Interreg
EUROPEAN UNION
North-West Europe
FABulous Farmers
European Regional Development Fund

EU POLICY PAPER

About this publication

This paper is supported by the European Union's Interreg North-West Europe programme, part of the European Territorial Cooperation Programme and ERDF funding. The work was supported by grant agreement No. NWE 810, project FA-Bulous Farmers (Functional Agro-Biodiversity in farming).

FABulous Farmers is a European project designed to support farmers in the transition to more agro-ecological practices on their farms. The project aims to reduce the reliance on external inputs, like chemical fertilisers and plant protection products, by encouraging the use of methods and interventions that increase the farm's Functional AgroBiodiversity (FAB). These are targeted measures of biodiversity in and around the field to improve pollination, pest management, soil and water quality on farmland.

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Key messages

1. Functional Agro-Biodiversity (FAB) refers to elements of biodiversity that provide ecosystem services, which support sustainable agricultural production, while also delivering benefits to the environment and society as a whole;

2. FAB projects in several EU countries have provided tangible benefits to farmers, for instance through improved pollination, natural pest control and enhanced soil quality;

3. By providing vital resources and reducing the need for external inputs such as plant protection products, FAB also supports biodiversity conservation;

4. FAB measures should be supported by both pillars of the new CAP;

5. The CAP can stimulate farmers to use these nature-based FAB measures, including through 1-year contracts.

6. Measures from pillars 1 and 2 should complement each other on the same surface area, generating year-round greening opportunities. Farmers should be compensated for all efforts made.

7. Cooperation at a landscape level brings increased benefits of FAB and should therefore be promoted;

8. Farmers' access to independent advice and existing knowledge on best FAB practices is essential. FAB measures require new knowledge and management approaches that most farmers are currently unfamiliar with;

9. FAB measures should be supported not only by agricultural policy, but also by other legislation and policies on for instance biodiversity, water, climate and use of agrochemicals.

10. More research is needed to further develop knowledge on how to optimise FAB measures and to study their interactions.

In summary: FAB can provide key solutions and should be a cornerstone of the green architecture of the new CAP.

Introducing FABulous Farmers

Agriculture provides ecosystems for a broad range of species, many of which are reliant on the quality of agricultural landscapes. Similarly, agriculture depends on important ecosystem services provided by species in the agro-ecosystem, such as insect pollination, natural pest control, erosion control, nutrient cycling, soil quality and water regulation. The well-documented decline in biodiversity resulting from increasingly intensive agricultural production processes has also resulted in a loss of these ecosystem services of essential importance to farming.

The FABulous Farmers project aims at developing more knowledge, experience and visibility of Functional Agro-Biodiversity: those elements of biodiversity that provide ecosystem services, which support sustainable agricultural production, while also delivering benefits to the environment and society as a whole.

Within the context of the project, farmers in four EU Member States (FR, NL, BE and LUX) and the UK have experimented with ten FAB measures aimed at promoting ecosystem services (annex A).

Projects carried out in the five participating countries have provided tangible benefits to farmers, the environmental and society. At the same time, important barriers to effective FAB uptake by farmers remain. On the basis of the project findings, this policy paper stipulates key policy recommendations for the implementation of FAB measures at the EU policy level, including through the new Common Agricultural Policy's (CAP) green architecture.

