Flower margin in the Hoeksche Waard (Netherlands) (Paul van Rijn)

Field Margin Strips (Netherlands)

Akkerrand

DESCRIPTION

Create strips with flowering plants in the margins of arable fields.

In the Hoeksche Waard area (Netherlands), field margin strips between 2 and 20 meters wide have been sown in the margins of arable or vegetable crop fields with a mixture of native flowering plant species, with plant species targeted to encourage certain target insect abundances. A mixture of annual flowers are sown in spring (April or May), or perennial plant mixtures (flowers and grasses) sown also in spring, or prefernetially in late summer (September). Annual flower strips produce flowers mostly in summer, whereas perennial strips produce mostly flowers in the following spring and following years.

The purpose of flower strips is to support the natural pest control and pollination by native insect species for reduced disease and increased production. Many flying natural enemies of pests require pollen and/or nectar in the adult stage for survival and reproduction, needing food on a regular basis, so must be in short range from the crop fields, i.e. in the margin of or within the field. Pollinators also need food when the crop is not flowering in order to build up a local population.

For the implementation of field margin strips to be successful, knowledge of the plant species mixtures was requried to know what would grow well in this semi-humid, deep heavy soil, agricultural environment, as well as growing well together with the right characteristics to support the target insect groups. For example, most natural enemies have small mouth parts and can only feed on nectar from shallow flowers, thus require a specific seed mix (<2 cm deep, see Van Rijn & Wäckers, Journal of Applied Ecology 2016). Here, the species were selected for their ability to support natural enemies of aphids (such as hoverflies) or wild bees, especially bumblebees. The first group includes flowers with accessible nectar (< 2 cm deep) such as Apiaceae, buckwheat, cornflower, and Asteraceae with shallow florets. The second group includes red clover, lotus and other Fabaceae, as well as Asteraceae with deeper florets (such as sunflowers). Perennial mixtures are generally supplemented with annual flowers (cornflowers and poppies) that already produce flowers the first year, as well as (slow growing) grass species (Festuca) to make the strips more robust when incidentally used as tractor paths.

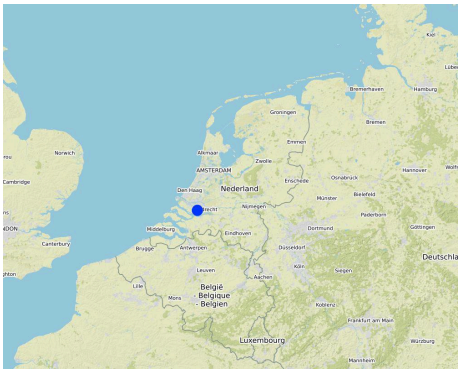
Additionally for implementation, knowledge on how to effectivly use the seed sowing machines, with special care required for preparing the seed bed in advance, to prevent segregation of bigger and smaller seed in the machine, and for sowing the seeds not to deep and the field margin strips should be maintained for a number of years to allow for a local build up of beneficial insect populations. Another considertation is the farming practise and the surrounding landscape as it should provide other resources needed by the insect population, such as hibernation habitat and bee nesting sites or additional (prey and flower providing) habitats for other generations of natural enemies.

The benefits are multiple. The reduced need to use insecticides, especially against aphids, increases the capacity for pollination and reduces the need to manage honeybees, although regular scouting of pest and natural enimies in the adjacent crop field is required to ensure benefits. The strip acts as a buffer to reduce the drift of fertilisers and pesticides into adjacent ditches and water courses. And, there is a social benefit with an increased appreciaiton of the arable landscape by citizens enjoying the mosaic of flowers and crops in the landscape.

The technology overall has been a great success, yet does have a small number of draw backs to be aware of and manage effectivly. Weeds usually occur in the year of sowing and there can be some dislike of the rough nature of the vegetation compared to crop fields. To help manage these challenges field margin strips are sometimes mown while still flowering, ideally mowing is done only once a year and at the end of the growing season (September).

