. 1 Xylazine - Ketamine I / M Protocol no. 2 Acepromazine + Xylazine - Ketamine I / M Protocol no. 3 Atropine + Asylum + Acepromazine - I / M Test Protocol No.4 Atropine + Xylazine + Ketamine I / M. Protocol No. 5 Ket-A-Xyl I / M.

Key words: *protocol, ketamine, gastric pathology, endoscopy.*

PRELIMINARY RESULTS ON CHROMIUM (Cr) CONCENTRATION IN WILD FISH TISSUES IN VARDAR RIVER, NORTH MACEDONIA

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Abstract

The concentrations of Chromium (Cr) in wild fish from the Vardar river of North Macedonia has been investigated. The selected tissues (muscle**,** liver and skin) of two fish species: Europian Chub (*Squalius cephalus*) and Common barbel (*Barbus barbus*) from Vardar river stream, Republic of North Macedonia. Samples are collected in nine different points (Hot Spots) in total distance of 301km and approximate 33km between sampling sites. The effect of environmental conditions and urban discharges on Chromium (Cr) accumulation in muscles, liver and skin were investigated. The metal analyses were performed using Inductively coupled plasma mass spectrometry (ICPMS). The average of metal concentrations (micrograms per gram wet weight) in nine hot spots (HS) occurred in the following ranges:HS-1: muscles 0.25-liver 1.00-skin 0.10, HS-2:muscles 0.25-liver 0.70-skin 0.20HS-3:muscles 0.10-liver 0.30-skin0.10,HS-4:muscles 0.15-liver 2.40-skin 0.10,HS-5:muscles 0.10-liver 0.54-skin 0.04,HS-6:muscles 0.10-liver0.20-skin 0.00, HS-7:muscles 0.10-liver 1.00-skin 0.10, HS-8:muscles 0.14-liver 1.40-skin 0.00and HS-9:muscles 0.15-liver 1.35-skin 0.00. The lowest levels of the Chromium (Cr) were detected in the skin. The muscles and liver were found to accumulate the highest amounts of Cr. In the case of organs, the highest levels were found, as follows: liver >muscles >skin. Further investigation of heavy metals is recommended, including a survey of fish consumption frequency among the local inhabitants.

Keywords: *heavy metals, Chromium, fish tissue, Republic of North Macedonia.*

OF *MORINGA OLEIFERA LEAF* EXTRACT ON REPRODUCTION AND OXIDATIVE STATUS OF DOE RABBITS

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Abstract

This research aimed to investigate the effect of *Moringa oleifera leaf extract* (MOLE) on reproductive performance, antioxidant activity and immunity, of rabbit does. Total of 100 primiparous NZW does were divided into 4 experimental groups (25/group). Does in the 1st, 2nd ,3rd and 4th groups were daily received drinking water supplemented with 0, 90, 120 and 150 ml MOLE/L, respectively, for 2 month as a treatment period. All does were naturally mated with fertile NZW bucks (5/group). Reproductive traits and ovarian characteristics of does were evaluated. Serum immunoglobulins and antioxidant status were determined at the end of treatment period. Results showed that does in 3rd and 4th groups improved ($P<0.05$) conception rate, viability rate and litter characteristics at birth and weaning. Concentrations of total antioxidant capacity and immunoglobulins (IgG and IgM) increased ($P<0.05$), while thiobarbituric acid reaction concentration as a lipid peroxidation decreased ($P<0.05$) in 3rd and 4th groups as compared to other group. In conclusion, treatment of doe rabbit with *Moringa oleifera leaf* extract at a level of 120 ml /L drinking water for 2 months prior to natural mating could be useful as a strong exogenous antioxidant, and could have interesting applications to improve the reproduction and immune response in rabbit farms.

Keywords: *Rabbit, Moringa oleifera, reproductive traits, immunity, antioxidants.*

ANTIMICROBIAL SENSITIVITY PATTERN OF EGYPTIAN AVIAN *PASTEURELLA MULTOCIDA* STRAINS

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Abstract

This work was designed to characterize *Pasteurella multocida* isolates from layers and breeders of chickens flocks in Egypt with emphasis on *in-vitro* antibiotic sensitivity and resistant pattern. Liver, heart, spleen and lungs were collected aseptically from diseased birds suffered from respiratory manifestations, septicaemia.Drop in egg production and mortalities during the period from 2016-2017 were observed. Samples were cultured on modified Das media for isolation of bacteria. Pure colonies of *P. multocida* isolates were identified according to microscopic morphology and biochemical characters. The isolated *P. multocida* were subjected to *in-vitro* antibiotic sensitivity test. Cultural study revealed small glistering, grayish, mucoid and dew drop *P. multocida* colonies. Microscopically, *P. multocida* isolates were Gram negative coccobacill. All the isolates were positive for catalase, oxidase, indol production, nitrate reduction and H_2S production tests, while negative for methyl red, Voge'sproskaur, urease activity and gelatin liquefaction tests. Moreover, they fermented glucose, fructose, mannose, mannitol, sucrose, sorbitol and xylose without gas production, but did not ferment arabinose, inositol, lactose, maltose, salicin, dulcitol and raffinose. Isolated *P. multocida* isolates were sensitive to Ofloxacin, Tetracycline, trimethoprim/sulphamethoxazole, Penicillin, Chloramphenicol, Norfloxacin, Azithromycin, and Erythromycin, while they were resistant to Ampicillin and Clindamycin. Intermediate sensitivity was observed for Cefoperazone, Gentamycin and Streptomycin.

Key words: *Pasteurella multocida, Antimicrobials, chickens, Egypt.*

DETECTION OF ODOUR FROM ANIMAL PRODUCTION IN FINLAND

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Abstract

Agriculture is the most significant source of Ammonia emissions that cause e.g. odour problems and acidification. Odour has become a local problem as a nuisance to the neighbourhood. Animal production farms have traditionally been situated in the rural areas well apart from densely populated areas. But as these urban areas grow, urban population comes nearer the farms. Problems arise when farms need to grow or change their production and neighbours oppose this due to expected odour annoyance. Odour annoyance has to be taken into account on environmental permissions for animal production units. There are two different estimation methods used in Finland. The first simple one is a curve that is based on the number of livestock units in the production unit. The other one, still under development, is a model that is based on animal and production dependent odour factors, prevailing wind directions and topography of the area. Both these methods have deficiencies. As the production unit has already been established, the prevailing odour can be measured with an olfactometric method that is based on odour sensation of a panel of people with different sensitivities to annoyance of odour. The olfactometric method can also be used when estimating the effect of different production technologies on odour. Examples of the use of olfactometric method are presented.

Keywords: *Animal production, odour, annoyance, measurement.*

EFFECT OF SALINE WATER ON WATER INTAKE, GROWTH PERFORMANCE AND BLOOD METABOLITES OF BARBARINE LAMB

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Abstract

This experiment was designed to study the effect of drinking saline water on growth performance, water intake and blood parameters in local sheep reared under Tunisia conditions. Twenty of Barbarine lambs (n=20; average starting weight of 20.5kg). The lambs were divided into two homogenous groups regarding age and live weight. Animals are grazed the open rangeland area of vetch. Control group having free access to a normal water; while the second group was receiving a water enriched with 10 g NaCl/l. The obtained results indicated that water intake, body weight, live body gain daily, plasma glucose and gamma glutamyl transferase were not affected by increasing salt concentration in drinking water. However, plasma cholesterol, total protein, albumin, creatinine, urea triglyceride, were significantly affected ($p<0.05$&0.01) by salinity. Barbarine local sheep, they could tolerate the salinity of water

Keywords: *sheep, salinity, intake, blood and rumen metabolism.*

THE NET GAIN IN PIG PRODUCTION IN THE REUNION ISLAND AFFECTED BY PINEAPPLE SILAGE

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Abstract

Pig production in the Reunion Island is one of the most important livestock and meat productions on the island. The context of being an island increases the feeding cost and leads to the fact that feedstock are largely imported. However, the island status of the Reunion Island facilitated the development of a strategy to reduce the cost and increase the feed process inside farms. This poster illustrates a new strategy to increase the local feedstock for pig breeding on the Reunion Island. There, the nutrition of pig needs to integrate the local possibilities to improve not only the nutritional value, the productivity but also the production cost The goal of this paper is to develop the pineapple silage to reduce the feeding cost of the farming system. The first step is to diagnose the pig system with respect to the pineapple. The second step is to create the protocol including a methodology based on the pineapple silage process. The final step is to estimate the net cost reduction in of pig livestock production. The main outcome of this study is the net cost reduction due to the use of pineapple silage protocol. This paper also discusses the protocol for silage preparation of pineapple and its integration into the farming system of the pig production process.

Key words: *pig production, Reunion, pineapple silage.*

UNIQUE BLACK CHICKEN VARIETY FOR WOMEN EMPOWERMENT IN HILLY AREAS OF JAMMU AND KASHMIR, INDIA

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Abstract

Kadaknath is only Black Meat Chicken (B.M.C.) breed of India along with Silkie chicken from china and Avami Cemani from Indonesia. It is very important to conserve and propagate this unique indigenous breed of India. Considering its unique medicinal and nutritious value, Krishivigyan Kendra made an attempt to introduce this variety among tribal women in hilly areas of Jammu and Kashmir. Studies have shown that backyard poultry farming results in women empowerment and socioeconomic upliftment. The main aims of the study were: 1. To conserve, promote and popularize this nutritious, medicinal breed for the first time in the state; 2. To analyze its nutritious value; 3.To encourage these farmers especially women to contribute to family income; 4.To provide these women with small, but steady source of income round the year. Data were collected from rural women involved in poultry rearing practices through pre structured interviews schedule. Factor analysis was performed to identify the empowerment factors. Almost 3000 of birds were distributed with 15 birds per household. Farmers were given training for rearing, feeding, housing and management of these birds. Kadaknath has special medicinal value in homeopathy and a particular nervous disorder. The tribal uses kadaknath blood in the treatment of chronic disease in human being. Kadaknath chicken has a peculiar effectiveness in treating women's discuss, sterility, Menoxenic (abnormal menstruation), habitual abortion. Kadaknath meat has high levels of vitamins B1, B2, B6, B12, C and E, niacin, protein, fat, calcium, phosphorus, iron, nicotinic acid etc. Kadaknath has Protein content of 25%, Fat content 0.73-1.03, Linoleic Acid 24%, Cholesterol 184.75mg/100g. Being completely black in color the meat and eggs are sold at a price at least 400 times higher than normal chicken meat and eggs. As a result, it provided a small, but steady income round the year for women farmers.

Key words: *chicken, women empowerment, India.*

EFFECT OF DIETS CONTAINING SYNBIOTIC (PROBIOTIC PROTEXIN AND PREBIOTIC MANAN-OLIGOSACCHARIDE) ON THE GROWTH PERFORMANCE, SURVIVAL AND BODY COMPOSITION OF WESTERN PACIFIC SHRIMP (*LITOPENAEUS VANNAMEI*)

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Abstract

A nutritional test was conducted to evaluate the interactive effects of probiotic Protexin and prebiotic mannan-oligosaccharide (MOS) on growth, survival and body composition of *Litopenaeus vannamei*. For this purpose 420 shrimps with anaverage weight of 5.53 ± 0.3 gand with a density of 20 shrimp were stocked in 500 liter tanks for 2 months. The diets included the control diet without additive, diet 1, 2 and 3 containing 0.5, 1 and 3 g of Protexin respectively + 1.5 g of MOS, diet 4, 5 and 6 containing 0.5, 1 and 3 g of Protexin respectively + 3 g MOS per kg of feed. At the end of the study, growth parameters, survival and carcass composition were studied. The results showed that adding synbiotic (probiotic Protexin and prebiotic mannan-oligosaccharide) to the diet significantly increased growth, improved feed conversion ratio, increased survival and improved carcass composition ($P < 0.05$). Also, the results showed a significant interaction between probiotics and prebiotics diets on growth indices and body composition ($P < 0.01$). The best result was the addition of 1 g of Protexin + 3 g MOS per kg of diet that could improve the growth performance and chemical composition of the carcass in western Pacific shrimp.

Key words: *Feed additive, western Pacific shrimp, sinbiotic, growth performance.*

SEROLOGICAL STUDY OF CHICKEN INFESCTIOUS ANEMIA DISEASES IN BROILER CHICKEN FLOCKS IN SANANDAJ, IRAN

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Abstract

Chicken infectious anaemia virus (CIAV) has been described in most countries with a developed chicken industry and can result in immunosuppressive syndrome in broiler chickens. In this study, 388 serum samples from 49 broiler flocks in Sanandaj area, Iran, were tested for the presence of chicken infectious anemia virus (CIAV) antibodies using a commercial enzyme-linked immunosorbent assay kit. The results indicateed that 35 farms out of 49 farms (81.8 %) had a high antibody titers (>3000) and were positive for CIAV antibodies. Seroprevalence was higher in autumn and winter, 100% and 90.5%, respectively when compared with spring and summer serum samples that were 45.5% and 60 %, respectively. This is the first report of serologic evidence confirming the high prevalence of seropositivity of CIAV in poultry farms in Sanandaj, Iran.

Keywords: *Chicken infectious anaemia, ELISA, broiler chicken, antibody titer*.

EFFECTS OF PISTACHIO BY-PRODUCT POLYPHENOLS ON OXIDATIVE STABILITY AND A-LINOLENIC ACID RETENTION IN EXTRUDED LINSEED DURING LONG TERM STORAGE

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Abstract

The current study was conducted to determine the effects of pistachio by-product polyphenols, on oxidative stability and α-linolenic acid retention in extruded linseed during long term storage. Linseed was mixed with pistachio by-product and alfalfa hay (by mass) in 80:10:10 ratios and extruded with (ELINT) or without (ELIN) tert-butylhydroquinone as a synthetic antioxidant. The data was analyzed by SAS (2003) and Proc GLM in a completely randomizing design. Means were separated by Duncan test at 0.05 probability level. The peroxide value (PV) of the ELIN group was higher than the ELINT treatment ($P<0.05$). After extrusion, the content of oleic, linoleic and, linolenic fatty acids in ELINT treatments were higher than the ELIN ($P<0.05$). There were no differences between treatments for α-Linolenic acid retention ($P>0.05$) after extrusion. As storage period increased, PV of treatments increased, too($P<0.05$) and, time of storage had significant multiplier effect on PV of treatments ($P<0.05$). Also, there was positive interaction between treatment and time of storage for PV ($P<0.05$). As storage period increased, the level of α-Linolenic acid retention decreased ($P<0.05$). In conclusion, phenolic contents of pistachio by-product in 10% extruded linseed could not be effective as a natural antioxidant. However, α-Linolenic acid retention in extruded linseed was not different between treatments after extrusion process, but it decreased with increasing of storage period and this decreasing in the ELIN treatment was higher than the ELINT treatment.

Key words: *Tannin, Extrusion, Linseed, Flaxseed, Peroxid.*

COMPARISON OF NUTRITIONAL VALUE AND IN VITRO GAS PRODUCTION OF SOME IRANIAN NUTS HULLS

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Abstract

This study was conducted in order to determine chemical composition and fermentational properties of different nut hulls that were included to almond, groundnut and walnut hulls. In this experiment after sample drying, samples were ground to pass 2 mm sieve and used for determination of chemical composition and in vitro gas production.The data wereanalyzed by SAS (2003) program and Proc GLM in a completely randomizing design. Means were separated by Duncan test at 0.05 probability level. There were significant differences among treatments for chemical composition ($P<0.05$) exceptDM and EE ($P>0.05$). Also, gas production parameters were significantly different among treatment and these parameters were significantly higher in almond hulls toward peanut and walnut hulls ($P<0.05$). However, these by-products may be useful as a fiber source in livestock diets instead of some other usual feedstuffs.

Key words: *Almond, Gas production, Peanut, Nut hulls, Walnut*.

SURVEY ON INFECTIONS BY *TRICHOMONAS GALLINAE* AND *TRITRICHOMONAS FOETUS* IN BIRDS, CATTLE AND CATS AND THEIR ECONOMIC IMPACT IN NORTH WEST OF IRAN

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Abstract

Trichomonas gallinae and *Tritrichomonas foetus* are flagellated protozoa causing trichomonosis in avian, bovine and feline. Trichomonads have worldwide distribution and induce economical losses in livestock industry. *Infection with T. gallinae* in general *can be asymptomatic* or cause mortality in bird populations. *T. foetus can* cause abortion storms in cattle and large bowel diarrhea in cats. This study was done in period of 2 years during 2014 - 2016. The swaps samples were taken from oropharyngeal area of 386 wild and domestic birds, genital secretion samples obtained from 100 cattle and fecal samples obtained from 327 cats. Samples were investigated by direct microscopic examination or cultured in modified diamond or In-Pouch^{TM}TV. Molecular work was done to identify genotype of *T. gallinae* using Polymerase Chain Reaction (PCR), based on Fe-hydrogenase and ITS1/5.8S rRNA/ITS2 genes. Direct microscopic examination showed that out of 386 birds, 75 samples were infected by *T. gallinae*. This number was 101 samples using culturing and PCR assay. Phylogenetic analysis revealed that Fe-hydrogenase and ITS1/5.8S rRNA/ITS2 genes in domestic pigeons were closely related to each other and they also had high sequence homology with other *T. gallinae* from Europe and South West of Iran. The nucleotide sequence information obtained in the present study was a valuable recourse for understanding the genetic nature and molecular epidemiology of *T. gallinae* which could be used for identification of existence strains of *T. gallinae* in the region. Also, according to the results obtained from 100 cattle and 327 cats by direct microscopic examination and culturing in modified diamond, *T. foetus* was not observed. It was concluded that absence of *T. foetus* in cattle could be due to the increasing rate of artificial insemination, management livestock in breeding fertility and in cats due to lack of contact with the feces of other cats. Due to high infected rate of *T. gallinae* in birds of the region more attention should be paid to prevent its negative economic impact.

Key words: *Trichomonas gallinae, Tritrichomonas foetus, birds, cattle, cat, PCR, Iran.*

PRODUCTION OF CHEESE FROM DONKEY MILK: MAY THE USE OF TRANSGLUTAMINASE IMPROVE THE CLOTTING ACTIVITY?

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Abstract

Donkey milk is characterized by poor clotting activity due to its low contents in caseins, specially k-casein, and fat that make the cheesemaking process very difficult compared to milks of conventional dairy species. The aim of this study was to assess the effects of two patterns of microbial transglutaminase additionto donkey milk on milk acidification and on some cheesemaking parameters. Four cheesemaking small scale sessions using microbial transglutaminase (MTGase; 5.0 U/g milk protein) were performed in mini-vat heated by thermostatic water bath according to the following patterns: control (CC), no MTGase addition; MTG1, MTGase addition (40 °C) 15 min before starter inoculation; MTG2, MTGase addition simultaneously with rennet (42 °C) in acidified milk (pH 6.3). Milk acidification evolution following bacteria starter inoculation (*Streptococcus thermophilus*; 0.01 g/L milk), as time necessary to reach the value of pH 6.3, cheesemaking parameters, gel viscosity and cheese yield were recorded. The addition of MTGase together with rennet (MTG2) had fortification effect on donkey milk improving curd firmness in comparison tothe CC, and the highest curd viscosity. In comparison to MTG1, MTG2 affected ($P<0.01$) the slower acidification time and the shorter gel formation time. The cheese yields were 7.39% in control, 7.13% in MTG1 and 6.91% in MTG2. In conclusion, the use of MTGase simultaneously with the addition of rennet to donkey milk determined an improvement of curd formation and firming, with potential application for innovative dairy products and for the further development of donkey milk productive chain.

Keywords: *Donkey milk, Cheesemaking, Transglutaminase.*

LIVESTOCK, SUSTAINABLE FOOD SYSTEMS AND THE SUSTAINABLE DEVELOPMENT GOALS

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Abstract

Animal production is an agriculture sub-sector together with crop production, fisheries and forestry. Agriculture is at the centre of the debate on sustainability and sustainable development. However, such a debate has, generally, two weaknesses; it ignores the contribution of livestock in agriculture and focuses on agriculture production rather than the whole food system. Therefore, the objective of this review is to analyse the relationship between livestock and sustainable food systems and to explore its implications in the context of the 2030 Agenda for Sustainable Development, including the Sustainable Development Goals (SDGs). After introducing the concept of sustainable food systems and providing an overview on the 17 SDGs, the paper explores linkages between agro-food systems and the SDGs. The analysis of the role of livestock in the context of the SDGs – both positive contributions and negative impacts as well as trade-offs – focuses on SDG 1 (No poverty), SDG 2 (Zero hunger), SDG 6 (Clean water and sanitation), SDG 13 (Climate action) and SDG 15 (Life on land). The review shows that livestock, sustainable food systems and the SDGs are strongly related. It also points out that intensive livestock systems, which are dominant nowadays especially in some developed countries, may jeopardise the achievement of the SDGs. Therefore, the paper argues that de-intensification – e.g. through conversion to environmentally-friendly livestock systems such as organic farming – can allow keeping the multifaceted and multidimensional benefits of the livestock sector while decreasing its negative externalities. This will contribute to the effective implementation of the 2030 Agenda as well as other regional agendas (e.g. CIHEAM Strategic Agenda 2025 in the Mediterranean region).

Keywords: *Climate change, Food security, Livestock, Sustainable Development Goals, Sustainable food systems.*

BODY AND CARCASS CHARACTERISTICS OF BALADI, DAMASCUS, BALADI-DAMASCUS CROSSBREED GOAT KIDS AND AWASSI SHEEP LAMBS SLAUGHTERED AT DIFFERENT AGES

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Abstract

Performance and carcass characteristics were evaluated in three goat genotypes in comparison with Awassi sheep breed at weaning and market ages. Ten Awassi ram lambs and thirty goat buck kids (10 Baladi, 10 Damascus, and 10 Baladi-Damascus (Hybrid)) were randomly selected and reared with their dams until weaning. Five animals from each group were selected randomly and slaughtered at weaning age (90 days old). The other animals were kept in individual pens and fed fattening ration containing 16% CP, then slaughtered at the end of fattening period (188 days). Results related to birth and slaughter weights and average daily gain (ADG) at 90 days showed that Awassi lambs were superior ($P<0.01$) to kids of all genotypes. The ADG up to 90 days for Awassi lambs (169 g/day) was 29, 16 and 20% higher than that for Baladi, Damascus and Hybrid kids, respectively. The ADG up to 188 days for Awassi lambs (212 g/day) was 155%, 138% and 100% higher than those of Baladi, Damascus and Hybrid kids, respectively. Feed efficiency was better in Awassi when compared to goats. At 90 days, final live weight was greater ($P<0.05$) in lambs than kids while hot and cold carcass weights and dressing percentage were greater ($P<0.05$) in kids than lambs. At 188 days, lambs showed higher ($P<0.05$) final live weight compared to kids. Hot and cold carcass weights and dressing percentage showed similar results between lambs and kids. However, Hybrid kids showed higher values ($P<0.05$) compared with Damascus and Baladi kids. Awassi lambs had higher ($P<0.05$) % of leg and tail cuts but lower % of loin, rack and shoulder cuts compared to kids. Results of the present study showed that lambs had higher growth rate and better feed conversion, thus making it more efficient to produce lambs than kids.

Key words: *Sheep, Goat, Slaughter age, Growth performance.*

EFFICIENCY OF USE BEANS AND PEAS IN THE DIET OF DAIRY COWS

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Abstract

Lactating Holstein-Friesian Black-and-White dairy cows (n=4×5) were included in the trial in the initial lactation phase with the average milk yield of 30.00 kg per day, fat content 4.10% and 3.20% protein content in milk. The analyses of the chemical content of beans and peas show, that crude protein and undegraded intake protein were higher in beans than in peas, respectively 29.97% and 25.04% of dry matter but undegraded intake protein content, respectively 40.51% and 39.69% of crude protein. The highest content of starch was in peas - 48.54%, beans - 43.29% but the lowest in soybean meal - 7.62% of dry matter. There was a total of 17 amino acids detected in beans, peas and soybean meal. The highest concentration of arginine, leucine, glutamic acid, aspartic acid and isoleucine was in beans, respectively 0.76%, 0.58%, 0.67%, 0.42% and 0.29% more than in peas. Even though the daily milk yields decreased for all the cow groups during the experiment, which was normal during the lactation period, yet the milk yield decreases for the trial groups. The milk yield decreases for the trial groups (1^{st} and 2^{nd}) were smaller – 0.8 kg, 1.3 kg, respectively, compared with the initial stage of the experiment ($P< 0.05$). In contrast, group 4 showed a significant decrease in the average daily energy corrected milk yield (4.9 kg), compared with the initial stage of the trial. Compared with the control group, none of the dietary interventions showed significant ($P>0.05$) deviations. The highest total amount of amino acids in milk was detected in 3^{rd} and 2^{nd} trial cow groups, respectively, 4.00 g kg^{-1} and 3.90 g kg^{-1} which was fed fodder beans and peas.

Keywords: *beans and peas, amino acids, dairy cows, milk.*

THE EFFECTS OF DIET ON GROWTH, CARCASS CHARACTERISTICS AND MEAT QUALITY OF LAMB AND GOAT KID

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Abstract

The aim of this study was to evaluate the effect of different diets of lamb and goat kids on the growth, carcass characteristics and chemical composition of fresh meat. Eight lambs and 8 goat kids were separated in 4 groups (n=4). Four Boer goat kids received oats (G1) as a feed supplement, four kids – oat mix with fodder beans (G2), four lambs – grains mix with fodder beans (L1), four lambs – grains mix with beans and peas (L2). Feed intake and growth performance were monitored for 84 days (L1 and L2) and for 72 days (G1 and G2). After slaughter of goat kids, the carcass yield of G1 kids was 45.1%, but for G2 kids it was 39.9%. Higher proportion of lean meat (59.1%) and fat tissues (16.3%) were observed to G1 kids. After slaughter of lambs, the carcass yield of L1 kids was 44.8%, but for L2 kids it was 45.9%. Higher proportion of lean meat (53.9%) and fat tissues (19.8%) were observed to L2 lambs. Lower dry matter (29.4% vs. 32.0%) and intramuscular fat content (7.3% vs. 12.9%; $p<0.05$) of *M. semimembranosus* muscle was observed in goat meat samples. The lowest cholesterol was found in G1 meat (59.3 mg $100g^{-1}$), but the highest – in G2 meat (96.9 mg $100g^{-1}$; $p<0.05$). The highest content of linoleic (335.26 mg $100g^{-1}$ and 330.72 mg $100g^{-1}$) and arachidonic (297.12 mg $100g^{-1}$ and 273.15 mg $100g^{-1}$) fatty acids were found in G2 and L2 meat samples. The results suggest that animal and diet has an impact on the quality of lamb and goat kid meat.

Keywords: *nutrition, carcass, lamb, goat kid, meat.*

STUDY OF FISH PARASITES *DACTYLOGYRUS* BY CONFOCAL LASER SCANNING MICROSCOPY

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Abstract

Fish Monogenoidea ectoparasites of the *Dactylogyrus* genus have direct life cycle without any intermediate host. Infection site of this monogenea is fish gills. Having a well-developed powerful hook system, monogeneans damage the filaments of fish gills and this leads to the disruption of gas exchange and the emergence of secondary infections. Local necrosis of gill tissues and overgrowth of the gill epithelium around the worms are observed. Disease cause massive mortality of carp fry. The characteristic features of the structure of the dactylogyrus are four eyespots, the attachment apparatus consisting of two central hooks, 1 or 2 plates and 14 marginal hooks. The structure and form of the attachment apparatus and the copulatory organ are specific for each *Dactylogyrus* species and are significant for parasite species identification. For wildlife and aquaculture fish 48 species of *Dactylogyrus* are registered in Latvia. The most pathogenic for cyprinids in aquaculture are *D. vaststor* and *D. extensus*. The study was aimed to develop rapid and efficient staining technique for *Dactylogyrus* spp. morphological examination by confocal laser scanning microscope using benzanthrone luminophores for sample labeling. Monogeneas were collected from fish gills, washed in 0.9% saline solution, fixed and stained by benzanthrone luminophore. Confocal laser scanning microscope (Eclipse Ti-E, Nikon, Japan) was used for parasite examination. Developed technique is appropriate to visualize the hard parts of dactylogyrus such as attachment apparatus, copulatory organ and studying their morphological features in details. Investigation of these structures is crucial for understanding of pathogenicity of these parasite species.

Keywords: *Dactylogyrus, fish parasites, confocal laser scanning microscopy, benzanthrone luminophores.*

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THE CHEMICAL CONTENT OF BEEF MEAT AT THE DIFFERENT FEEDING

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Abstract

Both, genetic and feeding factors, affect beef quality. Although breed or type contributes significantly to the genetic variation in beef quality, nutrition is one of the most important factors. The aim of our research was to study the influence of feeding of pea on beef meat quality. We had two groups with different feeding: ordinary feed ration and feed ration with pea. Three calves from each group were slaughtered (live weight 250 kg) at a commercial slaughterhouse via electrical stunning, followed by exsanguinations, and carcasses were dehaired via scalding, eviscerated, and split vertically down the midline. Hot carcass weights were obtained and measured. The samples of meat were taken from the *musculus longissimus lumborumetthoracis* 24 hours *post mortem* and subsequently subjected to the chemical analysis. The carcass traits in our studies were not influenced by peas included in beef cattle calves diets: carcass outcome weight was from 58 to 62%, muscle-eye area 62-76 cm^2. Higher results were in pea cattle group. The chemical content of meat also did not differ significantly, except crude protein, 24.1±0.16 and 24.9±0.31, respectively. The higher was in pea cattle group ($p<0.05$). The other indices were similar in both groups: crude fat 1.7±0.19 and 1.6±0.20, cholesterol, mg 100g - 56.0±3.99 and 58.2±4.79, ph 5.4±0.11 and 5.3±0.15. The pH of muscle considered "normal" was 5.6. Muscle color, texture, water-holding capacity and tenderness were influenced by pH. The pH in beef meat ranged from 5.3-5.4 in our research, a little less than in"normal" meat. This indicates that the animals may have been killed in stress. The concentrated feed with peas in cattle diets make beef carcasses more muscular.

Key words: *beef meat, pea, feeding, carcass traits.*

BENZANTHRONE LUMINOPHORES FOR EXAMINATION OF FISH DIPLOSTOMUM METACERCARIAE

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Abstract

Metacercaria *Diplostomum* (Trematoda) is a worldwide distributed parasite of the fish. Freshwater parasites *Diplostomum* are registered for 47 species of fish from ponds, rivers, lakes and the Gulf of Riga. *D. spathaceum* is the most common diplostomid of the four species found in Latvia. Trematode has an indirect life cycle in which birds, usually gulls are definitive hosts, *Lymnea* molluscs are the first intermediate hosts and fish act as the second intermediate hosts. Diplostomids metacercariae are up to 0.5 cm long, do not develop cysts and mainly are affected lens of the eye, rare vitreous body of the eye. In acute form of the disease is observed impaired coordination of fish movement. In chronic form of disease, parasitic cataracts develop and blindness occurs, and fish became more accessible to fish-eating birds. Fish disease diplostomosis causes economic losses in fisheries, also through the loss of fish weight due to blindness and malnutrition. The aim of the study was to investigate *D. spathaceum* metacercaria morphology using developed more efficient and less time-consuming staining protocol utilizing benzanthrone luminophores and confocal laser scanning microscopy (CLSM). *Diplostomum* larvae were collected from fish eyes, washed in 0.9% saline solution, fixed and stained by luminophore. Parasite visualization and imaging was performed using CLSM technique (Eclipse Ti-E, Nikon, Japan). Oral sucker, ventral sucker, holdfast organ, digestive tract (prepharynx, pharynx, oesophagus, and two blind intestinal caeca), excretory system and calcareous corpuscles were visualized and investigated. Metacercaria staining using developed protocol allowed visualizing more detailed internal structure of the parasite.

Keywords: *Diplostomum, benzanthrone luminophore, fish parasites, metacercariae, confocal laser scanning microscope.*

Acknowledgments: This work is funded by ERDF project No 1.1.1.1/16/A/211.

INFLUENCE OF LEPTIN GENE C3469T POLYMORPHISM ON PRODUCTION TRAITS IN PIGS

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Abstract

This study aim was to evaluate the influence of leptin gene C3469T polymorphism on production traits in tested pig hybrids. The investigated population consisted of three crossbred breeds: Yorkshire x Landrace crossbreeds, Yorkshire x Landrace x Landrace crossbreeds and Great White x Landrace x Landrace crossbreeds. DNA was extracted from 80 pig bristle samples, following PCR amplification. The aplicons were incubated with *Hinf*I restrictase, which cuts DNA at specific site if C3469T SNP mutation was present. The genotypes were determined after performing PCR-RFLP electrophoresis in agarose gel. While examining the diversity of alleles and genotypes in tested pig population, three genotypes were determined and their frequencies estimated: TT with frequency 0.900, TC with frequency of 0.088 and CC with frequency of 0.013. Also, frequencies of alleles T and C were estimated, 0.944 and 0.056 respectively. The same trend was observed in every pig hybrid breed separately. The influence of genotypes was determined on two production traits, that was ham weight, where TT genotype was observed to be 0.6 kg heavier than TC ($p = 0.043$),and the second one – fat content at 6 – 7 rib, where TC genotype was observed to be 5 mm fattier than TT ($p = 0.031$). Four genetic influence factors were determined. Breed factor influenced length of bacon half (42.33 %, $p < 0.001$) and fat content at 6 – 7 rib (15.12 %, $p < 0.01$). Boar factor influenced age at 100 kg weight (40.48 %, $p < 0.001$) and feed expenditure for 1 kg makeweight (41.35 %, $p < 0.001$). Genotype x boar factor had influence on carcass yield (21.46 %, $p < 0.001$) and carcass weight without head (12.74 %, $p < 0.05$). Finally, breed x boar factor had influence on feed expenditure for 1 kg makeweight (22.63 %, $p < 0.001$) and age at 100 kg weight (9.63 %, $p < 0.05$).

Keywords: *LEP gene, C3469T, polymorphism, SNP, production traits.*

THE EFFECT OF LACTATION NUMBER AND LACTATION STAGE ON COWS MILKING PARAMETERS

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Abstract

The aim of the research was to evaluate the influence of lactation number and lactation stage on cows milking parameters and to determine their influence on cows productivity. Cows were milked by GEA systrem „Mlone“ milking robots. We analyzed: milk yield (kg), average milk flow rates during first two minutes at 0-15, 15-30, 30-60, 60-120 s (kg/min), milk flow peak (kg/min), milking time (min), somatic cell count (thousand/ml), and milk yield in the first two minutes (kg). Milk flow in the second lactation cows was 0.21 kg/min higher than in the first lactation cows ($p<0.05$) and in the third lactation cows milk was released 0.33 kg/min ($p<0.05$) faster than in the first lactation cows. The highest milk yield in the first two minutes of milking was obtained in the third and older lactation cows and it was 0.43 kg higher than in the first lactation cows ($p<0.05$). The third lactation cows in the early stage of lactation (14 to 100 days) produced 0.29 kg more milk than cows in the middle lactation (101 to 200 day) and these cows gave 0.53 kg milk more ($p<0.01$) than cows in the late lactation stage (201 to 300 days). Milk flow peak of the second lactation cows producing more than 20 l was the highest in all milking intervals. Somatic cell count was lower about 19,61 thousand/ml in the third and older lactations cows producing from 10 to 15 l milk per day compared to the second lactation cows.

Keywords: *Cows, Lactation, Milking parameters.*

PRODUCTIVE AND REPRODUCTIVE PERFORMANCE OF DAIRY CATTLE ACCORDING TO CALVING SEASON IN LITHUANIA

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Abstract

The objective of this study was to evaluate and compare influence of cattle calving seasonon milk yield and its composition, and reproductive performance. Studies were carried out with 382 calved cows. Lactation of all cows during investigation period was fully completed. Seventy three cows calved in autumn, 98 in winter, 87 in spring and 124 in summer. Herd was formed of the first (43%), second (29%), third and older lactation cows (29%). Cow productive and reproductive indexes were obtained from dairy cattle farm and Rural Business and Information Center, e-GEBA livestock program. Productivity and somatic cell count in milk were carried out once a month during controlling milking. We analyzed influence of cows calving season on milk yield per season (kg), milk fat and protein (percent), somatic cell count (SCC/thousand/cm^3) in milk, and reproductive traits (service period, insemination index). Productive and reproductive parameters were compared according to lactations and seasons. Milk yield of cows calved in autumn was bigger than in winter and spring calved cows accordingly by 203 kg and 591 kg ($P<0.05$) respectively. Milk content of protein and fat in autumn calved cows was bigger than in spring calved cows by 0.08 % ($P<0.05$) and 0.14% ($P<0.05$) respectively. Service interval in spring calved cows was shorter comparing with in autumn calved cows by 25 days ($P<0.05$). Insemination index of cows calved in autumn was bigger than in cows calved in summer ($P<0.05$). The biggest milk yield during the first lactation was produced by in autumn calved cows. During the second and the third lactations milk yield was less. Fat content in milk during the third lactation was bigger than in cows of first, second, and fourth lactations by 0.20%, 0.21% and 0.16% respectively. Insemination and service intervals of the second lactation calved cows during autumn was bigger and longer than in cows of the fourth lactation.

Keywords: *Cows, Milk productivity, Reproductive performance.*

EFFECT OF BLUE LUPINE ON THE GROWTH RATE, CARCASS AND MEAT QUALITY OF HEAVY-TYPE TURKEYS

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Abstract

Soybean meal is the commonly used source of dietary protein in poultry feed. However, around 98% of soybean meal is produced from genetically modified plants. An alternative protein source might be lupines (*Lupinus* spp.). However, the available information is insufficient to develop the diets with blue lupines. The purpose of our study was to determine the effects of soybean meal replacement with different amounts of blue lupine in the diets of turkeys on the growth rate, carcass and meat quality. Three hundred and sixty cross BIG-6 turkeys were allotted to control and five experimental groups of turkeys. The control group of turkeys was fed with the diet containing soybean meal, whereas the trial groups were offered different amounts (from 20 to 30%) of lupines. Group 4 and 5 were additionally given probiotic mixture Bio Plus 2B and allzyme SSF. Soybean oil replacement from 20 to 30% lupine in the diet had no influence on the growth rate, dressing percentage, edible parts and abdominal fat content of turkeys. The study indicated that lupines in the diet of turkeys had a different effect on the meat quality of different genders. Lupines did not have any negative effect on the meat quality of female turkeys and 30% lupines even improved the protein value index of breast muscles. However, 20–30 and 25–30% lupines in male turkey diets lowered dry matter and protein contents in breast muscles. The results of the study showed that the negative effect on the male breast muscle quality might be avoided using Bio Plus 2B or allzyme SSF additives in the male diets containing 30% lupines.

Keywords: *Anatomic carcass dissection data, chemical indicator, growth rate, lupine, turkey.*

NATURAL RADIONUCLIDES IN POULTRY FEED AND ASSESSMENT OF RADIATION RISK

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Abstract

The researches of radioactivity in poultry feed are particularly important because a part of the quantity of radionuclides in the food that animals ingest could be transmitted to people by means of the path of radionuclides in the food chain. The study was conducted in order to detect the natural radioactivity in poultry feed and its values were compared with the measured values with poultry feed which is being produced in other parts of the world. The samples were analyzed by means of an instrument – gamma spectrometer (Canbera Packard) with a high purity germanium detector. The measurement was performed in a hermetically sealed container, whereby the spectra obtained from the measurement were analyzed by using the program GENIE 2000. The results showed that the activity concentrations in feed supplements are within the range from 59.6 to 127.4 Bq/kg for 40K, 12.7 to 18.5 Bq/kg for 226Ra and 4.6 to 11.7 Bq/kg for 232Th, while those of the compounded feed are within the range from 64.7 to 172.0 Bq/kg for 40K, 9.7 to 29.4 Bq/kg for 226Ra, and 19.6 to 42.1 Bq/kg for 232Th. As it was expected during the analyses, the obtained values for the compounded feed were higher than the values for the feed supplements, which is expected, since some of these supplements are used for compounding feeds. In addition, anthropogenic radionuclides were not detected which shows that there was no contamination due to artificial radionuclides. The values of the specific activity obtained in this study do not exceed the safety limits, emphasizing the insigificant danger of radiation that arises from the Earth's radionuclides that are naturally present.

Key words: *gamma spectrometry, feeds, natural radioactivity.*

FIRST RECORDS OF *ICHTIOPHTHIRIUS MULTIFILIIS* ON CYPRINID FISHES FROM AQUACULTURE FACILITIES IN MACEDONIA

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Abstract

A total of 192 specimens of common carp (*Cyprinus carpio*), 38 specimens of grass carp (*Ctenopharyngodon idella*), as well as 26 specimens of bighead carp (*Hypophthalmichthys nobilis*), from the most significant and larger cyprinid aquaculture facilities in Macedonia, including fish farms and reservoirs, were examined for parasitological investigations. This study was carried out by seasons. Protozoa *Ichthyophthirius multifiliis* is the largest known parasitic protozoan found on fishes. In our study, this protozoa was found in all seasons, except in winter. Total, prevalence with *I. multifiliis* in cyprinid fishes from aquaculture facilities in Macedonia, by seasons, was as following: spring - 0.79 %; summer - 2.99 % and autumn - 0.44 %, while mean intensity was: spring - 12.56; summer - 26.70 and autumn - 50.00. The records of *I. multifiliis* in grass carp and bighead carp in the present study is considered as the first records in Macedonia. Also, these two fish species is regarded as new hosts for *I. multifiliis* in Macedonian waters.

Keywords: *protozoa, Ichthyophthirius multifiliis, common carp, grass carp, bighead carp.*

TOLERANCE OF AFRICAN GIANT LAND SNAILS (*ARCHACHATINA MARGINATA*) TO VARYING DIETARY SALT

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Abstract

An experiment was conducted to determine the growth response of African giant land snail *Archachatina marginata* to fed diets containing different levels of sodium chloride. One hundred and twenty snails were subjected to four dietary treatments of T1, T2, T3 and T4 with 0, 0.25, 0.5 and 0.75% sodium chloride respectively. The treatments were replicated thrice with 10 snails per replicate. The measured parameters included weight gain, feed intake, shell length, shell circumference and shell thickness. Feed cost, cost of feed per kg weight gain and feed conversion ratio were, also, calculated. Results showed that there were significant differences ($p<0.05$) in average daily weight gain, average daily feed intake, feed conversion ratio, feed cost and shell thickness, but there were no significant differences ($p>0.05$) in cost of feed per kg weight gain, shell length and shell circumference in the snails fed the treatment diets. Treatment 2 had the highest average daily weight gain, average daily feed intake and feed cost, but the lowest feed conversion ratio, while treatment 1 had the lowest average daily weight gain, average daily feed intake and feed cost, but the highest feed conversion ratio. This implies that inclusion of sodium chloride above 0.25% in the diet of *Archachatina marginata* affects both the feed intake and weight gain of the snails.

Key words: *snails, treatments, sodium chloride.*

DIETARY SODIUM BUTYRATE IMPROVES FUNCTIONING OF THE SMALL INTESTINE ENTERIC NERVOUS SYSTEM AND INFLUENCES AN ELECTROLYTE PROFILE IN PLASMA OF WEANED PIGLETS

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Abstract

Weaned piglets are subjected to many stressors, which can lead to intestinal and immune dysfunctions such as diarrhea being a result of changes in intestinal microflora and intestinal permeability. Sodium butyrate (SB) has beneficial impact on intestinal health and improves their proper functioning. Studies were conducted to evaluate the effects of SB on expression of VACHT and α-synuclein in small intestinal enteric nervous system, electrolyte profile (K, P, Na, Cl) in plasma of pigs fed for 2-weeks before weaning with coated SB (3kg/ton of forage; SB-group). Control animals were fed for 14 days before weaning with standard forage with addiction of organic acids (fumaric, malic, citric and phosphoric). On the 28 day of life pigs were slaughtered and samples from the intestine and plasma were taken for further analysis. Immunohistochemistry was performed to identify the immunoreactive structures in enteric plexuses. Using cell image software the length and numbers of immunolabelled nerve fibers were analyzed. In experimental animals, a significantly higher (vs. control) immunoreactivity to VACHT was observed in duodenal and mid-jejunal nerve fibres of the myenteric and submucous plexuses ($P<0.05$). A relatively lower expression of α-synuclein was found in nerve fibres of the duodenal myenteric and submucous plexuses of SB animals (vs. control). In contrast, in ileum from SB animals α-synuclein-positive nerve fibres (both plexuses) substantially ($P<0.05$) outnumbered those observed in control animals. A significantly lower concentrations of phosphorus, sodium and chloride and significantly higher concentrations of potassium were found in blood samples of animals from SB-group (vs. control; $P<0.05$). In conclusion, we have shown that in weaned piglets a dietary addition of SB can modify the chemical profile of certain populations of enteric nerves and changes the electrolyte content in blood plasma.

Keywords: *Sodium butyrate, ENS, Feeding, Intestinals, Pig.*

THE PREDICTION OF DAILY BODY WEIGHT GAINS IN HARNAI SHEEP USING BOOSTED REGRESSION TREES

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Abstract

The aim of the present study was to predict daily body weight gains in the indigenous Harnai Sheep of Balochistan (Pakistan) using boosted regression trees (BT). The dataset included 7863 lambing records containing 6 predictors: lambing season (SEASON), lamb sex (SEX), type of birth (TOB), dam age at lambing (AGE), dam body weight at lambing (BWL), and lamb birth weight (BTW). Daily body weight gains from birth to 1, 2, 3 and 6 months of age were dependent variables. The dataset was randomly split into a training (75% records) and test (25% records) set. The best BT model for predicting daily body weight gains at one 1, 2, 3 and 6 months of age consisted of 461, 461, 453 and 718 component trees, respectively. The Pearson correlation coefficients between the observed and predicted values on the independent test set were 0.20, 0.20, 0.24 and 0.28, respectively ($P<0.05$). The most important predictors of daily body weight gains (in a descending order of importance) were BWL, AGE, BTW, SEASON, TOB and SEX for the daily body weight gains at 1 and 2 months of age. The sequence of predictors for the daily body weight gains at 3 months of age was AGE, BWL, BTW, TOB, SEX and SEASON, whereas for 6 months of age it was BWL, AGE, BTW, SEX, TOB and SEASON. In conclusion, the BT models developed in the present study were characterized by a relatively low predictive performance and their further improvement would be required in future research.

