

The feed conversion ratio is the lowest in the diet using 10% of *Moringa oleifera* leaf meal (2.13 kg feed/kg weight gain) and the highest in the negative diet control (2.60 kg feed/kg weight gain).

The mortality ratio is the lowest in the diet using 10% of *Moringa oleifera* leaf meal (4.38%) and the highest in the negative diet control (8.75%).

It, therefore, can be used *Moringa oleifera* leaf meal at levels of 10-15% for the broiler diet.

REFERENCES

1. Afuang W., Siddhuraju P. and Becker K. (2003), Comparative nutritional evaluation of raw, methanol extracted residues and methanol extracts of moringa (*Moringa oleifera* Lam.) leaves on growth performance and feed utilization in Nile tilapia (*Oreochromis niloticus* L.). *Aquaculture Research*, 34(13): 1147-1159.
2. Anwar F. and Rashid U. (2007), Physico-chemical characteristics of *Moringa oleifera* seeds and seed oil from a wild provenance of Pakistan. *Pak J Bot.*, 39: 1443-1453.
3. Gadzirayi C.T., Masamha B., Mupangwa J.F. and Washaya S. (2012), Performance of broiler chickens fed on Mature *Moringa oleifera* leaf meal as a protein supplement to soyabean meal. *Inter J Poultr Sci.*, 11(5): 5-10.
4. Ho Pham Hoang (2000), Vietnam Plants, Young Publishing house, edition III. Pp: 60.
5. Juniar I., Widodo E. and Sjojfan O. (2008), Effect of *Moringa oleifera* leaf meal in feed on broiler production performance. *Journal Ilmuilmu Peternakan Brawijaya*, 18: 238-242.
6. Melesse A., Tiruneh W. and Negesse T. (2011), Effect of feeding *Moringa stenopetala* leaf meal on nutrient intake and grow performance of Rhode Island Red chicks under tropical climate. *Tropical and Suptropical Agroecosystems*, 14: 485-492.
7. Mellor S. (2000), Alternatives to antibiotics. *Feed mix*. November, Pp: 6-8.
8. Olugbemi T.S., Mutayoba S.K. and Lekule F.P. (2010), Effect of *Moringa oleifera* inclusion in Cassava based diets fed to broiler chickens. *Inter J Poultr Sci.*, 9(4): 363-367.
9. Chi Vo Van (1999), *Pharmacopoeia Vietnamica*. Medicine publishing house. Pp: 1354-1355.
10. Yameogo C.W., Bengaly M.D., Savadogo A., Nikiema P.A. and Traore S.A. (2011), Determination of chemical composition and nutritional values *Moringa oleifera* leaves. *Pak J Nutr.*, 10: 264-268.

PRODUCTION, CONSUMPTION STATUS AND ECONOMIC EFFICIENCY OF DONG TAO CHICKEN PRODUCTION

Dao Thi Hiep^{1*}, Nguyen Van Duy² and Vu Dinh Ton¹

Submitted April 15, 2015 - Accepted May 22, 2015

ABSTRACT

The main objective of this study is to provide an overview of Dong Tao chicken production, evaluate its economic efficiency and consumption situation. Since then, some solutions will be suggested for enhancing economic performance and sustainable development of Dong Tao chickens. From the interviews with key informants, 30 Dong Tao raisers in Dong Tao commune,

¹ Faculty of Animal sciences, Vietnam National University of Agriculture

² Centre for Interdisciplinary Research on Rural Development, Vietnam National University of Agriculture

* Corresponding author: MSc. Dao Thi Hiep, Faculty of Animal sciences, Vietnam National University of Agriculture. Address: Trau Quy town, Gia Lam district, Hanoi; Tel: 0943116228; Fax: 043 8767361; Email address: dthiep@vnua.edu.vn/hiep.hua.hn@gmail.com

Khoai Chau district, Hung Yen province and actors involving in the value chain of Dong Tao chickens, the research revealed that taking advantages from the price and consumption market, the population of Dong Tao chickens were more and more developed at the large scale. Besides that, Dong Tao chicken's consumption network was well developed with the involvement of many stakeholders so it ensured the output for this chicken all year around. According to the surveyed results, the average flock size of the small and the large Dong Tao chicken farms were 135.55 individuals/household and 694.80 individuals/household respectively. However, due to the breed characteristics, the reproductive performance of Dong Tao chickens was still low with the egg production varied from 61.94 eggs/hen/year (small farms) to 83.11 eggs/hen/year (large farms). During the survey process, the cost-benefit analysis was carried out with two categories of Dong Tao chicken farms: the large farms and the small ones. The results confirms that the large scale chicken production could reduce the costs since then significantly increased income of the farmers. In 2012, the large farms gained average profit of 966.60 million VND/household while this value for the small ones was 85.75 million VND/household.