The compilation of this SLM is a part of the European Interreg project FABulous Farmers which aims to reduce the reliance on external inputs by encouraging the use of methods and

LOCATION



Location: Hoeksche Waard (Zuid-Holland), Netherlands

No. of Technology sites analysed: single site

Geo-reference of selected sites
- 4.48629, 51.7831

Spread of the Technology: evenly spread over an area (150.0 km^2)

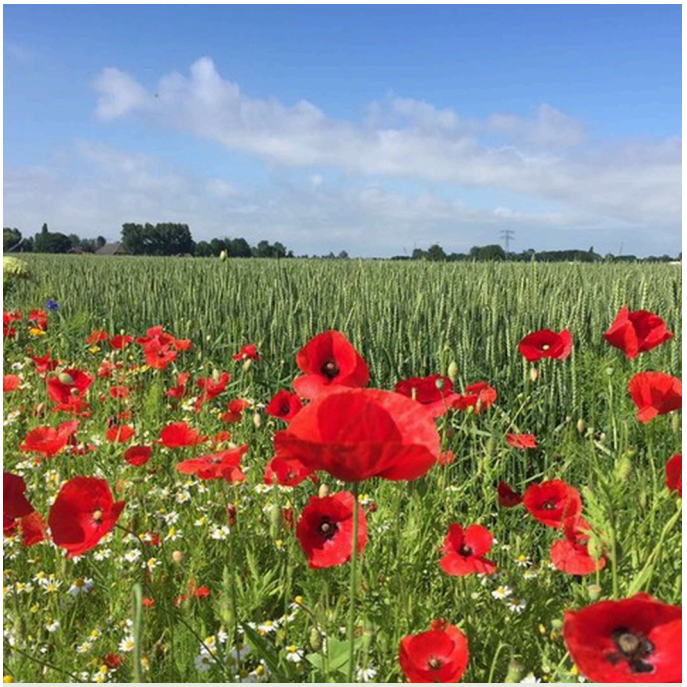
In a permanently protected area?: Nee

Date of implementation: 2005

Type of introduction
- ☐ through land users' innovation
- ☐ as part of a traditional system (> 50 years)
- ☑ during experiments/ research
- ☑ through projects/ external interventions

interventions that increase the farm's Functional AgroBiodiversity (FAB). Visit www.fabulousfarmers.eu and www.nweurope.eu/Fabulous-Farmers for more information.

Field margin strip



Field margin strip

CLASSIFICATION OF THE TECHNOLOGY

Main purpose

- [x] improve production
- [ ] reduce, prevent, restore land degradation
- [x] conserve ecosystem
- [x] protect a watershed/ downstream areas – in combination with other Technologies
- [x] preserve/ improve biodiversity
- [ ] reduce risk of disasters
- [ ] adapt to climate change/ extremes and its impacts
- [ ] mitigate climate change and its impacts
- [x] create beneficial economic impact
- [ ] create beneficial social impact
- [x] support natural pest control and improve natural pollination by native insect species

Land use

Land use mixed within the same land unit: Nee

Cropland

- Annual cropping: cereals - wheat (spring)

Number of growing seasons per year: 1
Is intercropping practiced? Ja
Is crop rotation practiced? Nee

Water supply

- [x] rainfed
- [ ] mixed rainfed-irrigated
- [ ] full irrigation

Purpose related to land degradation

- [ ] prevent land degradation
- [x] reduce land degradation
- [ ] restore/ rehabilitate severely degraded land
- [ ] adapt to land degradation
- [ ] not applicable

Degradation addressed

biological degradation - Bh: loss of habitats, Bp: increase of pests/ diseases, loss of predators

SLM group

- integrated pest and disease management (incl. organic agriculture)
- herbaceous field margin strips

SLM measures

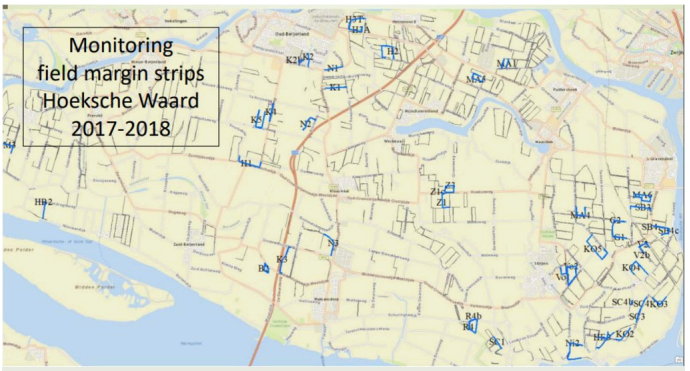
vegetative measures - V2: Grasses and perennial herbaceous plants

management measures - M7: Others

TECHNICAL DRAWING

Technical specifications

Overview of flower margins in the Hoeksche Waard (in blue).
Field margin strips are typically 3-4 meters wide but can range between 2 and 20 meters in width. They are typically present at all margins surrounding a crop field, especially where the field is delimited by a ditch. Here the land gradient is flat, but margin strips can be applied on any gradient, and would be particually effective at the bowwom of a slope for run off buffer strip benefits.



