



Organic Food and Farming in Flanders



NOBL

Netwerk Onderzoek Biologische Landbouw & voeding

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Research 2019-2020



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Dear reader,

Two years have passed, and you are now reading the 6th edition of our brochure 'Organic farming in Flanders: research 2019-2020'. This edition includes information on Flemish research relevant to organic farming and food sector. This overview is becoming more and more extensive, resulting in the thickest edition ever!

Under normal circumstances, we would have launched this publication and hosted you for our biennial seminar. Unfortunately, the Covid-19 pandemic did not allow for a physical meeting. We hope that this overview will contribute to the knowledge exchange that may inspire and help stimulate developments in the organic sector. The stricter legislation in conventional agriculture is leading researchers to look for alternatives for chemical treatments, we hope these insights will inspire farmers and growers from all sectors.

We thank all those who have contributed to this overview and who are committed to building and spreading knowledge about organic agriculture! And to each and every one of you who takes this publication in hand, enjoy reading it!

Lieve De Cock
coordinator NOBL

Kristiaan Van Laecke
chairman NOBL





Organic agriculture in Flanders

Positive evolution for the organic sector in Flanders

In 2019, the organic sector again showed substantial growth, both in terms of organic production and organic chain. The consumption of organic products also increased to a limited extent.

Promising growth figures for market, agricultural area and livestock

The number of organic farms is growing year after year and has more than doubled over the past decade to 562 farms. Two-thirds of these farms are fully organic. Of those farms, 160 keep organic livestock, either combined or not with organic vegetable production. At the end of 2019, there were 1,221 companies (excluding producers) under inspection for activities as distributor, processor, point of sale, importer and/or exporter of organic products. This is 11% more than in 2018. The organic area is now 8,677 hectares and represents approximately 1.4% of the total Flemish agricultural area. The organic livestock population expanded 13% compared to 2018. Especially in organic poultry farming, pig farming and sheep farming we see a solid growth.

Crops and animals in the spotlight

Almost two-thirds of the Flemish organic agricultural area consists of grassland, pastures, fodder crops and green cover crops. Arable farming comprises 15% of the organic area, while 12% is used for growing potatoes, vegetables and herbs. The organic fruit area increased by one-quarter in 2019, which is mainly due to newcomers in Flemish Brabant and Limburg. The organic livestock counts 5,706 cattle (almost 60% of which are dairy cows), 6,893 pigs, 681,365 poultry and 9,013 sheep and goats.

Government financial support is mainly directed to production

Government expenditure specifically aimed at the organic sector increased to over EUR 4.74 million in 2019. The main focus of this expenditure is on the financial stimulation of organic production in the form of, among other things, support per organic hectare, investment support and subsidised organic farm advice. Government expenditure on organic research, information and knowledge exchange has increased to EUR 1.36 million. More than half of the expenditure for research projects went to projects aimed at crop protection.



Limited growth in organic consumption

After a stagnation in 2018, the consumption of organic products in Flanders shows a slight increase again. Total spending on organic products (food, drinks, dry goods and non-food) increased to EUR 305 million in 2019. Spending on fresh organic food and drinks increased by 5%. Organic drinks grew by 5% to 200 million euros. Potatoes, fruit and vegetables remain the most important product category in terms of spending on organic fresh food. The market share of organic fresh food is 2.6% in Flanders.

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Partners: Department of Agriculture and Fisheries, VLAM, ILVO

More info: The report 2019 (in Dutch) is available:

www.vlaanderen.be/landbouw/studies

HEB JIJ
EN DRINGENDE
ONDERZOEKSVRAAG
?



ONDERZOEKS- & KENNISNETWERK

FORUM BIOLOGISCHE LANDBOUW

CO-CREATIEF

SYSTEEM MULTIDISCIPLINAIR

BOEREN

LAANDEREN

BIOLOGISCHE LANDBOUW & VOEDING

AGROECOLOGIE

EUROPA PARTICIPATIEF

DUURZAAM

VRAAGGESTUURD

faciliteren

onderzoekstrategie

onderzoeksdatabank

ngvlak

THORINCAS

faciliteren

BIOPraktijk.be

adviseurs

kennis

projecten

kennisontsluisen

BIOprak

Coördinat
praktijkonderzoek
Biocapra





Research organisation

Research on organic farming within the Flemish government

We are now halfway through the Strategic Plan for Organic Agriculture 2018 - 2022. This strategic plan of the Flemish Minister of Agriculture is the result of a collaboration between the Flemish Department of Agriculture and Fisheries, Algemeen Boerensyndicaat, Boerenbond, BioForum Vlaanderen, Comeos Vlaanderen, Fevia Vlaanderen and VLAM (Flanders' Agricultural Marketing Board).

Regarding the central ambition 'together for more and better organic agriculture', research is very much present in the word 'better'. This stands for the qualities and strengths of organic agriculture in Flanders. They are an incentive for future sustainability and innovation in both agriculture and horticulture. The organic sector has always been a pioneer and innovator in various fields. A well-developed research and knowledge network provides the organic farmer with tools to further optimize farm management. Therefore, the Government of Flanders will make substantially more resources available for organic research.

A selection from 2019 and 2020 in the field of research

In 2019 and 2020, the Government of Flanders' Department of Agriculture and Fisheries continued supporting and financing the activities of CCBT, NOBL and Organic farmers' networks. More information can be found on the websites: www.ccbt.be, www.nobl.be and www.bioforumvlaanderen.be.

The Department of Agriculture and Fisheries continued to publish an annual report on organic farming in Flanders in 2019 and 2020. This report still is the reference on the status, progress and special features of organic farming in Flanders. It also gives an overview of government spending for the organic sector (including research and knowledge) and the distribution and consumption of organic products.

In the framework of the Flemish call for research in organic farming, the Department of Agriculture and Fisheries awarded two project grants:

- 'Optimization of fertilization in organic vegetable production through a more correct estimate of the N effect of the basic fertilization and the N release from soil organic matter - NOPTIMO' (ILVO)
- 'Does intercropping of small fruits make pests and diseases more manageable?' (KULeuven)

A new call was launched in 2021.

Flanders will also continue to seek contact with European research



regarding organic farming. Following the CORE Organic –SUSFOOD call in 2020, the innovative projects ‘Leverage points for organic and sustainable food systems – FOODLEVERS’ (ILVO) and ‘The use of live insect larvae to improve sustainability and animal welfare of organic chickens production – POULTRYNSECT’ (Inagro) were selected.

In 2019 and 2020, both NOBL and the Department of Agriculture and Fisheries continued to actively participate in the negotiations in the run-up to this call, by which the Flemish research could tie in as far as possible with the identified themes.

What the future will bring ...

We are halfway through the strategic plan on organic agriculture for 2018-2022. The flagship of this plan are the ‘bioclusters’ (organic clusters). The first two clusters in Pajottenland and in Voeren-Haspengouw were launched in 2019 and 2020. It brings together potential converters and guides them through the conversion process, by informing them and bringing them into contact with local organic farmers, interested customers, (practical) researchers.... This is a good way to connect farmers with research results. The third cluster starts up in 2021. Are you also curious where the third cluster will be situated?

At the end of 2021, we will start drawing up the new plan that starts in 2023.

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Partners: Government of Flanders, Department of Agriculture and Fisheries

Organic farmers' networks: farmer wisdom as a basis for participatory research

Organic farmers' networks are networks of organic farmers who meet regularly to exchange practice-based knowledge. Experiments done by individual farmers on their farms are an irreplaceable source of knowledge. Sharing this experience - gaining experience from other farmers, but also bringing experience from your own farm - is the engine of these farmers' networks.

Farmers' wisdom and research hand in hand

The networks were initiated in 2009 by BioForum, Landwijzer and the Dutch Louis Bolk Institute. In running the sector networks, the experimental research centers and agricultural advisors active in the relevant sectors are involved. In this way, for each theme that raises additional questions in the networks, we can call on the appropriate source of knowledge. Experimental research centers and advisors broaden knowledge through the contacts with a broad group of organic farmers and bring in knowledge from previous research. The questions from the networks also drive new research.

The Organic Farmers' Networks are embedded in the Flemish Organic Research and Knowledge (FORK) network. In this we work together with CCBT and NOBL. These organisations ensure that questions from the Organic Farmers' Networks are taken into account in practical research and applied/fundamental scientific research. In this way, research is increasingly driven by the sector. Conversely, the organizations also ensure that there is feedback of research results to the sector. In addition, we also work on co-creation so that the research proposals are not only based on the questions of the farmers, but are also further developed together with the farmers.

This puts the Flemish organic sector at the forefront of innovation in the field of scientific research and knowledge development: cooperation of all knowledge institutions, with a central role for the farmer's knowledge from the day-to-day practice on his farm.



Networks within each sector and across sector boundaries

The fruit sector group is the longest-running growers' network for pome fruit growers. Others have been created since 2009: networks for dairy farming, goat farming, poultry farming, pig farming, small fruit farming and arable farming/field vegetables in both the long and short chain.

Often, the farmers' networks also work across sectors (e.g. consultation between livestock farmers and companies with vegetable production about the exchange of feed and manure) and within the sectors in specific theme groups (e.g. in the vegetable sector: short chain, own seed cultivation, ...). Since 2018, a new network for organic flower growers has been started.

The networks are normally reserved for established, organic farmers. In addition, the networks are also open to farmers in conversion or who have recently begun the conversion process. Over the years, the network coordinators have also done much work on the development of methodologies for exchanging experience among farmers. The Organic Farmers' Networks would like to share this experience with anyone who wants to work with farmer groups within the framework of research, including conventional agriculture.

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Funding: Government of Flanders, Department of Agriculture and Fisheries, EU-H2020 projects PPILOW and Diverimpacts

More info: www.bioforum.be/biobedrijfsnetwerken

CCBT vzw – Coordination and communication of applied research on organic farming

As the umbrella of applied research for organic farming, CCBT forms the bridge between research and practice. The annual subsidy from the Flemish government gives CCBT a budget for research projects. These projects are demand-driven from the sector and are carried out by the member research institutes with expertise in organic farming. The monthly newsletter BIOpraktijk reaches more than 1300 farmers and other interested parties with practical information for the organic farmer.

Demand-driven projects

CCBT ('Coordination centre for applied research and extension on organic agriculture') aims to coordinate and stimulate applied research and extension for organic farming in Flanders. The non-profit organization was founded in 2010, within the framework of the Strategic Action Plan for Organic Agriculture.

A yearly grant from the Flemish government makes it possible for CCBT to fund a number of projects. These projects are always initiated by the sector and provide practical, applicable results. The research needs that are addressed during the organic farmers' networks or technical committees are translated into research questions and further into practice-oriented projects, with the help of the practical research centers. Since 2010, CCBT has already funded 83 demand-driven CCBT projects. These projects are carried out by the partners, committed to the organic sector: Inagro, PCG, pcfruit, Proefcentrum Pamel, Proefbedrijf Pluimveehouderij and PIBO Campus. In 2019, PCS and PSKW also joined CCBT.

In addition to the CCBT projects, CCBT also stimulates and coordinates projects being set up with external funding specifically for the organic sector, such as demonstration projects, Interreg projects, Operational Groups, etc.

Tailored to the farmer

The emphasis is on the dissemination of practical information tailored to the farmer. For each completed project, a final report is made that summarizes the most important conclusions and recommendations. New research results are announced monthly via the website and newsletter ([BIOpraktijk.be](https://www.bio-praktijk.be)). Subscription to BIOpraktijk is free and open to all interested parties. CCBT also tries to stimulate the exchange of practical information for farmers on a European level.



BlOpraktijk.be

CCBT in the knowledge network

In Flanders, CCBT is building a research and knowledge network for organic food and farming together with NOBL and the Organic Farmers' Networks. Within this Flemish Organic Knowledge (FORK) Network, joint actions are taken to support research for organic agriculture.

Advising the government and updating the research agenda for Flanders are important tasks in this regard. In addition, a research database is kept, which collects all current and past projects for organic farming in Flanders. Expanding the national and international network is also an important strategy.

In addition, CCBT organizes the Network Day called 'Mechanization in organic horticulture' every two years. This event has room for demonstrations, knowledge transfer, meeting with researchers, knowledge exchange, etc. and the biennial Innovation Prize for organic farmers is awarded. In addition, CCBT facilitates participation in study trips, e.g., the visit to Tech&Bio and the biennial study trip from the FORK network.

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Partners: Research: Inagro, Proefcentrum Pamel, PCG, Pcfuit, Proefbedrijf Pluimveehouderij, PCS, PSKW, PIBO Campus vzw and NOBL; Other: Department of Agriculture and Fisheries, Bioforum, Biobedrijfsnetwerken, Boerenbond, ABS, Belorta, Landwijzer, provincies

Funding: Government of Flanders, Department of Agriculture and Fisheries

More info: www.CCBT.be

NOBL: Reflecting together on research for organic farming and food in Flanders

NOBL, the Network for Organic Food and Farming Research in Flanders, brings together a large group of representatives from research institutes, farmers' organizations and the Government of Flanders. By sharing information, ideas and experiences as well as supporting and organizing activities, the network aims to strengthen agricultural research and knowledge dissemination for the benefit of organic agriculture and food in Flanders. Flanders Research Institute for Agriculture, Fisheries and Food (ILVO) has committed to continue to coordinate the network within the Strategic Plan for Organic Agriculture 2018-2022 in Flanders.

More focus on fundamental and applied research

The tasks and activities of NOBL try to respond to current needs and opportunities. For example, researchers and the sector are brought together around themes to search for answers to current questions, scientific advice is formulated on priority research topics and opportunities are jointly explored for funding new research projects for the organic food and farming industry.

The network increasingly focuses on fundamental and applied scientific research and expands international contacts. Across borders, NOBL looks for research possibilities and for collaboration and knowledge exchange through active participation in international workgroups and networks (e.g., TPOrganics, COREOrganic ERA-Nets, Organic E-prints, and others). NOBL aims to promote the awareness of its partners outside Flanders as contact points of research for organic agriculture in Flanders. Researchers are encouraged to participate in national and international calls for organic research such as from COREOrganic, VLAIO, H2020, etc.

To do so, NOBL works closely together with the Living Lab for Agro-ecology and Organic Agriculture (LLAEBIO), launched by ILVO in 2020. This Living Lab aims to become a place where researchers are easily approachable, organic farmers can ask their questions to researchers, experiments can take place in real life settings, policymakers are involved and challenged in their agro-ecological approach, and researchers are brought together with other relevant stakeholders around specific themes.



NOBL takes action

Together with CCBT and BBN, NOBL represents the Flemish Organic Research and Knowledge FORK network. From their own strengths, NOBL, CCBT and BBN networks work together and coordinate their activities to arrive at a coherent knowledge policy for the organic sector in Flanders. In addition to their specific tasks and objectives for different target groups (farmers, researchers, policymakers), they inform each other about their activities, define joint objectives and develop joint actions. For example, NOBL and CCBT jointly manage a research database with an overview of current and past projects for the organic agriculture in Flanders. But NOBL and BBN are also working together more closely. Farmers can count on NOBL to find solutions to problems and BBN networks participate in research projects more and more as a full partners.

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Funding: Government of Flanders, Department of Agriculture and Fisheries, ILVO

More info: www.nobl.be

The Flemish Organic Research and Knowledge FORK network: Practice and research moving forward together

Three networks for the organic sector, BioBedrijfsNetwerken (Organic Farmers' networks), CCBT (Coordination centre for applied research and extension for organic agriculture) and NOBL (Network for Organic Food and Farming Research), have been working together since 2012. Together with their stakeholders, they are the driving force of the Flemish Organic Research and Knowledge network (FORK network). The aim of the joint network is to strengthen research and knowledge exchange for the organic sector in Flanders and to coordinate activities in order to develop an efficient knowledge policy for the organic sector in Flanders.

Three networks, one mission

The three networks, BioBedrijfsNetwerken, CCBT and NOBL, together with their stakeholders form the basis of the FORK network. In addition to their specific tasks and objectives aimed at different target groups (farmers, researchers, policymakers), they emphasize the importance of an efficient coordination of activities in order to pursue a coherent knowledge policy for the organic sector in Flanders.

Together the networks strive for:

- Achieving support and recognition
- Improving understanding of research needs together with the end users
- Optimizing efficient use of research and knowledge capacities
- Stimulating dissemination and exchange of research results and knowledge

Strength in unity

Through continuous coordination, the networks try to bring different actors within the knowledge and research landscape in Flanders closer together and to collaborate with each other. In addition to individual activities aimed at their different target groups (fundamental and practice-oriented researchers, chain actors, (organic) farmers, and policy), the networks reinforce each other by aligning their activities and by organizing joint actions (such as seminars, study trips, a shared research strategy, etc.)

For example, the questions and problems addressed in *Biobedrijfsnetwerken* are put on the research agenda of researchers or policy makers by CCBT and NOBL. To execute research that can provide an answer to these questions, NOBL and CCBT search for possible sources of funding and expertise. The knowledge acquired in the research eventually finds its way back to the farmer through the various information channels of CCBT, NOBL and *Biobedrijfsnetwerken*. Not only Flemish research but also knowledge exchange, translation and dissemination of foreign research results gets attention.



A joint research strategy

In 2018, the FORK network published an update of its research strategy adapted to new insights and challenges for the future. This jointly research strategy served in the previous period as a basis for advising Flemish and European research programs around research priorities in the Flemish agriculture production.

Central to this strategy is demand-driven, system oriented research and the co-creation of knowledge: research based on the needs of the sector, attention for the production system, exchange of experience and knowledge between actors, and knowledge tailored to the needs of the farmer. In addition to researchers, farmers and other actor in the chain are actively involved in the planning and implementation of research as co-facilitators of knowledge and the validation and implementation of results in practice. The FORK network wants to continue to take on a facilitating role in this.

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Funding: Government of Flanders, Department of Agriculture and Fisheries

More info: www.nobl.be, www.CCBT.be, www.bioforumvlaanderen.be, www.nobl.be/BioKennisNetwerk

Research for organic farming as the basis of an agroecological food system

With the 'Research Strategy for Organic Food and Farming in Flanders 2018-2022', the Flemish Organic Research and Knowledge Network (i.e., Biobedijfsnetwerken, CCBT and NOBL), wants to contribute, together with its partners, to the central ambition of the new Strategic Plan for Organic Agriculture 2018-2022: "Together for more and better organic agriculture". The research strategy thematically outlines where research efforts can contribute to creating insights into how robust and resilient agri-food systems can develop as well as understanding and scientifically underpinning the strengths of organic agriculture and food to make agriculture and society as a whole more sustainable.

Vision

Organic agriculture is seen as the basis of a transition to an agro-ecological food system that uses fewer external resources, makes sustainable use of our agricultural soils, is resilient in times of increasing instability and unpredictability, and ensures stable production and a consistent food supply. Here we:

- opt for a self-regulating system that functions on the basis of agroecological principles.
- attempt to make optimal use of synergies between plant, animal, micro-organisms and humans.
- strive for equilibrium and resilience achieved at the level of field, farm or landscape.
- search for the preservation of nutrients through the processing of organic products with a minimum use of chemical additives.

Soil health is a key element here. Animal and plant production systems are balanced by adjusting stocking densities to the feed and food supply. More extensive farming systems means less livestock and sustainable animal production based on local or regional balanced fodder production. But choosing organic production methods is only part of the drive towards an agro-ecological food system. Creating a sustainable food system is a shared responsibility that requires collaboration at various levels. Fair trade, adjusted consumption patterns, local production and consumption and less food waste are other key elements within this food system.

Research themes

Based on this vision, the organic sector calls for research within three interconnected themes:

- Robust organic production systems.
Here attention is given to optimizing soil fertility, increasing biodiversity, and applying best practices in the field of the environment and animal welfare

standards. The search for innovative strategies and technological developments is essential in the pursuit of further sustainability and optimization of organic production systems.

- Flexible organic chain systems.

To achieve stable market development, products must be available with a price/quality ratio that meets consumer expectations at a price that is cost-effective for the entire chain. Optimization, alignment and cooperation, based on the specificities of the organic chain, are necessary. Profitability, risk-limitation and healthy competitiveness are central to the search for economic sustainability. However, this economic sustainability must not be separated from the social and ecological sustainability of the organic sector.

- High-quality food and food processing.

The consumer of organic products expects food without the need to add any additives such as minerals, vitamins or other elements. Processing organic products implies more than just working with organic ingredients, and there is therefore a need for a specific, flexible approach that must largely be developed.

Research approach

In achieving this research strategy, attention should be given to:

- **Demand-driven research**, starting from concrete questions and needs of farmers, market participants, policy makers or legislation.
- **System-oriented research**, that takes into account the complexity of the agricultural and food system and the importance of viewing the production system as a whole instead of as a collection of individual parts or elements. The ecological, economic and social impact of the system is kept in mind. A system approach goes beyond the individual field, farm or company. The entire economy and the environment, such as the rural community, a region or the catchment area, needs to be addressed.
- **Co-creative approach**, with room for collaboration between different scientific disciplines and expertise. In addition to researchers, farmers and other actors from the chain are actively involved in the planning and execution of the research as co-facilitators of knowledge and in the validation and implementation of results in practice.

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Living Lab Agroecology and Organic Farming (LLAEBIO) facilitates knowledge exchange around agroecology and organic farming



new

Agroecology advocates for a resilient agricultural system where relationships between people, agriculture and nature are optimized to design and manage sustainable food systems. Agroecology combines a set of principles and practices including the sustainable use of local renewable resources, closing loops, food sovereignty, healthy and quality food and the use of biodiversity to provide ecosystem services. Organic farmers are often pioneers of agroecology, but some conventional farmers also already use agroecological practices. The Living Lab Agroecology and Organic Farming (LLAEBIO) deliberately wants to bring both groups together to stimulate knowledge exchange and further knowledge building.

Experimenting together

The Living Lab is first and foremost a meeting place, as well as an experimentation space where various scientific disciplines and practical experiences are brought together to tackle questions in the field. It is an open collective where new stakeholders are always welcome. The research questions and knowledge-sharing activities are tackled in alternating partnerships. LLAEBIO's mission and working principles are based on those defined by the European Network of Living Labs (ENoLL): openness and the active involvement of end-users and other stakeholders are central; and question-based research is conducted as much as possible under real-life conditions taking the specific context in which farmers work into account.

In addition to these working principles specific to living labs, an extra working principle is added, namely the system approach. By combining multiple types of expertise and knowledge (e.g., knowledge from the field and knowledge based on practical and fundamental research), a research question can always be put in a systemic perspective. During activities, methodologies are introduced that facilitate system thinking.

Activities of LLAEBIO

Knowledge development is done by supporting research initiatives in which agroecological principles, organic principles and/or a systems approach are paramount. In addition, LLAEBIO organizes activities aimed at exchanging



knowledge on systems thinking, agroecology and organic agriculture. At the end of December 2019, a co-creation workshop was organised to give these activities concrete form. For example, there appeared to be a clear need to confront policy makers with farmers affected by specific legislative issues when applying agroecology in the field. The dialogue between conventional and organic agriculture also needs support. This year, LLAEBIO also tackled concrete questions in the field. We worked on the question of a small-scale organic farmer who wants to offer a wide range of products but finds it difficult to set the price per product. By looking at the broad picture of the problem and bringing the right expertise to the table, LLAEBIO tries to find inspiring strategies. In the course of 2020, activities were organized where experts and farmers can share knowledge about this topic.

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An Experimental Platform for Agroecology in Flanders



new

The PHAE farm of Felix de Bousies, with 50 hectares of farmland is becoming a pilot platform for agroecological research, parallel to the normal running of the organic farm. To this end, ILVO signed a collaboration agreement with this organic farmer together with agricultural consultant and researcher Alain Peeters (RHEA) in March 2019. The theoretical principles of agroecology will be put into daily practice. Through experiments, field trials, innovative techniques and intensive scientific monitoring, the researchers will gain insight into the best systems and practices. These will then be shared with the entire agricultural sector.

An open experimental platform, inspiring for many target groups

The Experimental Platform for Agroecology in Hansbeke generates expertise for several types of professionals: farmers as well as agricultural advisors, contractors, machine builders, technology companies and companies active in crop protection and breeding. The given crop rotation is mainly of interest to arable and livestock farmers, but the system of crop rotation can also be of interest to vegetable growers, especially when they work together with arable or livestock farmers. The target group of farmers is not explicitly limited to organic growers. Many conventional farmers also have the ambition to use agroecological principles. Consultants, policymakers, agricultural scientists and ecologists in Flanders and abroad can also follow the experiments.

The Experimental Platform approach

The founders put their wish lists together each year and decide by mutual agreement what type of research will be carried out on which plots in the coming year. ILVO tries to frame the research largely within its project work and thus includes other research partners as well. The scientific experiments and monitoring must not interfere with farming operations and strategy. For PHAE, it is important that the accumulation of knowledge also occurs in support of the progress the farmer desires in the field of soil quality, crop performance, diversification and product valorization. RHEA brings in research opportunities that fit the business context and that answer knowledge gaps for further application of agroecological principles to sustainable agriculture.

The collaboration network can be expanded on an ad hoc case-by-case basis. Research is done in a living lab formula: multiple stakeholders and researchers can be involved whereby connection is sought with the network of existing living labs active in the agro-food sector, e.g. the Living Lab Agroecology and Organic Agriculture (LLAEBIO).



Current research agenda

Currently, the following research lines have been agreed upon:

- The improvement of soil quality with attention to carbon storage, remedying or preventing soil compaction, introducing useful biology through the preparation and application of farm compost, optimizing a no-till system and applying compost extracts.
- Testing mixed cultures, crop rotation, protein crops and use of atypical crops.
- Strengthening the integration of animal and plant production through cooperation with livestock farms in the neighborhood and the introduction of a livestock component on the farm.

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Partners: PCG, Inagro, ...

Funding: project funding ILVO and research partners

More info: www.ppaehansbeke.be





Robust organic production systems – crop production

Soil and soil management

Crop protection

Cultivation techniques

Varieties and breeding

Innovative crops

Innovative processes and technologies

Innovative strategies

Organic Agriculture, landscape and nature

Optimizing fertilization strategies from the perspective of organic farming principles



new

The tightening of P fertilization standards since MAP5 (Flemish Manure Decree) makes it difficult for mainly organic fruit and vegetable growers to work on soil quality and nitrogen supply for their crops through fertilization. The tighter standards lead to the phosphate standard being sometimes more limiting to the fertilizer dose than the nitrogen standard. However, an adequate organic matter supply is very important for good soil quality and healthy crop development in organic farming. Within this project we are looking for strategies to apply sufficient carbon and nitrogen at a limited external supply of phosphorus. This may require a "conversion" in terms of fertilization and soil management in general. The project focuses primarily on the subsectors vegetable cultivation, stone fruit and fodder production on land-based livestock farms.

Scientific trial designs for priority subsectors

For stone fruit cultivation, a multi-year trial design investigates the extent to which green cover crops grown in the grass strip or black strip can contribute to increasing organic matter supply and nitrogen availability for fruit trees. In this trial, a mixture of rye and leguminous green cover crops sown in the fall in the "green strip" was found to have good yield potential for adding organic matter to the black strip. A perennial grass clover, which the grower already had planted, also has that potential. The first year effect of applying material from the grass strip to the black strip is rather limited but a multi-year application will increase the soil organic matter content and thus may increase the nitrogen availability from the soil throughout the growing season.

In the multi-year trial design for vegetable cultivation and fodder production, the green cover crop mixture with legume component is used, either as fodder or not, and goat stable manure is applied which was either composted or not with brown residue. The effects of this on organic matter application and nitrogen input and utilization are investigated. The composting of goat stable manure with management residues required the application of carbon-rich residual streams to reduce the loss of nitrogen during composting. An autumn cut of natural grassland is too leafy and protein rich to act as a woody component in composting with goat manure. Additional woody components will be added to the composting in the final trial year.

Validation trials

One- or two-year trials were constructed in 2019 to validate soil management measures that can improve nitrogen utilization or reduce phosphorus application. Legumes, either as a main crop or green cover crop, apply



nitrogen without adding phosphorus. They were therefore found in the tried and tested green cover crop mixtures sown under cover crops or after a main crop in arable and vegetable production. In the case of stone fruit, the grass strip was sown with a mixture containing 8 herbs in the spring of 2020. But the drought resulted in very little germination.

Focus groups for conventional growers and validation trials

Focus groups were also organized for conventional farmers, where the measures selected in the focus groups with the organic sector were discussed. In 2020, 3 validation trials were already started. These were the optimization of no-till for the cultivation of sugar beet, the optimization of the sowing technique for the protein crop field beans and the application of mulching material from the grass strip to the black strip in the stone fruit cultivation.

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Funding: Flemish Land Agency (2018 - 2022)

Noptimabio - Optimization of fertilization in organic vegetable cultivation through a more correct estimation of the nitrogen effect of the basic fertilizer and the nitrogen release from soil organic matter



The Noptimabio project aims to provide farmers and growers with knowledge of how to optimize their fertilization practices by participating in fertilizer trials.

Influence of soil condition on nitrogen availability

The project aims to determine the influence of soil condition on nitrogen availability related to 1) the effect of basic fertilization and 2) soil organic matter decomposition. The project focuses on field vegetable growing because that subsector has the greatest need for efficiency gains in nitrogen management. The external supply of organic matter and nitrogen is severely limited by the stricter supply standard for phosphorus (MAP), especially in crop rotations with primarily vegetables.

Three research questions are addressed:

- Is testing of (potential) microbial activity useful for estimating expected nitrogen availability, and thus yield potential?
- What is the relationship between nitrogen release from soil organic matter and the nitrogen action of the base fertilizer?
- What is the relationship between soil management and soil condition?

The outcome of the study will provide the organic vegetable grower with tools for better fertilization practices in the context of sustainable soil management. This will enable the use of fast acting organic commercial fertilizers in crops with high nitrogen requirements to be limited to the level required for adequate yield and quality without posing a risk of excessive leaching of nitrogen to ground and surface water.

Monitoring nitrogen dynamics on field plots

The research is conducted on about 30 practical plots, which guarantees a sufficiently large range in terms of soil conditions and makes the research results immediately translatable to the growers' practice. The grower who makes a plot available chooses the basic fertilization that will be tested for



its nitrogen effect. In two consecutive years on the same fields a test set-up will be carried out, in which the nitrogen dynamics will be followed up in two objects, one with the application of the basic fertilization and one without any basic fertilization.

Based on a thorough characterization of the soil condition on the individual plots, a better understanding of the nitrogen availability will be achieved and the relationship between that soil condition and plot history in the field of soil management will be shown.

The results will be fed back to the involved organic vegetable growers but also widely reported to all organic growers, extension organizations, trade associations and government agencies.

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Funding: Department of Agriculture and Fisheries, Government of Flanders (2019 - 2022)

Persistent compaction under croplands and grasslands: search for feasible and effective solutions

Compaction of agricultural soils is a complex problem that is increasing in prevalence. ILVO, Inagro, Bodemkundige Dienst van België (BDB) and Ghent University are investigating how soil compaction can be sustainably remedied and which measures are economically and practically feasible. The project partners are focusing on the two biggest challenges. First, the deeper soil compaction under the topsoil (>30 cm) for which few or no effective and lasting solutions exist today. Second, is the stimulation of the application of existing soil pressure reduction techniques, which are still not breaking through because farmers are insufficiently aware of the true costs and benefits. In this research project, participation is central: together with farmers, contractors, machine manufacturers and distributors, field experiments will determine which strategies are the most effective and feasible.

Prevention measures: evaluation and cost-benefit calculation

Within the project, tests are done with low-pressure tires, air pressure exchange systems, fixed row paths and machines with multiple axles for better weight distribution. By involving farmers, contractors, manufacturers and distributors of machines and tires, we want to focus on feasible techniques and hope to create awareness. Ultimately this should lead to a clear overview of good practices and the associated costs and benefits. What impact does soil compaction have on crop yield? What are all the other costs and benefits of the investigated techniques, such as possible savings on fuel consumption?

This project should also deliver an improved Flemish version of the existing Terranimo© tool. Terranimo© is a web-based computer model that predicts the risk of soil compaction due to agricultural traffic. Users can calculate and visualize the soil stress for different soil texture types, soil moisture levels, tire types and machines. It can be an important decision tool that helps avoid soil compaction. But first more Flemish farmers need to use it. To make Terranimo© even more useful, we will add data on new relevant agricultural machines and tire types. Field measurements will be carried out to further refine the model parameters.

Finding solutions to existing, deep soil compaction

In contrast to compaction in the topsoil (0-30cm), deeper compaction (>30cm) is more difficult to alleviate. Normal tillage does not reach such deep levels. After 4 years, the project partners hope to find some answers to questions such as 'When is deep tillage successful? Which green cover or crop should be sown? Does tillage also work on grassland, possibly



combined with overseeding? And how do you combine this cultivation with measures to promote soil life (e.g. earthworms), such as the application of a soil improver, so that the self-regenerating capacity of the soil increases?’ There are currently 6 comparative trials on field plots (4 on arable land, 2 on grassland) set up on different soil textures (sand, sandy loam and loam). The effectiveness and the ideal time of deep cultivation, the type of crop, crop rotation and whether or not to apply a soil improver are all considered.