Keywords: *Boosted regression trees, Prediction, Daily body weight gains, Harnai Sheep.*

THE CHAID TREES FOR BODY WEIGHT GAIN PREDICTION IN HARNAI SHEEP

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Abstract

The aim of the present study was to predict daily body weight gains in the indigenous Harnai Sheep of Balochistan (Pakistan) using the chi-square automatic interaction detector (CHAID) trees. The dataset included 7863 lambing records with 6 predictors: lambing season (SEASON), lamb sex (SEX), type of birth (TOB), dam age at lambing (AGE), dam body weight at lambing (BWL) and lamb birth weight (BTW). Daily body weight gains from birth to 1, 2, 3 and 6 months of age were dependent (output) variables. The dataset was randomly split into a training (75% records) and test (25% records) set. The minimum node size of 786 as well as the p-values for splitting and merging of 0.05 were utilized as stopping criteria. The optimum tree complexity preventing overtraining was determined based on the 10-fold cross-validation. The best CHAID trees for predicting daily body weight gains at 1, 2, 3 and 6 months of age had 14, 16, 16 and 14 nodes, respectively. The Pearson correlation coefficients between the observed and predicted values on the independent test set were 0.17, 0.17, 0.16 and 0.23, respectively ($P<0.05$). Determination of the most important predictorsof the daily body weight gains with the standard module of the statistical software was not possible. In conclusion, CHAID treesused to predict daily body weight gains in Harnai Sheep had relatively low predictive performance and the use of more influential predictors in future research would be required.

Keywords: *CHAID, Prediction, Daily body weight gains, Harnai Sheep.*

THE PREDICTION OF DAILY BODY WEIGHT GAINS IN HARNAI SHEEP USING A RANDOM FOREST

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Abstract

The aim of the present study was to predict daily body weight gains in the indigenous Harnai Sheep of Balochistan (Pakistan) using a random forest (RF) model. The dataset included 7863 lambing records with 6 predictors: lambing season (SEASON), lamb sex (SEX), type of birth (TOB), dam age at lambing (AGE), dam body weight at lambing (BWL) and lamb birth weight (BTW). Daily body weight gains from birth to 1, 2, 3 and 6 months of age were dependent variables. The dataset was randomly split into a training (75% records) and test (25% records) sets.The number of randomly selected predictors for each split was three and the proportion of body weight records for each component tree was 50%. The best RF models for predicting daily body weight gains at 1, 2, 3 and 6 months of age consisted of 90, 1100, 1940and 490 component trees, respectively. The Pearson correlation coefficients between the observed and predicted values on the independent test set were 0.20, 0.22, 0.26 and 0.29, respectively ($P<0.05$). The most important predictorsfor the daily body weight gains at 1, 2 and 6 months of agewere BWL, AGE, BTW, SEASON, SEX and TOB, whereas AGE, BWL, BTW, SEASON, SEX and TOB were the most influential for the daily body weight gains at 3 months of age. In conclusion, the BT models used to predict daily body weight gains in Harnai Sheep were characterized by a relatively low predictive performance and their further improvement would be required in future research.

Keywords: *Random forest, Prediction, Daily body weight gains, Harnai Sheep.*

MORPHOLOGICAL ANALYSIS OF DIFFERENT GASTROINTESTINAL TRACT NEUROENDOCRINE CELLS POPULATIONS IN PIGS FEED WITH DIFFERENT VARIETIES OF RYE AND CORN

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Abstract

The implementation of natural resources (grain based) in feeding strategies of farm animals is one of the challenges of the modern livestock industry. Because of the presence of anti-nutritional components rye is usually considered as not efficient. However, not much is known about how such nutrients influence the delicate gut structure and homeostasis. One of hypothesis is that different kind of grain can switch different populations of neuroendocrine cells (NEC). In the present study we evaluated immunohistochemically the numbers of GLP1- and serotonin-immunoreactive NEC in the small intestine epithelium in the pigs fed with a diet based on population rye (60%; PR), hybrid rye (60%; HR), wild type rye (60%; WR), triticale (60%; T), corn (60%; C) and parallel controls (wheat/barely; 50%/50%). The following percentages of GLP1-immunoreactive NEC were found in the animals from individual groups: 119.2±15.8 (PR), 127.2±8.8 (HR), 115.2±11.0 (WR), 126.0±8.0 (T) and 130.4±19.9 (C). Although some reduction in numbers of GLP1-expression was observed, no statistical changes either in relation to parallel control (140.0±10.0) or between experimental groups were found. The subpopulations of serotonin-IR NEC were as follows: 101.2±12.6 (PR), 98.4±10.2 (HR), 99.6±9.7 (WR), 94.8±7.4 (T) and 87.4±6.7 (C). Except (C) group, in animals fed with different varieties of rye small (but not significant) downregulation of serotonin-IR NEC (in relation to parallel control; 87.8±9.7) was found. In summary we hypothesize that components present in different rye varieties may only in minor way disturb the physiology of the gut NEC and still may be considered as an additional source of energy added to traditional diet.

Keywords: *Rye, Grain, Feeding, Farm animals, Neuroendocrine cells, Gastrointestinal tract.*

Acknowledgments: Supported by BIOSTRATEG2/297910/12/NCBR/2016, ENERGYFEED financed by The National Centre for Research and Development – NCRD, POLAND.

THE CHEMICAL COMPOSITION AND QUALITY OF MEAT FROM POLISH NATIVE PIG BREEDS

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Abstract

The native breeds of pigs are those that grow in a certain region and / or country as local, autochthonous breeds. In Poland there are 3 breeds: Pulawska, Zlotnicka White and Zlotnicka Spotted pigs. The aim of work was to analyse the meat quality of Polish native breed of pigs. We performed chemical analysis of obtained samples as well as colour, shear force and thermal loss analysis. Highest fat content (%) were found in Zlotnicka Spotted while the lowest in Zlotnicka White. Highest L* value and thermal loss were found in Pulawska breed. Highest shear force value were found in Zlotnicka White and differ significantly compared to other breeds. The meat of Pulawska breed, produced for project BIOSTRATEG was characterized by better quality parameters in comparison to meat of fatteners of the same breed bought in a popular shop-network. The meat of Pulawska, Zlotnicka White and Spotted pigs is a good quality raw material which is used for production of traditional and regional meat products gaining high sensory scores and good recognition among consumers. Promotion of traditional products obtained from above breeds will favour the development of their breeding.

Key words: *fatteners, native pig breeds, meat, quality.*

THE IMPACT OF MODERN VARIETIES OF RYE ON THE HISTOLOGICAL STRUCTURE AND MUCOSAL BARRIER FUNCTION OF THE GASTROINTESTINAL TRACT OF PIGS

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Abstract

To date, rye was a cereal poorly used by pig producers due to the large amount of anti-nutritive factors. However, modern ryes have better nutritional valuemainly because of higher biological value of the protein, and higher lysine to protein ratio. Rye also has the very high fructan content (converted into butyrate) which improve the intestinal homeostasis including mucous layer function. Studies were conducted to evaluate the influence of the rye-based feeding rationon intestinal morphology and mucosal barrier function in pigs. Sixteen pigs were fed where the body weight rangedfrom 30 to 100 kg b.w. with the use of the wheat/barley (50%/50%; Control) and wheat/barley/rye (hybrid rye *cv.* Brasetto) (20/20/60%; HR-group). Animals were slaughtered and the samples collected for further analysis. Intestinal morphology and carbohydrate composition of mucins was determined using HE and PAS/HID/AB stains. Additionally, intestinal mucosal barrier function (MUC2, TFF3), nutrient transport and absorption (FABP2, GLUT2) were evaluated immunochistochemically. No significant changes between HR and Control groups were observed in the structure of the small intestine, goblet cells numbers and mucin properties. Numbers of sialylated mucins and MUC2- and TFF3-positive in HR tended to higher values (*vs.* Control). The distribution patterns of FABP2 and GLUT2 in jejunum was similar in HR and C. In conclusion, the results indicate no adverse effect of rye addition to feed ration on the small intestine structure, integrity and mucosal barrier function. Rye could be used as an alternative substitute for wheat in pig rations and offer health benefits.

Keywords: *Rye, Feeding, Goblet cells, Mucins, Small intestine.*

Acknowledgments: Supported by BIOSTRATEG2/297910/12/NCBR/2016, ENERGYFEED financed by The National Centre for Research and Development – NCRD, POLAND

EFFECTS OF *SACCHAROMYCES BOULGARDI* AND MIXTURE OF POWERED HERBS ON GROWTH PERFORMANCE AND INTESTINAL STRUCTURE OF BROILER CHICKENS

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Abstract

Salinomycin is widely used to control coccidiosis. In the near future, the use of ionophorecoccidiostats in the chicken feed will be prohibited. Due to this fact, there is an increasing interest to find natural alternatives for antibiotics in poultry production. One possible choice may be probiotics and carefully selected herbs, which beneficially modulate the intestinal health of the host. In this study, the effects of an alternative supplement containing probiotic *Saccharomyces boulgardi* and a mixture of powdered herbs: mustard, calamus, curcuma, ivy on growth performance and intestinal morphology of broilers were evaluated. A total of 8100 one-d-old Ross 308 broiler chickens were randomized into the group C+ fed a basal diet with salinomycin (90mg / kg). The group C- received the basal diet with no additive, the birds group SBH were fed diet with addition of probiotic *Saccharomyces boulgardi* (100g / ton) and a mixture of powdered herbs (200g / ton). At 43 day of the experiment, 7 birds from each group were slaughtered and samples from GIT were taken for histological analysis. The general performance was improved ($P < 0.05$) by dietary inclusion of a mixture of probiotics and herbs compared with both controls. Furthermore, the addition of SBH mixture significantly elongated the intestine and increased ($P < 0.001$) the mucosa thickness, villus height, crypt depth and V/C ratio in mid-jejunum and ileum, that suggests an increased surface area capable of greater absorption of available nutrients. In conclusion, dietary supplementation of probiotic *Saccharomyces boulgardi* and a mixture of powered herbs increase the growth performance, improve intestinal morphology and nutrients absorption and finally show promising effects as alternatives for coccidiostats.

Keywords: *Saccharomyces boulgardi, Herbs, Performance, Broilers, Gastrointestinal tract.*

EFFECT OF ALTRENOGEST ON DEVELOPMENT OF OVARIAN FOLLICLES IN PREPUBERTAL AND MATURE GILTS

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Abstract

Altrenogest (progestagen) and exogenous gonadotropins treatment caused higher follicular cysts appearance and lower ovulation rate in gilts. To explain mechanism of potential altrenogest effect on porcine ovary, comparisons between the morphological and endocrine profiles of primordial/primary and preovulatory follicles were performed in prepubertal and mature gilts during the first natural estrus or estrus following 18 days of altrenogest treatment. Twenty four crossbred gilts (n=6 per group) were ovariectomized on the second day of first (PC) and second (MC) natural estrus or the first estrus after altrenogest treatment in prepubertal (PA) and mature (MA) gilts. Altrenogest decreased number of primordial follicles ($p<0.05$) and increased the number of early primary follicles ($p=0.08$) in PA gilts. This suggests accelerated follicle recruitment and may lead to premature depletion of primordial follicles pool in prepubertal gilts. Altrenogest increased number of antral follicles in prepubertal and mature gilts. In addition, the percentage of healthy antral follicles was also higher in altrenogest-treated prepubertal ($p<0.01$) and mature ($p<0.05$) gilts. The sexual maturity positively affected estradiol 17β concentration in follicular fluid of preovulatory follicles ($p<0.01$). However, lower progesterone level depended on altrenogest treatment ($P<0.05$). The highest expression of HSD3B1 was found in theca preovulatory follicles of MC gilts together with parallel increase of $PGF_{2\alpha}$ synthase in granulosa and theca cells ($P<0.001$) and elevation of GATA4 and NR5A1. Overall, we concluded that altrenogest had rather beneficial effect on development of antral follicles in prepubertal and mature gilts. Endocrine milieu of preovulatory follicles depended, both on maturity status of gilts and altrenogest treatment.

Keywords: *Gilts, Sexual maturity, Altrenogest, Folliculogenesis.*

CHARACTERIZATION OF THE CALVING INTERVAL IN THE MERTOLENGA BREED - THE INFLUENCE OF THE COMMON AGRICULTURAL POLICY BETWEEN 1986 AND 2012 -

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Abstract

Natural conditions in most of the Portuguese territory (marginal soils and severe water deficit in the summer) do not favor intensive meat production, which in turn determines a low stocking rate unless the pastures are well managed and the animals adequately supplemented when necessary. These improvements are costly and pointless in most cases explaining why breeders do not adopt this strategy. As grassland and forage production, in most cases, are not suitable for efficient fattening, the conversion of land use has led to an increase in the number of suckler cows in the studied period (1986 to 2012), since these animals are less dependent on forage quality and have lower feed costs. It is under this complexity of factors that the Mertolenga breed stand out for its sturdy build, ease of delivery and low food requirements. Establishing periods of calving/mating, and the shortening of these periods, allows co-ordination of the greater nutritional requirements of the animals with the time of the year of greater pasture growth. This would enable the reduction of supplementary feed. The definition of breeding season allows the use of reproductive technologies, which increases neonatal survival until weaning. When the political conditions are added to the natural conditions, the question arises as to the extent to which the efficiency of production has been altered through the stages of the CAP. Also how can the economic viability be supported in the future regardless of the Community support.

Keywords: *Mertolenga, Calving interval, Productive efficiency, CAP.*

THE EFFECT OF APPLIED CROSSBREEDING ON INCREASING OF MILK PRODUCTION IN GOATS

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Abstract

The aim of research was represented by conducting of some research activities aiming to evaluate the lactogenic capacity for the experimental batches, as an effect of cross-breeding between goats belonging to local breed Carpatina and bucks from Anglo Nubian and French Alpine breeds. Estimation of milk production was done in according with International Committee for Animal Recording (AT4 method) and statistical analysis was performed using the Restricted Maximum Likelihood Method. In case of effectuated analysis for evaluation of ameliorative effect of milk production obtained from F1 half-breed females, resulted by cross-breeding of Anglo Nubian breed bucks with local females, a real absolute difference for total milk production of 17.74 milk kg could be observed, difference which have an increased statistical significance degree for P>1%. In the case of batch formed by F1 half-breed females, resulted by cross-breeding of French Alpine breed bucks with Carpatina local goats, a real absolute differences of 23.30 milk kg was found, being distinctively significant for P>1%. The obtained results show that effect due to heterosis have a higher manifestation on productive performances for F1 half-breed females resulted by cross-breeding of Carpatina breed females with French Alpine bucks. According to this observation we could say that Frennch Alpine breed have a higher ameliorative degree on milk production.

Keywords: *Romanian goats, Carpatina goat, Cross breeding, Milk production, Small ruminants.*

THE BREEDING CARD FOR FALCONS

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Abstract

This article is devoted to the problem of organization of breeding with non-farm animals. The authors provide the breeding card for falcons which was developed by them. This breeding card can be used both for breeding rare falcons for reintroduction into the wild, and for targeted breeding falcons for falconry. In our experience, the breeding card is suitable for using for species of large falcons such as Gyrfalcon, Peregrine Falcon, Saker Falcon and interspecific hybrids between them.

Keywords: *Breeding card, Falcons, Falconry.*

IDENTIFICATION OF SNPS ASSOCIATED WITH LITTER TRAITS OF PIG

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Abstract

The main method of pig breeding is the three breed cross system. On the first stage, there is use of Large White and Landrace pigs, for which Litter traits are priority. Reproductive traits have a low coefficient of heritability and are more susceptible to the effect of heterosis. In this regard, it is necessary to develop individual methods of assessment and take into account the traits of productivity and breed-specific characteristics. The aim of the work was to find SNPs associated with the Litter traits of Large White and Landrace. Studies were carried out on purebred sow of Large White (n=196) and Landrace (n=125) bred in a Russian farm. To select SNPs, we used data from genomic studies presented in databases and scientific literature. Specific oligonucleotide primers for SNP identification were designed using Primer-BLAST (https://www.ncbi.nlm.nih.gov/tools/primer-blast/). Localization of SNPs and genes was determined by NCBI Sus scrofa 11.1. Then SNPs, which showed polymorphisms within the studied groups of Large White and Landrace pigs, were selected. Some of them were localized in genes which biological functions were related or influenced by the development of productive traits. It is interesting to note that SNP rs80956812 (SSC1: 164,674,664) was localized in *SMAD6* (SSC1: 164,657,086-164,734,703), SNP rs81289355 (SSC11: 23,410,214) in *ENOX1* (SSC11: 23,237,692-23,894,699), SNP rs81379421 (SSC3: 27,307,613) in *XYLT1* (SSC3: 27,164,991-27,492,892), SNP rs80867243 (SSC5: 87,337,099) in *ELK3* (SSC5: 87,285,230-87,354,212) and in SNP rs80962240 (13: 52,784,022) in *FOXP1* (13: 52,348,094-52,974,267). Based on the results of the analysis, the distribution of allele and genotype frequencies across SNPs in Large White and Landrace was determined, and the effects of SNPs genotypes on Litter traits of sows were determined.

Keywords: *SNP, Litter traits, Large White and Landrace.*

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VARIANTS OF MTDNA COXII GENE IN PIGS OF DIFFERENT BREEDS

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Abstract

Polymorphism identified in mitochondrial DNA is one of the most common genetic markers used in population studies of many animal species. Changes occurring in mtDNA may be reflected in the phenotype. COXII mtDNA is one of the elements of complex IV of the respiratory chain and thus plays a key role in energy production. Given this important role of the gene in cells and the relatively high degree of intraspecific variability, the study of the nucleotide sequence of the COXII gene is important, as mutations in this gene may be associated with economically important traits of pigs. The aim of this study was to investigate the nucleotide sequence of the mitochondrial COXII gene in pigs of different breeds. The studies were carried out on purebred Large White breed pigs of English selection (n=12), Large White breed of Russian selection (n=12) and Landrace breed pigs (n=42) bred in Russia. We also studied Chinese Meishan (AF304200.1), Iberian (EU117375.1), Large White (AF486874.1) and Landerace (AF486866.1) pigs from the NCBI database. The analysis of variability COXII sho the presence of three haplotypes, with respectively in positions m.8292, m.8334, m.8419, m.8466, m.8526, m.8634, m.8664, m.8682, m.8682, m.8690. As a result of the research it was established that pigs of the Large White breed of the English selection belonged to Hap_1 (TTTCTGGAT). Hap_2 (CCCCCCCAAAGC) and Hap_3 (TTTTGGAT) were identified in Large White of Russian selection and Landrace pigs. Thus, the study of the nucleotide sequence of the COXII gene is important, as mutations in this gene may be associated with economically important traits of pigs.

Keywords: *mtDNA, COXII, nucleotide sequence, haplotypes, pigs.*

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SNP c.3469 T>C OF LEPTIN GENE AND ITS ASSOCIATION WITH REPRODUCTIVE TRAITS IN RUSSIAN LANDRACE AND LARGE WHITE BREED PIGS

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Abstract

Leptin is one of the most important hormones due to its role in regulating productive and reproductive traits in farm animals. It is encoded by LEP/ob gene, having highly conservative structure in mammals. LEP gene includes three exons and two introns. Because of its key role in metabolism LEP gene draws attention of animal scientists. Many studies have shown the association of polymorphisms in LEP with growth traits, meat quality and carcass traits, milk production traits and reproductive traits in pigs, cattle and sheep. Nowadays due to GWAS more than 100 SNPs are identified and their association with reproductive traits in pigs is evaluated. Last decades, sows reproductive abilities such as reproductive longevity have got worse because of intensive selection focused on number of piglets born. Here we report the study of c.3469 T>C polymorphism in pigs. Two populations of purebred Landrace (n=614) and Large white breed (n=288) sows were examined. The productivity of sows was evaluated according to the following reproductive traits: Total Number of piglets Born (TNB), Number of piglets Born Alive (NBA), Weight of Litter (WL) and the reproductive longevity (total number of farrowings). The data obtained from PCR-RFLP genotyping of sows revealed the differences in allele frequencies between Landrace and Large white breed sows. Furthermore, it was found that the homozygosity on minor allele (CC) had a significant positive effect on TNB, NBA and WL during the second and subsequent farrowings. On the other hand, our results revealed the great positive effect of heterozygous genotype on reproductive longevity. The data obtained can be used in marker-assisted selection in pigs breeding.

Keywords: *Leptin gene, Polymorphism, Reproductive traits, Longevity.*

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NITROGEN USE EFFICIENCY IN DAIRY CATTLE

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Abstract

In this paper we considered the possibilities for controlling or reducing the N losses and increasing N use efficiency in dairy cattle by using optimized feeding strategy and diet formulation. Ruminants have a low efficiency of N utilization compared with non-ruminants, whereas the N use efficiency in dairy cows is usually between 22 and 33%. The ruminal ammonia-N concentration between 6 and 18 mM is required to maximize microbial protein synthesis. Dietary strategies to reduce N losses should focus on an optimal supply of rumen degradable protein (RDP) and optimal efficiency of absorbed amino acid utilization for milk protein synthesis. Synchronization of the supply of rumen available protein and energy is an important factor for improving the utilization of dietary N. The optimal ratio of N to rumen fermentable OM is around 25 g/kg. A crude protein (CP) concentration in diets for lactating cows should be reduced to 15% DM to improve N efficiency and reduce environmental impact. Increased ratio of energy to protein improves N utilization and milk protein content as well as decreases milk urea N (MUN). Feeding adequate readily fermentable carbohydrates is critical for the efficient microbial capture of rumen available N. Improving the utilization of dietary protein is important for significant improvements in whole farm N balances, increasing the conversion of dietary N to animal products and providing opportunity for reducing environmental N losses.

Key words: *Dairy cows, Nutrition, Protein, Energy, Urea.*

IMPACT OF TEMPERATURE-HUMIDITY INDEX (THI) ON THE EGG WEIGHT OF HYBRID „HISEX BROWN“ LAYING HENS

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Abstract

The paper establishes how average egg production changes in the course of one year (per month) and how egg production is independently influenced by maximum daily temperature and maximum relative ambient air humidity, as well as what their joint impact is. For the purpose of investigating into the impact of average annual temperature, air humidity and daily temperature on production properties, egg laying capacity and weight of laid eggs, the authors conducted a relevant experimental research study on the farm Šurik Invest. The research subject comprised of 25200 heads of the HISEX BROWN light line hen hybrid that were 30 weeks old at the beginning of the experiment, i.e. 47 weeks old at the end of the research period. The research lasted for 18 weeks in the period between May, 1st 2016 and August 31st 2016. By means of statistical data analysis performed by calculating the ambient air humidity index and by means of various analytical models and nomograms it was ascertained that the THI in different months and seasons of the year was in correlation with the number of laid eggs and their weight and that its intensity had impact on the productivity of laying hens. Namely, in May, when the THI was >74 and productivity was 79.13%, egg weight was 68.06 g, i.e. in August, when the THI was >84; and productivity was 68.63%, average egg weight was 67.51 g. Likewise, the number of cracked eggs increased due to low food consumption and low protein intake, i.e. from 1. 65% in May to 4.40% in August.

Key words: *laying hens, eggs, productivity, egg weight, temperature humidity index.*

THE INFLUENCE OF FORAGER BEES NUTRITION WITH DIFFERENT POLLENS ON THE DEVELOPMENT OF HYPOPHARINGEAL GLANDS

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Abstract

The influence of the feeding of forager bees with the pollen of different quality on the size of the hypopharyngeal glands was studied in this paper. Forager bees, 1-2 days old, were sampled from the frames with an emerging brood and were kept in mini cages where they were fed with different types of pollen. Pollen was collected during the pollination of the red clover, and it was classified by color in 4 categories: beige, yellow, orange and gray. The beige pollen was from red clover while other colors were not identified. Pollen quality was determined by standard chemical methods, and the following parameters were studied: ash, crude protein, fats, cellulose, macro-elements (P, K) and certain micro-elements (Ca, Mg, Fe, Zn and Mn). The gray pollen had the highest ash and crude protein, while the beige one had the most crude fats and cellulose. Pollen was added into the sugar dough (cake). The control treatment was without pollen, and only the sugar dough was used. The largest glands have developed in the group of bees fed with the beige pollen (8.17 μm), and the smallest glands were found in bees fed only by sugar dough (the control, 6.53 μm) and with the gray pollen (6.84 μm), although it had the most protein. The differences between treatments were statistically significant. Three homogeneous groups were distinguished, and bees fed with red clover pollen were very different from other studied groups.

Key words: *hypopharyngeal glands, nutrition, forager bees, pollen.*

THE CHARACTERISTICS AND POSSIBILITIES OF BEEKEEPING PRODUCTION IN THE REPUBLIC OF SERBIA

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Abstract

The Republic of Serbia has good natural conditions for honey bee breeding and realising good yield of bee products. Due to variable climate factors, a honey production in 2016 and 2017 beekeeping seasons decreased in relation to 2015 by 53.1 and 42.8%, respectively. In the same period, number of beehives increased by 6.7%. Raw honey is a main export product of Serbian beekeeping production. Market value of this product is under a considerable influence of global climate changes and fluctuations in world market. The nutrition of honey bee is an important segment in honey bee breeding. There are some attempts to substitute lack of nectar and pollen in production practice by different similar feeds. The use of sugar syrup and pollen substitute is quite widespread. For adequate nutrition of bees and realisation of better yield it is necessary to provide additional sources of nectar and pollen for bees by introducing and growing different melliferous plants according to natural conditions of our country. Health state of bees and successful wintering of honey bee societies are necessary factors in developing beekeeping production. According to the records of the international association *Prevention of honey bee colony losses* overall winter losses of bee societies in winter 2016/2017 in Serbia accounted for 24.1% what was extremely disturbing record. In order to reduce bee losses, a number of synchronised measures which would encompass not only beekeeping production, but also other areas of agricultural production that have a significant effect on honey bee, its breeding, health care and survival are necessary.

Keywords: *Beekeeping production, Melliferous pasture, Breeding, Health care*.

Acknowledgment: Authors are grateful to the Serbian Ministry of Education, Science and Technological Development for providing Grants III46008 and III46009.

THE EFFECT OF THE ORIGIN OF THE QUEEN BEES AND THEIR INTERACTION WITH SURROUNDINGS ON THE DEGREE OF VARROA INFESTATION OF A BEE COLONY

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Abstract

Honey bee endures significant losses due to the presence of *Varroa destructor* mite in bee colony. Because of its wide-spread presence in bee colony it can cause its complete destruction. Different breeding programmes regarding honey bee pay a great attention to bee resistance to varroa. The trial was conducted in 27 bee colonies. Three groups of bee swarms were formed and in each there were nine queen bees originating from three mutually distant producers. Then, in three distant apiares the queen bees were placed in bee swarms so that in every apiary the queen bees of three different genotypes were represented. During 2017 and 2018, during six different periods, by a powdered sugar method the infestation of bee colonies by varroa mite was inspected. The degree of varroa infestation in relation to origin of queen bees ranged from 0.269 to 0.327 and difference determined was not statistically significant ($P>0.05$). In relation to a location, the least average infestation of societies accounting for 0.140 was observed in an apiary in north-eastern Serbia, while the greatest infestation accounting for 0.452 was observed in colonies placed in western Serbia. Determined difference in varroa infestation in relation to a location of an apiary was statistically significant ($P<0.05$). Continual monitoring of the varroa infested colonies by use of powdered sugar method indicated the differences between examined groups and reduced damage threshold for bees.

Keywords: *Honeybee, Queen bees, Varroa infestation, Powdered sugar method.*

CURRENT STATUS OF COMMON SWINE PNEUMONIA CASES IN SERBIA: MORPHOLOGICAL FEATURES

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Abstract

In spite of immunoprophylaxis many swine respiratory diseases caused primary by viruses are still present in domestic swine population in Serbia. Currently the most common diseases are: Porcine reproductive and Respiratory syndrome - PRRS, Swine influenza as well as Aujeszkys disease in pigs. However in wild swine population bacterial pneumonia is predominant respiratory lesion usually presenting secondary complication of initial parasitic infestation/verminous pneumonia (*Ascaris suum, Metastrongylus sp*.). In addition, bacterial respiratory diseases of swine caused by: *Actinobacillus pleuropneumoniae, Pasteurella multocida, Bordetella bronhiseptica, Haemophilus parasuis* are common. Morphological features of pneumonia in which several pathogenesisagents are involved, depend on predominant etiological agent. Differential diagnosis of these changes is challenging taskat necropsy. Appropriate sampling in such cases plays an important role for further pathohistological, immunohistochemical, molecular, microbiological and toxicological investigation and diagnostic. Therefore, this presentation is aimed to remind veterinarians on morphological manifestation of the most common pneumonia at our epizoothiologic area. The main feature of viral pneumonia at initial phase is acute interstitial pneumonia characterized by degeneration and desquamation of pneumocytes type I (caused by influenza virus mostly) followed by their replacement with type II pneumocytes. Bacterial infections could change the morphological manifestation of this pneumonia to purulent bronchopneumonia (*Bordatella bronchiseptica, Actinobacillus pyogenes*) or even fibrinous pleuropneumonia (*Actynobacillus pleuropneumoniae*). Some viruses with endothelial tropism, (CSF) as well as Clostridial infections are involved in hemorrhagic changes in respiratory system. In swine, embolic (*Erysipelothrix*) and granulomatous (mycotic) pneumonia could be found as well.

Key words: *swine, pneumonia, morphology.*

CHARACTERISTICS OF LOW FAT YOGURT

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Abstract

Yogurt is very popular fermented dairy product, already considered to be healthy food. Due to low calorie value, low fat yogurts have gained popularity in recent years. Quality, rheological and sensory characteristics of yogurt depend on many factors including milk type and its fat content, the microflora used and the applied technology. In Serbia, low fat yogurt is consumed as stirred and Greek style yogurt. Many consumers experienced these products as sour, insufficiently viscous or grainy. Therefore this work aimed to determine composition, sensory quality and some rheological characteristics of low fat yogurts with milk fat (MF) in the range 0-2 % that could be found on Serbian market. As expected, due to specific production process, the highest levels of total solids (13.54% and 15.69%) and proteins (8.01% and 7.90%) were detected in Greek-style yogurts with 0% and 2% MF. Significantly higher ($p<0.05$) values of viscosity were recorded in Greek style yoghurts. Among stirred yogurt samples, the highest viscosity was determined in yogurts with 0.9% MF. The highest syneresis (44.15%) and the lowest viscosity were determined in samples with 1% MF. Greek-style yogurts with 0% and 2% MF had the lowest sensory ratings due to grainy consistency (as a result of high protein content) and higher acidity levels (1.38% and 1.32% l.a., respectively). According to all parameters of sensory quality, the best rated was yogurt with 0.9% MF.

Keywords: *Low fat yogurt, Viscosity, Synresis, Sensory characteristics.*

IDENTIFICATION OF SELECTION SIGNALS THROUGH HAPLOTYPE STRUCTURE IN GENOME OF DUAL-PURPOSE BREEDS

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Abstract

The aim of this study was to analyse the selection signals by the integrated Haplotype Homozygosity Score (*iHS*) in dual-purpose Slovak Spotted cattle. The detection of selection signals is one of the tools for clarify effect of, whether natural or artificial selection. Overall 85 animals genotyped by high-density SNP array were used in analysis. After the quality control, 35995 autosomal loci with 69.3 kb average adjacent SNPs spacing were included in the analysis. Reconstruction of haplotypes for each chromosome was done. In the next step the R package *rehh* was used to compute the integrated haplotype homozygosity score (*iHS*) based on a matrix of integrated extended haplotype homozygosity statistics for both alleles, ancestral and derived. The average value of *iHS* score across the genome was 0.83. The selection signals in genome were based on positive *iHS* values. A common *iHS* proportion higher than 2.5 was chosen as an indicator of genomic regions with extreme *iHS* frequency based on outliers according to the boxplot distribution. For each region with selection signals quantitative traits loci (QTL´s) were identified. For BTA 3, 6, 21 signals in regions of milk production were identified, for BTA 8 there were signals in regions of milk production and marbling score QTL's and signals within the BTA 12 were placed around QTL's for calving ease. With regard to that information, we can conclude that the identified regions in genome affected by positive selection are in accordance with the breeding goals of the Slovak Spotted cattle.

Key words: *artificial selection, cattle, genomic region, homozygosity, iHS score.*

EFFECTS OF GENOTYPE AND SEX ON PRODUCTIVE PERFORMANCE AND CARCASS CHARACTERISTICS OF BROILER CHICKENS

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Abstract

In this experiment, 180 day-old chickens of Ross 308 and Cobb 500 broiler hybrids were used in a 42-day experiment to determine the effects of genotype and sex on productive performance and carcass characteristics. Chickens were housed in a 3-etage cage technology with proportion 75x50 cm (0.375 m^2) for each cage in half-operating conditions. Feed and water were provided ad libitum. We recorded body weight, body weight gain, feed intake, feed conversion ratio and mortality rate. Genotype had a significant effect ($p<0.05$) on feed conversion ratio, Cobb 500 being a better efficient in converting feed than Ross 308. Males were heavier at 42 days of age, gained more body weight, consumed more feed and utilized the feed more efficiently compared with females but had a higher mortality rate. There were significant genotype × sex interaction effects in 42-day body weight, body weight gain, feed intake and mortality rate. In case of carcass characteristics, genotype significantly affected ($p<0.05$) liver and gizzard weights with a heavier values in Cobb 500 than Ross 308. Sex significantly affected ($p<0.05$) slaughter, carcass, breast, legs, liver, gizzard weights with higher values for males than females. In contrast, abdominal fat weight was significantly higher ($p<0.05$) for females compared with males. Genotype × sex interaction effects significantly influenced carcass, breast, legs and liver weights.

Keywords: *chicken, genotype, sex, performance, carcass.*

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EVALUATION OF LACTOSE, MILK PRODUCTION, SOMATIC CELLS COUNT AND CALVING INTERVAL IN SELECTED FARMING CONDITIONS OF THE SLOVAK SPOTTED DAIRY COWS

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Abstract

Lactose is a major component of milk (typically around 5% of composition) that is not usually directly considered in national genetic improvement programs of dairy cattle. Lactose percentage and other traits of milk production in percentage may be used in indirect selection for health and fertility traits, which are economically important, but of low heritability. The aim to this study was to evaluate relation among percentage of lactose and others traits of milk production, somatic count cells and calving interval in selected breeding herds of Slovak Spotted dairy cows (S_0). A total of 16,334 control milk samples from 796 Slovak Spotted dairy cows born from 2001 to 2013 were used for estimation of parameters for percentage of lactose content (LC) and correlations with other milk yield (MY), somatic cell count (SCC) and calving interval (CI). These data were analysed using the Statistical Analysis System (SAS) version 9.3 and linear model with fixed effects: herds (H), years-season of control (YS), order of lactation (OL) and sire (S). By evaluation of milk yields we found out that the average of control samples of milk production during the examined period in all 16,334 control samples in 796 dairy cows were for lactose content 4.76±0.25%, 26.09±9.51 kgs of milk, 351.89±1,014.07 cells/ ml.10^3 of somatic cell count and 405.07±81.41 days of calving interval. The correlation among the traits of milk production, the somatic cells count and calving interval, for example lactose in % with milk in kgs, somatic cells count in cells/ml.10^3 and calving interval, was found as follows r = 0.45574, r = -0.29403 and r = -0.05025. These coefficients were statistically highly significant p <0.0001. The analyses by the effects on percentage of lactose (LC) reviled higher effect of sire R^2 = 0.158213 than effect of order of lactation R^2 = 0.082009. These effects were significant (P<.0001).

Keywords: *Slovak Spotted dairy cows, traits of milk, somatic cells count, calving interval, coefficient of determination.*

COMPARISON OF THE VEAL QUALITY AND CARCASS VALUE UNDER TWO FEEDING CONCEPTS

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Abstract

The aim of this study was to evaluate the carcass and qualitative parameters of veal from Holstein bull calves - two groups of 10 calves each. Calves of the 1st group received a basal diet (milk replacer and concentrate) for the first stage of experiment (60 days). Then, they received feed mixture (maize silage, alfalfa silage, concentrate). The 2nd group was during whole experiment fed with the milk replacers and the starter concentrate, while after 35 days, liquid milk was replaced with pellets form. Calves were slaughtered after about 4 months.The 1st group of calves had higher slaughter weight ($P<0.05$), but lower dressing percentage ($P<0.05$). Significantly higher proportion of kidney fat ($P<0.05$) exhibited calves of the 2nd group. No significant, but higher proportion of meat from right-half carcass was revealed in the 2nd group. Contrariwise, right-half carcasses of 1st group had higher proportion of bones and separable fat ($P>0.05$). According to the CIE colour scale of MLT measured 24 hours *post mortem*, calves of the 1st group had darker (lower *L**; $P>0.05$) and redder (higher *a**; $P<0.05$) meat. The MLT from calves of 1st group had higher pH_{24} value ($P<0.05$), electrical conductivity ($P>0.05$), but lower drip loss value ($P>0.05$). Chemical composition of MLT showed higher moisture content ($P<0.05$) in the 2nd group of calves. No significant differences in protein and intramuscular fat content were revealed. We found minimal differences in WB shear force between monitored groups ($P>0.05$).

Keywords: *Holstein veal, milk pellets, carcass value, physical - chemical parameters, redness.*

GENOMIC DIVERSITY AND LEVEL OF ADMIXTURE IN THE SLOVAK SPOTTED CATTLE

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Abstract

For the assessment of the population structure, evaluation of the genetic relationships and possible admixture between breeds the Bayesian clustering algorithm was used. Genetic analyses of relationships and admixture were performed in the local maintained population of Slovak Spotted cattle (N=85). The loss of diversity due to the rapid decrease of the population's size and the unequal use of founders was indicated by pedigree analysis before. To analyse the level of admixture, genotyping information of other, closely related breeds involved in the formation of Slovak Spotted cattle were used; Holstein (N=99), Swiss Simmental (N=78), Pinzgau (N=151) and Ayrshire (N=10). After LD pruning ($r^2 \leq 0.05$) final dataset consisted of 423 animals and 5,770 SNP markers. Generally, the F_{ST} (in average 0.15) index showed low value of genetic differentiation among evaluated populations mainly due to their common historical origin and high values of gene flow. Unsupervised analysis of population structure resulted in the most likely expected cluster number K=3–5. The graphical visualization of K=5, the likelihood that the individuals belong to the respective five populations, allowed to describe genetic variability and admixture of respective breeds. Observed changes among membership probability pointed out that the Slovak Spotted is closest to the Slovak Pinzgau cattle. Even both breeds having different history, selected set of SNPs could reflect the relationship to the authentic cattle living in Carpathians. Gene flow of Holstein, Ayrshire and Swiss Simmental in formation of Slovak Spotted could be proposed.

Key words: *admixture, Slovak Spotted cattle, population structure, Wright fixation index.*

EFFECT OF LACTATION STAGE ON THE CONCENTRATION OF SELECTED ESSENTIAL AND TOXIC ELEMENTS IN MILK OF SHEEPS FROM AREA OF SLOVAKIA WITH SLIGHTLY DISTURBED ENVIRONMENT

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Abstract

The aim of this study was to determine the lactation stage effect on the concentration of selected essential and toxic elements in the sheep milk from area of Slovakia with slightly disturbed environment and to find the actual contamination of selected areas, in view of its environmental character, and to refer to the suitability of the use of milk from this area to other food processing. The research was conducted with 300 sheep (Tsigai breed), average age of 6 years, where the milk samples were taken during the spring season (early lactation stage), summer season (middle lactation stage), and autumn season (late lactation stage). Sheep were reared on the extensive pastures, reared indoors afterwards, fed with pasture *ad libidum*. Milk samples were collected after morning and afternoon milking. Despite the fact that there was large number of animals on the farms, average milk samples were obtained from milk tanks at the end of milking. The samples of milk were analyzed by atomic absorption spectroscopy and atomic emission spectrometry. Significant increase ($P<0.05$) of Ca, Mg, Se and Fe concentrations were found in the milk during the lactation. In case of Mg, Se and Fe increase of concentration was found only in the last stage of lactation. Statistically significant difference ($P<0.05$) in concentration of Zn were found during the lactation stages, but the concentration of Zn decreased between the spring and summer lactation and increased between the summer and autumn lactation. Concentration of essential element (Cu) and toxic elements (As, Cd, Hg, Ni, Pb) in milk was low, below the LOQ. It can be concluded, that the use of milk of sheep from this area for direct use or for dairy products processing is appropriate, safe and poses no health risk for the consumers.

Keywords: *sheep, milk, environmental burden, essential elements, toxic elements, lactation stage.*

GENOME-WIDE DISTRIBUTION OF AUTOZYGOSITY ISLANDS IN SLOVAK WARMBLOOD HORSE

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Abstract

The objective of this study was to estimate the distribution of autozygosity islands represented by homozygous segments (ROHs) in the genome of the Slovak Warmblood horse. The Slovak Warmblood is a very efficient breed with the excellent characteristics of a sport horse. The study included 37 animals that were genotyped by GGP Equine70k chip (71,947 SNPs). Only animals (36) and autosomal SNPs (62,439) with call rate >90% and minor allele frequency >1% were included in subsequent analyses. The homozygous segments were defined as stretches with minimum 15 consecutive homozygous SNPs of >500 kb with minimum density 1 SNP per 100 kb and maximum gap between markers of 1,000 kb. The heterozygous or missing calls were not accepted. The analysis indicated in total of 8,501 autozygosity islands in the genome of the Slovak Warmblood horse. The majority of identified segments (85.42%) were most likely derived from the remote ancestors in the past. Only 0.15% of detected segments resulted from the recent selection events affecting the genetic structure of studied population. The proportion of segments varied across chromosomes. The major fraction of autosome residing in ROH was found on ECA1 (8.30%), while ECA31 showed the lowest ROH coverage. The scan for overlapping homozygous segments shared by more than 50 % of animals demonstrated that the ECA6 autosome may be under strong selection pressure. Inside those selection signals, several genes were identified including them associated with immunity and reproduction.

Keywords: *footprints of selection, horse, genomic data, runs of homozygosity.*

THE DIFFERENCES IN MACROMINERAL PROFILES IN WINE BY-PRODUCTS FROM SLOVAKIA AND AUSTRIA

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Abstract

In general, grape pomace is known as good source of nutrients with high antioxidant activity and high concentration of lignin that can affect the digestion of nutrients. However, scientific sources focused on macrominerals profile of grape by-products are limited. Thus, the aim of the research was to compare the concentration of macrominerals in wine industry grape by-products (bunch, stem, pomace) from 3 varieties of Vitis vinifera sp. (Green Veltliner - GV, Pinot Blanc - PB, Zweigelt - ZG) from Austria (AT) and Slovakia (SK). In the samples by High Resolution Continuum Source Atomic Absorption Spectrophotometry the content of macroelements - calcium (Ca), phosphorus (P), magnesium (Mg), sodium (Na) and potassium (K) were examined. Statistically significant ($p<0.05$) differences between the countries only in the Mg and K content in bunch were observed. However, in the stem of varieties, statistically significant differences ($p<0.01$) in the content of all macroelements between the countries were found. Similar results in the pomace macroelements profile were observed, thus the content of all macroelements was statistically significant. Between all varieties in AT samples main statistically significant differences in the content of Ca and Mg in the bunch, in the content of Ca, P and Na in the stem and in the concentration of every macroelement in the pomace were observed. In SK, main statistically significant differences between every variety only in Na concentrations in the bunch and in P, Mg and Na concentrations in the stem were found.

Keywords: *grape pomace, grape bunch, grape stem, minerals.*

RELATION BETWEEN THE FREE SALIVA TESTOSTERONE LEVELS AND BEHAVIOR IN NEW ROOM IN THE PIGLETS UNDER STRESS

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Abstract

The aim of this study was to evaluate changes in the free testosterone saliva (TSL) in pigs under stress and its relation to behavior. Fifty-five pigs were tested (28 gilts and 27 barrows). Males were castrated in 2nd week after birth. Behavior in new room was tested in open-field arena. Test lasts 20 minutes and was recorded by one camera. Saliva samples for TSL analyses were sampled in calm state before testing and immediately after test. Behavior was analyzed from records using Noldus Observer XT software. TSL were measured by ELISA method. TSL in calm state varied from 78.91 pg/mL to 621.37 pg/mL and from 93.12 pg/mL to 1589.36 pg/mL after stress situation in new room. There was not difference in TSL between gilts and barrows. TSL after stress was higher than TSL in calm state in 34 animals (group I), and in 21 animals (group D) TSL after stress was lower than TSL in calm state. For group I TSL in calm state did not correlate with TSL after stress ($r = 0.191$, $P = 0.278$). For group D TSL in calm state correlate with TSL after stress ($r = 0.603$, $P = 0.004$). Analysis did not show difference in behavior between I and D group. Despite no difference in behavior, correlation analysis detected small difference in relation between evaluated behavior traits and TSL in calm state as well as after stress. ANOVA by TSL quartiles in calm state did not show difference between pigs with low and high TSL values. ANOVA by TSL quartiles after stress discovered significant difference in total duration standing between pigs with the lowest (Q_1) and the highest (Q_4) TSL.

Keywords: *Pig, Piglet, Behavior, Open-field, Testosterone.*

HAPLOTYPE BLOCK STRUCTURE IN THE GENOME OF SLOVAK PINZGAU CATTLE

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Abstract

The aim of this study was to analyse the haplotype structure of Slovak Pinzgau cattle genome to identify and describe most frequent haplotype blocks reflecting the effect of selection in particular genomic regions. The high-density genomic data of 150 animals (BovineSNP50 BeadChip v2), covering nucleus of Slovak Pinzgau breed, were used to call haplotypes. After quality control of the data, the database included information of 41,068 SNP markers covering 2.50 Mb of the cattle genome. The average SNP spacing was 48.86±42.97 kb. The coordinates of haplotype blocks were generated from the phased SNP data based on the non-overlapping sliding windows of ten markers. The analysis indicated totally 4097 haplotype blocks with coverage rates of autosomal genome 44.82%. The majority part of blocks was concentrated on BTA1, BTA2 and BTA6. The longest haplotype block located on BTA12 (70.18 Mb – 76.95 Mb) included overall of 95 protein-coding genes. The shortest block was found on BTA14 (66.72 Mb – 68.80 Mb). To describe the most frequent haplotypes in Slovak Pinzgau genome, the frequency of each haplotype in blocks was plotted against the start position. From the identified haplotypes overall of 131 segments reached the frequency higher than 50%. Of these, two haplotypes on BTA3 (79.76 Mb – 80.47 Mb) and BTA6 (86.31 Mb – 87.53 Mb) were identified in more than 95% of animals. Inside these two regions several genes responsible for genetic control of economically important traits were detected; e.g. LEPR, CSN3, CSN2, CSN1S1. The beneficial effects of these haplotypes could be used to enhance genetic gain trough selection of animals with specific haplotypes depending on farmer's requirements.

Keywords: *autozygosity, cattle, genotyping data, selection signatures.*

MICROELEMET PROFILE ANALYSIS OF GRAPE BY-PRODUCTS FROM SLOVAKIA AND AUSTRIA

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Abstract

The aim of this study was to determine the microelements content of grape pomace, grape stem and grape bunch of three different cultivars of *Vitis vinifera sp*. (Green Veltliner, Pinot Blanc and Zweigelt) from two countries as a possible sources for animal nutrition. Mineral profile analysis was performed by using the High Resolution Continuum Source Atomic Absorption Spectrometer contrAA 700 for zinc, copper, iron, manganese. Significant differences ($P<0.05$) in mineral composition of analyzed samples were found between the countries, as well as between the cultivars within countries. The grape pomace samples from Slovakia and Austria had significantly different ($P<0.05$) content of all the studied microelements, except for zinc. In the case of grape stems significant differences ($P<0.05$) for copper and manganese content were found. The grape bunches from two counties significantly differed ($P<0.05$) in copper, iron and zinc content. The Austrian grape pomaces, as well as grape stems had significantly different ($P<0.05$) copper and iron content, while the bunch samples differed significantly ($P<0.05$) only in iron content. Between Slovakian grape pomaces significant differences ($P<0.05$) in copper and zinc content were found. All the stem samples from Slovakia differed significantly ($P<0.05$) only in zinc content and the bunches had significantly different ($P<0.05$) copper content. These results indicate a significant impact of the grape variety and location on the mineral profile of grape by-products.

