By using the less productive and marginal part of farmland, it is possible to implement natural habitats beneficial for biodiversity, with wider positive impacts on water and soil quality, without sacrificing high yields and productive agriculture. This approach takes into account the whole landscape, providing multifunctional benefits.

Project Details

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Multifunctional Field Margins - Enhancing Biodiversity in Agricultural Landscapes

See Also: Syngenta Case Study Operation Pollinator

CONTEXT

Syngenta is a leading agriculture company helping to improve global food security by enabling millions of farmers to make better use of available resources. Through world class science and innovative crop solutions, our 28,000 people in over 90 countries are working to transform how crops are grown. We are committed to rescuing land from degradation, enhancing biodiversity and revitalizing rural communities. To learn more visit www.syngenta.com and www.goodgrowthplan.com.

Food production has increased many folds since the advent of sophisticated farm inputs, better farm management practices, and technologies delivering greater food security around the world - saving over a billion people from starvation. Agriculture has involved developing high-yielding crop varieties, expanding irrigation infrastructure, modernizing management techniques, distributing hybridized seeds, synthetic fertilizers, and crop protection to farmers. Since then, agriculture has seen big changes in production methods, including increased mechanization and farm consolidation. These developments have been accompanied by reductions or even the removal of margins, hedges, ponds, and other uncultivated areas rich in biodiversity.

OBJECTIVE AND PROJECT OVERVIEW

To restore and enhance biodiversity in agricultural landscapes, it is essential to increase the quality and amount of farm's edge habitats while optimizing the farm yield and profitability. This land usually is less fertile and marginal and given over to uncropped areas such as field margins, field corners, and buffer zones. Protecting and restoring these uncropped areas along with sustainable intensive agriculture on cropped areas will provide multiple benefits, such as improved farm productivity, increased number of pollinator insects, and other faunas such as earthworms to maintain soil fertility, reduced soil transfer into local surface water bodies, enhanced carbon sequestration, and landscapes supporting a diversity of ecosystem services for the whole of society.

Simultaneously, achieving higher yields on farm will reduce the need for agriculture expansion into the remaining natural habitats that are vital for biodiversity and other ecosystem services. Achieving more crops per acre of land, per drop of water, and per measure of other

farm inputs will resist pressures on land occupancy and therefore provide more space for biodiversity and ecosystem conservation. Table 1 summarizes the various stakeholders and their interest.

Table 1

Stakeholders	Interest
Farmers	Productivity gains, higher farm income, prevention of soil erosion, enhanced pollination
Environmental nongovernmental organizations	Increased biodiversity in agricultural landscapes, sustainable farming for the environment, promotion of local plant species, improved water quality
Food chain partners	Procurement of biodiversity friendly products
Universities and research institutes	Training and education of farmers to enhance biodiversity in agricultural landscapes
Community at large	Sustainable food production, improved water quality, tourism, and recreation benefits
Governmental bodies	Preservation and management of biodiversity in agricultural landscapes

THE BUSINESS CASE

Research shows that the highest potential to create positive impacts on biodiversity can be expected from the greening element “ecological focus areas” (EFAs). EFAs are a means to create bounding systems in the agricultural landscapes, which should guarantee the networking of biotypes and habitat as well as improved protection of soil, water, and climate.