Get involved!

For the trials on deep soil compaction, the project partners are looking for field plots for testing. Farmers who suspect problems of soil compaction in their fields or grasslands should contact ILVO. Participants will be closely involved in the design of the trial and the choice of measures. After all, the researchers want to start from techniques that farmers consider the most promising and applicable. Furthermore, as little interference as possible will be made to the usual parcel management (e.g. fertilization).

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Partners: ILVO, Inagro, BDB and Ghent University

Funding: VLAIO LA trajectory (Agency for Innovation and Entrepreneurship, Government of Flanders) (2018 - 2022) some tire manufacturers (Bridgestone Europe, Michelin Belux, Alliance Tire Europe), Farmers organisations (Boerenbond and ABS), machinery manufacturers (Steen NV), contract workers (VDD Agri) and other industry representatives (Bayer Cropscience NV, PRP Technologies - Olmix Group).

More info: www.bodemverdichting.be

INTERREG-project SOILCOM focuses on product differentiation of compost



new

The Soilcom project aims to increase the use of high-quality, tailor-made compost in the North Sea region, for use as a soil improver in vegetable cultivation, ornamental horticulture and tree nurseries. The confidence of the growers in the application of compost will be stimulated by giving advice to the composting companies, specifically by measuring the quality of the developed composts and matching them to the intended use related to soil and cultivation system. The added value of compost application for crop and soil quality, including in the context of climate change, will be monitored through field and pot tests at the research institutions and growers. Finally, recommendations for policy and certification at the European level will be formulated.

Large variations by region

How compost products are currently produced, applied, and developed in the tailor-made project differs from region to region. Within the project, information is exchanged to work out a number of case studies on tailor-made compost in each region. This can be either compost tailored to a specific application related to soil type or cultivation, or an improvement in the general quality of compost. Besides differences in composting methods, there are also differences in cultivation systems, soil types and legislation between the participating regions. By surveying compost producers and growers, the researchers will try to align the needs and supply of compost products. The planned analyses of the compost go beyond the legally required parameters and, for example, also look at CEC (cation exchange capacity) and microbiological properties of the compost.

Common challenge: encouraging compost use

How can governments encourage farmers to work on building stable soil organic matter? This is a common working point within SOILCOM. The way nutrients in compost have to be taken into account is very different from region to region. Within the project an overview is made of the different legislations applied. Where possible, knowledge from one region is used in other regions. In addition, the composting method and the quality monitoring of compost in the different regions will also be examined. Optimization of the composting process and certified quality guarantees can increase confidence in compost among growers. The requirements and wishes of growers are mapped out when it comes to soil, cultivation and the appropriate organic matter supply. In study groups and demonstration trials on farm, they can assess the benefits and possibilities of compost application.



From waste to a quality product for soil improvement

Within SOILCOM, the entire composting process is scrutinized from start to finish to increase quality where possible. First, the residual flows are mapped out. Then advice is given to composters to prepare a high quality and tailor-made compost product based on the available residual flows and an appropriate process aimed at certain applications. Local composting initiatives are also encouraged. The final aim is to develop and use a suitable compost for various cultivation systems and soil types. In the SOILCOM project, the demos and field trials contribute to clarifying the benefits of compost when it comes to soil improvement.

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Funding: Interreg North Sea Region (2019 - 2023)

More info: <https://northsearegion.eu/soilcom/>

SoildiverAgro - Stable and resilient farming systems through enriched soil life



new

Can better soil management enrich soil life, thus improving the stability and resilience of agriculture? That is the central question in SoildiverAgro. We are investigating cropping systems and agricultural practices designed to improve the variation in soil organisms and their functioning. More functional soil life is known to improve crop health, production and quality. Healthy soil needs less external inputs and agriculture provides more ecosystem services. In this way, we want to contribute to solving the economic, social and environmental challenges facing agriculture. We are tackling these challenges with 22 partners from 7 European countries.

State of the art under the fields

First we determine the “state of the art” under the fields. In this way we want to gain insight into what lives there and what the relationship is with the farming methods. Samples were taken on 180 fields in 9 European regions in 2019, half on organic and half on conventional plots. After the wheat harvest, throughout Flanders samples of wheat and soils are taken and earthworms collected. We analyze these soil samples for physical (e.g. stability, moisture content) and chemical properties (e.g. organic carbon content, various minerals, residues) and soil life. We look at what microorganisms (bacteria, fungi, nematodes) are present and identify the types of earthworms (macroorganisms). We then analyze the relationships between all that life, soil characteristics, climatic conditions and production systems (organic or conventional).

In search of best farming practices and cropping systems

We look for the best agricultural practices and cultivation systems. Based on the previously determined ‘state of the art’, we follow the evolution of soil life and other parameters in the field. Starting in 2020, 15 field studies will run over 3 to 4 crop years. The four Flemish studies look at:

1. extensification of organic and conventional vegetable cultivation through organic fertilization, reduced soil tillage and green cover crops (PSKW)
2. increasing the species diversity of green cover mixtures in an organic arable rotation with potatoes (Inagro)
3. fertilization with farmyard manure or composted farmyard manure and the management of perennial green cover crops in organic arable farming (ILVO)
4. application of composted or fermented residues in an arable rotation with cereals from an agroecological approach (Pomona).



In other countries, this includes strip cultivation, the use of soil fungi or the development of products with plant growth-promoting bacteria. In all these studies we investigate the influence of different management approaches on soil life. We look for links between soil life and plant health, growth and production, potential reduction of inputs (e.g. fertilizers, pesticides) and ecosystem services (e.g. soil fertility, carbon sequestration in the soil). In the evaluation, we also consider the socio-psychological and economic impacts on businesses and regions.

Formulating recommendations for better soil management, together

Finally, we bring everything together in recommendations for better soil management and in an online decision support tool. In the meantime, you will certainly hear more from us as we will regularly survey and inform farmers and other stakeholders about our results.

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Funding: EU Horizon 2020, grant agreement 817819 (2019 - 2024)

More info: <http://soildiveragro.eu/>

Optimizing the vigor of Natyra® apples

completed

SQ159/Natyra® is a new apple variety for organic fruit growing. It shows weak vigor in the orchards, which causes i) low production volume of the trees and ii) too-small apples. Currently, the fertilizer companies are bringing various products on the market that would improve the vigor of this variety. In this project we wanted to see whether one or more of these products could add value to the growing of SQ159/Natyra®. A Natyra® trial in which various soil improvers were applied during planting in 2016 as part of the demonstration project 'Practical solutions for organic matter building in organic agriculture under MAP5, was further monitored for production and vigor

Planting a new orchard

When constructing a new orchard, an important step is making the parcel ready for planting. Apple orchards are rotated every 10 to 15 years, thus constructive improvement of the soil structure can only happen every 10 to 15 years. Here, the use of organic material (manure, mushroom manure, green compost, cover crops, and others) is certainly important. In addition to the provision of minerals, this will affect the soil structure, the pH and the organic matter content. These are parameters that have an influence on the soil life and the mineralization and so can influence the root activity and the vigor of the trees. In addition, soil improvers can also be incorporated in the planting hole. This makes it possible to work in a more targeted manner and to bring the products as close as possible to the root system.

Stimulating the vigor after a new planting

Once the trees are planted, it becomes more difficult to stimulate vigor. In spring 2018, therefore, a comparative trial was started in which various products that claim to stimulate vigor were placed next to each other. This happened on 2 different parcels of Natyra® in the 3rd growing year. Both parcels have different soil types and there is also a difference in standard fertilization by the grower.

The preliminary conclusions of the project 'Practical solutions for organic matter building in organic agriculture under MAP5' are:

- Using BVB Peat in the planting hole gave after 3 years the best result for vigor. This object also had the highest production. At the end of 2016, this object also had the highest organic matter content, but this decreased quite sharply in 2017.



control



BVB peat

- Vivimus also caused a little more shoot growth. But here the lower calcium content in the fruits is still a point of attention. The organic matter content was not strongly influenced.
- The impact of all other treatments on the organic matter content was very limited. Two additions of organic material + the extra sowing of Japanese oat (which was not equally good everywhere) had only a limited influence on the organic matter content. These trees still had a weak growth after 2 seasons.
- Organic material therefore needs to be applied every year in order to have a long-term effect.

With the second part of this project, we can now demonstrate above all that many commercially-available products are not worth applying in practice. Injecting certain products is labor-intensive and gives no noticeable results. Applying the soil improvers is easier, and will have an impact on the soil, but is not directly measurable on the trees.

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Funding: CCBT-project 'Optimalisatie van de groeikracht bij Natyra' 'Optimization of vigor Natyra®' - Department of Agriculture and Fisheries, Government of Flanders (16/02/2018-31/12/2019)

More info: Pcfruit vzw - unit Proeftuin pit- en steenfruit, www.ccbt.be

Optimizing fertilization of primocanes under plastic foil

completed

Knowledge is lacking about the optimal fertilization of organic primocanes under protection. Many growers notice symptoms of deficiency (yellowing of the leaves) at an early stage, together with a standstill in growth. This results in a decline in production and fruit quality.

New insights are necessary

The origin of the symptoms of deficiency may possibly be linked to fertilization strategy. As primocanes transition from a vegetative to a generative crop within the same year, their need for fertilization is complex. Some growers anticipate this by completely or partly fractionating the fertilization scheme. Until now, little research has been done on how to fractionate with organic fertilisers. The two-year project 'Optimizing fertilization of raspberries under protection' therefore attempts to gain new insights into the optimal fertilization of organic primocanes under protection. In this project a comparison was made between 100% stock fertilization versus a basic fertilization that is partly fractionated

Cause of yellowing

The project had two goals: one, to find the cause of the premature yellowing of the leaves, and two, to gain better insight about the optimal fertilization of primocanes. A shortage of Mn in the plant was detected and corresponded to the typical yellowing of the leaves. The use of a water-soluble Mn chelate (EC fertiliser) with 13% Mn resulted in the disappearance of the symptoms and the increase of the Mn concentrations in the plant. But this is only a temporary solution. The basis of the problem is not to be found in the plant, but in the soil. And not because of a shortage of available Mn, but because of a high soil pH (>7) in combination with a large buffer of (bi)carbonates. Both factors hamper the absorption of Mn by the plant.

More optimal fertilization through fractionation?

After two years of testing, the question of which fertilization strategy growers can best apply on their farms still remains unanswered. For example, in 2018, fractioning did not cause a yield difference while in 2019 it did. Moreover, production in 2019 was higher than in 2018. The underlying reason may be linked to the earlier treatments with Mn-chelate in 2019. This fits in with the idea that, in the event of a shortage, it is best to intervene as quickly as possible in order to disrupt plant growth as little as possible. Fractionating can possibly have an effect on primocanes, but only when there are no major deficiencies in the plant.



Yellowing of leaves in autumn primocanes

Good preparation and company knowledge

These results underscore the need for good soil preparation before planting. And most of all, dangers such as watering with a high pH, many (bi)carbonates, etc. must be detected and handled well in time. Even if the planting is well prepared and all other influencing factors are known, a deficiency can still occur in the plant, thus the grower must be aware at all times and act quickly when needed. Fast and accurate recognition of deficiency symptoms and efficient and effective action can even be a deciding factor in the profitability of the crop.

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Funding: CCBT-project '*Optimaliseren bemesting herfstframbozen onder bescherming*' Department of Agriculture and Fisheries, Government of Flanders (2018 - 2019)

More info:

<https://www.ccbt.be>

RELACS - European Consortium works on strategies to avoid controversial inputs in organic farming systems

Organic specifications guarantee high environmental protection and healthy, natural products. But the use of certain products is controversial, such as copper, conventional manure, antibiotics or anthelmintics. The RELACS project (Replacement of Contentious Inputs in Organic Farming Systems) aims to assist the organic sector in minimizing or even eliminating the use of these products.

Alternatives and management strategies

Various raw materials are covered. In particular RELACS pays attention to:

- Reducing or even avoiding the use of copper as crop protection or foliar fertilizer by testing alternatives and introducing reduction strategies;
- Developing strategies to address the use of mineral paraffin oils, including replacing them with plant extracts, use of functional biodiversity and use of biological control methods;
- Identifying sustainable sources of fertilizer as an alternative to conventional animal manure and natural phosphate sources, including technologies to sequester nutrients from human waste flows;
- The search for alternatives to anthelmintics for small ruminants;
- Developing preventive health measures and alternatives to antibiotics, particularly in the case of udder infections;
- Finding solutions for vitamin B2 needs in poultry and pigs, and vitamin E needs in ruminants. The availability of GMO-free vitamin B2 is becoming increasingly limited, and vitamin E is only available in synthesized form.

Broad European consortium

Since May 2018, 28 partners (research institutions, organic farming organizations and farms) from 11 European countries have been working together on this project, which is coordinated by FiBL Switzerland. The partners are research institutions as well as organic farming organizations and farms. IFOAM-EU is responsible for communication and facilitation of dialogue between science and practice.

Flemish involvement in the project

A multi-year RELACS trial of alternatives to the use of copper for apple protection is currently being conducted at pcfruit. The same trial is being conducted in different Member States, so that different circumstances can be taken into account. However, the results are not yet known. For most work packages, field trials are still ongoing.



To date, a limited number of scientific articles have been published. These can be consulted via <https://relacs-project.eu/resources/scientific-publications/>. In addition, the project has led to some inspiring fact sheets with practical guidelines:

- Organizing farmer learning networks about how to avoid antibiotics. See https://relacs-project.eu/wp-content/uploads/2020/03/RELACS_PA_01_AHWP_ITAB_final.pdf
- To calculate the nutrient budget of a farm to see if there is an imbalance or not. See <https://relacs-project.eu/2020/farm-gate-nutrient-budgets-in-organic-agriculture/>

BioForum will contribute to the formulation of policy recommendations in the final phase (2022) of the project.

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Funding: EU Horizon 2020, European Commission (1/05/2018 - 30/04/2022)

More info: <https://relacs-project.eu>

Organic control of cabbage flea beetle

completed

The goal of the two-year CCBT project 'aardvlooien uitgevlood' was to improve the control of cabbage flea beetles in organic cabbage production by testing preventive methods and organic control techniques under Flemish conditions. In addition, we carried out intensive monitoring on a number of farms to gain more insight into the population dynamics of these pest insects in Flanders.

A growing problem in cabbage crops

Flea beetles are small beetles (2-5 mm) of the leaf beetle family. In Flanders, three main species cause damage to cabbage crops: the crucifer flea beetle (*Phyllotreta cruciferae*), the yellow-striped flea beetle (*Phyllotreta nemorum*) and the small striped flea beetle (*Phyllotreta undulata*). In 2018 and 2019, we experienced dry and warm periods that greatly enhanced the activity and density of the beetles in sensitive crops. This resulted in a very high pressure across Flanders and caused damage to many crops, including pak choi, cauliflower, Brussels sprouts and radishes.

Monitoring to determine life cycle and population pressure

During the two growing seasons of 2018 and 2019, we carried out intensive monitoring on three Flemish farms. This monitoring shows that the flea beetle population, and consequently the pressure, follows the life cycle of the beetles. The population pressure during the monitoring period was similar on the different monitored farms, but there were large differences in absolute numbers. This shows that not only weather conditions determine population size. In this project, it could not be determined which other factors influence the population size. Perhaps the historical pest pressure, the spatial rotation of cabbage crops, the presence of suitable overwintering sites and the nearby flora, including both cruciferous weeds and other cabbage crops, play a role in the population growth of the pest.

Biopesticides have limited effect; physical trapping offers possibilities

During the project, several trials were carried out using pak choi as a model crop, in which preventive measures, physical trapping methods and various, still unrecognized biopesticides were tested. In the last field trial, two pesticides were able to slightly reduce the damage caused by the flea beetles after weekly application. However, it is clear that the use



of biopesticides alone does not offer a solution in cases of high flea beetle pressure. The physical trapping of the beetles with a glue board mounted on a wheel hoe works. However, very frequent repetition is required to provide effective protection.

Fine-meshed, lightweight insect nets offer protection

The field trials show that covering with a fine-meshed net with meshes smaller than 1 mm offers good protection from planting/seeding until harvest. In the trials, nets with a mesh size of 1 x 0.8 mm and 0.6 x 0.6 mm were tested. Under field conditions, good results were achieved with both nets. To assess the effective protection of these nets, we also carried out tests in the growth chamber. These tests show that the flea beetles are able to crawl through the net with the mesh size of 1 x 0.8 mm while they are not able to do so when the mesh size is 0.6 x 0.6 mm.

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Funding: CCBT project '*aardvlooien uitgevlooid*' - 'flea beetles under close examination' Department of Agriculture and Fisheries, Government of Flanders (2018 - 2019)

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Organic control of the allium leaf miner

completed

The allium leaf miner (Phytomyza gymnostoma) developed into a new pest problem in the period 2012 to 2015. Especially in autumn and winter leek, the larvae cause a significant yield loss by foraging in the shaft of the leek. During four years (2016 - 2020) PCG, Inagro, PSKW and ILVO researched how these flies can be better detected and monitored, which factors determine the life cycle, and what control possibilities are possible.

Towards control. The life cycle unravelled

The allium leaf miner has two generations per year, one in spring and one in autumn. In summer and winter it survives as pupa in the host plant or on plant debris in the soil. As its name suggests, also other plants of the genus *Allium* (garlic, onion, leek, etc.) are host plants. ILVO studied the attractiveness of these different host plants and the temperatures that determine the development of different life stages of the allium leaf miner. This was possible thanks to a successful culture of the insect under controlled conditions.

Monitoring

The use of yellow sticky traps and the follow-up of typical feeding dots on chive plants as signal plants were already known monitoring methods. However, both proved to be insufficiently reliable during the course of the project. Other monitoring methods have been tested but were not found to be effective. Because the specific leaf miner species is difficult to identify morphologically on the sticky traps, a molecular 'quick test' method using the LAMP technique has been developed. This increases the reliability of the catch results. However, a good monitoring method to estimate the risk of infestation in the field has not yet been found.

Prevention by limiting winter survival

The study of the influence of temperature on pupal survival indicated that under our winter conditions more than 80% of the pupae can survive. The project investigated which preventive measures growers can take to limit survival rates. The most important conclusion is that composting affected leek waste is the best treatment. Overwintering pupae found on the plant remains will not survive the composting process.



Image of the damage on harvested winter leeks: the feeding passages turn red-brown and sometimes small brown pupae can be found

Control by covering or use of biopesticides

Various types of covering materials have been tested to cover leeks against the first or second flight of the allium leaf miners. In the winter leek cultivation trials, the leeks were covered from the end of August to the end of November with either a climate net or insect screen. Both climate netting and fine-meshed insect netting proved effective to limit damage. The mesh sizes varied from 0.6 mm x 0.66 mm to 1.35 mm x 1.35 mm, with the finest mesh providing the best protection. A disadvantage of the covers is that they limit light, which was reflected in a paler leaf color and slightly lower production figures of the leeks.

Covering leeks is not a feasible choice in all cases. Applying pesticides is then the last control option. For three years, the effect of the available biopesticides has been tested by means of field and cage trials, both against the leaf miner flies and the larvae on/in the leaf. Spinosad and pyrethrins showed good activity against flies. Spraying with agents based on spinosad or azadirachtin can also control larvae. However, to achieve good effectiveness with these agents, it is important to intervene at the right time. Good monitoring remains crucial

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More info: www.inagro.be

Control of root-knot nematodes

Within the 4-year LA project "MELO: Management of Meloidogyne spp. in intensive organic greenhouse vegetable production" we aim to develop an economically and practically feasible, robust cultivation system for intensive organic greenhouse vegetable production. This objective will be achieved by building up knowledge on the population dynamics of the different Meloidogyne species occurring and by composing a practically feasible control strategy to keep the populations under control.

Catch crops during winter months

We investigated whether the population of root-knot nematodes (*Meloidogyne* spp.) can be kept under control by sowing a catch crop during the winter months, when there are no vegetables in the greenhouse. Catch crops attract the nematodes into the roots where they get trapped. It is important that the root knot nematodes are prevented from developing further. If the development does continue, the plant must be destroyed before new eggs are formed. Potentially interesting plant species still germinate and grow sufficiently during the winter period. They can be fitted into the crop rotation without major economic consequences and ensure a reduction of root-knot nematodes.

Rucola (rocket) proved to be a promising catch crop to sow during the winter months as it significantly reduced the number of root nodules. Tillage of crop residues resulted in a stronger decrease in root nodule numbers for fodder radish and mustard leaf compared to no-till. Fodder radish and mustard leaf are plants that are known for their presence of glucosinolates, which are converted to isothiocyanates upon decomposition. Isothiocyanates have a known nematicidal effect. The introduction of these crops has had a beneficial effect on the reduction of root knot nematodes, although the final populations still remain quite high.

Importance of sufficient ventilation in the catch crop

By using the intermediate crops (= crops that are sown or planted between the main crop of vegetables) which attract the root-knot nematode more strongly than the main crop, the latter can be better protected. Ideally, the intermediate crop also serves as catch crop and the nematodes are "captured", thus reducing the population.

The practical feasibility of underseeding/underplanting of different crops was evaluated for a main crop of sweet pepper. It is important to keep in mind that with an intermediate crop the humidity in the vicinity of the stem



Greenhouse sown in winter with various catch crops

must be kept to a minimum, as excessive moisture gives rise to fungal diseases such as *Sclerotinia*. The sowing or interplanting of the various types of intermediate crops did not affect the production figures of the peppers.

Importance of good rootstock

Having a good rootstock for the various fruiting vegetable crops remains one of the crucial factors for limiting production losses caused by root knot nematodes. For cucumber, tomato and sweet pepper, a list of current cultivars and rootstocks was drawn up in consultation with the growers. Both in pot tests and under practical conditions, the influence of the rootstocks on the nematode population is examined. On the other hand, the production of the most promising rootstocks is compared under field conditions.

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Controlling cabbage swede midge on organic CSA farms



new

*Organic CSA farms in the Antwerp and Flemish Brabant region reported increasing damage problems caused by the swede midge (*Contarinia nasturtii*) in 2018. Many cabbage crops were affected, resulting in 'twisty' or 'heartless' plants and other growth disorders. In order to find a solution that fits within their business context, an 'operational group' studied the pest and possible control methods in 2019 and 2020.*

Farm-specific problem

The larvae of the cabbage midge attack the growing points of cabbage plants, disrupting growth and cabbage formation. A number of factors specific to small-scale self-harvesting operations increase the risk of infestation. Different cabbage varieties are grown year round on a limited area. As a result, there is no limit to either the availability of host plants or the space available for the build-up of the pest population. Self-harvesting practice also often extends the harvesting period. In some types of cabbage like broccoli, this allows an additional generation of the insect to develop. On these farms we can only limit the population build-up of the mosquitoes by using targeted measures.

An operational group takes 'the mosquito by its antennae'

To solve the problem, some growers of the CSA-Network-Flanders set up a so-called 'operational group' with the support of the Flemish government. Together with Inagro and some supplying companies, the group started in 2019 to take the bull by the horns or in this case takes the 'the mosquito by the antennae'. Through monitoring of the cabbage swede midge and on-farm evaluation of possible control measures, the group aims to arrive at effective and feasible solutions to limit further harvest losses. The growers choose not to use pesticides.

Monitoring as primary action

In 2019 and 2020, we monitored the cabbage swede midge with pheromone traps on six farms. Pherobank (NL), as a partner, produced the necessary pheromones. At the three locations where we counted the highest peak catches, we also observed damage by the larvae to cabbage plants. This confirms the reliability of the pheromone traps as a monitoring method. The first flight appears in May, after which four overlapping generations develop until the beginning of October.



Cabbage swede midge caught on the sticky plate of a pheromone trap

Covering with insect netting: determining the right mesh size

For control purposes, the group looked for a suitable insect net that can protect cabbage plants from egg laying by the swede midges at the growing points. In cooperation with net supplier Howitec Netting (NL), two new types of insect netting were tested: (1) a knitted net with a mesh size of 0.8 mm x 1 mm and (2) a woven net with a mesh size of 0.6 mm x 0.66 mm. In addition to the effectiveness against cabbage swede midge, the growers also evaluated the ease of use in covering. Both nets protect against cabbage midge and reduce economic damage in the field. The mesh size of 0.8 mm x 1 mm does not offer complete protection, but covering with the netting does form an effective barrier in the field.

Further research needed to reduce the masking time

Covering crops with a fine-meshed net also has disadvantages. Especially in autumn and in crops with a long cultivation period, this practice can encourage diseases and other pests. To limit this risk, the cover must be removed as soon as the chance of egg laying or infestation is low. For this, monitoring is important and also, more insight into the population development of the pests in the field is critical. Based on this, guidelines for an efficient hedging strategy can be determined.

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More info: www.inagro.be

<https://ec.europa.eu/eip/agriculture/en/find-connect/projects/beheersing-van-koolgalmug-op-biologische-csa>



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Covering crops as a solution against cabbage fly

new

In Flanders, the cabbage (root) fly remains the most important pest in springtime crops of cabbage. In organic cultivation, spinosad can be used as a treatment before planting but many growers opt for physical protection by covering the crop. Inagro and the Research Station for Vegetable Production (PCG) have been carrying out field trials for several years to determine practical guidelines for covering cabbage crops. The most important questions are what type of covering materials, what mesh size and how long the covering should last.

Increasing range of covering materials on the market

In recent years, the range of covering materials has expanded greatly. Various types of material are suitable for keeping cabbage flies out of the crop, particularly fleece cloth, climate nets and insect screens. Non-woven fleece cloth is mainly used in early spring to accelerate crop development. Later in the season, climate nets or insect screens are a better and more sustainable choice. Climate nets have a stronger and more open structure and can be used year-round. The range of insect nets differs in mesh size, weight, color and the type of fabric. These properties determine the application possibilities in the field.

Looking for a suitable cover strategy

Planted and sown cabbage crops require a different covering strategy. This strategy includes not only the right choice of covering material, but also the correct laying and removal techniques of the nets, the duration of the cover period and the combination with other crop protection methods.

Protect planted cabbages for a sufficiently long time when cabbage fly pressure is high

With planted cabbages, the covering of the planting boxes begins as soon as the plants are delivered. Even after planting, the crop should be covered immediately. Caution is only advised at tropical temperatures and dry soil conditions; in those cases it is better to wait with covering until the plants have rooted.

In field trials, Inagro is looking for the minimum cover period and maximum mesh size of the net for optimal protection against cabbage fly. Several trials proved that a climate net and insect netting with a mesh size of 1.35 x 1.35 mm offer sufficient protection. In 2019 and 2020, a "small game" net with V-shaped meshes (5 to 7 mm) was also tested. Despite the rather large meshes, the barrier proved to be sufficient to limit plant loss in a spring planting. In the cultivation of Chinese cabbage, however, this net offers insufficient protection. The egg laying behaviour of the cabbage fly



is different in this crop. It not only lays its eggs at the base of plants but also on the parts of the plant above ground, resulting in damage to the leaf veins.

In 2019 and 2020, we found that covering the crop during the first four weeks is not enough to prevent plant loss. Moreover, at harvest time, the roots of all plants were completely damaged. Due to climate change, the peak egg laying period in spring now lasts up to two months. Therefore, we now recommend 7 to 8 weeks as a minimum cover period against cabbage root fly.

Finer mesh size for sown cabbages

For sown cabbages such as turnips, the crop should be covered as soon as the first leaves have formed and the mesh size should be smaller than for planted cabbages. The smallest tested mesh size (0.6 mm x 0.66 mm) gives the best protection (95%). Climate netting also gives good protection. The bigger the mesh size, the greater the risk of infestation. Meshes larger than 1.35 mm x 1.35 mm are insufficient to protect sown crops against cabbage fly.

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Interreg V project '*ZERO-PH(F)YTO F&L(G)*', European Regional Development Fund (ERDF) (2019 - 2022)

More info: www.inagro.be, www.proefstation.be
www.zerophyto-interreg.eu, www.ccbt.be

Sustainable control of cabbage fly

new

Cabbage fly (Delia radicum L.) is considered a common, hard-to-control pest in cabbage cultivation. This 6-7mm grayish fly deposits its eggs near the plant base. The larvae penetrate the roots and form feeding passages, causing rot and quality damage. Due to its hidden way of life, the pest is difficult to reach and control is not easy. Growers are often forced to resort to chemical crop protection. However, recent evolutions in crop protection and the increasing demand for residue-free fruit and vegetable products are putting pressure on them. The use of sustainable and natural pest control techniques can offer a way out of this impasse. During the LA trajectory 'Sustainable control of cabbage fly', University College Ghent, PCG, PSKW & INAGRO are working out a sustainable control strategy for cabbage fly with a focus on the optimal use of natural pest control and the application of preventive cultivation-technical measures.

Natural enemies set to attack

During the project, several natural pest control techniques will be validated in practice. For example, the application of an intermediate crop with nectar plants as a measure to stimulate natural enemies is being tested. The impact of different flowering plant species as intermediate crops on the natural control of cabbage fly in the field will be examined. Sometimes the stimulation of natural enemies proves insufficient to control the pest. In such cases, the introduction of commercially available enemies can be necessary. During the project, different methods of introduction of natural enemies of cabbage fly (respectively shorthorn beetles and nematodes) will be examined.



Prevention is better than cure

The applicability of preventive cultivation measures will also be examined during the project. Preliminary research shows that the use of cover materials or mechanical egg removal can prevent cabbage fly populations from growing into a pest. This project will address the remaining knowledge gaps regarding these techniques and validate their practical feasibility. Finally, all research results will be compiled into a sustainable control strategy for cabbage fly and maximally communicated to the target audience.

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More info: www.hogent.be/suscabfly

Tomato gall mite control: spray volume fine-tuned, beneficials on the way

Tomato gall mite (Aculops lycopersici) ('TGM') was rampant on several tomato farms 3 years ago, mainly in the conventional sector. However, it can also cause a lot of damage on organic farms, sometimes in consecutive years. Here, the 4-year VLAIO LA project BALTO that started on July 1, 2018 focuses on the development of an integrated tomato gall mite management strategy. The project focuses on the main IPM aspects: prevention, monitoring, biological control and chemical control.

Faster detection means a higher chance for containment and damage control

Last year, the Hoogstraeten Practical Research Center (PCH) set up a trial with the aim of mapping the spread of TGM in a greenhouse and determining the economic damage threshold. The monitoring of the spread was done with a magnifying glass that fits over the camera of a smartphone (magnification x20). The results showed that the infection of TGM usually starts at the bottom of the stem, and continues to the other stem in case of topped plants. Later in the cultivation the damage often starts higher up on the stem because TGM can travel across touching leaves. In addition, spread via insects (the predatory bugs *Macrolophus*, bumblebees), through the clusters and via greenhouse workers is also possible. The longer tomato plants were infected, the more visual damage on the stem. With a long-lasting infection, plant growth is inhibited. In this process, production also decreases with the number of weeks of infection/increasing damage.

Potential biological control agent found but not quite ready for practice

Just as predatory mites exist for other harmful mites such as spider mites, predators of TGM also exist. Within the project, we have identified two such predators: *Pronematus ubiquitus* and *Homeopronematus anconai*. Although similar, there are subtle differences between the two. For example, early this year we observed that *Pronematus* develops faster and predation of TGM is slightly higher than *Homeopronematus*. However, to date both predatory mites are not yet ready for commercialization. Within the project, a lot of research is still being done at the test centers PSKW, PCH and PCG and Ghent University to find the ideal conditions and deployment and maintenance strategy.



Correct spray volume and number of nozzles important for good protection

A survey and several company visits within the BALTO project have taught us that the spray volumes used in tomato differ greatly in practice. However, an optimized spray volume, adapted to the dimensions of the crop, often has more effect than the nozzle choice. In an article in *Proeftuinnieuws* (see link below) we proposed a simple formula to calculate the optimal spray volume for tomato based on crop height. In addition, we also indicated the optimal number of caps to spray with. Recognized agents against TGM that are allowed in organic cultivation with the best effect to date are those based on sulfur.

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More info: www.pcgroenteteelt.be

Control tomato gall mite: Match spray volume to crop height - *Proeftuinnieuws* (2020) <https://www.proeftuinnieuws.be/wp-content/uploads/2020/04/Bestrijding-tomatengalmijt-Stem-het-spuitvolume-af-op-de-gewashoogte.pdf>

BIOTRACT – Innovative biological aphid control in the protected cultivation of sweet pepper and small fruit

new

Aphids are one of the major threats in various outdoor and protected crops, resulting in significant economic losses. Biological control with natural enemies such as predatory insects and parasitic wasps is an important tool in controlling these pests. One of the problems with the use of parasitic wasps against aphids is that the parasitic wasps themselves are in turn parasitized by their natural enemies, the hyperparasitoids or hyperparasitic wasps. Moreover, the success of biological control does not only depend on the efficiency with which the natural enemies kill their prey or host, but also on the efficiency with which the natural enemies find the pest species in the crop.