Keywords: Dong Tao chicken, economic efficiency, production, consumption situation

1. INTRODUCTION

Biodiversity conservation in general and animal genetic conservation in particular is a burning issue worldwide (Zvi Katz, 1999). Cardellino (2001) warned that if nations do not establish an obvious strategy on scientific conservation, many traditional livestock might be in danger of disappear.

Vietnam is ranked as one of the highest bio-diversify countries over the world with an abundant number of animal breeds and plant varieties. There are up to 10% total number of animal species was found in Vietnam (Le Viet Ly *et al.*, 1999). Throughout a long historical period under the pressure of natural and artificial selection, local animals were formed some precious characteristics to adapt with environment conditions such as ability to use the low nutrient feeds and good disease resistance. However, the productivity and economic efficiency of these breeds were rather low. Besides that, the uncontrolled crossbred process has leading to reduce the population of purebred local animals. Amongst local breeds, Dong Tao chicken is famous for its big leg and the high meat quality.

However, as other indigenous chickens, Dong Tao chicken breed has been hybridized and degraded by time. Thus, it is necessary to carry out a study on the development status,

consumption situation as well as the economic efficiency of Dong Tao chicken production. It would help to find out a more effective solution for the sustainable development of this chicken breed.

2. MATERIALS AND METHODS

The research was conducted in Dong Tao commune, Khoai Chau district, Hung Yen province from January to June 2013. Secondary data relevant to chicken production in the study site was collected from annual statistic of Agricultural Department of Khoai Chau district and Dong Tao commune. While primary data was collected from the interviews with 30 Dong Tao chicken raisers and actors involving in Dong Tao chicken value chain mentioned by the farmers including 5 traders and 2 restaurants (one restaurant in Hanoi and another one in Hung Yen province) using semi-structured questionnaires. The study provides information on the development status, reproductive performance, economic efficiency and consumption situation of Dong Tao chicken production. Otherwise, in order to compare and evaluate the economic efficiency of Dong Tao chicken production in different farm scales, the surveyed households were divided into two groups according to the farm sizes suggested by the farmers: small

farms (<50 hens/farm) and large farms (≥ 50 hens/farms). All the results of economic performance were for Dong Tao chicken production in 2012. In-depth interviews were also conducted with the commune authorities, commune veterinarian and the head of Agricultural department in the district.

The data was analyzed by descriptive statistics in Microsoft Excel software and Minitab 14. T-test was employed to compare the difference of the hen reproductive performance between the small and large farms with following indicators: number of clutches/hen/year, number of eggs/hen/clutch, hatchability rate, number of eggs/hen/year and number of chicks/hen/year. The economic efficiency of Dong Tao chicken production was evaluated basing on the cost-benefit analysis with following indicators: total revenues, total fixed costs, total variable costs, profit, gross margin, profit/ total cost ratio, as defined by EC (1989) and used in some studies (Colson, 2008; Gelan, 2011; Ivana, 2011).

3. RESULTS AND DISCUSSION

Dong Tao chicken is called according to the name of Dong Tao commune in Khoai Chau district, Hung Yen province, the hometown of this chicken breed. The commune covers a total natural area of 535.25 ha with the main part of population practicing in agricultural production (nearly 70% of people at working age). Agriculture sector in general and chicken production in particular is the advantage of Dong Tao commune. According to annual commune statistic, the number of chicken herd

increased from 7,150 heads in 2010 to 9,530 heads in 2013 (an increase of 2,380 heads). Among livestock structure, Dong Tao chicken population is predominant. In 2013, the average number of Dong Tao chickens was 321.97 heads/household, while the number of pig and other chicken breeds were nearly 13 heads/household and 2 heads/household, respectively.

