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# From diversity of species to diversity of players

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## Sowing flower strips in a wheat field to enhance biological control of aphids and support pollinators

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**State-of-the-art**

Insect pests are responsible, among other factors, for reducing the productivity of crops. While chemical insecticides used to control them cause harmful effects on human health and the environment, conservation biological control, i.e. managing habitats in agricultural landscapes to support pest natural enemies, turns out to be a promising approach (1). Moreover, the decline of pollinators in agricultural areas is observed since a few decades (2), being partly due to the intensification of agriculture which homogenizes and degrades agricultural landscape. To reduce the detrimental effects of agricultural intensification on biodiversity, ecosystem functioning and ecosystem services, farmers have the opportunity to adopt agri-environmental measures. Among them, the establishment of flower strips, with a recognized interest in biological control and the conservation of pollinators, is proposed (3). However, their establishment is not systematically efficient and profitable for the farmers (4). Adapting mixture composition to farmer's need may encourage their adoption. Thus, the research project has double goals (i) to provide intercropping flower strips for promoting the attraction of beneficial insects against pests and for promoting pollinators diversity; and (ii) to suggests diversification of farm income by planting monospecific oilseed flower strips.

**Methods**

In an experiment conducted in Golzinne (Belgium), three different flower strips were sown within a winter wheat (Triticum aestivum) field: a monospecific sowing of Dimorphoteca (Dimorphoteca pluvialis), a monospecific sowing of Camelina (Camelina sativa) and a multispecific mixture of annual, biannual and perennial flower species. Each treatment was repeated three times within the wheat field. The multispecific mixture was composed for attracting pollinators (i.e. Apoidae, hoverflies [Diptera: Syrphidae]) and aphid [Hemiptera: Aphididae] natural enemies (i.e. aphidophagous hoverflies, lacewings [Neuroptera: Chrysopidae], ladybeetles [Coleoptera: Coccinellidae] and parasitoid wasps [Hymenoptera]). Dimorphoteca and Camelina are Asteraceae and Brassicaceae respectively, which can also be attractive to these pollinators and natural enemies. Moreover, they could provide additional income to farmers because their seeds can be used for the production of oil (5,6).

Between April and July 2017, pollinators, winged aphids and related adult natural enemies were pan-trapped in both flower strips and adjacent wheat, while aphids and aphidophagous larvae were observed on wheat tillers weekly. Transect walks were conducted to observe natural enemies and pollinators visiting flowers. Trappings and observations were also conducted in wheat being 60 m away from the flowers (i.e. control plots). Finally, the seed yield of Dimorphoteca and Camelina was measured to evaluate whether these flower species can be economically profitable for farmers.

**Main results**

The most abundant natural enemies trapped were ladybeetles, followed by lacewings, hoverflies and parasitoids. Ladybeetles were significantly more abundant in traps in the multispecific mixtures compared to Camelina, while hoverflies were significantly more observed visiting flowers in the mixtures and Camelina compared to Dimorphoteca. In the adjacent wheat crop, aphids were significantly less observed adjacent to the mixtures compared to the other treatments, despite that no significant difference between treatments was found for natural enemies.

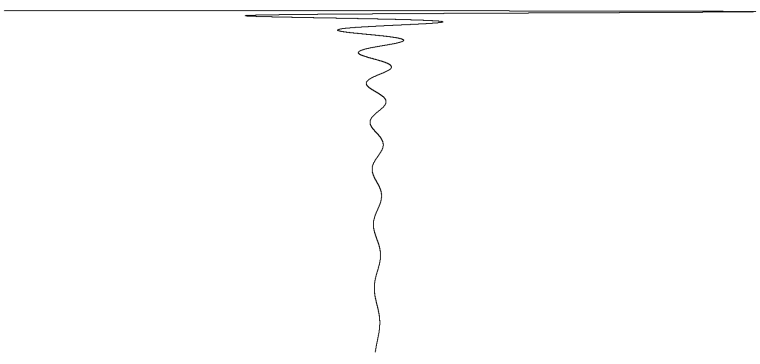
The results on pollinators showed no significant differences between the various treatments according to their abundance and diversity. Sowed mixtures allowed attracting particularly generalist pollinators. In parallel, the networks of plant-pollinator interactions realized with the results of transects allowed to support the importance of the floral features (colour and type of the corolla) in the plant-pollinator interactions.