The importance of aromatic substances for biological control

To detect pest organisms, natural enemies usually make use of the plant scents which are given off by the plants upon infestation by the pest or the scents given off by the pests themselves. However, not only plant and pest insect scent compounds can attract natural enemies; also scent compounds produced by micro-organisms, such as bacteria and yeasts, can influence the behavior of the natural enemies. This effect can be so strong that scents produced by micro-organisms attract beneficials at distances greater than 5 meters. The overall objective of the BIOTRACT project is to significantly improve biological control of aphids in economically important fruit and vegetable crops by identifying species-specific microbial lures and repellents and applying them to improve existing monitoring techniques and develop a new, innovative control technique.

Towards an application in biological control of aphids

As part of this project the KU Leuven found that the parasitic wasp *Aphidius colemani* can be attracted by odorants derived from *Bacillus* bacteria while the hyperparasitic wasp *Dendrocerus aphidum* is repelled by these odorants. This suggests that microbial odorants can be used to attract beneficial insects while repelling unwanted ones. Further research showed that attraction and repulsion to the scent mixture was caused by a small number of chemical components. This offers opportunities to create a customised synthetic mixture that can attract or repel insects and improve the efficiency of biological control.



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Can we grow zero-phyto fruit and veg?



new

Can we grow zero phyto vegetables and fruits? That is the key question of the Interreg France-Wallonia-Flanders project 'ZERO-PH(F)YTO F&L(G)'. Zero-residue and the zero use of crop protection products are current themes. In fruit and vegetable cultivation, this approach seems unattainable for the time being, but the conviction that we need to move more in that direction is growing. On April 1, 2019, PCG and Inagro, together with Walloon and French partners, launched this project to validate and demonstrate in practice crop protection strategies in which no pesticide is sprayed. The inspiration for this is sought in organic cultivation and both fruit and vegetable growers are the primary target group of the project.

Already a lot of (fragmented) knowledge available...

Many zero phyto methods, strategies and practices have already been described worldwide. However, this information is highly fragmented and insufficiently validated at the scientific and practical level. As a result, the strategies are not always directly applicable in our region. In this new project, we want to combine all this information. The project will make all the information gathered from literature studies, company visits and the practical trials available online in the form of a knowledge database.

...but all input is welcome on own 'zero phyto tips and tricks'

We would like to make an appeal to all growers for the creation of this knowledge database: do you already use certain zero-phyto 'tricks' of which you experience that they keep aphids, cabbage flies, butterflies/moths or earth fleas well under control? Or do you have creative ideas or knowledge from the past, from your environment or from other sources that you would like to share with us? Or are you simply interested in the project progress and want to stay informed? Please do not hesitate to contact us or go to our project website: <http://zerophyto-interreg.eu/>



Validation through field trials for various pests

The field centers will validate some innovative methods and strategies with hands-on field trials. In these trials we focus on pest management. In vegetable cultivation, Inagro and PCG focus on aphids, cabbage fly, caterpillars of butterflies and moths, and potato fleas. In fruit production, the focus is on pear gall midge, codling moth and apple sawfly. Through these field trials, promising methods will be tested at the local level. This will show which measures work effectively and which cannot deliver on their promises. To be continued.

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More info: <http://zerophyto-interreg.eu/>,
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(Side) effects of control agents allowed in organic small fruit production

new

Currently, the supply of crop protection products for organic fruit growing is rather limited in Belgium. For a plant protection product to be used in organic farming, two conditions must be met:

- *the product can be used in organic farming (under conditions described in Regulation (EC) No 889/2008)*
- *the product must be registered in Belgium as a plant protection product.*

In recent years, many efforts have been made to expand the range of products that can be used in organic cultivation. As a result, a number of control agents have been added, including agents based on micro-organisms/biological control organisms (BCOs) and agents with a physical action mechanism. Some of these physical agents interfere with the cuticle of insects or with smell perception, while others form a film that hinders insects in their behaviour or respiration. However, a major bottleneck for the effective use of these products is a lack of knowledge about their optimal use.

Under what conditions are biological plant protection products effective?

It is known that physical/organic crop protection agents differ from chemical crop protection agents due to the specific modalities of application, which are much less relevant for chemical insecticides. When chemical pesticides are applied, only the deposition, i.e. the quantity of product per unit area, is important (this is also the basis for the dose expression per ha leaf wall). This is not always the case for agents with a physical action mechanism. For example, there are indications for products based on potassium salts of fatty acids that the concentration of active ingredient may determine the effectiveness irrespective of the volume of spray used per unit area. Also for BCOs, the precise application conditions such as temperature, relative humidity, sunlight (whether degraded or not), concentration, timing of application in the development cycle of pest/disease/utility are of great importance for whether or not a certain efficacy is achieved. This project examines for a number of crop protection agents which preconditions (timing of treatment, interval, water volume, climate conditions before/ during and after treatment, etc.) have to be respected in order to have a good effect.



Is there also a possible side effect on natural enemies?

In organic fruit growing, natural enemies obviously play a very important role in crop protection. Can biological crop protection agents also have an effect or side effect on these beneficials? Yes, they can. So when using biological agents, it is also very important to keep a close eye on the impact on the balance between pests and beneficials. In this project, we will also look into this aspect for a number of biological agents, both via targeted laboratory tests and via follow-up in field applications.

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Small fruit

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More info: www.pcfruit.be

REFUSE RESIST - Re-evaluation of codling moth strain resistance as a basis for improved biological control

new

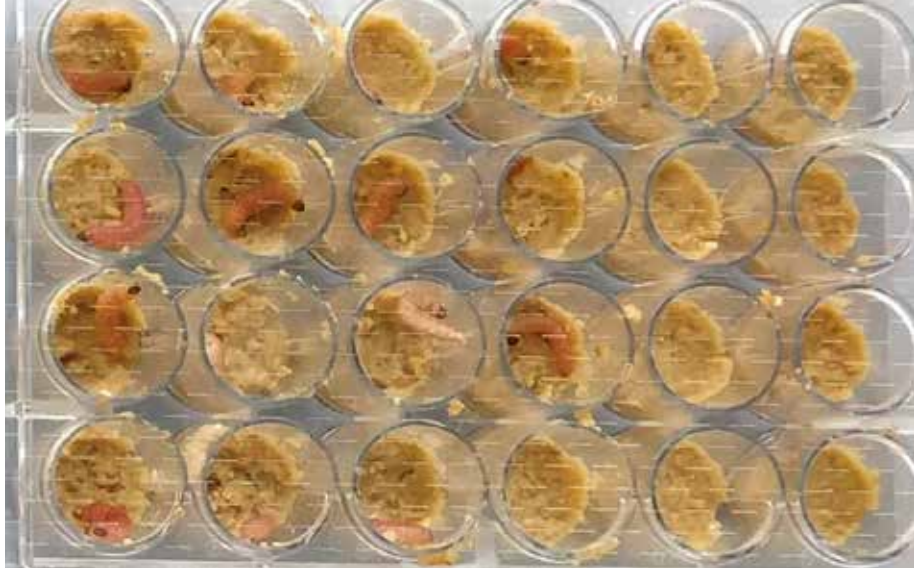
Since the start of the large-scale application of mating disruption in 2010, codling moth (Cydia pomonella) and caterpillars in general have actually been quite well controlled in the Flemish fruit sector. This is no small feat, because caterpillars have the potential to cause massive pest damage in a short period of time. The current strategy, with mating disruption on a large part of the area and targeted spraying after peaks in flight activity where needed, has worked well in general for a decade. However, codling moth has recently become a point of attention again, especially in organic fruit growing. In organic fruit growing, codling moth is controlled by the mating disruption technique and by one or more treatments with granulovirus preparations. Is there a possibility of resistance to these approaches?

Is mating disruption still effective?

Are codling moths that have been controlled by mating disruption for more than 10 years, as is the case in our organically managed orchards, still sensitive to the pheromone used? To date, neither pcfruit nor any other research worldwide has found proof of resistance to mating disruption. In recent research via choice tests in the pcfruit laboratory, codling moths were still very strongly attracted to this pheromone, so in principle the mating disruption should also still be effective. Resistance development to the pheromone as a attractant or to mating disruption is therefore highly unlikely. After all, just as with humans, communication between the two sexes is extremely complex. If there were resistance, this would mean that there would actually be male and female moths which - in addition to the language of the pheromone - would know how to communicate in another way. This is highly unlikely, given the numerous altered molecules/ biochemical processes that would be necessary to achieve this.

Do codling moths no longer get sick from the sprayed viruses?

Resistance of codling moth caterpillars to granulovirus products has been observed several times abroad. Therefore, within the framework of this project, pcfruit has developed a laboratory procedure to test the susceptibility of codling moth (eggs/ caterpillars) to various granulovirus strains. The procedure consists of introducing codling moth into culture on an artificial nutrient medium, and then treating eggs, young and old caterpillars with different doses of granulovirus products under controlled laboratory conditions in a 24-well plate (see picture). This was already



done for a reference codling moth population in pcfruit, and all tested virus preparations were still effective, so no reduced activity or resistance could be demonstrated.

In addition, codling moth caterpillars were sampled from different organic orchards. By starting up separate cultures from these caterpillars, it can be examined whether there is a possible local build-up of resistance against certain granuloze virus strains. The codling moth caterpillars in these cultures all became effectively ill and were not able to hibernate successfully. This is an indication that the granuloze virus is at least still effective at the sampled locations. This autumn (2020), additional tests will be carried out on codling moths originating from various organic orchards.

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Department of Agriculture and Fisheries, Government of Flanders (15/02/2019 - 31/12/2020)

More info: www.pcfruit.be/en

Automatic monitoring of insects

*In both organic and integrated cultivation, monitoring of insects (pests and beneficials) is crucial. However, the current monitoring and warning system in Flemish fruit and vegetable cultivation is labor-intensive and often requires specific expertise for the identification of the various pest insects. The rapid progress in domains such as electronics, sensors, camera technology and artificial intelligence (image analysis / detection) offers perspectives for automation of the monitoring system. In this project we focus on the possibilities and development of automated observation and warning systems for 4 target cases: codling moth (*Cydia pomonella*), *Drosophila suzukii*, lettuce root aphid (*Pemphigus bursarius*) and chicory miner fly (*Napomyza cichorii*).*

Automatische input en verwerking van waarnemingsgegevens

Within this project, first a new online tool/app was developed. The existing network of experienced observers in fruit cultivation can enter the observational data directly into one central database. This makes it possible to automatically input and process the monitoring data. At this time (after the beginning of growing season 2019) the database already contains \pm 27.000 unique observation records.

Automatic identification on photos using camera-equipped traps

A lot of progress has already been made in the so-called camera-based automated monitoring systems. This is actually a common pheromone trap in which a camera is mounted above the glue plate. At regular intervals, this camera takes pictures of the glue plate, and these photos are stored via a wireless connection on a server (cloud). The photos can be consulted there at any time and from anywhere by the grower or advisor to see if (and how many) target insects have been caught. Moreover, for a number of target insects, automated recognition has already been developed via image processing software. However, it is difficult to estimate how accurate, and therefore reliable, this automatic recognition is. The practical validation of these systems is the subject of this automated monitoring project. We also want to make improvements such as the automatic replacement of glue plates and improved camera and smart detection technology. We also investigate the possibility of combining multiple attractants/pheromones in one trap, to use camera-equipped traps for monitoring as many different insect pests as possible.



Automatic identification by measuring the wingbeat frequency

Another possibility for automated monitoring is the electronic identification of insects using an optical sensor. The principle of this detection technique is innovative yet surprisingly simple. An insect flies between a light detector and a light source, when the wings are fully open there is a maximum 'shadow' on the light detector, and when the wings are fully closed there is a minimum 'shadow'. The change in light intensity on the light detector will then have a similar frequency to the wing beat (typically for insects somewhere between 100 and 600 Hz). Because this wingbeat frequency is characteristic for each insect species, such a measurement signal results in a kind of unique 'barcode'. In this project, this technique has already been used to efficiently detect the harmful invasive suzuki fruit fly, and to distinguish it from the harmless native *Drosophila melanogaster*. Several prototypes of an automated trap equipped with sensor/camera have also already been developed.

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More info: www.pcfruit.be/en and www.pcfruit.be/nl/geautomatiseerde-monitoring

Natural allies in pear production



new

*Over the past decade, pear cultivation has become economically more important than growing apples in Flanders (Belgium). Moreover, the Conférence variety accounts for almost 90% of the pear area, which means that Flemish pome fruit cultivation is increasingly shifting towards a monoculture of Conférence. This transition to ever-larger contiguous areas of intensively managed pear orchards is, however, accompanied by increasingly difficult pest control. The natural defenses and balances are very fragile, which can result in sudden infestations that cause serious economic damage. The pear psyllid (*Cacopsylla pyri*) is the most damaging pest.*

The pear psyllid

The pear psyllid is particularly notorious for the phenomenon of “black pears”, where sooty mold develops in honeydew secreted by the pear psyllid on the fruit. In addition to these unsaleable pears, less severe infestations cause economic damage due to the roughening of the fruit and disturbed assimilation in contaminated (black) leaves. In addition, pear psyllids are responsible, through their sucking activity, for weakened and dead leaf- and flower buds, which of course also leads to production losses. It is becoming increasingly clear that a different approach is needed to maintain sustainable integrated pear production in Flanders.

Using knowledge and (practical) experience

This Operational Group forms a network between different actors who each follow their own approach to orchard management. This creates an effective and active link between practical experiences from integrated cultivation (IPM), organic cultivation, high standard tree orchard management and applied scientific research. Which beneficial insects/spiders contribute most to the natural suppression of pear psyllid in practice, and how can we stimulate and promote their presence in a practicable way? One of the knowledge gaps is also the relationship between available nitrogen (N) and pear psyllids. It is clear that the fertilization schedule has an impact on pear psyllids, but where is the optimal balance between good pear production, and possibly (too much) N, which stimulates the pear psyllid population? This is being investigated by a combination of scientific knowledge and targeted sampling.



The use of data in the fight against pear psyllids

This project also builds on the previously developed phenological models of pear psyllid and natural enemies. How can we use the climate/data driven models to achieve a more stable balance in pear orchards? Based on the results and feedback within the Operational Group, the models will also be improved and made more user-friendly.

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Funding: EIP Operational group, Government of Flanders – EU (2019 - 2020)

More info: www.pcfruit.be



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PROVERBIO - Protecting orchards through biological control: an adapted selection of beneficial insects



new

In both integrated and organic fruit cultivation, growers today still often rely heavily on spraying with plant protection products (organic or otherwise) for pest control. The PROVERBIO project aims to develop innovative biological control strategies by using natural enemies (parasitic wasps) that are adapted to our climatic conditions. The project focuses on the most problematic fruit pests, which are active early in the season at low temperatures: the rosy apple aphid, the pear psyllid and aphids in strawberry.

Early active pests require early active natural enemies

The parasitic wasps that are now commercially available are usually species/strains that can be efficiently produced on a large scale. However, these species/strains are often inactive or inactive at colder temperatures. Therefore, in this project, targeted monitoring is done in early spring at different locations in our climate region (Flanders, Wallonia, northern France). As a result, several early-active parasitic wasp species (strains) were sampled, with which cultures were started in the laboratories of different project partners. For the first time, a parasitic wasp (*Trechmites psyllae*) was identified that parasitizes the pear psyllid.

'Breeding' for parasitic wasps active at lower temperatures

The tolerance and activity of the sampled parasitic wasp species/strains at colder temperatures (8°C) is currently being tested in laboratory trials. Special cultures at low temperatures are then started in the laboratory with the species/strains best adapted to cold spring temperatures. Each time, the offspring that performs best in cold conditions is selected and bred on. In this way, we aim to breed parasitic wasps that are adapted to be active early in the spring.

And what about the natural resistance of fruit trees?

Different fruit varieties are also more sensitive than others to infestation by aphids. This can be due to a different attraction or repulsion, or a different resistance (physical or chemical) to the feeding behavior of stinging sucking insects. In this project, the genetic background for this sensitivity/resistance to aphids in fruit trees is mapped.



Can flower strips help with strawberries?

The project also focuses on strawberry, specifically which plant species in flower strips have a positive effect on the promotion of natural enemies (parasitic wasps and predators). At the same time, any possible negative effect (e.g., promotion of pest populations) will be evaluated.

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More info: www.pcfruit.be

'Biofruit debuggers': operational group fights against stink bugs

completed

*Stink bugs have been a major problem for several years in organic pear growing. They also cause damage in organic apple cultivation and integrated pome fruit cultivation, and they are very difficult to combat with the currently registered crop protection compounds. Moreover, this family of harmful stink bugs could soon be bolstered by the invasive Asian brown marmorated stink bug (*Halyomorpha halys*) which has been already detected in southern Europe and recently in our neighboring countries France and Germany, and which in no time has become one of the most important pests in pome fruit. With the EIP Operational Group "Biofruit (organic fruit) debuggers" we hope to prevent this.*

Knowledge is power in the battle against stink bugs

In order to determine the optimal (temporary) use of nets (see below), we want to know exactly if and when stink bugs migrate into and out of the orchard. For this purpose, we will conduct systematic monitoring in orchards and adjacent forests/hedgerows/flowering borders within the operational group's network and examine sampled stink bugs for the presence of mature eggs. Our hypothesis is that stink bugs need proteins in order to ripen their eggs when they develop in the pear orchard in June. At that moment they will start looking for protein in the nearby (forest/hedge) edges, and after feeding, they will fly back into the orchard to lay their ripened eggs in the pear trees (which would explain why there are more stink bug problems in orchards than in vegetative (forest) borders).

In addition, we aim to combine new knowledge, mainly originating from recent (international) research efforts on the invasive Asian stink bug *H. halys*, but also on the native red-legged shield bug *Pentatoma rufipes* ('forest bug'), and to use it for the elaboration of new control strategies against stink/forest bugs in organic fruit cultivation in Flanders.

Exclusion nets against stink bugs

Given the higher presence of stink/forest bugs along biodiversity elements (forest/hedge/flower) borders, we suspect that certain plants/shrubs that represent a food source have an important impact on the development



of local pest populations. With the aim of disrupting the migration to and from these food sources, we have installed exclusion nets over pear rows at several organic pear growers who participate in the Operational Group 'Biofruit debuggers'. These nets prevent adult stink/forest bugs from flying back and forth between pear (side) rows and surrounding hedges/forests. By closing these nets in the right period (when the bugs become adults and look for proteins), we prevent this important food intake and thus the production and ripening of eggs. The effect of the nets is evaluated through sampling of bugs and assessments of insect damage to the fruits.

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Funding: EIP Operational group, Government of Flanders - EU (2017 - 2019)

More info: www.pcfruit.be



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Ecological 'Attract & Kill' in the battle against *Drosophila suzukii*



new

The Asian fruit fly *Drosophila suzukii* or 'Spotted Wing *Drosophila*' has quickly become the most damaging insect pest for both stone fruit (cherry) and strawberries and woody small fruit (raspberries, blackberries and other berries) in Europe and the USA. In order to cope with this problem, the project 'Knowledge-based practical solutions for the protection of Flemish fruit cultivation against *Drosophila suzukii*' (VLAIO project IWT-LATR 135079 (2014 - 2018)) was performed in recent years. This project led to interesting insights and knowledge, and various practical control measures have been investigated and tested in the context of Flemish fruit growing. The most promising control measures were obtained in the 'Attract & Kill' section, which included the discovery of the control potential of the European bird cherry (*Prunus padus*) as a so-called 'dead-end host plant'. This project aims to further exploit the (ecological) 'Attract & Kill' control potential and to develop its practical application.

European bird cherry *Prunus padus* as natural enemy of *D. suzukii*

In laboratory studies we were able to show that the fruits of European bird cherry *P. padus* are very attractive for egg laying of *D. suzukii*. In fact, when they have a choice between ripening sweet cherries and ripening European bird cherries, *D. suzukii* females show a significant preference for laying their eggs in the European bird cherry fruits. However, as these fruits prohibit successful development of the *D. suzukii* larvae, it is a so-called 'dead-end host plant'. This represents a potentially effective way to naturally suppress the *D. suzukii* populations.

How to lure, how to kill?

With this project, we initially wanted to find out which (volatile) components of *Prunus padus* are responsible for the strong attraction to *D. suzukii*. We started by mapping the volatile aroma compounds of this plant via gas chromatography and mass spectrometry. Further research is currently being conducted on some of the identified compounds in choice/screening tests in both lab and field conditions (in monitoring traps), with a view to developing more efficient attractants. In addition, the 'killing mechanism' in *P. padus* fruits was also further scrutinized. The preliminary results point in the direction of a physical encapsulation/ suffocation of the eggs.



From knowledge to practical control solutions in the field

With the acquired knowledge we will develop a control strategy based on *Prunus padus* 'dead-end host' plants in fruit plantations. This could include *P. padus* borders around cherry or small fruit parcels. Or *P. padus* hedges between the rows, if the control effect of *P. padus* borders does not reach far enough. We also investigate the possibility of grafting *P. padus* onto cherry rootstocks. Finally, we investigate the possibilities for fitting identified (attract) substances for application in a classic 'Attract & Kill' strategy ('bait sprays' and/or 'mass trapping') independent of dead-end host plants.

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More info: www.pcfruit.be

SOS-PENTA - From theory to practice: protecting Flemish pome fruit cultivation against stink bugs



new

By feeding on fruit with their stinging, sucking mouthparts, stink and shield bugs (Pentatomidae), often referred to by fruit growers as 'forest bugs', have been causing increasingly serious quality problems in fruit cultivation in recent years. In the last decade a number of organically managed pear plots have experienced production losses of more than 50% due to stink bug infestations. Orchards with integrated pest management crop protection strategies are experiencing increasing damage from stink bugs, with up to 100% of the fruit damaged in a number of plots in the border rows. In addition, there is the real threat of the invasive Asian brown marmorated stink bug Halyomorpha halys. The main goal of this project is to develop biological and integrated control strategies against stink bugs so that Flemish pome fruit growers can control this emerging serious pest in a sustainable way

Lab cultures for testing

We discover the weaknesses of stink bugs by culturing them in the lab and performing tests. Native species of stink bugs (*Palomena prasina*, *Nezara viridula*) are easy to rear, while others such as *Pentatoma rufipes*, which naturally spends the winter as a nymph, need an optimized rearing protocol. The Asian invasive *H. halys* has also been successfully bred. The culture specimens are used for specific lab/cage tests, e.g., to improve lures or to check the effect of plant protection products on certain life stages.

What stink bugs eat

Stink bugs are polyphagous insects that need protein to produce and ripen their eggs. From the fact that they typically occur in high numbers in pome fruit orchards along biodiversity elements (forests/hedges/flower borders), we can deduce that certain plants/shrubs as food source have an important impact on the development of local stink bug populations. Therefore, molecular analysis of their stomach contents will be used to map the main food sources for the life cycle of the stink bugs. Based on this knowledge, the goal is to avoid these plants in plantations of biodiversity elements (hedges, flower borders) in and near orchards.



Natural enemies of stink bugs

Natural enemies can represent a great potential to suppress stink and shield bugs and keep them under the economic damage threshold. However, a necessary condition for this is to understand their main natural enemies so that we can ensure, stimulate and promote their presence with targeted management measures. To do so we map the main natural enemies (parasitic wasps and predators) in our fruit region and their main characteristics with regard to their role in biological control of stink bugs. In the first phase of this project, several parasitic wasps that parasitize the eggs have already been found and cultured.

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More info: www.pcfruit.be

Sustainable management strategy for fungal diseases in Rubus: a necessary step forward



new

The cultivation of Rubus species (raspberry and blackberry) is on the rise. These fruits are now available fresh from May to December and have gained a more prominent place in retail stores. These berries are associated with a healthy diet due to the high levels of vitamins, anti-oxidants, etc. present in the fruit. The disease management strategy, mainly in the originally smaller production areas, lags behind the trend in increased sales.

A reasoned and sustainable approach to reduce Botrytis and powdery mildew

At this moment there is a lack of knowledge for a sustainable approach of Botrytis fruit rot and powdery mildew control. As a result, too many treatments are probably carried out to control these diseases. This is particularly the case for protected production (nearly 100%) of raspberries and blackberries, as harvest protection can contribute to avoid yield losses due to fungal pathogens.

IPM in the cultivation of raspberries and blackberries

The aim of the project is to make a fundamental step forward in the disease management strategy as compared to the current management strategy for fungal diseases on Rubus. The principle of IPM will be further developed and implemented in the cultivation of raspberries and blackberries: first measure and interpret data and then apply the right control strategy if necessary, namely biological if possible and only chemical if absolutely necessary. The ultimate aim is to deliver a qualitatively strong product with the least amount of residues possible in order to strengthen the image of 'fresh and healthy' for these fruits. Through the envisaged fundamental steps forward, we want to preserve and even increase the competitiveness and growth opportunities of this sub-sector of the fruit and make a sustainable contribution to increasing the quality and characteristic (fresh and healthy) of the final product.



Organic if possible and only chemical if absolutely necessary

This project is aimed at all growers of *Rubus* species in Belgium. As we first look for biological solutions to control problems and only look for chemical applications if necessary, many aspects of this research are also very useful for organic *Rubus* growers.

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More info: www.pcfruit.be, Pcfruit vzw - TWO Mycologie

Flowers near a strawberry field - what is the added value?



new

By planting a flower border near crops, we can attract useful insects earlier and in greater numbers, which are already naturally present. In addition, commercially purchased beneficials can develop better on them. Flower mixtures make nectar and pollen available to beneficial insects, which allows these insects to live longer, lay more eggs and thus multiply faster. The benefit to pollinators has long been known.

Flower strip next to strawberry field tested

In March 2019, a flower strip (50 m long, 2 m wide) was sown next to a field of perennials. The variety 'Verity' was chosen because it is susceptible to fruit damage by insects. During the cultivation, several beneficials were released in the strawberry field namely the predatory mites *Phytoseilus persimilis* and *Amblyseius cucumeris* and on the flower strip itself the predatory bugs *Orius laevigatus*. Over the course of the season, counts were made on 26 plant species in the flower strip to get an idea of the diversity of the insect populations that settled there. In the production field, fruit damage due to thrips was evaluated on two dates as well as possible fruit deformation due to bugs. In addition, the number of adult predatory bugs and their larvae (*Orius*) were counted in 30 flowers scattered over the strawberry field.

Thrips: During flowering in June, thrips pressure was quite high. In July, fruit damage in the form of bronze discoloration was observed and the fruits became 'seedy'. A decreasing gradient in fruit damage from thrips was clearly visible the closer the strawberries were picked to the flower strip. The same gradient in fruit damage was also visible in August, but was less pronounced than before.

(Harmful) bugs: For bugs, no clear effect of the flower strip was observed. No relationship with distance from the flower strip was shown either. The high mobility of the bugs is probably an explanation for this.

Beneficial Orius predatory bugs: More adults and larvae were recovered in the strawberry beds closer to the flower strip than in the strawberry beds further away. It was striking here that the numbers clearly decreased further than five meters from the flower strip.

Hoverflies: Hoverflies, which are reasonably mobile, were detected in large numbers over the entire strawberry plot. Previous trials in vegetable production (FREDON Nord Pas-de-Calais) have already shown that for hoverflies the gradient from a flower strip easily extends up to 80 meters.



Flower species: Flowering plant species that attracted the most beneficials from nature were cornflower (*Centaurea cyanus*), viper's bugloss (blueweed, snakeweed) (*Echium vulgare*), sweet alyssum (*Alyssum*), yarrow (*Achillea millefolium*) and hyssop (*Hyssopus officinalis*). Common mallow (*Malva sylvestris*) attracted many predators and was very popular with bees, but many bugs (*Lygus rugulipennis*) that use this herb as a food source were also found on it. *Lygus rugulipennis* was also found on hyssop, but in much lesser numbers than the beneficials. Black pepper cv. 'Purple Flash' should be attractive to *Orius* according to research, but in practice these bugs were hardly found on it in contrast to some other plant species. Lamb's quarters (*Chenopodium album*) attracted a large number of specific aphids (*Hayhurstia atriplicis*) that served as food sources for various predators. In addition, a large number of ladybirds, especially *Hippodamia variegata*, *Harmonia axyridis* and to a lesser extent *Coccinella septempunctata* were also observed on the *Chenopodium album*, as were shield wasps (*Diaeretiella rapae*) and various bugs.

What does this mean in practice?

The use of a flower strip to better establish and support natural predators in strawberry cultivation currently seems like a possible tool, but more knowledge is needed. Questions such as which flower mixtures are ideal for housing beneficials, at what distance flower strips should be located near a strawberry plot, how frequently they should be sown to maximize results, will be further considered in future years.

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Risicover - Adequate control of soil-borne diseases in strawberry

Strawberry production requires a healthy, well-balanced soil or substrate, as well as disease-free plant material. Soil pathogens, like Phytophthora spp., Pestalotiopsis spp. and Verticillium dahlia, have always been present but have been increasing in recent years. Due to the scarcity of uncultivated fields, it is not possible for a grower to access an uncultivated plot to grow strawberries every year. This forces the grower to use the same parcel year after year, which can lead to the presence of specific soil pathogens such as fungi, bacteria or nematodes.

Increasing problems with soil pathogens

When problems arise it is often not known whether the pathogens were already present in the soil or in the plant material before planting. In order to protect the plants against these soil pathogens, a grower can use chemical soil decontamination, but this has come under increasing pressure in recent years. Organic growers do not have this option. Due to the disappearance of various chemical soil disinfectants, problems with soil pathogens in various crops, including strawberry cultivation, are on the rise and result in high losses and costs for the grower.

Limiting losses from soil pathogens through risk assessment

The aim of the project is to increase the profitability of strawberry cultivation by reducing the impact of the most important soil pathogen by selecting the best integrated pest management strategy based on a risk evaluation of both the plants and the soil or substrate. We want to give well-founded advice about controlling the diseases and reducing the damage before the start of the cultivation. This is done by supporting the grower in his decision whether or not to start a crop on a certain plot, or to take certain measures, and also by guiding and supporting the grower during cultivation as to which measures should be taken to make the crop profitable under the prevailing conditions. Fast and accurate quantitative detection techniques will be developed or optimized for the abovementioned pathogens. In addition, disease and action thresholds will be set up for plants as well as soil or substrate to make a better risk evaluation before the start of the cultivation. New management strategies, based on IPM and also biological or alternative techniques, will be tested and set up to reduce losses by soil-borne pathogens.



At the end of the project the new IPM strategy will be implemented in the cultivation of strawberries and the growers will be capable to better assess the risks associated with a specific cultivar or soil type so that the best management strategy can be implemented only when necessary to ensure that plant and yield losses are kept to a minimum.

Focus group

This project aims to reach all strawberry growers in Belgium. Many topics within this study are also highly relevant for organic strawberry growers.

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More info: Pcfuit vzw - TWO Mycologie www.pcfuit.be

Biological control of aphids in trees: A sticky problem

Trees play an important role in public green spaces. They improve the quality of the environment and promote the well-being of citizens. They counteract the urban heat island effect, provide oxygen, filter harmful dust particles from the air and are oases of biodiversity. However, when infested by aphids, trees can become a nuisance. These pests not only cause sucking damage but also produce honeydew, a sticky substance that ends up in the immediate vicinity of the tree. Cars, benches and terraces get a sticky layer, much to the annoyance of local residents. In addition to polluting the environment, honeydew also forms a breeding ground for sooty molds that not only reduce the trees' capacity for photosynthesis but also seriously affect the ornamental value of the plants. The general ban on chemical crop protection in public spaces and the health and environmental perspectives now prompt the search for alternative control strategies.

Green lacewing larvae and new cultivars 'to the rescue'

Natural pest control, where natural enemies fight the pest, could offer a solution. However, field observations show that naturally occurring predators and parasitoids often fail to control aphid populations. When attraction and stimulation prove insufficient, the introduction of commercially available enemies is an option. In Europe, the two-spotted ladybird (*Adalia bipunctata*) is often used for this purpose, but alternatives such as larvae of the green lacewing (*Chrysoperla carnea*) could also offer solace. In addition, choosing cultivars that are less sensitive to aphids can offer an opportunity to minimize this nuisance. This preventive measure could lead to fewer aphid populations and limit the tree damage.

Into the tree

Researchers at University College Ghent are putting this to the test and mapping the pest control capacity of *C. carnea* and *A. bipunctata* as part



of a practice-based research project. Different release strategies of this enemy are validated on lime trees (*Tilia cordata*) in public green spaces and nurseries. Larvae are released once or twice (1X or 2X) at different times in the growing season (early or late). The effect on the aphid populations in these trees is monitored on a bi-weekly basis. In addition, different maple, oak and lime cultivars and/or species are tested during the project for their sensitivity to aphids. This is achieved by bi-weekly counts of spontaneously occurring aphids in each of these cultivars

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Partners: Cooperation with various partners from the green sector (tree nurseries, garden contractors, tree doctors, public green space association, supply companies of beneficial insects, etc).