People in Dong Tao commune are favoured by large land possess. With the average area of 374 m²/household for animal production (surveyed data, 2013), Dong Tao chickens could produce at the large scale. According to surveyed results, in 2012 the average number of Dong Tao chickens was more than 58 hens per household. In 2013, it increased to 67.23 hens per household. Majority of Dong Tao chicken flocks in the surveyed households were chicks and reproductive hens. Number of chickens within 1 to 7 months old and reproductive cocks occupied small proportions.

In the large farms, the chicks and reproductive hens accounted for the highest proportions (50.01% and 23.75% of total chicken, respectively). Meanwhile, in the small farms, beside a predominant number of the chicks (60.05%), chickens from 1 to 7 months old shared 21.65% of the total chicken population. In local chicken production, the farm size depends strongly on the number of reproductive hens. According to surveyed results, the hen population in the large farms were 9 times higher than that of the small farms.

Table 1. Structure of Dong Tao chicken flock in the surveyed households

(Unit: head/household)

Chicken category	Small farms (n=21)		Large farms (n=9)	
	Mean	SE	Mean	SE
Reproductive cocks	6.45	0.94	74.30	37.60
Reproductive hens	18.35	2.00	165.00	54.50
Chickens (1-7 months old)	29.35	8.62	108.00	45.46
Chicks (< 1 month old)	81.40	16.08	347.50	87.44
Total	135.55	-	694.80	-

The reproductive performance of the hens is one of the key factors affecting the economic efficiency of the Dong Tao chicken households. According to surveyed results, the productivity of Dong Tao chicken flock was low varying from 4.57 clutches per hen per year (small farms) to 6.11 clutches per hen per year (large farms) and 13.52 eggs per hen per clutch (small farms) to 13.78 eggs per hen per clutch (large farms). The hatchability rate obtained from 69% (large farms) to 71% (small farms). According to Nguyen Chi Thanh *et al.* (2009), Dong Tao hens lay 16.58 eggs per clutch with 4.13 clutches per hen per year, its egg production was 67.09 eggs/year. Thus, the egg production of Dong Tao chickens raised in the large farms were higher but in the small farms were lower

than the results of the authors. Compared with other indigenous chicken breeds, the egg production of Ho chickens was 50.4 eggs per hen per year with the hatchability rate per number of laying eggs obtained 73.8% (Nguyen Van Duy, 2013). Meanwhile, the egg production of Mia and Mong chickens were 66.5 eggs per hen per year and 83.6 eggs per hen per year, respectively. The hatchability rate per number of laying egg of these two chicken breeds accounted for 65.6% and 71.6% respectively (National Institute of Animal Sciences, 2009). Thus, the egg production of Dong Tao chickens was similar to Ho chickens and lower than Mia and Mong chickens. However, its hatchability rate was higher than Mia chickens and similar to Ho and Mong chickens.

Table 2. The reproductive performance of Dong Tao chickens

Criteria	Small farm (n=21)		Large farm (n=9)		T-test
	Mean	SE	Mean	SE	
Number of clutches/hen/year (clutch)	4.57	0.29	6.11	0.56	*
Number of eggs/hen/ clutch (egg)	13.52	0.52	13.78	0.95	ns
Number of eggs/hen/year (egg)	61.94	4.84	83.11	6.95	ns
Hatchability rate (%)	71.00	2.57	69.00	1.69	*
Number of chicks/hen/year (head)	45.93	5.16	57.05	4.58	ns

Note: T-test was used for mean difference between the small and the large farms, *: significant at 5% ($P < 0.05$), ns: non-significant

On the other hand, hens were raised in the large farms producing number of egg per clutch were higher than that of the small ones (the difference was statistically significant at 5%). Thus, the large farms benefited from higher numbers of eggs and chicks per hen per year compared to the small ones. The reason here was the difference in production mode and the feed supply between the farms and it partly explains the higher economic efficiency of large scale chicken production.