Keywords: *Microelements, Grape pomace, Grape stem, Grape bunch.*

PRESENCE OF *CAPILLARIA* SPP. IN WILD RAPTORS FROM CATALONIA

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Abstract

Successful work in the field of conservation and management of raptors requires detailed knowledge about their pathogens, but the literature usually concentrates on those species that have the highest pathogenicity. In this study, we focused on *Capillaria* in order to provide base line data on the prevalence of this helminth in wild birds of prey. Raptors used in this study were collected dead or were euthanasied in Catalan wildlife rehabilitation centers. The final collected sample was composed of 34 specimens and included 13 different species: 2 *Accipiter gentilis*, 4 *Accipiter nisus*, 2 *Falco peregrinus*, 3 *Falco tinnunculus*, 2 *Milvus milvus*; 10 *Buteo buteo*, 3 *Circus aeruginosus*, 1 *Aquila pennata*, 3 *Gyps fulvus*, 1 *Pernis apivorus*, 1 *Tyto alba*, 1 *Strix aluco* and 1 *Bubo bubo*. On each animal, samples of tongue, esophagus, crop, proventriculus and ventricle were obtainedand examined by standard HE staininglight microscopy. Only a few raptors harboured *Capillaria* spp. (n=9, 26.5% of the total sampled). Regarding differences by raptor species, the parasite was found more frequently in *Accipiter nisus*, with a prevalence of 75.0%, followed by 66.6% in *Circus aeruginosus* and 20.0% in *Buteo buteo*. Raptors appeared to be well adapted to *Capillaria* which appeared to cause discrete pathological changes, or at least its effect being minor, in wild raptors. As data obtained in our survey differ greatly than most of other studies on endoparasites in birds of prey, we suggest that *Capillaria* would be strongly linked to "ecofactors" which would explain differences in prevalence among areas and species.

Key words: *helminths, raptors, wildlife.*

LOW LEVEL OF DEVELOPMENTAL INSTABILITY IN CAPTIVE YELLOW-BELLIED SLIDER TURTLES (*TRACHEMYS SCRIPTA SCRIPTA*) (SCHOEPFF 1792)

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Abstract

Animals can deviate from expected symmetry and manifest some kind of bilateral asymmetries, which, among others, are fluctuating asymmetry (FA) and directional asymmetry (DA). FA is considered a tool for evaluating developmental instability, whereas DA is inherited and can be used for evaluating evolutionary development. Developmental instability is the degree of developmental error induced by environmental disturbances. In the present study we approach to the study of FA in captive yellow-bellied slider turtle (*Trachemys scripta scripta)* by means of geometric morphometric techniques. For this purpose, a sample of 33 ♂ and 63 ♀ corpses belonging to *T. scripta scripta* were obtained from the CRARC, on which digital pictures of their plastron were obtained and 17 2D landmarks (homologous anatomical points) were digitized twice. Analysis indicated that variation between individuals was significant concerning both size and shape, DA and FA emerging as highly significant ($p<.0001$), but FA accounting a mere 1.9% contribution to the total asymmetric variation compared to DA (71.0%). These results on the whole indicate the presence of some asymmetry in the shell structure, but not sufficient to infer developmental stability. In other words: environmental stress does not affect FA by stressing the developmental pathways during shell formation, e.g. turtles counteract stressors and maximize fitness. The precise DA mechanism was not the focus of the present study and it must be explored further through future experimental models. Anyway from our study it emerges that geometric morphometric studies open up promising areas for stress and adaptative research in pets.

Key words: *asymmetry, stress, testudines.*

FRACTURES AMONG EURASIAN WOODCOCK *(SCOLOPAX RUSTICOLA*) (LINNAEUS, 1758)

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Abstract

Analysis documenting injuries to the skeleton are a very powerful tool in the examination of violent deaths. This study describes and analyzes fracture patterns in a qualitative mode in Eurasian Woodcock *(Scolopax rusticola*). Research was done on 6 corpses of Eurasian Woodcock found dead and collected at wildlife center in Planes de Son, N Catalonia. Conventional rentgen images on VL projection were done and images were studied visually. In all cases there appeared fractured bones and most of them were stellate fractures, normally opened, and mainly on legs and manus, but not only in long bones. The cranial vault was sometimes affected, too. Only one animal presented no signs suspicious of bullet impacts. Transverse, oblique, butterfly and spiral fractures were not detected. The common pattern was multifragment fractures, typical of high speeds of impact. In no case breakage was suspected to be the result of postmortem damage. Absences of an osteogenic reaction remains were compatible with the death caused by shooting. It is well known that the greater the magnitude of the force, the higher its energy content, and hence, the more bone destruction. Conversely, the more complex the fracture pattern the greater the energy needed to produce the fracture. A high-energy direct blow to an adult bone will cause a markedly comminuted fracture. So hunting of Woodcock causes considerable trauma. Future studies utilizing experimental models may provide additional insights on this complex issue, especially interesting in hunting species.

Key words: *birds, hunting, waders, wildlife.*

EFFECT OF FRUCTOOLIGOSACCHARIDES ON PERFORMANCE OF BROILER CHICKENS: A META-ANALYTIC STUDY

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Abstract

Supplementation of prebiotic oligosaccharides as an alternative to growth-promoting antibiotics has received increasing interest due to their asserted beneficial effects on the broiler performance. However, there are conflicting results regarding the effects of prebiotics on broiler performance. The aim of this study was to systematically investigate the effect of fructooligosaccharides(FOS) on body weight(BW), weight gain(WG), feed conversion rate(FCR) and feed intake(FI) of broiler chickens with the help of meta-analytical approaches. Four electronic databases were searched from 2005 to 2018. Studies with the following criteria were eligible for inclusion: 1) pen trial, 2) FOS-fed for the entire study period, 3) trials including negative control group, 4) trials with replication, 5) trials without stress factor. Ten reports were collected allowing 36 comparisons of negative control diets and FOS supplemented diets. Extracted data were analyzed using random effects models for all outcome measures. Heterogeneity was assessed using the Cochran Q-test. Bias was evaluated by calculation of the Egger test. Results showed that adding FOS to basal diets had no significant effect on BW (pooled SMD: -0.064; 95%CI: -0.723-0.596), WG (pooled SMD: -0.306; 95%CI: -0.969-0.358), FCR (pooled SMD: -0.294; 95%CI: -0.871-0.284) and FI (pooled SMD: -0.024; 95%CI:-0.509-0.462) in broiler chickens. Based on the current study results, we can conclude that dietary supplementation of FOS had no significant effect on broiler performance during non-stressful experimental conditions. It is well known that the effect of such products become smaller when the productivity rates of broilers are higher. Therefore, it would be useful to further assess the effects of this product during disease challenge or sub-optimal environmental conditions.

Keywords: *Prebiotics, Fructooligosaccharides, Broiler, Growth performance, Meta analysis.*

EVALUATION OF CURRENT SITUATION AND SOME PROBLEMS OF TURKEY BREEDING IN KONYA PROVINCES OF TURKEY

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Abstract

In this study, it was aimed to investigate the current structure of turkey breeding, detection of breeding problems and find some solutions among turkey breeders in Konya province. Data obtained from turkey breeding enterprises in Konya provinces were used in the study. This survey was mainly characterized by flock size and structure, housing system, feeding and management, health problems, marketing, socio-economic structure of ownership patterns. Data were analyzed by using SPSS (Version 23.0) to obtain descriptive statistics and chi-square test for comparing the variables. Average age of farmers was 41.21 ±13.57. More than 50% of the farmers kept turkeys in semi-intensive method and raised mainly American Bronze Turkey. Significant relationships were determined between housing system and type of photoperiod ($p<0.05$). Turkey breeders generally use to simple feeding cup and water container. 45.5% of the questionnaires start growing period by obtaining turkey poults with 2-3 weeks age. According to 51.5% of turkey breeders; the length of fattening season was lasted mainly 6-8 months for each period. So the fattening of turkeys have been usually terminated in November and December for marketing in Konya. Due to facing breeding, marketing problems and insufficient education level of farmers in Konya provinces, it was suggested that farmers should get educational and financial government supports to improve popularity of turkey meat production and consumption in Central Anatolia.

Keywords: *turkey breeding, housing systems, production and consumption, American Bronze, Konya.*

EFFECT OF CALF JACKET ON LIVE-WEIGHT PERFORMANCE, HEALTH AND BODY MEASUREMENTS IN HOLSTEIN CALVES

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Abstract

The purpose of the study was to see effect of wearing calf jackets to Holstein newborn calves in winter on some performance parameters, health conditions and some of body measurements. The research lasted from January to March 2019 in a commercial farm located to Konya province of Turkey. After obtaining birth weights; totally 100 healthy Holstein calves were selected and they were assigned to 2 groups (NJ: non jacket group and J: jacket group) equally considering to their weights and genders. Two calves from each group were died during the study. From birth to day 56, calves were raised in individual calf pens at indoor calf barn. Each calf was weighed and measured for body dimensions such as hearth girth, height at body length (BL), height at withers (HW), height at rump (HR), hearth girth (HG) on d 28 and 56 to see efficiency of wearing jacket against cold stress. As a result, there was not any significant effect of wearing jacket in terms of all investigated parameters on days 0, 28, and 56 except daily weight gain (DWG). This study encourages researches to make further and more comprehensive studies about calf jacket effects on different conditions like rearing calves in outdoors.

Keywords: *Calf jacket, calf blanket, Holstein calves, growth performance, cold stress.*

EVALUATION OF THE BUY-BACK PROGRAMME FOR FISHING VESSELS OVER THIRTY METERS IN TURKEY

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Abstract

The situation is particularly damaging the ecosystem and the fish stocks by wrong fishing techniques. One of the most important ways to solve this issue is there purchase "buyback" programs that are commonly encouraged by regulations of the state. In fact, most of the EU Countries having advanced fishing industry decided that the reduction of fishing fleet is an effective solution and they have accepted to put it in to practice. Implemented as of 2012 each year a new notification has been published in order to make buy-back program happen, purpose of these three different buy-back program is effective reduction in fleet therefore reduce the amount of hunting pressure on the fish and open the way to sustainable fishing.The ship buy-back program, which is currently in process in Turkey so far, has not been successful for various reason. In this study, considering the aforementioned situation, the success of ship re-shipment of 30 meters or more, which is quite dominant on the stocks in our seas, has been investigated. The investigation showed us that 30-metre or longer fishing boats that have the 90% production share, have the effect to protect the stocks and sustainable fishing; have no interest in the program. In this study, considering the aforementioned situation, the success of ship buy-back program of 30 meters or more, which is quite dominant on the stocks in our seas, has been investigated.The most important factor in fisherman's decision not to participate in the program is seen as economic. The amount determined in the buy back program was little for fishermen. This is one of the most important factors for not participating in the program. In addition, the possibility of gaining more than incentives, renewing the fishing vessel and selling the license is one of the most effective factors in making this decision for the fishermen not participating in the program. Father's profession was as effective as 86% of this decision.

Keywords: *long fishing wessels, Turkey.*

ROLE OF VITELLOGEN ON HONEYBEES

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Abstract

The importance of the ecosystem that we are in starts with the common life they create with the vegetation. Bees need nectar of flowers as a nutrient to live, plants need a pollinator to spread their pollen and thus reproduce. There are important hormones for bees to perform these activities better. Vitellogen is a phospholipoglyco protein that affects the honeybee life in many ways. Vitellogen is effective protein for the study of social behavior of honey bee, for oxidative stress resistance, cell-based immunity and survival. Vitellogen is a protein actively used in egg cell development. It is also effective on the proctoline hormone (contraction of the egg channels) in the ovulation activity of the vitellogen. Also this regulates insulin secretion, aging and fertility. Recognizes the cell binding of vitellogen by membrane binding and protects living cells from reactive oxygen species. Vitellogen synthesis begins in the fatty tissue cells of the pup eith the decrease in ecdysteroid level and increase in juvenile hormone levels in the hemolymph of honey bee queen in the pupal stage. Vitellogen is mainly synthesized in the ovaries at lower rates compared to adipose tissue cells. The titer of circulating vitellogen is highest in queen bees and lowest in males. It has been reported that high levels of dopamine secretion and synthesis in the brain in worker bees may have a direct effect on the development of ovarian follicle and vitellogen synthesis in adipose tissue during the previtellogenic period.

Keywords: *Vitellogen, Honeybee behavior, Honeybee hormone.*

DETERMINATION OF MACRO FAUNA USING A WATER INTAKE UNIT OF A MARINE AQUARIUM AS A REEF IN THE GULF OF ANTALYA, TURKEY

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Abstract

The aim of this study was to determine the macro fauna which uses this water intake as a reef. In our study, *Pennaria disticha* from hydroid, *Spirastrellacunctatrix*, *Crambe crambe* and *Irsinia spp*. from sponges, *Hermodice carunculata*, *Serpula vermicularis* from polychaeta, *Synaptulareciprocans, Arbacia lixula* and *Diadema setosum* from Echinodermata, *Phallusia nigra, Microcosmus sulcatus* and *Pyuramomus* from the tunicates, *Charybdis hellerii, Percnon gibbesi, Portunus pelagicus, Balanus sp*. and *Scyllarides latus* from Crustacea, *Pinctada radiata, Spondylus spinosimus, Chama pacifica, Saccostrea cucullata, Saccostrea commercialis, Dendrostrea frons, Malvu fundus regulus, Ostrea edulis* and *Arcanoae* from bivalvia, *Hexaplex trunculus*, *Cerithium sp*., *Conomurex persicus*, *Ergalatax obscura*, *Flabellina rubrolineata, Flabellina sp. Hypselodoris picta* from gastropoda species, *Trionyx triunguis* Nile turtle, *Caretta caretta* and *Chelonia mydas* from sea turtles and octopus (*Octopus vulgaris*), squid (*Loligo vulgaris*) and cuttlefish (*Sepia oficinalis*) from cephalopods were determined to use the unit of water intake as an artificial reef. It was determined that 75 fish species belonging to 28 families used the unit of water intake as artificial reefs. Of these fish species, 23 were Lesepsian fish species of Red Sea origin. In the calculation of biodiversity indices of fish *The Shannon-Wiener diversity index* (H ') and t*he Berger-Parker index* (d) was used for dominance and the most dominant species was Striped Cardinal fish (Cheilodipterus novemstriatus). In this study, *Upeneustragu* was determined as specie found in and around the unit of water intake and having the least amount individual is 1 (% F = 0.00387).

Keywords: *Antalya Gulf, artifical reef, fauna, water intake.*

HISTOPATHOLOGICAL AND MICROBIOLOGICAL EVALUATION OF UTERUS IN REPEAT BREEDER COWS SHIPPED TO SLAUGHTERHOUSE

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Abstract

The purpose of this study is to determine endometritis in repeat breeder cows by histopathological examination and to investigate the bacteria that may cause endometritis. A total of 63 uterus specimens taken from 53 repeat breeder cows brought to the slaughter houses in Konya province for slaughtering and from 10 cows without any reproductive problem were examined by macroscopic, histopathological and microbiological methods. Histopathological examination showed that 22 out 63 samples were diagnosed as endometritis. The types of the endometritis were determined and 5 catarrhal endometritis, 5 purulent endometritis, 5 chronic nonpurulent endometritis, 6 chronic purulent endometritis and 1 granulomatous endometritis were found. In the microbiological examination, it was found that while bacteria were isolated in 11 uteri, mostly *Streptococcus spp.* and *Escherichia coli* were isolated. According to the antibiogram results, all of the identified bacteria were determined to be susceptible to Amoxicillin/Clavulanic acid and Florfenicol. It is also found that isolated bacteria were foud as increased penicillin G resistance. It has been determined that endometritis is major causing factor in the etiology of repeat breeder in cows. Histopathological exams are key to diagnose endometritis causing repeat breader. It has been concluded that when clinical findings are combined with histopathological and microbiological findings, the effective treatment protocol can be established.

Keywords: *Endometritis, Histopathology, Cow, Microbiology, Repeat breeder.*

THE BEHAVIOR OF BROWN SHRIMP (*Farfantepenaeus aztecus*) LARVAE IN THE GULF OF ANTALYA

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Abstract

In this study, it was aimed to investigate whether *Farfantepenaeus aztecus* larvae entered into brackish waters in the mouth of fresh water flowing to the Gulf of Antalya. This study was conducted between May and June 2018. This study was carried out in Beşgöz Creek, 15 km east of Antalya. In the research, 8 m long boat and 200 m trammel net were used. The trammel net used had 60 mesh height, zero number and 20 mm mesh size. The trammel net, that lest in Beşgöz Creek at the sunset, was collected in the early morning. Trammel net were left three times in the Beşgöz Creek on 15 May and 30 May and 23 June 2018. In the research, total 143 specimens, (87) 60,83% female and (56) 39,17% male of *F. aztecus* were caught. Average live weight 11,99 ± 0,28g and average carapace length were found 26,41 ± 0,23 mm. In our study, the average shrimp CPUE 5 kg/100m trammel net shrimp was found (May 2018). In terms of coastal fishing in the Gulf of Antalya, this fishing yield was very high. During our research, very few individuals were caught (1.5 kg/100m trammel net) in late June. In our study, it was determined that *F. aztecus* larvae were collected in fresh water mouths of the Gulf of Antalya and migrated to deeper waters towards sexual maturity.

Keywords: *Larval behavior, Farfantepenaeus aztecus, Gulf of Antalya.*

IMPORTANCE OF ANTIMELANOTIC AGENTS IN SHRIMP INDUSTRY

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Abstract

Shrimp, which is delicious seafood, has high economic value. However, it is a perishable food product with limited shelf life due to microbial spoilage and melanosis formation. Melanosis is an enzymatic browning process caused by polyphenoloxidase (PPO) enzyme and occurs as soon as harvesting. PPO remains active during refrigeration, ice storage and post freeze-thawing. The presence of black spots is not harmful to human health, but it reduces the market value and consumer acceptability of shrimp. This is one of the most important problems of shrimp industry. Various techniques and mechanisms have been developed for many years for this undesired enzyme activity. Therefore, the methods have been focused on inhibiting of PPO activity to prevent blackening. The methods are based on the elimination of one or more of the components required for this reaction (oxygen, enzyme, substrate or copper). Sulphides have been used as major inhibitors of melanosis worldwide. However, because of the frequent allergic reactions that cause health problems in humans, it is being investigated whether there are natural alternatives to the chemical compounds used to prevent melanosis. Antimelanotic agents are grouped according to their field of activity. These are acidifiers, chelating agents, reducing agents and enzyme inhibitors. In this presentation, antimelanotic agents that can delay the darkening of shrimps and which have been emphasized in recent years will be discussed. The use of new and different agents is being tested. Especially natural agents attract attention.

Keywords: *antimelanotic agents, shrimp, melanosis.*

USE OF ASCORBIC ACID TO DELAY MELANOSIS AND MAINTAIN QUALITY IN SHRIMP (*Melicertus hathor*)

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Abstract

In this study ascorbic acid was used to investigate its inhibitory effect on melanosis in shrimp (*Melicertus hathor*). The shrimps were obtained directly from fisherman immediately after the catching. They were divided into 5 different groups. Five different solutions: (ascorbic acid 2% (A2); ascorbic acid 4% (A4); sodium metabisulphite 1.25% (S); combinations of ascorbic acid and sulphite (A2S and A4S)) were prepared. The shrimps were immersed in the solutions and then placed on styrofoam plates and stored at +4°C. Melanosis development was investigated at 24 hours intervals during storage. L *, a *, b * colour values of the same samples were measured and quality control analyses were performed every 24 hours. It was determined that melanosis scores were higher in the control group. Combination of ascorbic acid and metabisulphite was found to be more effective in inhibiting of melanosis than the application alone. Total volatile basic nitrogen (TVB-N) and Trimethylamine (TMA-N) values increased with increase in storage time. There were no significant differences statistically in TVB-N and TMA-N contents between treatment groups. There was no significant difference between the groups in terms of L * values. The values of a * were found to be the lowest in the control group. Ascorbic acid was found effective on inhibition of melanosis and quality changes in *M. hathor*.

Keywords: *shrimp, melanosis, quality, ascorbic acid.*

PHENOLIC SUBSTANCE PROFILE OF PROPOLIS IN TURKEY

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Abstract

Propolis is a resinous substance with strong adhesive properties that bees produce from different herbal secretions. The color of propolis varies from green to red and brown. Propolis has a characteristic smell. The bees use propolis for the holes in the hive to cover and protect the hive inlet from the occupants. It contains more than 300 different substances. Although many substances in the content of propolis have been identified, many substances are still unknown. In general, propolis has natural structure includes 30% wax, 50% resin and vegetable balsam, 10% essential and aromatic oils, 5% pollen, and other components. There are phenolic acids, esters, flavonoids, various kinds of enzymes, vitamins and minerals in propolis. However, chemical composition of propolis varies according to the geographic characteristics of the site of collection. Poplar is the main propolis source in Europe, North America and non-tropical regions of Asia. Known propolis species in the world are birch propolis in Russia, green propolis in Brazil, red propolis in Cuba and Venezuela, Pacific propolis in Pacific region and Canarian propolis in Canary Islands. Propolis has many different biological and pharmacological properties such as antibacterial, antifungal, antiviral, antiprotozoal, antitumor, anti-ulcer and anti-inflammatory properties. The different climatic conditions and vegetation have been seen in Turkey. For this reason, the content of propolis affects both bees' selection of different plants and plant diversity. This study revealed phenolic substance profiles of propolis collected from Turkey. Apigenin, benzoic acid, caffeic acid, chrysin, cinnamic acid, ferulic acid, gallic acid, galangine, naringenin, quercetin, p-cumaric acid, pinobanksin, pinocembrin, pinostropin and vanillic acid are the main phenolic component of Turkish propolis.

Keywords: *Honey Bee, Propolis, Phenolic Component, Turkey.*

PROTECTIVE EFFECT OF POPLAR-TYPE PROPOLIS ON CISPLATIN-INDUCED TOXICITY

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Abstract

Cisplatin is a cytostatic, widely used drug in the treatment of cancer. Despite its efficacy in the treatment of some types of cancer, it causes various toxic side effects such as nephrotoxicity, neurotoxicity and ototoxicity. The aim of this study was to determine the protective role of propolis with biochemical and histopathological approaches to cisplatin induced toxicity. Sixty-four adult male Wistar rats were divided into eight groups, control, propolis (100 and 200 mg / kg, orally daily for 10 days) and combined therapy (propolis 10 days before and after CP injection). Haematological (Wbc, Rbc, Mpv, Hgb, Htc, Mcv, Mch, Mchc, Lym, Neu), biochemical (Triglyceride, total cholesteol, HDL and LDL-cholesterol, glucose, BUN, uric acid and testosterone level), epididymal sperm concentration, sperm motility, and histological studies. According to the results, cisplatin has negative effects on hematological, biochemical parameters, and sperm motility compared to control group. Administration of pre-cisplatin propolis ameliorated wbc, hct, mcv, mchc, neu, BUN and uric acid levels.

Key words: *propolis, cisplatin, heamatological, biocehmical, histopathological parameters.*

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REFORMS IN EU AQUACULTURE POLICIES AND THE IMPACT OF THESE REFORMS ON TURKISH AQUACULTURE SECTOR

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Abstract

Due to its geographical features, Turkey is one of the leading countries in aquaculture production. Turkey aquaculture sector hasen supported in the last years, and subjected to various regulations in export and production. Thus, significant progress has been made in the aquaculture sector over the last 30 years. In the EU, aquaculture is especially important in coastal regions of the community. In community policies for fisheries and aquaculture are regulated under the CFB ( ). The CFB aims to ensure that fishing and aquaculture are environmentally, economically and socially sustainable and that they want to provide a source of healty food. The first studies on CFB started in the 1970's Currently, the CFB has four main policy areas. These policy areas are fisheries management, International policy, Market and trade policy, funding of the policy, respectively. CFB has undergone many different changes and reforms since its seperation from the CAP( ). CFB has been updated several times as aresult of reforms and the most recent of which took effect on 2014. In this research , new regulations on CFB and aims to evaluation of the impact of new regulations on the aquaculture sector in Turkey.

Key words: *EU, Common Fisheries policy, Aquaculture, Aquaculture policies.*

EFFECTS OF PRESTORAGE APPLICATION OF GAM ARABIC COATING ON EGG QUALITY OF TABLE CHİCKEN EGGS DURİNG STORAGE

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Abstract

The aim of this study is to investigate the effect of prestorage applications of gam arabic coating with different levels on egg quality of table chicken eggs during storage in refrigerator and room conditions. The treatment groups were consisted of 4 treatment groups, with no application (Control), 1% gam arabic group (G1), 5% gam arabic group (G5) and 10% gam arabic group (G10). Totally 400 table eggs were used in the study. The research was conducted a 2 x 4 factorial design. After the coating applications, the eggs will be stored in refrigerator and room conditions for 2 weeks. The egg quality was determined using ten eggs for per treatment groups at the before coating application and at 7 and 14. days of storage. Storage and gam arabic treatment interaction effect, 10% gam arabic coating group for egg weight loss and specific gravity were better than the other treatments groups ($P<0.05$). The effect of the storage temperature on egg quality characteristics except shell strength and yolk pH was statistically significant and the egg stored in refrigerator were found to be better than the eggs stored in room conditionsin terms of quality characteristics. It is observed that the 10% gam arabic coating protects the egg quality criteria better during storage. As a result, it can be said that 10% gam arabic coating can be used to extend the shelf life of eggs during storage.

Key words: *Hen table eggs, gam arabic, storage, egg quality.*

EFFECT OF DIFFERENT NITROGEN FERTILIZER APPLICATION LEVELS ON YIELD AND QUALITY OF THE GREEN FODDER *TRICHANTHERA GIGANTEA*

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Abstract

The purpose of this study was to determine the effect of different nitrogen (N) fertilizer application levels on leaf yield and quality of the green fodder *Trichanthera gigantea* as material for leaf meal production for poultry feed in order to improve meat and egg quality. The experiment included five formulas (NT) representing five different nitrogen applications, namely NT1: 0kgN, NT2: 20kgN, NT3: 40kgN, NT4: 60kgN and NT5: 80 kgN/ha/cutting. All five formulas were arranged in a complete block randomized design with five replicates for each formula. The other factors such as plantation density, cutting height and cutting intervals were similar among the treatments. The results showed that from NT1 (0kgN) to NT5 (80kgN/ha/cutting), the leaf dry matter yield was 10.33, 11.22, 11.85, 12.13 and 12.15 tons/ha/year, respectively; the crude protein yield was 2.41, 2.70, 2.95, 3.15 and 3.24 tons/ha/year, respectively. Thus, the increase of nitrogen application from 0kgN to 80kgN/ha/cutting had decreased 10.8% dry matter in the fresh leaf, increased 14.1% crude protein on leaf dry matter and decreased 11.6% crude fiber on leaf dry matter. Based on the statistical analysis of leaf dry matter, crude protein yields and the chemical composition of leaves, it is recommended that the application of nitrogen fertilizer for *Trichanthera gigantea* should be at 40 – 60kg N/ha/cutting.

Keywords: *Nitrogen fertilizer levels, Foliage yield, quality, Trichanthera gigantean.*

EFFECT OF CUTTING INTERVALS ON YIELD AND QUALITY OF THE GREEN FODDER *TRICHANTHERA GIGANTEA*

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Abstract

This study was aimed to determine the effect of cutting intervals on leaf yield and quality of the green fodder *Trichanthera gigantea* used as feed material, mostly in poultry and rabbit diets, in order to improve farm animal products (such as meat and egg). This study included five different formulas (NT) representing five different cutting intervals, namely: NT1: 40 days, NT2: 50 days, NT3: 60 days, NT4: 70 days and NT5: 80 days of cutting intervals. All treatments were allocated in a complete block randomized design; each treatment was repeated 5 times. The other factors such as plantation density, cutting height and fertilizer dosage were similar among the treatments. The obtained results showed that from NT1 to NT5, the leaf dry matter yields were 7.34, 12.13, 12.41, 11.94 and 11.80 tons/ha/year, respectively; crude protein yields were 1.88, 3.13, 3.06, 2.78 and 2.69 tons/ha/year. When the cutting intervals increased from 40 to 80 days, the proportion of dry matter in the fresh leaves increased from 12.91% to 21.04%, crude protein proportion on dry matter decreased from 25.56% to 22.77%; crude fiber proportion on dry matter increased from 9.92% to 12.50%. Based on statistical analysis of dry matter yield and leaf chemical composition of green fodder *T. gigantea*, it is recommended that the most suitable cutting intervals for *Trichanthera gigantea* should be 50 – 60 days.

Keywords: *Cutting intervals, leaf yield and quality, Trichanthera gigantea.*

ECONOMIC DEVELOPMENT IN THE CONTEXT OF ENVIRONMENTAL PROTECTION OF AQUACULTURE PRODUCTION IN PROTECTED COASTAL AREAS: THE CASE OF XUAN THUY NATIONAL PARK, VIETNAM

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Abstract

The survey was conducted in Xuan Thuy national park, coastal Northern Vietnam in 2017-2018 growing season to assess economic development in the context of environmental conservation of aquaculture systems including intensive shrimp (ISH) and integrated aquaculture – mangrove (IAM). Formal survey was used to collect relevant data from 138 farmers through Fish Bowl Draw sampling method. Through assessing economic performances of farming systems, results demonstrated that ISH produced total 1,017 million Vietnam Dong (mil.VND/ha/year) value of output per hectare annually which was much higher compared with 32.99 mil.VND from IAM. Farm net return of ISH (321.17 mil.VND) was relative higher than those from IAM ponds (19.7 mil.VND). Ordinal least square (OLS) regression was used to assess causal relationships between social-economic-environmental factors on farm net returns. Heightening education and strengthening advisory for farmers at the same time reducing effects from effluent and pesticide, as well as lower disease occurrence, production costs and price squeeze can help to improve returns in ISH production. Meanwhile, maintaining more forestry coverage and reduce negative effects of polluted water are solutions to achieve greater returns of IAM pattern. The expanded analysis will be useful in promoting farming management toward more environmentally friendly perspectives simultaneously ensuring farmers receive more profit.

Keywords: *economic development, aquaculture, Xuan Thuy national park, Vietnam.*

6. RURAL DEVELOPMENT AND AGRO-ECONOMY

SOCIO-PROFESSIONAL IMPORTANCE AND TECHNICAL-ECONOMIC INDICATORS OF GREENHOUSE CROPS IN THE BISKRA REGION (ALGERIA)

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Abstract

Greenhouse crops are widely grown in Biskra region. Indeed, this region ensures the supply of more than 38 cities, mainly with tomatoes, sweet and hot peppers. In addition to the favourable climatic conditions, the location of this region close to the major cities of the north has made it a preferred destination for market gardeners and potential agricultural investors. It should also be noted that the introduction of this production technique in the study area has created a set of good conditions to agricultural and rural development. For Biskra, greenhouse market gardening provides a significant fraction of the population with regular financial income, especially young investors from the region or from other regions of the country. Our contribution is to situate the socio-professional dynamics, as well as the economic profitability that this sector has brought to the region, and for this reason field work has been carried out with farmers and other actors having a direct relationship with our research subject. As a result, we have observed that this sector has contributed to the socio-professional progress of young people. As well as the social dynamics that this sector has brought to the region through the emergence of new conurbations and the encouragement of young people to invest in this technique, it has also made it possible to reduce the unemployment rate in the region in a very remarkable way. Economically, it is considered a very profitable activity because the average production estimated for a tunnel greenhouse (8×40 m) planted with Tofane variety tomatoes is 33 quintals and the payback period for funds invested in a tomato greenhouse is on average 3 years.

Keywords: *Greenhouse crops, Socio-professional importance, Biskra, Techno-economic indicators.*

FACTORS DETERMINING ADOPTION OF IRRIGATION TECHNOLOGIES BY FARMERS IN WESTERN MITIDJA, ALGERIA

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Abstract

Since 2000, the public authorities have aimed at encouraging the development of water-saving irrigation technologies. However the rate of adoption of these technologies has remained low in most of the areas in Algeria. This study aims at shedding some light on the potential factors influencing irrigation technology adoption in Mitidja. It does so by reviewing previous studies done on technology adoption. In the study, technological, economic, institutional factors and human specific factors have been found to be the determinants of agricultural technology adoption. This study seeks to explain the behavior of farm holders towards adopting new irrigation technologies. The modeling of drip irrigation adoption is chosen as a methodological framework. It consists of defining the determining factors of drip irrigation adoption by farmers in Mitidja farming land. In this sense, a survey has been conducted randomly on a sample of 120 farmers, taken from the irrigated area of west Mitidja Land 1. Analysis results showed that the adoption of drip irrigation was influenced by: the type of crop grown, investment cost, subsidy to drip irrigation, education level, age and agricultural extension. Other factors,such as irrigator's association membership, farm status, public water price, ground water access by well-drilling are not determining factors of the adoption. The study recommends the future studies on adoption to widen the range of variables used by including perception of farmers towards new technology.

Keywords: *Irrigated agriculture, West Mitidja Perimeter, Land 1, Technologies adoption, Drip irrigation, Binomial Logit model.*

SEROPREVALENCE OF PESTIVIROSIS IN SHEEP IN THE REGION OF KSAR AL BOUKHARI (ALGERIA)

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Abstract

Border Disease Virus (BDV) is a member of the genus *Pestivirus* which causes abortion, wool deformation, congenital malformation and weak lamb syndrome in small ruminants and it causes significant economic losses to sheep and cattle industries. The main source of infection in a flock is the Permanently Infected (PI) animals. The present study was conducted to determine the herd seroprevalence of the disease in region of Ksar Al Boukhari Algeria and some associated risk factors. The serological presence of BDV was investigated between December and February 2012, in sheep flocks. A total of 14 flocks were visited and 144 blood samples were collected from young sheep under 6 years of age. Indirect ELISA was used to detect specific antibodies against BVD. A questionnaire was distributed to collect different information on flock's characteristics. The analysis was done at the Anses reference laboratories, Sophia-Antipolis Laboratory, Ruminant Pathology Unit, Nice, France. The results of the preliminary survey revealed that 78 samples were positive out of the 144 tested, so we assumed that the seroprevalence is 54.2%. Several risk factors were identified as linked to BDV such as climate, landscape, flock management and presence of other species in the farm. These high seroprevalence rates suggest that BDV is widespread and is probably endemic all over the country. Further studies are needed in other regions and animal species to detect and isolate the virus circulating in the country and understand the distribution and impact of *Pestiviruses* in the Algerian livestock to develop an adequate prophylaxis program.

Keywords: *Border Disease Virus, Pestivirus, seroprevalence, sheep, Algeria.*

ALGERIA PLACE ON THE WORLD OLIVE MARKET

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Abstract

Algeria has a great history and tradition in the culture of the olive-trees. "It is the fourth producer and the third larger consumer of olives on table in the world and it has a specific strategy for the development of the olive-growing sector". Indeed, Algerian olei culture knew these last decades, of profound mutations, for its levelling necessary to its integration in the mondial economy. In this work, we propose to evaluate the technical and social condition of transformation and conditioning of olives in Algeria. It is a very important segment of the downstream of this sector. That results from the inexistence of a dynamics in this direction. On the other hand, the packaging operations in the olive growers are very classic and traditional. Although aware of reforms, all the actions of the State in this segment remain insufficient compared to the potential of production in quantity and quality, comparing with the results recorded in Tunisia, main competitor on the international markets. This means that several technical and socio-economic constraints influence this situation, which calls for adaption of new measurements allowing to ensure durability in the market.

Key words: *Olive sector, Market, actors strategy, Algeria, olive oil*.

DIGITAL TRANSFORMATION IN AUSTRIAN SECONDARY COLLEGES FOR AGRICULTIRE AND FORESTRY

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Abstract

The process of digital transformation has been gaining momentum in secondary colleges for agriculture and forestry. Based on data from an online survey about the digital transformation of Austrian secondary colleges of agriculture and forestry this paper gives insights into the status quo. It focuses on three central questions. (I) What is the standard of digital equipment at the colleges in relation to its integration into the learning environment and the education offered? (II) What is the level of confidence of pupils in their own digital competence? (III) Who are the learners and teachers and what are the levels of acceptance of digital transformation among the latter? This paper looks at the above in the greater context of employability within today's global, political and administrative settings. The paper proposes the notion of a 'digital-generalist' who has a level of expertise and is able to act in an ethically responsible and sustainable way. This notwithstanding the results reveal that these colleges are in the process of digital transformation. It is an ongoing process that should be based on a sustainable and smart integration of modern digital technologies and media into the teaching and learning environment. Suitable equipment, learning settings and teachers trained are crucial for digital transformation in secondary colleges, as is the support from appropriate governing and institutional structures. Furthermore, there are enormous potentials in digital transformation that demand research activities and networking as well as continuous information and awareness-raising.

Keywords: *Austria, digital transformation, education, secondary colleges for agriculture and forestry.*

CROP PRODUCTION AND FOOD CONSUMPTION FOR FARMERS' WELFARE IN RWANDA

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Abstract

Agriculture is a source of livelihood for increasing population in the world. It provides mainly food and is expected to avail enough income to farmers and thus improve their livelihood through the increased yield. This study attempted to assess the effects of crop production and food consumption on farmers' welfare. We used secondary data collected at national level during the Fifth Integrated Household Living Conditions from October 2016 to October 2017. For data analysis, Chi-Square test, Pearson's correlation coefficient, t test, and ordinary least-squares (OLS) methods were used. The results revealed that the crop output increased with the increase in inputs (labour, fertilizers, pesticides, and seeds). The return to scale of crop production was 1.06, which implies that the crop production system scored increasing returns to scale. The OLS estimates indicated that food consumption was positively influenced by the age and the marital status of the household head, the household size, farm income, land size, crop production, when bean, maize, potato, rice and soybean were the main crops selected by the farmers, while it was negatively affected by the sex of the household head, when coffee and wheat were the crops chosen by the farmers. The results from Pearson's correlation analysis showed that food consumption was positively and significantly (p=0.00) correlated with family size, farm income, land size, and crop production. With reference to these findings, we recommend that the strategies to increase the crop yield and farm income and thus sustain food consumption and improve farmers' welfare should be enhanced.

Keywords: *crop yield, farm income, food consumption, farmers' welfare, Rwanda*.

RISK ANALYSIS IN THE PEASANT FRAMEWORK: EMPIRICAL ANALYSIS OF FARMERS IN SOUTH KIVU, DEMOCRATIC REPUBLIC OF CONGO

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Abstract

This study attempted to highlight the risks threatening the peasant farmers and affecting the development of their activities in the locality of Mbinga Sud in Kalehe Territory and the localities of Bugorhe and Irhambi in Kabare Territory in South Kivu, Eastern Democratic Republic of Congo. Data were collected using a questionnaire from a sample of 150 peasant farmers randomly selected and fairly distributed in the three locations of the study area. Descriptive statistics were used in data analysis. The results showed that financial risks were not among the significant threats to farm development in the short term. Nevertheless, farm operations were more exposed to risks in Mbinga Sud Locality than in Irhambi and Bugorhe Localities with respect to financial autonomy, access to short-term liquidity and availability of investment funds. The results also revealed that natural hazards (including flooding and erosion) were not currently among the threats of farming activities. For the whole study area, the respondents confirmed that the risks of flooding and erosion are weak, at the rates of 73.3% and 78% respectively. On the other hand, low prices of agricultural commodities, climatic disturbances, crop diseases, crop theft and raptors were the major long-term farm threats in the study area as confirmed by 60.0%, 47.3%, 40.7%, 23.3% and 45.3% of the respondents, respectively. From these findings, we recommend that the strategies for sustainable environment management should be initiated; the proximity of extension services to farmers should be enhanced; and security should be permanently kept and guaranteed.

Keywords: *Risks, peasant framework, farm activities, South Kivu, Democratic Republic of Congo.*

THE CONTRIBUTION OF MICROFINANCE TO THE RESILIENCE STRATEGIES OF SMALLHOLDER TEA FARMERS IN BURUNDI

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Abstract

Microfinance services are of undeniable importance in the development of agriculture and in improving living standards in rural areas. However, their accessibility in developing countries is problematic. The objective of this article is to assess the contribution of microfinance to improve the living conditions of the population in rural areas of Burundi. An exploratory survey was conducted among 120 smallholder tea farmers in 2018 in two zones (Ijenda and Teza). These smallholder tea farmers are between 30 and 86 years old with a basic level of education. The results of the survey showed that the loans made it possible to carry out small projects and met some urgent needs. However, the level of indebtedness was low due to lack of collateral guarantee and the interest rate was relatively high. In addition, the information collected in Microfinance Institutions (MFIs) revealed a lack of support services within MFIs to enable optimal allocation of credits. To compensate for financial shortfalls, smallholder tea farmers are developing mechanisms for saving in kind and tontine systems with multiple socio-economic roles built up. Credit beneficiaries in MFIs are increasingly losing interest in the MFIs credit systems in favour of tontines. In Ijenda zone, only 37.5% want to renew the credits against 41.4% in Teza zone.

Key words: *Burundi, microfinance, MFIs, tea, tontines.*

MONITORING AND EVALUATION SYSTEM IN AGRICULTURAL ADVISORY SERVICE

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Abstract

Monitoring and Evaluation in Agricultural Advisory Service provide the basis for organized learning from experience according the reliable information collected during and after the implementation of advisory programs. These processes allow improvement of the provision of services, responsible resource allocation as well as planning of advisory programs in accordance with agricultural policy as well as the needs of agricultural producers. The objective of the research is to determine the existing situation regarding monitoring and evaluation system. Research has been implemented on two levels. The first part of research is on the level of the Public Advisory Service of Republic of Srpska while the second part of the research has been conducted at the level of institutions and organizations that are partners of Public Advisory Service. Based on empirical research and data from different sources the goal is to create basic elements of monitoring and evaluation in agricultural advisory services that can be used in practice by employees in the Public Advisory Service of Republic of Srpska. Based on the analysis of the situation and the results of the research, it is concluded that for the implementation of the monitoring and evaluation process the most important commitment of the management of the public agricultural advisory service is to collect and analyse the data. It is also necessary to improve the human, material and technical capacities within the advisory service and also ensure the development of information systems as well as special resources, both human and material, for the implementation of monitoring and evaluation.

Keywords: *Monitoring and evaluation, Agricultural Advisory Service, Republic of Srpska.*

THE SYMBIOSIS OF MODERN ICTS AND MARKETING STRATEGIES IN AGRICULTURE

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Abstract

Nowadays, we are witnessing immense improvements in a wide scope of domains driven by novel Information and Communication Technologies (ICTs). Agriculture didn't remain immune to the progress of modern technologies, and it moves towards smart and sustainable agriculture. One of the key components that influence the success of the agriculture domain is marketing. The purpose of the paper is to examine the role and opportunities of ICTs use in agricultural marketing, and the significance of effective agricultural marketing in business development. The particular attention has been devoted to the digital marketing strategies applicable in agriculture and the benefits they bring. The presented research shows that the symbiosis of modern ICTs and marketing strategies in agriculture transformation will increase the satisfaction and loyalty of current customers, gain more customers, and boost sales and profits.

Keywords: *ICT, agriculture, marketing, customer.*

PREDICTION OF SUNFLOWER PRODUCTION IN THE ENTITY OF REPUBLIC OF SRPSKA (BOSNIA AND HERZEGOVINA) UNTIL 2022

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Abstract

Based on twenty-two-year series of data (1996-2017), the author carried out a five-year prediction (2018-2022) of sunflower production indicators in the Entity of Republic of Srpska (Bosnia and Herzegovina). For the purpose of the prediction, the Box-Jenkins methodology was used, where the selected and evaluated ARIMA models tried to predict the future change of the basic parameters of the production of this oilseed. The results showed that sunflower was characterized by positive tendencies and changes in all three measured indicators, as well as by very unstable movement. The area of the sunflower in the current period was significantly under the influence of random fluctuations from the previous period, and it could be expected that there would be a constant increase of area year after year in the period of prediction. Expected area of sunflowers would be 287,5 ha in 2022. Production of sunflower is the most stable indicator and, in addition to random fluctuations from the previous two years, its value in the current year has an impact on the production from the previous three years. The value of sunflower production is expected to increase during the predicted period, but only until the after most year, where the production will be at the level of 342.33 tons. The yield of sunflower had a very slight tendency of growth, and yields from the previous two years had the statistically significant impact on it. The period of the next five years will be characterized by oscillations in sunflower yields, where by 2022 the yield will reach the value of 1.45 tons per hectare.

Key words: *sunflower, prediction, ARIMA models, Box-Jenkins methodology.*

INTERFERENCE OF CLIMATIC CHANGES OVER THE GRAIN PRODUCTION FORECASTING IN BRAZILIAN SEMIARID REGION

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Abstract

There were created models of rainfall distribution and to forecast fluctuations of variables associated with grain production in the semiarid region of Brazilian Ceará State from 1947 to 2017. The used Data came from IBGE (Brazilian Geography and Statistical Institute) and FUNCEME (Meteorological Foundation of Ceará State). The study principal assumption was: rainfall instability caused instability over the grain production forecast in semiarid zone of Ceará State. Using average and standard deviation, the study created three models of rainfall for that period. The study used ARIMA (autoregressive, iterative and moving average) models in order to predict year values of endogenous variables: harvested areas, yield per hectare and average price of grains. Effects of rainfall (exogenous variable) over the generated forecast models were tested. The results showed that according to the average and standard deviation, it was possible to classify the climate of Ceará State semiarid in periods of shortage, normal and rainy. Shortage years of rainfall had the higher probability to be observed. In the shortage periods the phenomenon of drought was observed. The prediction models for all variables showed to be influenced by the rainfall instability. Contrary to the variables harvested areas and yields, which showed to be positively influenced, the forecasting model of average grain price fluctuated negatively under influence of rainfall non predicted fluctuation. The study main conclusion is that the climatic changes over rainfall instability induced instability over the decision variables used to produce grain in Semiarid of Ceará State from 1947-2017 period.