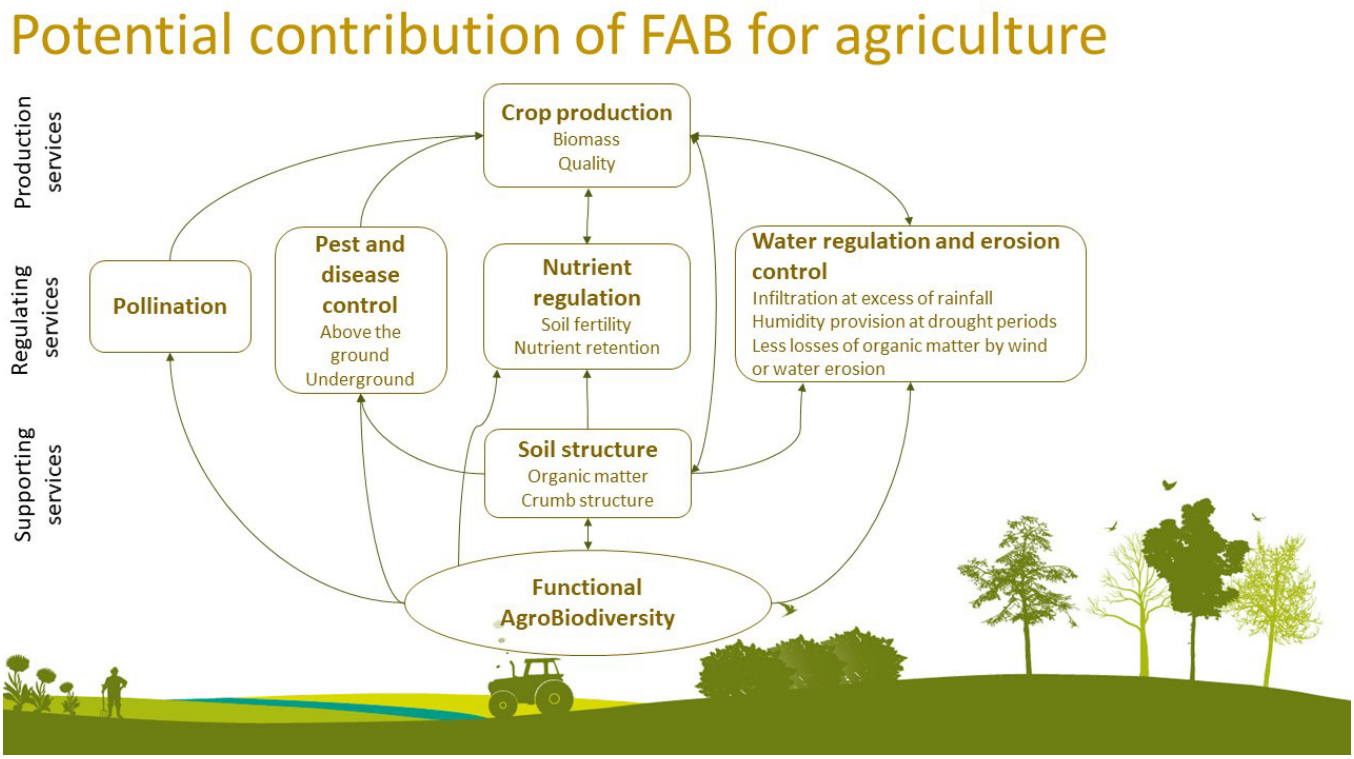

Figure 1: Scheme of the potential contribution of FAB on agriculture related ecoystem services.

WHAT IS FAB?

Functional Agro-Biodiversity (FAB) refers to those elements of biodiversity that provide ecosystem services, which support sustainable agricultural production, while also delivering benefits to the environment and society as a whole.

Figure 1 shows the various ways in which FAB can deliver different ecosystem services. In devising FAB schemes, it is important to note that ill-considered efforts to increase agricultural biodiversity may be ineffective overall, and may even result in unintended side effects such as pest or disease problems.

To realise and optimise ecosystem service benefits through FAB, targeted and focused measures are needed, allowing for FAB benefits to be maximised, while avoiding potentially negative effects of increased biodiversity.

Targeted management strategies can range from the right choice and management of non-crop vegetation (e.g. field margins, hedgerows), to conservation tillage and informed crop diversification or rotation. Through FAB, an important contribution can be made to the nine objectives of the CAP, as a cornerstone of its green architecture, as shown below:

FAB and the 9 CAP objectives

1. Fair income
FAB measures result in more resilience and a reliable food production.

2. Competitiveness
FAB makes farmers less reliant on external inputs and helps improve their production process.

3. Food value chain
By implementing FAB measures, farmers contribute to different environmental and societal objectives.

4. Climate change
FAB measures contribute to the mitigation of climate change. By improving soil quality, carbon can be sequestrated and greenhouse gas emissions from soil reduced.