Regarding the consumption situation, Dong Tao chickens were rather easy to sell all year around with the involvement of various stakeholders including the traders and restaurants. Not like other local chicken breeds, the trade of Dong Tao chicks was not influenced by the season since it has created distribution channels to the South of Vietnam where the climate conditions are virtually stable. However, it was not the same for the broiler chickens. The chick price varies slightly during the year while the broiler

chicken price increases sharply in the days near Tet holidays.

The main product of Dong Tao chicken production was the chicks accounting for a predominant proportion of 95.1%. These chicks were mainly sold to the traders in Hung Yen province (59%) and the raisers (40%) from other regions in Hung Yen and various provinces nationwide. Meanwhile, the broiler and reproductive chickens (chickens for breeding purpose) shared the

small percentages of 4.6% and 0.3%, respectively. According to surveyed results, a large number of these broiler chickens were consumed by the restaurants and consumers (80%) so the price of Dong Tao broiler chickens depended not much on the traders. The eggs were also sold with an insignificant rate of 2% (of total egg production) mainly to the traders and raisers in distant regions who might get difficulties during chicken transportation process (Figure 1).

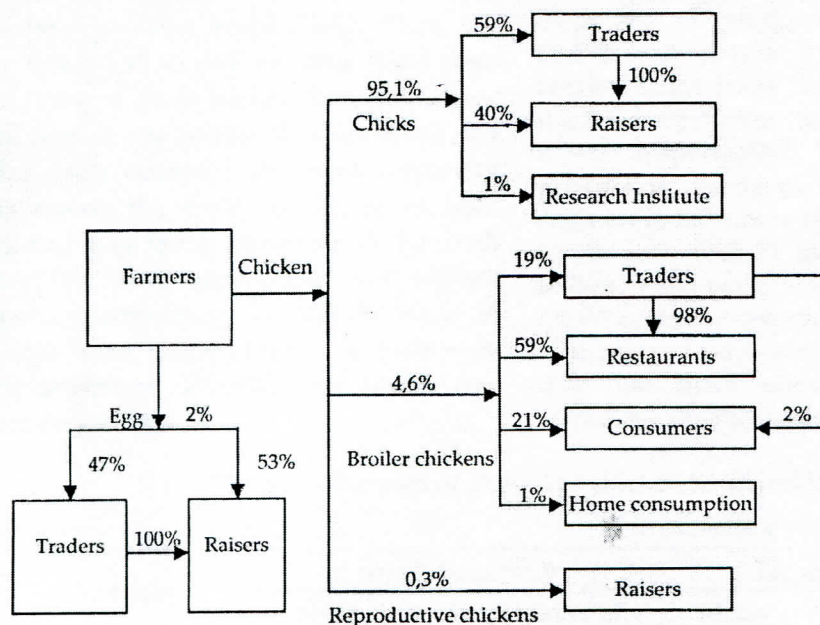


Figure 1. The consumption channels of Dong Tao chicken

According to FAO (2008), in the semi-intensive system, poultry products are sold directly to consumers or traders through direct agreement between the seller and the buyer. Traders bring poultry products to markets or cities. The poultry products are then brought to smaller markets, the local markets in the city. Small traders slaughter poultry before it is sold. The poultry price is highly fluctuated in different places and times, depending on the season and the amount of

poultry sold by the farmers. Thus, some similar results was found out from this study. On the other hand, Dong Tao chicken is the famous breed so its distribution system is quite different compared to other chicken breeds. Firstly, Dong Tao chickens were mainly raised to sell the chicks (only a small part of its products was provide as the chicken meat). Secondly, the Dong Tao broiler chickens (chickens for selling the meat) were not only sold to the traders and consumers.

There were up to 59% of these chickens be consumed by the restaurants. Otherwise, the majority of Dong Tao broiler chickens were sold to the restaurants by the traders (98%) as well. It was traded as live chickens and not delivered through the markets.

During the research, the cost and benefit of Dong Tao chicken production in the households was taken into account to evaluate its economic efficiency. The average fixed costs of the small and large farms were 4.06 million VND and 15.58 million VND per household per year respectively. Thus, the large farms had to pay the total fixed costs were nearly 4 times higher than that of the small ones. It can be seen that the breed and raising tools occupied the most important parts among the fixed cost items in both small and large farms. However, in the small farms, the breed represented the highest proportion accounting for 52.93% while in the large farms, the cost for raising tools were more important (47.69%), the breed cost shares only 27.81%.