Key-words: *Agribusiness, Family farming, Technological instability, Rainfall.*

FAMILY AGRICULTURE AND THE IMPORTANCE OF AGRICULTURAL PRODUCT CENTERS FOR AGRICULTURAL AND ORGANIC PRODUCTS

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Abstract

In the extreme west of Santa Catarina, Brazil, the agricultural activity became the main local cultural activity over the years through new techniques and practices. However, the competitiveness in the agricultural sector, due to the implantation of the use of machinery in the substitution of the family labor, made the small and average farmer lost force in the commercial market. The need was noticed to appreciate the productivity of family agriculture and the importance of centers where the families can market their products directly. In this context, the article seeks to study about family agriculture and pluriactivity, aiming at valorizing the agricultural sector and emphasize the marketing of agricultural and organic products. In this way, bibliographical researches were carried out to understand the object of study, specially, the centers of agricultural products as spaces of commercialization, culture and education. As a result, it was understood that the pluriactivity developed by family agriculture played an important role in improving the quality of life of the farmers, because the diversification of activities and the integration between rural and urban as a means for these activities could promote a greater productivity, profitability and, consequently, the permanence of these people in the agricultural sector and the rural environment. In this way, the importance of agricultural product centers have been reinforced, which offers better conditions for the commercialization of agricultural products and enables to cultivate and disseminate the local culture in these spaces.

Keywords: *Family agriculture. Pluriactivity. Agricultural product centers.*

BIOECONOMIC POTENTIAL EVALUATION OF BULGARIAN REGIONS

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Abstract

In 2012 EC approved Bioeconomy Strategy: "Innovating for sustainable growth: A Bioeconomy for Europe" in order to answer to global economic and environmental challenges related to world population growth and depletion of strategic energy resources. The goal was to focus efforts of member states in right direction and toconvert their economies to a "post-petroleum" low carbon state, using natural resources in a more sustainable and efficient way. The aim of the studyis to present a methodological approach in order to evaluate bioeconomic potential of Bulgarian regions (with focus on rural areas). The applied approach is based on set of criteria for classification of the regions, including socioeconomic and specific bioeconomic criteria (evaluation of formed biomass from agriculture and forestry as well as waste). Relying on developed classification of the rural areas SWOT analyses per region have been conducted assessing the opportunities for development of businesses and network structures (clusters) based on revealed bioeconomic potential. The results from the study can be used by policy makers, government agencies and local authorities to develop programs fostering creation of specialized clusters and increase of bioeconomic added value, thus facilitating implementation of the Bioeconomy Strategy on regional level.

Key words: *bioeconomic potential, evaluation, Bulgarian regions.*

MOBILE AND STATIONARY BEEKEEPING – SUCCESSFUL EXAMPLES

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Abstract

In the Republic of Croatia beekeeping is a traditional and esteemed agricultural activity. Due to different climatic zones (continental, mountainous and Mediterranean), Croatia has different conditions for the development of beekeeping, and this variety and richness of plant species allows the production of many types of honey. However, for most beekeepers in Croatia beekeeping is an additional activity. The honey production has increased significantly since the year 2010, with the highest recorded production in 2015 (11,477 tons). The number of beekeepers in the Republic of Croatia decreased by 42% in 2018 compared to 2015, while the number of beehives decreased by 34% in the same period. Only 4% of beekeepers have more than 150 beehives, while 42% have 1 to 30 beehives. Mobile beekeeping makes it possible to achieve higher honey yields per beehive, but additional equipment is also needed which increases production costs, estimated at EUR 1,474.53 a year (registration, maintenance of vehicles, fuel and work required when moving beehives). In case 1 (stationary production) 16 kg of honey was produced and income of 35.97 euros per beehive was generated, while in case 2 (mobile beekeeping) 42 kg of honey was produced and income of 100.45 euros per beehive was generated.

Keywords: *Honey, income, mobile beekeeping, stationary beekeeping*.

THE ROLE OF AGRICULTURAL EXTENSION TOWARDS FACING CLIMATE CHANGE IN Al-GHARBIA GOVERNORATE, EGYPT

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Abstract

This study aims to identify the knowledge of extension agents at extension centers of the forms, causes and effects of climate change, and to identify the role of agricultural extension in addressing climate change. This study was conducted in all extension centers in Al-Gharbia governorate, Egypt, during December 2018. Data were collected from 68 respondents of agricultural extension agents affiliated to 17 extension centers; 51 respondents were males and 17 respondents were females, questioned through a personal interview questionnaire made especially for this purpose. Several statistical methods were used such as percentage and frequency tables. The most striking results of the study showed that 9.41% of the respondents had a high level of knowledge about the forms of climate change.76.47 % had a high level of knowledge about the causes of climate change, while 73.52 % had a high level of knowledge about the effects of such climate change. The most of respondent were aware of the role of agricultural extension in diminishing the causes of climate change and overcoming the effects of climate change. The effects of climate change on agricultural extension work were as follows: difficulties in implementing the action plan due to change in rain patterns, difficulties in running farms and applying new farming techniques, growing workload put on agricultural extension agents, and an increase in costs of training.

Keywords*: Agricultural extension, climate change, extension centers, Al-Gharbia governorate, Egypt.*

ATTITUDE OF AGRICULTURAL EXTENSION AGENTS ABOUT ELECTRONIC AGRICULTURAL EXTENSION IN Al-GHARBIA GOVERNORATE, EGYPT

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Abstract

The main objective of the study was to identify the attitude of agricultural extension workers towards the applications of e-agriculture extension in Gharbia governorate. The size of the sample was determined by using the krejcie & Morgan table to determine the size of the sample. The sample was 196 randomly selected participants according to the percentage of each category of agricultural extension workers in the overall. A questionnaire was distributed to the respondents during monthly meetings. Data were collected, and 192 cases were retrieved by 97.96%. Frequencies, percentages and T test were used for statistical analysis.The most important results were: Percentage of agricultural extension specialists 50.5% of sample size. About 80.7% of the respondents did not receive training courses in the field of e-agricultural extension. Only 39.6% of the respondents had computers connected to the Internet. 54.2% of respondents had a mobile phone with internet access. Half of the respondents had a low attitude towards e-agricultural extension. The most important problems of electronic agricultural extension were: lack of training of agricultural extension workers on e-agricultural extension, lack of Internet services in the work place, and lack of financial allocations to provide e-agricultural extension services.

Keywords*: E-agricultural extension application, ICT, VERCON, RADCON, Egypt.*

RURAL WOMEN NEEDS ABOUT EXTENSION KNOWLEDGE REGARDING CLIMATE CHANGE PHENOMENON IN Al-GHARBIA GOVERNORATE, EGYPT

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Abstract

This study aims to identify the extension knowledge needs of rural women of the meaning, causes and effects of climate change phenomenon on agriculture, food and nutrition, public health, poultry raising, breeding and care of farm animals, and the field of protection and conservation of environmental resources. This study was conducted in some villages of Gharbia Governorate, Egypt, during December 2018. Data were collected from 300 respondents, randomly selected multistage-clustered sample, through a personal interview questionnaire made especially for this purpose. Several statistical methods were used such as percentage and frequency tables. The most striking results of the study showed that 51.34% of respondents had a high extension knowledge need about the meaning of climate change phenomenon. 60.34% of respondents had a high extension knowledge need about the causes of the climate change phenomenon. 54.67% , 62% , 73.67% , 53.67% , 35.33% , 54,67% of respondents had a high extension knowledge need about the effects of climate change in order on; agriculture, food and nutrition, health, farm animal breeding, poultry, and the protection and maintenance of environmental resources, respectively.

Keywords: *Agricultural extension needs, climate change phenomenon, rural women, Al-Gharbia governorate, Egypt.*

VITALITY OF EDUCATION ORGANIZATIONS IN QALIUBIYA RURAL AREAS; CASE STUDY IN SHEBIN DISTRICT, EGYPT

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Abstract

The present study aimed to study the vitality of education organizations in Qaliubiya governorate as one of the high ranking governorates according to the Human Development Index (2008). The study aimed first to identify the vitality of rural education organizations Q;secondly, to identify the impact of personal variables and administrative on vitality degree for education organizations; thirdly, to estimate the size of the gap between the current vital degree and optimal vital degree of educational organizations. The sample frame of Shibin el-Qanater district included 92 primary schools, 50 junior high schools, represented by 18 elementary schools, 12 junior high, total of 30 schools. The study results indicated that vitality degree of education organizations was 58.3%, while the vitality gap was 41.7%, and the axes of internal environment, efficiency of the school class, and the effectiveness of parents boards had top score on the scale and ranked first among the eleven axes, followed by importance of efficiency of the human element axes, and the success rate, and the efficiency of the external environment, while the axes of school activities, horizontal communication, and vertical communication represented the minimum degree in their contribution to the construction of the scale. The results also indicated that the age variables, and practical experience, management experience were all negatively associated within dynamic scale, while the variables associated with training, labor relations, and the effectiveness of parents boards were with positive vital degree.

Key words: *vitality-vitality, gap- basic education, organizations.*

RURAL TOURISM AND SUSTAINABLE DEVELOPMENT: THE CASE OF TUNIS VILLAGE'S HANDICRAFTS, EGYPT

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Abstract

Tunis Village, Fayoum governorate, Egypt, is considered a successful model in Egypt inmaking full use of handcraft in promoting the Village and achieving sustainable tourism development.This research aims at exploring the current status of Pottery handcraft in Tunis Village and assessing its role as a tool for tourism promotion and achieving sustainable development in the Village.Three segments were surveyed in July 2019; the first segment is Pottery crafters where forty Pottery crafters were interviewed, while the second segment are the Tourists where unstructured face to face interviews conducted with fifteen tourists, and finally a survey was directed to Tunis Village's Local residents (non-crafters) where thirty questionnaires were completed. The results revealed that allPottery crafters indicated that the profession helped them to provide better education and health care to their families, they stated also that they are feeling safe and social secure. Both craftersand tourists stated that the Potteryhandicraft is main motivationfor tourists to visit Tunis Village. The most important challenges facing the profession of handicrafts are high prices of raw materials, as well as the great effort and long time needed for the preparing and processing the raw materials till it become ready for shaping.Local residentsstated that Potteryworkshops have attracted the tourists to visit the village, the matter which enabled them to increase and diversify their source of income, as it has created many Tourism related jobs. The researchhas come up with a number of recommendations to sustain the model of Tunis Villagewhich managed to use the Handicrafts inachieving sustainable tourism development, among these recommendations;making some modifications in the furnaces to reduce the emissions generated during firing the products and holding special events such as exhibitions, fairs and festivals showcase Pottery handcraft products, especially in the low season in summer.

Keywords: *Sustainable development, Rural tourism, Tunis village, Pottery handicrafts.*

IS RESIDUE RETENTION THE HICCUP FOR PROMOTION OF CONSERVATION AGRICULTURE IN MIXED CROP-LIVESTOCK PRODUCTION SYSTEMS?

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Abstract

In the mixed crop-livestock production systems of the dryland areas, crop residues have great economic significance as sources of feed. This poses a major challenge in the promotion of conservation agriculture in which crop residue retention (RR) is one of the three main pillars. While the benefits of the other two pillars (zero tillage and rotation) have been well documented, the literature on RR, especially in the dryland areas is scanty. Using data from a nationally representative sample of 1,230 wheat farm households and their 2292 wheat fields in the wheat-based production system of Morocco, this paper provides estimates of the adoption and livelihoods impacts of RR. We find that 14% of farmers retain at least 60% of the crop residue on the field. Results from an instrumental variables regression model show that retention of at least 60% residue leads to 346.1 kg/ha (38.6%) higher yields, US$135.6/ha (48.9%) higher net wheat farm income, and 100% and 45% reductions in the risks of obtaining yield levels below 500 kg/ha and 1000 kg/ha, respectively, in the subsequent wheat crop. Considering current feed prices, the gain in net returns can offset the cost of alternative feed sources that provide equivalent amounts of calories and proteins showing that residue retention can be justified on economic grounds.

Keywords: *Residue retention, adoption, impact, drylands, Morocco.*

THE ROLE OF INNOVATION SUPPORT SERVICE PROVIDERS IN AGRICULTURAL INNOVATION MANAGEMENT

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Abstract

Innovations in agriculture tend to be slow because of the conservativeness of the agricultural sector. 'Sustainable Precision Farming through User-Centered Design', a research project of the author funded by the Co-operative Research Programme (CRP) of the Organisation for Economic Co-operation and Development (OECD), suggests that the adoption phase of innovation is a major reason for the slowness. Adoption could be better if the R&D process was more user-centred. In order to succeed in this challenge, the participation of end-users in innovation should be much more efficient. All actors in innovation should gain more skills in User-Centred Design (UCD). The adoption phase needs more support from advisory services or consultancies. This is because the potential benefits of innovations are not realized if the adoption is inefficient. A Horizon 2020-funded research project, 'AgriSpin – Space for Innovations in Agriculture', aimed to find efficient methods to enhance innovation. In AgriSpin, there were 15 partner organizations from 12 countries. The goal of AgriSpin was to systematically explore Innovation Support Service Providers (ISSPs) in agriculture and rural development across Europe. The overall goal was to help create a stimulating environment for innovations. The results point out the urgent need for effective Multi-Actor Approach (MAA) to support all phases of innovation. The paper promotes the role of ISSPs as actors in efficient agricultural innovation. The growing need of agricultural engineering consultancy is discussed. Needs for further research and development are outlined.

Keywords: *innovation management, agriculture, User-Centred Design, Multi-Actor Approach*.

PERCEPTION OF ESSENTIAL OIL OF YOUNG POPULATION IN ANGERS, FRANCE: CASE OF CARDAMOM AND TURMERIC IN FUNCTION OF DIFFERENT MARKETS

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Abstract

The panel of products based on essential oils is very large, since they are not only used as flavors and fragrances, but also as medicines and food supplements. According to business forecasts for the potential of essential oil market in 2020, it is expected to increase to 370,000 tons globally and they consider that production value is estimated to 10 billions USD. Hence, the quality of essential oil is often substandard based on the European legislation, which impedes the resulting value. The final customer stays however puzzled about the real quality criteria of essential oils even if the marketing efforts of essential oil providers try to offer them information, which is often not verifiable. This poster is based on the characterization of the quality criteria about the cardamom and turmeric sourced from three different markets: International exportation market, national consumer market and a short supply chains with low volumes. The quality perception of the two essential oils is characterized with a panel of young people. Our methodology uses two tools: gas chromatography and qualitative analysis. The gas chromatography shows that active principle concentration varies with essential oil source. The qualitative analysis is based on two evaluations: sensory analysis and consumer interview. As a result, the panel was able to differentiate curcuma of different market origin. Consumer interviews showed that young people's choice is oriented by quality and price. Hereby labelization is equal to quality.

Key words: *Essential oil, young population, market, cardamom, turmeric.*

RURAL DEVELOPMENT THROUGH THE INTRODUCTION OF A PIG FARM MODEL:CASE OF ATTAPEU, LAO PDR

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Abstract

Pig farming system in the province of Attapeu in Lao PDR is extensive with free ranging. The most important challenge of his low performance production system is to improve education of local populations concerning disease control through vaccination, and medicine for bacterial diseases as well as improved feeding and farm infrastructure. The pig breeding of the small farms is used for self-consumption and sociocultural aspects, the village consumption and the local market. The farmers also occasionally sell pigs to get income when it is necessary for them. The growth duration of fattened pigs is about one year the farmers sell pigs by estimating their weight. Each pig is worth for the farmer between 50 and 100 Euros depending on its looks and the weight. The commercialization network is not structured and few actors characterize the network: some retailers and two or three wholesalers. A rural development and food security project has proposed parallel introduction of three farming models to improve the pig production but also address farmers' technical education. This paper analyses the results of the project with respect to the distinct pig farming model. The most important improvements are, i) improved permanent stables ii) introduction of new feedstock iii) improved disease control iv) introduction and spread of crossbred animals. The implementation of this action lead to animals that are more resistant and demonstrates the progress about not only the economic aspect of pig farming, but also the improvement in feedstock availability and weight gain.

Key word: *rural development, pig farm model, Attapeu, Lao PDR.*

WHY INVEST ON INNOVATIVE PRODUCTION? A QUALITATIVE EVALUATION OF THE EMERGING AVOCADO SECTOR IN CRETE, GREECE

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Abstract

Avocado is actually one of the most lucrative agricultural activities worldwide. Demand is rising rapidly relating to healthy diets and social status, while the increasing supply does not seem able to cope with it. Chania area in the Greek island of Crete has ideal climate and soil conditions to produce high quality avocados. As a result, orange trees are being eradicated and replaced by avocados. The purpose of this study is to provide a qualitative assessment of avocado production in Crete, in order to demonstrate under which prerequisites its growing trends will lead to overall sustainability (economic, social, environmental). The system is assessed by means of a SWOT analysis integrating considerations of actors across the value chain. The key finding is that the system requires synergies with other sectors but also close collaboration among stakeholders in order to achieve overall sustainability in the long term. Strategic design and collective actions are required towards this end.

Keywords: *Innovative production, Qualitative evaluation, Avocado.*

CHANGES OF THE CULTURAL LANDSCAPE ON HAJDÚHÁT (HUNGARY)– FROM AGRICULTURAL LANDSCAPE TO THE MONOCULTURE

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Abstract

The structural diversity and landscape components were studied in detail based on historic maps and recent remote sensed data in a study area on loess plateau of Hajdúhát, covered by chernozemic soils with 2500 ha extent dominated even traditionally by agricultural land use. In 1860, 79 individual farms could be found on the study area, in 1941, there were 95, and in 1962, there were 154. In following period of the socialist restructuration of agriculture and expansion of intensive farming the earlier network of farms practically declined. In number of farms a strong decrease can be detected: in 1989-44. According to the recent data, 38 farms still exists, and only 23 are in use. At the same time, the share of plough lands increased from 1751 ha (70%) (in1860), to 2250 ha (90%) in recent times. Extent areas of former wetlands and meadows were occupied by plough lands. Until the 50s of the 19th century, wetlands covered totally more than 500 ha (20%). Actually, they cover less than 10 ha (0.4%), extent of the mown meadows decreased to their third. The orchards, represented originally by an area of 0.8 ha, disappeared completely. The decline of the farm network is also detectably in changes of the road density. In the first period the total length of roads was 93 km within the study area, but it decreased in contemporary times to less than 50 km. In recent condition the area could be characterized rather as agricultural monoculture instead of traditional cultural landscape.

Keywords: *Landscape complexity, Agricultural landscape, Landscape changes, Farming network.*

CHANGING CROPPING PATTERNS AND IRRIGATION PRACTICES: IMPLICATIONS FOR SUSTAINABLE GROWTH OF AGRICULTURE IN WEST BENGAL, INDIA

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Abstract

The existing studies generally focus on how changes in cropping patterns have affected irrigation requirements and its structures in the Indian state of West Bengal. Accordingly, policy changes and institutional arrangements are suggested to provide the farmers greater access to irrigation facilities. While this is imperative to promote inclusive agricultural growth, ensuring its sustainability requires exploring how changes in cropping patterns subsequently affect extent and patterns of irrigation. The rationale for carrying out the study in the context of West Bengal lies in its agrarian nature with highly fragmented landholdings, existence of large number of small and marginal farmers and increasing emphasis on minor lift irrigation. The study uses both secondary and primary data to address the research objectives. The paper finds that there has been significant shift of cultivated area towards boro paddy, although aman paddy still remains the significant crop in the state. Further, while area under high yielding paddy, jute and potatoes as proportion of gross cropped area has increased, that under pulses has declined sharply. Such changes in cropping patterns coupled with drying natural water bodies with high siltation, degraded ecosystem, erratic rainfall and deterioration in quality of surface water seem to have added pressure on groundwater level. While deeper investigation at micro level is necessary to draw more robust conclusions, initiatives should be taken towards guiding the farmers towards choice of appropriate cropping patterns for more judicious use of water. Local level institutions like water users' association should play a crucial role in this regard.

Keywords: *Irrigation, Cropping patterns, Sustainable growth, Water users' association, West Bengal.*

ROLE OF IMPROVED PRODUCTION TECHNOLOGIES IN ENHANCING FARMERS PRODUCTIVITY IN OILSEED BRASSICAS IN INDO-GANGETIC PLAINS OF INDIA

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Abstract

Rapeseed mustard is an important oilseed crop of world with area of 36.53 million hectare average productivity of 2.05 tonnes per hectare and global production of 74.91 million matric tones. India is a global player in edible oil arena, being the 2nd largest importer, and 3rd largest consumer of edible oil as well as 4th largest oilseed producer. *Brassica rapa* (L.) and *Brassica juncea* (L.) (Czern & Coss) are the major cultivated oeliferous *Brassicas.* Its cultivation is facing some major constraints like non availability of quality seeds, poor soil health not being grown as sole crop, effect of major biotic and abiotic stresses and slower adoption of improved production technologies. Front line demonstrations (FLDs) being conducted under All India Coordinated Improvement Project on Rapeseed & mustard Research are playing an important role in mitigating the major constraints in rapeseed-mustard productivity. A large number of FLDs were carried out in farmer's field involving seven districts of eastern Uttar Pradesh region (Varanasi, Mirzapur, Chandauli, Sonbhadra, Ghazipur, Deoria and Jaunpur) for over three consecutive years i.e. during *(Rabi)* winter seasons of 2016-17, 2017-18 and. 2018-19. Studies were carried out on overall effect of use of two improved varieties Giriraj (IJ-31) and NRCHB-101 over local variety 'Varuna' as well as the improved practices also including line sowing, proper weeding, spacing, Sulphur application along with the recommended dose of NPK, integrated disease and pest management and mechanized row sowing. The results exhibited remarkable increase in yield as well as NMR (Net Monetary Return) percentage by following improved Practices (IP) over Farmers Practices (FP).

Keywords: *Rapeseed-mustard, improved production technologies, INM, IPM.*

ADOPTION OF WATER AND SOIL CONSERVATION PRACTICES: THEORETICAL FRAMEWORKS AND ATTITUDINAL COMPONENTS

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Abstract

Agricultural production requires two main resources; water, as a source of life, and soil, as a living environment. Water and soil conservation is a critical issue in areas facing water and soil resource constraints. The purpose of this review paper is to provide an overview on the theoretical frameworks used in the analysis of the adoption of water and soil conservation practices. Different models and frameworks have been used in the analysis of the acceptance and/or adoption of new technologies and practices; these include Technology acceptance model, Motivational model, Theory of reasoned action, theory of planned behavior, innovation diffusion theory and the unified theory of acceptance and use of technology. The Icek Ajzen's Theory of Planned Behavior (TPB) has been used as a conceptual framework in many studies on the factors affecting the adoption of water and soil conservation practices. The TPB allows examining the impact of individual factors (i.e. attitude), social norms (cf. subjective norms) and situational factors (i.e. perceived behavioral control) on the adoption of practices. It posits that if a person assesses the suggested behavior as positive (cf. attitude) and if he/she thinks that others want them to perform the behavior (cf. subjective norm), these results in a higher intention and motivation to do so.

Keywords: *Theory of Planned Behavior, Adoption, Water conservation, Soil conservation*.

UNIVERSITY STUDENTS' ATTITUDES, PERCEPTION AND KNOWLEDGE TOWARDS RENEWABLE ENERGY USAGE IN THE AGRICULTURAL SECTOR IN IRAN

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Abstract

The concept of sustainable development has been transferred to the energy sector, resulting in defining a new term: the sustainable energy development.Renewable Energy Sources (RES), such as hydro power, biomass, geothermal, wind and solar, provide several benefits, representing a viable alternative to traditional fuels. The present descriptive survey aimed to analyze the behaviors (attitude, knowledge and perceptions) of agriculture students in the universities of Guilan province, Iran, with respect to renewable energies in the agricultural sector. The statistical population was composed of all students of agriculture faculties in Guilan province (N = 2000) studying in BSc, MSc and PhD. The sample size was determined to be n = 200 using the least sample size tables of Bartlett and colleagues. The research instrument was a researcher-made questionnaire, after in depth review of literature, composed of two sections. The first section was designed to collect demographic information and the second section dealt with behavior indicators (knowledge, attitude, and perception). The face and content validity of the questionnaire was confirmed by a panel of experts, and its reliability was estimated by Cronbach's alpha (to be 0.843 for knowledge subsection, 0.714 for attitude subsection, and 0.754 for perception subsection). Data were analyzed at descriptive and inferential levels by the SPSS19 software package. The results showed that knowledge of using RE had a significant positive relationship with the marital status, age, educational level and job of the studied people. The age and educational level of the participants were related to their attitude significantly. Similarly, there was a significant relationship between the perception of students and their job. The RE knowledge of participants was different significantly in terms of marital status, age, educational level, job. Also, the attitude of the individuals toward RE differed in terms of their ages and educational levels. A significant difference was observed in the perception of participants with different educational level and jobs. According to the results of K-mean cluster analysis, 17.5%, 48.5% and 34.5% of individuals had a low, moderate and high level of knowledge, respectively. Also, 58%, 1% and 41% had a low, moderate and high level of attitude, respectively. With respect to the perception, 44 individuals (22%) had a low, 98 individuals (49 %) had a moderate, and 58 individuals (29%) had a high level. This study highlights the importance of implementing RE education as early as possible to encourage RE development, which is necessary to alleviate the risk from fossil fuel-related environmental problems.

Keywords*:* *renewable energy, solar energy, perception, attitude, knowledge.*

WILD ECONOMY, CIRCULAR ECONOMY AND RESILIENCE THE CASE STUDY OF THE WILD ANIMALS IN UMBRIA REGION (ITALY)

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Abstract

The authors analyzes the world reference framework of development processes marked, on one hand, by the risks of food, social and environmental security dictated by the impending change of climate. On the other hand, we are at front line at the challenge of fighting poverty, achieving safe feeding and healthy life for all and for all age and the road map to follow concerning the implementation of 17 Goals of 2030 Agenda for Sustainable Development Strategy. The analysis shows that the territories and the local communities should be brought to the center of the development processes with a view to relaunching the local productive potential and to enhance the autochthonous resources. The wild economy and the circular economy are two innovative and sustainable options that intersect synergistically in the perspective to achieve the creation and the spreading of Smart Territory and Smart Community in the Rural Areas of all world. They are presented as a case study related to an innovative proposal of exploitation of wild animals, in a perspective of marked sustainability and strengthening of resiliencein the territories of the Umbria Region in Central Italy.

Key words*:* *Wild Economy, Circular Economy, Resilience, Sustainable Development, Territorial Contracts Management.*

GREEN TECHNOLOGIES FOR THE EXTRACTION OF BIOACTIVE PHENOLICS FROM WINERY BY-PRODUCTS

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Abstract

Wine production represents one of the major agricultural activities worldwide. This production generates tremendous amounts of by-products exceptionally rich in bioactive compounds (especially phenolics). Particular attention should be addressed towards biorefinery and circular economy concepts, since winery by-products contain bio-based compounds that could have potential benefits. Recovering these molecules constitutes a key point for the valorization of the wine-processed materials. Conventional extraction processes generally require large amounts of organic solvents, high energy expenditure, they are time consuming, leading to the generated interest in green technologies such as supercritical fluid extraction (SFE) and ultrasound-assisted extraction (UAE). These can eliminate the use of toxic solvents, and thus preserve the natural environment and its resources. An overview of the main findings obtained after several years of research on the application of SFE and UAE to winery by-products for the recovery of phenolics, especially proanthocyanidins, will be reported.

Key words: *green economy, biorefinery, supercritical carbon dioxide, ultrasonics.*

IMPLEMENTATION OF THE SUSTAINABLE DEVELOPMENT GOALS IN THE MEDITERRANEAN: INSTITUTIONAL AND GOVERNANCE ARRANGEMENTS

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Abstract

A robust institutional framework is necessary to turn into reality the ambition of the 2030 Agenda for Sustainable Development, which encompasses the Sustainable Development Goals (SDGs). This review paper analyses the institutional arrangements and governance mechanisms adopted in the Mediterranean countries for the implementation of the 2030 Agenda. It is mainly based on an analysis of the Voluntary National Reviews submitted by Mediterranean countries to the United Nations' High-Level Political Forum on Sustainable Development (HLPF) from 2016 to 2019. Basically, a variety of institutional arrangements have been used by Mediterranean countries with the aim of ensuring an effective and operational inter-ministerial coordination (cf. "whole-of-government" approach). In this respect, there are two types of institutional mechanisms: coordinating mechanisms at the highest government level (e.g. national committee under prime minister's or president's office) and implementation coordination by specific ministries (e.g. Ministry of Development in Turkey, Ministry of Foreign Affairs in Cyprus and Morocco, Ministry of Tourism and Sustainable Development in Montenegro). Some countries opted for the establishment of new structures (e.g. National committee for monitoring the implementation of SDGs in Egypt), while others use the institutional arrangements put in place for the Millennium Development Goals (MDGs). Apart from inter-ministerial coordination, these institutional arrangements also aim to ensure the "localisation" of the SDGs and their implementation at sub-national level (e.g. regional, local), increase the involvement of the legislative power and parliaments in the process, and improve the inclusiveness of and ownership by a wide range of stakeholders (e.g. civil society, private sector, academia). The achievement of the SDGs implies going beyond fragmented, hierarchical and "siloed" processes and cultures and working across institutional boundaries. Finally, this review provides evidence of good practices and helps to promote mutual learning among Mediterranean countries.

Keywords: *Sustainable Development Goals, Mediterranean region, institutional architecture, governance, coordination.*

CONTRIBUTION OF GRASSROOTS INITIATIVES TO SUSTAINABLE URBAN FOOD SYSTEMS: THE CASE OF A CAMPUS GARDEN IN MUENSTER, GERMANY

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Abstract

Cities depend on a constant food supply from the outside. Current challenges (e.g. climate change, soil depletion, biodiversity loss) and their interrelatedness with modern, industrialised food production may compromise future food security for millions of urban dwellers. Evidence shows that grassroots initiatives can foster transition towards resilient and sustainable urban food systems. This research contributes to the literature on grassroots initiatives and their role in sustainability transitions by analysing the urban gardening project campus garden GrüneBeete e.V. in Muenster. Semi-structured interviews with key informants from the initiative served as a basis for the analysis that was conducted according to an integrated sustainability transition framework. The analysis was performed along the three elements of the Multi-Level Perspective, i.e. niche, regime and landscape. Potential leverage points for transition, sustainability dimensions the initiative touches and its impacts were also studied. Special attention was devoted to social practices in educational and communal spheres. Urban gardening can be considered as a radical niche that aims to create an alternative urban food system. However, the analysed initiative has developed anchoring mechanisms with the regime institutions. Therefore, campus garden GrüneBeete e.V. is rather a symbiotic niche that, nevertheless, has the potential to induce a cumulative, incremental transformation in the regime. The main levers of change used by the initiative are raising awareness and spreading knowledge. In doing so, the campus garden impacts different dimensions of sustainable food systems (environmental, human, social, cultural, political, economic/financial). While the initiative is still small, it has a high upscaling potential given the favourable institutional and political landscape in Muenster and Germany at large. Urban gardening can be identified as a growing, but rather regime-compatible niche, one main strength being its potential impact on society's beliefs and value systems, and fuelling sustainability transitions through influencing social practices.

Keywords: *urban gardening, sustainability transitions, urban food systems, grassroots initiatives, food security*.

THE WINE ROUTES IN SICILY AS A TOOL FOR RURAL DEVELOPMENT: AN EXPLORATORY ANALYSIS

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Abstract

"Food and Wine Tourism" is framed inside wider context of promoting and developing rural areas of a territory. The Wine Routes (alias wine roads) (WR) should allow the promotion of wine tourism and the enhancement of the rural territory, offering a particular "integrated system of tourism supply" that winds along with a specific territory and operates as a "center of multi-services". The Sicilian Wine Roads (SWR) have been established in 1999 to pursue these aims and to offer wine producers a different opportunity to diversify their offer. The Wine Roads (WR) are routes along the wine-growing territories that offer to tourists and visitors the opportunity to take advantage of different complementarian services to the wine, proposing a form of experiential tourism with powerful emotional involvement, as it combines gustative elements with naturalistic (e.g. wine landscape), recreational (e.g. socializing) and cultural ones. This study has the aim to know the current situation of the SWR, identifying their contribution to the Sicilian rural territory, highlighting strengths, weaknesses and treats that still exist. The results have highlighted that "Enjoy the experience of visiting the winery" was the main motivation for tourists, nevertheless, visitors appeared more experienced than in the past and aware of what wine tourism is.

Keywords: *Wine tourism, Sustainable toursim, Experiential Tourism, Motivational study, Rural Tourism.*

MULTIFUNCTIONALITY, A STRATEGIC PILLAR FOR AGRICULTURE IN DEVELOPING COUNTRIES: AN EVIDENCE FROM NEPAL

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Abstract

The approach multifunctionality of agriculture in the developed countries is applied as a means of rural revitalization and economic circulation. Although farm diversification and diversification in the developing countries is much more crucial, in most of the rural areas of the developing countries, it is not performed, and it is delayed. In this regard, the main objective of this study was to explore the potentialities of the multifunctionality of agriculture to support the sustainable rural development in the framework of the sustainable development goals (SDGs 2016-2030) in the developing countries. The empirical study was conducted in two of the rural districts of Nepal called Nuwakot and Rasuwa. The authors intentionally selected these districts because it is one separate block at the northern part of the capital city Kathmandu and connected to China. Further, even though it is located in the nearby capital city, and the rural villages have high potentials for tourism activities, the farmers are still focusing on subsistence farming without getting benefits from tourism. Based on the macro data of Nepal government and field visit, we conducted a case study. The result explored that this block needed the external supports in terms of knowledge, technology, and more importantly, supportive policy. The federal and central government should give support to the farmers so that they can implement multifunctionality in their farms, which leads to sustainable rural development.

Keywords: *multifunctionality, circular economy, SDGs 2016-2030, sustainable rural development, Nepal*.

MEAT QUALITY AS A FACTOR INCREASING THE COMPETITIVENESS OF DEER FARMING

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Abstract

Product quality is recognised as an important factor of competitiveness. Product properties such as nutritional value, healthiness, and safety, i.e. product quality, start dominating in the food market. Foreign scientists have extensively researched competitiveness advantages, emphasising a niche strategy with a specialisation in high level services and high quality goods (key product qualities) for small and highly specialised enterprises, which is the most appropriate competitiveness strategy for selling products produced by non-traditional agricultural enterprises. In Latvia, over the recent years, great attention has been paid to non-traditional agricultural industries. Deer farming as a non-traditional agricultural industry in Latvia started developing in the 1990s. Venison is characterised by an optimal amount of cholesterol, amino acids, fatty acids and microelements. Besides, venison features a specific and express taste, pointing that the quality of venison is a significant factor increasing competitiveness in the development of deer farming, which enables venison to be positioned in the market as a healthy, safe, and valuable product for consumers. The quality of livestock products is closely associated with the nutritional value and quality of feed fed to animals. However, profitability is affected by the usefulness and cost of this feed. The pulses as faba beans, peas and lupine seeds are a protein and energy-rich legume seeds well adapted to grow in various climatic zones of Europe and widely used for feed and food. Amino acid composition is key to the evaluation of a dietary protein source. In this study, feeding legumes led to a significantly higher level of EAA, NEAA and TAA in the diets. The amino acid content in the experimental feeds varied. The MET contents was similar for all the trial groups. The CYS content was significantly higher in diets T1, T3. The LYS content was significantly higher in diets T1. The results indicated that in most cases, the average level of total amino acids (TAA) was increased in meat from the deer fed with peas (200 g/kg) (group T1), faba beans (200 g/kg) (group T2) and lupine seeds (150 g/kg) (group T3) compared with control group (group C). In total, the highest average EAA level (by 3.73%) was recorded in group T3. The MET content was significantly higher in muscle of deer from diet with peas (T1) (by 3.92%) and with lupine seeds (T3) (by 5.88%), while CYS – in deer meat from group T3 (by 10.53%). Inclusion of pulses (peas, faba beans and lupine seeds) in the diet of deer was more appropriate because of the amino acid composition in the muscle tissue of deer changed.

Key words: *deer farming, meat quality, competitiveness*.

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OPPORTUNITIES TO USE SAPROPEL FERTILISER IN ORGANIC FARMING

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Abstract

In Latvia, total sapropel resources are estimated at 2 billion cubic metres. Sapropel is a widespread mineral resource in Latvia – organogenic lake sediments that were formed from the residues of water plants and other living organisms as well as mineral particles. Sapropel is widespread in most lakes in Latvia, and approximately 732.4 mln. m^3 of it could be industrially extracted. The compositions and quantities of sapropel in lakes considerably differ. The precondition for organic farming, which uses no chemicals, pesticides and chemical fertilisers, is healthy soil. The soil is enriched with natural fertilisers to ensure the fertility of the soil. In Latvia, sapropel is little used in agriculture. The research investigations done to date indicate that sapropel could be used in agriculture, horticulture and forestry to fertilise and enhance the soil. Available research investigations in the world showed that the use of sapropel in soil made the soil less acidic, increased the water capacity of the soil in the arable layer and contributed to the absorption of little active chemical elements. Plants can absorb two times more N and P from a soil enriched with sapropel than from a control soil; accordingly, it is possible to considerably increase crop yields. Sapropel is a biologically active substance, and it could be applied both alone and in combination with peat to enhance the soil. For sapropel to be applied to soil, the moisture content of it has to be lowered to 60%. Sapropel with such moisture content can significantly enhance the agro-physical properties of soil (bulk density, porosity, moisture content). Besides, sapropel could be used for enhancing sandy soils as well.

Keywords: *Sapropel, Organic farming, Fertiliser, Latvia.*

Acknowledgement: The research received funding from the EU EAFRD Research application "Study of application of an innovative dehydration technology in sapropel production, application options of the products, produced on the basis of sapropel, in crop and livestock farming" (No. 18-00-A01612-000010).

ANALYSIS OF FACTORS OF FARMS TERRITORY IN LATVIA

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Abstract

Land in rural areas is the main source of production and therefore subsistence depends on land use. Different land use factors have a more or less impact on land use. The use of agricultural land is affected by geographical location, number of parcels, configuration, artificial or natural barriers, etc. The shortcomings in farm territories complicate the rational use of land, increase transport and other farm costs, so it is important to create a more compact farm area. The compact size of the farm area can contribute to rational land use by reducing stoning, overgrowth and bogging, thereby increasing the area of land units and improving the configuration of the unit of land and improving the diversity of landscapes of land units. The most advantageous form of field or separately treated plots is a rectangle. The main requirement for determining the shape of the field is that the longest sides of the field are parallel to each other and their directions coincide with the direction of the field. The treatment of disadvantaged fields not only increases the consumption of time and fuel, but also decreases the quality of work and increases the compaction of the soil, resulting in reduced crop yields. From the aforementioned facts, it is known that the use of agricultural land can be improved by improving the size of farmland, making it compact. One of the tools that could do this is land consolidation. Consequently, land consolidation can be one of the most effective measures for promoting rural development and agricultural land use in the Latvian economy.

Keywords: *Rural area, Farm territory, Land use, Land consolidation.*

CONSUMERS' ATTITUDES TOWARDS THE IMPROVEMENT OF AGRICULTURAL LANDSCAPE: LITHUANIAN CASE STUDY

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Abstract

Rural landscape as a space being consumed for amenity, living space, leisure activities, identity preservation and as cultural heritage. In Lithuania, agriculture has an exceptional significance in forming, shaping, and enhancing the landscape. Therefore, this study aimed to identify consumers' attitudes about agricultural landscape and its improvement in Lithuania. The survey of 316 Lithuanian citizens aged above 18 was performed in period June 2017–January 2018. The sample was representative stratifying the population in terms of gender, area of residence, and education. Considering the age, the sample was not representative because of a low willingness of older individuals to participate. Research results showed that majority of respondents observed the positive impact of agricultural activities on the landscape, and approximately one fifth of the respondents thought that agriculture negatively affects the landscape. Preservation of ecologically important territories (including coastal areas) and farming styles and intensiveness were identified as the main agricultural environment factors, which had the most substantial impact on the landscape. The majority of the respondents (63%) stated that farmers should be encouraged by payments to be interested in landscape management and improvement. However, approximately 34% stated it would be better to prevent their harmful farming practices and decrease their non-willingness to preserve the landscape. More than 80% of the respondents agreed that agricultural support played a crucial role for improving the agricultural landscape.

Keywords: *agricultural landscape, farming practices, policy measures, Lithuania.*

THE NATIONAL RURAL INSURANCE SYSTEM IN MEXICO: PRIVATE PUBLIC PARTNERSHIP FOR RISK MANAGEMENT

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Abstract

In several countries there are initiatives to develop agricultural insurance schemes operated either directly by governments or by promoting this market with participation of private companies. Interest in the study of agricultural insurance arise from its impact on the sustainability of agricultural holdings by allowing farmers to conserve their means of production and maintain the capacity to reinvest in the next agricultural cycle in case of losses. In this paper an analysis of the National Rural Insurance System (SNARM), in Mexico is made. The participation of the government is provided by AGROASEMEX, a national insurance institution that functions as an agency for the development and research of the sector. Its functions include promoting the agricultural insurance market, providing reinsurance services to other stakeholders and granting subsidies to support cost of the insured's premium. It also provides support to the operation of the Insurance Funds. Also, the Ministry of Agriculture and Rural Development (SADER) has developed insurance schemes against natural disasters in recent years and provide additional support to producers with access to commercial insurance. There are six companies organized as corporations that have authorization to operate in agricultural and animal insurance. Finally, there is the participation of the producers who have set up 529 Insurance Funds. These are regional associations and they operate with non-profit and mutual principles. As a result, in Mexico there is a developed private-public partnership for risk management, adding to the government and private companies the participation of farmers providing self-insurance.

Keywords: *Risk management, agricultural insurance, insurance funds, catastrophic insurance.*

APPLICATION OF WINE MARKETING MIX IN MONTENEGRO

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Abstract

The aim of this paper is to carry out scientific verification of work method of improving wine marketing in the domestic market in order to increase its consumption. To this end, it is necessary to invest considerable efforts in improving quality, sales channels, promotion and other relevant activities. Emphasis is placed on research and possibilities of better positioning of wine on domestic and foreign market with the application of all marketing mix elements. Only higher presence of marketing, taking into consideration wine characteristics should contribute to its successful placement both on the domestic and foreign markets. Considering that agriculture is one of economic branches and activities where marketing is being applied more and more, it is the same case with the wine. As of recent, wine has become an international product where consumers want more and more to try new wines, most often of high quality. Some research show that regardless the price of wine, consumption of more quality wine shall increase more whereas less quality wine demand shall slightly increase. In previous years, there has been a growing number of small and medium wine producers in Montenegro facing the issues such as how to price their wines, where to market and sell them and what promotion model to use for their wines. With good results, wine as a traditional segment of agricultural production contributes to the development of the economy of the whole country. Wine is a specific agricultural product in Montenegro due to its relatively low domestic consumption and significant export volume. If Montenegro were observed from the point of view of data on exports of various agricultural and food products, then it would be considered as a "wine country". For many years now, this product has registered significant foreign trade surplus.

Keywords: *agriculture, wine marketing, export, promotion, consumption.*

AGRIBUSINESSES AND RURAL DEVELOPMENT: STATISTICAL EVIDENCES OF POTENTIALS TO GROW NIGERIAN ECONOMY

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Abstract

The Nigerian rural economy is driven by 70% of rural subsistent smallholder farmers who produce 90% of Nigeria's food. These proportions of the population are engaged in various agricultural related businesses that sustain their rural households. The persistent decrease in the world crude oil prices has squeezed the Nigerian economy with an estimated population of 182 million people. This situation calls for attention to agriculture to revive the crumbling economy. The agricultural sector in Nigeria contributes 23% of the GDP and employs about 75% of the working population directly or indirectly. Most of these people are engaged in agricultural production, processing, warehousing, marketing and distribution and different agricultural enterprises. Agribusiness therefore becomes a sure way for economic recovery. A robust investment in agribusinesses in Nigeria will enhance job creation, provide income, reduce poverty, improve GDP and improve the livelihood of the rural population. This article made a review of the potentials of agribusinesses in growing Nigeria economy. The research adopted a desktop approach making statistical presentations and analysis of the present agribusiness situations in Nigeria. Documents from the National Bureau of Statistics (NBS) were used as secondary sources of data. The review made policy recommendations based on statistical evidences as reviewed.

Keywords: *Agribusiness, Rural Development, Rural Population Potential, Evidences, Nigeria.*

TOWARDS SUSTAINABLE RURAL ENTERPRISES : ADOPTION STUDY OF INTEGRATED AQUACULTURAL TECHNOLOGIES AMONG FISH FARMERS IN OSUN STATE , NIGERIA

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Abstract

The study was designed to assess Adoption of Integrated Aquacultural Technologies among Fish Farmers in Osun State, Nigeria. Specifically, the personal attributes of respondents were described, level of awareness of integrated aquacultural technologies were determined, identified the sources of information on integrated aquacultural technologies available to fish farmers in the study area and constraints inhibiting adoption were also identified. A purposeful sampling procedure was used to select 150 farmers that registered with Osun State Agricultural Development Programme (ADP) . Validated and structured interview schedule was used to elicit requisite information from the respondents. Simple descriptive statistical techniques were used to summarize the data, while Pearson Moment Correlation was used to make inferential deductions. The results showed that respondents had a mean age of 42.5 ± 8.12 years and majority of them (84.30%) were males. It was also revealed that, higher percentage of the respondents were aware (60.0%) of the technologies. Also, majority (56%) of the respondents adopted 7-9 integrated aquacultural technologies out of (15) integrated aquacultural technologies introduced to them. Extension agents were the information providers for the respondents. In addition there were positive and significant relationships between (AIAT) and educational level (r=0.316) and numbers of ponds owned (r= 0.325) at P≤ 0.05 significant level. It was therefore concluded that regular training and capacity building of the fish farmers would enhanced sustainable fish farming in the study area and Nigeria in particular.

Keywords: *Fish farmers, integrated aquacultural technologies, adoption, sustainable fish farming.*

FFECTIVENESS OF COMMERCIAL AGRICULTURAL DEVELOPMENT (YCAD) PROGRAMME AMONG RURAL YOUTH IN EKITI STATE, NIGERIA

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Abstract

The study described the socio-economic characteristics of the beneficiaries of the Youth Commercial Agricultural Development (YCAD) Programme in Ekiti State, Nigeria. Specifically, it identified type of enterprises in YCAD programme and isolated the factors influencing the effectiveness of the programme in the state. Multistage sampling procedure was used to select 174 beneficiaries/respondents for the study. A validated interview schedule was used to collect data which were summarised with percentages, means and standard deviation while chi-square and correlation were used to draw inferences. Also, factor analysis was used to isolate factors influencing the programme effectiveness. Results showed that the mean age of respondents was 37±5 years, mean household size was 5±2 persons, mean year of formal education was 15±2 years and mean monthly income was ₦41,000±23,000. Results, also, showed that arable crop enterprises (47.7%) and poultry (27%) were the most preferred enterprises by the beneficiaries in the study area followed by tree crops enterprise (12.6%) and aquaculture 12.6 percent respectively. In addition, five crucial factors such as Institutional factor (26.672%), Personnel factor (16.345%), Socio-economic factor (10.626%), Experience factor (9.243%) and Constraints factor (7.506%) were isolated. Further results showed that household size ($r = 0.224$; $p \leq 0.01$) and years of formal education ($r = 0.211$; $p \leq 0.01$) had positive and significant relationship with effectiveness of the YCAD programme. It was concluded from the study that YCAD was highly effective in employment generation, provision of incentives and creation of market for agricultural produce among the beneficiaries.