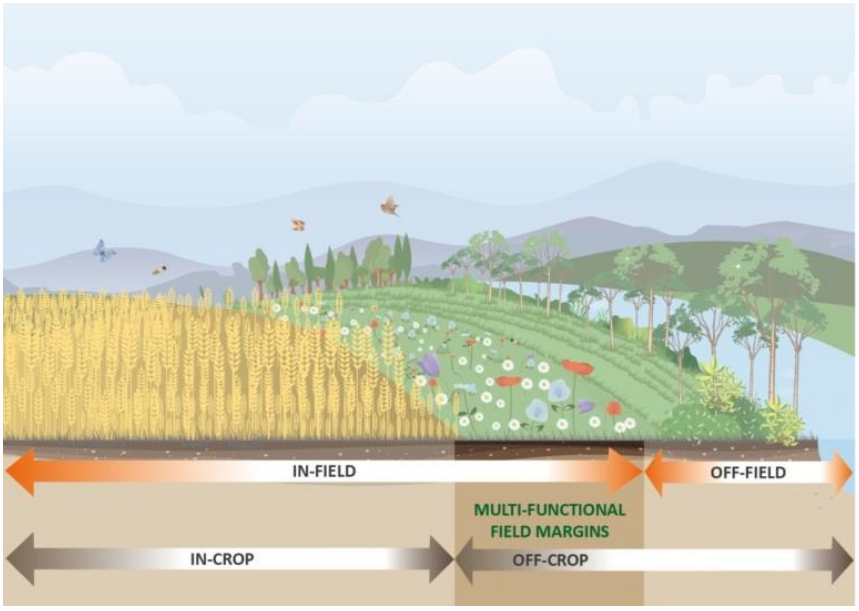

Figure 1. *Through a simple assessment of the landscape, soil type, geography and climate, it is possible to fit existing farm management options, as well as subsidy and achieve multiple benefits from the implementation of this unitary approach whilst maintaining a sustainable and productive farming business.*

To make EFAs truly effective, agriculture needs to move from single-function to multi-functional benefits of agro-environmental measures. This is possible through the proactive and integrated management of multifunctional field margins (MFFM), which can create a number of benefits for biodiversity conservation, and managing soil and water resources. The concept of MFFM aims to identify and solve multifunctional issues to improve resource efficiency in a practical manner, integrating result-oriented seed mixtures, management practices, and land use planning on a farm scale.

MFFM provides the following specific benefits:

a) Restoring, preserving, and enhancing biodiversity and the state of landscapes

Creates a network of essential habitat to:

- Reintroduce local plant species
- Boost the number of pollinating and beneficial insects
- Increase earthworm populations and activity
- Provide food sources for birds and small mammals

b) Improving water management, including fertilizers and pesticide management

Creates high-quality vegetative buffer strips by watercourses to reduce runoff to:

- Protect watercourses and ponds from contaminated runoff entering them
- Improve the efficiency of water use by crops in drier parts of the landscape
- Decrease flooding by slowing down the transfer of precipitation to surface water

c) Preventing soil erosion and improving soil management

Creates high-quality vegetative buffer strips in key landscape positions to:

- Prevent the loss of soil as a key natural resource for agriculture and food security
- Prevent aquatic environment contamination by sediments from adjacent fields
- Increase the resilience of agro-ecological systems to climate change

Below SWOT analysis help connects projects' objectives and strategies to implmented actions to better determine Syngenta strengths and weaknesses in relation to the opportunities and threats the company faces on the project implementation.

Table 2. Strenghts, Weaknesses, Oportunities and Threats (SWOT) Analysis

Objective	Strength	Weakness	Opportunity	Threat
Restoring, preserving, and enhancing biodiversity in multi-functional landscapes	Productive Farming and biodiversity enhancement can coexist in different areas of the same field (e.g. land sparing). Research proves the effectiveness of the implementation of proactively managed field margins in restoring biodiversity and ecosystem services.	The growing demand for land has caused a one-sided optimization of individual functions in agricultural landscapes, in particular the production of food. This has a negative effect on biodiversity. Reducing or removing essential natural habitats in agricultural landscapes can lead to the reduced resilience of agri-ecosystem services, resulting in increased vulnerability to climate change.	Farmers can easily implement and proactively manage field margins on their land by using less productive or marginal land on farm for habitat restoration.	MFFM are not a one size fit all measure but require local adaptation and a study of local conditions. Farmers need to be trained with skills to perform farm assessment. Farmers also need to commit to this measure for a long-term, alongside the production of food crops, managing margins as they manage crops.
Improving water management, including fertilizer and pesticide	Alongside providing ideal habitat for local biodiversity, buffer strips planted at the	Increasing levels of runoff from agricultural land can negatively affect crop growth and	Farmers have the necessary tools to effectively manage buffer strips, but they	Proper financial and advisory infrastructures are needed to implement

Table 2. Strenghts, Weaknesses, Oportunities and Threats (SWOT) Analysis

Objective	Strength	Weakness	Opportunity	Threat
management	edges of cropped field can help reduce runoff by improving soil permeability and increasing the number of earthworm channels, slowing down water and soil movement.	productivity, alongside polluting water streams in the vicinity of cultivated fields.	need training and agronomic advice to identify the most suitable location for buffer strips to have the biggest impact on water protection.	MFFM. If they are not properly managed, they cannot be effective, and farmers risk to unwillingly have a negative impact on the environment alongside compromising their productivity.
Preventing soil erosion and improving soil management	Buffer strips can prevent soil erosion while at the same time providing habitats for local biodiversity. Extensive research proves that extending soil management to non-cropped areas around fields prevents soil erosion more effectively that simply adopting soil conservation techniques in cropped areas.	Due to a combination of intensive cultivation, lack of crop rotation and low vegetative cover, soil erosion can create unsustainable losses. This is highly damaging for soil fertility, as it deprives the soil of nutrients and organic matter.	The additional training required to implement soil conservation best practices is relatively straightforward and can be delivered in a cost effective way.	To be effective, MFFM need to be properly managed to deliver their multifunctional value.