The average variable costs of the small and large farms were at 31.41 million VND and 189.67 million VND per household per year respectively. So, the variable costs of the large farms were 6 times higher than that of the small ones. Among variable cost items, the feed cost represented the highest proportion of 77.04% (small farms) to 78.73% (large farms). Besides that, the cost for veterinary medicine also occupied considerable rates in both the small and large farms (11.14% vs 10.50%).

Regarding to the total costs, variable costs shared predominant proportions of 88.55% and 92.41% of the total costs in the small and the large farms respectively while the fixed costs accounted for only 11.45% and 7.59% respectively. To operate chicken production, the large farms had to pay the costs were 5.8 times higher than that of the small ones (205.25 million VND vs 35.47 million VND per household per year) (Table 3). Whereas, the average number of the hens in the large farms were nearly 9 times higher than the small ones. This confirms the advantage of large scale chicken production.

Table 3. The costs of Dong Tao chicken households

(Unit: million VND per household per year)

Cost item	Small farm (n=9)		Large farm (n=21)	
	Mean	Proportion (%)	Mean	Proportion (%)
Total fixed costs	4.06	100.00	15.58	100.00
Breed	2.15	52.93	4.33	27.81
Chicken housing	0.85	21.03	1.37	8.81
Raising tools	1.06	26.05	7.43	47.69
Land rent	0.00	0.00	0.44	2.85
Loan interest	0.00	0.00	2.00	12.84
Total variable cost	31.41	100.00	189.67	100.00
Veterinary medicine	3.50	11.14	19.91	10.50
Rice husk	0.03	0.11	1.83	0.96
Electricity	2.00	6.37	7.16	3.78
Feed	24.20	77.04	149.32	78.73
Others	1.68	5.34	11.45	6.03
Total costs	35.47	100.00	205.25	100.00

In 2012, both of the small and large Dong Tao chicken farms got high revenues (121.22 million VND/household vs 1,171.85 million VND/household). So, the revenues of the large farms were 9.7 times higher than that of the

small ones. In which, the chick and broiler chicken were the main output items among product types accounting for 61.88% and 24.24% in the small farms; 60.65% and 36.58% in the large farms respectively (Table 4).

Table 4. Average revenue of Dong Tao chicken households

(Unit: million VND per household per year)

Product type	Small farm (n=21)		Large farm (n=9)	
	Mean	Proportion (%)	Mean	Proportion (%)
Broiler chicken	29.38	24.24	428.66	36.58
Chick	75.01	61.88	710.78	60.65
Egg	1.99	1.64	7.88	0.67
Home consumption	14.84	12.24	24.53	2.09
Total revenues	121.22	100.00	1,171.85	100.00

The Dong Tao eggs were mainly sold to the South of Vietnam and several Northern mountainous provinces for hatching purpose with inconsiderable proportions. A part of product from Dong Tao chicken production was also used for the home consumption accounting for 12.24% and 2.09% of total revenues in the small and the large farms respectively. Thus, it can be seen that the main purpose of Dong Tao chicken production was for selling (commercial purpose).

Dong Tao chicken production bring a high income to the raisers. According to study results, in 2012, the average profit of the small and large farms were 85.75 million VND and 966.60 million VND per household per year respectively. The profit/total cost ratio were at 4.71 and 2.42, respectively. Thus, chicken production was profitable for both two farm categories especially the large farms. In reality, high profit from chicken production attracted an increasing number of people in Dong Tao commune involving in this job.

Table 5. Economic efficiency of Dong Tao chicken households

(Unit: million VND per household per year)

Indicators	Small farm (n=21)	Large farms (n=9)	Comparison
Total costs	35.47	205.25	5.79
Total revenues	121.22	1,171.85	9.67
Total variable costs	31.41	189.67	6.04
Gross margin	89.81	982.18	10.94
Profit	85.75	966.60	11.27
Profit/hen/year	5.69	5.80	1.02
Profit/total cost ratio	2.42	4.71	1.95

4. CONCLUSION

Dong Tao chicken production was developed quite well with business orientation more and more obviously. Besides that, its consumption channels have been well created with the involvement of many stakeholders ensuring the output of Dong Tao chickens all year around.