Keywords: *Effectiveness, rural youth, youth commercial agricultural development (YCAD).*

EFFECTIVENESS OF INDIGENOUS KNOWLEDGE ON CONTROL PRACTICES OF SHEEP AND GOAT DISEASES AND PEST AMONG FARMERS IN IKOLE EKITI, EKITI STATE, NIGERIA

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Abstract

The study attempts to investigate the level of access, use and effectiveness of indigenous knowledge practices in controlling diseases and pests in sheep and goats among goat and sheep farmers in Ikole-Ekiti, Ekiti State, Nigeria. Data were gathered through interview scheduled on 90 goat and sheep farmers. The data were analyzed using descriptive statistics tools of frequencies, percentages, and means to describe parameters such as age, sex, household size, educational qualification, and farm size. Pearson correlation coefficient was used to determine the relationship between the dependent variable and independent variables. The results revealed that the mean age of the respondents was 58 years and 63.3% of the goat and sheep farmers were females. The farmers in the study area had low contact with extension workers. The main sources of information were family members, friends and neighbours and radio. Using sand paper leaf for mange infection and palm oil for bloat was ranked highly effective. The constraint with the highest percentage was inadequate information of the technique used. Based on the result of the Pearson correlation, accessibility had a positive and significant relationship with effective usage of indigenous knowledge practices. Sequel to the findings of the study, it was recommended that agricultural extension services in Ekiti State should make extension agents available in rural areas to educate the farmers on various indigenous knowledge practices.

Key words: *Bloat, diseases, indigenous knowledge, mange, sand paper leaf.*

CONSUMERS' WILLINGNESS TO PAY FOR PESTICIDES FREE APPLE IN DISTRICT SWAT KHYBER PAKHTUNKHWA

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Abstract

This study examines consumers' willingness to pay for pesticides free apple in district Swat of Khyber Pakhtunkhwa province, Pakistan for the year 2018-19. Data were collected through a contingent valuation method (CVM) from a randomly selected sample size of 160 households. Ordinary least square method (OLS) was employed to analyze consumers' willingness to pay for pesticides free apples. The estimated mean value of willingness to pay during the survey period was Rs.11.23 per kg with a maximum willingness to pay of Rs. 80 per kg for pesticides free apple. Results of the regression analysis showed that income and knowledge had greater effect on willingness to pay while, age, education and health consciousness had significant effect on consumers' willingness to pay. As it is evident from the findings of this study, the high income households were aware and able to pay more for pesticides free product than the lower income households. Based on the findings of this study, it is recommended that the government may subsidize costly pesticides free product and conduct awareness sessions about the negative effect of chemical pesticides through mass media which is most reliable source of information. It is also recommended that government should give incentives for those producers who produce pesticides free products.

Key words: *Pesticides free apple, Willingness to pay, Contingent Valuation Method, Swat-Pakistan.*

FARMERS' PERCEPTION ABOUT RESPONSES TO AGRICULTURAL RISKS IN PARACHINAR, KURRAM AGENCY

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Abstract

In almost all management decisions of the agricultural system risk is related to the prices, yield, weather, and uncertainty of resources. There are five types of risks found in agriculture. These risks are production risks, marketing risks, human resource risks, finance risks and environmental & legal risk. The present study is therefore planned to determine factors responsible for the adoption of two marketing responses ie. spreading sales and forward contracting, by using bivariate probit approach. For this study, using a multistage sampling technique, four villages in two tahsil of Kurram Agency of Pakistan are selected randomly and a total of 110 respondents were selected randomly for data collection. The results indicate that most of the farmers in all regions are literate, owner-cum-tenants and small farmers. The results from bivariate probit model signifies the importance of farmers' perception and their access to information and credit sources in their decision to adopt the risk management tools. The results of the study also indicate that off farm income, risk of pest and disease, risk of heavy rain and agriculture credit significantly encourage the desire to adopt Forward Contract while family size strongly discourage the desire to use Forward Contract to manage farm risks. In case of Spreading Sale financial risk, agricultural credit and access to information significantly encourage the desire to adopt Spreading Sale and the risk of heavy rain strongly discourage the desire to use Spreading Sale to manage farm risks. Based on the findings of the study, it is recommended that government should launch training programs to educate farmers regarding the state-owned risk management tool (crop loan insurance scheme). Credit access of the farmers should be enhanced through simplifying and shortening the sanctioning period and procedure. Moreover, the banks should accept livestock and/or crop as collateral in advancing loans to farmers.

Key words: agriculture, risk, survey.

THE ECONOMIC AND SOCIAL EFFECTS OF LIGHTING DEVELOPMENT IN THE FIELD OF FISHING ON THE PRODUCTIVITY OF FISH WEALTH IN THE GAZA STRIP

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Abstract

The present study aimed at identifying the impact of the introduction of modern innovations of marine lighting in the Gaza Strip on the socio-economic aspects of the fishing sector. The study used the analytical descriptive method to identify the effects of marine lighting on the fishing sector. The study relied on the secondary and primary data collection, where the method of literature review related to the research subject was used to form a theoretical framework for the subject of the study. Moreover, the questionnaire was used as a tool to collect primary data: over the study population of 300 fishermen in Gaza city, 120 questionnaires were distributed and 85 valid forms were retrieved for analysis purposes. The study concluded with some results on different aspects. The most important result was the presence of a significant effect between the aspects of development in the field of marine lighting in the Gaza Strip, the size of fisheries production and the cost of marine production. Moreover, marine lighting resulted in the development of different aspects of marine management, including the volume of fisheries production in the Gaza Strip of 0.50: the expansion in the field of marine luminescence and double use would contribute to increase in the volume of fish production by 50%. In addition, the expansion of marine lighting and the doubling of its use would contribute to the reduction of marine production costs by 65%. Finally, the results showed that the use of the central lighting method positively influenced the development of the marine management by a factor of 0.735: the introduction of lighting technology contributed to the development of aspects related to maritime management by 73%. The study recommended the use of central luminescence by the official authorities supervising the fishing sector and supporting the efforts of continuous development of the fisheries. The study recommended the need to expand the use of marine light in the various geographic regions within Gaza Strip.

Keywords: *fishing sector, marine lighting, development, Gaza Strip, production.*

SMART RURAL ENTREPRENEURSHIP – AN EUROPEAN PERSPECTIVE

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Abstract

Smart Specialization is a place-based and innovative approach that aims to boost growth and jobs, by enabling each region (nation) to identify and develop its own competitive advantages. It is strongly supported by European Union regional policy based on three pillars: being smart, being sustainable and fostering inclusive growth. Smart Specialization of regional economies should implement these goals. It is also a useful tool to meet local challenges at the national level, such as demographic changes, limited access to natural resources, energy security and climate change. Especially regarding rural development challenges, these aspects seem particularly important. The concept of smart specialization in the context of regional and local development is an approach based on strengthening potentials and developing modern solutions based on this potential. Rural areas are regions with a significant potential that requires proper use. The main goal of this paper is to analyze smart specialization from the perspective of rural regions. We focus on economic activity in rural areas and their relation with smart specialisation strategies. The research question is: what is the significance of rural regions in implementing smart specialization strategies? The sample includes European countries characterized by Smart specialization priority areas and entrepreneurship in rural areas. The research findings may help the monitoring and evaluation of national and regional smart specialization strategies (RIS3) and indicate the endogenous potential of rural regions.

Keywords: *Smart specialization, rural regions, entrepreneurship, cross-country analysis*.

CREATING SUSTAINABLE DEVELOPMENT OF RURAL AREAS

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Abstract

Rural areas account for around 93% of Poland territory, and they play a very important role in social life and the economy. Rural areas are places of residence and employment, but they are also recreational sites which enable visitors to enjoy unspoiled nature. Rural areas are suppliers of raw materials and products, but they are mainly providers of space for other functions. For these reasons, rural space should be managed effectively and in line with the principles of sustainable development. The aim of this study is to denote the limits of human activities in relation to the natural environment, to estimate the extent to which human needs can be satisfied with the existing natural resources, and to determine the permanence of the three pillars of sustainability. A universal approach to the implementation of sustainability strategies has never been proposed because space is a highly diverse phenomenon that requires a multidisciplinary, multidirectional and multicriteria approach. The relevant indicators are developed by measuring the constituent elements of eco-development: balanced development, permanent growth and self-sustained development. The presented studies rely on the following research hypotheses: Sustainable development of rural areas is a conscious transformation process during which human needs must be aligned with the needs of the natural environment. As the result of the research the optimal directions of sustainable development were identified in view of changing external circumstances, including legal, social and economic. Institutional and spatial domains have been proposed as the fourth pillar of sustainable development.

Keywords: *Rural areas, Sustainability, Environmental protection.*

ANALYSIS OF CHANGES IN RURAL AREA AS A RESULT OF CITY BYPASS CONSTRUCTION

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Abstract

After Poland accession to the European Union, there was a rapid development of the road communication network. In the first years, an intense increase in the length of motorways was noticeable. Currently, construction of many city bypasses is being implemented in Poland. Bypasses are necessary, among others in order to ensure transport smoothness, safety and minimize the emission of harmful substances into the atmosphere. At the same time, they are an element of an expansive character, excluding from agricultural production land useful for agriculture, affecting the landscape and the environment, as well as forcing changes in the planning and development of space in their neighborhood. The use of GIS tools, through spatial analyzes already at the road planning stage, helps to minimize the negative impact of bypasses on the environment, the spatial structure of neighboring areas, and the conclusions of the analyzes help to prevent and mitigate conflicts on the investment-local society line. The article presents changes in the spatial structure of agricultural areas as a result of the construction of the bypass. Particular emphasis was placed on the presentation of the method of managing the areas adjacent to the bypass. The transformations of the function of areas which take place after the construction of the bypass were analyzed, when typically agricultural areas were changed into non-agricultural areas. The ability to determine the directions of changes occurring in space is necessary to make the right decisions taking into account the development of cities, intensity and the nature of the use of space. It helps to create a suburban space and control the processes of "city sprawl". The results of the research were presented on maps, charts and tables. The results of the research are important especially for the developing countries of Central and Eastern Europe, where the proper development of the road transport network is an important element regarding the development of the economy of the country.

Keywords: *bypass, rural area, land use, land function.*

PROBLEMS OF THE AGING OF THE FARMERS' POPULATION IN SMALL FARMS IN POLAND

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Abstract

The human factor plays a very important role in the production processes of the commercial sector enterprises. Its importance is now also large in many sectors of the national economy and in the economic development of local communities, regions and states. Not only the number of people, but also their age and the ability to work is important. Nonetheless, formal and informal qualifications of employees, their level of education and professional experience are also important. All these factors affect the competitiveness of business entities in which they work and which they manage. Population aging is perceived in many branches of the economy, and agriculture and rural areas are also heavily affected. The research carried out concerned the group of owners of small farms operating in south-eastern Poland. They were implemented as part of the SALSA project "Small farms, small food and sustainable food and nutrition security". As indicated by the conducted research, most of the small farms are managed by people at a mature or older age. The share of people aged up to 40 years was at the level of 20.2%. This shows that young people are mostly not interested in running small farms. The level of education of farmers was also low, which was particularly evident in older age groups. Many older farmers also spoke negatively about the future of their farms, which was often associated with the lack of successors. The presented results prove the existence of many problems resulting from the aging of small farm owners and the need to undertake remedial actions.

Keywords: *demography, farms, aging.*

CONSUMER BEHAVIOUR AT THE LOCAL FOOD MARKET

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Abstract

Consumer behaviour at the food market is determined by several factors which can be classified as external and internal. Literature review points out that the most important factors are economic components, however economic, social and environmental circumstances cause the emergence of new factors affecting consumers' decisions. The following can be listed among them: consumer ecological awareness, ethical food production, production in line with traditional methods, paying special attention to the quality of food processing, place and manner of food production, place of purchasing food or distribution channels. The paper presents the results of the surveys carried out in 2018 among 371 residents of the Małopolska Province, the aim of which was to determine the attitudes and behaviours of consumers at the food market with special regard to local products. Based on the conducted studies it has been determined that about 1/3 of surveyed respondents prefer buying food on local markets. A third of the contents found in the food products baskets come from local producers. The respondents were also surveyed in terms of reading labels on food products, and it was found that while percentage of such responses is quite high among women (63%), it is very low among men (18%). Four out of five respondents always or sometimes check the price of the products before purchasing them, thus this factor strongly impacts their decisions. The interest of consumers in local food and ability of local producers to meet this demand in the near future will build opportunities to strengthen as well as expand small farms and small food businesses.

Keywords: *consumption, local production, consumer behaviour*.

SALE AND LEASE OF AGRICULTURAL LAND FROM THE AGRICULTURAL PROPERTY STOCK OF THE STATE TREASURY IN POLAND

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Abstract

Selling agricultural real estate properties is the permanent and most desirable way of distributing the state's property. Since its foundation until the end of 2016, the Agricultural Property Agency sold 2 703.6 thousand ha of land (57.03% of the total land transferred to the Agricultural Property Stock of the State Treasury). The amount of land sold depends on economic circumstances (economic standing of buyers, dynamics of land prices) and on legal regulations of the agricultural land trade (e.g. suspending the sale of agricultural properties which belong to the State Treasury), which resulted in decreasing land sale in 2015-2016. In the early days of transformation, lease was a widespread form of land use in the Polish agriculture. With time, it was becoming less popular. Leasers maintained that the land lease did not ensure land management security (the contract can be easily terminated) which added to the uncertainty intrinsic to any type of farming, and in particular to plant production, which is heavily dependent on factors beyond the control of farmers. In recent years, the importance of farmland lease has regained its importance. Apart from Poland being a European Union member state, this was also affected by amendments in Polish law, whereby the sale of agricultural land owned by the State Treasury was suspended. It is a widespread practice to lease farmland, but lease contracts are often informal and there are no official statistics available with respect to this subject. The area of agricultural land leased by individual farmers (including informal contracts) is much higher than declared (statistically verified). In the future, it is likely that transactions done on the private market will become more important. The supply-side in this case could be represented by both farmers who have farmed land for generations and investors, who have bought farmland to sell it at a profit.

Keywords: *agriculture land, farmland, agricultural land trade.*

INNOVATIVE LEARNING ARRANGEMENTS FOR RURAL AREA DEVELOPMENT

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Abstract

Innovation is a key element of modern societies and economies, and that includes the way how people learn. Regional learning and innovation is a key to promote more esilient, robust and inclusive rural areas OECD (2006) stated that rural development policies need to focus on places instead of sectors to ensure more dynamic rural areas in an era of globalisation. In the process of building the competitiveness of rural area, learning skills of people and organisations are key factor. The goal of this paper is identification and design of innovative learning arrangements for rural area development. Based on literature and surveys carried out at the Agricultural Advisory Centre in Krakow, modern methods of so-called active didactics were identified, the conditions in which the methods were applied and/or the conditions that should occur. The Kirkpatrick model was taken into account in the evaluation of methods. The model is based on the effectiveness analysis at 4 levels, creating a related chain (reactions, knowledge, behaviours, and results). The Kirkpatrick model utilises the concept of ROE (Return on Expectations), and thus evaluates the effectiveness of the training, comparing the achieved effects with the expected ones. The four levels of evaluation are closely related in such a way that each subsequent one is dependent on the previous one. The conditions of applying the model as well as the advantages and disadvantages were described in the context of the proposed methods of active didactics.

Keywords: *innovation, active learning, Kirkpatrick model, rural area.*

FINANCING NON-AGRICULTURAL ACTIVITIES IN THE RURAL REGIONS OF ROMANIA. A REAL SOLUTION FOR RURAL DEVELOPMENT AT THE BEGINNING OF THE SECOND DECADE OF EU MEMBERSHIP ?

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Abstract

The current paper intends to present the non-agricultural rural economy from Romania. Following the end of the centralized communist economy it still lacks a private sector strong enough in order to ensure production and services at an appropriate level. That is why the financing of non-agricultural activities through National Rural Development Programme (NRDP) was one of the requested financing lines by the beneficiaries. For that purposes the present paper intends to present the situation of the European funds available for the financing of non-agricultural activities for the 2014 – 2020 financial period using the publicly available information. The financing line analysed is the Sub - measure 6.4. Investments in the creation and development of non-agricultural activities. The paper would use a quantitative method in order to emphasize the interest of potential beneficiaries toward this type of activities. That would provide enough empirical evidences concerning the interest of potential beneficiaries of the financing.

Keywords: *NRDP; non-agricultural activities; financing; Sub- measure 6.4.*

CONSUMERS' PREFERENCE AND ATTITUDE REGARDING ONLINE FOODS IN CAHUL, MOLDOVA

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Abstract

In a global society, the online transactions have gained significant place to characterize the act of trade. For the food sector, online trade has opened business opportunities for the economic agents in EU member countries. In contrast, non-EU countries show a more unstable development of this type of trade. In order to quantify the impact of the development of online food trade, through the study, we aimed to evaluate consumer's preferences and attitudes towards online food trade. To achieve this goal, we sampled a representative group of consumers from the Republic of Moldova, a country with a predominant agrarian economy. Three hundred participants were randomly chosen and data were collected through face-to-face interviews using a structured questionnaire. The methodology of the study was based on interpreting of the results of the questionnaire in the areas of interest like availability, economic efficiency, the attractiveness of the trade method, and aspects of food safety and food security for online traded foods based on an econometric model. The results of the study highlighted the vulnerabilities of the online food trade system in the Republic of Moldova and the interferences of globalization on changes in consumer behavior.

Keywords: *Food safety, Online food consumer, Econometric model, Consumer behavior.*

COW MILK ROUTE FROM ROMANIAN DAIRY FARMS TO MARKET

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Abstract

Milk is obtained in all countries of the European Union and occupies an important place in the economy of the Member States. In Romania the raising of dairy cows is a tradition among the inhabitants of rural and mountain areas. In this regard, the paper presents data on the production and marketing of cows milk for human consumption in Romania. The period covered is from 2010 to 2017. The following data were analyzed: the dairy cow herds, the total cows milk production in Romania and the place occupied with this production in the EU countries, the selling price of cows milk, the position occupied by Romania in the top of the main importers and exporters of cow milk worldwide. Following the analysis, it was noted that the dairy cow herds were steadily decreasing for the analyzed period, starting with 2010. The largest amount of cow and buffalo milk was produced in Macroregion One, on individual agricultural holdings, and the smallest quantity in individual agricultural holdings in the Macroregion Three. In 2017, Romania recorded the lowest price, among the EU countries, for 100 liters of raw cows milk, with an actual fat content. As far as exports were concerned, Romania was ranked 29th in the list of exporters of cows milk worldwide and ranked 19th among importers. The information found in this article was taken from specialized websites such as Eurostat, Faostat and ITC.

Keywords: *Cow milk, Dairy farms, Milk production, Romania.*

ASPECTS REGARDING THE PRODUCTION AND MARKETING OF APRICOTS IN ROMANIA DURING 2012-2017

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Abstract

The paper focuses on the evidence of the main quantitative aspects regarding the production and marketing of apricots in Romania during 2012-2017. Currently, there is a growing demand for apricots worldwide because they are characterized by a high food value. In essence, the chemical composition of apricots is different depending on the variety. It is necessary to specify that the chemical composition of apricots is determined to some extent by certain factors, such as: culture technology, degree of maturity, climatic factors, etc. The apricot is part of the *Rosaceae* family, the genus *Prunus* L. and the *Prunophora subgenus*. In Romania, the number of apricots is small compared to the number of plum trees and apple trees. To reflect as objectively as possible the evolution of apricot production and marketing in Romania, the key indicators specific to this sector of activity were analyzed. Among the indicators analyzed there were: the area cultivated on national level, apricot production at national and macroregional level, average price for apricots, total apricot consumption, import and export of apricots. Romania is not among the top 10 world apricot producers, unlike the top 10 plum producers, where it ranks second, after China. In Romania, there are favorable conditions for apricots, allowing the expansion for the surfaces cultivated with apricots. The specific data used in this paper were taken mainly from the National Institute of Statistics and from international sites. As a conclusion, domestic apricot production, nowadays, cannot cover the consumption needs of the population, which may increase the interest of growers in this crop.

Keywords: *apricots, total production, imports, exports, Romania.*

DIGITALIZATION ECONOMY OF AGRICULTURE OF RUSSIA: AN EXPLORATORY SURVEY

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Abstract

The national program "Digital economy" was adopted in Russia in 2018. As part of the implementation of this program, the Ministry of agriculture of the Russian Federation has developed a departmental project "Digital agriculture". The main goal of the digital economy is the digital transformation of agriculture through the introduction of digital technologies and platform solutions that provide a technological breakthrough in agriculture and achieve productivity growth in the "digital" agricultural enterprises twice by 2021. General and specific methods and algorithms of agricultural digitalization can be distinguished for regions. Among the General we can highlight the need for the formation of the digital space of agriculture in the form of databases, new descriptive methods and programs. Specific methods will be to ensure the tasks of production growth, which will be associated with the specialization of territories. At present, the informatization of agriculture, digitization of soil resources, the introduction of electronic records of livestock and their movements. The entire production process from sowing to sale is described in databases and allows you to obtain data on the status and stage of production anywhere in the region. Of particular importance are the mechanisms for stabilizing agricultural production in various climatic zones, not only in the country but also in the region. The further development of digital technologies requires an assessment by these pilot organizations of the transition to mass implementation of the presented designs and projects. Implementation of digitalization involves its implementation in several stages, the timing of which is adjusted in accordance with the unfolding horizons and prospects. Currently, the main directions of digital transformation of agriculture in the framework of the departmental project "Digital agriculture", which include the following areas: Effective hectare, Smart contract, AgroExport, Smart solutions for agribusiness, "Land of Knowledge". In addition to special programs for the digitalization of agriculture, Russia has developed a State program "Integrated Development of Rural Areas", taking into account the needs of digitalization and innovative ways of integrated development of agriculture in connection with the development of rural areas. Digitalization of agriculture is possible only on the basis of conceptual high-performance interaction of economists-farmers, authorities, business representatives, as well as programmers specifically focused on the agricultural sector, with knowledge of the features of its technological processes and of the economic mechanisms of their implementation.

Keywords: *Digital economy, Agriculture, State program, Russia.*

PERSONNEL POTENTIAL AND ITS ROLE IN THE SUSTAINABLE DEVELOPMENT OF RURAL AREAS

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Abstract

Sustainable development of rural territories is based on their stable socio-economic growth. The latter is impossible without an increase in agricultural production, improvement of agricultural efficiency, achievement of full employment of the rural population and increase of their life quality, efficient land use. High skilled workers in agricultural production can help to meet the challenges of the growth of agrarian economy in general. Modern personnel potential is for agrarian sector a carrier of innovative knowledge and techniques that are necessary for best practices and technologies related to the production and management of agribusiness. Human resource capacity-building is a multifaceted process, based on the agricultural education. Currently, Russian agricultural education is seeking new growth points. The difficulties occurred in the education industry linked to political and structural economic changes in Russia at the end of the 20th century. The decrease in the level of economic development, worsening of the demographic situation, reducing industrial and technological capacity, falling productivity and wages in the countryside reflected in prestige and popularity of agricultural education. In 2018 in higher education there were 1314 organizations attended by more than four million students. Less than 4% of students study agriculture and related courses. The "Strategy of development of agricultural education in the Russian Federation up to the year 2030» aims at improving the content and technology realization of educational programs through computerization and the introduction of new learning technologies. In this regard, a significant role in raising the educational level of rural residents can have their distance learning processes based on digital communications.

Keywords: *rural areas, sustainable development, human resources, agricultural education, distance learning, digital communications.*

RISK ANALYSIS IN THE PEASANT FRAMEWORK OF RURAL WOMEN FARMERS IN RWANDA

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Abstract

The agricultural sector accounts for a third of Rwanda's GDP (**G**ross **D**omestic **P**roduct) and 76 per cent of economically active Rwandan women are engaged in farming activities. Yet, they do not have the same access to land, production inputs, finance or markets as men. This impacts them negatively as well as their dependants. Their needs and the drive to improve their livelihoods would be achieved if they have partner with Joint UN Programme, "Accelerating Progress towards the Economic Empowerment of Rural Women. In addition, it would be better if there is a clear collaboration between these women and international organisations to help them eradicate poverty as well as getting developed. Going forward, UN Women and partners would continue build good relationship with these rural women to attain noticeable achievements and empower women farmers as well as reaching new beneficiaries. All in all, if a rural woman is empowered, financed and funded by both government and international organisations, the country will get sustainable development and poverty will be eradicated forever. This is because a rural woman is involved in different developmental activities such as: environmental protection, farming, animal husbandry, educating and household chores, etc. The accomplishment of these will lead to a better standard of living for all Rwandans since a wife is the root and at the same time a backbone of a family which is considered as a basic unity in our country.

Keywords: *risk analyses, agriculture, rural women.*

MIGRATION DECISIONS AMONG RURAL HOUSEHOLDS IN RWANDA: WHAT DOES THE PUSH-AND-PULL MODEL REVEAL?

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Abstract

A country economic status is strongly linked to the transition of its population from one area to another. This, because labor and other forms of migration, has a two-fold advantage: (I) resourcing the targeted location by skilled labor force, and (II) improving migrant households' livelihoods by lowering the vulnerability level. This research aimed at understanding the factors affecting migration decisions among rural households in Rwanda. Data on internal migration were collected in 5033 rural households in 2016/2017 as a part of the fifth nation-wide cross-sectional survey on the Households Living Conditions, and analyzed using the binary logistic regression model. The major findings showed that internal migration was higher in Southern (31.9%) and Western (24.3%) provinces, where official reports pointed out a high level of poverty. The lower rate was observed in Kigali City (3.5%) which was actually considered as richest area and the most internal migration 'pull factors' (jobs and other livelihoods opportunities) offering zone. Results also revealed that, on one hand, being from a rural area, the age, having a large household size, having advanced education level, and being an female household head were the '*push factors*' increasing by around 30% and more the probability of deciding to migrate to another region. On the other hand, owning a land and being reach decreased the likelihood of moving to other zones. This leads to affirm that employment opportunity and availability of diversified livelihoods sources in receiving regions constitute the main '*pull factors*' of migration decisions at rural household level. In light of these findings, it is recommended to (I) ensure more balanced regional growth and opportunities for increased access to off-farm employment for a larger proportion of the rural population and (II) carry out a study on the effects of migration on the livelihoods of migrant-sending households in order to make a thorough and refined situational analysis.

Keywords: *Internal migration, Pull factors, Push factors, Rwanda.*

EFFECT OF MICROFINANCE ON SMALLHOLDER FARMERS' LIVELIHOOD IN RWANDA: A CASE STUDY OF NYAMAGABE DISTRICT

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Abstract

Microfinance in Rwanda is considered as one of the most crucial mechanisms in the implementation of the Government program to reduce poverty and to increase economic growth. However, despite the effort made by the Government of Rwanda to put in place microfinance institutions in rural areas, little is known about the effects of microfinance on smallholder farmers' income in Nyamagabe District of Rwanda. This study aimed at examining the contribution of microfinance services to the income of smallholder farmers in Nyamagabe District. Primary data were collected from 240 respondents randomly selected in 3 sectors of Nyamagabe District using structured questionnaires. Data were analyzed using descriptive statistics to describe the socio-economic characteristics of the respondents and Propensity Score Matching was used to assess the effect of microfinance on smallholder farmers' livelihood. The results from descriptive statistics showing that 117 respondents were participants in microfinance services and 123 were non-participants and more men were committed to participate and to access microfinance services than women. Results from Propensity Score Matching Model using both Kernel Based Matching and Nearest Neighbor Matching showed that the households participating in microfinance services increased their total annual income by 256,674 Rwandan francs and 228,246 Rwandan francs more than non-participants, respectively. The study recommended that smallholder farmers should be encouraged to participate in microfinance services to increase their income and agricultural productivity. The use of SACCOs and microfinance services needs to be promoted in order to provide an instrument for mobilizing savings and extending credit.

Keywords: *Microfinance, Smallholder farmers, Livelihoods, Rwanda.*

LEVEL OF KNOWLEDGE OF EEXTENSION PPERSONNEL IN THE KINGDOM OF SAUDI ARABIA ON GLOBAL GOOD AGRICULTURAL PRACTICES

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Abstract

The Ministry of Environment Water and Agriculture (MEWA) in Saudi Arabia has recognized the role of Good Agricultural Practices (GAP) and its impact on increasing quality, quantity, and the competitiveness of agricultural products. The MEWA has therefore sought to award a certificate of national GAP to farmers (Saudi GAP) through a local network linking farmers and trademark owners. Through the application of GAP with a view to creating a sustainable future. The purpose of this paper is to study the level of knowledge of agricultural extension workers in Saudi Arabia in terms of good agricultural practices through investigation their opinions on: the benefits of obtaining a Saudi GAP certificate, the importance of applying good agricultural practices, and information farmers should include in farm records. Data were collected from a sample of 102 agricultural extension workers in some regions of the Kingdom during the period from April to May 2019 using an electronic questionnaire. Frequency, percentage, and range were used in data presentation and analysis. Results of the study revealed that applying of GAP would help on: sustainable use of irrigation water and modern irrigation methods (74% of respondents), implementation of IPM programs, pesticide reduction, safe disposal of waste and contaminants and ensuring that they are not near work sites (73%), compliance with the law (system) of seedlings, fertilizers and soil improvement materials (72%), easy management of farm using farm book keeping (72%), following necessary hygiene instructions (69%), and periodic maintenance of production tools and equipment (66%). Result also revealed that, 88% of respondents had good knowledge of the benefits of obtaining a GAP certificate, (76%) of the respondents said that GAP implementation was significant, and (83%) said the GAP implementation characteristics were significant.

Keywords: *Agricultural Extension, Saudi GAP, Knowledge, Saudi Arabia.*

ECONOMIC ASPECTS OF HAZELNUT PRODUCTION IN REPUBLIC OF SERBIA

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Abstract

Areas under hazelnut made 1.8% of total areas under fruits in Republic of Serbia in 2017 and significant increase was recorded in comparison with previous period (7.9% relative to 2016 and 19.1% in comparison with 2015). In this work, costs and achieved results in hazelnut production are analyzed on the agricultural holding from Republic of Serbia which is primarily involved in crop production. The main aim of the research is to determine profitability level in hazelnut production. Average hazelnut production in the world, from 2008 to 2017, was 863,847 tons. Turkey predominates with 66.3% share in world production, then follow Italy with 12.3% and Azerbaijan with 3.8%. Hazelnut production demands high labor share primarily because of the fruit collection and crunch the hazelnut. Because of that, in the cost price structure labor cost are dominant with 37.7%, followed by depreciation of equipment costs with 34.6%. Material costs made 12.1% of total production costs. Coefficient of economy is 2.23 and profitability rate is 55.1%. Investment in raising the plant is payed for 9 years and 259 days, which is relatively long period of time but it is important to emphasize that the period of profitable orchard exploitation can be more than 50 years. Also, investment in modern equipment can additionally intensify hazelnut production which represents good way for increasing earnings of agricultural holdings, with multiple positive effects on increasing export, rural and whole agrarian sector development in Serbia.

Keywords: *Hazelnut, profitability, coefficient of economy, agricultural holding.*

ANALYSIS AND PREDICTION OF APPLE PRODUCTION IN REPUBLIC OF SERBIA AND BOSNIA AND HERZEGOVINA

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Abstract

The Republic of Serbia and Bosnia and Herzegovina are characterized by excellent natural conditions for apple production. The paper analyzes the parameters of the apple production in the Republic of Serbia and Bosnia and Herzegovina in the period 2006-17. The analysis was performed by descriptive statistics. The prediction of apple production parameters in the next year was carried out based on a linear trend model and moving average. The following were analyzed: area harvested (ha), yield (t/ha) and total production (t). In Serbia, there were 24.760 hectares of apple on average and in Bosnia and Herzegovina 19.040 hectares. The average apple yield was 12,7 t/ha in Serbia and in Bosnia and Herzegovina 3,43 t/ha. In the observed period, there was a growing tendency to yield 3.78% in Serbia average per year, and for Bosnia and Herzegovina, there was a negative rate of change of 1.17% average per year. The average annual apple production in Serbia was 313.177tons and in the analyzed period there was a growing tendency of 4.22%. In Bosnia and Herzegovina, the average annual apple production was 65.186 tons and in the analyzed period there was a negative rate of change of 0.96%. In the next year, the Republic of Serbia should achieve apple production of 431.305 tons, while Bosnia and Herzegovina should produce 60.657 tons.

Keywords: *Apple production, Prediction, Republic of Serbia, Bosnia and Herzegovina.*

COMPARATIVE ANALYSIS OF ONION PRICES

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Abstract

This paper analyzes the prices of onion. The main goal of this study is to use quantitative analysis to find out the trends in onion price movements and to make a comparative analysis of onion prices in Serbia, Macedonia and Entity of Republic of Srpska (Bosnia and Herzegovina). The onion prices are analyzed for the period 2012-17. The prices in the study are based on the average annual prices. The quantitative analysis was performed by using the method of descriptive statistics and the average annual change rate to determine the trends in changes for the analyzed period. The average annual price of onion in Serbia was 182.40euro/t. The price fluctuated in the interval between 159 and 208euro/t. The price variation in the observed period was low (CV=10.42%). The price of onion in Serbia showed a slightly negative trend, almost stagnation. The annual change rate of onion prices in Serbia in the analyzed period was -0.76%. In Macedonia, the average annual price of onion was 304.07euro/t. The price varied in the interval between 259 and 392euro/ton. The price variation in the observed period was medium (CV=16.90%). The price of onion in Macedonia showed a very slight negative trend, almost stagnation. The annual change rate in the analyzed period was -0.05%. In the entity of the Republic of Srpska, the average annual price of onion was 276.07euro/t. The price ranged between 195 and 364euro/ton in the analyzed period. The price of onion in the Republic of Srpska showed a negative trend. The average annual change rate in the analyzed period was -3.55%. The lowest price of onion was in Serbia. In the Republic of Srpska, the price of onion was 51% higher, while the price in Macedonia was 10% higher than in the Republic of Srpska, and 67% higher than in Serbia. The prices of onion show a negative trend in all analyzed countries (entities).

Keywords: *onion, price, Serbia, North Macedonia, Republic of Srpska.*

FARM PRODUCTION EFFICIENCY IN SERBIA

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Abstract

Process of farm structure changes in Serbia has sped up. Significant decrease of farm number followed by increase of average resources motivates farmers to re-examine their production types. Farm production efficiency becomes more important to understand how they adjust production strategies. The main goal of this paper is to investigate the technical efficiency farms in the regions of Serbia during 2017. All data for 1420 farms used in research originates from Farm Account Data Network (FADN) database. The efficiency analysis is performed on the basis of two criteria: region and production type. In order to determine technical efficiency, input-oriented Data Envelopment Analysis (DEA) with variable return to scale (VRS) was used. The results reveal that farms in region Serbia North are in average more efficient than farms in Serbia South. Also, among production types in plant production higher average efficiency scored farms oriented on horticulture indoor and outdoor, as well as fruit producers. In livestock production types higher average technical efficiency is reached by farms focused on poultry and pig production

Keywords: *Farm, Efficiency, DEA, FADN, Serbia.*

THE OPERATIVE PROFIT MARGIN IN RETAIL FOOD

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Abstract

Both theoretical and practical importance have recently been attached to an analysis of the operating profit margin or earnings before interest, taxes, depreciation and amortization (EBITDA margin) as a measure of the long-term performance of companies. In the integrated financial reporting it is presented through various indicators based on it. In view of this, we have made a comparative analysis of the operating profit margin and its impact on the performance of food trade companies in Serbia and comparable countries. Under the influence of different factors, the dynamics of the size of the operating profit margin of food trading companies in Serbia varies from comparable global food retailers in various countries. The EBITDA margin of the leading food trading companies in Serbia is lower than the in analyzed comparable food retail trade companies. It points to the conclusion that it is necessary to efficiently manage revenues, costs, profit, assets, and financial structure in order to improve the performance of food trading companies in Serbia in the future**.** The general conclusion is that it shows a growth tendency and is, nevertheless, lower in comparison to food trading companies from countries of a developed market economy. In order to increase the operating profit margin, as a measure of long-term performance, it is necessary to manage the financial structure of the food trading companies in Serbia as effectively as possible. (JEL codes: L81, M31, M41, O32)

Keywords: *net profit, interest, tax, depreciation, amortization.*

THE INFLUENCE OF PRODUCTION IN THE PREVIOUS YEAR ON SOWING AREA IN THE NEXT YEAR REGARDING PRODUCTION OF INDUSTRIAL CROPS IN SERBIA

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Abstract

This paper analyzed the influence of total production of certain kind of industrial crops on sowing area in the next year in Serbia for period 2005-2018. The observed industrial crops were: sugar beet, sunflower, soybean, tobacco and oilseed rape. The data were taken from official publications of Statistical Office of Republic of Serbia. Quantification of that influence was solved by adequate and statistically valid regression models. The analysis was initiated by determining the correlation between the total production and sowing area for each crop separately. It was found that there was statistically significant correlation between total production and sowing area for all types of industrial crops, except tobacco. In the continuation of the analysis, based on the defined regression models, it was established that there was a statistically significant impact of the previous year production on the sowing area in the next year only in soybean production. The obtained results point to the significant influence of some other factors, primarily the price. The conducted analysis enables a complete overview of the production of industrial crops in Serbia for a long-time period, what is the basis for forecasting and making business decisions.

Key words: *industrial crops, regression analysis, Serbia.*

RISK AS AN ELEMENT OF MICROECONOMIC ANALYSIS OF AGRICULTURAL ENTREPRISES IN SERBIA

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Abstract

Profit is the most important goal of any agricultural enterprise. It is in connection with the creation of the value and of enterprise positioning on the market. But, profit is always under the pressure of business risk as a consequence of external and internal factors i.e. natural causes, policy measures, market circumstances, technical and/or man failure, etc. So, in the paper authors are discussing the logic of financing the operation of agricultural enterprises in the circumstances of permanent business risk. They, at first, are identifying the basic methods of quantification the business risks such as method of probability distribution, method of simulation and method of sensitivity analysis and are trying to predict potential profit in different market circumstances (the state of boom, normal market conditions and the state of recession). Upon such analysis they are calculating expected values using standard financial and statistics methods. As the business risk is relatively difficult to predict, authors are examining the consequences of all three methods and calculate the profit by increasing the values of main operating variables within agricultural enterprise production process. They are presenting the cash flow during several years (sales volume, product prices, variable costs, initial outlay and cost of capital) and are discussing the results using different risk probability levels i.e. the level of risk acceptable. Finally they are trying to comment the possible outcome of such analysis and its importance as an additional guidance to the managers of agricultural enterprises and its production/investment decisions.

Key words: *Risk analysis, Agriculture, Enterprises, Decision Making.*

CROP PRODUCTION IN THE COUNTRIES OF THE WESTERN BALKANS

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Abstract

Crop production is one of the most important branches of agriculture and represents the raw material base for other agricultural production. Areas under basic crops have a dominant share in the structure of sown areas, and the value of realized yields significantly participates in the GDP of the observed countries. The agrarian budget is an integral part of the total budget of each state and its size speaks about the importance of agriculture in the observed country. The authors analyzed achieved yields for the countries of the Western Balkans, candidate for EU members in all phases. Data for the Republic of Serbia, Bosnia and Herzegovina, North Macedonia and Albania are compared for the production of wheat, corn, rye, barley and sunflower. On the basis of the obtained results, production can be estimated in the next few years for each country in the region. Although, countries with different sizes and different areas for crop production are suitable for comparison of areas and yields over a longer period of time and allows noticeable changes in the structure of production, progress in the yields of individual production, etc. The obtained results enable the assessment of the market supply and self-sufficiency of each country in the near future as well as the potential for export. Adjustment of agrarian policy through the introduction of subsidies and reliefs, as well as the forcing of certain production, allows negative trends to be stopped and the dependence on imports decreases. This is especially important for strategic agricultural products.

Keywords: *Wheat, Maize, Barley, Rye, Sunflower, Country of Western Balkan.*

STRATEGIC APPROACH TO LAND CONSOLIDATION

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Abstract

Land consolidation is defined and considered as the process through which the fragmented parcels and land ownership are grouped into more functional shapes. Consequently it contributes to reduction of agricultural production costs, increment of agricultural production and consequently increases the competitive potential of agricultural production in certain country. The development of agricultural production is one of more significant aims in contemporary society because of rising demand for food. On the one side the demand for food is expecting to rise, while on the other side the land could be considered as non-renewable and limited resource. What more, the food industry is nowadays treated as commercial issue what additionally increase the complexity of food security problem in the future. Bearing in mind that food is mostly produced by agriculture immediately follows the very big importance of agricultural land. Land consolidation as a process of grouping fragmented land ownership is not only mechanical approach in that direction, actually it allows the improvement of land involved functionality. The functionality of land included in land consolidation process is reflected in increasing efficiency of agricultural production obtained by improvement of road and channel network, regularization of parcels shapes and their grouping. Considered on the level of the country the land consolidation could influence the increase of gross domestic products, food safety and instigate sustainable economic development. In that sense, decision of providing land consolidation on the level of the country is strategic decision which shall be treated as investment in agricultural land preservation and long term development factor. This paper aims to investigate the strategic aspects of the land consolidation.

Keywords: *Land consolidation, strategy, agriculture, economy, sustainable development.*

AGRICULTURAL TRAINING CHALLENGES FACED BY SMALLHOLDER FARMERS IN THE AMATHOLE DISTRICT, EASTERN CAPE IN SOUTH AFRICA

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Abstract

Agricultural training plays a strategic role in improving the competitiveness and the productivity of the agricultural sector. This study aimed at identifying the agricultural training challenges faced by smallholder farmers in the Amathole District. Representative sample consisting of 37 smallholder farmers with 801 beneficiaries was taken. A number of smallholder farmers in seven local municipalities were visited: Nxuba (8.1%), Ngqushwa (5.4%), Amahlathi (5.4%), Mnquma (21.6%), Mbashe (54.1%), Buffalo City (2.7%) and Great Kei (2.7%). Quantitative and qualitative design was used with a detailed questionnaire written in English. Stakeholder's discussion and field observations were also part of the data collected. A purposive sampling technique was used to select thirty-seven smallholder farmers. Data was coded, captured and analyzed with the software Statistical Packaged for Social Sciences (SPSS version 24). Descriptive and Univariate analysis were conducted. Results identified the following agricultural training challenges: Soil Preparation, Seed Sowing, Pests and Diseases, Marketing, Harvesting, Transplanting and Post-Harvest Storage. The Univariate analysis showed a high level of positive association among Pest and Diseases (Dependent variable) and the following Independent variables: Water source, Crops planted, Land size, Education and Farming experience. The model fit was predicted by the r^2 at 0.937 (94%) and in general, the higher the r^2, the better the model fits the data and the better interaction between dependent and independent variables. It is thus concluded and recommended that the transfer of agricultural knowledge to support smallholder farmers should be a priority for the government especially the seven training challenges identified by smallholder farmers.

Keywords: *Smallholder Farmers, Agricultural Training, Amathole District, Limpopo Province, South Africa.*

ASSESSMENT ON PERFORMANCE OF PARTNERSHIP EXTENSION MODELS IMPLEMENTED IN TEA SMALLHOLDING SECTOR IN SRI LANKA

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Abstract

Tea smallholding sector provides the highest contribution to Sri Lankan tea industry. In recent years the productivity of tea smallholding lands has shown a declining trend. This could mainly be attributed to limitations of providing an optimum extension service. The Public-Private Partnership (PPP) extension models have been introduced during the last decade as an alternative to the tea smallholding sector. This study was carried out to assess the performance of three such well-established partnership extension models and to identify the factors affecting their success. Three partnership extension models representing a factory-based model (FBM), an input supplier-based model (ISBM) and, a development agency-based model (DABM) were selected for the study. Six key components of a successful partnership i.e. trust and cohesiveness, motivation to participate, resource sharing, support to achieve long-term expectations, sharing technical information and, satisfaction about the model were used to assess the success of PPP. The primary data was collected using pretested questionnaire schedule followed by key informant interviews with randomly selected 90 smallholders (30 from each model) and extension partners from each model. The findings was revealed that productivity of tea smallholder lands in factory-based model is highest when compared to that of other two models due to frequent contacts with smallholders and supplement of needful services by the extension partner. The success factors among the models such as trust and cohesiveness, resource sharing, technical information sharing and motivation to work showed a significant relationship with age, experience, tea land extent and productivity (p<0.05). Development agency model was highly rated by poorer tea smallholders, while those smallholders with higher land extent were highly rated the other PPP models. Partnership models should serve equally to all tea smallholders. It could be recommended that partners of PPP extension model should promote trust and cohesiveness, sharing of technical information and resources to establish successful partnership.

Keywords: *Public-Private Partnership extension, Partnership components, Tea, smallholders.*

SOCIAL INNOVATIONS IN MOUNTAIN REGIONS

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Abstract

Two case studies developed in the framework of the Horizon 2020 project *Social Innovation in Marginalised Rural Areas (SIMRA)* are presented: (a) The Val Lumnezia, a lateral valley in Grisons in the Alps. This Romansh-speaking valley was particularly isolated and characterised by ongoing emigration. An initiative of young craftsmen/entrepreneurs in the 1980s led to a structural change from purely agricultural production to agro-tourist specialisation. They were not guided by a strategy of mass tourism, but were among the first to work together with environmental organisations for environmentally compatible tourism. (b) Val de Travers, a lateral valley in the canton of Neuchâtel in the Swiss Jura, specialised in the watch and micro-industry. The crisis in the watchmaking industry and an increasingly visible division between mountain areas and the littoral plain led to the initiative to develop a mobility and agglomeration concept for the entire canton. They involve both municipalities and local companies in a participatory manner and follow an integrated approach of the local economy (agro-tourism, manufacturing). Social innovation is always triggered by a crisis in the regional trajectory. Such upheavals are often associated with the generational change of the most-important decision-makers. Although civil society initiatives play an important role, public and private institutions must not be neglected and it is the interaction between all three groups of actors that decides on the trajectory of a social innovation.

Keywords: *Mountain regions, Social innovation, spatial disparities, spatial justice, cohesive societies.*

THE ECONOMIC EFFICIENCY OF THRIFT AND CREDIT COOPERATIVES IN NORTHEAST OF THAILAND

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Abstract

Thrift and Credit Cooperatives (TCCs) in Thailand are the biggest operation in terms of business volume. Their members are people having the same career and the same community. Their main purpose is to promote savings and provide loan for members. These research objectives were to 1) study the operation of TCCs in the northeast of Thailand, and 2) analyze the economic efficiency of TCCs in the northeast of Thailand. The study population was divided into 2 groups 1) TCCs members in the northeast of Thailand which comprised of 1,230 individuals and 2) TCCs committee and management staff of 9 TCCs. Purposive sampling technique was applied as the sampling technique. It turned out with the 400 samples and 18 samples of committee and management staff. Primary data were collected by questionnaires and focused group. The secondary data were collected from the database of Cooperatives auditing department. Ministry of Agriculture and Cooperatives. Data analysis was composed of descriptive statistics, Data Envelopment Analysis Model (DEA Model) and content analysis. The research found that 1) from last 20 years, all of 9 TCCs have operated their business with their good shape in terms of financial status which were assets, debts, capitals, income, expenditure, and profit. Most of the time, 2 main businesses of TCCs are saving and lending for members, 2) 6 out of 9 TCCs acquired the economic efficiency while 3 of them faced with economic inefficiency. According to the research results, TCCs whose face with economic inefficiency could have their own business strategies to improve themselves to achieve economic efficiency. Economic efficiency of TCCs also made members confidently and trustworthy.

