

EcoOrchard – collecting existing knowledge and generating new knowledge on functional biodiversity of organic orchards

L. Sigsgaard¹, F. Warlop², A. Herz³, M. Tchamitchian⁴, L. Pffiffner⁵, M. Kelderer⁶, L. Jamar⁷, D. Kruzynska⁸, M. Korsgaard⁹, M. Tasin¹⁰, L. Ozolina-Pole¹¹

¹University of Copenhagen, Department of Plant and Environmental Sciences, Thorvaldsensvej 40, 1871 Frederiksberg C; ²Groupe de Recherche de Agriculture Biologique; Maison de la Bio, 255 Chemin de la Castelette, BP 11283, 84911 Avignon Cedex 9, France; ³Julius Kühn-Institut, Federal Research Centre for Cultivated Plants; Heinrichstraße 243, 64287 Darmstadt, Germany; ⁴UR Ecodéveloppement, INRA; Avignon Cédex 9, France; ⁵Research Institute of Organic Agriculture; Ackerstrasse 113, Postfach 219, 5070 Frick, Switzerland; ⁶Laimburg Research Centre for Agriculture and Forestry; Pfatten, Laimburg 6, 39040 Auer, Italy; ⁷Walloon Agricultural Research Centre; Bâtiment Emile Marchal, Rue de Liroux, 4, 5030 Gembloux, Belgium; ⁸Research Institute of Horticulture; 96-100 Skierniewice ul. Pomologiczna 18, Poland; ⁹Gefion-Ecoadvice; Fulbyvej 15 4180 Sorø, Denmark; ¹⁰Swedish University of Agriculture Sciences, Dept. of Plant Protection Biology, Box 102, 23053 Alnarp, Sweden; ¹¹Latvian Plant Protection Research Centre; Struktoru iela 14a, 1039 Riga, Latvia
e-mail: les@plen.ku.dk

Abstract: Organic fruit growers often suffer economic losses due to insect damages. The available natural pest control products are not always effective; and most important: many organic fruit growers would prefer not to use any pesticide at all. EcoOrchard, a CORE Organic Plus project (2015-18) aims to collect existing knowledge and generate new knowledge in order to use Functional AgroBiodiversity (FAB) successfully in orchards. This includes experimental trials in seven countries on the potential of inter-row flower strips for control of key pests and natural enemy augmentation, the establishment of the EBIO-Network as a European-wide network of stakeholders for collecting, sharing and improving scientific and practical knowledge and experience in FAB management, the development and testing of simple FAB assessment tools for use on-farm by growers and advisors, and finally, using a participatory approach to learn about potential constraints that may hamper the adoption of innovative tools and how to solve these constraints by iterative reevaluation.

Key words: inter-row flower strip, natural enemies, *Dysaphis plantaginea*, *Cydia pomonella*

Introduction

Organic fruit growers often suffer economic losses due to insect damages. The available natural pest control products are not always effective; and most important: many organic fruit growers would prefer not to use any pesticide at all. The project EcoOrchard “Innovative design and management to boost functional biodiversity of organic orchards” is a CORE Organic Plus project (2015-18) aiming to collect existing knowledge and generate new knowledge in order to use functional agrobiodiversity successfully in orchards (Sigsgaard, 2016; Sigsgaard *et al.*, 2016). Tracking innovative practices is one element of this including

interviews with growers and advisors and the establishment of the EBIO-Network as a European-wide network of stakeholders for collecting, sharing and improving scientific and practical knowledge and experience in functional agrobiodiversity (FAB) management. Further simple FAB assessment tools for use on-farm by growers and advisors have been developed and tested. Experimental trials have been established in seven partner countries on the potential of inter-row flower strips for control key pests and to augment natural enemies. Finally, using a participatory approach to learn about potential constraints that may hamper the adoption of innovative tools and how to solve these constraints are assessed through iterative reevaluation.

Tracking innovative FAB practices

More than 50 advisors and more than 100 growers (i.e. the EcoOrchard-stakeholder network) in the participating countries were interviewed for their knowledge and experiences on techniques for FAB management. The implementation of the ten most known or preferred methods (“Top- ten”) was characterized for each country, revealing a high diversity between countries (Fernique *et al.*, 2016).

EBIO-Network

Literature collection from all partners resulted in 200 priority papers, reports and presentations on functional agro-biodiversity, available also on the EBIO-Network portal. Analysis of this literature is ongoing and will supplement the knowledge gained from the interviews. It is planned to summarize the analysis of this literature in a comprehensive review, especially on the results of the last five years and including the results of the practical knowledge analysis of the interview data. Online EBIO-network (European Biodiversity Orchard-Network) is available at <http://ebionetwork.julius-kuehn.de/>. The current content will be supplemented by material provided and developed by partners during the project period. The publishing of stakeholders’ data still need their approval or their active registration at the thematic portal (Herz *et al.*, 2016).