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ESTABLISHMENT AND MAINTENANCE: ACTIVITIES, INPUTS AND COSTS

Calculation of inputs and costs

- Costs are calculated: per Technology unit (unit: **1 ha**)
- Currency used for cost calculation: **Euro**
- Exchange rate (to USD): 1 USD = 0.89 Euro
- Average wage cost of hired labour per day: 100 euro

Most important factors affecting the costs

Seed mixture choice can vary in price and weed control can be challenging

Establishment activities

1. Creating seed bed using shallow plough to invert weeds and provide bare soil surface o sow seed (Timing/ frequency: 1 month before sowing)
2. Fertiliser application (as required) (Timing/ frequency: Just before or with sowing)
3. Sowing seed. Annual flowers are typically sown in rows (30 cm apart), allowing for mechanical weed control (once or twice) in between the rows. Perennial strips are broadcast sown (at a density of 18 kg/ha) and not weeded. (Timing/ frequency: April/May or September)
4. Weeding using machinery (of annual strips) (Timing/ frequency: 1 month after sowing)
5. Mowing using machenery (Timing/ frequency: 1 month after sowing)
6. Ploughing (when strips are removed or resown) (Timing/ frequency: after mowing)

Establishment inputs and costs (per 1 ha)

Specify input	Unit	Quantity	Costs per Unit (Euro)	Total costs per input (Euro)	% of costs borne by land users
Labour					
Farm worker	person-days	2.5	100.0	250.0	100.0
Equipment					
Tractor	machine-days	2.5	50.0	125.0	100.0
Sowing machine	machine-days	0.75	50.0	37.5	100.0
Plough	machine-days	1.5	50.0	75.0	100.0
Mower	machine-days	0.75	50.0	37.5	100.0
Plant material					
Seed mix	kg	18.0	40.0	720.0	
Fertilizers and biocides					
Fertilizer	kg	100.0	2.0	200.0	
Total costs for establishment of the Technology				**1'445.0**	
Total costs for establishment of the Technology in USD				*1'623.6*	

Maintenance activities

1. Mowing (Timing/ frequency: Once per year)

Maintenance inputs and costs (per 1 ha)

Specify input	Unit	Quantity	Costs per Unit (Euro)	Total costs per input (Euro)	% of costs borne by land users
Labour					
Farm worker	person-days	0.75	100.0	75.0	100.0
Equipment					
Tractor	machine-days	0.75	50.0	37.5	100.0
Mower	machine-days	0.75	50.0	37.5	100.0
Total costs for maintenance of the Technology				**150.0**	
Total costs for maintenance of the Technology in USD				*168.54*	

NATURAL ENVIRONMENT

Average annual rainfall

- ☐ < 250 mm
- ☐ 251-500 mm
- ☐ 501-750 mm
- ☑ 751-1,000 mm

Agro-climatic zone

- ☐ humid
- ☑ sub-humid
- ☐ semi-arid
- ☐ arid

Specifications on climate

Average annual rainfall in mm: 800.0
Name of the meteorological station: Rotterdam

- [ ] 1,001-1,500 mm
- [ ] 1,501-2,000 mm
- [ ] 2,001-3,000 mm
- [ ] 3,001-4,000 mm
- [ ] > 4,000 mm

Slope
- [x] flat (0-2%)
- [ ] gentle (3-5%)
- [ ] moderate (6-10%)
- [ ] rolling (11-15%)
- [ ] hilly (16-30%)
- [ ] steep (31-60%)
- [ ] very steep (>60%)

Landforms
- [x] plateau/plains
- [ ] ridges
- [ ] mountain slopes
- [ ] hill slopes
- [ ] footslopes
- [ ] valley floors

Altitude
- [x] 0-100 m a.s.l.
- [ ] 101-500 m a.s.l.
- [ ] 501-1,000 m a.s.l.
- [ ] 1,001-1,500 m a.s.l.
- [ ] 1,501-2,000 m a.s.l.
- [ ] 2,001-2,500 m a.s.l.
- [ ] 2,501-3,000 m a.s.l.
- [ ] 3,001-4,000 m a.s.l.
- [ ] > 4,000 m a.s.l.