DECISION MAKING PROCESS

High level support for the Multifunctional Field Margin Program was obtained due to the project's on-the-ground success in terms of pollination and soil conservation benefits. Results of 5 years of research from the Buzz Project led by the Centre of Ecology and Hydrology, in the UK, shows that pollinator abundance can be increased 12-fold by establishing Pollen + Nectar rich field margins. MFFM is already implemented in 18 European countries on more than 3,000 commercial farms on average on 1 percent of the total farmland.

The project also gained popularity through communication and outreach activities both within and outside the company.

Universities, academic institutes, nongovernmental organizations, banks, and value chain partners are involved in the project, supporting to varying degrees – for instance, identifying the correct seed mix implementation, and monitoring and reporting results. Local conservation organizations and academic institutes monitor and report implemented margins and their impacts on biodiversity conservation. Additionally, farmers' engagements improve opportunities for "market access" for farmers participating in the program.

Third-party organizations, such as conservation organizations, or farmers collect on-farm data through field surveys. These data help monitor the number of hectares of farmland implemented with MFFMs. Additionally, impact evaluations for biodiversity improvement are run jointly with third parties.

PROJECT DETAILS

Multifunctional field margins: Practical implementation

Ecological focus areas such as field margins need management as every other crop does. Effectively managed margins will last for many seasons.

When properly managed, field margins and other landscape elements such as hedges and rows can deliver multifunctional benefits, meaning their impact extends beyond biodiversity conservation. For example, properly placed and managed field margins can reduce chemical runoff from crop fields, therefore protecting water from contamination and limiting soil erosion and improving the levels of soil biodiversity. To achieve these benefits, vegetative buffer strips need to be properly designed, located, established, and managed. Simple design aids are now becoming available. For example, there are simple ways to calculate the ideal width of buffer strips based on soil types and other climatic and cropping factors. Location is normally more straightforward, based on some simple diagnostics over where runoff is likely to be highest. Establishment and management are largely as already described for biodiversity; however, for effectiveness at reducing runoff, it is often important to loosen compacted soil, plant some deep-rooted plants, and ensure farm traffic is limited to that required for managing the buffer strip.

Stages of Implementation of MFFM

Figure 2 maps out the four stages of implementation of MFFM and provides a brief explanation on what is expected at each stage.

The assessment of the type of a margin required is the most crucial stage of the project. For example, to reduce runoff on loose soil, it is often important to have margins with deep-rooted plants and keep farm machinery traffic as low as possible in the margins to reduce the chance of soil compaction.

Farmers that implement MFFMs on their farms need to consider a few implementation and management costs that refer to implementing and managing the measure. Implementation costs refer to the steps that farmers must take to establish MFFMs on their farm. For example, regardless of the type of field margin, farmers will need to set aside some land from production and will invest in the appropriate seed mixtures and the machinery needed to sow it. The choice of location, which are generally marginal lands, and seed mixture will depend on an analysis of the local conditions of the farm, including climate and target species for biodiversity restoration. Management costs refer to the costs incurred by the farmers in the years subsequent to establishing the margins. Farmers need to invest time on the proactive and targeted management of MFFMs to ensure the expected

Farming Guidelines:

Establishment in the first year:

- Do not use any fertilizer. As the ground becomes more impoverished, the better the floristic character of the habitat will be.
- Cleaning cuts will remove annual weeds. Cut newly sown mixture in late April. Spring sown mixtures need to be cut in June.
- If annual weeds persist, cut again 6 to 10 weeks later.
- A cut at the end of the flying season (September-October) will support the establishment of a dense margin in subsequent years.