Funding: PWO (project based scientific research)-project – University College Ghent, Government of Flanders (1/01/2018 - 31/12/2020)

More info: www.hogent.be/beblabo

Organic leguminous plants as drivers of innovation and cross-border chains

Organic farming is growing strongly in Belgium and in France. Yet the necessary nitrogen supply poses a challenge in arable farming and vegetable production. Leguminous plants offer the solution by providing nitrogen for subsequent crops and contributing to soil fertility. These benefits make leguminous plants a driving force behind organic farming systems.

Developing a chain with leguminous plants: a major challenge

The commercialization of leguminous plants as a local protein source currently appears to be difficult. It is however necessary to develop and structure a chain of organic legumes, both for animal and human use. In their location between the major cities of Brussels, Lille and Paris, Flanders, Wallonia and France offer significant development opportunities for organic farmers and organic chain operators. To develop the cultivation and chain of organic legumes, Flemish, Walloon and French partners are joining forces in the cross-border project 'SymbIOse'. Knowledge and experience exchange are central. In an innovative pilot program the partners, together with farmers, are looking for the right cultivation technique for leguminous plants and their place in the crop rotation. During annual visits and via videos, farmers and advisors exchange experiences. Through roundtable discussions with market players, the partners also want to promote cross-border exchange and transparency in the chain for grain and protein crops as well as for field vegetables.

Nutritional importance: trials with innovative (mixed) crops

Research into the production of protein-rich seeds concentrates mainly on the cultivation of lentils, peas and field beans (summer and winter cultivation). The focus here is mainly on mixed crops with a partner plant. A combination of legumes with grain, for example, can provide better weed suppression, better crop vigor and greater harvest security than pure legume cultivation. Among other things, suitable sowing doses are sought and combinations of species and cultivars are tested. Several varieties in the supply of the regional seed houses are also compared in mixed cultivation. In addition, (exploratory) research is also conducted on some (new) species such as lupine, soy and chickpea. These very high-protein crops still present many challenges for the (organic) cultivation in our regions.

Importance for organic crop rotation

Trials comparing different crop rotations with varying shares of leguminous plants over a three-year period were initiated in 2018-19. The effect of



the legume on soil fertility, the presence of the soil pathogens *Sclerotinia* and *Aphanomyces* and crop yields is being investigated. In Flanders, six cultivation rotations are followed in which in two rotations the main crop is a legume every year, in two others every other year and in the remaining two, never. In half of these rotations, the green cover crop that is put on in the fall is a mixture with legumes, in the other half only non-legumes are chosen. For example, in 2019, wheat and a mixture of wheat with field bean were grown. In the fall, the green cover crop mixtures Phacelia/Japanese oat and Phacelia/Alexandrine clover/Winter vetch followed. Finally, in 2020, the main crops were white cabbage and green bean. In some shorter ongoing trials, research is also focusing on the value of leguminous green manures. Species are being tested as a pre or post crop but also as an underseed in grain or in a mixed crop of grain with a legume.

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Funding: Interreg France – Flanders – Wallonia (1/4/2018 - 31/03/2022)

More info: www.symbiose-interreg.eu

Do mini-tunnels maximize yield?



new

Within this project we investigated whether mini tunnels offer potential for organic growers to extend their season. Demo tests showed which type of mini tunnels were most suitable and for which type of farm. The results of the research also showed for which crops such infrastructure can be used.

Different constructions possible

For the construction of the mini tunnels different arch materials were tested. Iron arches, pressure PVC arches of 20 and 16 mm and electricity pipes of 20 and 16 mm were tested. The mini tunnels made with these materials were 1 m wide and 75 cm high. To also test the effect of mini tunnels with a larger air volume, a structure was made with flat iron bars that was twice as wide (i.e., 2 m wide and 75 cm high). Iron arches and arches made of pressure PVC of 20 mm diameter were the only arch materials that were satisfactory. Thinner pressure PVC pipes and both types of electricity pipes proved unable to cope with the windy conditions in the autumn and either kinked or broke. The mini tunnels that were twice as wide proved very difficult to span with the cover materials and harvesting ease was also suboptimal in these mini tunnels.

Best choice of cover material depending on type of spring

There are also several options of cover material for the mini tunnels. Hyticlear plastic, foil with small holes, agryll cloth and natural foil were compared. For the extension of the zucchini season, we saw in spring 2020 the clearest extension in the tunnels where perforated foil and agryll cloth were used. The atypical spring weather undoubtedly played a role. Where plastic can have the advantage of warming up faster, the year 2020 proved to be a smaller advantage as the climate became too extreme under tunnels with plastic film.



Mini tunnel with iron arches and foil with small holes as cover material

Challenges of using mini tunnels

When using mini tunnels in the fall, a sufficiently airy structure of the covering material was important to prevent fungal infections from taking over and the crop from being lost. For the extension of zucchini in spring, pollination remains a difficult issue. With closed tunnels, pollination is more difficult since bees and bumblebees cannot enter the tunnels. Mini tunnels are also too small to accommodate a bumblebee nest and the temperatures are a bit too high for bumblebees.

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Funding: CCBT-project 'Zorgen minitunnels voor maxirendement?'
Department of Agriculture and Fisheries, Government of Flanders
(15/02/2019 - 31/12/2020)

More info: www.pcgroenteteelt.be

Optimizing Natyra® cultivation



new

SQ159/Natyra® is a new apple variety with specific characteristics that may require an adapted cultivation method. For example, organic growers using Natrya® are confronted by I) weak growth; II) too-high fruit yield resulting in small apples, III) coloring problems and IV) black spots around the lenticels. The aim of this project is to optimise the cultivation of 'Natyra®' so that organic growers can grow this variety with a higher return.

Weak vigor

The weak vigor of 'Natyra®' in organic fruit growing became apparent immediately in the first professional plantings of organic growers. The CCBT-project 'Optimization of the vigor of 'Natyra®'' revealed that many commercially-available products do not give sufficient results. A moderate fertilization schedule is not sufficient to ensure balanced growth in the trees. This project examines the effect of providing nitrogen in the form of fast-acting nitrogen.

Trees with weak growth often have a weak June drop. This causes trees to hang too full and results in smaller fruit. In organic fruit growing, one can only work with flower burning or mechanical flower thinning. Both are not without risk, because at the time of thinning no one can predict the fruit set or possible night frost that can cause damage afterwards. Nevertheless, it is important to thin in time, to guarantee sufficient fruit size and to avoid alternate years. Within this project, thinning is done by flower burning.

Natyra® under hail nets

Organic growers are starting to grow 'Natyra®' under hail nets. However, in some years a hail net can have a negative influence on the coloring. Leaf removal can help, where part of the leaves are blown away about 1 month before picking to increase the amount of light reaching the apples and thus develop better color. The balance between the number of leaves and the number of fruits must be maintained. To check this, a trial was carried out on a parcel 'Natyra®' under a hail net.



Removing leaves from Natyra®

Black spots on Natyra®

The occurrence of black spots around the lenticels makes the fruits of 'Natyra®' unsaleable, which can lead to major economic losses (on some plots up to >30% of the harvest). The aim of this project is to gain a better understanding of the cause of the appearance of these black spots and to formulate an appropriate approach to minimize the occurrence of these black spots. The focus will be on obtaining a good mineral composition of the fruits, as well as on developing an adequate spraying scheme in case fungal infestation is the cause of this problem.

Results will be published as soon as they are available.

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Funding: CCBT-project '*Optimalisatie van de teelt van 'Natyra@'*' 'Optimizing Natyra® cultivation' - Department of agriculture and Fisheries, Government of Flanders (16/02/2020 - 31/12/2021)

More info: Pcfuit vzw - unit Proeftuin pit- en steenfruit

Improving harvest security and fruit quality in pear by optimizing the pollination process

completed

Pear is the most important fruit crop in Flanders in terms of surface area and economic value and is dominated by 'Conference'. This variety usually has no problems with fruiting thanks to its strong parthenocarpic fruit set in less favorable conditions. But the harvest security is much less with 'Doyenné du Comice' and 'Sweet Sensation', a red mutant of Doyenné. The harvest security is also lower for other new varieties than for 'Conference'. In this project we aimed to generate and implement knowledge that leads to a better pollination of pear, resulting in a higher and more constant fruit set with fruits of optimal size and high quality.

Diversification of the pollinator community

To try to increase cross-pollination, the effects of (i) installing nest blocks for mason bees, (ii) the insertion of a combination of honey bees, bumblebees and mason bees and (iii) a combination of the previous two treatments in 12-16 'Sweet Sensation' orchards for several years were investigated. The natural populations of bees and hoverflies were driven out by the induced bees and they did not complement each other. There was no effect of pollination treatment on the wealth of bee and hoverfly species nor on the Shannon diversity index. There was also no measurable effect on fruit set. The number of pollen grains per stigma and percentage of pollinated stigmas was comparable between the three pollinator treatments. However, it was clear that the more initial flower clusters were present, the lower the fruit set. Fruiting was highly variable between orchards with the same pollination treatment, which indicates other factors than the pollination community to determine fruiting in 'Sweet Sensation'.

Increase attractiveness pear nectar using a gistinoculum

Spraying on a limited scale in one 'Sweet Sensation' orchard in 2018 with a preparation of a *Metschnikowia reukauffii* strain alone and the combination with a bacterial strain was promising. In the combination treatment in 2018, flower visit frequency by honey bees was three times higher and fruit set was doubled compared to the untreated control and the single yeast application. These results could not be confirmed in 2019.

Most suitable pollinator trees

For optimal production and fruit quality at 'Conference' and 'Sweet sensation', based on flowering overlap data from previous years (own research and orchard foundation), S-alleles, susceptibility to disease, cultivation and



picking compatibility and economic value, potential pollinator trees (2 to 3 varieties for both 'Sweet Sensation' and 'Conference') were chosen. During the test of the pollinator trees in 2019 and the determination of the ideal planting distance, no effect on fruit set of the pollinator trees was measured. The small bloom overlap between certain cultivars that did bloom simultaneously in previous years is part of the explanation. This indicates that selection of the ideal pollinator tree is best when based on as many years of flowering dates as possible. Correction for number of flower buds is also needed. Frost also played a major role in the plots selected.

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Funding: VLAIO LA trajectory 150907, Agency for Innovation and Entrepreneurship, Government of Flanders (2017 - 2020)

Irrigation in organic crops



new

The dry seasons of recent years reveal vulnerabilities in the organic cultivation system. Targeted and reasoned irrigation techniques can be of help. Small and large scale growers, whether they grow outdoors or under protection, all need clear information about different irrigation techniques adapted to their cultivation system and crops. They are curious about the effects on rooting and the impact on plant availability and leaching of nutrients in the soil by applying irrigation under organic cultivation conditions. In a two-year CCBT project "Irrigation in Organic", the three partners Inagro vzw, Provinciaal proefcentrum voor de groententeelt Oost Vlaanderen vzw (PCG) and Proefstation voor de groententeelt vzw (PSKW) want to provide answers and disseminate the available information on irrigation.

Survey within the broad organic sector

It is no secret that water supply is a bottleneck in Flanders. In order to prepare the organic sector against a higher water demand, it is important to get a good picture of how irrigation is handled. Since organic farms are very diverse, both in area and in crops, the approach to irrigation is very different between farms. At the start of the project, the partners made a questionnaire to find out how these farms are organized so that solutions can actually fit the needs and practices of the farms. At the same time, we want to use this questionnaire to get an idea of the knowledge and experience available and to get a clearer picture of the current knowledge needs.

Demo field trials with irrigation steps

Over the two years of the project, the partners will carry out several trials for demonstration on their experimental plots in various crops. Some of these trials are aimed at improving the judicious use of water and at identifying the irrigation needs of different crops. To this end, the trials are installing irrigation steps to see if we can achieve acceptable yields and quality with less watering. Rooting is assessed via a profile well and the influence of irrigation on the mineralisation of nutrients in the soil is also monitored by analyzing soil samples.



The optimal use of drip hoses

Drip irrigation is often promoted as a more economical irrigation method, where water can be applied exactly where it is needed. For application in field crops, the challenges are often of a practical nature. The combination with mechanical weed control raises concerns, there are questions about the required number of irrigation hoses per area or per crop row, about possible problems (damage, blockage) during the cultivation, about the placement of the irrigation hoses, and so on. Inagro and PSKW are doing some demonstrative tests in open field crops to answer some of these questions.

The use of T-tape, drip hoses and strip irrigation in the cultivation of fruit vegetables in tunnels is quite common, but also here there are quite a few practical questions about the differences between these possible irrigation techniques. In the project, an extensive trial is conducted in tomato grown under tunnels, combining different types of irrigation.

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Funding: CCBT project 'Irrigatie in Bio', 'Irrigation in Organic', Department of Agriculture and Fisheries, Government of Flanders (2020 - 2021)

Is irrigation vital to the cultivation of organic cut flowers?

new

The extremely dry and hot summers of recent years are a concern for organic flower growers. A sufficiently moist soil is important for a good, continuous crop development. If cultivation conditions are too dry, the plant may experience stress and vegetative growth can stop. In this situation, the crop will flower too early, resulting in short flower stems, while sufficiently long flower stems are necessary for making qualitative bouquets.

Irrigation in the cultivation of snapdragons and sunflowers

The cultivation of organic cut flowers has been booming in recent years. This cultivation takes place on rather small farm areas outdoors. Water supply is often either not available or only available to a limited extent. With this grower supported CCBT project, we aimed to demonstrate the benefits and offer guidelines and target values for optimal irrigation. For this purpose, a trial was set up for two consecutive years on a sandy loam test plot in conversion for organic cultivation. This was done with two commonly grown summer flowers, snapdragons (*Antirrhinum majus*) and sunflowers (*Helianthus annuus*), which have different water requirements. For both crops a non-irrigated setup was compared to two irrigated objects.

Irrigation control on soil moisture level

Irrigation was performed using T-tape applied between the plant rows. The soil moisture content was monitored using tensiometers placed at 15 and 30 cm depth. For continuous recording of the soil moisture content, soil moisture sensors were installed in the soil at 15 cm depth. Defining the optimal frequency and volumes for irrigation were the biggest challenges.

Effect of irrigation on production, crop length and shelf life

Effects of these irrigation systems on production (number of stems) and the quality of harvestable stems (length and weight) were monitored, as well as the vase life of flowers after harvest.



Due to the persistent drought during the past seasons, the effect of irrigation on the snapdragons was abundantly clear. Irrigation did not affect the number of harvestable flowers significantly but did improve flower quality by producing stems which were up to 10 cm longer as compared to the control treatment. Influence of irrigation on vase life appeared rather limited.

In sunflowers sown in situ, soil moisture was crucial for the emergence of the crop, but was less important during the further course of cultivation.

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Funding: CCBT project '*Irrigatie, een noodzaak in de teelt van biobloemen?*' 'Influence of irrigation on the quality and shelf life of organic cutflowers', Department of Agriculture and Fisheries, Government of Flanders (1/01/2019 - 31/12/2020)

More info: <https://pcsierteelt.be/>

Organic cut flower growers search for ways to extend the sales period



new

The organic cut flower sector is relatively young and is growing quickly in Flanders. It includes not only CSA picking gardens, but also growers who sell their flowers or bouquets to florists or directly to consumers. Currently, the sales season for organic flowers starts in early spring (March-April), with spring bulbs such as tulips and daffodils, followed by mostly annual or biennial cut flowers. This period continues until the first frost in autumn.

Dried flowers

The largest production of organic flowers coincides with the summer months. Then demand for cut flowers traditionally comes to a standstill, due to the warm weather and the fact that consumers are often abroad. A whole series of cut flowers are harvested and dried during this period, to be sold in dried bouquets during the winter. In this way, a certain continuity in sales is created. However, there is a great need for fresh cut material in the winter months, especially if the hype for dry bouquets should fade. There is also a need to spread the work better throughout the year.

New crops

In order to meet this need, the CCBT project 'Extending the sales period for organic flowers by measures in the field and adjustments to the assortment' was started in 2020 at PCS (the Experimental Research Center for Ornamentals). Based on a literature study and discussions within the sector, new crops are being sought that provide an attractive production when the day length is short (early spring or late autumn). This search leads us mainly to perennials that have a decorative value in the gloomy months. For example, the colorful branches of *Cornus*, various winter bloomers (*Amelanchier*, *Forsythia*, *Viburnum*, *Helleborus*, ...) and berry-producing or evergreen shrubs and bushes (rose hip, ivy, *Hypericum*, ...),...

Adapted crop management

We also explore whether the production season of typical spring bloomers can be brought forward by means of cultivation techniques, such as covering



the crop with a roof and soil. These techniques are known in the conventional cultivation of peonies, for example, where the season is brought forward by placing tunnels over the crop.

In the organic cultivation of ranunculus and anemone, typical spring products, it will be investigated whether a more profitable production can be realized by using shelters such as mini tunnels or a straw bed. The difference in planting time will also be taken into account.

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Department of Agriculture and Fisheries, Government of Flanders
(15/02/2020 - 31/12/2021)

More info: www.pcsierteelt.be

Affordable mechanization for weed control

new

Effective weed control is one of the most important elements for efficient organic management. The aim of a new demonstration project is to support growers in deploying affordable and/or widely applicable solutions for mechanical weed control. We will demonstrate a range of techniques for small-scale vegetable cultivation, for berries, for beet cultivation and for tackling root weeds both at research centers and on farm.

Inagro, pcfruit and Proefcentrum Pamel are joining forces for this demonstration project 'Smart use of affordable mechanization for weed control'. Umbrella organization CCBT is the coordinator of the project.

From smart to creative!

Efficient weed control is one of the main concerns of both organic and conventional growers. Organic growers are solely dependent on mechanical and physical methods, while conventional growers are also looking for alternative and more sustainable solutions, due in part to the restrictions on available herbicides. Weed control affects labor and labor costs, choice of cultivation and the ability to deliver a quality product.

Mechanical weed control has undergone a strong evolution in recent years, especially regarding technological innovation (GPS, camera, weed recognition and inrow weeders, etc.). Lower-tech developments seem less 'smart' but are at least as important for successful weed control. With this project, we aim to place these affordable techniques more in the foreground and encourage Flemish (organic) growers (both vegetables, small fruit and arable farming/fodder cultivation) to get to work with them in a creative manner. In practice, we notice that growers are often still hesitant to get started with these techniques due to a lack of tailor-made references. Attention will be also given to a number of preconditions (e.g. quality of planting work and seedbed preparation) important for a successful introduction of a new tool or method.

Demonstrations in East and West Flanders

Throughout two years, we will demonstrate various systems in four areas of application: small-scale vegetables, berries, beets and how to tackle root weeds. The consistent use of the precision weeder (Treffler or other manufacturers) and the application of torsion and/or finger weeders are a few examples of machines that are still insufficiently used in vegetable cultivation. An effective, widely applicable, inexpensive and reasonably easy to make device for fighting root weeds is the 'Rod weeder'.



Growers gather around a small type of Treffler weeding harrow, tailored to small scale vegetable cultivation

On the basis of demonstration trials and moments in East- and West Flanders, on-farm where possible, the machines and systems are demonstrated and the results of weed control are shown in practice.

In 2020 we shared this information via video and we hope to organize another in-person demo day in 2021. The seminar on root weeds in 2021 and the Organic Farmers' Networks with a focus on weed control in beets will complete this series of demonstrations.

All experiences are bundled in movies and articles, which are collected on BIOpraktijk.be/onkruid.

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Funding: Demonstration project '*Slim inzetten van betaalbare mechanisatie voor onkruidbeheersing*', Government of Flanders, Department of Agriculture and Fisheries (1/03/2020 - 28/02/2022)

More info: BIOpraktijk.be/onkruid

HOPBEL - Development of regional Belgian hop varieties



new

Hops are an important ingredient for beer and the characteristic crop for the Poperinge region. New and better hop varieties are being developed abroad, adapted to the rapidly changing climate conditions and with a strong focus on disease resistance. These new varieties, however, have a license which prevents them from being cultivated in other hop regions such as Belgium. With the establishment of an own breeding program in which hop growers cooperate with different research centers and breweries, own local hop varieties will be developed.

A remarkable crop with a strong terroir effect

Hop cultivation in Belgium consists mainly of varieties of foreign origin. For decades, Belgian hop growers successfully cultivated these foreign varieties by selecting the most suitable hop varieties themselves. Indeed, not all varieties developed abroad are suitable for cultivation here. Research has also shown that the aroma profile of hop varieties can differ depending on the region where they are grown, the so-called terroir effect. The yield and the content can also vary. Typical of Belgian hop cultivation is the proximity of the sea, which creates different growing conditions in comparison with, say, Germany, where the climate is more continental.

Belgian hop cultivation under pressure?

New and better hop varieties from abroad are increasingly being legally protected. In concrete terms this means that Belgian hop growers can no longer make use of these newly developed varieties, which puts them at a competitive disadvantage in relation to growers abroad. In the future this could even be disastrous for Belgian hop growing. Recent studies in fact also show that these newly developed hop varieties are more resistant to changing weather conditions and in dry years such as 2018 had clearly better yields compared to the old varieties.

Local anchoring of the breeding program

A breeding program for hops easily takes about 10 years. The HOPBEL LEADER project provides a solid basis for the breeding program that will continue independently after the project. At the start of the project there was already a large parent collection that has in the meantime been expanded with varieties grown locally. This collection now includes more than 100 varieties. In order to make new varieties, male plants are also needed in



addition to the mother plants. For this purpose, a call was launched to detect male plants in Flanders: currently about 120 reports have been registered. These male plants will be sampled in 2021 and disease tolerant plants will be included in the crossing program.

Besides starting material, we are also looking for support from the various stakeholders to further develop this breeding project. Most hop growers already indicated their willingness to participate in the project, and in the meantime the first candidate varieties have been planted at some hop growers. In addition, a survey will also be organized for the brewing sector in the autumn of 2020. In this way, an innovative collaboration can be created between the various stakeholders (growers, brewers, processors, plantation breeders and research institutes) that carry the breeding program across the Hopbel project.

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Funding: LEADER West Vlaanderen (2020 - 2022)

More info: <https://www.interreg-fwvl.eu/nl/durahop>

QUILO: Starting up a profitable conventional and organic quinoa cultivation in Flanders

new

Quinoa has earned a permanent place on store shelves and in Belgian cuisine. Although this sustainable crop with interesting nutritional properties can be grown here, almost all quinoa comes from South America. ILVO wants to change this together with the practical research centers Inagro (Rumbeke-Beitem) and Praktijkpunt Landbouw Vlaams-Brabant (Herent). To remove the obstacles for local quinoa cultivation and to help farmers on their way, researchers will work intensively together for four years, both with each other and with pioneers who already cultivate quinoa or who want to start doing so.

Why grow quinoa in Flanders?

Quinoa is a sustainable and stress-resistant crop with highly nutritional properties that can be grown perfectly well in Flanders. It is also an ideal crop within a crop rotation as it is not demanding and has a positive impact on soil health and structure due to its deep root system. Already since 2014, a number of pioneers are growing quinoa in Flanders. Our goal is to be able to fill 10-15% of the demand in Flanders locally at the end of the project. Not only farmers want to get started with quinoa; the food industry, catering and retail are always looking for new locally-sourced raw materials and quality agricultural products.

Expanding the variety list

A first focus is on broadening the range of available varieties in Flanders. In addition to varieties under contract cultivation, we are also looking for (new) varieties that do not fall under this category. This will make the cultivation of quinoa more accessible. It is necessary to subject the varieties to a variety test to compare their yield, disease resistance and protein content quality in our Flemish conditions. In addition, other quality traits such as color, texture and taste are also important in the choice for the most suitable varieties. In the variety trial at ILVO in 2020, 17 varieties of Danish, North American and Austrian origin were tested. During the growing season we monitored early growth, soil cover, susceptibility to downy mildew and ripening. Afterwards, we compared the saponin content of the different varieties. This component causes quinoa to taste bitter, and bitter varieties are less popular with consumers. Due to the dry and warm weather of August, all varieties were harvested by early September. We will have to wait for the first yield results.



Is it profitable to grow quinoa in Flanders?

Profitability is an important issue if you want to convince farmers to start a new crop. The QUILO project wants to achieve a quality end product for all links in the chain. The feedback from the pioneers and new growers, together with data collected during the project, will form the basis for the profitability analysis. The rollout of quinoa cultivation in Flanders will depend on its economic sustainability. By involving seed companies, machine manufacturers, food industry, retail, etc., we hope to promote the development of local chains for supply, processing and sales.

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Funding: VLAIO LA trajectory, Agency for Innovation and Entrepreneurship, Government of Flanders (1/11/2019 - 31/10/2023)

The search for Belgian sweet potatoes



new

The cultivation and consumption of sweet potatoes in Flanders is growing rapidly. Newly developed varieties of this tuber - mostly from the US - have a sufficiently short growing cycle so that they are also suitable for cultivation in the Northwest European climate. However, these varieties have a license which means that they may not be propagated locally. This has consequences for the plant material delivered to farmers. The development of a local breeding program is urgently needed.

Healthy root vegetable becoming popular in Flanders

Sweet potato (*Ipomoea batatas*) is originally a tropical crop – and despite what the name might imply – totally unrelated to the potato. This tuber is a source of energy, vitamins and minerals. The complex carbohydrates are broken down by the human body very slowly, which keeps blood sugar levels fairly stable.

Consumption has been rising in Flanders since 2011. Consumers know the tuber mainly as an orange-fleshed tuber with a brown/orange skin. However, there are many variations possible in both flesh and skin color, ranging from white to yellow to red or purple colors. There is also a great variety of tastes available.

Flemish cultivation is rising

Due to rising consumption, imports are increasing sharply. In order to limit these imports and the associated food miles, its cultivation is also being investigated in Flanders. And with success, because it is estimated that around 100 ha of this crop will already be grown in 2020. This is mainly due to the fact that varieties are becoming available with a sufficiently short cultivation cycle, coupled with the increasingly warm climate. Moreover, for the time being this crop is hardly affected by diseases and pests, and certainly not by the common potato blight. Since it is not related to any other agricultural crop, it also fits into many crop rotation schemes.

Propagation quality

Sweet potatoes are propagated by cuttings. These cuttings come from the tendrils that develop from the tuber under sufficiently warm conditions. Until now, farmers buy cuttings from abroad, but the quality of this plant material is sometimes substandard or the time of delivery is not respected. Local or 'on farm' cultivation of quality planting material can overcome this problem, but due to licensing issues this is not possible.



Breeding program

To provide local varieties and quality planting material for Flanders in the future, the Yacobat project was established in 2016. It is a community based breeding program, where sweet potato enthusiasts, researchers, horticultural schools and farmers work together.

The breeding program consists of several steps.

- Year 0: flowering induction, crossing and seed harvest
- Year 1: growing from seed and first field selections
- Year 2: clonal propagation of the best selections from Y1 and further evaluation on some 3 locations
- Year 3 and beyond: further evaluation of the best selections from Y2 at several locations, coupled to taste and storage trials

Over the past 2 years (2019-2020), 12 candidate varieties have been selected from about 700 seeds, which will advance to the Y2 or Y3 phase of the breeding program in 2021, while new seeds have also been harvested in 2020. The intention is to be able to offer to the market in the near future not only standard orange varieties, but a broad arsenal of colors and flavors.

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Funding: After a PWO and PDPO project this project is supported with VIVES own capital.

More info: www.yacobat.be

Search for resistant and/or less susceptible apple varieties



new

Variety testing is and remains an important issue for organic fruit growers. On organic as well as in-tegrated orchards, the main variety currently grown is Jonagold. There is a big demand for disease-resistant varieties.

Testing for susceptibility to scab, powdery mildew, nectria canker and storage diseases

Within "Proefcentrum Fruitteelt vzw – unit Proeftuin pit- en steenfruit" all new apple varieties are tested for their susceptibility to scab, powdery mildew, nectria canker and storage diseases. The tests are performed on 4 trees per variety in a separate parcel that is not sprayed against powdery mildew, nectria canker or storage diseases. The trees are only sprayed against scab under very heavy infections. In this way we get an idea about the susceptibility of the new varieties and their opportunities for organic fruit growing.

Since 2009 interesting new apple varieties for organic fruit growing are also planted in a separate parcel with an organic spraying scheme. Here we focus among other things on the influence of copper and sulphur sprays on the quality of the skin.

When choosing a new apple variety the aspect of "sustainability" is very important. Previously, the focus was primarily on scab resistant varieties. In the future, susceptibility to powdery mildew, storage diseases and susceptibility to pests such as woolly aphids and spider mites will play a role in variety selections.

If promising varieties are found in the first screening for the organic fruit grower, we plant more trees to find solutions for the specific problems of the new variety (especially concerning cultivation techniques). At this moment we have 1 scab resistant apple variety (SQ159/Natyra®) that is planted on a larger scale.

Results

SQ159/Natyra® is a cross between Elise x a scab resistant variety from the Netherlands (WUR - Wageningen). It is a firm, sweet apple with a dark red striped blush and a very good taste. In taste tests, both in Belgium and abroad, SQ159/Natyra® is always in the top 3. The harvest time falls in the 2nd half of October, the same as Braeburn. To have enough colored fruits, 2 pickings are required. It is a moderately productive variety with a rather



SQ159/Natyra®



Bonita®

small fruit size. The storability and the shelf life are good.

SQ159/Natyra® is a scab resistant variety (vf) and, moreover, not very susceptible to powdery mildew. In the Netherlands, the vf resistance on one plot has been broken. This has happened on a plot that was not sprayed against scab at all. That is why we recommend treating scab resistant varieties under very heavy scab infections. In this way, the breakthrough of the vf resistance can be prevented. SQ159/Natyra® is very sensitive to necrotic canker. According to research in Klein-Altendorf (Germany), an interstem of Golden could already solve this problem for a large part. In 2016, infections of fire blight were also detected for the first time in late planted trees.

Another variety for which there is interest at the moment is Bonita®. It is a cross of Cripps Pink (Pink Lady) x Topaz from the Czech Republic (Institute for Experimental Botany - Prague). Bonita® is a very productive apple with an attractive pink to red blush (90% of the surface). The variety is scab resistant (vf), but moderately susceptible to powdery mildew. Harvesting time is end of September-beginning of October.

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Funding: GMO-project (50% Europe and 50% growers (1/01/2019 - 31/12/2023))

More info: Pcfuit vzw - unit Proeftuin pit- en steenfruit

QUILO: how to best grow quinoa in Flanders

Quinoa has earned a permanent place on store shelves and in Belgian cuisine. Although this sustainable crop with interesting nutritional properties can be grown here, almost all quinoa comes from South America. ILVO wants to change this together with the practical centers Inagro and Praktijkpunt Landbouw Vlaams-Brabant. To remove the obstacles for local quinoa cultivation and to help farmers on their way, researchers will work intensively together for 4 years, with each other and with pioneers who already cultivate quinoa or who want to start.

Why grow quinoa in Flanders?

Quinoa originates from Bolivia, Peru, Ecuador and Chile. It is a herbaceous crop, which is why we speak of a pseudo-grain, with a growing season of 4-6 months in Belgium. Already since 2014, a number of pioneers are growing quinoa in Flanders and Wallonia. It is an ideal crop within a crop rotation because it is undemanding and has a positive impact on soil health and structure due to its deep root system. In a changed climate, the fact that it is a drought-tolerant crop is also a bonus. So growing quinoa in our regions is certainly possible provided the varieties meet certain requirements. The plants must be day length neutral so that they flower at long day lengths. Our climate is more humid than that of the area of origin, so early ripening is important to obtain a good yield. The main disease that occurs is downy mildew, we are always looking for varieties that are less sensitive to this.

How do you best grow quinoa?

Besides searching for suitable varieties for the cultivation of quinoa in Flanders, a new crop requires practical answers on fertilization requirements, sowing density, harvest time, cultivation technique, weed control, etc. By conducting our own field trials and trials on farm, we build up this practical knowledge. At ILVO, in addition to the comparative variety trial, we included different fertilization levels in 2020, results are due by the end of the year. Fertilization is an important parameter because besides yield, it influences the protein content in quinoa. In addition, we still do not know enough about the exact effect on quality. The fertilization trial was conducted under conventional conditions because this allows to very precisely relate the amount of applied nitrogen to protein content, among other things, results from this can be translated to organic farming.

In 2020 and 2021, Inagro's organic agriculture department and the Praktijkpunt Landbouw will acquire more insight into soil cultivation, sowing and mechanical weed control. Optimal sowing density (three sowing densities) will be tested in function of yield, disease and weed pressure with two reference varieties. The space between two rows is crucial for the



method of mechanical weed control to be used. Weeds are always tackled mechanically in the absence of recognized herbicides, so not only in organic but also in conventional cultivation. Depending on the chosen row distance, a cradle or a hoe is used. A weed-free field with low disease pressure is an important step towards a quality product.