Technology is applied in
- [ ] convex situations
- [ ] concave situations
- [x] not relevant

Soil depth
- [ ] very shallow (0-20 cm)
- [ ] shallow (21-50 cm)
- [ ] moderately deep (51-80 cm)
- [ ] deep (81-120 cm)
- [x] very deep (> 120 cm)

Soil texture (topsoil)
- [ ] coarse/ light (sandy)
- [ ] medium (loamy, silty)
- [x] fine/ heavy (clay)

Soil texture (> 20 cm below surface)
- [ ] coarse/ light (sandy)
- [ ] medium (loamy, silty)
- [x] fine/ heavy (clay)

Topsoil organic matter content
- [ ] high (>3%)
- [x] medium (1-3%)
- [ ] low (<1%)

Groundwater table
- [ ] on surface
- [x] < 5 m
- [ ] 5-50 m
- [ ] > 50 m

Availability of surface water
- [ ] excess
- [x] good
- [ ] medium
- [ ] poor/ none

Water quality (untreated)
- [ ] good drinking water
- [ ] poor drinking water (treatment required)
- [x] for agricultural use only (irrigation)
- [ ] unusable

Water quality refers to: surface water

Is salinity a problem?
- [ ] Ja
- [x] Nee

Occurrence of flooding
- [ ] Ja
- [x] Nee

Species diversity
- [ ] high
- [ ] medium
- [x] low

Habitat diversity
- [ ] high
- [ ] medium
- [x] low

CHARACTERISTICS OF LAND USERS APPLYING THE TECHNOLOGY

Market orientation
- [ ] subsistence (self-supply)
- [ ] mixed (subsistence/ commercial)
- [x] commercial/ market

Off-farm income
- [x] less than 10% of all income
- [ ] 10-50% of all income
- [ ] > 50% of all income

Relative level of wealth
- [ ] very poor
- [ ] poor
- [x] average
- [ ] rich
- [ ] very rich

Level of mechanization
- [ ] manual work
- [ ] animal traction
- [x] mechanized/ motorized

Sedentary or nomadic
- [x] Sedentary
- [ ] Semi-nomadic
- [ ] Nomadic

Individuals or groups
- [x] individual/ household
- [ ] groups/ community
- [ ] cooperative
- [ ] employee (company, government)

Gender
- [x] women
- [x] men

Age
- [ ] children
- [ ] youth
- [x] middle-aged
- [ ] elderly

Area used per household
- [ ] < 0.5 ha
- [ ] 0.5-1 ha
- [ ] 1-2 ha
- [ ] 2-5 ha
- [ ] 5-15 ha
- [x] 15-50 ha
- [x] 50-100 ha
- [ ] 100-500 ha
- [ ] 500-1,000 ha
- [ ] 1,000-10,000 ha
- [ ] > 10,000 ha

Scale
- [x] small-scale
- [ ] medium-scale
- [ ] large-scale

Land ownership
- [ ] state
- [ ] company
- [ ] communal/ village
- [ ] group
- [x] individual, not titled
- [ ] individual, titled

Land use rights
- [ ] open access (unorganized)
- [ ] communal (organized)
- [x] leased
- [x] individual

Water use rights
- [ ] open access (unorganized)
- [x] communal (organized)
- [ ] leased
- [ ] individual

Access to services and infrastructure

health	poor		✓ good
education	poor		✓ good
technical assistance	poor		✓ good
employment (e.g. off-farm)	poor		✓ good
markets	poor		✓ good
energy	poor		✓ good
roads and transport	poor		✓ good
drinking water and sanitation	poor		✓ good
financial services	poor		✓ good