Keywords: *Economic efficiency, thrift and credit cooperatives, northeast of Thailand.*

LIVELIHOOD DIVERSIFICATION IN THE CONTEXT OF CLIMATE CHANGE: EVIDENCE FROM FARM HOUSEHOLDS IN SOUTH-EAST TUNISIA

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Abstract

Livelihood diversification reduces farm household vulnerability to the adverse effect of climate change. This study aims to analyze livelihood diversification of the farm households in southeast Tunisia. The research used a multistage random sampling technique to collect data from 50 farm households. Data were gathered through structured questionnaires and were described by means of descriptive statistics. The Simpson diversity index (SDI) was used to assess the level of livelihood diversification of households. Furthermore, with reference to the sustainable livelihood framework, the study showed the difference of capital endowments between livelihood groups. It also highlighted the determinants of livelihood diversification using a logistic regression model. The results showed that households with high levels of SDI (SDI > 0.5) were likely to have more sources of income. Furthermore, there was a significant difference ($p < 0.05$) in capital endowments between households that diversified their livelihoods and those that did not. Households with high SDI are more endowed with human, social and financial capital. Results of the logistic model highlighted that level of education, farm size, herd size, non-farm income and distance to the main plot are the key determinants of livelihood diversification.

Keywords: *Livelihood diversification, households, Simpson index, Sustainable livelihood Framework, Logistic regression.*

THE TUNISIAN CITRUS SECTOR: EXPORT PERFORMANCES

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Abstract

The citrus sector is strategic for Tunisian agriculture with more than three million working days and a supply of fresh fruit market for 8 months of the year. However, its contribution to exports has been declining for years. To better identify the sector, field work was carried out in 2018 based on interview with producers and exporters as well as public actors in the sector. Our surveys covered different types of farmers and showed a difference in their production costs based on the performance recorded. Cost recovery throughout the export chain allowed us to compare the final cost to the selling prices in the export markets. The main results showed a lack of performance at different levels for the export market, while citrus fruit production was growing and the local market was doing well. A single product dominates citrus fresh fruit exports, which is the Maltese Orange. It is mainly sold in France. The institutional relations shows a concentration of decision-making power between a few operators. This gives this sector an oligopolistic structure. The export market is close to the oligopoly of Cournot. Export companies produce identical goods and compete in quantity. The public sector is heavily involved in the management of these export goods which quota to the EU is not honored. This study used also an analysis of price competitiveness and non-price competitiveness in order to better characterize the performance of Tunisian citrus export.

Key words: *Exports, fresh citrus fruits, Tunisia, competitiveness.*

THE ASSESSMENT OF TURKEY COMPETITIVENESS IN CHERRY TRADE

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Abstract

Trade of agricultural products has gained importance with the development of global trade. Cherries have a crucial place in Turkish agricultural exports. Fresh cherries are in the scope of this study. The aim of this study is to examine Turkey position and competitiveness in cherry trade. Trade Intensity Analysis Method which represents the course of trade flow among countries is used in the study. The study indicates that European countries which are Turkey tradition trade partners have a biggest trade share with Turkey and that share has not changed much in years. By the way, Asia market, especially China, has become a game changer in cherry trade and Turkey should prepare itself for this situation.

Keywords: *Cherry, trade intensity analysis method, concentration coefficient, Turkey.*

DEVELOPMENT PROCESS AND AGRICULTURAL LABOR

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Abstract

Economic growth and development, development in global markets in this process, natural resources, capital and labor factor is also to use effectively and efficiently. In this requirement-oriented economy, a neo-classical approaches oriented towards the efficient and efficient use of resources have put in an effective time process in managing the economic growth and management system of the natural structure and the elements of the obtained physical capital. The lack of neoclassical approaches and the formation of internal growth models were needed. Internal growth models include economic growth; technology use, R&D execution and human capital formation. Internal growth models are being managed and managed, and ultimately I believe in the level of what has been lifted. Human capital; These are expressions of positive values such as talent, experience and dynamism, which give information about the production-oriented labor force and that other production factors are not more productive. Where these valuable, new technologies need to be used effectively and effectively, their open health is accelerating the goal of economic growth. The process of economic growth and technological development is open another thing that should not be ignored is the agricultural sector. Agriculture; connected to other sectors. Depending on where agricultural and R&D activities are provided; they cause a vertical mobility of labor through migration to urban areas. The fact that the level of education, income and working conditions of the labor force in this rural countryside is open opens up economic growth and focus. Comparisons of GNP, optional population in agriculture, country of education expenditures, economic growth and intercity analysis will be made.

Keywords: *agriculture, labour, human capital.*

AN ANALYSIS OF THE CURRENT SITUATION OF SEED SECTOR IN TURKEY

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Abstract

Turkey has optimum climatic conditions, large lands, and geographical location advantage for the production of high-quality seed. In the country, as the public sector has been dominating the seed sector until the 1980s, the private sector has started to operate in the mid-1980s as a result of the legal and administrative regulations made at that time. Thus there has been a significant progress in the sector regarding human resources, capital accumulation and technology transfer with the cooperation of domestic and foreign companies. The Law on the Protection of Breeders' Rights for New Plant Varieties Law No.5042 and Seed Law No. 5553 were entered into effect respectively on 15.1.2004 and 08.11.2006. By Seed Law No. 5553, quality assurance in seed production has been provided, plant variety registration system in accordance with the EU and seed, seedling and sapling certification system have been established. The law has contributed to the development and strengthening of the sector through new regulations on the seed production and trade. In parallel with the developments in the sector, seed production and exports of Turkey have gradually increased over the years. The production amount increased from 145,227 tones in 2002 to 1 059 300 tones in 2018 and seed exports to 85 countries realized as 151,691 million US dollars and an amount of 102,786 thousand tones in 2018. Despite these developments, various problems still exist in the sector such as lots of small capital firms in the sector, lack of qualified technical staff, lack of capital to be allocated to R & D, problems regarding technology transfer, high production cost, the informal production and sale of seed, and the need for legislative amendment on some issues. In this study, the current situation in Turkey on seed sector is examined and basic problems and solutions to them in the sector are discussed.

Keywords: *Seed, Seed sector, Production, Trade.*

EUROPEAN CRANBERRYBUSH PRODUCTION VERSUS SOLAR POWER PLANT: AN ECONOMIC APPRAISAL

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Abstract

In recent years, solar power plants for energy production in Turkey have been established on agricultural areas. These investments were located especially in the Kayseri and surrounding provinces. However, traditional products such as wheat, barley and alfalfa were grown before solar energy investments in the region. Besides, the province of Kayseri is motherland to European Cranberrybush which is an endemic species. In this study, it was aimed to compare the economic returns of European Cranberrybush fruit production (1000 trees) and solar power plant (1000 kW) investments in 20 decare area. As a result, it was predicted that solar panels may generate around 1,500,000 kWh of electricity annually in Kayseri and lose 0.7% of power annually during the life span of 25 years. The solar power plant's refund ($ 1.3 million) period was found to be approximately 8 years with the net purchase guarantees (11.4 $ ct/kWh [excluding the electricity distribution price]). In addition, the net profit at the end of its 25-year life would be approximately $ 2.5 million considering the maintenance and operation costs (2%) of the solar power plant. On the other hand, European Cranberrybush is being grown organically in nature without any tree care. It has a life span of 300 years with a yield of 8.4 kg per tree and a market selling price of 1.7 $/kg. It was estimated to gain approximately $ 357,000 income (excluding the pruning and harvesting costs) at the end of 25 years with no initial investment (sapling) cost. As a conclusion, the income from European Cranberrybush may increase with the development of alternative innovative products especially by using in the health sector. Besides, the installed solar power capacity target of 2023 (10 GW) indicates that more agricultural areas will be solar power plants unless the rooftop installations are focused.

Keywords: *Agriculture, Viburnum Opulus L., Energy, Turkey.*

EFFECT OF ULTRASOUND PRETREATMENT ON DRYING OF AGRICULTURAL PRODUCTS

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Abstract

Agricultural products are exposed to chemical and microbial spoilage caused by external factors after the harvest. Various post-harvest processes are used to protect the products from these deteriorations. Drying is one of the most widely used methods. By this means, the moisture in the product is reduced and the product is consumed in every season. Although different drying methods are used in the food industry, long drying times are disadvantageous. Furthermore, long drying times cause significant deterioration in food quality (nutrient loss, low rehydration capacity, structural changes and shrinkage). In order to reduce the drying time, some pretreatments are applied to the agricultural products before drying. These are classified as liquid phase (hyperosmotic solution, alkali liquor, sulfite liquor and acid liquor), gas phase (sulfur dioxide, ozone and carbon dioxide), thermal (hot water, steam, superheated steam impingement blanching, ohmic and microwave) and non-thermal (high hydrostatik pressure, freezing, pulsed electric field and ultrasonic field). The ultrasound technology is used in drying processes in two various methods as ultrasound-assisted drying or as a pre-treatment with high (megahertz) and low (kilohertz) frequency. In the ultrasound-assisted drying process, the mechanical waves produced by the machine are carried with air on the agricultural product. With the application of ultrasound process, agricultural products are immersed in a liquid (distilled water or osmotic solution). Reducing the internal resistance of the product causes structural changes such as micro channel formation. As a result, ultrasound pre-treated products were dried in a shorter time and an increase in product quality was observed.

Keywords: *Drying Time, Food Quality, Post-harvest, Food Technology.*

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ECONOMIC VIABILITY OF INTERCROPPED FARMS IN DAK LAK PROVINCE, CENTRAL HIGHLANDS, VIETNAM

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Abstract

Perennial crops have been applied by diversified approaches to get a high income and perennial crop sustainable development in Dak Lak Province, Vietnam. The study provides a comparative analysis of the economic viability of crop cultivation by two approaches: mono-crop farm and intercropped- crop farm. Based on an investigation of 120 selected farms conducted from January to April 2019 in Dak Lak Province - the largest growing region of Vietnam, the general operation of perennial crop farms as well as economic indicators comprising costs, revenues and profits were also collected. The finding indicated that the yield of each crop in intercropped farms was less than mono-crop farms due to a space competition. Fortunately, the intercropped farm approach seems to be more economic efficiency than mono-crop farm one where a reduction of variable costs, especially intermediate costs while profitability increases. The higher input costs in intercropped farms are constraints considered to be appropriate for capital-endowed households. However, these results provide empirical evidence of agronomic benefits in applying intercropped farms for farmers in setting alternatives strategies and policymakers to making plans of sustainable perennial development.

Keywords: *Economic viability, intercropped farm, perennial crop, Vietnam.*

THE CONCEPT OF "RURALITY" ACCORDING TO YOUNG PEOPLE'S PERCEPTIONS AND ITS INFLUENCE ON THE RURAL IDEAL. CASE STUDY: MOUZAKI

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Abstract

"Rurality" is a complicated concept to define because it is influenced by several factors that need to be explored in order to approach it. Even if the 'rural ideal' is considered a myth, the idyllic presentation of the countryside remains largely rooted in people's consciousness. In this research, we sought to investigate and interpret the experiences of young people, the images and perceptions of a sample of the population of Mouzaki, definition of "rurality" and whether it was influenced by modern expressions of the rural ideal. On the one hand, the main aim was to seek out key features which would reveal how the concept of rural area - countryside was defined, and how everyday people felt there. On the other hand, we wanted to see if their views were influenced by the so-called "rural ideal". The survey was conducted on a sample of 50 residents of the Municipality of Mouzaki in three different categories of population: a) urban residents, b) residents living in villages, and c) those living in the city, but have a rural background. Most of the respondents attributed the countryside with some environmental characteristics, depicting the countryside with 'nature' away from urban centers, with 'clean air - oxygen', with the concepts of 'green, meadow fields', with words' animals and birds. In addition, much of the sample associated the countryside with emotions and sensations such as "happiness", "calmness", "relaxation", "optimism", "rest", "freedom", "odours", "rejuvenation" and "solidarity". The results of the research show that the way young people perceive the concept of 'rurality' depends on the existence of a rural past and largely converges on the so-called 'rural ideal' which is redefined by an ever-changing rural and urban environment.

Keywords: *Rurality, young people, rural ideal, living spaces.*

DEVELOPMENT OF SUSTAINABLE AGRICULTURAL LAND OWNERSHIP AND LAND USE STRUCTURE IN RUSSIA

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Abstract

One of the important factors in the land management system is the form of ownership in general, and land ownership in particular. There are conflicting opinions among scientists and practitioners: some believe that only private land ownership determines the effectiveness of agriculture, others do not play a decisive role of private property, and are supporters of the formation and optimization of the ownership structure. According to federal statistical monitoring in the Russian Federation, at the beginning of 2019, 133 million land plots were privately owned, which amounted to almost 8% of the country's land fund. The area of state and municipal land amounted to 1579 million ha, or 92%. The following changes have occurred in the structure of land ownership in recent years: (i) there was a reduction in the area of land owned by citizens, and an increase in the ownership of legal entities, as well as state and municipal property; (ii) there was a change in ownership of the share in the common ownership of land from agricultural land (land share) in favor of the legal entity and the state, which became possible after the adoption in 2002 of Federal Law No. 101-FZ "On the Turnover of Agricultural Land"; (iii) noticeable changes took place in the land structure of Russian regions, which is explained by the unevenness of their economic development. Even more significant changes have occurred in the ownership structure of agricultural land, however, the issue of protecting agricultural land from speculative transactions in the real estate market and other misuse of land remains very relevant. The scientific article proposes measures to solve this problem and, on the whole, optimize the ownership structure of agricultural lands and increase the efficiency of agricultural production, as well as sustainable development of rural territories.

Keywords: *Land ownership, Land use, Sustainable development, Russia.*

TRADE IN TERMS OF GREEN ECONOMICS

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Abstract

The issue of quality has always been present in trade, but mostly as a commercial requirement in the establishment and functioning of buying and selling relations. However, the quality of products and services that are subject of buying and selling relations between producers, trade and consumers cannot be viewed outside of space and time. It has its own evolution, which is closely related to the needs and demands of consumers. Historically observing, it can be concluded that the quality of the trade in market developed countries has evolved from elementary properties of assortment quality (durability, utility), over the quality of serving, to the eco-quality. Direction of quality evolution was determined by development of ecological awareness about the vulnerability of nature and environment. This is why the economies of certain countries are at different levels of ecological economics and eco- quality. In these circumstances, companies from different business segments, including trade, are identified as one of the key links in the environmental responsibility chain. Therefore, they are increasingly required to meet customer needs for products and services, while also taking into account the environmental impacts they have. Adequate identification of emerging trends that are reflected in, among other things, increasing demands for environmental responsibility, results in the creation of new ways to improve competitiveness. Thus, more and more companies are trying to integrate the concept of environmental responsibility into their business by introducing practices that have the epitome of "green". This paper will discuss the responsibilities of companies, especially trade, in the fight for environmental protection, the way companies incorporate environmental principles into their businesses, as well as the unfair practices that arise in pursuit of greater competitive advantage in a green economy.

Keywords: *Trade, Eco-quality, Eco-standard, Green economy.*

SALES MANAGEMENT IN THE DIGITAL ENVIRONMENT

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Abstract

The subject of this paper is related to the contemporary aspects of sales management in the digital environment. Sales management is a business discipline which is focused on the practical application of sales techniques and the management of a firm's sales operations. The growth of competition, the globalization of the market, the shorter product life cycle, the increase in indirect competition in all spheres of business have all influenced the new approach to managing the sales process. The main goal of the paper is to analyze the significance and necessity of investment in information and communication technology and modern software solutions in sales management. Contemporary sales are becoming highly dependent on information and communication technologies, both for traditional commerce and especially for e-commerce. Global computer networks have brought tremendous benefits to commerce as well as new problems. Successful sale of agricultural products within a short period of their harvest is essential to the overall growth and survival of agribusiness. Agricultural producers are also trying to develop digital sales channels.

Keywords: *Sales management, Digital environment, Agribusiness.*

TRADE IN TERMS OF GREEN ECONOMICS

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Abstract

The issue of quality has always been present in trade, but mostly as a commercial requirement in the establishment and functioning of buying and selling relations. Historically observing, it can be concluded that the quality of the trade in market developed countries has evolved from elementary properties of assortment quality (durability, utility), over the quality of serving, to the eco-quality. Direction of quality evolution was determined by development of ecological awareness about the vulnerability of nature and environment. This is why the economies of certain countries are at different levels of ecological economics and eco- quality. In these circumstances, companies from different business segments, including trade, are identified as one of the key links in the environmental responsibility chain. Therefore, they are increasingly required to meet customer needs for products and services, while also taking into account the environmental impacts they have. Adequate identification of emerging trends that are reflected in, among other things, increasing demands for environmental responsibility, results in the creation of new ways to improve competitiveness. Thus, more and more companies are trying to integrate the concept of environmental responsibility into their business by introducing practices that have the epitome of "green". This paper will discuss the responsibilities of companies, especially trade, in the fight for environmental protection, the way companies incorporate environmental principles into their businesses, as well as the unfair practices that arise in pursuit of greater competitive advantage in a green economy.

Keywords: *Trade, Eco-quality, Eco-standard, Green economy.*

7. FORESTRY AND AGRO-FORESTRY

NATIONAL PARK OF BABORS NORTH EAST OF ALGERIA (POLLUTION AND PRESERVATION)

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Abstract

The Babors forest is situated in the central part of North Algeria. It is dominated by Cedrus atlantica and several endemic species like: insect Macrothorax morbillosus, a bird Sittaledanti, fungus Tricholoma calligatum, and tree Abies numidica. However, this biodiversity is experiencing considerable pressure besides the vulnerability that characterizes the the Mediterranean forest. We see several factors of degradation. In our present study we will enumerate major human actions unfavorable to the forest such as: fires (we give the burned area), the amount of cedar resins extraction and the species affected by illegal logging. Different factors of pollution are air acidification due to sulfur and acidification due to the phytochemical pollution. In this study we propose also solutions like phytoremediation and biological fight.

Key word: *Forest, Babors, Endemic, Pollution.*

IMPACT OF DROUGHT AND SITE CHARACTERISTICS ON VITALITY AND RADIAL GROWTH OF *CEDRUS ATLANTICA* MANETTI IN THE OUARSENIS MASSIF (ALGERIA)

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Abstract

This work investigates the impact of drought and site characteristics on vitality and radial growth of Atlas cedar (*Cedrus atlantica* Manetti) in Ouarsenis cedar forests (Algeria). The choice of this zone was dictated by the appearance of the phenomenon of decline since the 1980s and the lack of study on this subject. Our hypothesis seeks to understand how climatic factors interacted with site characteristics affected radial growth and vitality of Atlas cedar. We used the dendroecological approach where 09 populations of Atlas cedar distributed on the two cedars of Ouarsenis (Theniet El Had and Ain Antar) and covering a varied range of environmental conditions (substrate, altitude, exposure) were studied. The climatic signal recorded in ring-width series of Atlas cedar trees was investigated by bootstrapped response function over the period 1936-2010. The results show a good agreement between the individual curves and those of mean site chronologies, which reflects the influence of climatic factors on tree radial growth. Atlas cedar is very sensitive to rainfall fluctuations throughout the year. This sensitivity is more pronounced for populations located at low altitude, on steep slopes and on sand stone or marl substrates. The dry years induced a significant radial growth decline and triggered massive tree mortality, particularly in 1983, 1984, 1988, 1994 and 2002. The vitality of the species seems to be conditioned by the frequency of drought years.

Keywords: *Atlas cedar, decline, Algeria, radial growth, drought.*

INFLUENCE OF CLIMATIC DISTURBANCES ON THE APPEARANCE OF ALLENIAUTIQUE GROWTH RECORDS OF ALEPPO PINE IN THE SOUTHERN MEDITERRANEAN

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Abstract

This study incorporates data from periodic radial increments carried out on samples of Aleppo pine wood and sections from artificial and homogenous reforestation and corresponding rainfall slices at the same time periods. Reports of the relative discrepancies of successive rings (ERC) show a clear regressive trend in young trees. Thus the mean sensitivity (SM) and the inter-dating (SR) coefficients for young trees and the oldest ones confirm the relatively strong dependence of the former on climatic factors, particularly rainfall. The results of this work show a fairly strong correlation between the periodic radial increase over 5 years and the corresponding rainfall over the same period. Thus, from the analysis of the obtained results it is established that the rainfall variations have a more marked influence on the young subjects. These various observations led us to ask ourselves a certain number of questions relating to the interpretation of the values of the mean sensitivities and the coefficients of inter-dating. Indeed if, on the one hand, all the samples of the same age have equivalent average sensitivities, It remains to be seen whether there is a definite relationship between mean annual rainfall and annual radial increase. On the other hand, the relation between the periodic rainfall over 5 years and that of the current radial increase of the same periods remains established. On the basis of these results, confirmed by the values of the correlation coefficients, it is possible to consider placing the dendroclimatology of the Aleppo pine of this Maghreb region in a valid approach to knowledge and determination of the local Mediterranean climate, particularly the periodic five-year rainfall.

Key words: *Rainfall variations, Radial increase, Mean sensitivity (SM), Inter-dating coefficients (SR), Aleppo pine.*

SUPPLY OF NPK ELEMENTS THROUGH PRECIPITATION AND THROUGHFALL IN A COPPICE OF GREEN OAK IN THE EAST OF ALGERIA

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Abstract

Nutrient provisions through precipitation and throughfall represent major factor of the sustainability of the forest ecosystem. Nevertheless, data related to this aspect are non-existent in Algeria. Precipitation and throughfall volumes and their contributions in NPK elements were evaluated between 2012 and 2013, in a green oak coppice at Marconna in Aurès (eastern Algeria). Precipitation volumes were evaluated by the placement of 10 containers in a bare soil. To quantify the throughfall, four containers were installed under the canopy of each tree among 25 selected trees. Water samples taken from previously rinsed plastic bottles with distilled water were kept away from light and transported to the laboratory for volume estimation and chemical analysis, as quickly as possible. After rapid filtration, samples became ready for NPK analysis. Various devices and chemicals were used for the measurements of NPK elements in the laboratory. Kjeldahl's method, colorimetry and flame photometry were used for quantifying total nitrogen, phosphorus and potassium respectively. The results showed that annual rainfall amounts varied between 223,9 and 289,6 mm, whereas the annual throughfall was 127,1 mm for 2012 and 189,8 mm for 2013.Besides, the annual quantities of N, P and K returned to the soil by the rainfall ranged from 5,05 to 7,62 kg/ ha/year. However, the throughfall results showed that the coppice accumulated amounts of N, P and K elements varying between 4,08 and 5,47 kg / ha / year. On average, nitrogen was the most provided element. It represented 47,07%.

Keywords: *Nitrogen, potassium, phosphorus, rainfall, Marconna.*

FLAMMABILITY OF CERTAIN CONIFERS AND OAK SPECIES OF NORTH WEST ALGERIA

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Abstract

Fuel samples (Quercus suber, Quercus ilex, Quercus, Pinus halepensis, faginea, Juniperus oxycedrus and Tetraclinis articulata) were collected in a cork oak (Quercus suber L) forest in the southern part of the mountains of Tlemcen (Western Algeria). A series of flammability tests were carried out using a Mass Loss Calorimeter device (FTT ®). The results showed that the conifers species (T. articulata, J. oxycedrus and P. halepensis) were highly flammable because of their high combustibility and sustainability. A significant correlation was located between FMC and PHRR (combustibility, $r = -0.52$, $p < 0.05$) and between FMC and AEHC (sustainability, $r = -0.31$, $p < 0.05$).Analysis offreshfuels revealed Juniperus oxycedrusto be the most flammable species (FMC = 60,71 %, TTI = 46,85 s, PHRR = 190,72kW/m2, AEHC = 10,2 MJ/kg and RMF= 2,52). By contrast, Oak species presented low values of the four flammability parameters (high ignitability but low combustibility, sustainability and consumability). The fuel moisture content of Quercus spp. was significantly lower than that of other more flammable species. The findings suggest that the P.halepensis presents a very significant risk to the cork oak forests in Algeria.

Kew words: *Cork oak forests, conifers, oak species, mass loss calorimeter, flammability, Tlemcen.*

PHYSICOCHEMICAL AND MICROBIOLOGICAL CHARACTERIZATION OF ALEPPO PINE (*PINUS HALEPENSIS* MILL) FOREST LITTER IN SEMI-ARID AND ARID ZONES OF WESTERN ALGERIA

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Abstract

In this study, the physicochemical characteristics and biological activity of litters were compared in coniferous plots located in the semi arid and arid zone of western Algeria. This work is part of the general framework of the research currently being carried out for a better understanding of the functioning of the Algerian forest ecosystem. We analyzed the physicochemical and biological properties of 50 samples of Aleppo pine litter collected from five stations in each zone. The results showed a significant difference in physicochemical properties (humidity, pH, conductivity, carbon, nitrogen and C/N ratio) between the two zones. Comparison of the mean of microbial biomass and their efficacy showed what was homogeneous in both zones with a small difference in basal respiration. The heterogeneity of these results showed that such observations needed to be made in other forests of the Algerian territory in order to better understand the functioning of forest ecosystems and the effect of climate on these compartments especially soil.

Keywords: *Litter, physicochemical properties, biological parameters, Semi arid and arid, Aleppo Pine.*

HETEROBASIDION SPP. ASSOCIATED WITH THE DIE-BACK OF NORWAY SPRUCE IN BOSNIA AND HERZEGOVINA

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Abstract

Norway spruce (*Picea abies* (L.) Karst.) is a coniferous tree native to Northern, Eastern and most of the Central and South Eastern Europe, including Bosnia and Herzegovina. It prefers cool, moist, and humid climates. In Bosnia and Herzegovina, *P. abies* is commonly found in mountain regions where it forms pure stands and forest mixtures with fir and beech. It is also one of the most economically and ecologically important forest tree species in the country. Since 2012, Norway spruce trees in forest stands have exhibited die-back of stems and branches followed by a needle fall. Samples of symptomatic *P. abies* tissues were collected in natural forests across Bosnia and Herzegovina in 2018 and 2019. White, fluffy fungal colonies were frequently obtained from diseased parts and the aim of this study was to identify them. Isolates were initially screened using morphology and the Internal Transcribed Spacer (ITS) sequence data of the ribosomal DNA and two phylogenetic groups were identified. The first group included species of the *Heterobasidion parviporum-abietinum* species complex, and the second group represented *Heterobasidion annosum*. The root and butt rot caused by *Heterobasidion* spp. is one of the most destructive disease of conifers in Europe and there is a need for further research on the biology and identity of these fungi in Bosnia and Herzegovina.

Keywords: *Picea abies, Heterobasidion, conifer tree disease, root and butt root.*

ANALYSIS OF ROAD NETWORK DENSITY AND MEAN SKIDDING DISTANCE IN FOREST MANAGEMENT UNIT "MEŠTREVAC" USING MODERN TECHNIQUES AND METHODS

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Abstract

The paper shows the results of road network data analysis for associated compartments and forest categories in Forest Menagement Unit "Meštrevac" (the municipality of Foča, Entity of Republika Srpska, Bosnia and Herzegovina), performed in the GIS software package ArcMap 10.5. The real mean skidding distance is obtained as a product of the mean geometric skidding distance and correction factor. The correction factor is calculated as the average value of the correction factor by terrain slope and correction factor by relief areas. According to the current state, the entire road network is made up of roads with a macadam type of pavement. The total length of mentioned roads is 124,95 km. Due to the spatial position of certain sections that unilaterally open the forest area, the total length of the roads is taken into account with 79.31% of its length (99,10 km) and so openness of FMU "Meštrevac" has a value of 8.63 m/ha. From a total of 157 analyzed compartments, 41 of them are not opened with forest road network at all. The mean geometric skidding distance has value of 330.96 m. With the calculated correction factor of 1.48 in mind, the real mean skidding distance has value of 489.82 m. Based on characteristic cases of the spatial position of some sections in the road network, the criteria used to determine road network density are subsequently supplemented by the corresponding criteria.

Key words: *road density, openness, mean skidding distance, correction factor, GIS.*

THE INFLUENCE OF GROWTH RING WIDTH ON WOOD DENSITY OF SERBIAN SPRUCE (*PICEA OMORIKA* (PANČIĆ)PURKYNĚ)

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Abstract

The growth ring width has a different effect on the density of the tree, depending on which type of wood it is. In this paper, it was studied how the growth ring width and the participation of late wood affects the density of the Serbian spruce wood. Fifteen trees of Serbian spruce were analyzed in total. Three trees originate from a Serbian spruce plantation located near Banja Luka, and three from the plantation near Srebrenica. Nine trees originate from natural stands of Serbian spruce from the vicinity of Visegrad at three sites. The total number of samples tested for the influence of the growth ring width on the wood density is 411. The average oven dry density values range from 0.504 g/cm^3 for the growth ring width 0.01-1 mm, to 0.385 g/cm^3 for the interval growth ring width 6.01-7 mm. Regression analysis has established a negative correlation between the growth ring width and the density. The value of the correlation coefficient is - 0.76, which tells us that this correlation is very strong. Negative dependence is clearly visible up to an average growth ring width of 4 mm. By increasing the growth ring width (over 4 mm), the regression curve goes to approximately horizontal position, which means that further increase in the average growth ring width does not have a special effect on the oven dry wood density. Between the participation of late wood in the growth ring width and oven dry density there is a strong positive correlation (the coefficient of correlation is 0.74).

Key words: *Serbian spruce, growth ring width, wood density, plantations, natural stands.*

MORPHOLOGICAL TRAITS OF COMMON BEECH (*FAGUS SYLVATICA* L.) IN INTERNATIONAL PROVENANCE TEST

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Abstract

The aim of this study was to compare growth of beech provenances in international provenance test. In the spring of 2017, we measured height and root collar diameter of plants in provenance test. The test was raised in the spring of 2007 with seedlings of age 2 + 0 and 3 + 0. It is located in Bosnia and Herzegovina, in section 41 of "Donja Trstionica - Goruša" forest management unit, forest management area "Kakanjsko", 510 to 540 meters above sea level. The test included eight provenances from Bosnia and Herzegovina, four from Germany, three from Serbia, two from Croatia, two from Romania, two from Switzerland and one from Hungary. Average height of plants for all provenances was 164.6 cm, and average root collar diameter was 33.4 mm. Alkalulia provenance from Romania had the lowest average height (104.2 cm) and root collar diameter (22.6 mm). Provenance Dilj Čaglinski from Croatia had the highest average height (197.4 cm) and root collar diameter (40.1 mm). Variance analysis showed statistically significant differences between provenances. During measurements in the international provenance test of common beech plants were 12 and 13 years old. In order to determine growth tendencies of particular provenances in the next stages of development we need to continue measurements of morphological traits. Results of this study will serve to determine juvenile-adult correlation of morphological traits of common beech.

Key words: traits, beech, measures.

THE CHOICE OF OPTIMAL TECHNOLOGY OF PROCESSING OF WOOD GREENERY IN THE CONDITIONS OF INTEGRATED UTILIZATION OF FOREST DENDROMASS

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Abstract

In our forests, around 2.94 mil. m^3 of dendromass is cut down each year. Of these, about 4-6% or 117,000 to 176,000 m^3 makes wood greenery - twigs with needles or leaves, with 10 mm diameter at thick end, measured with bark. Based on the experience of others, first of all from Russia, the Baltic and Scandinavian countries, it is known that wood greenery represents valued raw material in different sectors of economy: agriculture, pharmaceutical and cosmetics industry, and others. The entire annual attack of wood greenery remains unused, with us. There are two reasons for this: a) because there are still no elaborated and proven practices of rational collection and concentration of raw materials to processing plants; and b) because we are not familiar enough with the methods of wood greenery processing. A detailed analysis of the technology of wood assortment production in our forestry practice has been carried out. Based on these findings, a model of integrated forest utilization was conceived, including wood greenery. Then, the technology of wood greenery processing was analyzed in the following ways: mechanical drying and fractionation processes, chemical extraction processes, thermal processes by classical heating and energy use of the microwave electromagnetic field and their combinations: mechanical-chemical methods and thermo-chemical methods. Finally, such technology of wood greenery processing has been selected to optimally matches with the integrated use of forest resources, in terms of the following criteria: minimal negative environmental impact, maximum safety at work, low energy consumption, primarily from renewable sources, maximum quality of final products.

Keywords: *wood greenery, processing technology, forest dendromass.*

BIOINDICATION OF VITALITY ON THE BASIS OF DIAMETER INCREMENT OF EUROPEAN SILVER FIR (*ABIES ALBA* MILL.) ON THE MOUNTAIN BORJA

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Abstract

In this paper, the diameter increment of European silver fir is analysed on the basis of bioindication of the vitality of trees and forest stands. The research is accomplished by examining characteristics of the annual diametre increment on Mt Borja for the period of 50 years. The required data are collected on five trial plots in various stands, with four of them placed in mixed stands of fir and beech, and one being an exclusive fir stand. A total of 75 trees of the first, second, and third biological sites respectively are cored. In order to minimise the influence of age, to better detect the reaction of trees to exogenous factors on the radial growth and the evaluation of vitality of trees and stands, indexes of the tree rings width are calculated. The average values of the tree ring width are obtained through levelling in the ANTEVS programme (using the so-called smoothing cubic spline). Summarising the explored stands, it can be concluded that their vitality is solid and that possible devitalisation in the future can be prevented by the application of appropriate silviculture measures.

Keywords: *European silver fir, diameter increment, vitality, bioindication, Borja*.

MONITORING ON APPEARANCE AND SPREAD OF HARMFUL INVASIVE PATHOGENS AND PESTS IN BELASITSA MOUNTAIN

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Abstract

Belasitsa Mountain is located on the territory of Southwest Bulgaria, Northern Greece and Northern Macedonia. The Bulgarian part of the mountain includes most of its northern slopes and ridge territories, characterized by variety of vegetation zones and plant communities. At lower altitudes, *Quercus* spp., are the most distributed, but gradually replaced by the sweet chestnut forests (*Castanea sativa*). Chestnuts are distributed between 400-1300 m a.s.l., forming the largest natural locality in the country. Along the river valleys in the mountain, natural population of *Platanus orientalis* occurs. Since 2018, a system for monitoring of two pathogens (*Cryphonectria parasitica* on *Castanea sativa* and *Ceratocystis fimbriata* on *Platanus orientalis*) and three invasive pests (*Corythucha arcuata* on different oak species and chestnut, *C. ciliata* on *P. orientalis* and *Dryocosmus kuriphilus* on chestnut forests) has been implemented. Until now, a high density of *C. ciliata* was established on *P. orientalis* causing significant damages on host trees. *C. arcuata* has spread in Bulgaria since 2013. Over the next few years, the species penetrated many regions of the country by affecting predominantly oak forests, but in 2017, it was registered for first time on the chestnut trees. In Bulgaria, *D. kuriphilus* has not been found yet, but as the pest was established in Greece in 2014, natural spreading of the species to Belasitsa Mt. could be expected. The possible penetration of this pest could increase the rate of damaged stands that had already been severely attacked by the fungal pathogen *C. parasitica.*

Key words: *invasive pests, monitoring, Belasitsa Mt., Bulgaria*.

HEALTH STATUS OF PINE STANDS AS A PART OF THE EXTENSIVE TREE HEALTH MONITORING NETWORK IN BULGARIA

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Abstract

Since 1986, Bulgaria has been a part of the International Cooperative Program 'Forests' launched in 1985 under the auspices of the United Nations for European Economic Commission (UN/ECE). During the period 1986-1989, a large-scale network of 256 observation plots were set in ten regions throughout the country in order to monitor the health condition and dynamics of changes occurring in forest ecosystems. During the period 1986-2009, experts from Forest Research Institute, Bulgarian Academy of Sciences, annually conducted assessments in 130 permanent observation plots in five regions of the monitoring network. Among all plots, 54 were established in Austrian pine (*Pinus nigra* Arn.) and Scots pine (*P. sylvestris* L.) stands. In 2009, the number of plots was reduced to 80, as twenty-seven of them (predominantly plantations) were set in pine stands with 696 *P. sylvestris* and 384 *P. nigra* trees. The health status of trees in natural pine stands remained unchanged for the entire studied period. In recent years, worsening of *P. sylvestris* plantations has been observed at lower altitudes (below 700 m a.s.l.). Insect pests mainly bark beetles, and fungal pathogens, were the most frequent causers of damages. Snow- and wind-throws damages often occurred provoking the bark beetle attacks.

Key words: *pine stands, monitoring, health status, Bulgaria.*

ECONOMIC ASSESSMENT OF THE WATER ECOSYSTEM SERVICE PROVIDED BY FOREST AREAS WITH WATER PROTECTION FUNCTIONS IN NORTHWESTRN BULGARIA

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Abstract

The EU Biodiversity Strategy for 2020 (2011) adopted by the European Commission recommends that Member States map and assess the state of ecosystems and their services in their national territory, assess the economic value of such services, and promote the integration of these values into supervisory and reporting systems at EU and national level. The Bulgarian legislation (Forestry Act, 2011) defines 9 paid services provided by forest areas, as well as the possibility that certain forest areas be designated in regional development plans as areas providing paid ecosystem services. The money collected from these payments are going to be divided among the owners of the forest areas – territorial units of forest and hunting holdings, municipalities, etc. The question should be answered: what a fair income the forest owner should receive from the water protection function as a part of the gross added value created in the country's water sector. The purpose of the latest study is to make an economic assessment of the water ecosystem service provided by forest areas with water protection functions of two municipalities in the North-West region in Bulgaria. The results show that about 2.5% of the cost of water that is used and paid for by water users and water-producers must be given to forest owners. When the water is used for irrigation, the cost of the ecosystem service is 0,007 BGN for 1 m^3 water, for electricity production - 0,003 BGN for 1 m^3 water and for drinking needs - between 0,018-0,026 BGN for 1 m^3 water.

Keywords: *Ecosystem services, Economic assessment, Forest areas, Bulgaria.*

GENETIC RESOURCES OF THE SPECIES OF GENERA *TILIA* AND *ULMUS* IN BULGARIA

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Abstract

Genera *Tilia* and *Ulmus* contain tree species called noble hardwoods. Even though they possess some remarkable characteristics, they are of relatively lesser importance, compared to the stand-forming tree species, due to their lower proportion in forests. However, the noble hardwoods could be of particular scientific interest because they demonstrate some peculiar distribution of genetic diversity within and among populations. We present a survey on the distribution and diversity of the species of genera *Ulmus* and *Tilia* species in Bulgaria. There are three Ulmus and 3(4) Tilia species naturally occurring in the country, each of them with its own life history characteristics. The survey was performed in relation to an international project for studying of the species phylogeography. A special database was established with detailed information about all stands with participation of *Ulmus* and *Tilia* species. The results showed that the most represented elm species is *U. minor*, sharing more than 50 % of the territory occupied by all *Ulmus* species. Analogously, *Tilia tomentosa* occupies more than 60 % of the territory of all *Tilia* species. Also, a survey on the Holocene presence of the target species on the territory of Balkans is performed. The main challenges and approaches to the gene conservation of the species of interest are discussed.

Keywords: *Elm, Lime, Phylogeography, genetic resources.*

Acknowledgments: The financial support provided by the Bulgarian National Science Fund: Project № 26/4, "Structure of Glacial refugia on the Balkan Peninsula and in Bulgaria – analysis of the model of genera *Tilia* and *Ulmus*", is very much appreciated.

VALORISATION OF FOREST WOOD PRODUCTS OF THE BLACK LOCUST (*ROBINIA PSEUDOACACIA* L.)

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Abstract

Black locust forest are spread on more than 35000 hectares and it's share in wood industry is 2,3% with that it takes up significant part of surface and etats of Croatian forests. Goal of this project was valorization of black locust products. In planning management of more frequent black locust forests, the assortment charts were missing so foreign or replacement ones were used, and another goal of this project was to determine assortment structure in classes of black locust by method of sectioning. Tree sectioning was carried out for precise determination of tree volume with and without the bark. Assortment charts are necessary with planned cutting and value of wood products, in other words etats, but also for effectiveness grade of processes for use of forest resources. In accordance with new normative system, classification by quality, by assortment structure, the results showed distribution of wide diameter. Next goal was to determine value of forest wood products in round state, and after that from residue which did not have technical value, specifications and value was determined in form of wood cutting. Value of wood chips was obtained by weighting small branches, and mass density by sampling trunk rings and treetops. Adding volume gained by sectioning and weighing small branches, by mass density, the total volume of above ground tree biomass was calculated. Furthermore lab analysis showed results of examining mass part of water, mass part of ashes, netto calorie value of each tree part by type of wood product and it was specially tested for quality for wood chips by regularity of new normative system for firm biofuels, HRN EN ISO, TO 238:2014.

Key words: *Black Locust, growing stock, non-wood forest products, wood forest products, wood biomass.*

THE EFFECT OF FOREST MANAGEMENT ON NET NITROGEN MINERALIZATION IN ESTONIA

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Abstract

This is a synthesis based on the results of three studies focussing on the effect of forest management on the net nitrogen mineralization (NNM). One in a 32-year-old grey alder stand, where the clear-cut effect was studied; second study focused on the stump harvesting effect in three Norway spruce clear-cut areas; third study estimated the annual NNM in stands of different tree species growing on drained peatlands. In all three studies the NNM flux was estimated using the in situ method with incubated polyethylene bags. In the grey alder stand the total annual NNM did not intensify in the clear-cut area: in the upper 0-20cm soil layer the NNM was roughly in the same proportion in both grey alder stand and the clear-cut site. Nitrification rate was 100% and NNM intensity was the highest in July in both cases. The effect of stump harvesting on annual NNM was soil specific and highly variable. Stump harvesting affected also the proportion of the nitrification and ammonification processes in total NNM. Third study focussed drained forest: a downy birch stand and a Norway spruce stand in *Oxalis* full-drained swamp (ODS) and a Scots pine stand in *Myrtillus* full-drained swamp (MDS). The highest value of NNM was found in stands that were growing on fertile ODS and a significantly lower annual NNM flux occurred in the Scots pine stand growing in MDS. These results indicate that forest management effect on NNM in long and short term is mostly tree species as well as soil specific.

Keywords: forest, mineralization, Estonia.

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SOIL RESPIRATION AND NITROGEN LEACHING DECREASED IN GREY ALDER (*ALNUS INCANA* (L.) MOENCH) COPPICE AFTER CLEAR-CUT

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Abstract

Grey alder (*Alnus incana*) is one of the most productive forest tree species in the Northern and Baltic countries both on mineral and organic soils. It is a suitable tree species for short-rotation forestry with an optimal rotation length of 20–25 years. As an actinorhizal N_2-fixing tree species it can be used for the biological fertilization of soil. We investigated the development of a new forest generation, as well as the nitrogen (N) and carbon (C) storages and fluxes in a grey alder regenerating coppice (COP) after clear-cut and in an adjacent unharvested 21-year-old stand (MAT), which had reached its bulk maturity. The regeneration of COP was rapid and 5 years after clear-cut, stem mass was 6.4 t ha^{-1}. The nitrogen demand of the aboveground part of the 5-year-old COP trees was roughly half of the corresponding value for MAT, depending mostly on leaf production. The annual N leaching flux in MAT was in the range of 16–29 kg ha^{-1}, the corresponding values for COP were roughly half of that. N leaching was detected in spring and late autumn. Net nitrogen mineralization did not differ significantly between MAT (117 kg ha^{-1}) and COP (129 kg ha^{-1}). For the soil respiration study, we included a 32-year-old grey alder stand with a similar study design growing at a similar site. Soil respiration was significantly higher in MAT compared to COP in all study years in both studied stands.

Keywords: *Alnus incana, nitrogen, soil respiration, clear-cut, leaching.*

WOODED MEADOW – A SUSTAINABLE CHALLENGE OF AGRO-FORESTRY

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Abstract

During the intensification of agricultural management in the 20th century the average area of field plots has increased drastically as larger fields are easier to access by effective machinery. Such change, however, have led to the loss of border areas including these covered with bushes and trees. In the 21st century we have realised that such development has decreased the local biodiversity and especially habitats for useful insects-pollinators. Less attention has been paid in the agricultural areas to the role of trees in *sensustricto*. Typically, trees are unwanted in agricultural land as they may decrease the amount of light available for crop plants and competition for nutrient and water resources. On the other hand, they may perform a shelter from drying sunshine or wind. Our long-term study on a wooded meadow revealed that trees on an extensively managed grassland supported the maintenance of annual biomass production of herb layer. Besides, shaping local microclimate favouring the grass growth, we assume that deeper root system of trees enables the nutrient uptake. NPK-rich compoundsmay be available forsurrounding herbs through rhizosphere processes or via leaf litter in order to replace the nutrient removal during haymaking. Hence, we conclude, that such local agro-ecosystem supports the ideas of sustainable nature management and should be considered in organic farming.

Keywords: *biomass, long-term experiment, production, sustainable management, wooded meadow.*

THE EFFECT OF THINNING ON THE DEVELOPMENT OF SILVER BIRCH STANDS: ABOVEGROUND BIOMASS, LEAF AND FINE ROOT CHARACTERISTICS

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Abstract

Silver birch is the most prominent commercial deciduous tree species in the Northern and Baltic countries and in recent decades' silver birch timber has increased in economic importance in Estonia. However, for producing high quality timber for industry, well timed thinnings in naturally regenerated young birch stands are inevitable. To clarify the effect of thinning on the ecosystem level, aboveground biomass, leaf traits and fine root biomass (FRB), as well as fine root production (FRP) were studied in three naturally regenerated silver birch stands of different ages growing at fertile sites. The results of the present study reflect long-term and early post-thinning effects. Thinnings decreased standing aboveground biomass, including foliage on the stand level. However, no clear effect was found on fine roots, leaf traits or the aboveground leaf litter flux. In all studied stands, leaf area index (LAI) was higher for control plots. Specific leaf area (SLA) was higher in the timely thinned stand while in the case of delayed thinning it was higher in the control plots. Thinning increased average stem mass, fine root biomass and production on the single tree level, since the number of trees decreased. Also, thinning resulted in longer living crowns and higher leaf nitrogen content in the stand with a long thinning history. In general, thinnings had a clear effect on the level of individual tree and, through improved growing conditions for the remaining trees, ensured their higher production potential. On the stand level, the effects on leaf and root traits were vague or, in some cases, contradictory.