5. Environmental care
FAB measures contribute to the transition to more sustainable agro-ecosystems by reducing dependency on agrochemical inputs and conserving natural resources including soil, water and biodiversity.

6. Preservation of habitats and landscapes
Through targeted farm and landscape management practices, habitats are created or preserved for beneficial organisms. FAB measures promote ecosystem services such as pollination, biological pest control, soil erosion control, and water retention.

7. Generational renewal
FAB shows a new generation that agricultural production and nature conservation can go hand in hand and creates new opportunities for sustainable farming.

8. Rural areas
FAB measures make the rural landscape more attractive, boosting employment and tourism.

9. Food health
By providing management tools to enhance natural pest control and reduce the use of agrochemical inputs, FAB contributes to safe, nutritious and sustainable food.

FARMERS AND FAB

Within the context of this project, participating farmers have experimented with a host of FAB measures, namely reduced tillage, mixed crops, increased crop rotation, cover crops, organic matter input, modification of manure quality, agroforestry, hedgerows management, flowering field margins and physical and biological crop protection.

One of the many tangible benefits of FAB is that of improved pest control. This allows farmers to reduce or even avoid plant protection products use, thus saving costs, while protecting biodiversity.

Additional benefits to agricultural productivity include nutrient cycling, nutrient retention, nitrogen fixation, water regulation and purification, erosion control, and improved yields.

Benefits to society include reduced environmental degradation, conservation of natural biodiversity, improved landscape aesthetics, improved water quality, mitigation of greenhouse gas emissions, and higher quality goods.

Based on inventories of farmers participating in the FAB pilot, key existing barriers to FAB measure uptake were distinguished, including: perceived risks associated with increased biodiversity to agricultural production; bureaucracy involved; insufficient time or worker's availability; poor mainstreaming within existing (AES) policies; low costs of plant protection products; advice from producers; general reluctance to change and, finally; a lack of knowledge on specific FAB measures and their benefits for agricultural production.

For effective FAB uptake, it is of key importance to address these issues through policy design.

Figure 2: Farmers in the Netherlands discussing FAB results. Photo © Marleen v Haaften

Policy Recommendations

Based on the project findings, seven policy recommendations have been formulated that will support the uptake of FAB measures by farmers and establish the policy conditions necessary to realize the agricultural, ecological and societal benefits of Functional AgroBiodiversity.

Recommendation 1:

Use the CAP as an instrument to stimulate farmers to implement FAB measures, including through 1-year contracts.

EU agricultural policy can play a key role in stimulating farmers to employ FAB measures. FAB measures should be included in both pillars of the new CAP, using pillar 1 for short-term measures, and pillar 2 for long-term and further-reaching commitments. By assigning FAB measures to the right pillar, an important contribution can be made to the 9 CAP objectives.

All FAB measures benefit from a multiple year engagement and therefore deserve attention in pillar 2. While generally less effective, annual engagements are also possible for FAB measures without woody elements. For FAB measures with woody elements, such as agroforestry and hedgerows, higher investments are needed. As such, these measures only work with a multiple year engagement.

At the same time, participating farmers emphasised they feel more comfortable making a long-term commitment when they have had the opportunity to test a new measure first. The possibility to initially try a measure for one year helps to remove barriers to participation by farmers. The experiences of these farmers can also help to convince others to start implementing FAB measures.

It is important that all measures, even if only applied for one year, are compensated financially.

Recommendation 2:

Stimulate ownership and learning by farmers by allowing more flexibility in the implementation of FAB measures, shifting the focus from rules to results.

In order to stimulate ownership and learning by farmers, Member States should have the option of implementing a result-based approach to FAB, with higher payments for higher delivery of ecosystem services. The implementation of a system of monitoring results – as opposed to having a system centred only on prescriptive rules – helps to enhance the motivation of farmers.

Recommendation 3:

Facilitate year-round greening on the same land area through complementarity.