Common participatory methods for FAB assessment

In 2015, several methods to assess functional biodiversity have been chosen based on our previous experience with the methods and literature. We tested and set up in 1-2 orchards for each of the 3 countries concerned and compare them for different performance criteria (time, material or skill needed, information provided etc.). (i) visual observation, (ii) beating, (iii) sentinel preys or (iv) cardboards were considered as potentially feasible for farmers and presented to them during workshops (in France, Sweden, Denmark) or in the field directly.

At the beginning of the 2016 field season, interested and motivated farmers were asked to choose at least one method to use in their own orchard. Partners initially trained farmers at workshops or in the field, and provided all material needed. A preliminary booklet for partners and farmers was produced and translated to partner country languages. Based on experiences from 2016 they will be revised and made available on the EBIO-Network platform. The European network of involved farmers is getting established, with mostly organic farmers but also some integrated farmers. Winter 2016-17 a questionnaire is being completed about farmers’ opinion of using the method(s), information obtained and any changes in farmers’ practices.

A short didactic video was produced to inform the methods to farmers and advisors: <https://www.youtube.com/watch?v=ahBsb-nA2AM&feature=youtu.be>.

New collaborative experimental trials and new orchards designing actions

We made two principal flower mixtures targeting our functional-agro biodiversity (FAB) criteria, a basic and complex mixture which will be tested in our field trials. Two types of field trials were set up considering botanical or entomological/botanical aspects of wild these flower strips (Wäckers & Van Rijn, 2012). Thus we will test both mixtures botanically (plant species richness, establishment, botanical successions) under the specific condition of orchards (nutrient rich soils, shaded by trees, greatly altered by machinery). We have installed these field trials in seven partnering countries, analysing the impact on natural pest control in relation of the botanical resources (with and without flower strips). Accordingly we have developed specific assessment field protocols and guidelines for entomology, botany and management practices.

The field trials data about the impact of flower strips on natural pest control of aphids and other pests of 2016 are currently being analysed. Spring recordings showed that most flower strips are still improving their floral qualities (number, quantity of sown plants). A good establishing of strips have been found in three countries (Be, CH and It) and moderate (poor to medium/good) in four countries (DK, D, PL and S). Up to now, we have got the impression that the establishment of strips in Northern-European countries could be more challenging due to the climatic conditions, and therefore it needs still more adapted mulching regimes (later dates and maybe fewer cutting dates). Thus we are anticipating these topics, e.g. using an indicator plant- list to optimise mulching dates.

Seed mixtures

Selection criteria of plant species for flower strips include good success in establishing under orchard conditions (adapted to orchard soils and shadowing by trees), durability and stability over 8-10 years of flowering species diversity, permanence and persistence of flowering key species (important for functional biodiversity) and significant impact to increase populations of key beneficials of apple pests, thus preferring species with short corolla blossoms and well accessible nectar and pollen sources.

The composition of the seed mixture aims to achieve a competitive and over 8-10 years perennial flower strip in the orchard alley way with a long flowering period with plants supporting key beneficials with respect to FAB. The strip must be compatible with 3-4 times cutting/mulching per year. This requires among other that the plant community is tolerant to regular mulching – 3-4 times a year and is composed of bi-annuals and perennials, preferring ecotypes or wild form species and including some grass species typical for this species community which have to stabilize the plant community in mid-term.

Learning from all sides and dissemination

Informal networks of growers, advisors and researchers have been built in France, Denmark and Sweden, through the workshops and the deep exchanges they fostered. A second workshop round with the same participants in winter 2016-2017 to share their experiences about the monitoring methods they decided to test in 2016. This should reinforce the community feeling and the installation of lasting exchanges, built through the EBIO-Network support.

Knowledge has been shared between the participants and the organizers of the workshops: about the different representations of what FAB is, about what are the practices to favor biodiversity and about FAB monitoring methods. Farmer's representations of FAB remains to be analyzed in details, but it already reveals large diversity, and some surprising

facts: – some conceptions are widely shared and rather expectable (FAB relates to beneficial insects, to ecological habitat, to natural elements like hedges or inter-row grass), some reveals a conception deeply linked to human-nature links (FAB relates to landscape planning, to local political choices concerning land use etc.).

Workshops reveal also a large diversity in the management styles of FAB. For some participants FAB management should partially and sometimes even totally be delegated to a specific person, for others the FAB management by the grower himself. If preliminary results are confirmed, we should foresee that FAB monitoring methods will not be the only way to invite farmers to use FAB, we will also have to work on on-farm and perhaps between farms organizational aspects of FAB monitoring.

Preliminary observations show that levers to control FAB and make it work for farmers are not all in the sole hand of the farmers, according to their own feelings as some require coordination among farmers, or between farmers and other landscape actors. If such different levels of *controls* are confirmed, we should foresee that FAB monitoring methods will not be the only way to invite farmers to use FAB, and some coordination actions should also be proposed. These conclusions might be tested during the next workshop round.

Acknowledgements

The authors acknowledge the financial support for this project provided by transnational funding bodies, being partners of the FP7 ERA-net project, CORE Organic Plus, and the cofund from the European Commission.

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