Recording all this practical cultivation information in a cultivation guide and database named 'QUILOpedia' will make the research work easier for future quinoa growers. QUILOpedia will be an open source knowledge base which will make all generated and available knowledge about quinoa cultivation in Flanders available in an easily accessible way. It is also a meeting point for all the developed cultivation tools from QUILO.

Keeping the green image

The green and healthy image of quinoa is something that all links in the food chain cherish. For this reason, and because of the lack of suitable herbicides, not only the organic but also the conventional cultivation of quinoa will be developed without the use of chemical crop protection agents. By bringing organic farmers and conventional farmers into contact with each other, they will share experiences regarding mechanical weed control, among other things. In this way, we hope that techniques from organic farming will become established in mainstream agriculture.

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Funding: VLAIO LA trajectory, Agency for Innovation and Entrepreneurship, Government of Flanders (1/11/2019 - 31/10/2023)

Small and innovative crops at the Research Station for Vegetable Production



new

Since the end of February 2020, the Research Station for Vegetable Production (PSKW) in Sint-Katelijne-Waver has an 82-acres organic trial field. During the two-year conversion period, this plot was sown with a grass-clover mixture to optimally prepare the soil for this new production system. The organic sector is growing and we want to support it with targeted research and demonstration activities. Now that the research can also be carried out on an organic test plot, we can carry out tests that are more relevant to the organic grower.

Mainly small-scale vegetable crops

The focus within this diverse research is on small-scale outdoor vegetable crops. In this way, we can work in complementarity with Inagro and PCG, who also conduct research in organic vegetable crops, but rather for larger crops or under protection respectively. The cooperation between these three practical centres now has a broader scope, making the results applicable to growers with all kinds of vegetable crops.

Together with BelOrta, but also as much as possible at the request of the entire organic sector, we follow up on developments and determine which crops and which research are most interesting. For the smaller crops, we look at which varieties are most suitable and try to optimize the cultivation technique in order to improve the profitability. We also test innovations and look at their market opportunities. In addition, together with other research centres, we carry out projects with diverse research aimed at, for example, soil management or crop protection (naturally organic).

Innovations tested from first year onwards

The Research Station also had some experience with innovative crops in the mainstream department. A few crops that were tested in the demoproject "Lots of small things add up: innovative crops in Flanders" turned out to be very successful. The attention for fresh garlic, edamame (fresh soya) and cime di rapa, among others, is maintained even after this project. Good use of these experiences can be made to grow these crops in an organic system as well. There are often few or even no approvals for crop protection products in these crops, which makes the switch less of a challenge.

The first experiences in 2020 have already taught us a lot. After a vertical protected crop and a horizontal open-air crop of melons, this year we tried a horizontal protected crop that combines the advantages of both: high



production and low labor requirements. Artichokes are not yet very well established in Flanders. Nevertheless, it also appears to have potential here. The first year of cultivation has already taught us that there are large differences in the time of harvesting. We also grew different types of beans, such as runner beans, butter beans and a number of types of dried beans. The latter are labor-friendly and provide production in the winter months. We are curious about the market opportunities for these. Various other small crops were grown during the first year, such as spring onion, little gem and sugar peas. We will continue to focus on innovations in the future.

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Funding: a diversity of funds

More info: www.proefstation.be

New crops in the picture at PCG

completed

On June 30, 2019, the Leader project "Zin voor innovatie: start met nieuwe teelten!" (in English, "Excited about innovation: start with new crops!") was completed within the Leader region of Flemish Ardennes. Within this project, we wanted to introduce growers to new, as yet unknown varieties and species that offer potential for our region. After all, we have to evolve with the times and renewal and innovation are crucial in this. Not only producers, but also various sales channels are constantly looking for new products that can bring added value for the company. The consumer is also not insensitive to novelties that are promoted in the context of a healthy and varied diet.

Promising first introduction to sweet potato

The project introduced the cultivation of sweet potato. Different varieties were compared under the Flemish climatic conditions. It was immediately clear that sweet potato can be grown successfully in our region, including under organic conditions. The cultivation requires little fertilization and has so far not suffered much from diseases or pests. We notice a clear added value of the use of black foil. The better warming of the soil provides a clear increase in yield and also for weed control the foil has clear advantages.

Yacon shows potential as a niche crop

For 6 consecutive years, a demonstrative trial was conducted with 11 varieties of yacon from different origins. The results over the years enabled us to select some varieties best suited for cultivation in our region. The varieties "Blanco", "Most common, yellow variety" and "Morado" obtained the best yields over the years. In terms of palatability and sweetness, the "Peru I" and "From New Zealand II 'Richard'" varieties scored best in the consumer survey. The "Most common, yellow variety" was also found to be tasty.

Consumer interest in mysterious tubers

In the project, we also tried out some lesser-known crops. Following in the footsteps of yacon and sweet potato, we focused on a few - albeit smaller - tuberous crops. These are oca, ulluco, mashua and crosne. These crops were planted in a demonstration garden to evaluate the feasibility of the crops. Consumer interest and willingness to purchase these new varieties was also assessed through an online consumer survey.



We saw clear differences in the familiarity and attractiveness of the different varieties. Sweet potato is clearly the most well-known tuber, as 81% of those surveyed knew this product. Contrary to expectations, yacon tubers were found to be more attractive than the better known sweet potato. Despite being less familiar with yacon, 78% of the participants would be willing to purchase these tubers. A smaller group (24%) of those surveyed indicated that they were familiar with the oca tubers but only 25% of them could also name the tubers correctly. The tubers were very often confused with Jerusalem artichoke. Mashua was the least known tuber. These tubers were found to be the least attractive. The ulluco tubers in contrast were found to be by far the most attractive, with 48% of all participants finding them rather attractive and 39% finding them very attractive. Despite their unfamiliarity with the tubers, 83% of the participants indicated that they would be willing to purchase them because of their attractive appearance. The willingness to purchase was lowest for crosspike tubers (45%).

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Sweet potato cultivation is growing in Flanders

The cultivation of sweet potato has made a flying start in Flanders. After an initial introduction to the crop on a number of farms in 2017, accounting for some 10 hectares, more than 40 hectares of sweet potato were grown in 2018. In 2019, sweet potato was added as a separate crop in the single application and around 80 hectares of sweet potato were registered in Flanders. In 2020, this area was doubled. Across Belgium, approximately 200 hectares of sweet potato are now grown (both organic and conventional). Although good results are already being achieved, optimization of the cultivation and choice of varieties remains very important.

Project research must answer questions

To provide an answer to the questions of the sector, we have already been carrying out trials for several years at the PCG as part of the VLAIO LA project 'Successful development of sweet potato growing in Flanders'. Besides a very extensive variety trial with no less than seventeen different varieties of the main plant suppliers, there is also a large demonstrative cultivation trial in which we compare two different plant densities (75 x 30 cm and 75 x 20 cm) for two different varieties (Orleans and Bellevue) and this for three different planting times (week 20, 21 and 23).

Orange varieties (for now) the norm

Among the orange varieties, in 2019 it was again standard variety Orleans that achieved the highest saleable yield at 50 tons/ha. Because of its high yield and also attractive tuber shape, this variety is currently the most widely grown in practice. The Bellevue variety is also gaining in importance. With its 42 ton/ha saleable yield it stays, as far as production is concerned, a little bit below the Orleans variety, but its tuber shape is often found to be slightly more attractive. Its grading is also very attractive for the fresh market (not too coarse) and its paler skin color makes grub damages to the skin less noticeable. Bayou Belle, Nativaland's newcomer to the trial for the first time this year, already did very well, achieving the second highest yield at 44 tons/ha. Although Beauregard does not reach the top yields of the previously mentioned varieties, this variety performs consistently well year after year and remains present on field plots because it is a license-free variety. The tubers do tend to be slightly more elongated in shape, which is not always desirable.



Use of black mulch film is an added value

The 2017 crop science study clearly showed that the use of biodegradable black film is a yield-enhancing factor. Sweet potato is a heat-loving crop, so it is not surprising that the roots thrive better in warmer soil. Weed control is an added value of the use of foil. Before harvesting can begin, the foliage must be removed. When harvesting the tubers, attention should be paid to handle the tubers as gently as possible. After all, the skin of the sweet potato tubers is very fragile when harvested and can be easily damaged.

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More info: www.pcgroenteteelt.be

Local oils for a bio-based economy



new

From the vegetable oil processing industry came the desire to use more locally grown crops. In the Interreg project 'Growing a green future', Belgian and Dutch partners joined forces to better meet this demand. Praktijkpunt Landbouw Vlaams-Brabant contributed by constructing an 'innovation garden'. The purpose of this innovation garden was to see which interesting oil-bearing crops could grow in our climate.

Colorful and diverse innovation garden

Some crops that were disappointing in 2018, such as dill, caraway, coriander, safflower and evening primrose, were given another chance in 2019. Sowing densities were adjusted and the oil pumpkin and match plant - which barely grew the previous year after being sown in open ground - were sown in advance so they could be planted out. The following crops were sown in 2019 in the innovation garden: deder, crambe, black cumin, dill, caraway, coriander, safflower, ethiopian mustard, brown mustard, yellow mustard, hemp, Lucifer plant, snakeweed, evening primrose, blue poppy seed, tagetes and sesame. All crops were sown with a trial field seeder. The cradle was used extensively for weed control. Weeds were easily kept out of the fast-growing crops in this way but weeding was insufficient for the crops with slow and irregular emergence. Mature seeds were harvested with a trial field thresher and cleaned with a small thresher based on wind and sieve.

Crops with potential

After this 3-year Interreg project, two crops can be put forward that can provide high-quality locally produced oils: oil pumpkin (*Cucurbita pepo*) and deder (*Camelina sativa*). Both vegetable oils proved to be particularly interesting in terms of fatty acid composition. The cultivation technique of oil pumpkin is different from the other oil crops. Oil pumpkins were harvested manually in the absence of appropriate harvesting machinery. These are pumpkins with naked seeds, a convenient feature unlike common pumpkins that have a hard membrane around their seeds. These pumpkin varieties have been bred for seed (oil) yield and the oil is considered very healthy. Hemp is also a crop with great potential. It has relatively few location requirements and grows densely quickly. Numerous applications exist for both hemp fibers and seeds but there are still a number of bottlenecks. The strength of hemp fibers creates difficulties in harvesting, and specialized mechanization is required. Furthermore, the crop also suffers from the reputation of its illustrious and illegal relative cannabis. As a result, the legal framework is very strict.



Short chains for innovative niche crops

The research on local oilseed crops continues in the project 'Streek(k)eten: innovatieve niche teelten' ('short chains for innovative niche crops'). In addition to cultivation research, this project focuses on the development of sustainable and profitable short chains. We will try to remove possible obstacles that hamper the creation of these short chains, and also bring farmers, processors and sellers together in order to achieve good cooperation. In this way we want to stimulate the local cultivation of for example oil pumpkin and yellow mustard, but also the cultivation of old grain varieties.

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Funding: The innovation garden was part of the project 'Growing a green future' and was financed within the Interreg V program Flanders-Netherlands, the cross-border cooperation program with financial support from the European Fund for Regional Development (1/01/2017 - 31/12/2019).

The project '*Streek(k)eten: innovatieve niche teelten*' is realized with the support of Europe, Flanders and the province of Flemish Brabant (1/02/2020 - 30/06/2022)

More info: <https://www.grensregio.eu/en>
www.vlaamsbrabant.be/praktijkpuntlandbouw

Calendula, a golden child: from trial fields to practice

The Praktijkpunt Landbouw and ILVO are investigating the potential of calendula as an alternative crop for Flemish agriculture with a focus on dual-purpose cultivation of flowers and seeds. In 2019 and 2020, variety trials were set up and work was done around the cultivation technique of calendula, more specifically around fertilization and weed control. The cultivation was also tested in practice at a number of farmers, both as main crop and as secondary crop. On these practical plots, the focus was mainly on the harvesting and post-harvest technique.

Optimization of crop technical aspects

To get off to a good start with calendula cultivation, it is important to identify the right varieties that produce enough well-filled flowers, and then also have profitable seed production. Orange Beauty and Lemon Beauty are promising free varieties, as the trials of about ten varieties showed. The varieties developed by Wageningen University (under license), are also promising in terms of seed yield. Calendula is a crop with low nitrogen requirements. Fertilization trials showed that nitrogen and potassium fertilization does not affect yield. Weed control remains an important concern during cultivation. Row distance and seeding density did not seem to have an effect on weed numbers. Weed harrowing gave fewer weeds but was so far insufficient for effective weed control. Another bottleneck is uneven seed maturity, which makes threshing difficult. Immature seeds in the harvest also produce a green seed oil. This color is not desirable for processing. Sowing early and maturing during dry and warm weather seemed to ensure good maturity this year. In 2019, the dual-purpose yield for variety Orange beauty was 11 tons of fresh flowers/ha and 1 ton of seeds/ha when harvested manually weekly for 8 weeks, followed by seed harvest with a trial field thresher.

The search for optimal (post)-yield techniques

To make calendula cultivation profitable in Flanders, a machine flower harvester is necessary. The current prototype flower harvester of ILVO is based on a harvester for camomile flowers. The amount of waste in the harvested mass varies greatly depending on the picking height and the condition of the crop. Limiting the amount of waste requires further research: two new picking systems have been developed and are being tested. It is important to dry the flowers as soon as possible. When stored in tubs, the flowers begin to heat up after just a few hours, and the temperature rises steeply. The seeds must also be dried after harvesting and cleaned. Experience was gained with different dryers: hop dryer, warm air dryer, box dryer, and cleaning of the seeds at different companies.



Interest from the processing industry

Several processing companies are interested in working with a sample of calendula oil for research and development. The flowers can be used in cosmetics and pharmaceuticals or as a natural colorant. For the seed oil, a market study was conducted by KdG for non-food applications and by Flanders' Food for food applications. Non-food applications are mainly paints and coatings. There is interest from the market, primarily as a replacement for tung oil. Possible food applications are margarine, mayonnaise/dressings and food supplements but due to the Novel food legislation this is less evident.

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Funding: VLAIO LA trajectory, Agency for Innovation and Entrepreneurship, Government of Flanders (1/10/2017 - 30/09/2021)

More info: <https://www.vlaamsbrabant.be/nl/economie-en-landbouw>

Agroforestry in Flanders: Five years of research and practical experience

completed

With the project 'Agroforestry in Flanders' ILVO, Inagro, Ghent University, Bodemkundige Dienst van België and Agrobeheercentrum Eco² (now Boerennatuur Vlaanderen) offered solutions and guidance for the target group to get agroforestry off the ground in Flanders. This was done via integrated collaboration throughout the chain and by building research knowledge and practical experience. We focused primarily on the land-based agricultural sector, without losing sight of the other links in the chain, from tree nurseries to wood and biomass processing companies.

Feasible, profitable and effective agroforestry systems in Flanders

The overarching project objective was to facilitate a breakthrough in a relatively short term of feasible, profitable and effective agroforestry systems in Flanders. This objective was pursued by conducting a participatory process with relevant stakeholders, fed by knowledge-building research on agroforestry in Flanders as well as by effective knowledge dissemination and access to information.

On the research side, two doctoral studies were conducted, one by Paul Pardon (impact of trees on soil quality, crop yield and biodiversity) and one by Lieve Borremans (agroforestry in Flanders: socio-economic and institutional context). The results of all research can be found in the project reports and scientific publications.

Agroforestry in practice

After the project ended, a practical manual was written. The aim of this manual is to provide an overview of the knowledge and experience of agroforestry as it is available in Flanders today. It is based on the work of the Consortium Agroforestry Flanders during the period 2014-2019. In other words, it summarizes the information contained in a large number of scientific papers, thematic project reports, the online knowledge counter,



knowledge sheets, testimonials from practitioners, field trip reports and much more. The handbook is divided into four major sections:

- (1) an introduction to the many forms of agroforestry and their occurrence,
- (2) an understanding of how agroforestry systems work and their likely impact,
- (3) the social, institutional, and economic context, and
- (4) a practical section with handles and tools to get started.

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Funding: VLAIO LA trajectory 'Agroforestry in Vlaanderen' ('Agroforestry in Flanders'), Agency for Innovation and Entrepreneurship, Government of Flanders (2014 - 2019)

More info: <https://www.agroforestryvlaanderen.be/en/>

AGROMIX: Agroforestry and mixed farming systems



new

ILVO takes an important role in the European project AGROMIX, which stands for "AGROforestry and MIXed farming systems. The aim of the AGROMIX project is to conduct participatory research to stimulate the transition to resilient and efficient land use in Europe.

Agroecological solutions for agriculture and land management and associated value chains

AGROMIX will provide practical agroecological solutions for agriculture and land management and for related value chains where mixed farming systems (combinations of animal and plant production) and/or some form of agroforestry are being adopted. At the scientific level, the project group aims to remove uncertainties in assessing economic and climatic resilience, the provision of ecosystem services and the carbon balance in such complex land uses.

Maximizing impact

To maximize impact, AGROMIX will explore the potential of new approaches and technologies, such as 'serious games', to foster innovation in highly diverse contexts. In twelve European pilots, under real-world conditions, all relevant stakeholders will be involved in the participatory design process and implementation of innovative forms of mixed farming and agroforestry.

Transdisciplinary and participatory

AGROMIX takes a transdisciplinary, participatory approach to enable and further develop synergies in mixed cropping systems and agroforestry, and to achieve ecological and socio-economic resilience in the given context of climate change.

AGROMIX will integrate evidence-based contributions between sciences (from biophysical to social sciences) with a practice-based approach involving farmers and other stakeholders, with the aim of achieving greater resilience. This will take into account various factors, including environment, stable farm income and supply chain.



The AGROMIX approach analyzes the delivery of ecosystem services (ES) within the studied agricultural systems. This analysis will be used in the development and implementation of practical solutions for agriculture and land management, with a view to increasing the delivery of ES and reducing potentially negative impacts in terms of e.g. habitat competition, yield losses, poor air quality, loss of income, and loss of biodiversity.

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Partners: Consortium of 27 partners from 14 European countries, coordination Coventry University (UK)

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More info: <https://agromixproject.eu>

SUREVEG - Strip cropping and composted vegetable waste streams as a new cultivation system for organic vegetables in open air

The increasing demand for organically grown vegetables requires a further optimization of the current organic cultivation systems, with even more attention to biodiversity and soil fertility. That is why the European partnership SUREVEG was launched in 2018. The focus is on strip cropping and on the use of vegetable waste streams as soil improvers and as fertilizers.

Looking for new cropping systems

The project aims to renew and intensify cropping systems for organic vegetables in open air to increase biodiversity and use resources more efficiently. The organic fertilisers and soil improvers studied serve to recycle residual flows as nutrients and improve soil carbon storage. Strip cropping has some potential benefits, the most important of which are higher yields through more efficient nutrient and light use and improved natural pest and disease control.

Field trials with leek and celeriac

In the second and last trial year, 2019, celeriac was grown in the fields where only leeks had been in the first year, and vice versa. The strip cultivation with alternating rows of both crops was located in the same fields as the year before. In these fields, celeriac was grown in the rows where leeks were grown in the first year, and vice versa, in the second year.

In this second experimental year, the same composts were used as in the first: a pure plant based compost, a compost that also contained farm manure, and pure farm manure. In terms of crop yield and nitrogen uptake, no differences were found between the forms of fertilization in both years. In the second trial year, a larger amount of mineral residual nitrogen was measured in all sampled soil layers in the case of farm manure compared to both compost forms. With the different forms of fertilization, the same amount of phosphate was applied, resulting in a (slightly) different nitrogen input.

Only in the second trial year, the two cultivation systems show a significant difference in terms of yield. The dry matter yield in the fields with only leeks was higher than that of the leeks grown in strips, which was entirely related to a higher dry matter content. Infestation by leaf miner was more pronounced in the strip cultivation than in the pure cultivation of leeks. Perhaps the narrower rotation distance for leeks in the strip culture had a negative impact. It was striking that the variation in the total nitrogen content in the soil, which was measured per individual field and varied



between 0.10 and 0.12%, also determined the yield. This content is a measure of the organic matter content in the soil and therefore a measure of soil quality.

Research is going on

In 2021, the results of field trials in six different partner countries are examined together for effects of strip cropping and fertiliser forms on yield, nitrogen dynamics, root development and above- and below-ground biodiversity. In addition to the crop combinations tested within the project, suitable crop combinations are searched for on the basis of literature and possible advantages and disadvantages are discussed with the growers. A robotic application of liquid organic fertiliser is also being developed for a site-specific application in strip cropping.

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Funding: EU Horizon 2020 – ERAnet, CORE Organic Cofund (Flemish partner: Department of Agriculture and Fisheries, Government of Flanders) (1/03/2018 - 28/08/2021)

More info: <https://projects.au.dk/coreorganiccofund/core-organic-cofund-projects/sureveg/>

Diverimpacts puts farmers on the way to more diverse cropping systems

Research has shown that a cultivation system is more stable and resilient as the more diversified it is. A wide and diversified crop rotation, the incorporation of intermediate crops and intercropping are three possible instruments to this end, but in practice, they collide with numerous obstacles. Diverimpacts is actively looking for levers to break these deadlocks through an integrated chain approach.

Application and impact of diversified cropping systems through crop rotation, intercropping, and multiple cropping

Diverimpacts or in full 'Diversification through crop rotation, intercropping and multiple cropping, supported by the full chain for greater sustainability' is an EU research project that aims to strengthen the application and impact of diversified cropping systems through crop rotation, intercropping and multiple cropping in practice. Diverimpacts aims to explore the full potential of diversified cropping systems on yield, ecosystem services, resource efficiency and sustainable chain development through:

- Supporting research (10 long-term trials to be continued)
- Twenty -five case studies spread across the European Union as natural experimentation environments where farmers, together with actors from the entire chain, search for levers and innovations to remove existing barriers and to achieve full exploitation of the benefits of diversified cropping systems at the level of the farm, the production chain and the environment.
- Developing recommendations for policy, chain actors and sector organizations to optimally facilitate this process.

Bioforum Flanders and Inagro are the Flemish partners in this project, developing two case studies in Flanders. In this co-innovation process we are methodologically supported by the project partners at Wageningen University.

Case study 'Akkerfood'

Food patterns in society change over time. The demand for vegetarian food is picking up, bringing about a demand for new raw materials. Soy and quinoa are well-known examples of this, but the demand is much more diverse. Today, these are very often imported from abroad while some crops can also be grown in Flanders. In the 'field food' case study, we are looking for ways to connect Flemish organic farmers and regional processors in order to broaden the arable rotation. The challenges are diverse: agricultural, logistical, process-related, fair price and risk distribution, etc. Two farmers and one processor have committed themselves to collaborate and follow this road.



Case study 'Interfarm'

Organic livestock farms and organic arable/vegetable farms are generally specialized in Flanders. This is driven by the external environment and seems necessary from the point of view of labor organization, efficiency, scale, etc. Nevertheless, from an organic point of view, there is a lot of added value to be discovered in the mixed farm in which manure, feed, straw, soil circulate between and over the different sections on the farm. The case study 'Interfarm' aims to realize this 'mixed' form of farming through cooperation between specialized farms. Three couples are followed and guided. We look at what motivates them, how they approach it, what obstacles they encounter and how they (can) deal with this. At the Flemish level, we bring organic growers and livestock farmers together to get to know each other better and to discuss themes that are important to both sectors. An important issue appears to be the mutual (financial) valuation of exchanged goods and land. Because distance is a major barrier to cooperation, regional meetings were organized during 2019-2020 to bring together organic farmers from the Poperinge region and Diksmuide-Roeselare. This subsequently resulted in a PDPO project 'Biofarmers from the Westhoek, strong together'.

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Funding: EU Horizon 2020 – grant agreement n° 727482 (1/06/2017 - 31/05/2022)

More info: www.diverimpacts.net

GREENRESILIENT - Agroecological production systems for organic greenhouses

Within the CORE Organic Cofund ERA-NET project 'Greenresilient' an international research team wants to design agro-ecological production systems for organic greenhouses in different European regions. In the Flemish cases, the focus is on crops that are possible to grow, despite low light levels, in winter and on a more agro-ecological approach to vegetable crops in summer.

Cultivation systems compared

In the project, the researchers hypothesize that the implementation of more resilient production systems, based on low energy consumption, extended crop rotation, the use of Agro-Ecological Service Crops (ASCs) and local organic inputs, is possible at almost any latitude in Europe. Two years after the start of the project, the main research activities carried out so far seem to support the hypothesis, but further analysis of the data collected are needed to confirm it.

Research at 5 locations throughout Europe

The five pilot field sites of the project (located in Belgium, Denmark, France, Italy and Switzerland) compare two types of production systems under sheltered conditions:

- A more intensive "Business As Usual" (BAU) system, characterised by an "input substitution" approach and based on common practice and organic regulations in the individual countries, and
- One or more innovative (INN) systems, which introduce more diversified crop rotations and a range of agro-ecological practices that differ from country to country.

The BAU and INN systems are assessed through a multidisciplinary approach, looking at crop yield, nutrient availability, soil fertility, soil health, functional biodiversity (nematodes, microbiological activity, weed biodiversity, diseases and pests) and life cycle analysis.

In Belgium, the BAU system has a fallow period between main crops, uses green compost that is brought in from outside, and uses root cloth to control weeds. In the INN system, green cover crops are included in the rotation, different types of winter leafy crops (WLC) are grown and high quality farm compost is applied. Straw is used as a natural material to control weeds and flower borders are sown.



Innovative cultivation system in Belgium during summer: mixing tomato and cucumber, straw as natural mulch and flower borders to attract natural enemies

Strong differences in between the pilot field sites

Differences in soil health and functional biodiversity in the different BAU and INN cropping systems of the experimental field sites are evaluated by studying the composition of bacterial, fungal and nematode communities in soil samples and of above-ground insect and weed communities. The highest soil microbial activity was found in samples from France, the lowest in Belgian and Danish systems. The metagenomic analysis of the initial status regarding the composition of the bacterial and fungal communities is currently ongoing. The initial status regarding the number of nematodes and the number of genera varies between the different experimental field sites. Analysis of functional biodiversity using DNA meta-barcoding and indices for nutritional status (enrichment index, EI) and nematode diversity (structure index, SI) will allow the resilience of the different systems to be assessed.

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Funding: EU Horizon 2020 ERA-net, CORE Organic Cofund, European Commission (Flemish partners: Department of Agriculture and Fisheries, Government of Flanders and EU) (2/04/2018 - 1/10/2021)

More info: www.pcgroenteteelt.be, www.greenresilient.net, <https://projects.au.dk/coreorganiccofund/core-organic-cofund-projects/greenresilient/>

Does intercropping of small fruits help to manage pests and disease?

new

Intercropping is the simultaneous cultivation of different crops in one plot. It has several advantages, such as increased production, better use of natural resources, and protection from drought and erosion. In addition, an important benefit is reduced spread of diseases and pests in the crop. However, this does not always occur and both positive and negative effects of intercropping were observed.

Monocropping versus intercropping

The spread of pests and diseases can be prevented by the diversity of species and varieties. In monocropping, pests and diseases can adapt more easily and evolve, triggered by the selection of strains, resulting in higher virulence and insect attack. In this project, we aim to characterize these biological and genetic adaptations. In Western conditions, no studies have yet been conducted in small fruits. That is why we started this project.

Start of organic raspberry and blackberry cultivation

Raspberry and blackberry were planted in open field in the summer of 2019. The raspberries and blackberries were planted in row intercropping (crops planted per row); mixed intercropping (crops alternately planted in the row) and monocropping. During the project we will monitor the development of pests and diseases. We are monitoring the fungus *Botrytis cinerea* as disease. For pests, we will monitor the bean spider mite *Tetranychus urticae* and several aphids *Amphorophora* spp. For botrytis and spider mite, genetic fingerprints (maps) are made at KU Leuven that can be compared with on farm intercropping and monocropping. For the Asian fruit fly (*Drosophila suzukii*) we are investigating whether we can work with the catch plant European bird cherry (*Prunus padus*) as dead end plant or as indicator plant. These raspberries and blackberries are grown organically.

Project progression

In 2019 and 2020, plenty of samples have been collected for botrytis, both in the trial plot in pcfuit and on farms doing both monocropping and intercropping. Numerous strains have been purified and these samples are now being analyzed at KU Leuven to make the genetic characterization. For spider mite, the first samples have also been collected in 2020 and DNA extraction is being started. Lices were not abundant so no conclusions can



Mixed intercropping with raspberries and blackberries alternating in the row

be made yet. The first trial design with the European bird cherry in the test plot did not give the expected results. Around the European yellow cress, there was no lower infestation of *D. suzukii* as well as no eggs of *D. suzukii* to be found in the berries of the European yellow cress. This will be repeated again next year.

Continued in 2021

Further samples will be taken in 2021 for botrytis and spider mite in the trial plot and on farm. The genetic characterization will be deepened in order to make further conclusions. Production will also be monitored to look at picking efficiency and yield.

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Funding: Department of Agriculture and Fisheries, Government of Flanders (1/04/2019 - 31/03/2020)

More info: www.pcfuit.be

What is the best way to grow organic raspberry long canes?



new

The aim of the 'How to grow organic raspberry long canes' project at Research Centre Pamel is to investigate the possibilities of growing organic long floricanes. Besides the involvement of the propagation sector, we also aim to encourage organic growers to test the potential of organic long canes. At the end of the project a roadmap will be made with the information that was acquired during the project.

A diminishing supply of bare root long canes

Bare root long canes were shown to have a lower yield and a higher chance of plant failure as compared to the formerly used conventional potted long canes, according to the CCBT-project 'Organic raspberry cultivation: suitable varieties and organic planting material'. Now that derogation is no longer granted for conventional long canes in pots, organic growers are forced to buy bare root long canes from conventional cultivation, for which a derogation is still granted. However, it is becoming increasingly difficult to obtain bare root planting material due to the decreasing offer from propagation companies.

Growing qualitative organic long canes

The project goal is to breed high-quality organic long floricanes with sufficient yield and good plant characteristics, as these will not be subject to derogation in the future. The organic planting material must have the same or better yield than the conventional bare root planting material. During this project, the parameters necessary for growing planting material will be determined. The final goal is to provide existing breeders with necessary certainties and information to be able to breed organic long canes on their own. This information will be made freely available to encourage new initiatives.

Objectives achieved

The results will be communicated after the project results have been finalized. Interim findings are encouraging. The intended objective, to grow high-quality biological long canes with sufficient yield and good plant characteristics, has already been achieved. Points of attention that emerged from the first year of cultivation were followed up better in the second year, which had a major impact on working hours and crop health.



The cultivated long canes from the first year were planted in soil during the second year, both at the research centre and on several farms. In this way, organic small fruit growers could get acquainted with this type of planting material. Despite a number of attention points, most growers saw potential in the cultivated planting material. During the production follow-up at the research centre, the planting material showed clear potential.

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Funding: CCBT-project '*Hoe biologische longcanes framboos opkweken?*'
Department of Agriculture and Fisheries, Government of Flanders and
Province of Flemish Brabant (15/2/2019 - 31/12/2020)

More info: www.ccbt.be

CIMAT – development of multi-purpose robots for small farms

new

Small-scale farms are important to an accessible and sustainable food system. Yet the agricultural sector in Flanders and the Netherlands is constantly under pressure. Cost efficiency must increase to compete internationally. So far, the answer has been to increase scale, combined with the use of increasingly heavy, task-specific machinery. This is often not an option for small and medium-sized farms and growers. Rather, they are asking for small-scale and versatile agro robots. CIMAT is a new Interreg Flanders-the Netherlands project that aims to stimulate the development of such robots.

Bigger is not always better

The available agricultural land in Flanders and the Netherlands is smaller and more fragmented than in neighboring countries as Germany and France. In the quest for greater cost efficiency, the limits of scale are reached more quickly in densely populated regions. An alternative strategy to improve cost efficiency is to increase the performance of agricultural machinery. This can reduce labor costs. Agricultural machinery is getting a larger installed capacity so that the machining or processing speed increases. That trend leads to larger, more expensive and heavier machines that are task-specific.

This strategy does not offer an answer for smaller farms focusing on organic cultivation or niche crops, such as specific vegetable, (small) fruit or tree cultivation. These farms are more likely to benefit from smaller, multi-purpose, intelligent machines.

Moreover, over the last decade there has been a growing awareness that agriculture must become more sustainable. There is a strong evolution towards fully integrating agricultural activities into ecosystem management. In terms of policy, too, there is more emphasis on agriculture with a net neutral environmental impact. This contrasts with traditional agricultural mechanization, which is strongly based on the use of heavy machinery driven by powerful diesel engines.

Need for high-tech agricultural machinery

Existing crop-specific machines are expensive and have limited functionality. Many smaller machine manufacturers customize machines. But they often lack expertise and capacity to develop innovative mechatronic technologies such as Internet of Things, sensor networks, electric traction or software for autonomous, flexibly deployable machines. The development of small, multifunctional robots for small-scale farms is the goal of the Interreg project CIMAT. This project aims to accelerate the development of high-



tech agricultural machinery for small-scale farming. It is important that the modular, autonomous robot can be used for various agricultural and horticultural tasks. This can be done by linking task-specific tools to a semi-autonomous unit. By having multiple units work together on a task, the system can also be deployed on a larger scale.