Various FAB measures can reinforce each other when applied year-round. In the current CAP, rules on double-funding make it impossible to apply multiple greening measures on the same land area within the same year. As a result, significant FAB potential is lost. Below, a combination scenario is sketched that was trialled in the Hoeksche Waard partner region (NL). As shown, farmers engage in different activities under the different pillars, each of which requires its own commitment and expertise. As such, there is no double-funding of single measures. Catch crops after the yield were used as an example of conditionality (pillar 1), extended catch crops over winter as possible eco-measure (pillar I), and a one-year flower strip as an agri-environmental service (pillar II).

Recommendation 4:

Speed up the development and implementation of innovative FAB-practices on the ground by promoting independent farm advisory services.

In various Member States, farmers rely almost entirely on (free) commercial and technical advice from suppliers, including those of plant protection products and fertilisers. Since FAB works to reduce farmers' dependence on chemical inputs, there is a conflict of interest for

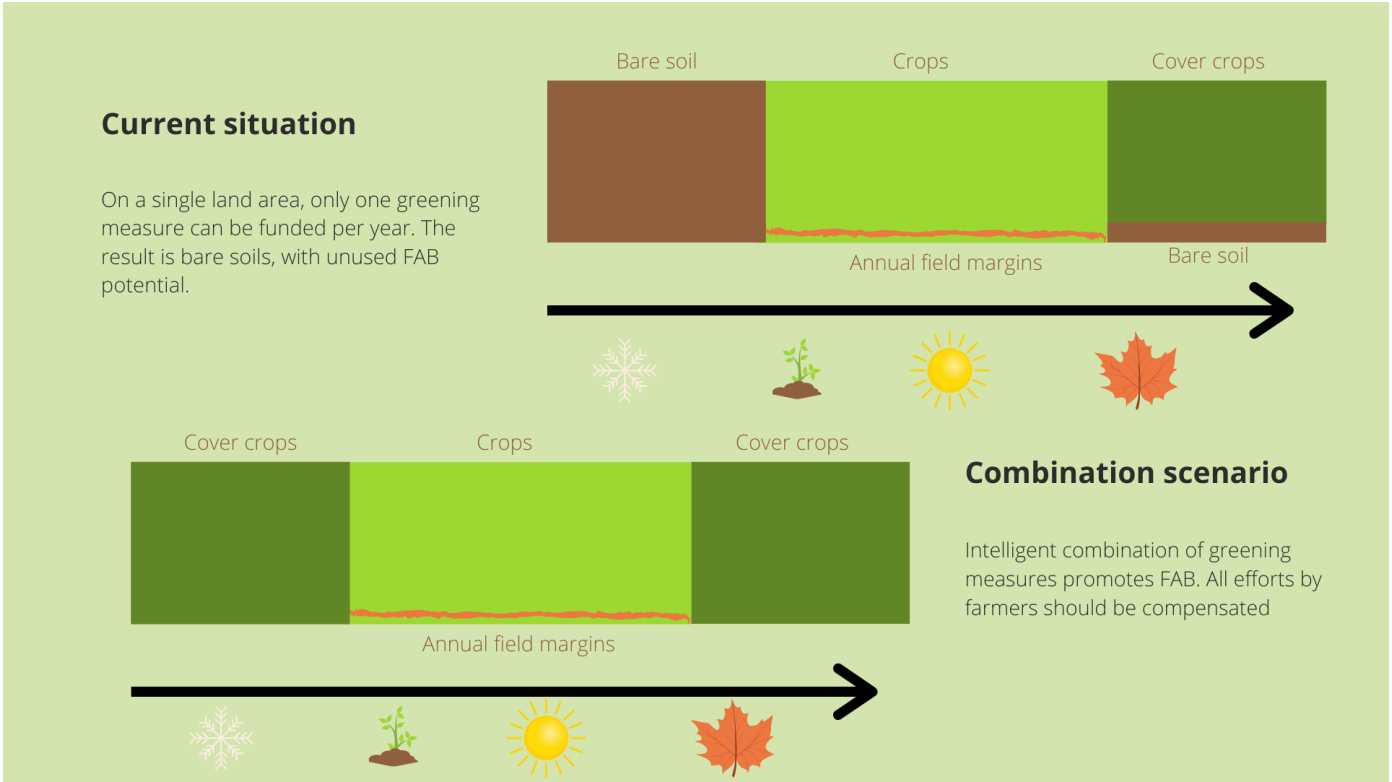

Figure 3: Example of complementarity between greening measures, as detailed under recommendation 3.

these commercial advisers in relation to the promotion of FAB measures. In addition, when farmers experiment with FAB without solid advice, they may implement these measures incorrectly, which may lead to FAB being ineffective or even having adverse effects. In order to prevent a situation in which farmers' motivation is adversely affected due to ineffective implementation, independent knowledge and training is crucial. Therefore, it is pivotal to establish free independent farm advisory services, supported by the CAP.