Management in subsequent years:

- To provide overwintering habitat for butterflies, cut only 50 percent of the margin and alternate in the following year.
- Removal of cutting is recommended, as it helps perennial species to re-germinate.
- Seed mixtures targeted to local conditions are crucial to establishing habitats for biodiversity, as they need to meet the local fauna food and nesting requirements. Examples of mixtures are:
    - Flower and plant mixtures provide a good source of pollen and nectar and some cover for many species. They attract a wide range of insects and provides habitat for small mammals. Successfully managed margins can last 10 to 15 years.
    - Legumes and wildflowers mixes are also proven to provide a lot of pollen and nectar to attract bumble bees and other bees. Successfully managed margins can last 3 to 5 years.

environmental benefits. However, most of the costs will already be covered by the traditional activities on the farm.

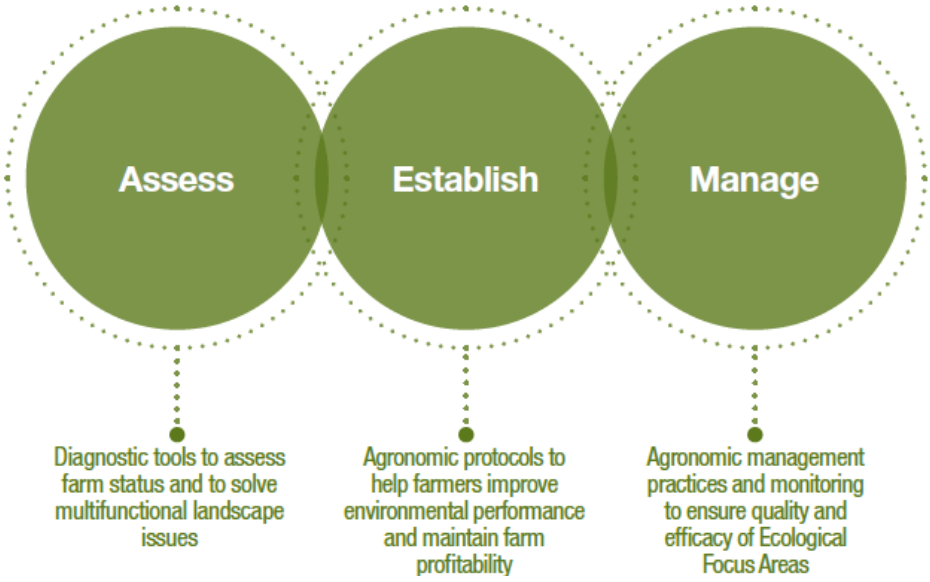

Figure 2. *Stages of Implementation of MFFM.*

LESSONS LEARNED

A number of key lessons were learned from this program:

- MFFMs are not a one size fits all measure but require local adaptation and a study of local conditions.
- MFFMs need to be properly established and managed for a long period of time to deliver their multifunctional value and connected to the ecosystem.
- To make the implementation and management effective, farmers would require training and advice. If they are not properly managed, they cannot be effective, and farmers risk to unwillingly have a negative impact on the environment.
- Proper financial and advisory tools may support the implementation of MFFMs.

There are multiple socio-economic benefits accruing to growers as of our engagement with them on this project. Our intervention through Multifunction Field Margin Project helps growers enjoy income stability through facilitating them better access to markets and securing them a long-term relationship with customers. Stable income also encourages growers for additional farm investments to improve productivity. The project also provides an opportunity to growers to communicate and co-operate with local community, and hence help them improve social networks, social responsibility, and a sense of community and trust. In some countries efforts of farmers are supported by local community by contributing in investments to establish field margins, or by offering a price premium on products produce on farms with MFFM.

FUTURE IMPLEMENTATION AND NEXT STEPS

The project success, which proves that the proactive management of field margins delivers many benefits, has led Syngenta to expand the program over the last 3 years, both geographically and into different terrains. It has also provided the basis for Syngenta's increased focus on multifunctional landscapes.

The concept of multifunctional landscapes can help to

move the discussion on biodiversity from single-function measures to those that provide these multiple and integrated benefits.

To this end, Syngenta is developing practical tools adapted to local conditions and cropping systems. Diagnostic tools assess farm status and solve multifunctional landscape issues, and agronomic protocols help farmers improve environmental performance and maintain farm profitability. Similarly, agronomic management practices and monitoring help farmers ensure quality and efficacy.

Syngenta now has corresponding pilot projects across the world in oilseed rape, sunflower, apples, pears, melons, vines, olives, and golf courses.

We believe that with scaling up of MFFM project in other parts of the world we will significantly help in increasingresource efficiency and make a vital contribution towards sustainable farming in the future.

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