Input from the sector

The project aim is to realize this development together with Flemish and Dutch farmers and machine constructors. Therefore, the partners set up a co-creative trajectory. At regular intervals, we bring together co-creation groups for a brainstorm session in which we sound out the needs and wishes of the sector. We then adjust the development of the agro robot accordingly. In this way, the prototype robot platform will be further developed in the course of the project.

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More info: www.cimat.be

AgriSus - towards more sustainability in arable farming



new

Producing sufficient and high-quality food in a changing climate while protecting natural resources and biodiversity is one of the major challenges facing agriculture today. Developing cultivation systems that provide a solution for these objectives is complex, as it requires an understanding of the interaction between the environment and the production system as well as the economic and social drivers.

Sustainable arable farming: multidisciplinary research needed!

Although current agricultural research is focusing on ways to increase sustainability, most studies are monodisciplinary: they look at specific aspects of cropping systems (e.g. crop diversification, crop rotation, biodiversity conservation and stimulation, disease and pest control, soil health). Empirical research into the functioning and sustainability of cultivation systems as a whole is lacking. However, due to the many interactions and trade-offs between the different components of a cultivation system, a systems approach is essential.

In the AgriSus project, the sustainability of a conventional and an organic production system is tested via a field trial at the Bottelare experimental farm (co-managed by University College Ghent-Ghent University). Both growing systems aim to minimize the environmental impact and external input while ensuring a qualitative and quantitative yield. In a multi-year field trial conducted at this experimental farm, the two cultivation systems, with three crop rotations in each, are compared through the monitoring of a number of sustainability factors: (i) soil fertility, (ii) diversity of beneficial organisms as well as ecosystem services and their impact on pests, diseases and weeds, (iii) climate resistance, and (iv) the qualitative and quantitative yield parameters of each system.

The essence of crop monitoring: preventive and curative support

Preventive cultivation is based on following good agricultural practices. The use of a field border as well as variety choice, soil cultivation, green cover crops, maintaining the organic matter content of the soil, crop rotation, etc. can all help maintain crop yield. To stimulate the presence of beneficial organisms, a perennial field border is planted with a combination of plants tailored to the selected arable crops (e.g. potatoes, grass-clover, winter



wheat).

During the project, the various crops are intensively monitored: soil life is mapped and diseases, pests and weeds are also intensively monitored. Research shows that integrated crop management (ICM) goes beyond curative measures. The aim of this project is therefore to be able to support the practice of good, sustainable crop management in the long term. All results will be communicated to the various target groups (growers, advisers, suppliers, education and citizens) as much as possible.

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More info: <https://www.hogent.be/onderzoekscentra/agrofoodnature/>

TRANSÆ - Transition to agroecology

The INTERREG TRANSÆ project brings together seven partners from 3 regions, namely Flanders (ILVO and Inagro), Wallonia (CRA-W and Greenotec) and Northern France (Parc naturel régional des Caps et Marais d'Opale, Université de Picardie Jules Verne, Initiatives Paysannes) in supporting some 40 pioneering farmers in their transition to agroecology. During local and interregional contact moments, knowledge about agroecological practices is exchanged and networks of partners and farmers are strengthened. The project aims to further develop and disseminate agroecological practices. TRANSÆ uses on-farm experiments and a participatory approach to support the transition to agroecology.

Experimenting with new agroecological practices

In the project, farmers are given the opportunity to experiment with innovative practices on their farms. Work is being done around 2 themes: healthy soil (through e.g. reduced tillage, green cover crops, use of wood chips, etc.) and feed autonomy in animal husbandry (optimal pasture management and production/valorization of roughage).

Agricultural advisors and researchers supervise these experiments in the field. Together with the farmers, they monitor the effect of these measures on soil life and fertility, food quality and energy availability. This generates not only knowledge, but also questions about the applicability of these practices on the farm.

The farmers in each region are united in a network, which acts as a knowledge network in which experiences, questions and solutions concerning these agroecological practices are shared. Through trans-regional training sessions and demo days, this knowledge is also shared between the three regions to a wider network of farmers interested in agroecology.

Role of the context

In addition to the knowledge about the implementation of these agroecological practices on the farm, TRANSÆ also focuses on understanding what is needed in the internal (the situation of the farmer) and external context (supporting and hindering factors) to be able to support the transition to agroecology.

For this purpose, we followed 26 participating farmers and based on a qualitative study of in-depth interviews, the farm management and trajectory followed together with their related choices was analysed. Preliminary results show the importance of a certain attitude (open,



flexible, critical,...), knowledge (system and professional knowledge) and skills (networking, eager to learn, experiment,...) that farmers need to take the leap to agroecology. In addition, it became clear which factors from the external context could be steering in taking steps towards a more agroecological management: e.g. being part of innovative networks, farm visits to colleagues, the opinion of family and neighbors, the influence of customers and crops under contract, etc.

A guidance methodology for farmers in transition to agroecology

During TRANSÆ activities, the focus is on knowledge exchange and stimulating learning processes between farmers, researchers and advisors across borders. Reflection, mobilizing different types of knowledge and conducting a joint problem-solving process makes room for a 'new frame of reference' in which new thoughts, values and norms are included that promote the transition to agroecology. The methods and tools used to promote learning during TRANSÆ activities are evaluated. This should result in a proposal of a guidance method to best support farmers in transition to agroecology.

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Funding: INTERREG France, Wallonia, Flanders, with support of the European Fund for Regional Development (2018 - 2021)

More info: <https://transae.eu/nl>

FarmLIFE - Farming the future



new

The European project FarmLIFE (Farming the Future - Building Rural Networks for Climate-Adaptive Agriculture) runs from September 2018 to August 2023. FarmLIFE aims at a transition towards climate resilient, diversified and multilayer farming systems, with a special focus on agroforestry practices. Seven partners from Flanders and the Netherlands want to work on this through pooling and sharing information, developing and demonstrating innovative adaptation strategies, and bringing together farmers, policy makers and other stakeholders. In this way, FarmLIFE aims to contribute to a climate resilient Europe.

Activities within FarmLIFE

In Flanders, an important part of the project activities lies in the organization of a series of master classes on agroforestry, covering a variety of topics at the technical, economic and legislative levels. A first series ran in 2019, a second series will run in 2020 - 2021.

Other activities within FARM LIFE can be broadly summarized as:

- **Adaptive Farm Plans**
We are developing 'adaptive farm plans' that the partner farmers involved within the project can use to develop a profitable agroforestry revenue model, adapted to their own context and conditions.
- **Co-creation**
We are developing a roadmap to effectively implement the transition envisioned, together with farmer-entrepreneurs, knowledge institutions, governments and social partners.
- **Transition toolkit**
We build a transition 'toolkit': a set of handholds and tools that can be used by farmers, policymakers and civil society actors.
- **Future transition ambassadors**
We are training a wide group of future ambassadors who can facilitate and support the transition to innovative, resilient agricultural practices. This is done through an extensive program of Masterclasses and a Master's degree program.
- **Knowledge sharing**
All already available and newly developed knowledge and information within FARM LIFE will be made widely available to anyone interested in this topic. We will make a direct link to other EU projects and develop training tools, including a Massive Open Online Course (MOOC).



- **Farmers in the driver's seat**
Together we build chain arrangements and networks within which farmers can make autonomous decisions and organize sustainable networks themselves.
- **Value creation and competitiveness**
We develop innovative agroforestry food products and marketing strategies.
- **Connection with policy**
We connect with policy makers and bring project results to their attention, at the regional and European level (the Netherlands, Flanders).

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Funding: EU LIFE + for Climate action (1/09/2018 - 31/08/2023)

More info: <https://www.agroforestryvlaanderen.be/en/>

Urban agricultural parks as innovative food landscape

completed

A consortium of ILVO and Ghent University investigated the concept of 'urban agricultural parks' as a possible step to deal with the many social, agronomic and spatial challenges of agricultural areas in urbanized regions. Agricultural parks are essentially multifunctional; a main aim is to protect open space. Agriculture is the main manager, enhanced with ecological, educational, social, recreational and other functions. Agricultural parks are related to urban structures and actors. Inspiring the (re)connection between urban cores and surrounding agricultural hinterland is one of the important focal points in urban agricultural parks. Agricultural activities and food production form the connecting 'object'.

Agricultural parks in Europe

A quick scan of 40 existing European agricultural parks and an in-depth analysis of 11 cases illustrates the wide range of possibilities and particularly the great diversity, both in terms of scale and in terms of type of agriculture, spatial characteristics, as well as types of collaborations. Some parks are only a few hectares in size, while others easily encompass several thousand hectares. Given the need for strong local embeddedness and therefore context specificity, this diversity is not surprising. Nevertheless, a number of fundamental characteristics recur, such as the presence of a strong story and clear mission, a practice of cooperation, and an embedding in the local patrimony and landscape.

The concept is a key in many European regions to protect productive agricultural land while giving it new meaning. Food production and agriculture become visible again to other actors through the assignment of an 'agricultural park' identity. It gives them their rightful place in urban life, and allows inhabitants to better understand the social relevance of food. At the same time, it provides farmers with the perspective of developing a new, broader, sustainable business model, for example, through sales close to the city, but also by providing other social services such as water storage, rest and recreation areas, landscape management, etc.

Opportunities for regionally organised and anchored food production

The generic idea is in line with the ongoing and growing societal focus on food and the related dynamics of multifunctional and urban-oriented agriculture. Agricultural parks scale up this focus and offer opportunities, but the focus is not limited to short chain, urban agriculture or 'Community Supported Agriculture' (CSA) initiatives. Agricultural parks offer opportunities for



scaling up and professionalizing existing fragmented and small-scale initiatives into a full system alternative, parallel to the existing 'industrial' agriculture and food scene. At the same time, they offer opportunities to existing professional agriculture in various ways (through new outlets, maintaining a 'license to produce', preserving fertile land, etc.). Agricultural parks relate the spatial and the agricultural story back to back. In this, they contain potential for transformations towards a more regionally-organised and anchored food production; climate resilient agricultural systems and cities; circular production and consumption; water efficiency; and soil health. Clearly, this is about transformation on more than the physical terms; it is equally (or even more) about social and mental transformations. However, it is not the latest spatial planning concept of open space policy. Urban Agricultural Parks, as an integrating concept, offer first and foremost a supportive framework for processes of social and relational innovation.

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Funding: Department of Environment, Government of Flanders (2018)

More info: <https://www.ruimtevlaanderen.be/beleidsverkenningen/OpenruimteStad>

m²-measurement gardens: An interactive measuring instrument to study biodiversity and ecosystem services!

new

The conservation and enhancement of biodiversity in agricultural landscapes is an important policy objective at global, European and national/regional levels. Therefore, in this research we want to quantify the importance of this network of semi-natural elements in the landscape by constructing "foster gardens" specifically designed to measure the effect of the (biodiversity in the) environment on the crops in the gardens.

Biodiversity under pressure

The diversity of biological life (biodiversity) in the agricultural landscape is under severe pressure. Intensification of agriculture in the recent past has led to an increased use of fertilizers and chemical pesticides on the parcel level, to an increase in scale and to the disappearance of semi-natural elements such as woody borders, hedges and rows of trees at the landscape level. Populations of animal and plant species bound to the agricultural area are therefore declining or have already disappeared. In recent years it has been demonstrated that this loss of biodiversity also affects human well-being. After all, wild animals and plants provide numerous services that are crucial for the production of food and the creation of a livable environment. Think, for example, of bees and bumblebees that are responsible for the pollination of crops, of natural enemies that help suppress pest species, and of trees and shrubs that produce wood but also help determine the character of landscapes.

Multi actor landscape approach

By actively involving users and residents of the landscape (actors) in following up the gardens we want to increase their awareness of the role they can play in strengthening biodiversity in their own environment. Ultimately we want to move from a 'one actor - one field' approach (cf. the management agreements), to a 'multi-actor landscape' approach, in which there is a sustainable and broad-based collaboration on a greener and more biodiverse agricultural landscape.

Foster gardens as observation points in the landscape

As of February 2018, 40 foster gardens have been placed in Merelbeke, Melle and Oosterzele, as it were observation points in the landscape. The whole can therefore be called a landscape observatory. These foster gardens serve as measuring points in this area. Each foster garden is exactly one square meter and is constructed in the same way according to a fixed spatial scheme and with a fixed set of about 10 crops. These are mainly vegetables, but also strawberries or raspberries. In the gardens we not only



monitor the growth, health and development of the crops, but we also take numerous other measurements. We monitor soil moisture, temperature, weed penetration, the presence of living organisms of all kinds (both pests and beneficials - pollinators, natural enemies of pests, butterflies, etc.). We use sensors, traps, etc. for this purpose and also collect a lot of photographic material. Everything is kept in a dynamic logbook.

We do not maintain the gardens alone - the idea is to involve interested local residents (actors). This not only allows us to install a large set of gardens in the landscape, these gardens are also a means to bring people together, to create awareness about agriculture, ecosystem services and biodiversity, and to generate knowledge together.

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More info: www.bel-landschap.be, www.facebook.com/BELLandschap

Gerits, F., Messely, L., Reubens, B. *et al.* A social-ecological framework and toolbox to help strengthening functional agrobiodiversity-supported ecosystem services at the landscape scale. *Ambio* (2020).

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Biodiverse fruit cultivation in a climate-resistant landscape

new

The Haspengouw fruit sector faces many challenges, both economic and ecological. Ecologically speaking, it appears that intensive fruit-growing areas are on average ecologically poor, despite more sustainable approaches such as integrated pest management. However, a climate-resistant fruit-growing landscape offers plenty of opportunities for biodiversity, erosion and landscape perception. That is why het Regionaal Landschap Haspengouw en Voeren and the pcfuit research station, as part of this project, want to promote integrated landscape care by dressing the fruit-growing landscape in Haspengouw in a climate-proof way in terms of biodiversity, erosion and landscape perception.

Opportunities: ecological and economic

Large open spaces of monoculture provide insufficient habitat for beneficial insects. As a result, pest insects have more chances to break out and cause economic damage. In pear production, for instance, the pear psyllid is more difficult to control in areas with high density of pear plantations. In isolated fields or fields surrounded by other woody plants, there is usually a better natural balance. By planting local mixed hedges with an appropriate choice of plant species, beneficial insects are attracted and fed, allowing them to build up populations and avoid outbreaks of pear leaf-feeding in nearby pear orchards. Hedging the fruit landscape therefore has a positive role in pest control. In terms of erosion control and drift reduction, hedgerows are also an asset while also providing an interesting and attractive landscape for locals and tourists alike.

Searching for the ideal mixed hedgerow

The composition of the hedge is a dynamic fact. Driven by international trade and climate change, invasive pests such as the Spotted Wing *Drosophila* (*Drosophila suzukii*) and stink bugs have emerged in recent years. Our own native bird cherry (*Prunus padus*) is proving to be an ally in combating *D. suzukii*, while certain harmful bugs may benefit from specific host plants in the mixed hedge. In this project, we will pool our knowledge and adapt the species composition in function of the changing environment.



Demonstration is the shortest route to practice

In this project, together with fruit growers, we will reinforce knowledge build-up and -transfer regarding functional agro-biodiversity, erosion and landscape perception. This can best be done by testing and demonstrating a number of measures at farm level. Only then will we know whether the measures are effective and how they fit in with farm management. That is why several demonstrations and information events are organized on these and other subjects: hedgerow planting and composition, how to stimulate earwig populations, the natural control of *D. suzukii*, measures regarding erosion control and information about point sources of pollution of crop protection products.

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Funding: PDPO Government of Flanders - EU (2020 - 2021)

More info: www.pcfruit.be, www.rlhv.be

More nature for seedy fruits through pollination by wild bees

*Bees are important pollinators of many agricultural crops and are thus a crucial link in the food production chain. In the past years, one of the prime pollinators, the honey bee (*Apis mellifera*), has suffered heavy losses. Wild or solitary bees can help the honey bees to pollinate fruit trees, as they have proven to be efficient pollinators.*

Nesting possibilities for bees

The goal of this project is to stimulate the presence of (wild) bees in fruit orchards. Therefore we investigated which bees occur in the orchard during the blossom period, which species inhabit the nest boxes, if the bees really visit the apple flowers and if – as a consequence - fruit set and pollination level are increased. Doing so, we placed nest boxes in many orchards in Belgium (and The Netherlands) in order to offer wild bees nesting possibilities. In addition, a detailed analysis of the environment is executed revealing important obstacles or opportunities for the wild bees.

Food for bees

Sufficient food for bees is extremely important for their survival. In order to provide pollen and nectar during the whole growing season, we investigate the influence of flowering plants/trees in and at the borders of fruit orchards. The impact of the increased biodiversity and pollen/nectar supply is followed up. These mitigation measures are also applied at bigger scale in the surrounding environment.

How is fruit set and pollination level?

In each orchard trees, and in particular flower clusters are marked and followed up during the season in order to get an idea of fruit set (number of fruits/number of flowers per cluster). Fruits are counted and weighted, seeds are counted as indicator of the pollination level, and the quality is determined.

Other beneficial predators against pest insects and (water) voles in fruit orchards ?

The mitigation measures for increased biodiversity also offer opportunities to other beneficial organisms in fruit orchards like natural enemies of pest insects and (water) voles (e.g. mustelids).



What is the impact of the increased biodiversity elements?

Natural population building with mason bees worked well in most orchards. Most nest boxes were fully or partially occupied after three years. However, there are large differences in the speed of population establishment: in some orchards, mason bees only found the first nest boxes in the third year. Parasitization of the nest boxes remained limited after three years. From year three onwards, the mite *Chaetodactylus osmiae* was detected in a few places, and in many places there was a clear increase in parasitism by the fly *Cacoxenus indigator*.

From the third season onwards, a positive effect was seen in fruit crops, both in apples and pears. While in apple there was no consistent effect on fruit set in the third year, the average fruit weight was clearly better in the presence of the mason bees. In pear, there was a positive effect on fruit set, average weight and fruit quality.

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Funding: Interreg V, Province of Limburg, Province of Vlaams-Brabant (2016 - 2019)

More info: www.pcfruit.be

FABulous Farmers - Farmers increase efficiency of natural resources with Functional Agro-Biodiversity

new

Functional Agro-biodiversity (FAB) is the targeted promotion of biodiversity to provide ecosystem services such as pest and disease control, pollination, soil and water quality. This offers opportunities to drastically reduce dependence on external inputs, such as fertilisers and crop protection products. Within the project, 10 FAB measures have been defined: non-inversion tillage, mixed cropping, crop rotation, green cover crops, organic matter input, adapted manure quality, forestry, hedge edge management, field margin management and physical and biological crop protection. The project partners will work with farmers, policy-makers and society to implement these measures.

Embedding FAB in practice, policy and society

The knowledge about FAB is still very fragmented and insufficiently embedded in agricultural practice, policy and society. Within the project we bring together the knowledge that exists among the partners and in the literature. During the project this will be completed with results from 12 pilot areas, spread over 5 countries (FR, NL, UK, BE and LUX). Within these pilot areas a FAB learning network is set up in which farmers exchange knowledge and experience and draw up a FAB action plan for the area.

In addition, cooperation is taking place with local actors, citizens, policymakers and chain partners in order to embed FAB more broadly in society, policy and the market. Finally, a long-term development plan will be drawn up for the continuation and expansion of the FAB learning networks after the end of the project.

Flemish pilot areas

In Flanders, two pilot areas are selected. In **Pajottenland**, under the leadership of Boerennatuur Vlaanderen, field-margin management is being implemented. Specific flower mixtures are sown to attract pollinators, but also to attract predators of harmful insects in the nearby agricultural crops. Monitoring is essential in order to gain good insights.

The activities in **the Merode** focus on a wide range of FAB measures. Hooibeekhoeve set up demonstrations on crop rotation, organic fertilization, green cover crops, adjusted manure quality and non-inversion tillage. In addition, Boerennatuur Vlaanderen also focuses on field margins and hedge borders. Besides demonstration and networking opportunities for farmers,



a citizen science project will be set up in the Merode. With the help of m²-gardens (www.bel-landschap.be/) citizens monitor biodiversity in more and less complex landscapes. Their experiences serve as a starting point for the dialogue between farmer and citizen. To further strengthen the FAB concept, a FAB landscape integration plan will be drawn up in each pilot area. In it, places and actions are defined that strengthen the FAB concept on the farmer's field. These include targeted roadside management and the choice of species when creating small landscape elements.

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Funding: Interreg North – Western Europe (2019 – 2023)

More info:

<https://www.fabulousfarmers.eu/en>;

<https://www.nweurope.eu/projects/project-search/fabulous-farmers/>;

<https://www.facebook.com/FABulousFarmers>





Robust organic production systems – Animal production

Animal welfare and health

Animal feed

Production systems

Occurrence of CAE, CL and paraTBC on organic dairy goat farms and reasons for higher paraTBC infection pressure

completed

The diseases 'caprine arthritis and encephalitis (CAE)', 'caseous lymphadenitis (CL)' and paratuberculosis (paraTBC) are the main reason why dairy goat farmers choose not to feed their lambs their own colostrum. This colostrum is very important for the newborn lambs, however, and increases their chance to grow into a robust, resilient dairy goat. These 3 infectious diseases therefore have a major impact on management in dairy goat farms. Reason enough to gain more insight into the frequency of occurrence and to make an estimate of the risk of introduction into the farms.

How important are these diseases on organic dairy goat farms in Flanders?

During spring 2018, 620 blood and milk samples were collected from 10 Flemish organic dairy goat farms to determine the seroprevalence of CAE, CL and paraTBC. The results:

CAE

- On average, per farm, 32% of the animals tested positive.
- Four farms follow a control program, so they also tested negative in this study. The other 6 had several positive animals.

paraTBC

- On average, per farm, 47% of the animals tested positive.
- Nine farms had several positive animals - on 1 farm no antibodies were found in the sampled animals.

CL

- This disease occurred only on 1 small farm, with 80% animals testing positive.

What now?

For farms with CAE prevalence < 20%, it is highly recommended to participate in a control program for CAE-free certification. Farms with a higher prevalence would need to cull too many animals. Testing all animals and continuing to breed only with negative animals and strictly separating lambs from dairy goats may be a solution here.

For farms with paraTBC, the story is more difficult. The results made it clear that paraTBC is nearly ubiquitous on infected farms. The vaccine against paraTBC was used on 7 farms. On these farms, the number of seropositive animals present was found to be higher compared to non-vaccinating farms. Although vaccine antibodies only remain detectable for about 6 months after vaccination, it seems that many animals then come back into contact



with the bacteria and produce antibodies again. The causative agent of paraTBC is therefore everywhere, even in stable dust. Contact cannot be avoided. Eradication is therefore not an obvious option.

Can a goat farmer do anything to reduce or delay contact with paraTBC bacteria?

On each farm visited, a survey was used to study possible introduction risks and reasons for a higher antibody response to paraTBC. The following listed items had a significant limiting effect on the antibody response:

- Mucking out the barn before housing a new group
- Routine disinfection after mucking out
- Purchasing as few bucks as possible from other farms
- Allowing lambs access to outdoor runs as young as possible.
- Avoiding the use of farmyard manure to fertilize grazing land
- Waiting with ParaTBC vaccination until the lamb is at least 14 days old.

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Funding: Department of Agriculture and Fisheries, Government of Flanders (1/03/2018 - 31/07/2020)

Is MAP, the causative agent of paraTBC in cattle and goats, also excreted through goat colostrum?

completed

Mycobacterium avium subsp. paratuberculosis (MAP) is the causative agent of paratuberculosis (paraTBC or Johne's disease) in large and small ruminants such as cattle and goats. ParaTBC is prevalent worldwide. In Belgian dairy cattle, seroprevalence is 16.2% (DGZ, 2020). Prevalences in goat farming are less known and interpretation of serology is difficult due to frequent vaccination. In Belgium we only know the seroprevalence on organic dairy goat farms; this was 47% in 2018. The large difference in seroprevalence between cattle and goat farms is due in part to active efforts made by the dairies that collect cow's milk. This is not done by dairies collecting goat milk. On the other hand, vaccination is frequent on goat farms but not on cattle farms. Therefore, no comparison of seroprevalences between these animal species should be made.

MAP in colostrum ...

ParaTBC is a zoonosis. Organic goat farmers are aware of this and make efforts to limit the spread of MAP on the farm. That is why they vaccinate the lambs shortly after birth and why feeding them with colostrum from the own farm is not an obvious choice. After all, it is known from the cattle industry that MAP is present in 12 - 50% of colostrum samples.

In 2018, some very good news came - the health service of the Netherlands had examined several colostrum samples from clinically ill paraTBC goats for the presence of MAP by qPCR. They could only find MAP in these colostrums in exceptional cases and certainly not in colostrum from healthy goats. This would mean that CAE- and CL-free certified farms could feed farm-grown colostrum to lambs without any worries.

Better safe than sorry ...

At the request of organic goat farmers and in collaboration with the Food Pilot of ILVO and Flanders' FOOD, 38 colostrum samples from seropositive but healthy animals originating from 4 farms were bacteriologically examined for the presence of MAP in 2019. Bacteriology is 100x more sensitive than qPCR for this bacterium. Of these samples, 4 (10.5%) were found to be MAP positive. In 2020, another 58 colostrum samples were collected from healthy animals on 6 farms. Of these samples, 7 (12%) tested positive. Of the positive samples, 7 out of 11 were from vaccinated goats.



Further research needed

These results again create uncertainty about whether or not farm-produced colostrum should be given to lambs. It is therefore necessary to seek an answer to the significance of the presence of MAP in goat colostrum. The bacterial titer is presumably very low since detection is not possible with qPCR but with bacteriological isolation. Is this titer sufficient to trigger an infection in the newborn lamb?

Goat breeders also need rapid, reliable diagnostics that can distinguish infected from uninfected colostrum samples. Trained tracking rats may be a solution here.

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Funding: Department of Agriculture and Fisheries, Government of Flanders (1/03/2018 – 31/07/2020)

The (non)sense of testing for milk in control programs for CAE-free goat farms

Caprine Arthritis and Encephalitis (CAE) is a chronic viral disease of dairy goats characterized by the occurrence of incurable pneumonia, arthritis and/or mastitis. Because of the economic and welfare impact of this disease, many goat farmers choose to eradicate it from the farm by following control programs. The programs applied in Belgium and the Netherlands are mainly based on diagnostics using blood as a biological medium in which antibodies are detected. However, taking blood is invasive for the animal as well as costly for the goat farmer because sampling must be done by a veterinarian.

Can testing be done differently?

Because milk can be considered as a non-invasive, inexpensive and easy sample to collect (by the farmer), the sensitivity and specificity of 2 commercial ELISAs (antibody detection) and a qPCR (virus detection) on matrix milk were investigated. Paired milk and blood samples from 321 dairy goats from 8 farms with a CAE history were collected during a prevalence study for CAE, paraTBC and CL.

The reliability of milk as a biological medium in CAE control programs.

The IDscreen® ELISA, when compared to results in serum, had high relative sensitivity (97%) and specificity (100%) compared to the Elitest® which scored 93% and 97%, respectively. The qPCR results are less convincing: the test was only 81% sensitive and 88% specific compared to the results on blood. qPCR is therefore not a useful diagnostic when using milk as a medium.

Can we avoid blood samples in CAE control programs?

The IDscreen® ELISA appears to be the most interesting test to apply to milk. Compared to its application to blood, it is slightly less sensitive - meaning it will miss about 3% of positive animals. In practice, when we want to check on seronegative farms to see if they remain negative, using milk as a matrix takes an additional risk of missing positive animals, with a possible spread of CAEV on the farm. Therefore, milk as a matrix is not



recommended for this objective. Milk does represent an interesting matrix on farms where we do not know the infection status or for early screening of the CAE prevalence is on the farm.

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Funding: Department of Agriculture and Fisheries, Government of Flanders (1/03/2018 - 31/07/2020)

More info: Adjadj, N.R., Vicca, J., Michiels, R., De Regge, N. 2020. (Non-) Sense of Milk Testing in Small Ruminant Lentivirus Control Programs in Goats. Comparative Analysis of Antibody Detection and Molecular Diagnosis in Blood and Milk. *Viruses* 12,3; doi:10.3990/v12010003

A healthy dry-off approach for organic dairy cows

new

The Operational Group called 'Healthy drying-off in organic cows' aims to identify ways to facilitate the drying-off process in organic dairy cows without any or with only a very limited use of antibiotics. The operational group works with the organic dairy farmers of the BioBedrijfsNetwork (BBN), as farmers learn best from practice and from colleagues. Some dairy farmers in the network already have positive experiences with minimal or no use of antibiotics in their drying-off process. Before this individual approach can be transferred to the wider group of organic dairy farmers, it must first become more transparent and be tested against scientific insights.

Starting from real-life experiences

In this operational group we start from the practical experiences with different drying-off strategies of the organic dairy farmers and map them out together. By comparing the management measures that can have an impact on udder health and documenting these with figures on antibiotic use, key figures for udder health and recent scientific insights, we want to arrive at a customized drying-off strategy for the organic dairy farming sector. This information can then also serve as a guide for converting dairy farmers in an 'organic' approach to udder health and can guide organic farms in optimizing udder health with limited antibiotic use.

Identify 'good practices'

We start from mapping the approach of two organic dairy farmers who have achieved good udder health with limited use of antibiotics and teat sealants. We will try to identify the decisive elements that lead to this good result and check this analysis against scientific literature. Based on these data, farmers in the operational group that want to work intensively on udder health are brought together, where we work out a strategy and follow up the cows' udder health during a longer period. Besides this intensive process, we also get a better idea of the situation in the entire organic dairy sector in Flanders. Farmers will be surveyed in order to map the current practices related to udder health and dry-



off strategies. Last we will document the use of antibiotics in order to be able to formulate a target for the sector for the future.

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Funding: EIP Operational group, Government of Flanders – EU (12/2019 - 12/2021)



Europees Landbouwfonds
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Determining suitable planting as shelter for animals at pasture



new

The 'Weidescherm' (Pasture shelter) project aims to determine adequate planting as shelter for animals kept outdoors. A growing part of the population pays attention to animal welfare and a natural environment is perceived as being part of this. In addition, our climate is becoming more extreme. In Flanders, more and longer periods of drought and heat are expected. BOS+ and ILVO were asked Dierwelzijn Vlaanderen (Animal Welfare in Flanders) to investigate how the welfare of cattle, sheep and horses can be guaranteed while at pasture.

State of the art

The project starts with a literature study to investigate the effect of extreme weather conditions on the welfare of outdoor animals as well as their preferences for shelter, microclimate or feed value and which tree and shrub species are less suitable or even toxic. Because not all trees tolerate the open conditions of a meadow equally well (e.g. wind or trampling by cattle), we also include this aspect in our research. We also discuss which characteristics of tree species influence their effectiveness as shelters, such as growth rate. We also summarize the relevant legislation and subsidy possibilities. Practical information sheets inform farmers about construction and management of various types of natural shelter (wood edges, hedges, orchards, etc.). Finally, site visits to 10 users will reveal how the farmers perceive reality of this application on the farm, including any advantages, disadvantages, bottlenecks and future needs.

Online tool

During the project, a new user-friendly module will be built for the 'Agroforestry Planner', an online decision support tool aimed at supporting farmers in making an appropriate tree species selection and planting design. Input from the literature review and field experiences is used to develop that tool. The Belgian Soil Service (*Bodemkundige Dienst*) is responsible for the technical development of this new software module.



The resulting knowledge will be widely disseminated by means of an attractive brochure and five interactive informational meetings at provincial level. In addition, other communication channels will be used to publicize the results, such as the platform website of Agroforestry Flanders, the *Rundveeloket* (Cattle Information Center), newsletters, the agricultural press and the Living Lab for agro-ecology and organic agriculture (LLAEBIO).

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Funding: Dierenwelzijn Vlaanderen ('Animal welfare service of the Government of Flanders') (2020 - 2022)

More info: www.agroforestryvlaanderen.be/NL/Projecten/Weidescherm

PPILOW: Welfare in organic and free-range systems with poultry and pigs



new

The PPILOW project, a collaboration of 23 partner institutes from 9 European countries, aims to improve the welfare of poultry and pigs in organic and free-range farms by using innovative techniques and methods. In Flanders, ILVO and BioForum are project partners.

Innovative solutions for animal welfare

In the first phase, the most important problems and bottlenecks regarding animal welfare were identified, both through literature research and by surveying farmers. In Flanders, BioForum was responsible for the input from the field. For pigs, castration emerged as the main problem and for laying hens, worm infections and the design and use of the outdoor area were the main bottlenecks. This phase was completed in the summer of 2020 and the results will be used to further develop the innovations that will be tested.

Co-creation

To ensure that farmers benefit from the project as well, close cooperation with farmers and other stakeholders is built into every step. For this purpose, BioForum has set up the so-called 'National Practitioner Groups', in which, depending on the topic under discussion, will ensure consultation with all stakeholders. These NPGs also provide feedback on the results of the other work packages in the project.