A first instrument here is the CAP's 'Farm advisory services'. As FAB knowledge is currently not yet widespread within these services, we recommend a dual strategy that involves adding FAB as a separate advisory theme, while also setting up FAB training programs for existing farm advisory services on themes such as soil management, pests and disease control, and biodiversity management. FAB farm advice should be linked to both pillar 1 and 2 measures.

The European Innovation Partnership for Agricultural Productivity and Sustainability (EIP-AGRI), then, is a great initiative designed to speed up innovation on the ground through its interactive innovation model. For this reason, we propose the inclusion of FAB as a recommended theme for EIP's Operational Groups.

Recommendation 5:

In the new CAP, enhance the support for cooperation between farmers delivering ecosystem services through FAB.

Functional agro-biodiversity, like biodiversity in general, does not stop at the border of a single field or farm. By cooperating at a landscape level, synergies can be realised between farm initiatives, enhancing the robustness of the ecosystem. In the current CAP, cooperation support in many Member States is focused on Producer Organisations, who work together to strengthen their resilience in the supply chain. For the future CAP, we recommend an increased focus on facilitating cooperation between farmers delivering ecosystem services through FAB.

Cooperation between farmers on FAB can be supported for instance through the inclusion of farmers as beneficiaries for CAP subsidies (ecoschemes, AECM's, non-productive investments), by compensating farmers for organisational costs of cooperation (training, advisory costs, developing collective management plans, monitoring, communication), or by setting a bonus payment for the coordination of measures at a landscape scale.

Best practice examples of cooperation

- Operational Groups of farmers in France experiment and innovate with agro-ecology by jointly visiting other farms and exchanging experiences to find common solutions.
- Environmental cooperatives in the Netherlands, agro-environmental groups in Belgium (Flanders) and Farmers Clusters in the UK cooperate on a landscape level. By working together, helped by an advisor or 'facilitator', farmers can collectively, at a landscape level, deliver on environmental objectives.
- Machine cooperatives in France (CUMA) embody initiatives where different farms join resources to invest in agricultural machinery together. They share costs and receive co-funding support to buy suitable equipment for precision and transition farming.
- In the Netherlands, environmental cooperatives are responsible for distributing agri-environmental subsidies among participating farmers, and creating a cohesive mosaic of measures to promote biodiversity and landscape qualities.
- In Switzerland, farmers can get a network bonus on top of their individual payments in order to encourage spatial coordination in auction mechanisms to allocate ESS payments.

Recommendation 6:

Promote FAB through wider EU laws and policies alongside the CAP.

While effective take up of FAB measures by farmers requires important changes in the new CAP, it is important to recognise the potential of other EU laws and policies in promoting and mainstreaming FAB measures, including with respect to the following four policy themes:

A. Climate change:

Several FAB measures, such as reduced tillage, cover crops and organic matter input, help to mitigate climate change by increasing soil carbon content and reducing greenhouse gas emissions. Furthermore, many FAB measures make agriculture more resilient to climate change, for instance by improving water absorption and water retention, doing so reducing flooding risks, erosion, and increasing resilience to drought.

B. Biodiversity:

While key environmental laws such as the Birds and Habitats Directives have focused on nature-conservation areas, we argue that a larger emphasis should be put on the role of agriculture in promoting biodiversity. A good example here is the Dutch 'Delta-plan for Biodiversity restoration'.

C. Nitrate Directive:

To increase soil organic matter, synthetic fertilisers should partly be replaced by animal or green manure. This is often not possible without at least temporarily going beyond the legal limits for nitrate applications on the field. Underestimation of the value of the soil carbon content is a missed opportunity in the current Nitrate directive.