Keywords: *Thinning, silver birch, aboveground biomass, LAI, fine root biomass.*

CARBON DYNAMICS IN GREY ALDER STAND GROWING ON ABANDONED AGRICULTURAL LAND – LONG TERM STUDY

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Abstract

Concerning the policies of mitigating climate change impacts, there is an increasing demand to assess the carbon (C) dynamics of different forest ecosystems. Moreover, mentioned characteristics are essential for interpreting ecosystem C sequestration ability. In the current study, C storages and fluxes of the grey alder stand, growing on former arable land, were estimated for clarifying its C sequestration capacity. The net ecosystem production and the net primary production were studied. The results of above- and belowground biomass and production of the 22-year-old stand were compared to earlier published respective data from the same stand. C budget for the studied stand was compiled of the data of the C input and output fluxes. The studied grey alder stand acted as a C sink, NEP was positive, being almost 7 t C ha^{-1} yr^{-1}, indicating that studied ecosystem sequestrates C effectively into the soil and biomass. The greatest share of C was accumulated in tree biomass. C accumulated in stemwood formed ca. 70% of the total biomass of the 22-year-old grey alder stand. Belowground biomass formed a remarkable portion of total forest biomass. C sequestrated into fine- and coarse roots made up to 15% of total biomass of the studied stand, providing an essential C pool. Largest C input into the soil originated from the leaf litter forming ca. half of the total annual organic C input flux, followed by the belowground organic C input via tree fine roots. This study contributes to our understanding of growth, development and C dynamics of grey alder plantations.

Keywords: *Grey alder, Net ecosystem production, Net primary production, Soil respiration, Carbon fluxes.*

THE FRACTIONAL DISTRIBUTION AND PRELIMINARY MODELS OF ABOVE-GROUND BIOMASS AND STEMWOOD DENSITY OF BIRCH IN ESTONIA

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Abstract

The aim of the study was to determine the aboveground biomass and fractional distribution of birch (*Betula pendula* Roth. and *Betula pubescens* Ehrh.) model trees, also to create country specific models for estimation of aboveground biomass and to investigate the basic wood density of birch. Basic density samples were taken from different heights of the model trees ($D_{1.3}$ and $H_{70\%}$). The study material consisted of 69 model trees from 18 stands. Model trees were taken from stands with different site indexes and divided into three classes: Ia–I (n=42); II (n=20) and III–IV (n=7). Model trees from each site index class were further divided into five age classes: 1. 11–20-yr old; 2. 21–40-yr old; 3. 41–60-yr old; 4. 61–80-yr old and 5. 81–100-yr old. The average share of stemwood in aboveground biomass was 79%, 70%, and 71% in Ia–I, II and III–IV site index class, respectively. The share of stem bark varied between 13–15%. The average share of branches did not depend on the site index class and was 12%, 10% and 6% in II, III–IV and Ia–I site index class, respectively. The average share of leaf biomass was 4% in II, III–IV and 1% in Ia–I. The stemwood density varied according to the model tree age and site index class. The average stemwood density measured at $D_{1.3}$ of Ia–I, II and III–IV site index classes were 0.627; 0.569 and 0.593 g cm^{-3} and at $H_{70\%}$ 0.583; 0.557 and 0.554 g cm^{-3}, respectively. The overall estimated average birch wood density was 0.582 g cm^{-3}.

Keywords: *Above-ground biomass, Betula, biomass fractions, biomass models, wood density.*

VASCULAR PLANT DIVERSITY AS A VALUABLE TOOL FOR THE ECOLOGICAL AND CULTURAL PROJECTION OF THE NATIONAL PARKS IN GREECE

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Abstract

National Parks are natural areas that usually possess high ecological and cultural value. Their intact landscapes, the representativeness of their natural ecosystems and the high diversity of their biota give them outstanding ecological, aesthetic, cultural, educational and scientific values. They have high conservation value and attract numerous visitors aiming to experience nature. A recent project co-funded by the European Union and the Greek National Funds is AdVENt*: Augmented Visitor Experience in National Parks*, started in 2018 and has a 3-year duration. The AdVENt project aims to develop innovative applications to enhance visitors touring experience in protected areas of particular environmental interest and natural beauty, as well as the production of rich and technologically advanced multimedia content for their promotion, to highlight their natural wealth as a remarkable and attractive touristic product. More specifically, the project focuses on the mountain complex of the Region of Central Greece, which includes the National Parks of Oiti and Parnassos. Both areas host a remarkably diverse flora and fauna, while Mt Parnassos is considered as a hotspot of plant species diversity and endemism. Important archaeological sites like Delphi, major ski centers and popular hiking trails are combined with remarkable natural fir forests and other mountain habitat types and a rich endemic flora. It is noteworthy, that AdVENt project will create: a) a vascular plant database of the National Parks of Oiti and Parnassos, available to the scientific community and the general public, which is expected to promote research in the relevant fields of botany, ecology etc., b) an integrated Augmented Reality (AR) mobile application for enhancing the visitors touring experience and c) the development of cutting-edge technology for the visual identification of vascular plant species.

Keywords: *Vascular plants, Application, Augmented Reality, National Parks, Natura 2000.*

RESTORATION, MANAGEMENT AND VALORISATION OF PRIORITY HABITATS OF MEDITERRANEAN COASTAL AREAS

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Abstract

The Mediterranean Basin is one of the most bio-diverse regions and the third most important plant diversity hotspot worldwide. However, the Mediterranean region is also known as one of the planet most threatened territories, being the 4th most significantly altered biodiversity hotspot of the planet, and the 2nd in habitat area loss. Therefore, one of the recent projects co-funded by the EC is LIFE17 NAT/GR/000511: "*Restoration, management and valorisation of PRIority habitats of MEDiterranean coastal areas*" (project areas: Anatoliki Makedonia – Thraki, Greece and Lazio, Italy). The primary aim of the project is to improve the conservation status of the habitats included in the Habitat Directive 92/43/EC: 1. Annex II (a) 3170* Mediterranean temporary ponds; (b) 91E0* Alluvial forests with *Alnus glutinosa* and *Fraxinus excelsior*; (c) 5230* Arborescent matorral with *Laurus nobilis;* 2. Annex I (d) 91M0 Pannonian-Balkanic turkey oak-sessile oak forests, as well as of the species included in the Annex I of the Habitat Directive 92/43/EC: (e) *Eurotestudo hermanni*, (f) *Emys orbicularis*, (g) *Callimorpha (Euplagia) quadripunctaria**, through interventions taking place within SCI GR1150010 and SCI IT6030022. It is noteworthy that the accurate and innovative interventions, that will be implemented in this project, can represent a good opportunity for conservation and restoration of biodiversity and ecosystem services, providing solutions for mitigating the climate change effects. Furthermore, the innovative interventions will be implemented and valorised during the project's duration so that replication and transportation to other similar environmental contexts will be feasible, thus promoting and enabling the long-term conservation of these habitats and species.

Keywords: *Restoration, Management, Valorization, Natura 2000, Mediterranean.*

EPIGENETICS VS GENETICS: A DIFFERENT VIEW BEHIND THE EMBASSY OF GENES IN NATURAL FOREST POPULATIONS

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Abstract

Phenotypic variation, adaptation to climate changes, resistance to fungi and diseases for forest trees until recent years have been studied in relation to their genetic component. Results from genetic studies which used molecular markers explained only a small percentage of this variation. So the important question which still remains is: *what component we miss and we cannot fully understand those variations?* A new perspective showed that epigenetics is also strongly associated with genetics and must be studied in detailed for natural ecosystems. The term epigenetics refers to the study of heritable changes in gene expression and function that cannot be explained by changes in DNA sequence. Our study focused on DNA methylation which was the addition of a CH3 in a cytosine without changes of nucleotide sequence. The study of epigenome, at the landscape level may add important acumen in order to identify genomic regions which are associated with adaptive variation. This complex issue has recently become a priority and studies which target genetic and epigenetic diversity have been conducted in natural forest tree populations in order to identify the relationship between them and examine additional component of epigenetic diversity in phenotypic variance and plasticity. By estimating epigenetic diversity and especially DNA methylation, improvement of our understanding of the mechanisms underlying natural variation in ecologically important traits will be accomplished.

Keywords: *epigenetics, MSAP, DNA methylation.*

INVESTIGATING FACTORS AFFECTING CONSUMPTION OF CONSTRUCTION TIMBER FOR TEN SELECTED EUROPEAN COUNTRIES. A FOOTPRINT APPROACH

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Abstract

Europe is a world leading producer and consumer of wood products, which generates a substantial forest "footprint" both inside and outside European borders. However, there has been limited research on what factors shape consumption, and in particular, the relative roles of local forest abundance, forest production and economic wealth. This paper helps to address this issue, by assessing the relationship between few key variables–consumption of construction timber, forest area, GDP and finally forest products footprint. Ten European countries were selected, ranging from countries with very high forest cover and low population density to those with very low forest area per capita. Pearson correlation was employed. It was found that, on average, the wood products consumption is more related to people in more forest-endowed countries than those in countries with less forest per capita. However, this relationship shows regional variation. In other words, higher rates of forest areas appeared to support higher rates of consumption rather than lower imports or "external footprints". The results for per capita GDP revealed a significant correlation with per capita consumption, primarily within the examined emerging economies. This decoupling of wood consumption from GDP in wealthier countries is consistent with past studies. Finally, significant correlation was found between footprint and sawnwood consumption almost across all the case studies, while in only three of them wood panels consumption was related to footprint. All of these observed patterns, taken together, highlight the need for additional research to understand the causal factors and net environmental and social impacts.

Keywords: *Consumption, forest products, forest footprint, GDP, correlation.*

EXPERIENTIAL ACTIONS IN THE FOREST: AN INNOVATIVE PROJECT

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Abstract

The main aim of the project is the capitalization of forestry research field with a view to enhance the knowledge of primary and secondary teachers on specific issues related to forest ecosystems and climate change. Improving students' environmental knowledge and attitudes must be considered essential because the same students will be responsible for nature conservation in the future. For the needs of the project, the aesthetic forest of Kaisariani in Hymettus mountain, was selected as a study-implementation area. The phases of the project are divided into: a) preparatory phase b) preparation and experiential training of the teachers and c) dissemination of results. The expected results of the project are related to: a) knowledge transfer to teachers and eventually to students b) dissemination of training material to all Primary and Secondary Education Directorates and to Environmental Education Centers across the country and (c) promoting the value of the protected Hymettus Aesthetic Forest which is part of the NATURA 2000 Network. The teachers who will be trained through the project will act as mediators of knowledge and environmental awareness message to pupils, who in turn will be the new generation of sensitized, informed and active citizens. The long-term goal of the project is to promote, conserve and protect forest ecosystems, promoting simultaneously biodiversity and ecosystem services.

Keywords: *Forest ecosystems, experiential learning, climate change.*

THE RED FOX AS A "ONE HEALTH" CHALLENGE IN THE PERIURBAN MATRIX

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Abstract

The emergence of medium-sized carnivores, the mesopredators around human settlements is a well-known phenomenon all over the world. Some of these species can play a significant role in the epidemiology of diseases, such as bovine tuberculosis (bTB), as maintenance or spill-over host of the disease. The red fox as a reservoir was studied slightly with controversial results. Hence, we aimed to assess the prevalence of bTB and to evaluate the public health risk caused by a bTB infected red fox population living in a periurban matrix within a bTB hot spot. Whereas foxes could not be hunted around human settlements, specimens for isolation of mycobacteria originated from the adjacent sylvatic environment, exclusively. In order to determine whether the urban and sylvatic fox populations were separated or mixed, we collected scat samples for parasitological investigations. The difference in species diversity, prevalence, and intensity of parasitism was regarded as an indicator of population separation between urban and sylvatic foxes. Out of 76 red foxes examined between 2008 and 2016, we detected *Mycobacterium caprae* in six ones (CI95% prevalence: 3.5-16.3%); none showed any macroscopic or histopathologic lesions. Parasitological investigation on urban (N=31) and sylvatic (N=35) scat specimens could not confirm the separation of the urban and sylvatic fox populations; therefore, we considered the periurban matrix as the part of the sylvatic fox habitat. In spite of the permanent movement between the forest and the periurban matrix, our findings did not confirm the hypothesis that the red fox caused a recognizable public health risk as a bTB reservoir for the present. On the other hand, some parasite species identified in the studied fox population have got zoonotic concern and needs further, multidisciplinary research to determine the real risk exactly. In urban ecosystems, One Health approach is the only way to study and manage diseases originated from wildlife.

Keywords: *mesopredator, periurban matrix, One Health, public health risk.*

SILVI-MEDICINAL SYSTEM FOR CLIMATE SMART AGRICULTURE

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Abstract

The research experiment entitled "Silvi-medicinal system for climate smart agriculture" was conducted in Alfisols at AICRP on Agroforestry, PJTSAU, Rajendranagar, Hyderabad during seasons of 2008-09 and 2009-10. The experiment site of the plantation area (amla and terminalia) was characterized by semi arid climate with low organic carbon (0.28 to 0.57%), low available N (160 to 194 kg ha-1), medium available phosphorus (28 to 37 kg ha-1) and available potassium (233 to 265 kg ha-1). The medicinal crop of andrographis was intercropped in the existing tree crops of amla and terminalia. The treatments consisted of three cropping systems as main plot treatments and six INM treatments as sub plot treatments. The treatments were laid out in split plot design and replicated three times. The results of the experiment on andrographis intercropped silvi-medicinal system revealed that soil available N, P and K content after crop harvest were more under terminalia intercropping situation followed by amla intercropping situation and with low status in sole cropping. Soil N, P and K status after crop harvest were also the highest under the treatment with 20 kg N ha^{-1} through urea + Vermicompost @ 2 t ha^{-1} among the different INM treatments. Thus, Silvi-medicinal system does not only provides more economic returns to the farmer, but also plays an important role in climate smart agriculture by enhancing the soil fertility which is needed in the present context of climate change.

Key words: *Silvi-medicinal, andrographis, terminalia, amla.*

INVESTIGATION OF EFFECTIVE FACTORS ON SUCCESS RATE OF NATURAL RESOURCES COOPERATIVES IN WEST AZARBAYJAN PROVINCE, IRAN

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Abstract

Cooperatives, as a collaborative management tool, are a suitable and practical solution for successful forest management. This research was conducted among registered agricultural and natural resources cooperatives in West Azarbaijan province with the aim of determining the factors affecting the success rate of them. The statistical population includes 32 cooperatives in 14 counties. 205 questionnaires containing 7 criteria were distributed among the members of the board of directors. Cronbach's alpha was used to measure the reliability. Two and multiple logistic regression analyses were used to investigate and determine the factors affecting the success rate of cooperatives. The Cronbach's alpha coefficient for the whole questionnaire was 0.860. The results showed that educational, social, attitude, economic and managerial factors affected the success rate of cooperatives. Among these factors, the economic factor with negative coefficient played the most important role in the success rate of cooperatives. Also, the study of economic indicators in the province indicated the inappropriate situation, so that the province rank in terms of per capita income, development index and per capita production among the countries (Iran) was 26, 24 and 28, respectively. The above mentioned results showed that the weakness of the province economic situation that played an important and fundamental role in the success of cooperatives, especially in the field of natural resources and agriculture, along with other factors, therefore, for the success of cooperatives and even other institutions. It is necessary to make strategic plans for improving the economic situation of the province.

Keywords: *Participatory Management, Forest Cooperatives, sustainable development.*

EFFECT OF FIRE ON SOME PHYSICOCHEMICAL PROPERTIES OF FOREST SOILS DYNAMICS, NW IRAN

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Abstract

This study aimed to investigate the effect of fire on physical and chemical properties of soil in North Zagros forests that were burned in September 2017. A control area was selected with the same conditions in the vicinity of the burned area. After surveying the forest conditions, 9 plots each with 500 m^2 were taken in each area (totally 18 plots) using systematically randomized grid. Specifications of all trees with a diameter of over 5 cm were recorded for species type, diameter, and crown diameter. Also, the height of the nearest one to the center of plot and thickest tree were determined. Soil samples were collected three times at a three month intervals after fire in 0-10 cm depth. PH, EC, K, P, OC, Ca, Mg, N and soil texture were measured. The results showed that the amount of soil elements in the burned area was slightly higher than the control, which was not statistically significant. The results of analysis of repeated measures showed that the effect of time on pH, calcium and magnesium content in both burned and control area was statistically significant. It was also found that the fire had not any impact on soil texture. As a general conclusion, it can be said that soil properties show significant changes over time, but the low intensity of fire in the studied area has not had much effect on the physical and chemical properties of soil, and after 6 months more elements returned to the early levels.

Keywords: *Repeated measures, Forest fire, Zagros forest, Soil, Iran.*

USING MULTI-CRITERIA DECISION-MAKING METHOD AND VISIBILITY ANALYSIS BASED APPROACH IN LOCATING FIRE LOOKOUT TOWERS, SARDASHT FORESTS, NW IRAN

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Abstract

The present study aimed to locating forest fire lookout towers in northwest of Iran with an area of 27328.36 ha. For this purpose, the following criteria were selected for lookout towers mapping: elevation, slope, distance from previous burned areas, and distance from residential areas. Using Analytical Hierarchy Process method, influence of each factor on the locating was compared pairwise and weights were assigned to them. Then, initial locating map was created using the weighted linear combination approach, and it was reclassified in four classes to prepare a suitability map: totally unsuitable, unsuitable, fairly suitable and totally suitable classes. After defining four specific-zones, the high-elevated ridges were selected separately for each suitable class and zone with constraints of 10 and 15 meter height of the towers and 10000 meter radius. By selecting four points with the highest visibility based on an comprehensive spatial visibility analysis and maximum spatial coverage over the region, results revealed that all proposed tower locations with 10 and 15 meter heights were capable to cover spatially about 46.44 and 48.36 percentage of the entire region and nearly 45.90 and 47.3 percentage of areas within high and very high fire risk classes on previously-developed forest fire map, respectively.

Keywords: *Analytical Hierarchy Process (AHP), Fire observation tower, Visibility analysis, Forest fire, Sardasht.*

CONSEQUENCE OF FOREST PROTECTION MANAGEMENT (STUDY AREA: ARASBARAN BIOSPHERE RESERVE IN NORTHWEST IRAN)

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Abstract

Concurrence of global climate change and the decline in natural resources has led scientists to focus on the sustainable development of forest management. Protection of forests is an important strategy to improve quantitative and qualitative characteristics of forest stands around the world. Arasbaran forest with an area of 146138 hectares is located in a semi-arid zone, Northwest of Iran. Forest protection policy has been implemented in a part of this forest since 1973 (about 77493 hectares, nearly 56 percent of total Arasbaran forests area) and after four years in 1977 it was placed by UNESCO on the list of international network of Biosphere Reserves. A comprehensive sampling schedule from both protected and unprotected areas was designed to compare two areas. Finally, about 132 circular sample plots with an area of 300 m^2 were located on the northern aspects of the studied areas (66 sample plot in each one). Quantitative and qualitative characteristics of woody species in each plot were recorded. Results revealed that parameters including diameter at the breast height (DBH), basal area (BA) and proportions of seed-originstems, total height, crown's height and canopy area were significantly higher in protected area ($p<0.05$). Proportions of coppiced stems were significantly higher in unprotected area ($p<0.05$). Also results showed that diversity indices for both protected and unprotected areas did not significantly differ between sites. In conclusion, accordingly, forest protection policies integrated with developing appropriate deforestation and degradation indicators for improved forest conservation measures are highly recommended.

Keywords: *Arasbaran forests, Forest protection, Quantitative and qualitative characteristics.*

VARIATIONS OF HERB LAYER DIVERSITY IN RELATION TO FOREST MANAGEMENT IN TEMPERATE MIXED FORESTS OF IRAN

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Abstract

Understory plant diversity is considered as relevant indicators for human impact and evaluate biodiversity in ecosystem-based forest management. Hyrcanian forests (in Iran) are managed with single tree selection systems. The aim of this paper is to address the following questions: Does single tree selection management lead to change in herb layer diversity in managed forests compared to unmanaged forests? Three lowland mixed forests and three upland mixed forests were selected. Managed stands were compared to stands that had not been managed since at least 30 years at each of six sites. A total of 120 plots were established (10 plots within each forest to record the percent cover of each plant species). Comparison between species richness and diversity indices in managed vs. unmanaged forests was done with Mann Whitney test. Non-metric multidimensional scaling ordination (NMDS) was used to investigate variations of species composition in managed and unmanaged forests. Generalized linear models (GLM) were employed to analyze the effect of management on species diversity indices. The results showed that that there was no significant difference between in managed and unmanaged forests in respect to total cover and diversity measures. GLM analysis illustrated that forest management did not have significant effect on species richness, species evenness and Shannon diversity. Also NMDS demonstrated that managed and unmanaged sample plots were not ordinated by variation of their species composition. It was concluded that the single tree selection method operated in the managed forests was a suitable approach to maintain herb layer diversity in Hyrcanian forests.

Keywords: *Forest management, Species diversity, Hyrcanian forests, Iran.*

EVALUATION OF DIFFERENT HARVESTING METHODS FOR THE SUPPLY OF WOOD-CHIPS IN AGROFORESTRY SYSTEMS

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Abstract

This study is a part of a project supported by the Italian Ministry of Agriculture and Forestry under the FAESI Project to allow agro-forestry biomass management for energy supply at a regional level. In fact, wood biomass is a valuable energy source, which is attracting much interest from scientists and agro-industry managers. Before energy conversion, wood biomass is generally processed into particles of variable size and shape. The comminution of wood is performed to homogenize different wood assortments (logs, branches, etc.) and to increase the load density. Typically, woodchips are used for energy production and making chipboard panels. At present, in Italy and in Europe, large amounts of woodchips are used as biomass for energy production because there are many economic incentives for this biofuel use. The goal of this study was to determine productivity, cost and product quality achieved from different harvesting methods for the supply of wood-chips in agroforestry systems. To obtain real data, time observations recorded by stop-watch were conducted in different area tests. Data about operational working time as well as working productivity were recorded according to CIOSTA and IUFRO requirements. The preliminary outputs revealed satisfactory results, despite some encountered problems due windrow characteristics about agricultural crops and the different levels of mechanization adopted.

Keywords: *agro-forestry mechanization, wood biomass supply chain, productivity, quality, FAESI.*

MAJOR OAK PESTS OF LEBANON

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Abstract

Lebanese forests cover around 13% of the national territory. Broadleaved forests constitute 57% of the total forest cover, whereas coniferous forests 32% and mixed forests cover 11%. The kermes oak, *Quercus calliprinos* (Fagaceae) is the most common species in broadleaved areas followed bythe Gall oak *Q. infectoria*, the Turkey oak *Q. cerris var. pseudo cerris* and the Brant's oak *Q. brantii*. The other native species found with low number are: *Q. libani, Q. cedrorum, Q. ithaburensisungeri, Q. microphylla* and *Q. pinnatifida*. Like the other forests in Lebanon, oak forests are subject to stress due to climate change, fragmentation, quarries, chaotic and firemake trees more vulnerable to native and exotic invasive pests. A total of 14 insect species associated with oak trees were identified in this study. The oak leafminer *Phyllonorycter libanotica* (Lepidoptera, Gracillariidae) and the Giant mealybug *Ceroputo pilosellae* (Hemiptera, Coccidea) are the species most recorded during the last 2 years and they share the same geographic area. They are followed by the Eriophid mites *Aceria sp.* (*Eriophyidae*) and the oak *processionary Thaumetopea processionea* (Lepidoptera, Thaumetopoeidae). Other minor pests found are: the leopard moth *Zeuzera pyrina* (Lepidoptera, Cossidae), 2 insect galls *Cinips quercus* and *Andricus coriarius* (Hymenoptera, Cynipidae), 4 armored scales (Hemiptera, Diaspididae) *Chionaspis lepineyi, Aspidiotus nerii, Diaspidiotus viticola, Aonidiella aurantii* and 1 species of aphids belong to the genus *Myzocallis* (Hemiptera, Aphididae). Two species *Xylosandrus compactus* (Coleoptera, Scolytidae) and *Kermes echinatus* (Hemiptera, Kermesidae) have been identified for the first time in Lebanon on *Q. calliprinus* and *Q. ilex respectively*.

Keywords: *Lebanon, Quercus, bark beetles, forest degradation, invasive species.*

NATURAL HYBRIDIZATION AND FEATURES BETWEEN *ALNUS INCANA* (L.) MOENC. AND *ALNUS GLUTINOSA* (L.) GAERTN. IN LITHUANIA

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Abstract

Trees of the black alder, grey alder and their hybrids were evaluated according to morphological features of bark and leaves in mixed species composition seed plantation, short-term 0.05 ha plots self-regenerating young stands, near mixed stands of both species in four forest districts and in experimental plantations in Lithuania. Phenological differences in the distribution of leaves of these trees were also identified. According to the wood samples, the width and density of the annual tree rings of both species and hybrids were determined. We performed a phenological and taxonomic evaluation. We found 8.8% of hybrid alders of the total number of trees in the plots. The proportion of hybrids found in the experimental plantations was 2.6% of the total number of trees. 49% of the hybrid trees selected in the plantations were harder and denser than their family average. Selected hybrid trees were 70% more resistant to frost than their families on average. The use of specific combinatorial power can produce good results in cross-planting in black alder and grey alder and their hybrid plantations. The flowering time of hybrids and parent species overlaps (in this case, the phenomenon of black alder is more important, because the grey alder pollination of black alder pollen is more successful).

Keywords: *Hybridization of alders, Morphological features, Phenology, Taxonomic evaluation.*

CHARACTERIZATION OF *POPULUS* HYBRIDS BY THEIR DIFFERENT RESPONSES TO ABSCISIC ACID DURING *IN VITRO* CULTURE

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Abstract

The aim of the study was to determine the effect of phytohormone abscisic acid (ABA), known for its accumulation in plants during stress (e.g., drought), on four selected *Populus* genotypes. These represented the crossings of Eurasian aspen with either American aspen (*P. tremula* × *P. tremuloides*; genotypes L191, Wa13, and 174/10) or white poplar (*P. tremula* × *P. alba*; genotype 91/78). Experiments were conducted on clonal *in vitro* cultures through two stages. First, explants – apical shoot segments – were cultured on different media, either hormone-free or enriched with 3 µmol/L ABA, in darkness (thus, genotype responses to the absence of light were also tested). Afterwards, the apical segments of control and ABA-treated shoots were excised again and transferred onto fresh hormone-free medium under standard light conditions. The results showed that genotype L191 was most negatively affected by darkness and further suppressed by ABA. In comparison to L191, Wa13 was less affected by darkness, but its root formation and development remained suppressed by ABA even during the following subculture on hormone-free medium. Genotype 174/10 developed relatively well in darkness and, among the tested genotypes, was least affected by ABA. Meanwhile, genotype 91/78 showed the most complex response to ABA: it had weaker shoot growth and root development under direct ABA treatment. However, on the fresh hormone-free medium, the ABA-affected 91/78 explants had longer shoots and dominant roots than their counterparts from the control variant. This suggests that, in crossings with aspen, white poplar genes can improve a proper response to stress hormone ABA.

Keywords: *Aspen, White poplar, Hybrid tree, Nutrient medium, Rooting.*

THE LOCATION OF THE NORTHERN GLACIAL REFUGIUM OF SCOTS PINE BASED ON MITOCHONDRIAL DNA MARKERS

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Abstract

Several recent studies based on mitochondrial DNA markers suggested a northern refugium for Scots pine somewhere westwards of the southern part of the Ural Mountains. The objective of our study was to assess the mtDNA polymorphism of Scots pine at the Nad7-1 and Nad1-B/C loci with the aim of detecting the location of this northern glacial refugium and the associated post-glacial migration routes. We studied 54 populations densely covering the European part of Russia westwards of the Ural Mountains, but also populations from the Czech Republic, Poland, Sweden, Finland, Scotland, Georgia and eastern Siberia were included. For the Nad1-B/C locus, all our material was monomorphic. Of the total of 474 individuals tested at the Nad7-1 locus, 348 individuals (73%) possessed the universal haplotype A of 300 bp and 126 individuals (27 %) - the northern haplotype B of 295 bp. Geographical distribution of the Nad7-1 northern B haplotype was not random (SAMOVA, BAPS) forming a consistent cline directed towards north-west of the south-eastern part of European Russia up to the Scandinavia in the north. This provides a stronger support for the south-eastern rather than the central European location of the northern glacial refugium. A possible location of the northern refugium could be at about 300 km south-east of Moscow, where the northern B haplotype occurs in high frequency and Scots pine could possible survive during the LGM. There is also a possibility for a more southern location of the northern refugium, assuming that such signature has been lost during the northward migration or via genetic drift.

Key words: *differentiation, glaciation, Pinus sylvestris, phylogeography, mtDNA, organellar DNA.*

SOCIO-ECONOMIC CONTRIBUTIONS OF FOREST RESOURCES TO LIVELIHOODS IN ALIMOSHO LOCAL GOVERNMENT AREA OF LAGOS STATE

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Abstract

There is an increasing understanding that forests play crucial roles in sustaining livelihoods among the rural communities and is a key element in poverty reduction strategies. This study assessed the socio-economic contributions of Forest Resources to Livelihood in Alimosho Local Government Area of Lagos State through a random selection of two hundred (200) respondents interviewed with a questionnaire with both open and closed ended questions to elicit needed information on respondents' socio-economic and other relevant characteristics. The data gathered were collated and analyzed using regression analysis and frequency distribution. The findings showed that more than half (63%) of the respondents were females between ages 15 and 50 years; a greater part (76%) were married with average of 5-10 persons in their households. All respondents (100%) had one form of formal education or the other and were engaged in different forms of vocation. Regression results confirmed that access to forest products was associated with household's characteristics such as age, position in the household, level of education and distance to the forest all indicating significant relationship with forest access and utilization of forest resources. Households' dependence on forests and activities they engaged in also had a significant impact on the forest in terms of conservation and sustainability of forest resources. The study concluded that forest resources played vital roles in the livelihoods of the respondents and recommended that more attention should be given to forest resources conservation by the government and assistance should also be given to foresters in the form of subsidy.

Keywords: *Forest, Livelihoods, Socio-economic, Lagos, Sustainable.*

SOCIO-ECONOMIC SURVEY OF FOREST FOODS IN AFIJIO LOCAL GOVERNMENT AREA OF OYO STATE, NIGERIA

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Abstract

Forest supplies diverse products and services to mankind especially in the area of wild plants and animal food products. This research involved a socio-economic survey of forest foods in Afijio Local Government Area of Oyo state, Nigeria. The specific objectives were to identify and describe the socioeconomic characteristics of the respondents; to identify the available edible forest wild plants; to determine the contribution of forest foods to nutrition and food security among the respondents as well as to identify and describe major problems facing forest foods collection. Primary data were collected from 150 respondents selected through random sampling techniques from seven Districts of the Local Government. The data were analyzed using descriptive statistics, logit regression and Pearson Correlation Coefficient. The findings showed that a greater part of the respondents (58%) were male and 87% of the respondents were married. The results revealed that 47% of the respondents were in their active ages between 41-60 years and 76% of the respondents had family size of 1-5 persons. The study further revealed that over whelming majority of the respondents made use of forest food products. The major problem encountered by forest products users was the unavailability of forest food products in the off season. Based on the findings, it was suggested that, there should be provision of good storage facility and orientation of the farmers on modern ways of preserving wild foods to make them available throughout the year.

Keywords: *Logit Regression, Forest Foods, Wild Plants, Storage, Afijio.*

OUTBREAK DYNAMICS OF THE EUROPEAN BARK BEETLE *IPS TYPOGRAPHUS* (L.) (COL.: *CURCULIONIDAE*, *SCOLYTINAE*) DEPENDING ON THE AGE OF THE STAND AND THE FOREST HABITAT

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Abstract

The research was conducted in Białowieża Forest in NE Poland. The paper presents the development and dynamics of bark beetle gradation in one of the forest inspectorates in the Białowieża Primeval Forest. The development and dynamics of the bark beetle population in the years 2012-2016 were estimated using data on settled trees as well as tipping and scrap on individual secretions. Using the numerical map of the Białowieża Forest, an analysis of the spatial distribution of settled trees (m^3/ha) was carried out. The analysis was based on a habitat type of forest, age class and stand function. The increase in the size of the bark beetle population is currently influenced by favorable conditions for its reproduction, that is, damage from wind and hydrological disturbances. It is advisable to continue monitoring the emerging settled deposition, even if it cannot be obtained. The collected results will give the opportunity to provide detailed documentation of the course of gradation and research. The analyses confirmed the influence of the age of forest stand and forest habitat on the course and dynamics of gradation.

Key words: *Ips typographus, Białowieża Primeval Forest, Outbreak dynamics*.

THE STRUCTURE AND SEASONAL DYNAMICS OF DUNG BEETLE COMMUNITIES IN EARLY DEVELOPMENTAL STAGES OF PINE STANDS IN NW POLAND

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Abstract

The research was conducted in Człuchów Forest in NW Poland. Eight research plots, representing early developmental stages (forest plantation and thicket stage) of pine stands, were established. Five traps baited with cow dung were set in each of the plots. In total, 24 811 specimens of dung beetles (*coprophagous Scarabaeoidea*) were collected, representing 34 species. The structure of dung beetle communities inhabiting forest plantations and thicket stages of pine stands changes in the course of the vegetation season. The culmination of the process takes place in July, when a dramatic drop of the number of both individuals and species occurs. Dung beetle communities inhabiting forest plantations and thicket stages of pine stands are dominated by earth-boring dung beetles (*Geotrupidae*). The proportion of individuals representing *Aphodiinae* and *Scarabaeinae* dung beetles amounts to less than 2/5 of the total. *Anoplotrupes stercorosus* plays the role of the superdominant in those communities, and *Trypocopris vernalis* is a superdominant or dominant species. Two communities of dung beetle were differentiated, based on the season of adult activity: spring-autumn type (characterized by high species richness and the presence of *Agrilinus ater*, *Calamasternus granarius*, *Chilothorax paykulli*, *Copris lunaris*, *Esymus merdarius*, *Heptaulacus testudinarius*, *Melinopterus sphacelatus*, *Nimbus contaminatus*, *Oxyomus sylvestris* and *Rhyssemus puncticollis*) and spring-summer type (characterized by the lowest species richness and the presence of *Bodilopsis rufa*, *B. sordida*, *Geotrupes spiniger*, *Limarus zenkeri*, *Othophorus haemorrhoidalis* and *Rhodaphodius foetens*).

Key words: *Scarabaeoidea, Geotrupidae, Scarabaeidae, coprophagous beetles, Pomerania*.

TRENDS IN THE LENGTH OF THE THERMAL GROWING SEASON IN THE NORTH POLAND

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Abstract

This study presents the temporal and spatial tendencies in the thermal growing season (TGS) length in North Poland in 1951−2015. The analyses were conducted using long-term and homogeneity daily data sets from 35 meteorological stations in the studied area. Trends in the TGS length as well as start and end dates were analysed for the whole study period as well as for successive 30−years periods: 1951−1980, 1961−1990, 1971−2000 and 1981−2010. The results show a general increase of the length of the TGS in this part of Poland in 1951−2015 period. However, there are spatial and temporal differences in TGS evolution. In the western and central part of the region, the growing season in the past 65 years became ca. 20 days longer, while in the eastern part the lengthening of TGS was weaker and amounted to 7−10 days. Most of this change was due to earlier onsets of the TGS in spring. The observed trends and tendencies showed spatial and temporal variability in TGS evolution. Trends in parameters of TGS, calculated for 30−years period, varied directionally and spatially with no significant trends before 1980. In the period 1981−2010 the growing season was longer than in the previous years (~ 0,5-1.2 days/year). Since the 1980s the frequency of long growing seasons increased. A particularly large and steady increase TGS occurred over the first 15 years of the 21st century. Length as well as start and end dates of the TGS displayed large inter−annual and decadal variability with tendencies for increased range of variability. Finally, relationships between the changes in TGS and frost days during growing season were determined.

Keywords: *change climate, extended of growing season, variability of parameters of growing season, Poland.*

EFFECTS OF AIR POLLUTION ON SCOTS PINE STANDS IN INDUSTRIAL AREAS IN POLAND ON THE BASIS OF DENDROCHRONOLOGICAL ANALYSIS

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Abstract

Air pollution and climate change are two key factors comprising the global change threat to forest health and sustainability. Intensive development of industry in the second half of the 20th century brought significant changes in the level of pollutants emitted into the atmosphere in Poland. Dry and wet deposition of toxic pollutants (mainly SO_2, NOx, NH_3), continuing over more than 40 years, has caused serious damage to forest stands. One of the ways describing the effect of industrial emissions on forests is the tree-rings (dendrochronological) analysis, which has been used in our research. The main aim is to evaluate of Scots pine stand degradation caused by the pollutants emitted from the nitrogen fertilizer factory in Puławy, the one of biggest polluters of the environment in Poland for over 25 years (1966-1990). Wood samples were collected from 110 old trees growing at seven plots, located at the different distances and directions from factory. Pollutant emission caused disturbances of incremental dynamics and long-term strong reduction of growth. Scott pine growing in the vicinity of the factory showed a dramatic growth reduction after 1965, following the beginning of the pollution period. Significant decrease in growth was observed for the majority of investigated trees (75%) to the end of the 1990s. At the end of 1990s decreasing trend stopped and the wider tree−rings could be observed. This situation was related with a radical reduction of ammonia emissions and an improvement of environmental conditions. However, growth of damaged trees due to the weakened health condition is lower than the growth of Scots pine on the reference plot and treesare more sensitive to stressful climatic conditions.

Keywords: *tree−ring analysis, industrial pollution, forests damage, Pinus sylvestris, Poland.*

HURRICANE WINDS IN 2017 – THE GREATEST NATURAL DISASTER FOR THE POLISH FORESTS IN HISTORY

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Abstract

Climate change, which was particularly marked at the turn of the 20th and 21st centuries, was accompanied by extreme weather events. One of these events that caused catastrophic damage to forests were the strong winds. Destructive storms occurred throughout history, but during the last century damage has increased markedly. Storms are now responsible for more than 50% of primary damage to European forests. With climate change, wind damage in Europe will continue to increase. Knowing and monitoring the mechanisms leading to strong winds, assessing their impact, and managing risk in the context of their effects is one of the important elements of a forest management strategy. In this study, we present a brief description of the most damaging storms in Poland in last decades. The basic aim of our study is the detailed analysis of the hurricane, which caused the most critical disasters in Polish forests in the last 100 years - the hurricane in August 2017. This hurricane devastated forests in the area almost 80000 hectares of forests in Poland, which of more than 39 thousand hectares were classified to complete restoration. The estimated timber volume of broken and fallen trees caused by the hurricane mounted to about 9,8 million m3 (approximately 20 million of trees). The areas affected by this hurricane included 22 nature reserves, numerous nature monuments, valuable seed stands, bird protection zones, and habitats of many precious or rare species of animals and plants. We present on maps atmospheric conditions, development and evolution of this destructive storm and describe them in relation to ecological, social and economic effects observed in 1992, 2003 and 2013.

Keywords: *destructive wind, forest damage, Poland.*

BENEFITS BROUGHT BY THE ABUNDANCE AND IMPORTANCE OF FOREST FRUITS FROM SATU MARE COUNTY, ROMANIA

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Abstract

Non-timber forest products (NTFPs), also known as non-wood forest products (NWFPs), minor forest produce, special, minor, alternative and secondary forest products, are useful substances, materials and commodities obtained from forests which do not require harvesting (logging) trees. NTFPs is an important source of food and income. Several million households world-wide depend heavily on NWFP for subsistence or income. Some 80 percent of the population of the developing world use NWFP for health and nutritional needs. NWFP have also attracted considerable global interest in recent years due to the increasing recognition of their contribution to environmental objectives, including the conservation of biological diversity. It is an important "branch" of forest management which not include the harvesting. Due to the fact that Romania has a wide variety of relief forms, numerous NWFPs can be found on her territory, the most important ones being forest fruits. Across the country, the distribution of NWFPs is not so uniform. These are rich in vitamins and have antioxidant properties, being used in alimentation, medicine and the cosmetic industry. The present article exposes the most representative forest fruits from Satu Mare County. Their classification is also realized based on an analytical hierarchy that takes into account 19 well-established criteria. Based on an analytical hierarchy, their classification it was been realized by 19 well-established criteria. The abundance was dominated by fruits like sweet chestnuts, raspberries and wild pears.

Key words: *analytical hierarchy process, forest fruits, harvesting period, perishability, NTFPs.*

SPECIES COMPOSITION OF LIVING GROUND COVER ON ABANDONED AGRICULTURAL LAND IN THE SOUTHERN TAIGA ZONE

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Abstract

The object of study - abandoned agricultural land of different ages in the Tver region (South taiga zone). The relief of the territory is hilly. Each of the three hills was explored in 4 directions – North, South, West and East slopes, as well as the top of the hills. The aim of the study is to assess the species diversity of vegetation on arable lands abandoned in different periods. Vegetation accounting was carried out on circular areas of 10 m2. Woody vegetation is represented by birch, pine Aspen and alder. In all cases, birch dominates. Some of the trees are of artificial origin - shelterbelts, ordinary planting along roads and reclamation ditches, single trees on the edges of the fields. The main part of them is of natural origin. It is established that in the composition of the living ground cover on abandoned agricultural land there are 63 species of higher plants, cereals predominate. The number of types of the individual elements of the relief is from 19 to 28 species. In the first years, the change of plant associations is dynamic. The species composition of the herbage on the former arable lands stabilizes in 15-20 years

Keywords: agricultural land, taiga zone, species diversity.

TYPES OF LIVING GROUND COVER ON FORSAKEN AGRICULTURAL LAND

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Abstract

Living ground cover, in particular grass, plays a huge role in the life of the forest. Stable ground cover, which is usually represented by shade-tolerant species, appears after 10-15 years. The cereal formation is not very stable and is eventually replaced by one of the main forest types that relevant these conditions. In the living ground cover grows more than 60 species of higher plants, several species of green mosses. At the first stage forest development of phytocenoses (15-20 years) in the composition of the living ground cover forest species make up no more than 10% of the total number of recorded species. The composition of the herbage is dominated by cereals, red clover, hypericum, goldenrod, field horsetail.

Keywords: *agricultural land, forest, ground cover.*

REVEALING THE SPECIAL NATURE RESERVE "KOVILJ-PETROVARADIN MARSHES" CURRENT LAND USE OBTAINING A TERRAIN MODEL

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Abstract

Basic natural values of the Special Nature Reserve "Kovilj-Petrovaradin Marshes" are the representative and rare hydrologically conditioned stands of white willow (*Salix alba*), white and black poplars (*Populus alba*, *Populus nigra*), pedunculated oak and ash forests (*Quercus robur* and *Fraxinus spp*.), as well as the unique open wetland habitats, meadows and swamps However, the Management Plan for the protected area from 2012 only describes it as an inundation plane located mostly at an altitude of 72-76 m and descriptively states that the bottoms of some swamps lay on 70 m and dry up at the lowest water level, while the beams along the Danube reach 80 m. A digital terrain model for the Special Nature Reserve "Kovilj-Petrovaradin Marshes" was made in order to better understand the area current use. Interpolation of the geo-positioned points was performed using ArcGIS software package and the obtained terrain model reflects the terrain hydrographic positions, revealing a conspicuous microrelief throughout the entire area. The hydrographic positions determine the habitat conditions in which certain forest types appear: black and white poplar natural stands and Euroamerican poplars plantations mostly appear on higher hydrographic positions (order of hydromorphic soils, class of undeveloped, semiglay and gley soils, mostly fluvisol), while willow forests mostly appear on lower hydrographic positions (on euglay). The terrain model contributes to the studies of the protected area habitats bio-ecological conditions and has the main goal to support understanding the area use from the aspect of optimization of different tree species cultivation.

Keywords: *terrain model, natural habitats, poplar forests, willow forests.*

PLANNING THE SIZE OF SAMPLE PLOTS IN THE RESEARCH MACEDONIAN PINE STANDS IN THE STRICT NATURE RESERVATE "MALI BELEG"

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Abstract

Determining the size of the sample plots is a demanding and complex issue and it depends largely on the character of the planned research. The approach of defining the stands as a set of trees was respected in this paper. Methodological procedure on the dendrometric-statistical basis was fully applied. Planning the size of the sample plot started from choosing an optimal number of trees in it using the classical statistical formula to determine the sample size. In even-aged, pure stands of Macedonian pine, optimal number of trees was analyzed on the basis of the predefined level of accuracy and the variation of their properties. In the pre-investigation process the coefficient of volume variation (CV%) was 78.59% based on 145 measured trees at a elementary test surface of 0.20 ha. The density of the stand is determined on the basis of 30 test surface. The optimal number of 371 trees was determined according to the usual level of the desired accuracy of volume determination ($\pm$ 8%). The size of sample plot of 0.58 ha was established using the principles of proportionality. Derived values can vary within the determined accuracy of the estimated density stand of $\pm$ 9.10%. The value of the sample size had an orientational character. When determining the surface it was necessary to respect all the factors influencing the definition of the optimal real size of the sample plot.

Keywords: *Planning, sample plot, stand, Macedonian pine.*

BREEDING OF NEW POPLAR CLONES FOR MULTIPURPOSE USES IN SERBIA: A REVIEW

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Abstract

Breeding of fast-growing trees such are poplars has been conducted at the Institute of Lowland forestry and Environment (ILFE) since 1958 when institute was established as Poplar Research Institute. Up to date result of breeding has been represented with 16 nationally registered poplar cultivars originating mostly from hybrids obtained by crossing between and within European black polar (*Populus nigra* L.) and eastern cotton wood (*Populus deltoides* Bartr.). Previous focus on breeding of new cultivars was mostly on productivity, resistance to diseases and rooting ability. Contemporary trend in forestry, which is affected by land degradation, restoration of natural forests and climate change directed breeding of poplars to achieve additional traits of new clones. Modern poplar breeding in Serbia includes early stage greenhouse and nursery trials which include physiological and biochemical research in order to make early assessment of the potential clone candidates. Early stage testing is implemented in order to assess potential of selected clones from the point of their use in environmental improvement (phytoremediation, reclamation) and in changed conditions (ecophysiology, pest tolerance). After early testing, best candidates should be tested in plantations in order to prove their superiority. For this purpose, ILFE has established network of 8 field trials spread along main rivers in Serbia. Field trials are measured and inspected on annual basis until the end of their production cycle, with aim to estimate productivity of selected clones. On the basis of obtained results in both testing phases, selected clones will eventually be registered at the Ministry of agriculture, forestry and water management of Republic of Serbia. This paper presents brief overview of poplar breeding activities in order to obtain multipurpose clones which have been conducted at the Institute since 2000.