Picking larvae in the free range area

ILVO is responsible for testing a number of strategies to increase welfare in laying hens. Among others, ways to stimulate outdoor use by laying hens are investigated. Research shows that they often do not use all the space they are given and stay relatively close to the house. To see how the hens use the runs, a tracking system is used that provides information about the location of individual hens. One of the things that will be investigated is the effect of an environment enriched with larvae. The hens are given live larvae from automated feeders that open when they step on them, but the trays are moved regularly, requiring the hens to explore the outdoor run to find the larvae again. This may encourage the hens to venture further into the run.



Farmers assess animal welfare themselves

ILVO also collaborated on the development of an app for both pigs and poultry that allows livestock farmers themselves to assess the welfare of their animals in organic free-range farms. Those apps contain questions about health, nutrition, housing and behaviour. After performing a welfare scan with the app, livestock farmers not only receive automated feedback on their results, but they can also compare those results with those of other livestock farmers using the app. The use of such an app could potentially cause livestock farmers to look at their animals differently and perhaps pick up earlier signs of welfare problems that occur. The actual welfare effect of the use of these apps by livestock farmers will be investigated by following up pig and broiler farmers in Belgium, the Netherlands and France who will use the app for 2 years. This will make it possible to monitor whether the scores of these farmers improve when the app is used over a longer period.

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Funding: EU Horizon 2020 work programme (grant agreement n° 816172) (2019 - 2024)

More info: www.ppilow.eu

Early-life and outdoor enrichment for organic laying hens



new

In June 2020, the first of two experimental rounds involving free-range laying hens of the ChickenStress and PPILOW projects got underway at ILVO. ILVO's work on ChickenStress focuses on improving laying hen welfare via housing and early-life conditions, while our work within PPILOW is to mitigate injurious pecking in organic flocks (i.e., with intact beaks). To that end, novel early-life and laying-period management practices are evaluated for their effects on reducing stress, fearfulness, injurious pecking, and increased range use in organic laying hens.

Early life paves the way for later behavior

It is well established that the early-life environment is critical for determining how animals behave in later life. In the context of maladaptive behaviours such as injurious pecking in fowl, this period has been shown to be of particular importance. One example is the provision of adequate foraging substrate during chick rearing, which helps prevent the development of injurious pecking tendencies. Enrichment of the rearing environment can also have beneficial effects, not just for mitigating the development of injurious pecking, but in reducing stress and fearfulness. Furthermore, the environment of the chicks before hatching (during incubation) also plays a role as they are still early in their development. A pilot study showed the potential benefits with respect to injurious pecking and stress responsiveness of incubating the eggs in a light-dark cycle, particularly in green light, rather than in constant darkness.

As such, the layers in this experiment were subjected to early-life treatments of this kind – incubation in a light-dark cycle using green light and enrichment of rearing pens with black soldier fly larvae provided in small dispensers at partner institutions. The pullets were then transferred to the experimental free-range poultry facility at ILVO, where they are being followed for a year-long laying phase (and repeated in a second round next year), as well as subjected to a range enrichment treatment. It is hoped that these early-life treatments will decrease the likelihood of the development of injurious pecking during rearing and adulthood, and will decrease stress responsiveness and fearfulness.

Encouraging better use of the range

Commercial flocks of organic and free-range poultry commonly avoid to use the full range available. At any given time, only a very small proportion of the flock will be outdoors, while those that do venture outside tend to stay close to the house. Poor range use is a risk factor for injurious pecking (negative welfare impact). A large part of the benefit of free-range systems



lies in the positive welfare potential. Therefore, addressing the issue of poor range use should increase animal welfare by both reducing negative welfare and increasing positive welfare.

The experimental hens are housed in mobile poultry stables, with each group having access to an approximately 21m x 88m outdoor run divided into roughly two halves based on two types of vegetation – a more open area containing hazel trees, and an area of denser vegetation with short rotation coppice of willow.

To encourage greater range use, black soldier fly larvae are provided to some of the hens outdoors in biosecure operant feeders. It is hoped that the presence of larvae will result in more regular visits by more individuals to the farther reaches of the range. Range use will be monitored with an ultra-wideband-based animal tracking system and wearable that have been developed in collaboration with local companies. Such a system will allow us to track range use in more detail than has previously been done.

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More info: www.chickenstress.eu

www.ppilow.eu

FreeBirds – Focus on health and environmental issues in free-range chickens

*In an outdoor run, laying hens come into contact with the eggs of parasites, such as of the roundworm *Ascaridia galli*. When hens use more square meters of the run, they have fewer worm infections. This was shown by previous research on more than 100 organic farms in eight European countries. To date, it is difficult to track individual chickens in a flock. The outdoor area use of individual animals is therefore difficult to record. When more is known about why there is variation in outdoor run use, this can be taken into account in the design of the run or the management of the animals. Within the CORE Organic project Freebirds, the ILVO collaborates with European researchers to study the use of free-range areas by individual chickens and to link this to welfare, production and environmental impact.*

Relationships between outdoor use, well-being, health, and performance

The FreeBirds project has the overall goal of generating more insights into the relationship between the use of the outdoor run by chickens (broilers and layers) and their health, performance and welfare, as well as the impact on the nutrient load of the soil in the free-range area.

In doing so, the partners within the project are focusing on:

- comparing different patterns of outdoor animal use using an innovative automatic tracking system. It concerns an Ultra-Wide Band (UWB) system in which the position of animals with a tag can be followed very closely. This makes it possible to relate the use of the outdoor runs to the occurrence of specific welfare problems at the level of the individual hen.
- investigating the relationship between the use of the outdoor area and parasite infections in organic laying hens, and between the use of the outdoor area and the intestinal health of broilers. In the Netherlands, the project partner investigates whether the presence of plants, tillage and/or the disinfecting effect of the sun have an influence on the number of worm eggs in the soil of the run.
- determining the environmental impact of nutrients from manure on the soil of the outdoor run.
- evaluating the suitability of different breeds for meat or egg production in terms of behavior, health, performance and welfare. In Denmark and Poland, the extent to which laying hen breeds differ in their use of the outdoor run is being examined.

The research is conducted in the different countries on both commercial and experimental farms.



In addition, the project aims to formulate management strategies for improving the use of outdoor runs in organic production systems. By increasing farmers' awareness of the relationship between their management system and the health, welfare and performance of their animals, the project aims to contribute to more sustainable organic poultry production in the long term.

Rearing and animal welfare

As part of the project, rearing conditions are examined at the ILVO trial farm. We investigate whether shelter possibilities in the rearing house, which should offer a comparable safe feeling as a mother hen, lead to less fear in young hens. The idea is that if young hens are less fearful, they will be more willing to go outside later. Groups of hens were reared with and without so-called 'dark brooders', and then tested to see if this has an effect on fearfulness, outdoor use and feather pecking later in life. Outdoor area use of individual hens was also related to welfare indicators, such as plumage damage, leg problems or breastbone fractures. Parasite infection pressure and nutrient concentrations at different locations in the outdoor were related to the frequency hens were present at these locations. Finally, it was tested how outcrop use is affected by shelter type (short rotation wood vs. hazels), age of the birds, and weather conditions.

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Funding: own funds ILVO within COREOrganic Cofund ERAnet (2018 - 2021)

More info: <https://projects.au.dk/en/coreorganiccofund/core-organic-cofund-projects/freebirds/>

Tools in prevention and control of worm infections in organic laying hens



new

Worm infections are common in (organic) laying hen farming. In Flanders, flubendazole is often (sometimes even systematically) used to control such infections in chickens. In other countries (e.g. Sweden), but also in Wallonia, flubendazole is hardly used and there are no major problems concerning worm infections. Therefore, it seems that it is possible to control worm infections with less medication. The basic principle of organic poultry farming is to raise healthy chickens with minimal use of medication. Therefore, this project aims to search for possible alternatives with regard to prevention and control of worm infections in organic laying hens. The ultimate goal is to reduce the use of flubendazole in organic poultry farming without compromising technical performance.

Alternative methods to control worm pressure

The PREBEBIOLEG project aims to help organic layer farmers to make informed choices about worm problems on their farms. It is crucial to keep the worm pressure on the farm as low as possible. Often a worm treatment with flubendazole is applied without knowing the exact worm pressure on the farm. During the project, ILVO and partner Bioforum will draw up 'Standard Operating Procedures' (SOPs) that can help the organic layer farmer. For example, an SOP will be drafted on monitoring and diagnostics in which it will be clearly described how one can find out the worm pressure on the farm. Questions like 'what do I need to pay attention to in order to deliver a good sample that determines the worm pressure?' or 'how do I interpret a lab analysis?' will certainly be dealt with. Besides the SOPs on monitoring and diagnostics, SOPs will also be drawn up on prevention, introduction and control.

Combining scientific knowledge with practical experience

In order to produce these SOPs, ILVO and Bioforum will combine scientific knowledge with practical experience. Joining (scientific) knowledge with practical experience of organic poultry farmers in e.g. focus groups leads to increased knowledge exchange. Sector participation is very important in this project. By involving the sector from the beginning, ILVO and Bioforum hope to achieve a large support base for this issue. The SOPs will also be carried out on a practical organic layer farm. In this way any gaps will be identified, but it will also be possible to check whether the SOPs are effective and above all practically feasible. One overarching goal is to keep the farmer's workload to a minimum.



Dissemination of information through various channels

The practice-oriented SOPs will be made available free of charge via the Pluimveeloket (Poultry Information Center), Bioforum and CCBT, among others. The aim of this project is to reduce the use of flubendazole without having to compromise on technical results.

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Funding: CCBT-project '*Alternatieve beheersingsmethoden ter preventie en bestrijding van worminfecties bij biologische leghennen*', '*Alternative control methods to prevent and control worm infection in organic laying hens*', Department of Agriculture and Fisheries, Government of Flanders (2020 - 2021)

More info: www.ilvo.vlaanderen.be, www.pluimveeloket.be

EKOPTI – Optimize protein use in the cow for cost-effective reduction of N and P excretions to the environment

new

The Ekopti project aims to increase the efficiency of how cattle use feed protein. Specifically, we focus on improving the protein quality of farm-grown feeds, developing protein-saving feeding strategies through precision feeding, and improving feed efficiency and protein utilization by optimizing rumen functioning. At the same time, we investigate the most cost-effective ways to reduce nitrogen and phosphorus excretions and emissions to the environment.

Investing in grass quality

The basic ration for cattle consists largely of home-grown roughage. When the supply of nutrients through the forage can be increased and optimized, less concentrates are needed to cover the cow's needs. Grass, clover and grass silage are protein-rich roughages, but yield and (protein) quality can vary greatly between farms depending on growing conditions and harvesting and storage conditions. Often, grass silages have a very high crude protein content, but with an average rumen degradable protein (RDP) content. These silages contain a lot of unstable protein that is poorly utilized in the rumen, resulting in more ammonia emission and nitrate leaching. In Ekopti, we investigate how factors such as growth stage, mowing time, sugar and dry matter content can boost the RDP content of the grass silage. In addition, we specifically investigate how autumn grass (characterized by low dry matter content, high protein but low sugar content) can be better valorized by using silage additives or by pre-drying the grass.

Investing in local protein-rich crops

Leguminous crops such as field bean, pea and lupine are protein-rich crops and are also interesting because of their ability to fix nitrogen from the air. However, the protein consists of a high proportion of unstable protein that is largely broken down in the rumen and is thus not optimally utilized. Research has shown that the resistance of the protein can be increased by protection processes (e.g. heating with lignocellulose) or toasting, but more practical research is needed to assess the consequences for animal performance and the economic picture. Within this project we bring together knowledge and expertise in a case on the farm of organic dairy farmer Johan Boussemaere,



where field beans as such or toasted are incorporated in the ration. The feed value of the untreated and toasted field beans will be determined through chemical analysis and rumen incubations.

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More info: www.ilvo.vlaanderen.be

AgroMeatsNature - Agriculture with an eye for nature goals

completed

In Flanders, there is competition for scarce open space between agricultural production and nature goals, which sometimes results in conflicts between the two. The AgroMeatsNature project uses a case study in a concrete project area in Berlare - Zele - Lokeren to examine whether grasslands in nature reserves can be used by cattle farms and to what extent extensive grazing can be a win-win for agriculture and nature.

Ecological targets

In the ecology working group, farmers and nature managers discussed together how nature management can be combined with grazing and mowing management. Samples of grasslands in the project area were taken and the nutritional value of herb-rich grasslands was investigated as well as whether herb-rich grasslands can have health-promoting effects through extra input of minerals, as well as which breeds of cattle are most suitable for extensive grazing. A survey gauged the motivation of farmers to engage in nature management and the bottlenecks they experience in doing so.

Economic targets

The working group on economics focused on the profitability of extensive meat production and value creation for meat from valley farming and herb-rich grassland. The results of the case showed that incorporating extensive grassland into a milk or meat ration is possible to a certain extent, without having a negative impact on the economic results. However, the costs for farmers to manage such fields are higher than previously estimated. In comparison to common grassland economic losses were observed. The project partners advocate compensation for the nature management by farmers. The arguments are both the currently very small margins in the sale of meat or milk from nature management and the additional governmental costs if nature is managed separate from agriculture. The establishment of a label for nature meat with the aim of still getting sufficient added value from the market proved not to be easy and has only limited support from farmers.



Finally, a good understanding and dialogue between farmers and nature managers is essential to achieve a qualitative and sustainable working relationship.

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More info: <https://oost-vlaanderen.be/wonen-en-leven/publicaties/brochure-kwaliteitsvlees-uit-kruidenrijk-grasland.html>

Optimisation of energy crops: demand for resistant starch in rations



new

When drawing up the cropping plan in organic livestock farming, priorities are soil fertility and in particular the build-up of organic matter and the fixation of nitrogen through leguminous plants. As a result, the cropping plan contains a large proportion of grass-clover and a limited presence of silage maize. Many farms that do not have maize in the crop rotation experience a shortage of resistant starch in the ration that is mainly found in the starch of maize grains. However, many farms experience difficulties in growing maize. Weed control is the main bottleneck in an organic production. Furthermore, the variety availability of organic maize seed is fairly limited and, to date, no variety trials have been carried out in Flanders on organic silage maize. Organic maize cultivation has a number of bottlenecks that we want to address in this project. In addition, we are exploring the cultivation of sorghum, which has a similar type of starch as maize.

Maize varieties and sowing date

Typically, organic maize is sown later than conventional maize, with the intention of achieving faster youth growth and better weed suppression in warmer conditions. At the same time, organic farmers prefer not to harvest too late in the autumn to avoid structural damage in wet conditions and to be able to sow a grass-clover crop if necessary. From the range of organic maize varieties, 4 varieties were selected with a different FAO number which is an indication of earliness. Ultra early varieties have an FAO number <170, very early varieties from 170 to 200, and early varieties from 200 to 230. These varieties were sown at 4 different times.

Seed treatment maize and sowing depth

Bird damage is a major problem in organic maize cultivation. In Wallonia the product Vitam'sure, based on plant extracts and essential oils, is sometimes used to reduce bird damage. In addition, deeper sowing could also reduce bird damage. The first rough figures already clearly indicate that there were hardly any differences between the different seed treatments, and sowing depth in particular had a protective effect on bird damage.



Sorghum varieties

Sorghum, a new crop in our regions, can replace maize in the cropping plan and in the ration of ruminants. The crop potentially has some advantages over maize, such as better drought tolerance due to a more extensive root system. This also benefits the organic matter build-up in the soil. A screening of some commercially available varieties is done comparing yields and feed value with maize. Among the sorghum varieties we distinguish the starch types (*Sorghum bicolor*), the structure types (*Sorghum sudanese*) and the hybrid types (*Sorghum bicolor* x *sudanese*). Whereas the starch types are shorter plants with a well-developed seed panicle, the structure types grow very tall and mainly produce a lot of (green) biomass.

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Funding: CCBT project '*Optimalisatie energieteelten voor een evenwichtig herkauwerrantsoen*', '*Optimisation of energy crops for a balanced ruminant ration*', Department of Agriculture and Fisheries, Government of Flanders (1/02/2018 - 31/12/2020)

KUILEG – Ensiling of moist legumes and cereals for organic laying hens

As of 2018, organic poultry farmers are legally required to use 100% organic and regional feed. The search for regional protein sources as an alternative to today's conventional protein sources is therefore of utmost importance. From previous research, it seems that field beans and peas can fill this role. However, the presence of anti-nutritional factors (ANF) such as tannins and glycosides (degradation product of vicin and convicin), together with low ileal digestibility of methionine and cysteine make that field beans are only used to a limited extent in poultry rations. The 'KUILEG' project is looking into how more use can be made of field beans in poultry rations.

Mixed crops of moist legumes (pulses)

In the summer and winter of 2017-2018, different varieties of field beans were sown in the KUILEG project in combination with either winter wheat, triticale, spring wheat or oats. Based on various parameters, it was decided to keep the field bean Axel in combination with triticale as the winter mixed crop and the combination of field bean Tiffany with spring wheat as the summer mixed crop in a new trial. The choice for these mixed crops was not only based on the yield in the field, but also on the quality of the silage and its nutritional value. Also the presence of the anti-nutritional factors (ANF) vicin and convicin in these mixed crops and especially their (possible) reduction after ensiling played a role. For the new trial, the winter mixed crop Axel+triticale was sown in the winter of 2018 on an organic farm. The summer crop Tiffany+summer wheat was sown in the spring of 2019 on the Inagro fields. Both mixed crops had a good yield.

Ensiling to reduce anti-nutritional factors vicin and convicin

After harvesting the mixed crops, they were ensiled without additives for a period of 90 days. At the same time, Axel field beans (field beans only) were ensiled under the same conditions as the mixed crop, for a period of 90 days. Also during this second trial, the ensiling proved to be a successful technique to reduce the ANFs vicine and convicine and this without negatively influencing the quality or the nutritional value of these silages.

Use of field beans in laying hen feed?

Early 2020, a digestion trial was carried out at ILVO to determine the nutritional value of the silage for laying hens. Shortly afterwards, a performance trial with laying hens was conducted (also at ILVO) in which



the laying hens were subjected to one of the following 5 treatments: either they received a control feed (in accordance with the organic legislation and with 5% soya in it) or they received one of the four feeds without soya, but with field beans as a source of protein. These four feeds contained either the dry Axel field beans (not ensiled), or the ensiled Axel field beans, or a ensiled winter mixed crop Axel+triticale, or a ensiled summer mixed crop Tiffany+summer wheat.

The laying hens that received the ensiled mixed crop (both summer and winter mixed crop) performed as well as the laying hens that received the control feed. The laying hens that received dry field beans or the silage of field beans only, performed less well than the other laying hens.

Results show that mixed field bean silage can be used as an alternative source of protein for organic layers.

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More info: www.ilvo.vlaanderen.be, www.pluimveeloket.be

OPTIPLUIM – Optimal cultivation of protein crops for poultry feed



new

The search for alternative (local) sources of protein that can be mixed in poultry feed continues. The use of imported soya from overseas is far from sustainable. Via the 4-year VLAIO-project OPTIPLUIM, the partners ILVO, Inagro and the experimental farm at Bottelare (University College Ghent/ Ghent University) want to provide Flemish arable farmers, poultry farmers and the feed industry with tools for the use of locally cultivated protein-rich leguminous crops, both for organic and for conventional agriculture.

Anti-nutritional factors are problematic for use in poultry

The disadvantage of leguminous crops is that they contain anti-nutritional factors (ANF) which hinders their use for monogastric animals (such as poultry) due to adverse effects on performance. In a previous research project ('KUILEG - Ensiling moist legume and cereal crops for organic laying hens'), it was demonstrated that ensiling moist legume and cereal crops was a successful processing technique to reduce these ANF. However, more in-depth knowledge is needed. Furthermore, OPTIPLUIM aims to provide solutions for poultry in all production systems (both organic and conventional).

Processing of mixed crops and possibility of use in chickens

There is a need to match the processing of the mixed crop harvest with its use in laying hens and broilers. The valorization of the crop residues will also be addressed in the project. This fiber-rich material could possibly provide a second source of protein after aerobic degradation by white rot fungi. In the context of a 'zero waste' story, this can certainly mean added value. Apart from the cultivation technique and the processing of the harvest, OPTIPLUIM also wants to determine whether there are interactions between the use of alternative protein sources and the quality of the animal end products or the nitrogen excretion by the poultry.

Is it a sustainable solution?

Finally, OPTIPLUIM wants to demonstrate that the use of locally produced leguminous crops is more sustainable compared to soybean (whether locally produced or not) through sustainability analyses.



OPTIPLUIM will implement improvement strategies and advice on the use of leguminous crops for both arable and poultry farming

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More info: www.ilvo.vlaanderen.be, www.pluimveeloket.be

Insects as enrichment for organic chickens



new

Consumers are increasingly aware of the origin of the products in their shopping cart. The sustainability of meat is being questioned and violations of animal welfare are leading to public outrage. Consumers are also attaching more and more importance to healthy, tasty and natural products. Worldwide, chicken meat is one of the most consumed food products of animal origin. The new Poultrysect project aims to capitalize on these trends. The consortium wants to put insects back on the menu of chickens. Feeding insect larvae to organic chickens could improve the health and welfare of the animals. It would also improve the quality and taste of the chicken.

Organic broiler chickens love to eat live insects

When chickens cannot engage in natural behaviors, the risk of mutual aggression and feather pecking rises. There are already several rules designed to improve the welfare of organic chickens. For example, slow-growing breeds are chosen that are only slaughtered after 71 days, while non-organic commercial broilers are slaughtered after 42 days. A maximum of 10 animals per m² may be housed and they must have access to an outdoor run. Insects are part of the natural diet of poultry. Chickens living outdoors are naturally fond of insects and spend about 35% of their time looking for and eating them. Feeding chickens live insects therefore not only provides nutrients but also stimulates their natural behaviour.

Black soldier fly larvae show the most potential

By far the most popular insect species for processing residual flows is the larvae of the black soldier fly. They can feed on organic material such as plant residues and by-products from the food industry. Thanks to their high protein and calcium concentration, the larvae are suitable for animal feed. In Europe, there are already numerous breeders, from hobby farmers to professional growers with a highly industrialized process. Research relating to this species has been growing rapidly in recent years. For example, a number of studies have been carried out into the influence on the animal welfare of chickens by feeding them live larvae. The results were positive.



Are insects as organic feed possible?

Currently, there is no European framework for organic insects. This is a stumbling block for the organic sector, as organic chickens can only be fed with organic feed. IPIFF, the interest group for European insect breeders, is aware of the need for a clear framework for organic insects and is currently working on this. The Poultrysect project also wants to contribute to this. An international team of scientists with expertise in agronomy, poultry nutrition, entomology, food and veterinary science will work together on this project. By processing organic residual streams with the help of black soldier fly larvae and then feeding them live to organic broiler chickens, the partners of Poultrysect want to improve the sustainability and animal welfare of the chicken industry.

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Funding: ERA-nets SUSFOOD2-CORE ORGANIC Co-fund joint call, Flemish partner: Department of Agriculture and Fisheries, Government of Flanders (1/11/2020 - 31/10/2023)

Together towards an optimal weaning feed composition for organic piglets



new

Why do organic piglets, despite their higher weaning age, eat less well around weaning than conventional piglets? And how can we formulate and produce organic weaning feed so that it is better absorbed by the piglets, taking into account the nutrient needs of organic piglets and within a certain price range? These are questions that ILVO, Varkensloket, organic pig farmers, Ghent University, CCBT, Bioforum and Molens Dedobbeleer are working on within the operational group BioBIG.

Feed composition and management: both important for optimal weaning

Disease prevention in organic production is even more important than in conventional production due to the limited use of antimicrobials. The weaning process must therefore be handled with care. Despite the higher weaning age of at least 40 days, several organic pig farmers and feed manufacturers indicate that piglets absorb insufficient feed even before and shortly after weaning, making them more susceptible to weaning diarrhea. Moreover, in organic production, no pure amino acids may be added to the feed, which causes the proportion of protein in organic weaning feeds to often be higher than in conventional practice feeds. The insufficient feed intake and the higher proportion of crude protein in the weaning feed make the piglets more susceptible to intestinal infections.

The objective of the operational group, which was established after a concrete question was posed to the *Varkensloket*, (Pig Information Center), is to exchange knowledge and experiences in order to optimize the feed strategy and weaning feed composition so that organic pig farmers can wean their piglets more efficiently. Think for example of a higher health status, better technical performance and lower feed costs. During the project it soon became apparent that in addition to the feed composition, other aspects such as housing, hygiene and general management are extremely important and must not be overlooked within an optimal weaning process.

Strategies to optimize weaning feed composition and palatability

The operational group inventories various approaches to optimize the composition and palatability of organic weaning feeds. The relevant (practical) knowledge and results from international (organic) research on the feeding strategy are combined. The adapted formulated and produced feeds will be used during practical trials at the participating pig farmers.



A survey maps the success factors and critical points of weaning management

In addition to optimizing the weaning food composition and strategy, the critical points and success factors of weaning management on organic farms are mapped out via a survey among Flemish, Walloon and Dutch organic pig farmers.

By applying concrete improvement trajectories concerning the weaning feed composition and by addressing the critical factors in their weaning management, organic pig farmers should be able to wean their piglets more efficiently. The main recommendations will be compiled in a practice-oriented booklet.

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Funding: EIP Operational group, Government of Flanders – EU and Molens Dedobbeleer (2019 - 2020)

More info: www.varkensloket.be



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OPTISPEEN - Optimal feeding strategy of sows and piglets in the farrowing pen



new

In both conventional and organic sow husbandry, it is crucial that piglets learn to ingest solid feed during the lactation period. This not only improves feed intake and performance after weaning, but also stimulates intestinal development, resulting in fewer digestive problems shortly after weaning. A smooth feed intake both before and after weaning results in fewer digestive problems and diarrhea during the weaning period and in the following weeks. The aim of the CCBT project OPTISPEEN is to optimize the overall feeding strategy in the farrowing house of sows and piglets in organic pig farming with the aim of weaning piglets smoothly without weaning dip.

Tasty roughage as an alternative

Conventional pig farming often uses specific feeds for piglets in the farrowing pen that are made extra attractive by adding flavour and aromas. However, the results of this are variable and the feasibility of such feeds for organic pig farming is not very realistic. Therefore, in this project we investigate whether an alternative can be offered by offering roughage and/or silage substitutes to both lactating sows and suckling piglets.

On an organic pig farm, 20% of the feed must come from either the farm itself or from a farm in the region. By using silage roughage in the rations of both pregnant and lactating sows and weaned piglets, this requirement can easily be met. Therefore, within the project we are investigating the most suitable roughage that can be grown (or purchased) and fed to lactating sows and weaned piglets. In addition to the choice of the crop, a choice will also have to be made about harvesting time and storage form (e.g. dry or dough ready grain or as whole plant silage). Within this project, we pay attention not only to the classical roughages such as grass, grass-clover, alfalfa and maize silage, but we will also look at moisture-rich concentrate substitutes such as silage mixtures of pasture-ready grain with peas and/or field beans.

Through a literature review we will bring into focus the current practices and innovations regarding feed and roughage produced on farm in European organic and conventional pig farms. In addition, some pig farmers who are already using roughage for sows and piglets today, will be interviewed in order to make an inventory of the advantages and disadvantages. This literature study, supplemented with practical examples, is the basis for a discussion with the Flemish organic pig farmers. The results of this literature study will also be tested against the results of the operational group BioBIG,



where the focus is mainly on the composition of a balanced weaning feed for organic piglets using the raw materials available for organic pig farming. Next, a number of samples of potentially interesting roughages will be collected and a feed value analysis will be performed in order to get a first insight into the nutritional quality of the available organic roughages in Flanders suitable for sows and piglets. Based on this analysis, we will select 3 silage roughage products that will be tested in a practical trial.

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Funding: CCBT project 'OPTISPEEN', Department of Agriculture and Fisheries, Government of Flanders (2020 - 2021)

Toasting field beans for better nutritional value

new

In the cropping plan of many organic livestock farmers, mixed crops such as triticale with field beans are a regular feature and provide an increase in the farm's own protein. However, part of the protein from grass clover and field beans is unstable and is quickly broken down in the rumen. If this protein cannot be used fast enough to make microbial protein it is lost in the form of urea through urine, manure and milk. If the protein is made more resistant it is better utilized and less supply of soybean meal is needed. By giving field beans a heat treatment (toasting), less protein is broken down in the rumen.

In 2019, a French mobile toaster was brought to Flanders and a mixture of triticale and field beans was toasted. The impact on feed value was analyzed and milk production was monitored at three organic dairy farms when soybean flakes were partially replaced with toasted field beans.

Effect on nutritional value

Using the 'in sacco' method, a digestion trial in cows, the feed value and degradation characteristics of the toasted seeds were determined. This determination allowed to determine accurate feed values that can be used in ration calculation Table.

Table: nutritional values determined via 'in sacco' digestion trials from field beans and triticale, either toasted or not

	CP g/kg DM	%BRE %RCP	RCP g/ kg DM	RDP g/ kg DM	STARCH g/kg DM	% RSTARCH	FOM g/ kg DM	FUM
Field beans	301	27	116	134	375	36.6	625	1171
Field beans toasted	297	45	69	184	396	47.0	523	1171
Triticale	135	21	-16	100	597	9.6	797	1237
Triticale toasted	139	63	-50	147	600	30.2	614	1237

From this we can see that by increasing the percentage of resistant crude protein (%RCP) we get a 38% increase in RDP value, and at the same time a decrease in RCP. From the results we also learn that the RDP value of grain increases. However, what may be of interest in a ruminant ration is the increase in the percentage of resistant starch (%RSTARCH). Since starch from triticale breaks down quickly in the rumen, there is a chance of rumen acidification when larger amounts of grain are fed. However, toasting



increases the amount of resistant starch, starch which is therefore no longer broken down in the rumen so that more grain can be fed. With these feed values in hand, the toasted products were tested in a feed trial on practical farms.

Practice trials

A total of 4 trials were conducted on the three organic dairy farms where a ration of toasted field beans was fed for about 3 weeks and then compared to animal performance during a period without or with less toasted field beans. In all four trials, replacing soybean meal with toasted field beans resulted in a decrease in feed cost while milk production remained nearly the same. This increased the feed balance (=milk yields - fodder cost) everywhere. On an annual basis, depending on the results of the four trials, this yields savings of 13 to 34 tons of soybean meal and a profit of €6,000 to €21,000 for a farm with 100 dairy cows.

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Funding: CCBT project 'toasting of leguminous plants for improved feed value', Department of Agriculture and Fisheries, Government of Flanders in cooperation with the VLAIO LA trajectory EKOPTI (Optimizing protein in the cow, Agency for Innovation and Entrepreneurship, Government of Flanders (15/2/2019 - 31/12/2020)

Drought-resistant mowing mixtures



new

Dry summers are detrimental to the roughage stock as well as its nutritional value. In recent years, we have frequently experienced dry periods which resulted in the yield of one or more cuts remaining below expectations. Also in 2020, with the exception of June, the amount of precipitation throughout the growing season remained below the annual average. Climate researchers predict even more dry summers in the future due to global warming. In a normal year, mowing fields with ryegrass and red clover give good yields with a high nutritional value, but in a dry year other mixtures may be more appropriate.

Searching for drought tolerant species

In the search for drought-tolerant species to expand grass-clover mixtures, species such as alfalfa, cock's foot and tall fescue come to the fore, as well as less common crops such as chicory or narrow leaf plantain. Alfalfa, for example, offers more yield potential in dry periods due to its deep taproot. In Flanders, alfalfa is not as commonly used as red clover. French research shows that mixed crops of alfalfa with a grass component generally yield better than pure alfalfa. But herb-rich grassland also offers prospects. In the Netherlands, very good results were obtained last year with mixtures containing narrow leaf plantain, a plant that proved to be quite unaffected by the dry conditions.

Comparing mowing mixtures

At the start of the project, a number of mixtures were chosen based on a literature study and trial results from neighboring countries. These mixes have the potential for a higher yield in dry years as well as a good yield in a 'normal' year compared to grass/red clover. We want to select the best grass components in combination with alfalfa where a compromise must be struck between nutritional value and yield potential in dry conditions. Herb-rich mixtures are also selected to compare with the standard grass-clover mixtures. With the 10 selected mixtures, a multi-year comparative trial was set up on a field plot. Besides the reference grass-clover mixture, 6 commercial mixtures were sown with different proportions of grasses, clover, alfalfa and herbs. These are compared to a monoculture of alfalfa and mixed crops of alfalfa with grass and clover.