D. Water Framework Directive:

FAB can play a crucial role in meeting the objectives of this Directive, including by promoting the reduction of chemical fertilisers and plant protection products in agricultural landscapes surrounding waterways.

Figure 4: FAB measure combined: catch crops and flower strip. Photo © Marleen v Haaften

Recommendation 7:

Stimulate additional research to further develop knowledge on how to optimise FAB measures and to study interactions between FAB measures.

Research and experiments conducted in the context of the FABulous Farmers project showed that, while outcomes of implementing FAB measures are predominantly positive, there are also important trade-offs to be considered. In addition, there are multiple potential synergies between FAB measures, spatial configuration and landscape contexts, which may differ by region. The EU has a range of programmes that could be used to advance the understanding and implementation of FAB measures, including the European Bioeconomy strategy, the EU Green Deal, and Horizon Europe (Mission areas 'Soil Health and Food' and 'Adaptation to climate change including societal transformation')

In the context of these programs, the following research opportunities would be particularly worthwhile:

- Developing living labs with multiple stakeholders to increase innovation;
- Improving understanding of where FAB measures are best located to obtain the highest returns;
- Creating guidance on timescales required to achieve optimal FAB results;
- Quantifying economic and environmental trade-offs when using FAB measures;
- Understanding how FAB measures interact to produce the best outcomes;
- Determine how FAB measures should be implemented effectively and managed over time;
- Finding the most effective ways of encouraging farmers to try FAB measures.

Conclusion

Functional Agro-Biodiversity refers to those elements of biodiversity that provide ecosystem services and support sustainable agricultural production, while also delivering benefits to the environment and society as a whole.

In the context of the FABulous Farmers projects conducted in four EU countries and the UK, it became clear that FAB provides tangible benefits to farmers, for instance through improved pollination, natural pest control and increased yields. In addition, by providing vital resources and reducing the need for external inputs such as plant protection products and fertilisers, FAB also supports biodiversity conservation.

To promote the uptake of FAB measures by farmers and enhance their effective implementation, this policy paper detailed seven policy recommendations. Through these recommendations, FAB can be implemented as a key solution for sustainable agricultural production, becoming a cornerstone of the green architecture of the new CAP.

Annex A: Impact of FAB measures on ESS

Within the context of the FABulous Farmers project, a literature study was published on the impact of different FAB measures. Figure 5 shows the 8 tested FAB measures and their contribution to ecosystem service provision and farm management. The figure is an abbreviated version from the full report.

This review found that the outcomes of implementing FAB measures are predominantly positive, with a number of mixed effects. Notably, there is still significant uncertainty regarding the impact of FAB measures on yields, with a range of both positive and negative results being reported. This is predominantly due to the metrics, location and timeframe reviewed in each study, and complex interactions between management and context. Some effects on yield could be short-term and the long-term benefits of a more sustainable system may exceed yield loss with time.

For some FAB measures, evidence is limited. For example, organic matter input is most beneficial for carbon sequestration and soil quality, but effects on biodiversity are less well documented - with some positive effects on invertebrates, but potentially negative effects on soil microbial diversity. Similarly, a potential decrease in water quality with the application of organic matter or fresh manure depends heavily on the timing and execution of application.

Trade-offs must be considered when implementing FAB measures, e.g. reduced tillage techniques combined with an increase in use of plant protection products could lead to reduced water quality. These trade-offs either need to be considered in each region for their broader implications, or offset through the use of other FAB measures. Spatial configuration and landscape context are also important considerations when locating interventions.