According to the surveyed results, the average number of Dong Tao chicken population was rather high. However, due to breed characteristics, its reproductive performance of Dong Tao chickens were still low in both the small and large farms.

Dong Tao chicken raisers gained the high economic performance which was shown through some criterias: total revenue, gross margin, profit and profit/total cost ratio. In 2012, the profit of the small and large farms were 85.75 million VND and 966.60 million VND per household per year respectively while the profit/total cost ratio were 2.42 and 4.71, respectively. It, therefore, operating chicken production at large scale will reduce the costs and bring higher profits to the farmers.

REFERENCE

1. **Cardellino R.** (2001), The risk of biodiversity reduction, downloaded from: <http://www.enn.org>, 18/9/2001.
2. **Colson F., V. Chatellier and K. Daniel** (2008), Using the Farm Accounts Data Network (FADN) to identify the structural characteristics and economic performance of EU cattle systems, download 12/2/2013 from <http://www.macauley.ac.uk/elpen/work1/fcab.htm>.
3. **Nguyen Van Duy** (2013), Master thesis: The reproductive performance of Ho chickens raised in the households in Thuan Thanh district, Bac Ninh province, Hanoi University of Agriculture.
4. **EC** (1989), Farm Accountancy Data Network. An A to Z of methodology, Luxembourg: Office for Official Publications of the European Communities, downloaded 11/1/2013 from http://www.hq.nasa.gov/iwgsdi/SDI_Full_Issue_List.htm.
5. **FAO** (2008), Poultry production systems in Vietnam, prepared by Nguyen Van Duc and T. Long, GCP/RAS/228/GER Working Paper No. 4. Rome.
6. **Gelan A., B. Muriithi and I. Baltenweck** (2011), Key economic performance indicator, Project Brief: East Africa Dairy Development Project Baseline Survey Brief No.5.
7. **Ivana Brozova'** (2011), The economic performance analysis of organic farms in the Czech Republic Agric. Econ. Czech, 57(5): 240-246.
8. **Le Viet Ly, Hoang Kim Giao, Mai Van Sanh, Vo Van Su and Le Minh Sat** (1999), Monograph: Conservation of livestock genetic resources in Vietnam. Agriculture Publishing House, Volume 1: 13.
9. **National Institute of Animal Sciences** (2009), Report on the findings of livestock genetic resources conservation program in Vietnam (2005-2009). National Institute of Animal Sciences, Ministry of Agriculture and Rural Development.
10. **Nguyen Chi Thanh, Le Thi Thuy, Dang Vu Binh and Tran Thi Kim Anh** (2009), Biological characteristics, productivity of three local chicken breeds: Ho, Dong Tao and Mia. Journal of Animal Husbandry Sciences and Technics, Animal Husbandry Association of Vietnam, 4(122): 2-10.
11. **Zvi K.** (1999), The breeders need to consider natural factors, downloaded 15/11/2012 from: <http://www.kabir.co.il/articles/99/text.htm>.

TẠP CHÍ KHOA HỌC KỸ THUẬT



CHĂN NUÔI



Journal of Animal Husbandry Sciences and Technics (JAHST)

Year 23th [197]

ISSN 1859 - 476X



SCIENCE - TECHNOLOGY

ANIMAL HUSBANDRY ASSOCIATION OF VIETNAM

(AHAV)



Vũ Đt Cũ

Journal of Animal Husbandry Sciences and Technics (JAHST)

No 8 [197] - 2015

Editor in chief:

Dr. DOAN XUAN TRUC

Vice-editors:

Assoc. Prof. Dr. DINH VAN CAI

Prof. DrSc. LE HONG MAN

Assoc. Prof. Dr. NGUYEN DANG VANG

Secretary:

Assoc. Prof. Dr. NGUYEN VAN DUC

Editor members:

Assoc. Prof. Dr. NGUYEN TAN ANH

Assoc. Prof. Dr. HOANG KIM GIAO

Assoc. Prof. Dr. DO VO ANH KHOA

BSc. LE BA LICH

Publishing Manager:

MA. CAO THI KIM DUNG



Permission: Ministry of Information and Communications of the Socialist Republic of Vietnam

119/GP-BTTTT date 26/1/2010

ISSN 1859 - 476X

Publish: monthly

Office: Floor 8, Sunrise Tower, 187, Nguyen Luong Bang, Quang Trung, Dong Da, Ha Noi.