IMPACTS

Socio-economic impacts

Crop production	increased	Increased crop yeild from improved pollination
crop quality	increased	Increased crop health with reduced pests
expenses on agricultural inputs	decreased	Less pesticides required due to better natural pest control
farm income	increased	Cost of implementation offset by larger crop yield and health
workload	decreased	Implementation and management of flower strip takes longer than using whole field for single crop

Socio-cultural impacts

food security/ self-sufficiency	improved	Less reliance on pesticide input
recreational opportunities	improved	Social apprication of flowers from public

Ecological impacts

water quality	increased	Less pesticide use leading to less being washed into adjacent ditches
soil loss	decreased	Buffer strip adjacent to ditch reduces surface run off from field
vegetation cover	increased	Margin strips have greater land surace coverage than crops
plant diversity	increased	Large diversity in margins
animal diversity	increased	Habitat and forage for a range of biodoversity
beneficial species (predators, earthworms, pollinators)	increased	Targeted to pollinators and natural pest control species
habitat diversity	increased	Habitat and forage for a range of biodoversity
pest/ disease control	increased	Targeted to improve natural pest control species

Off-site impacts

buffering/ filtering capacity (by soil, vegetation, wetlands)	improved	Buffer strip adjacent to ditch reduces surface run off from field of soil, fertilisers and chemicals

COST-BENEFIT ANALYSIS

Benefits compared with establishment costs

Short-term returns	very negative	very positive
Long-term returns	very negative	very positive

Benefits compared with maintenance costs

Short-term returns	very negative	very positive
Long-term returns	very negative	very positive

Evaluation based on no subsidies; with subsidies the returns are balanced or slightly positive.

CLIMATE CHANGE

Climate-related extremes (disasters)

insect/ worm infestation	not well at all	very well

ADOPTION AND ADAPTATION

Percentage of land users in the area who have adopted the Technology

- [ ] single cases/ experimental
- [ ] 1-10%
- [x] 11-50%
- [ ] > 50%

Of all those who have adopted the Technology, how many have done so without receiving material incentives?

- [x] 0-10%
- [ ] 11-50%
- [ ] 51-90%
- [ ] 91-100%

Has the Technology been modified recently to adapt to changing conditions?

- [x] Ja
- [ ] Nee

To which changing conditions?

- [ ] climatic change/ extremes
- [ ] changing markets
- [ ] labour availability (e.g. due to migration)
- [x] changing CAP subsidy regulations

CAP subsidy regulations are financial supports for land management, changes since technology implementation have supported the use of flower margin strips making the implementaiton more favorable. More general information on CAP can be found here: https://ec.europa.eu/info/food-farming-fisheries/key-policies/common-agricultural-policy/cap-glance_en#documents

CONCLUSIONS AND LESSONS LEARNT

Strengths: land user's view

- Use of land difficult for agricultural practices can be used
- Community building when implemented across an area, connecting farmers together and connection to the public who appreciate more flowers in thier landscape

Strengths: compiler's or other key resource person's view

- New habitat for wildlife, including pollinators and natural pest controls: increased numbers of flowering plants increased numbers of bees, hoverflies and natural enemies
- Multifunctionality of flower margins makes them more cost effective; e.g. flower margins close to ditches increases macrofauna diversity in waters
- Bufferzone for surface water pollution
- Recreational (human health) benefits

Weaknesses/ disadvantages/ risks: land user's viewhow to overcome

- Additional work & costs sowing and maintaining the flower margins compared to leaving the areas unused Community effort of the Hoeksche Waard reduces individual efforts

Weaknesses/ disadvantages/ risks: compiler's or other key resource person's viewhow to overcome

- Without subsidy the implementation costs can be prohibitive Ensure subsidies available for continued sustainable land use.

REFERENCES

Compiler
Alan Radbourne

Editors
David Robinson
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Sabine Reinsch

Reviewer
Renate Fleiner
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Resource persons
Paul Van Rijn - co-compiler
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Full description in the WOCAT database
https://qcat.wocat.net/af/wocat/technologies/view/technologies_5187/

Linked SLM data
n.a.

Documentation was faciliated by

Institution
- UK Centre for Ecology & Hydrology (CEH) - United Kingdom

Project
- European Interreg project FABulous Farmers

Links to relevant information which is available online

- Research on field margins by the University of Amsterdam: https://ibed.uva.nl/content/news/2019/02/importance-of-flower-strips-in-arable-fields.html?1570545036515