Legumes and herbs do well in drier conditions

In early September 2020, the fourth cut was harvested in the trial that had been sown in early September 2019. After a hot and dry summer, legumes and herbs are prominent in the mixtures. The highest yields were recorded in mixtures where the leguminous plants were able to develop well. The reference mixture, English ryegrass with red and white clover, was abundant, as was a Sencier grass-clover mixture with extra alfalfa. Chicory and plantain, also known for their drought tolerance, developed well in the herb-rich mixtures. The single-crop alfalfa (lucerne), which was slow to get going in spring, produced the highest yield in the fourth cut, with excellent nutritional value. The trial will be followed up further in the coming years to monitor the evolution of the mixtures.

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Funding: CCBT project '*Droogteresistente maaimengsels*' - 'Drought tolerant grass mixtures', Department of Agriculture and Fisheries, Government of Flanders (1/02/2019 - 31/12/2020)

Rotational grazing as a key to the climate question and more autonomy?



new

Meat and milk producing ruminants are often pointed at in discussions about methane emissions and the production of CO₂ during fermentation in the forestomachs. Answers are often sought in the direction of 'ration adjustment', 'adjusted barn concepts' or 'use of technology'.

And what about the grasslands?

Grassland management has a significant impact on biodiversity, carbon storage, soil health and water holding capacity of the soil. This impacts yields in DM/ha, animal health and welfare and reduces dependence on external inputs such as animal feed, veterinary drugs, pesticides, fertilizers and fossil fuels. Applying rotational grazing with animals (cattle, sheep, goats, deer, horses, chickens) at an appropriate rotational rate combined with a sufficiently high density per ha provides the greatest progress, as confirmed in the final report of the Eip-agri focus group 'grazing for carbon'.

Application of rotational grazing in Flanders

Despite the increasing number of success stories abroad and in Wallonia, rotational (or regenerative) grazing is still hardly applied according to best practices in Flanders. Reasons for this are the fragmentation of agricultural parcels and the lack of practical expertise. Each farm requires a different approach.

Network of rotational grazing

To encourage and support Flemish livestock farmers in a more regenerative approach to grassland management, a grant application was submitted to the Department of Environment to start a network for rotational grazing.

- This network met for the first time in December 2019, as an initial introduction and to better understand the needs of livestock farmers.
- During the 2nd network event in March 2020, the principle of rotational grazing was explained mainly theoretically, supported by practical examples, by Prof. Alain Peeters of the Rhea Institute.
- In October 2020, a group of 26 farmers visited 3 cattle farms (2 organic and 1 conventional) that apply rotational grazing in Wallonia. Pieter Van Rumst (Obs'Herbe) coordinated this excursion.



© Jos Van Reeth (www.grasvlees.be)

Mixed intercropping with raspberries and blackberries alternating in the row

Future

Flemish livestock farmers also see the advantages of rotational grazing. That is why we are again looking for a subsidy to continue working on this in Flanders as well.

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Funding: Departement Environment, Government of Flanders (1/05/2019 - 31/03/2021)

Agroecology in practice? Just ask Flemish beef farmers!

completed

Agroecology is an often used term by many involved in the alternative food movement. A frequently heard criticism, however, is that it is unclear what this means in practice. This research provides an answer to this by assessing the practices of Flemish beef farmers.

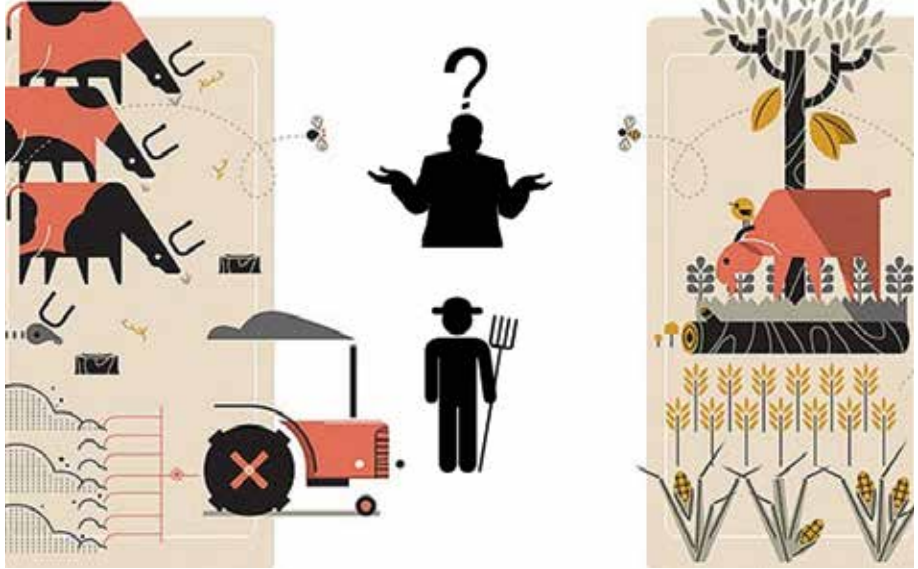
Thirteen principles

In 37 semi-structured interviews, we asked a diverse group of farmers (including 12 organic) how their practices relate to the following list of 13 principles found in agroecological literature. In addition to the techno-productive and ecological dimensions of agroecology, these principles also emphasize the socio-economic, socio-cultural and socio-political dimensions that agroecology stands for.

1. Strengthen animal health in an integrated manner
2. Close nutrient cycles
3. Maintain a high diversity of species and genetic varieties in time and space
4. Preserve and use biodiversity
5. Reduce the use of external chemical inputs
6. Increase the resilience and adaptability of the farm-ecosystem against environmental shocks
7. Strive for autonomy from powerful input suppliers and purchasers
8. Pursue financial independence and control over economic and technical decisions
9. Exchange knowledge from a diversity of sources to solve problems
10. Maintain the social network on the countryside
11. Strengthen the bonds between producers and consumers
12. Create locally embedded food systems of production and consumption
13. Divide the burdens and the benefits of food production and consumption equitably

A wealth of practices

We confronted every beef farmer with these principles, and asked them if and how they put each principle into practice on their farm. From their responses, we identified 690 different practices that could be associated with one or more of these agroecological principles. Further qualitative analysis of these interviews, informed by existing scientific literature, and assisted by fellow researchers, allowed to bundle these practices and describe 36 different action paths that indicate how the same principle can be fulfilled in different ways.



Connecting the dots

By documenting farmer practices, we showed that farmers can greatly contribute to the realization of both the technical and the social dimensions of agroecology. A doctoral dissertation compares the actions and perspectives on farming of these individual farmers. From this we conclude that there is both a conceptual and empirical relationship between the interpretation of the more technical dimensions of agroecology and the more social dimensions. We also provide a socio-theoretically substantiated explanation for the different extent and manner in which the interviewed farmers pursued these principles. Out of this dialogue with farmers and agroecology a broader societal reflection has emerged that clarifies the role of farmers in transforming food systems towards sustainability.

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Funding: ILVO (2016 - 2020)

More info: Tessier, Louis, Jo Bijttebier, Fleur Marchand, and Philippe V. Baret. 'Pathways of action followed by Flemish beef farmers—an integrative view on agroecology as a practice.' *Agroecology and Sustainable Food Systems* (2020): 1-23.

Forage trees add value in outdoor areas for organic ruminants

new

Organic farmers of small and large ruminants are required to provide an outdoor run for the animals. Practice shows that this obligation does not automatically result in optimal design and management of the outdoor area, with especially the woody elements remaining underused. Nevertheless, trees and bushes have undeniable advantages for the welfare and health of animals. With the project 'Forage trees for organic ruminants' Inagro, Odisee and consultancy Wim Govaerts & Co are working on a better substantive and practical support for farmers who integrate trees on their farms.

Forage trees are valuable for animal, environment and farmer

Combining trees or shrubs with agricultural crops or livestock farming is not new. But the smart integration of forage trees in the management of organic ruminants certainly is. It offers structural solutions to several challenges facing the (organic) sector:

- Trees provide protection from rain, wind and sun. Heat stress in cattle is an increasing problem in Belgium with a negative impact on animal welfare, milk production and quality.
- Leaves and twigs (fresh, ensiled or dried) are an excellent addition to the ration in terms of feed values and mineral composition. At the same time, they allow animal-specific behaviour such as nibbling.
- Tannin-rich plant material as feed can contribute to the prevention of gastrointestinal worm infestation.
- Diversified cultivation and release systems with the integration of woody plants offer more income security in terms of forage production and forage autonomy.
- Woody landscape elements promote agrobiodiversity and landscape quality of the countryside

Need for accessible knowledge and practical tools

Despite these many benefits and a growing interest from the sector, the operational use of trees and shrubs at the farm level remains rather limited. Which tree and shrub species are good for animal health? What is the impact of forage trees on mineral supply and on gastrointestinal worm infections? How should trees be planted on a specific plot? What about tree protection? How can tree feed be offered? ... These are some of the many questions presented by farmers.

Experts and livestock farmers work together in the project to capture relevant and 'locked-in' knowledge and experiences. Via sector-specific workshops, excursions, demo days and a practical guide, their acquired



insights are made accessible. With this project, we address all holders of organic ruminants, and in particular dairy cattle, beef cattle, goat and sheep farmers.

Forage trees on the farm

An optimal outdoor run is designed, including the integration of trees and shrubs, on four farms. On two of them, the design is also effectively constructed and made available for demonstration purposes. The sample farms were chosen to represent the different sectors and include a range of soil types. During the elaboration of the outdoor runs we take into account, among other things, the mineral requirements (hair sample analyses) and gastrointestinal worm pressure (manure sample analyses). The farmer's specific motivation to work with trees and shrubs (ecological, economical, animal welfare,...) also determines the design of the outdoor run.

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Funding: CCBT-project 'Voederbomen voor bio-herkauwers' - 'Forage trees for organic ruminants', Department of Agriculture and Fisheries, Government of Flanders (15/02/2020 - 31/12/2021)

More info:

<https://www.inagro.be/Wie-is-Inagro/Projecten/project/288>
<http://www.wimgovaertsenco.be/voederbomen/>

P'Orchard: Agroforestry for outdoor pigs

completed

In September 2017, the operational group 'P'orchard: Agroforestry for outdoor pigs' was launched. Within this project, Inagro, ILVO and a number of committed pig farmers started working together on agroforestry to set up outdoor runs for pigs. Each of the farmers aims to market a local, sustainable and high-quality product via a short chain to restore the relationship between consumer and producer. Unlike conventional pig farmers, the involved pig farmers had a free-range meadow where the pigs could root freely.

Agroforestry example: an orchard as outdoor pig run

In Flanders there is still very limited experience with outdoor pig breeding and the spatial and economic integration of the outdoor run for the pigs. Agroforestry in the form of an orchard can certainly play a role in this; this project was a first step. Through the operational group, possible bottlenecks were identified and knowledge, experience and innovative ideas were brought together and exchanged. This ranged from very practical issues such as: "How can trees be protected from pigs in a cost-effective way?", "Which pig breeds are more suitable?", "Can nuts and fruits be used as supplementary rations?", to rather legislative and health aspects such as: "What about food safety when nuts and fruits from the outdoors are grown for human consumption?",

Three farmers participated in the project. The participating farmers saw several advantages in the establishment of an outdoor area with agroforestry: namely (i) improved animal welfare through protection against wind, sun and rain, (ii) multi-level use of space whereby fruit/nuts can be used as additional feed rations or for human consumption, (iii) improvement of the image of the pig farmer with the consumer, (iv) and indirect environmental benefits.

This operational group was a major step forward, as in general Flemish experience with outdoor pig breeding in an agroforestry setting is still quite



limited. The group members' contributions helped to generate more insight into the choice of suitable tree species, tree protection for pigs and advice on the legal framework, animal welfare, feed supply, housing, possible organic production, etc. The results of the literature study and the mutual exchange of practical experiences were compiled in a [practical guide](#) for pig farmers to optimise their outdoor runs. To conclude the operational group P'Orchard, a [video](#) was made that summarizes the essential insights about outdoor pigs and trees.

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Funding: EIP-AGRI Operational Groups 'P'Orchard' Government of Flanders – EU (1/09/2017 - 31/08/2019)

More info: www.agroforestryvlaanderen.be



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LEGCOMBIO - Added value through sustainable combinations of vegetable crops with poultry outdoor run

completed

In a densely populated region like Flanders, open space is under increasing pressure. This leads people to look for ways to produce more on the same surface area. At the same time there is growing concern about the impact of intensive agricultural practices on the environment and on animal welfare. This project investigated how efficiency and sustainability can be maximized by thoughtfully combining a perennial, vegetable crop in the run of (organic) poultry.

1 + 1 = 3 ?

Perennial crops can be planted to provide shelter for chickens in an outdoor run. However, to speak of an efficient mixed production system, a woody crop can also produce wood, biomass, nut or fruit production, or a combination of these. In addition, chickens can also be useful in an existing crop to control pests and weeds or clear fallen fruit.

To obtain an optimal mixed system, negative impacts must be minimized. If the chickens do not spread out uniformly over the plot or if they stay close to the house, a local accumulation of manure will lead to high concentrations of nitrogen and phosphorus in the soil, and soil compaction may occur. The puddles that then appear can be a breeding ground for bacteria and can lead to more leg disorders.

Long term experiment at ILVO

We investigated the influence of weather conditions, rearing method, and type of planting (hazels on grass vs. short rotation coppice with willows) in the enclosure on the use of the area by laying hens. The hens used the shelter provided by the short-term coppice, especially when temperatures rose. Regardless of the weather, they most often stayed near the barn. Specifically, the vegetation proved more useful than the use of a dark brooder (a dark warm space in rearing) to overcome fear and thus improve use of the outdoor run.

The chickens' preference for the short rotation coppice was also observed in the soil (higher nitrate residue, organic carbon content near the barn, phosphorus and potassium content). Soil samples closer to the house revealed a higher negative impact of the chickens on the soil, thus (more) regular displacement of the mobile houses and periodic changing of a litter layer was recommended.

The influence of the laying hens on growth, yield and quality of the crops was found to be limited. From this mixed land use a good harvest and thus an additional income and/or diversification could be obtained



Tested in practice

The influence of broiler chickens in an existing small fruit plantation (kiwi berry) was evaluated at the O'Bio farm. During a first round of trials, it was observed that the chickens did not use the run uniformly but rather stayed mostly around the house. This caused root damage to the kiwi berry plants and very high mineral nitrogen levels in the top layer of the soil. The presence of chickens around the house led to local reduced weed pressure, but there was no impact in the run with increased distance from the house.

To encourage use of the outdoor run, in a second round of trials the distance between the drinking water supply in the outdoor run and the barn was systematically increased. This had a beneficial effect on the outdoor use, and provided a more even distribution. Mineral nitrogen levels were significantly lower, but again we observed a difficult to avoid peak in mineral nitrogen near the (opening of the) mobile barns. In addition, there was also more pronounced root damage in the entire outdoor run.

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Funding: Department of Agriculture and Fisheries, Government of Flanders (2017 - 2020)

More info: www.agroforestryvlaanderen.be/NL/Projecten/LegComBio
https://www.agroforestryvlaanderen.be/Portals/89/documents/Brochures/20201020_LEGCOMBIO.pdf





Flexible organic chain system

Agroforestry in Flanders: Feasible financial and business models



new

Increasing the adoption of agroforestry as a system within the Flemish agricultural sector is the goal of VLAIO project AGROFORESTRY 2025. Development trajectories for agroforestry in the economic and institutional landscape, and thus for feasible business models are sought.

Benefits of agroforestry

Agroforestry involves the combination of woody crops (trees or shrubs) with agricultural crops and/or livestock to create new products and services. With a well-considered approach, the system can overcome several challenges: increase farm profitability and resilience, respond to climate mitigation and adaptation, create opportunities for other links in the chain, and help to optimally use, conserve and protect biodiversity and natural resources.

Is agroforestry in the Flemish agricultural sector feasible?

With the new project AGROFORESTRY 2025 we aim to increase the applicability of agroforestry as a system within the Flemish agricultural sector. The specific aim is to optimize various aspects of the cultivation system. At plot and farm level, it is investigated how agroforestry can contribute to resilience, which management is suitable and how the agroforestry and farm system performs at its best. Development trajectories for agroforestry in the economic and institutional landscape are sought, i.e. feasible financing and business models.

Setting up action labs

All of this will be done through action labs: a set of concrete, participatory change processes will be set up around widely supported and efficient agroforestry systems, and around feasible financing and business models. The project pays attention and time to knowledge dissemination through communication, dissemination and exploitation. Strong interaction is aimed with farmers and other actors, who will take on a steering role as project ambassadors.

We expect the end result of 'agroforestry 2025' to be that the potential of the best supported, efficient and profitable agroforestry systems in their various forms is unlocked. We also expect clarity on best management



practices, on cultivation systems at farm level and on a successful growth trajectories for agroforestry in the economic and institutional landscape.

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Funding: VLAIO LA trajectory project 'AGROFORESTRY.2025', Agency for Innovation and Entrepreneurship, Government of Flanders, with co-financing by 21 stakeholders (1/10/2020 - 30/09/2024)

More info: www.agroforestryvlaanderen.be

FOODLEVERS: Leverage points to scale up organic and sustainable food systems



The transition toward sustainability has become a main societal challenge. The goal of the FOODLEVERS project is to identify key leverage points to further develop and scale-up existing innovative organic and sustainable food systems (FS). It aims to promote higher resource efficiency, highlight inefficiencies, specify the reasons for decision-making processes that led to the current configuration of the FS, and thus identify configurations that "work" and may be scaled up.

Re-connect, Re-structure and Re-think

To investigate potential leverage points in FS, FOODLEVERS takes a systems view, encompassing products, production technologies, marketing practices and actors. The framework of 're-connect, re-structure, re-think' provides a holistic conceptualization toward sustainability of actors' behaviours and the structure of FS (Abson *et al.*, 2017):

- 're-connect' people to nature to encourage sustainable behaviours while shortening feed-back cycles and improving well-being;
- 're-structure' institutions and consider how institutional dynamics can create an enabling environment for sustainability;
- 're-think' how knowledge is created and used, shared and validated.

Rather than treating each unit of FS in isolation, FOODLEVERS considers the interdependencies between interacting FS units. The aggregate of changes in actors' behaviors is therefore a potential source of system change toward sustainability. To build a holistic view of FS sustainability status, this project applies a multi-disciplinary and multi-actor approach. We identify different behaviors as potential levers to increase sustainability by examining innovative case studies of organic and sustainable FS from cradle to grave.

Characterizing innovative food systems

The FOODLEVERS methodology is to first seek the distinctive elements of FS, several innovative case studies throughout the EU, and the data needed for a common reference system. The FS is then characterized in terms of its ecosystem services, life-cycle analysis, socio-economic value and consumer behaviour in order to understand potential sources for change. These sources may be practices, technologies, products or other factors at the level of the actors. To study the effectiveness of these sources, we use different models: decision-making scenarios of actors, Agent-Based Modeling and qualitative scenario modeling. Agent-Based Modeling simulates complex FS scenarios to study the effect of combinations of different actors' behaviors on the



entire system. Different mechanisms are thus explored experimentally as potential levers for sustainability. Qualitative scenario modeling engages FS actors to draw on current expertise and experiences to gain insight into future scenarios. FOODLEVERS engages actors on an ongoing basis, from the selection of case studies through the validation process and analyses, to the formulation of recommendations.

Levers to scale up organic food systems

Best practice processes are identified by analysing innovative organic FS and from simulations, to identify ways to increase resource efficiency and reduce trade-offs between production/distribution stages. Subsequently, we formulate leverage points to re-connect, re-structure and re-think FS.

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Partners: ILVO is the Flemish partner in a consortium of 8 partners from 7 EU-countries (BE, DE, FI, IT, PL, RO, UK) with Philipps-Universität Marburg (DE) as coordinator

Funding: ERA-nets SUSFOOD2-CORE ORGANIC Co-fund joint call, Flemish partner: Department of Agriculture and Fisheries (1/12/2020 - 30/11/2023)

More info: Abson D.J., Fischer J., Leventon J. *et al.* (2017) Leverage points for sustainability transformation. *Ambio* 46 (1): 30-39, <https://link.springer.com/article/10.1007/s13280-016-0800-y>

'VerdienWijzer' - step by step to a new business model



new

The general belief is that more knowledge about business models can increase farmers' chances of having an economically, ecologically and socially sustainable agri-food sector. The 2019-2024 Agricultural and Fisheries Policy Paper states that there is a need for more knowledge about earning models. That is why research on this subject is encouraged within the Flemish knowledge institutions.

Knowledge present in sector organizations...

ILVO, other knowledge institutions, agricultural organizations, etc. already have a lot of knowledge about business models. This information usually concerns concrete cases, e.g., being a specific adjustment to the earning model for a specific farm or a group of farms. There is also a lot of academic knowledge about agricultural economics and earning models, but it remains a challenge to put this knowledge into practice.

...applied to the farm

That is why ILVO developed the *VerdienWijzer* ('Business Compass'), a practical and inspiring overview of the wide range of possible business models in the agricultural sector. Using simple selection criteria, the farmer can determine which adjustment to the earning model best suits each individual farm, farmer motivation as an entrepreneur, and especially (prospective) customers.

Book of recipes

The *VerdienWijzer* is actually like a recipe book. It contains different business concepts (recipes), and each business concept is analyzed based on sub-activities and the added value that each sub-activity brings (the ingredients). The *VerdienWijzer* can be used as a tool to create new recipes, because you can easily search which ingredients go well together.

Use in organic farming

The *VerdienWijzer* focuses on the value that a farm or company delivers to its customers. That value can be totally different for seemingly identical activities. For example, if there are two farms that both grow organic apples, but one sells apples through the farm shop, and the other has a self-pluck concept. At the first farm, customers come because they want

VerdienWijzer

Welkom bij de VerdienWijzer. Lees hier wat een verdienmodel is en laat je inspireren door aantal bedrijfsvoorbeelden. Ga daarna zelf aan de slag en ontwikkel een nieuw verdienmodel.



+ Wat is een verdienmodel?

+ Bedrijfsvoorbeelden

+ Nieuwe verdienmodellen

quality, fresh, healthy produce. At the second one, customers come mainly for the experience, to be in the outdoors, to harvest apples themselves, etc. Two organic apples, but a totally different value.

Practical

As an entrepreneur, you need to both know what value you provide and ensure that you use and market it to the fullest. In the self-pluck example above, this means making sure that this experience is played out to the maximum and that the customer does not experience any friction. This can be in small things, such as providing gloves for forgetful customers, ensuring that children can walk around freely, providing a place where customers can rest and drink after plucking, etc. Also, the promotional material should fully reflect the value delivered (so in the case of self-pluck, many images of the 'harvesting experience'; in the case of a farm shop, much focus on quality, freshness and health). Ultimately, the better an entrepreneur understands and optimizes a delivered value, the more that value can be monetized.

ILVO launched the *VerdienWijzer* as a web tool in the summer of 2021.

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A decent market for organic buck kids



new

The demand for organic goat milk is increasing. Given this favorable market situation, existing farms are expanding and new organic goat farms are starting up. This leads to a larger number of bucks being born. These have no financial value and thus represent a loss on most farms. At best, these kids are sold (usually at a loss) to a trader and transported to southern Europe, where there is more demand for goat meat. At worst, the goats are euthanized. Finding an acceptable solution for the kids is socially relevant, ethically necessary, financially difficult and technically challenging. There is also a very explicit demand from the buyers of milk to find a solution for the male kids.

How to approach the problem

The approach to the problem is twofold: first, to avoid giving birth to large numbers of bucks and, second to find an organic outlet for the meat from bucks that are born.

Avoidance of birthing bucks:

- Experiences from various farms at home and abroad will be shared, together with research and project results.
- Cost-effectiveness of the different ways of avoiding bucks will be studied, together with ways to structurally integrate this into the milk price.

Organic marketing of organic bucks:

- There will always be male kids born on organic goat farms. The aim of the project is to raise them organically and to sell them in an organic chain. The market for this still needs to be developed and cooperating farmers still need to be found.

Steps in the process

- Share results of previous projects and research with the goat farmers.
- Review and compare rearing options: pros and cons, cost price analysis. Possible scenarios are central rearing, decentralized rearing, permanent milking, fattening strategy on the farms, and rearing bucks with dairy goats that produce less well.
- Study visit to existing initiatives for marketing of organic bucks abroad. We know about initiatives in Germany and the Netherlands (Allgoiß-project in Allgäu (DE), Goatober-project in Spessart (DE), Bio Goat Meat (NL) ...
- Market analysis: Which parties are potentially interested in goat meat and under which conditions? Discussions with possibly interested chain



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actors. Consultation with the 'milk chain' in order to tackle the problem together and to bear joint responsibility, e.g. by reserving part of the milk price for the sale of the male kids. If the consumer prefers to drink milk rather than eat goat meat, then the financial loss from the male kids must be included in the milk price.

- Product development: with/by the market actors who are interested in marketing the meat, work on product development is needed: both in terms of cutting and processing. This is best done with the involvement of consumers by means of, for example, test panels. ('*Bio zoekt Keten*' ('Organic seeks Value Chain') together with those who process the meat)
- Creating interest in the market: goat meat is not well known in Flanders, so we need to create interest in the market, among consumers as well as among wholesalers, buyers, butchers and the catering industry. This can be done through tasting sessions, events, a recipe competition, a campaign like the one in the Netherlands 'Man in the pan' (literally 'Male in the pan'), etc.

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Funding: Department of Agriculture and Fisheries, Government of Flanders '*Bio zoekt Keten*' (vanaf 1/09/2020)

More info: <https://www.bioforum.be/mobiele-slachthuizen>

Opportunities for mobile slaughter units in Flanders

completed

In recent years, many slaughterhouses have closed down. For the slaughter of smaller batches of poultry, it is increasingly difficult to find a slaughterhouse within a reasonable distance. For sheep and goats, too, there is a severe lack of slaughter capacity. Transport of live animals to the slaughterhouse is a thorn in the eye of many farmers and consumers. The last day of the animals' lives is full of stress with many negative effects on their welfare and ultimately on meat quality. A mobile slaughter unit (MSU) offers a solution for respectful and dignified slaughter. Moreover, an MSU proves to be a good alternative for animals that are not transport worthy, but are still suitable for consumption. This contributes to preventing food waste.

Technically feasible

An MSU for poultry is technically feasible. The required infrastructure is limited in size and weight and fits into a larger van or trailer.

An MSU for cattle is technically much more difficult to achieve. The bottleneck is the great height required to hoist a beef carcass. Ultimately, the solution was found in hydraulically raising the roof of the MSU and lowering part of the floor.

A mobile killing unit (MKU) offers the possibility to kill the cattle on the farm and to carry out the further processing in a regular slaughterhouse. This practice has been used for some time in Switzerland, Germany and the Netherlands. The animal is clamped in a box, anesthetized, throttled and bled. The dead animal is then taken to a regular slaughterhouse within the shortest possible time for further processing.

Regulations

An MSU is feasible within the current regulatory framework:

- In order to be able to sell meat in a shop, a veterinary inspection of the cattle is required before and after slaughter. The cost of this is the main bottleneck.
- A rendering company can offer a solution for the slaughter waste (feathers, blood, intestines, etc.).
- Because the Flemish regulations for mobile installations have not yet been established, we checked whether we can obtain an environment permit for each individual site.

Financial feasibility

The practical implementation of an MSU is quite expensive. For an MSU for poultry, we calculate about €100,000 in investment costs. For an MSU for



cattle this is €800,000 (€8 to 10 head/day). The investment for an MKU is estimated at €400,000 plus the cost of operation. In general, it seems that both MSUs (beef and poultry) are financially feasible if enough animals are slaughtered on an annual basis and per slaughter location.

A market survey shows that there is sufficient demand for poultry slaughtering. An MSU for poultry was assumed to slaughter 250-300 animals per slaughter site.

For cattle, on the other hand, the typical demand per slaughter day of 1 to 2 cattle seems often insufficient for the MSU to function profitably. A possible alternative is the use of an MKU.

How do we proceed?

For poultry, we are working on the concrete realization of an MSE together with an interested operator. We hope to have the MSU operational in 2021. BioForum is working together with *Steunpunt Korte Keten* and *Innovatiesteunpunt*.

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More info: <https://www.bioforumvlaanderen.be/nl/mobielslachthuis>

Klimrek - Climate measures with economic opportunities on farms



new

Klimrek is a VLAIO agricultural trajectory project that started in September 2019. In this project, ILVO, Innovatiesteunpunt (Innovation Support Center) and VITO work together for four years on a climate trajectory for dairy farmers, pig farmers, and arable farmers with potatoes in the cultivation plan. To this end, a climate consultant goes 'on the road' with a targeted climate scan and climate course. Both conventional and organic agricultural and horticultural farmers are individually coached to take feasible climate-smart measures on their farms. Climate-smart measures reduce the net emission of greenhouse gases or make the farm more climate-resilient.

How do we approach this?

For three sectors, starting with dairy farming, we develop a climate trajectory that consists of a climate scan and climate guidance. Arable farming with potatoes in the cultivation plan and pig farming are the other two sectors. The climate scan shows the climate situation of the farm, elucidates where the climate impact of the farm lies and where there is room for improvement. The climate guidance plan leads the farmer to implement climate-smart measures on the farm. A climate scan starts from an extensive life cycle analysis (LCA) of a number farm types and is reduced to a workable instrument that includes the most important emission and consumption items. Farms are visited by a climate consultant who performs the scan using data from accounting and other available data sources. The scan tells us what the carbon footprint and carbon storage of the farm is at that time. The consumption of raw materials (e.g. water, land and fossil fuels) and the contribution to other environmental problems (e.g. acidification and eutrophication) are also mapped out. From there, an individual improvement process is started: the climate guidance plan. Possible climate measures are weighed up in terms of environmental gain, economic feasibility and practical feasibility. At the same time, the farm is benchmarked against other farms. In addition to individual support, the farmer is also guided in groups through learning networks. There, he/she comes into contact with experts and fellow farmers who have experience with a particular measure, and tips and tricks and practical feasibility are discussed and exchanged. Every year, the farm is scanned and progress is quantified. Step by step, several measures are implemented.



By looking at the farm's performance on multiple environmental impacts, we prevent problem shifts. By quantifying carbon storage, we also take negative emissions into account. We do this for both conventional and organic dairy farms. Suitable climate measures may differ, but the individual improvement process is paramount

Together towards a more climate-resilient and climate-friendlier farm management

The ultimate goal is to support farmers in their transition to a more climate-resistant and climate-friendly way of farming. They are guided individually but also learn from their fellow farmers during joint activities. The annual follow-up has a motivating and enriching effect and the threshold is very low. The aim is to start up 90 individual improvement projects. After the project, trained climate counselors continue the work.

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More info: <https://www.klimreproject.be/over>





High quality food and processing

Sustainable production of innovative sparkling wine



new

Of the total European vineyard area, 7.3% is devoted to growing organic grapes (Eurostat, 2015) . Almost 90% of this total organic grape production worldwide is located in Europe. In 2015, about a quarter of the total European grape area was in transition from conventional to organic production (Willer & Lernoud, 2015). Given this leading role of European organic wine in the world, new insights into organic viticulture are of increasing economic importance. The new project 'Sustainable production of innovative sparkling wine' (SPiwi) aims to contribute to this by optimizing the sustainability and economic return of new, fungus-resistant grape varieties. Belgium, a relatively new wine region, is cooperating in this project with two established European wine regions, Italy and Germany.

SPiwi

The name 'SPiwi' comes from two words 'SParkling' wine and 'Piwi'. Piwi is an abbreviation for the German name for fungicide-resistant varieties ('*Pilzwiderstandsfähige*'). The cultivation of these varieties has the potential to reduce the number of fungicide applications in viticulture and to grow organically. However, little is known about the vinification of these varieties, and more specifically for the production of a quality sparkling wine.

To a future-oriented production of organic sparkling wine

The Spiwi project aims at gathering knowledge, researching and optimizing strategies for a future-oriented sustainable production of organic sparkling wines in one classic European wine producing region (Northern Italy and Germany) and a more northern region (Belgium). In Belgium, the wine grape growing area is currently small but is gaining importance with an annual growth rate of about 15-20%.

Within the project, sustainability is approached from several angles:

- (i) In the field phase, the focus is on the selection of suitable resistant cultivars for organic cultivation and on the development of an adapted biological control scheme with a minimum number of applications. The use of alternatives to sulphur and copper, the crop protection agents allowed in organic cultivation, such as plant reinforcement agents and biological control agents is considered.
- (ii) A chemical-free vinification process adapted to the selected varieties is developed.
- (iii) A comprehensive consumer survey shall be conducted to assess consumer acceptance of 'piwi' sparkling wine.
- (iv) Furthermore, the waste streams from the vinification process are



qualified and quantified and the presence of bioactive substances in them is described. The potential for creating added-value products based on these bioactive substances in the pharmaceutical, cosmetic and food industries are assessed by presenting the results to these industries and examining their needs and interests in further product development.

Besides guidance on the selection of disease-resistant wine grape varieties for planting, organic vineyard management practices will be demonstrated and an economic feasibility study will be communicated to farmers.

Regional differences in the consortium will be used to address the needs of local farmers and provide insight into the best choice in view of the upcoming climatic challenges.

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