Keywords: *Poplars, Breeding, Growth, Physiology, Multifunctional.*

CHLOROPHYLL*A* FLUORESCENCE TECHNIQUES IN DETECTION AND MONITORING OF SEVERE BIOTIC STRESS OF PEDUNCULATE OAK (*QUERCUS ROBUR* L.) CAUSED BY POWDERY MILDEW INFECTION

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Abstract

The present study aimed to investigate and monitor the effects of powdery mildew infection on the photosynthetic apparatus of *Q. robur* by using techniques of slow chlorophyll fluorescence kinetics and chlorophyll *a* fluorescence transient. Therefore, an experiment with 25 one-year old seedlings infected with *Erysiphae* spp. showing 50% leaf coverage by the epiphytic mycelia, and a same number of seedlings with coverage of 75% were conducted in semi-controlled conditions. During the experiment, the infection progressed by its natural course, until the treatment group with the higher initial leaf coverage showed signs of plant mortality. Concerning chlorophyll *a* fluorescence transient all of the observed parameters showed to be significantly influenced by the mentioned obligate leaf parasite, in both of the studied treatment groups, detected immediately during the first round of measurements. In terms of slow kinetics of chlorophyll *a* fluorescence quantum yield of non-regulated heat dissipation and fluorescence emission, quantum yield of light-induced non-photochemical fluorescence quenching and coefficient of non-photochemical fluorescence quenching showed an expected increasing trend. Meanwhile, relative electron transfer rate, coefficient of photochemical fluorescence quenching and Stem-Volmer type non-photochemical fluorescence quenchingdecreased gradually under stress conditions caused by *Erysiphae* spp. Overall, the result of this study evidences that chlorophyll *a* fluorescence techniques can be successfully applied for detection of severe biotic stress.

Key words: *Quecus robur, Erysiphae spp, chlorophyll a fluorescence transient, slow fluorescence kinetics.*

MORPHOLOGICAL VARIABILITY OF *QUERCUS ROBUR* L. LEAF IN NATIVE POPULATION

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Abstract

The undefined taxonomic status of some oak species is due to their wide range of distribution, absence of phenological barriers and occurrence of intra- and inter-specific hybridization. Pedunculate oak is one of the most valued forest species in Serbia. Individual variability in leaf morphology is induced by the interactions between the genetic structure and the effects of the environment. The study of leaf morphology from the aspect of genetic differentiation provides useful information on population and intrapopulation variability and can be the basis for the determination of species and lower categories as well as intraspecific hybrids. The aim of this study was to asses intra population variability of the pedunculate oak leaf morphology in one native populations in Serbia. The examined parameters of the leaf were: length of petiole, length of lamina, maximum width of lamina, width of the main lobe (left and right), height of maximum width, length of lamina from the base to the widest part, depth of sinus of the main lobe (left and right) and width of terminal lobe. Analysis of variance revealed significant differences ($p<0.05$) among ten individuals for all parameters except for length of petiole and width of terminal lobe. In the case of the height of maximum width, the calculated F value turned out to be the highest ($F=42,54$), and it was on the level of statistical significance $p<0.001$. The results of LSD's comparison test revealed that the mean values of the studied parameters showed among-individuals differences in all examined parameters. The analysis showed that some individuals stood out from the others based on the desired characteristics of leaf parameters.

Keywords: *Quercus robur, leaf morphology, intrapopulation variability.*

APPLICATION OF MULTISPECTRAL SENSOR AND SMALL UNMANNED AERIAL SYSTEMS FOR EARLY DETECTION OF STRESS IN FOREST STANDS OF WESTERN SERBIA

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Abstract

The main goal in the sustainable forestry is to achieve healthy forest stands which will be passed on to the next generations. Healthy ecosystems and economies rely on high-quality forests. Massive forest decline has occurred in many countries in the last several decades caused by high-number of pest infestation induced by draught and climate change. After the trees have been already physiologically stressed, pests come as the secondary infestation. Many forest pests are capable of devastating the entire forests. In the forest health protection, the key of success is to prevent major pests to breed in high number, as well as early detection of symptoms invisible to the naked eye. The object of study chosen for the application of the multispectral sensor mounted on unmanned aerial system (UAS), were coniferous forest stands, located at Mt. Kopaonik, W Serbia. Utilization of the multispectral imagery have provided us with sufficient information on the forest health and vigor. This was the first application of 5-sensor high-resolution multispectral imagery for the identification of stress of forests in Serbia. Through applications of algorithms and vegetation indices, it was possible to identify not only the dead trees in the remote and hard-to-reach areas, but also the trees which were still physiologically active, but possibly threatened by pests, although without any visible signs of health problems. The results of the study proved that the use of the multispectral sensor and small UAV has in early detection of stress for purpose of improving the health of forest ecosystems were justified.

Keywords: *Remote sensing, Forest protection, Early detection, Forest pests, Multispectral camera.*

ECTOMYCORRHIZAL FUNGAL COMMUNITY IN YOUNG PEDUNCULATE OAK STAND

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Abstract

Mycorrhizal fungi are important part of belowground biodiversity, and they are responsible for functioning of forest ecosystems. Pedunculate oak (*Quercus robur* L.) is ectomycorrhizal tree species famous for its long-lasting and durable heartwood. The greatest areas under forests of this species in Republic of Serbia are situated in Srem region. The aim of this study was to analyse community of ectomycorrhizal fungi in 18 years old pedunculate oak stand under the management of Public Enterprise "Vojvodinašume", forest administration "Morović". Six soil samples were taken with soil corer of 274 ml volume in July 2018. Identification of the fungal partner in ectomycorrhizae was performed by combining morphological and anatomical characterization of ectomycorrhizae with molecular identification approach, based on sequencing of the ITS rDNA region. Since morphological and anatomical descriptions of ectomycorrhizae of many fungi had not existed in the literature, majority of ectomycorrhizal types were identified with molecular methods. *Hebeloma sacchariolens* Quél., *Russula cf. odorata*, *Russula insignis* Quél., *Russula lilacea* Quél., *Russula pectinatoides* Peck. and *Scleroderma bovista* Fr. were identified to the species level, *Entoloma* sp., *Inocybe* sp., *Laccaria* sp., *Scleroderma* sp., *Tomentella* sp.1, *Tomentella* sp. 2 and *Tuber* sp. to the genus level; *Hyaloscyphaceae* sp., *Thelephoraceae* sp. 1 and *Thelephoraceae* sp. 2 to the family and Pezizales to the ordo level. On the other hand, fungus *Cenococcum geophilum* Fr. was identified only with morpho-anatomical methods. Overall diversity of ectomycorrhizal fungi in investigated young pedunculate oak stand was high. However, studies should be continued in older oak stands and in different seasons.

Keywords: *ectomycorrhizae, Quercus robur L., diversity, sequencing.*

AN IMPROVEMENT OF FOREST ECOSYSTEM SERVICES IN NATIONAL PARK TARA

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Abstract

For humans, time spent in nature, specifically forests, has always been cherished and nurtured in different shapes and forms. In recent years, various research in the field of ecosystem services present results in order to define and valuate all goods and benefits that are provided by nature. For as long as we know, trees have a special role in different cultures on a global scale, but not so long-ago medicinal research has showed a direct connection between time spent among trees and quality of our lives and our health. Up to date, different researches from this discipline have proved that spending time in forests can reduce stress, decrease high blood pressure and increase the production of lymphocytes that are responsible for fighting cancer. It is still not clear what elements of forest have positive effect on human health, but it is suspected that aromatic volatile substances called phytoncides play an important role. This preliminary research has a focus on defining the presence of different biogenic volatile organic compounds in trees trough gas chromatography. Presented results show a markup of species of interest for this research subject in Tara National Park that could provide a basis for valuation of forest ecosystem services in terms of its impact on human health.

Key words: *Biogenic Volatile Organic Compounds, Gas Chromatography, Forest, Ecosystem Services.*

THE CYNIPID GALL WASPS FAUNA (HYMENOPTERA: CYNIPIDAE) ON SESSILE OAK IN THE NATIONAL PARK FRUŠKA GORA (SERBIA)

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Abstract

This study presents investigation of cynipid gall wasps fauna of sessile oak. Oak gall wasps are insects, from the family Cynipidae, that induces galls mainly on oaks. Complex of sessile oak cynipid gall wasps were investigated in a protected area of the National Park Fruška Gora (Vojvodina Province, Serbia) during 3 year period (2016 – 2018). The National Park Fruška Gora is an isolated mountain in the Great Pannonian plain characterized by forest of sessile oak and lime.The survey was carried out on five sites on Fruška Gora: Kraljeve stolice (N 45° 09′ 22,1″; E 19° 48′ 41,8″), Spomenik (N 45° 09′ 14,8″; E 19° 50′ 41,8″), Brankovac (N 45° 09′ 22,8″; E 19° 44′ 36,6″), Ležimir (N 45° 08′ 11,8″; E 19° 37′ 3,3″) and Rohaljbaze (N 45° 08′ 29,2″; E 19° 31′ 47,3″). At total,number of 11 cynipid gall wasp species were identified: *Andricus lignicolus* (Hartig,1840); *Andricus solitarius* (Fonscolombe, 1832); *Andricus lucidus* (Hartig, 1843); *Andricus curvator* (Hartig, 1840); *Andricus dentimitratus* (Rejto, 1887); *Cynips quercusfolii* (Linnaeus, 1758); *Andricus glutinosus* (Giraud, 1859); *Andricus coriarius* (Hartig, 1843); *Cynips quercus* (Fourcroy, 1785), *Biorhiza pallida* (Oliver, 1791) and *Neuroterus anthracinus* (Curtis, 1838). The most frequent species were *A. lignicolus* and *A. glutinosus*, which were found on all five observed sites. In particular, there was a highest number of *A. glutinosus* galls at the Ležimir site.

Key words: *Gall wasps, Sessile oak, Fruška Gora.*

ECOLOGICAL-COENOLOGICAL VITALITY OF NORTHERN RED OAK ON HABITATS OF TURKEY OAK AND OAK OF VIRGIL WITH BLACK ASH IN THE PARK-FOREST "KOŠUTNJAK" IN BELGRADE, SERBIA

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Abstract

The paper presents the results of research of ecological-coenological adaptability, vitality, ecological-coenological relationship and in that sense the planned sustainability in the artificially established red oak (*Quercus rubra* L.) stand on type of primary forest habitat of Turkey oak and oak of Virgil with black ash (*Orno-Quercetum cerris-virgilianae typicum*) on pararendzina and loam soil in the park-forest "Košutnjak" in Belgrade. The results of the research unambiguously confirmed that red oak on the habitat of this type of forest showed different flexibility and vitality in the ecological-coenological sense. Red Oak on the habitat of this type of forest at the age of 50 achieved high production effects (dg=45 cm; hg= 24m), i.e., significantly higher than the type (edificators) of the primary type of forest (Turkey oak-dg=40 cm; hg=20.5 m). On the habitat of this type of forest, the red oak was, coenologicaly observed, beyond its optimum and showed incompatibility and unsustainability on habit conditions of this type of forest. The priority goal of this research is to examine the ecological-coenological relations, with the aim of ensuring the biological stability and multifunctionality of the forest park "Košutnjak".

Key words*: northern red oak, forest type, ecological-coenological vitality, park-forest "Košutnjak".*

PARASITOID COMPLEX OF *BRUCHIDIUS TERRENUS* IN BIOCONTROL OF FABACEAE HOST PLANTS AND ITS SPERMATOPHAOGOUS ENTOMOFAUNA

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Abstract

Bruchidius terrenus (Sharp) Coleoptera: Bruchinae, is suppressor of generically potencial of introduced leguminous *Albizia julibrissin*, Durazz in significant number as a seed beetle. So far this weevil has been proven as a monophagous species in Serbia. The name of the species in the Serbian language, according usually for taxonomic affiliation and the host plant, is mentioned for the first time in our research as a Persian silk tree, or pink silk tree seed beetle. Adults were first found in 2013, in Ruma, with the observation of insects wintering in adult stage, waiting for the silk tree flourishes from June to August. The pods are ripe from September to November. In 2014, the young adults start emergence of ripe pods (this is the latest stage of ripening) in late summer. These Bruchine can be considered as successfully adapted, and with regard to the host, i.e. with high potentional bioagent agenst host plant. The data on the percentage of infestation for the season 2013/14, varied from the dissection of pods and the maximum was 88 %. In the same period, parasitoids appear for the first time.

Key words: *parasitoids; Albizia; Bruchidius; Chalcidoidea; Serbia, invasive species, DAISIE, catalogue, identification keys, taxonomy, biology, Chrysomelidae: Bruchinae.*

TREE-RING GROWTH AND ISOTOPE RESPONSE TO CLIMATE CONDITIONS IN TWO OAK SPECIES FROM THE SAME STAND

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Abstract

Tree-ring width (TRW) as well as wood stable carbon isotope ratio (^{13}C) can be a valuable tool for the reconstruction of past climate impact on trees and understanding tree response to changing environmental and climate conditions. The ^{13}C carbon isotope is heavier than ^{12}C, and during the Calvin cycle, plant firstly uptakes the easier isotope (isotope effects). Hence, in the stressed conditions, caused by drought for example, plants in the lack of easier isotopes in intercellular $CO_2$are forced to adopt and metabolite more ^{13}C, and this ratio can be used as drought and stressed indicator. Previous studies suggest that oak growth and isotope content which rely on climate conditions are not always predictable. Noticed deviations can be caused by genetic and external influences. Differences in response of the two tested oak species (*Quercus robur* L. and *Quercus cerris* L.), in terms of ^{13}C and ^{12}C ratio ($\delta^{13}C$) and TRW were noted. Also, different patterns between isotope ratios and TRW response to climate were noted inboth oaks. In the present study, no differences between TRW chronologies were noted, in contrast to the $\delta^{13}C$ response. Based on the $\delta^{13}C$, *Q. cerris* had a better adaptability to the drought conditions, less negative $\delta^{13}C$ values than *Q. robur* during the entire analyzed period (1960−2010). Based on our results, the two oak species showed very similar TRWs and different $\delta^{13}C$ response in drought conditions. In conclusion, different physiological response and stomatal cross talk with drought were noted in tested oak species. Based on the $\delta^{13}C$ value, *Q. cerris* exhibited better adaptive potential to drought than *Q. robur*.

Keywords: *Stable isotopes, Tree-ring width, Dendrochronology, Quercus robur, L., Quercus cerris L.*

THE VARIABILITY OF ANATOMICAL STRUCTURE OF THE LEAF AND GROWTH PARAMETERS OF POPLAR CLONES

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Abstract

Anatomical parameters of the leaf and growth parameters of rooted cuttings of different poplar clones in three field trials were investigated. The thickness of palisade and spongy tissue and stomata number per mm^2 were measured at the end of the growth period. The main growth parameters i.e. diameter and height of the plants were also measured at the end of growing period. The results of the research showed a significant variability of most investigated parameters the under study. Statistically significant differences between clones and insignificant between repetitions, medium and high coefficients of heritability in a broad sense, indicate that the majority of study characters are controlled by genetic factors which result in considerable specificities of some clones. The results indicate that it could be possible to create the hybrids with desirable anatomical structure of the leaf.

Key words: *poplar clone, leaf anatomical structure, variability.*

CHARACTERISTICS OF ALKALIZED SOILS IN THE BAČKA REGION (SERBIA) AND THE POSSIBILITY OF THEIR AFFORESTATION

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Abstract

Alkalized soils occupy 80,333 ha or 3.75% of the total area of Vojvodina and represent the areas fragmentally covered with scarce halophytic shrubby vegetation. Besides alkalization processes endanger about 34,000 ha, or 1.60% of primary agricultural land, which represents in total 5.35% areas endangered with alkalization in Vojvodina. Bearing in mind the surfaces that are endangered by alkalization, in the Bačka region, the study of alkalized soils was carried out on relief forms in the form of depressions representing river basins from the geological past. In these relief areas of Bačka, where alkalisation is present, alkalized soil is formed at the soil type designated as solonetz, class solonci. The paper presents the properties of solonetz soils, ie their physical and chemical properties. The study of these soils is significant for the purpose of finding a suitable method for the melioration of such areas. On the basis of the soil studies, the tree species that can be planted on these habitats will be determined. The soil quality of these areas will be improved through forest establishment.

Keywords: *Alkalized soils, Afforestation, Forest melioration.*

THE EFFECTS OF CLIMATE CHARACTERISTICS ON THE DIAMETER INCREMENT OF DOUGLAS-FIR IN THE CITY OF BELGRADE

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Abstract

The paper presents the study results of the influence of climate factors on the size of earlywood and latewood and the total diameter increment of Douglas-fir (Pseudotsuga mendesi). For the analysis, 30 core samples were taken at 1.3 m trunk height. All the data were related to the mean monthly air temperature and sums of precipitation (in the period from April to September). Additionally, the tree age was included as an important factor and presented by calendar years. The analyzed parameters explained 54.2% of the current diameter increment, 33.9% of the share of latewood and 51.1% of the share of earlywood.

Keywords: *adaptability, climate change, Douglas- fir, earlywood, latewood.*

BIG DATA AND DATA SCIENCE FOR EVALUATION OF HABITAT SUITABILITY OF EUROPEAN FOREST SPECIES

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Abstract

Habitat suitability for forests are becoming of larger importance lately as the climate warming is stressing our forest more than ever. Now it is possible to do habitat suitability studies for current state and futuristic scenarios on the global level using comprehensive free open source datasets, which is the goal of our study. Free geographic open source data is becoming available even on global level, and it is more and more utilized. Logical step is to try to utilize the most of it to get the complete and comprehensive global results. This implies big data problems, and directs to data science approach for doing analysis. This in hand allows more freedom in choosing the modeling algorithms such as machine learning and neural networks and can show us patterns in data confirming the current hypothesis or inspiring new ones. Data sources are analyzed, set of data describing soil, terrain, climate and current distribution of forest species are processed and prepared. Analysis of different machine learning and neural networks algorithms performance on this problem is done, and habitat suitability is evaluated for *Fagus sylvatica* (European beech) on European level, with a goal of global analysis. Difficulties arising from Big Data have been solved and discussed.

Keywords: *Big Data, Data Science, Neural networks, Habitat suitability, Fagus sylvatica.*

EFFECT OF DROUGHT ON GROWTH AND MULTIPLICATION OF WHITE POPLAR GENOTYPES IN TISSUE CULTURE

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Abstract

The aim of this study was to examine the response of white poplar genotypes on drought stress based on six morphometric, survival and biomass parameters. The microshoots of five genotypes (Villafranca, L-12, L-80, LBM and LCM) were cultivated on media with two different concentrations of polyethylene glycol (PEG) 6000: 20 g/L and 50 g/L, as well as on control treatment without PEG. The media were based on ACM (Aspen Culture Medium) with 9 gL^{-1} agar, 20 gL^{-1}sucrose, 1μM kinetin, 1μM benzylaminopurine (BAP) and 100 mg L^{-1} myoinositol. Results of two-way ANOVA and LSD tests suggested that the effect of media was significant for all examined traits, with clear increase in inhibitory effect by the increase in concentration of PEG. The effect of genotype was significant for number of new shoots and fresh and dry shoot mass. The effect of interaction genotype × medium was significant only for number of new shoots. The difference between genotypes was the highest on medium with the highest PEG concentration (50 g/L). This medium was suggested for further drought studies in white poplar *in vitro* including drought tolerance evaluation. The best performance was achieved with genotype L-80, and the worst with Villafranca. The study suggests significant potential of tissue culture in the research of drought tolerance in controlled conditions.

Keywords: *Populus alba, micropropagation, drought tolerance.*

MORPHOLOGICAL CRITERIA FOR ASSESSING QUALITY OF SERBIAN SPRUCE (*PICEA OMORIKA / PANČIĆ/PURKYNE*) SEEDLINGS FROM 21 HALF SIB FAMILIES

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Abstract

In serbian spruce (*Picea omorika /pan~./ Purkyne*) in addition to the research of genetical, physiological and morphological variability of the species, during the current decade numerous analyses of the seedling quality have been started. A part of the research results significant for assessing quality of Serbian spruce seedlings have been presented in this paper. The variability of seedling quality inter and intra half sib linies has been observed on eighty (4 x 20) five - year old seedlings from 21 half sib families grown in the nursery. This study aims to identify correlations between growth variables and quality index in seedlings of *Serbian spruce* The experiment was conducted in a nursery and the following variables were observed: stem base diameter, shoot height, stem base dry matter, root dry matter, shoot dry matter, total dry matter, ratio of shoot dry matter to root dry matter and ratio of shoot height to stem base. Assessing of seedlings quality have been done using quality index which involved seedling biomass in addition to height and diameter:

$$\text{Quality index} = \frac{\text{Total sedling dry weight (gr)}}{\frac{\text{Height (cm)}}{\text{Diameter (mm)}} + \frac{\text{Shoot dry weight (gr)}}{\text{Root dry weight (gr)}}}$$

Quality index involving combinations of morphological characteristics and offers an easy method for quality assessment that can be used throughout the growing season to judge seedling crop development. Using Pearson correlation and also path and regression analyses, correlations were analyzed between observed variables and the quality index. Stem base diameter was found to have stronger correlation with seedling quality in comparison to shoot height. Root dry matter was found to have stronger correlation with the quality index. Stem base diameter was the most suitable parameter to indicate seedling quality due to its higher correlation level with the quality index.The knowledge of Serbian spruce seedling quality manifested in the economical characteristics is of great importance to the precise and make comprehensive construction of future variance patterns.

Key words: *Serbian spruce, seedlings, quality index.*

PRESENCE OF INVASIVE PLANT SPECIES IN THE REGENERATION OF OAK WOODLAND

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Abstract

Globalization of the market, climate change, increased trade, travel and tourism have led to the spread of plant species outside their natural areas. Many activities in forestry, such as the total harvest, afforestation and regeneration of woodland, have an impact on changing conditions of site. In the changed of edaphic and hydrological conditions of area and parameters of light, many plant species find favourable conditions for own development. In such conditions, the regenerated area with herbaceous vegetation mainly nitrophyl, ruderal and invasive plant species come to overgrowth. The spread and pressure of invasive species outside their natural areas, affects negatively to the floristic composition and structure of autochthonous communities, as well as the diversity of flora. The studies were conducted in the Forest Administration Visnjicevo (44056' 43,64"N, 19015'48,67"E). During the vegetation season 2016 - 2017 research included the collection, hebraization and determination of plant material. Analysis of ground flora in the regeneration of oak woodland recorded 23 plant species which were grouped into 12 families. The most numerous weed species were *Ambrosia artemisiifolia* L., *Erigeron canadensis* L. and *Stenactis annua* (L.) Ness. which belong to the family *Asteraceae*. An analysis of the biological weed spectrum was determined that the most numerous species were perennial herbaceous plants hemicryptophytes. Presence of invasive species in relation to the total number of weed species indicates their spread in forest ecosystems, especially in the regeneration woodland area.

Keywords: *Invasive plants, Oak, Regeneration woodland.*

VARIABILITY OF CONCENTRATION OF PHOTOSYNTHETIC PIGMENTS IN LEAVES OF SYCAMORE MAPLE (*ACER PSEUDOPLATANUS* L.) ONE-YEAR-OLD SEEDLINGS OF DIFFERENT HALF-SIB LINES

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Abstract

The variability of concentration of photosynthetic pigments in leaves of Sycamore maple (*Acer pseudoplatanus* L.) one-year-old seedlings was studied at the level of 11 half-sib lines in the seedling nursery conditions. Three types of pigments have been examined: chlorophyll a, chlorophyll b and carotenoids. Their concentration at the level of the half-sib lines as well as the interdependence was determined. The seedlings were produced in the seedling nursery of the Institute of Forestry in Belgrade (Serbia) in equal environmental conditions and from the seed of known origin. The leaf sampling was carried out in the middle of the growing season. The highest average value of chlorophyll a (0.878 mg/g) was determined in the half-sib line 9, and the lowest in the half-sib line 7 (0.496 mg/g). The highest average value of chlorophyll b (0.952 mg/g) was determined in the half-sib line 5, and the lowest in the half-sib line 11 (0.568 mg/g). The highest average value of carotenoids (0.462 mg/g) was determined in the half-sib line 9, and the lowest in the half-sib line 8 (0.197 mg/g). The strongest interdependence was determined between carotenoids and chlorophyll b (R^2 =0.0053), and the weakest between carotenoids and chlorophyll a (R^2 =0.0005). The researches have shown that the concentration of the photosynthetic pigments in the Sycamore maple leaves changes depending on the origin, or in this case the mother tree. The conclusion arising from the obtained results is that during the selection of mother trees the attention has to be paid to concentration of the photosynthetic pigments in leaves and the intensity of the photosynthesis because that will significantly affect the elements of seedlings' development.

Key words: *Sycamore maple, half-sib line, photosynthetic pigments, leaves.*

ANALYSIS OF YIELD QUALITY OF BALD CYPRESS (*Taxodium distichum* L. Rich.) AT THE LEVEL OF SEED STAND RS-2-2-tdi-00-240

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Abstract

The results of the analysis of yield quality of Bald cypress at the level of the seed stand RS-2-2-tdi-00-240 have been presented in the paper. Cones were firstly collected from 20 mother trees evenly distributed throughout the seed stand and then transported to the laboratory of the Institute of Forestry in Belgrade (Serbia) for further processing and yield quality analysis. The following yield quality parameters were analyzed: coefficient of extraction, absolute seed weight, and technical germination in the field trial. The average value of the coefficient of extraction as per mother tree ranges from 13.14% to 17.38%. The absolute seed weight ranges from 96.5 g to 134.7 g. The technical germination ranges from 57.2% to 73.4%. The analyzed yield quality indicators are very important for planning nursery production because knowledge on these indicators can considerably influence the optimization of production costs. The analyzed yield quality indicators can also be used to assess the genetic quality of seed stand and to make recommendation for the transfer of seeds. The obtained results are the good starting point for future researches in the breeding of species and can serve for improvement of the mass production of high quality reproductive material of Bald cypress in Serbia.

Key words: *Bald cypress, seed stand, yield, germination.*

SALT STRESS-RESPONSIVE MECHANISM OF RD17 GENE IN DIFFERENT POPLAR CLONES: TOWARD BIOCHEMICAL AND TRANSCRIPTOMIC MARKERS

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Abstract

Halomorphic soils cover the significant area in Vojvodina region and represents economical challenge in forestry sector. The aim of the study was to investigate the salt tolerance mechanisms of two economically important Serbian poplar clones in order to select the most tolerant one that could be used in afforestation of halomorphic soils. Stress inducible RD17 gene belongs to the dehydrin protein family and responds to osmotic stress, ABA and dehydration. In this research work expression profile of RD17 gene in poplar clones was examined regarding theirresponse to salinity stress. Furthermore, several biochemical parameters such as different radical scavenger capacities (estimated by DPPH and ABTS assays) and accumulation of total phenolic content and flavonoids as well as accumulation of two osmolytes, glycine betaine and proline, were quantified. Clones Pe19/66 (*Populus deltoides*) and M1 of hybrid genetic background (*P. nigra* x *P.deltoides*) e.g. *P. x euramericana* were subjected to NaCl induced salt stress in concentration of 150mM and 300mM, respectivelyhydroponically and the plant responses were tracked at different time points (3h, 8h and 24h) at the leaf level. RD17 was highly expressed in M1 clone while slight activation in PE19/66 clonein stress treatments occurred in comparison to control. Most of the biochemical assays were triggered and showed increased activity after 8 hours, while total antioxidant activity at the end of the treatments (after 24h) decreased in comparison to the corresponding control. Differential expression of RD17 and biochemical assays showed that M1 responded as a tolerant clone to salt stress and Pe19_66 expressed lower tolerance in comparison to M1.

Keywords: *Poplar, Salt stress, RD17, Transcriptomics, Scavenger capacity.*

EDAPHIC CHARACTERISTICS OF MARGINAL SOILS FOR POPLAR GROWNING IN MANAGEMENT UNIT „GRABOJEVACKO VITOJEVACKO ISLAND“ (SERBIA)

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Abstract

In riparian zone soil characteristics are never so separated that only one process of soil formation will take place. In research we considered the dominant one resulting in the development of special soil types. Possibility of fast cultivation of fast growing decidous trees on soil in riparian zones depends on evolution characteristics of genetic parts in the riparian zones. The research was conducted in management unit „GrabojevackoVitojevacko Island“ (Serbia) in poplar plantation. In regards to micro-relief soil profiles were examined and two soil types were determined. Eugley was determined on the lower part and chernozem gleyic was determined on the higher part of study area. Chernozem gleyic was developed on the loess and that was the most important difference between two determined soil types. Soil depth was higher in chernozem gleyic than in eugley. Textural class of humus accumulative horizon in the both soils was clay loam. This type of textural class is characterized with overbalance of inaccessible water in soil. Limiting factor of this soil (parent material, granulometric composition and textural class) disables the poplar growing and represent marginal soils for poplar plantations. According to soil limiting factors on this sites the most favourable species for reforestation are pedunculate oak (*Pedunculate oak*), ash (*Fraxinus angustifolia*) and willow (*Salix alba*). Bioecological characteristics of this species predetermines grown of pedunculate oak on higher micro-relief position (chernozem gleyic), and on the lower part of study area (on eugley soil) with ash and willow. On this way it is possible to improve of soil use in studied area.

Key words: *eugley, chernozemgleyic, poplar.*

Acknowledgement: *This paper was realized as a part of the project "Studying climate change and its influence on the environment: impacts, adaptation and mitigation" (43007) financed by the Ministry of Education and Science of the Republic of Serbia within the framework of integrated and interdisciplinary research for the period 2011-2014.*

THE QUALITATIVE AND QUANTITATIVE CHARACTERISTIC OF SELECTED POPULATION (*JUNIPERUS COMMUNIS* L.) IN DIFFERENT AREAS OF SLOVAKIA

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Abstract

Juniperus communis is a shrub or rather a small tree, original and formely widely-spread in the Slovak Republic. Nowadays it belongs to the endangered species. Its galbulas, called juniper berries, are used as spice or for production of alcoholic beverages. The aim of this work was to map the population of juniperus communis in the selected area of the Slovak Republic (Čachtický vrch, Jalšové, Rajecká Lesná, Kláštor pod Znievom, Valčianská dolina, Donovaly, Kráľová (Zvolen), Veľký Folkmár, Volica, Kamenica nad Cirochou), further to perform dendrological measurements and draw up maps. In the locality mentioned above, the population of 200 pieces of original junipers was found out. The tallest individual, 500 cm, grew on Kraľová (Zvolen) and had a thickness of $d_{0.15}$ 10.5 mm. The thickest individual, with $d_{0.15}$ 14.5 mm, grew in the area of Veľký Folkmár and had a height of 300 cm. Overall, the height of the sites studied ranged from 20 cm to 500 cm and the thickness $d_{0.15}$ from 1 mm to 14.5 mm. Polymorphism in juniperus seed storage protein from fruits was investigated. Preparation of the seed samples, protein electrophoresis and staining of the protein patterns was performed in accordance to the method SDS-PAGE (sodium dodecyl sulphate polyacrylamide gel electrophoresis). The unweighted pair-group mean arithmetic method (UPGMA) was employed to construct the dendrogram. Genetic similarity coefficients resulted from comparison by total protein pattern and ranged from 0.273 to. 0.714. This work was supported by the Slovak Research and Development Agency under the contract no. APVV-17-0113.

Keywords: *Juniperus communis L., fruit seed, storage proteins, SDS-PAGE, population.*

PSEUDOTSUGA MENZIESII (MIRB.) FRANCO IN THE NW OF IBERIAN PENINSULA: SITE QUALITY AND FORESTRY

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Abstract

Pseudotsuga menziesii (Mirb.) Franco, Douglas-fir, is a conifer of the *Pinaceae* family. The Oregon pine name, used to refer to both the tree and its wood, can take to confusion, because its needle-like leaves are not sheathed. It can reach up to 100 meters height in the country of origin –discovered by Menzies in Vancouver in 1792–, existing in Europe trees of 50 m. The cup is conical and pointed, and it needs a long time to crown, which indicates a great capacity to maintain continued growth. The first plantations in Spain were ornamental, and in Galicia large specimens dating from the nineteenth century have been conserved. Its use during the repopulation period of the Forest Heritage was scarce, especially in the NW of Iberian Peninsula, where the oldest stands are not older than 40 years. In other Spanish regions, Forest Administration used this species more amply. According to the latest data, an area greater than 30,000 ha is estimated. Douglas-fir grows on a wide climatic range, from oceanic to continental, with uniform distribution of rainfall. Optimal conditions for increased production are a wet oceanic climate with 2-3 months of drought. Oregon pine is a fairly demanding tree in edaphic conditions, preferring deep soils with a light texture and fertile. It is a species capable of producing high quality wood and forest treatments should be directed for this. It will be basic to prune so wood is formed free of knots and to eliminate unnecessary branches. In Galicia the maximum production range would go from 14 to 23 $m^3ha^{-1}year^{-1}$.

Key words: *Pinaceae, Douglas-fir, Site, Forestry.*

PSEUDOTSUGA MENZIESII (MIRB.) FRANCO IN THE NORTHWESTERN OF THE SPAIN: WOOD PROPERTIES, PRODUCTION AND FINAL CUT

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Abstract

The Oregon pine wood is of excellent quality and it is imported from North America with the same name. Afforestation with this species carried out in northern Spain, Galicia, Asturias and other regions; in many European countries is considered very important because it produce wood of equal or superior quality to the imported one. Oregon pine has slightly orange heartwood and clear sapwood. The growth rings are particularly visible, and with an appropriate forestry are very homogeneous. Their density is higher than in most conifer species of commercial interest, 0.48 $gr.cm^{-3}$. The wood has excellent technological qualities, even when the tree has grown quickly. Its major defect is the presence of knots, which are usually alive and so healthy. Pruning is essential to allow the development of the tree. The wood production that could be obtained depends on the site quality, the material and the repopulation techniques, and the cultural treatments. The French production tables of the Massif Central consider 3 quality classes with maximum production ranging from 15 to 23 $m^3ha^{-1}year^{-1}$. In Galicia and Asturias, growth studies have been carried out to compare with these tables, obtaining the following results: i) In the repopulations carried out in abandoned agricultural lands and with intensive cultural cares in Galicia, the quality far exceeds the best French and the production, if the density –number of trees per hectare– is high, reaches spectacular values. In general, the maximum production interval would be between 14 and 23 $m^3ha^{-1}year^{-1}$; ii) The researches carried out in Asturias show lower results due to that most of the stands of a certain age be correspond to forests repopulated by the Administration on poor quality soils. In any case, the production would be between 12.5 and 21.4 $m^3ha^{-1}year^{-1}$.

Key words: *Pinaceae, Oregon pine, Wood features, Growth, Rotation.*

TEMPERATURE-INDUCED CHANGES IN HUMUS QUALITY AND $\Delta^{13}C$ SIGNATURES AS A PROXY INDICATOR OF SOIL BURN INTENSITIES AFTER FOREST WILDFIRES

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Abstract

Due to the increasing number and virulence of forest wildfires recently observed around the world, the establishment of a simple, accurate and reliable index that would correctly evaluate the fire effects on soil quality as a support for a suitable forest recovery management is becoming progressively more necessary. This objective is addressed here by using both $\delta^{13}C$ isotope ratio mass spectrometry and traditional solvent fractionation methods (widely used to assess soil biogenic components or humus fractions) to quantify the temperature-induced changes in soil chemical and isotopic composition. Soil samples from the upper 5 cm layer of two Cambisols developed over granite under pine forest in the NW of Spain were heated in an oven under controlled conditions to attain moderate or intense soil burn severity levels by using two different temperatures (220ºC or 350ºC). Biochemical changes induced by the heating process appreciably differed according to the intensity of the temperature applied. Multilinear regression modelling not only showed a significant relationship between soil C isotopic signature shifts (□□soil □^{13}C) with temperature increases, but also revealed other key outcomes: i.e. >96 or >81% of its total variance could be predicted by changes in lignin or non-humified organic matter, respectively. Indeed, □□soil □^{13}C explained by itself ≈60% of thermal variance, pointing to the aptness of using ^{13}C shifts as a valid index for soil burn severity estimation in wildfires.

Key words: *forest, soil quality, Spain.*

SPATIAL EVALUATION OF RECENT CLIMATE CHANGE AND VULNERABILITY OF FOREST ECOSYSTEMS: A CASE STUDY IN SPAIN

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Abstract

Recent and future climate change is a driver of deep changes in the structure, function and distribution of forest ecosystems. Increased temperature and variation in precipitation patterns can promote the proliferation of pests, diseases and forest fires, decouple biological cycles, reduce primary production, decrease forest soil carbon sink capacity or ecosystem resilience, among other changes. Conservation of biodiversity and ecosystem services of forests and tree plantations, and their adaptive management, require a spatially explicit knowledge of climate change. In the framework of the CLIMVAC project funded by the Ministry for Ecological Transition, a high spatial resolution (1 km^2) model of recent climate change in Spain was generated and validated. Using data from Spanish meteorological station network and advanced algorithms, the model explained about 70% of the variability of the change in annual mean temperature between the period 1998-2017 and the reference period 1971-1990. Change in total annual precipitation was also modeled. Considering changes of climatic variables, degree of exposure to recent climate change was mapped. Besides, the spatial distribution of the main classes of forest ecosystems and their susceptibility or intrinsic sensitivity to climate change were considered. Through spatial analysis in a GIS environment, an evaluation method of climate change vulnerability was successfully applied, which provided a preliminary assessment of potential impacts. The results obtained represent the first known high spatial resolution evaluation of recent climate change and vulnerability of forest ecosystems in Spain, a very useful reference framework for adaptation to climate change and adaptive forest management.

Keywords: *Adaptation, Climate change, Forest ecosystems, Modelling, Vulnerability.*

SCIENTIFIC BASIS OF AGROFORESTRY HOME GARDENS: A CASE STUDY IN SOUTHERN SRI LANKA

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Abstract

The components of agroforestry home gardens in developing countries featured social and traditional aspectsutilizing low capital inputs and simple technology. Strengthening the scientific basis of agroforestry would enrich the traditional home gardens to improve livelihoods and enhance household food security and nutrition. The "Green Lanka" program of Sri Lanka emphasized the promotion of home gardens through scientific basis of agroforestry. This study aimed: to examine the concern of households for scientific practices of agroforestry home gardens; to compare their concern and knowledge of scientific practices; and to identify the barriers to improve scientific basis. The study interviewed selected households in Hambantota district measuring their perceptions using five point Likert scale, and analyzed the qualitative data using non-parametric statistics. The study revealed that the concern of households for scientific basisof agroforestry practices remains little on planning and site placement, site preparation and establishment, and main cultural practices, while moderate on selection of species, selection of planting materials, and agroforestry health care. Scientific basis of agroforestry practices was rated more favorably than the scientific knowledge ($Z = -2.50$, $p = 0.12$) of the households. The main barriers for improving scientific basis were: the lack of access to information and technology (W=0.284, P=0.003); lack of interest (W=0.444, P=0.000); and limited resources (W=0.284, P=0.003). Time limitation (W=0.093, P=0.095) was not considered as a barrier. Households practiced scientific practices of agroforestry without scientific knowledge. Effective extension programs for provision of scientific knowledge would improve scientific basis of agroforestry practices in home gardens.

Keywords: *Traditional Practices, Scientific practices, Scientific knowledge, Barriers for Improvement.*

EFFECT OF CLIMATE CHANGE ON GAS EXCHANGE RESPONSES AND HYDRAULIC TRAITS OF *PINUS HALEPENSIS* MILL

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Abstract

The now regenerating forests will have to adapt to overcoming novels of climatic conditions in order to sustain for several decades, even more than a century. These terrestrial ecosystems play an important role against the increase of greenhouses gas emissions in the atmosphere and so in the prevention from climate change that significantly modify ecophysiological responses of trees and deeply affects ecosystems. The aim of this study was to compare the water status of three Aleppo pine sites from different bioclimatic stages: Djebel Zaghouan (DZ), Djebel Mansour (DM) and Djebel Sarj (DS), based on soil-plant-atmosphere continuity. The experimental approach was based on monitoring soil water behavior, gas exchange and hydraulic conductivity with climatic variability. Results showed that DZ was tolerable to both water status and physiology compared to the other sources of DM and DS. It also showed the best performance in terms of adaptation with a low average of ET_0 (3.2 mm/d), while DM and DS recorded 5.3 and 5.5 mm/d, respectively. In addition, DZ showed a significant relative humidity in the soil reaching 26% and a xylemic conductivity with 16.3% of embolism compared to DM and DS, which had the highest percentages related to the increase in drying up. In conclusion, our results showed a significant difference in physiological behavior between three provenance contributing to difference in pedoclimatic conditions of studied area.

Key words: *Aleppo pine, climate change, gas exchange, conductivity, water status.*

DETERMINATION OF POSSIBLE ENERGY POTENTIALS OF BANANA RESIDUES IN TURKEY

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Abstract

The world has been relying on fossil fuels as its primary source of energy. Renewable energy, particularly from biomass, is gaining public interest as a result of the global warming, environmental impacts and depletion of fossil fuel resources. Biomass has emerged as an attractive option due to its huge renewable energy potential. Biomass, such as banana, should be considered as having a great potential plant biomass. This paper will discuss on its potential and availability for conversion of the biomass to energy in Turkey. In this study potential banana residue recycling in Turkey will be determined and estimated as the amount of energy in solid biofuels.

Keywords: *Energy, Biomass, Banana residue.*

CURRENT STATUS AND POTENTIAL OF SOME IMPORTANT SPECIES OF MANGROVE FOREST IN KIEN GIANG AND CA MAU PROVINCES, VIET NAM

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Abstract

Identifying the component and distribution of some important species of mangrove forest in Kien Giang and Ca Mau will be useful for stragegy of mangrove forest protection development. After a preliminary survey of the entire forest, random measurements of 3 plots were used to calculate the coefficient of variation as a basis for calculating the sample size needed to conduct forest surveys. The area is required for the study is 1666ha, with a 95% confidence level and 10% error, each plot needs 100m^2. The results of survey show that natural forests and coastal forests (apart from shrimp farms) are the main protective forest belt of the coastal line, so there are only 17 species belonging to 11 families of plants including 14 species Woody plants, 3 species of shrub species, in which the Rhizophora (Duoc) and Avicennia (Mam) families are dominate. Regions can be grouped into four sub-regions depending on number of species as well as component of each species. At the similarity level of 40% of the plots, it can be divided into 5 groups. The analysis results show as follows: Group 1 has dominant species like Gia, Group 2 dominant species is White Avicennia, Group 3 has 4 dominant species: White Avocado, Avicennia, Sonneratia, Rhizophora. Group 5 has 2 dominant species as Black Avicennia and Rhizophora. In conclusions, Mangroves and Black Avicennia (Mam den), it should be considered for developing and protecting mangrove forest.

Keywords: *Avicennia (Mam), Mangrove, Myrsinaceae (Su), Rhizophoraceae (Vet, Duoc).*

INCENTIVES FOR INDEGENOUS CONSERVATION OF FORESTS; A CASE OF MATEPATEPA, ZIMBABWE

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Abstract

Zimbabwe underwent a resettlement programme to address the imbalance in land access. It is hypothesized that the resettlement programme exacerbated deforestation in Zimbabwe. Existing research on resettlement has focused mainly on gender, land tenure, productivity and livelihoods. Less attention has been paid on issues concerning farmer perception on incentives offered by management organizations and the factors that influence the farmer perceptions of the incentives offered in resettlement areas. A survey was conducted in Matepatepa, Zimbabwe. A sample of 247 respondents were randomly selected and stratified as 98 A1 farmers, 50 A2 farmers and 99 Old resettled farmers. The data was collected using structured questionnaires, interviews and observations. The study identified, described and quantified various management organizations and activities in Matepatepa district. The study analyzed farmer perceptions of the management organizations by generating management satisfaction rankings. An ordit regression was used to analyze factors influencing the overall satisfaction rankings. The results indicated that socio economic factors were not significant in explaining the level of satisfaction ranking in A2 farmers but significant in A1 and Old resettlement areas. Policy recommendations were made in respect to the result of satisfaction ranking of management organizations and activities and the factors influencing these perceptions on incentives offered by the organizations.

Keywords: *deforestation, resettlement, organization, incentives, Zimbabwe.*

REMOTE SENSING IN FORESTRY: EXPERIENCE AND PROSPECTS OF COOPERATION BETWEEN RUSSIA AND KAZAKHSTAN

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Abstract

Forest plantations are the real lungs of the Earth and if the forest area is reduced, it negatively affects the life of all life that is on our planet. However, the forestry sector is currently in a critical situation. According to the International Institute of World Resources and the World Conservation Monitoring Centre, almost half of the once existing forests have been reduced in the last 8,000 years. Of the remaining, only 22 percent consist of natural ecosystems, the rest are heavily modified due to the activities of economic entities. Studies have shown that more than 50 % of the former forest area on the planet has already been completely destroyed, only about 1/5 of the remaining forests are relatively untouched by people, especially in countries such as Russia, Canada and Brazil. Asia has the highest forest losses, followed by Africa and Latin America. Over the past 40 years, the world's forest area per capita has decreased by more than 50 %, from 1.2 hectares to 0.6 hectares per person. Kazakhstan is a country where there are some unresolved problems in the field of forestry, but where an appropriate state development program has been developed. In the field of remote sensing, Kazakhstan and Russia have a great experience of cooperation and good prospects that will help our countries in environmental management and improvement of environmental situation. The analysis of advantages of applying remote sensing for regulating economic and nature protection activities in Kazakhstan and Russia is made in this article. In the work potentials for applying remote sensing to minimise the negative impact of threats for forestry are defined. The research target is to identify whether remote sensing has any benefits for controlling economic activity and protection in forest areas. The research methodology is using deductive epistemology. The practical research significance is that recommendations for applying remote sensing to increase efficiency of nature protection and economic activities in forests. The research result shows that remote sensing may help to collect the required data which has the significance for developing the reaction strategy to the external threats and for minimising their impact on forestry.

Keywords: *Remote sensing, Forestry, International cooperation.*

PINE DRYING, CAUSES AND PROSPECTS OF PROTECTION

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Abstract

Forest ecosystems are the most complex biological set, so the problem of tree drying, in particular pine trees, should be considered from the standpoint of synecology, considering that plant death at the final stage is caused by phytopathogenic microorganisms and pests. According to our research, a significant the revealed increase of the content of ammonia nitrogen in the soil under dried pine trees is due to the rapid destruction of forest litter, soil compaction and intensive development of grassy vegetation. The comparative analysis of the NH_4^+ distribution in the horizontal and vertical projection under the pines showed an increase of nitrogen in the soil under dried pines 1.3-2.4 times compared with healthy plants. In model experiments, it has been proved that the increase of soil temperature in the experimental areas from 20°C to 40°C facilitated the growth of ammonia nitrogen concentration. After 13 days in the thermostat, the NH_4^+ content in soil decreased 1.5 times under the healthy pine, while on the contrary, it increased 3.3 times under drying pine. The results of estimation of the number of ammonifiers in the root soil under dried pines have shown that when the temperature increased to 30°C, their number increased by 3 times, and at 40°C - 9 times. There were no significant changes in the size of this group of microorganisms in the background of temperature growth in the soil under healthy plants. According to the results of the studies, the differences in the concentration of NH_4^+ are consistent with the data on the emission of CO_2 from the soil surface. The ways of improvement of the condition of pine plantations are proposed. They involve the application of silicon compounds in order to reduce the negative influence of ammonia nitrogen on the root system of plants and management of the processes of soil micro biota.

Keywords: *pine drying, ammonia nitrogen, ammonifiers, silicon, Ukraine*

AUTHORS INDEX