FAB measure	Fertiliser use	Pesticide use	Pollination	Biodiversity	Soil quality	Water quality	Flooding	Yield	SOC	GHG
1. Reduced tillage techniques	↑	↑		↑↔	↑	↓	↑	↑↓	↑↓	↑↓
2a. Mixed crops & crop rotations	↓	↓	↑	↑	↑	↑	↑	↑	↑↓	↑↓
2b. Sward diversity	↓	↓	↑	↑	↑	↑	↑	↑↓	↑	↑↓
3. Cover crops inc. legumes	↓	↓		↑	↑	↑	↑↓	↑↓	↑	↑↓
4. Modify manure	↓			↑↓	↑	↓	↑	↑	↑	↑↓
5. Organic matter input	↓			↑↓	↑↓	↓	↑	↑	↑	↑↓
6. Agroforestry	↓	↑↓	↑	↑	↑	↑	↑	↑↓	↑↓	↑↓
7. Hedgerow management		↑↓	↑	↑	↑	↑	↑	↑↓	↑	↓
8. Field margin management		↓	↑	↑	↑	↑	↑	↑↓	↑	↓

Figure 5: 8 FAB measures. Note: green represents positive effects, red represents negative effects. Upward and downward arrow = mixed effects. Horizontal arrow = no effect. SOC stands for soil organic content and GHG for greenhouse gasses. Adapted from: L Maskell, L Norton, J Alison, S Reinsch & DA Robinson, 'Review of current methods and approaches for simple on farm environmental monitoring of FAB solutions'.

Annex B. FAB and natural pest control

A number of FAB measures can support beneficial insects that deliver natural pest control. These beneficial insects require shelter against harsh conditions, alternative prey when no crops with pests are present, and floral resources that (in many species) are essential food for ovipositing females. Some of these resources are best provided by woody habitats, such as hedgerows and other semi-natural landscape elements, whereas floral resources are often best provided from herbaceous plants in the margin of the fields. The optimal support of these beneficial insects is obtained when all resources are sufficiently available in the agricultural landscape, which partly explains the mixed results indicated in the table when focusing on a single measure. Among all landscape measures, field margin strips are relatively easy to realize.

In a number of large-scale projects in the Netherlands and the UK, it was demonstrated that:

- Perennial flowering field margins provide superior overwintering sites for many biocontrol organisms.
- Biocontrol organisms can refuel their energy supplies, but only when provided with appropriately selected flowering plants.
- Targeted flowering field margins harbour many more insect predators and parasitoids than grassy margins.
- These insect predators and parasitoids effectively spill over into the crop for 50 metres or more from the flower margins.
- Crop pests suffer more attacks from the larger contingents of predators and parasitoids.
- Significant reductions in crop damage and even increases in yield can be achieved.
- Conventional wheat and potato growers were able to consistently reduce insecticide use by 90%.

The demonstrated drop in pesticide use represents an important positive result in itself, safeguarding the local insect fauna and the ecosystem services they provide. Moreover, the result creates a positive feedback loop that further strengthens natural pest control. It also has important positive effects on water and soil quality. Finally, the flower margins and other landscape structures provide recreational and aesthetic values and thus contribute to the wellbeing of the local population and to a positive image of the agricultural sector.

Annex C. FAB and soil quality

The soil is the basis of the agricultural system, since a healthy soil is the base for a good yield. There is a direct link with various FAB measures:

- Reduced tillage techniques have a positive influence on soil life. Habitats are disturbed as little as possible, damage on soil fauna (e.g. cutting of worms) is reduced, and erosion is combatted. Low tyre-pressure and/or controlled traffic, further helps to reduce soil compaction.
- A well-chosen crop rotation can increase the organic matter content of the soil, with key positive effects. The diverse root depths of the crops improve soil structure, water infiltration and retention, and better uptake of the soil nutrients. Moreover, crop rotation is an efficient way to lower weed pressure, resulting in less need for herbicides and better water quality. Mixed growing seasons of crops increases possibilities in diversification of cover crops.
- Cover/catch crops ensure that the soil is not left bare during the seasons when it is vulnerable to erosion (wind and rain). The uptake of nutrients by these crops reduces nutrient leaching, which reduces the need of (chemical) fertilisers.
- Organic matter increases the infiltration and water retention capacity of the soil, increasing reslience against droughts. Organic matter input also increases the number and variety of earth worms in the soil.
- The use of different forms of (organic) manure improves quality of yield, but also reduces leaching of nutrients with better water quality as result. In addition, compositing manure provides a more equilibrated C/N-ratio, better availability of nutrients, and a reduction in weed seeds.