**Conclusions**

Finally, the first harvests of seeds, in particular Camelina, revealed interesting characteristics in terms of yield (1,4t / ha). This study thus opens new perspectives in the conception of floral mixtures by revealing a possibility of economic profits for the farmers.

**References**


1. Gurr G. M., Wratten S. D., Landis D. A., You M., 2017. Habitat management to suppress pest populations: progress and prospects. Annual review of entomology, 62, 91-109.
2. Potts S., Biesmeijer K., Bommarco R., Breeze T., Carvalheiro L., Franzén M., González-Varo J.P., Holz- schuh A., Kleijn D., Klein A.-M., Kunin, B., Lecocq T., Lundin O., Michez D., Neumann P., Nieto A., Penev L., Ras- mont P., Ratamäki O., Riedinger V., Roberts S.P.M., Rundlöf M., Scheper J., Sørensen P., Steffan-Dewenter I., Stoev P., Vilà M., Schweiger O.,2015. Status and Trends of European Pollinators. Key findings of the STEP project. Pensoft Publishers, Sofia. p72
3. Haaland C., Naisbit R. E., Bersier L.-F., 2011. Sown wildflower strips for insect conservation: a review. Insect Conservation and Diversity, 4, 60–80.
4. Hatt S., Uyttenbroeck R., Bodson B., Piqueray J., Monty A., Francis F., 2015. Des bandes fleuries pour la lutte biologique : état des lieux , limites et perspectives en Wallonie – Une synthèse bibliographique . Entomologie Faunistique, 68, 159–168
5. Defontaines C., 1997. Potentialités et limites de dis espèces oléagineuses alternatives. Thèse universitaire. Gembloux : Faculté universitaire des sciences agronomiques de Gembloux. 82p
6. Gugel R. K., Falk K. C., 2006. Agronomic and seed quality evaluation of Camelina sativa in western Canada. Canadian Journal of Plant Science, 86(1609), 1047–1058.

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## Context

To reduce the adverse effects of agricultural intensification, farmers have the opportunity to adopt agri-environmental measures (1). Among them, the establishment of flower strips, with a recognized interest in biological control and the attraction of pollinators, is proposed (2,3). However, their establishment is not systematically efficient and profitable for the farmers (4). Adapting mixture composition to farmer's need may encourage their adoption.

## Project

We assessed whether sowing flower strips within a winter wheat field in Golzinne (Belgium) allows mitigating pests (i.e., aphids) and supporting predators (i.e. aphidophagous hoverflies, lacewings and ladybeetles) and parasitoid wasps in the crop. An assessment of the biodiversity of pollinators (Apoidae, hoverflies) was also carried out to determine whether flowering mixtures could be of interest in attracting pollinators to the field. Finally, the yield measurement of the flowers of Dimorphoteca and the Camelina was evaluated to assess whether these flowers can be interesting in terms of economic value for the farmers.

## Experimental design & methods

### Multifloral composition

*Daucus carota*
*Oenothera biennis*
*Echium vulgare*
*Coriandrum sativum*
*Fagopyrum esculentum*
*Glebionis segetum*
*Silene latifolia alba*
*Malva moschata*
*Geranium pyrenaicum*
*Trifolium incarnatum*
*Trifolium repens*

### Methods

- Insect trapping and observations of interactions on plants/flowers
- Observations of the abundance of aphids in the crop
- Vegetation monitoring with quadrats in floral mixtures
- Insect identification
- Analysis of the biodiversity
- Sampling pollination networks
- Crop yield measurements