Telephone: 04.36290621

Fax: 04.38691511

E - mail: tapchichannuoi@hoichannuoi.vn

Website: www.hoichannuoi.vn

Account:

Name: Hội Chăn nuôi Việt Nam (AHAV)

Number: 1300 311 0000 40, tại Chi nhánh Ngân hàng Nông nghiệp và Phát triển Nông thôn Thăng Long - Số 4, Phạm Ngọc Thạch, Hà Nội.

Print 1000 copies, Size 19x27cm at Agriculture Publishing House. Complete and legal copyrighting in August 2015.

ANIMAL GENETICS AND BREEDING

Nguyen Huu Tinh, Nguyen Van Hop and Tran Van Hao. Estimation of the genetic association between purebred and crossbred performance for growth and backfat thickness traits of pigs in Vietnam 2

Do Duc Luc, Ha Xuan Bo and Dang Vu Binh. Growth performance, carcass characteristics and meat quality of crossbred fattening pigs from stress negative Piétrain boars mated to Landrace x Large white sows 8

Nguyen Huu Tinh, Tran Van Hao, Pham Tat Thang, Nguyen Van Hop and Nguyen Quoc Vu. The estimation of direct additive and dominant genetic effects on performance traits for terminal crossbred sires from Duroc and Pietrain pigs 18

ANIMAL FEEDS AND NUTRITION

Tran Thi Bich Ngoc and Lai Thi Nhai. The effect of dietary fiber level on gut environment and bacteria development of Mong Cai and (Landrace x Yorkshire) crossbred pigs 26

Nguyen Thi Hong Trinh, Nguyen The Thao and Metha 32 Wanapat. Effects of mangosteen peel and garlic powder mixture supplementation on rumen fluid fermentation of beef cattle by using *in vitro* gas technique

Ho Trung Thong, Ho Le Quynh Chau, Vu Chi Cuong and Tanaka Ueru. Determination of ileal amino acid digestibilities of some feedstuffs for chickens 38

Nguyen Thi Hong Nhan and Nguyen Van Hon. Using ipomoea aquatica and enydra fluctuans as agents for wastewater treatment and as basal diet of growing crossbred rabbits 44

ANIMAL PRODUCTION AND TECHNOLOGY

Suphawadee Y., Hiep T. and Thang C.M. Effects of Leucaena leucocephala supplemental levels in the diet for dairy cattle on animal productivity and enteric methane production 50

Vu Dinh Ton, Han Quang Hanh, Do Thi Hue, Nguyen Thi Phuong and Nguyen Xuan Trach. Factors affecting the biogas development in Hai Duong and Bac Giang provinces in the North of Vietnam 60

Nguyen Van Hon and Nguyen Thi Hong Nhan. Effect of silage methods to the chemical composition of taro (*Colocasia esculenta*) and tithonia diversifolia 68

Nguyen Van Duy, Dao Thi Hiep, Bui Huu Doan, Pham Ngoc Thach, Nguyen Van Thang, Pham Kim Dang, Nguyen Chi Thanh, Nguyen Cong Oanh, Ha Xuan Bo, Do Duc Luc and Vu Dinh Ton. Ho chicken breed: morpho-biometric characteristics and economic efficiency of production 73

Le Thi Thanh Huyen and A. Valle Zárate. Cattle farming systems in northern mountainous region of Vietnam and their economic efficiency 80

Phan Van Sy and Nguyen Thi Thu. The use of moringa oleifera leaf meal in broiler diet 86

Dao Thi Hiep, Nguyen Van Duy and Vu Dinh Ton. Production, consumption status and economic efficiency of dong tao chicken production 91

ANIMAL SCIENTIFIC NEWS

Nguyen Tan Anh. Some achievements on animal production 98

Pham Van Tiem. Dairy bulls successfully selected by progeny testing in Vietnam