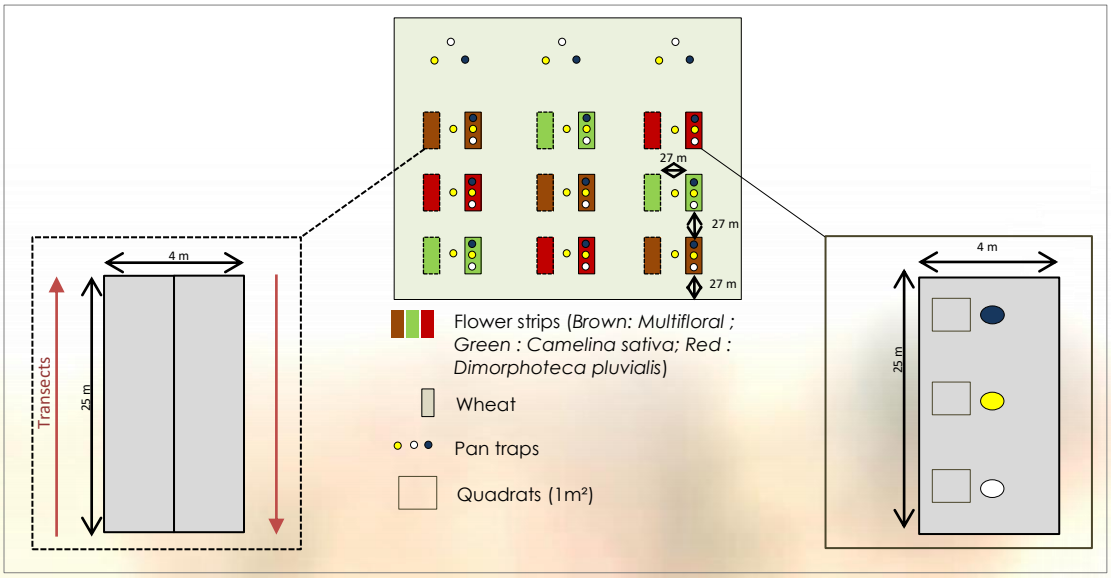


**Fig.1 : Field experimental design**


**Fig 2 : Floral mixture (*Fagopyrum esculentum*)**


**Fig. 3 : *Camelina sativa***

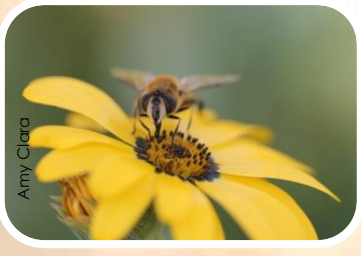


**Fig. 4: *Dimorphoteca sp.***

## Preliminary results - Conclusion

The preliminary results reveal that the sowed flowers showed interesting characters to attract non-specialized pollinators as well as natural enemies, particularly Coccinelidae. The results obtained show that the flowers, particularly Camelina, can be interesting in the conception of floral mixtures with the aim of increasing the economic profitability of agri-environmental measures/ wildlife-friendly farming (habitat management sounds more like managing existing natural grasslands, etc.) for farmers.

**(1) NaTagriWal**, 2015. 1995 – 2015 : 20 années de Mesures Agro-Environnementales ( MAE ) en Wallonie. Dossier de presse. 4p
**(2) Haaland C.**, Naisbit R.E .& Bersier L-F., 2011. Sown wildflower strips for insect conservation: A review. Insect Conservation and Diversity, 4(1). p60–80
**(3) Hatt S.**, Uyttenbroeck R., Bodson B., Piqueray J., Monty A. & Francis F., 2015. Des bandes fleuries pour la lutte biologique : état des lieux , limites et perspectives en Wallonie – Une synthèse bibliographique . Entomologie Faunistique, 68. p159–168
**(4) Le Féon**, 2011. Insectes pollinisateurs dans les paysages agricoles : approche pluri-échelle du rôle des habitats semi-naturels, des pratiques agricoles et des cultures entomophiles. Thèse. Ecologie, Environnement. Université Rennes 1, 2010. 257p.