Brassica grown as green manure (Evelyn Simak)

Increasing organic matter content on arable land (Netherlands)

Bodemverbetering landbouwgrond

DESCRIPTION

The organic matter content of arable land is increased by spreading mushroom compost ("champost"), growing green manure during the winter season, and reducing tillage

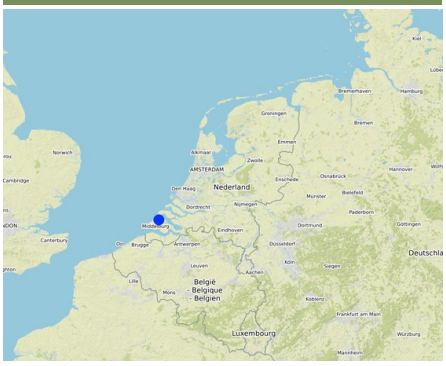
Zeeland is the least populated area of the Netherlands. It consists of islands and peninsulas with almost half the area covered by water, but is also the largest agricultural province of the country. Significant areas are below sea level. Zeeland is known for its onion production, but also potatoes, grain legumes, sugar beet, wheat/grain and flax. The SLM technology described here, on Functional AgroBiodiversity, is applied in the North-West of the FABulous Farmers project pilot area, Zeeland.

The technology is being implemented on a 40 ha area after the harvest of the main crop in autumn. The land is fertilized with mushroom compost ("champost") a by-product of the mushroom production industry, then a cover crop is sown, which is cut and shallow tilled into the soil as a green manure in early spring.

The aim is to increase the organic matter content in the soil to support the growth of (micro-) organisms, improve the water buffering capacity and increase soil fertility. Improved soil health will support better crop growth and yields, with other inputs reduced, thus saving on costs. However, with machinery being used to spread the mushroom compost, the sowing of a green manure catchcrop, and mowing and tilling at the end of the season, the SLM technology is quite labour - and cost-intensive. This technology can be applied as a single operation, or repeated as long as the costs offset the benefits.

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

LOCATION



Location: Kamperland, Zeeland, Netherlands

No. of Technology sites analysed: single site

Geo-reference of selected sites

- 3.68608, 51.59567
- 3.68608, 51.59567

Spread of the Technology: applied at specific points/ concentrated on a small area

In a permanently protected area?: No

Date of implementation: 2019

Type of introduction

- [ ] through land users' innovation
- [ ] as part of a traditional system (> 50 years)
- [ ] during experiments/ research
- [x] through projects/ external interventions

Brassica species green manure crop (Evelyn Simak)

Soil profile (Delphy)

CLASSIFICATION OF THE TECHNOLOGY

Main purpose

- ✓ improve production
- ✓ reduce, prevent, restore land degradation
- conserve ecosystem
- protect a watershed/ downstream areas – in combination with other Technologies
- preserve/ improve biodiversity
- reduce risk of disasters
- adapt to climate change/ extremes and its impacts
- mitigate climate change and its impacts
- create beneficial economic impact
- create beneficial social impact

Land use

Land use mixed within the same land unit: No

Cropland

- Annual cropping

Number of growing seasons per year: 1
Is intercropping practiced? No
Is crop rotation practiced? Yes

Water supply

- rainfed
- ✓ mixed rainfed-irrigated
- full irrigation

Purpose related to land degradation

- prevent land degradation
- ✓ reduce land degradation
- restore/ rehabilitate severely degraded land
- adapt to land degradation
- not applicable

Degradation addressed

chemical soil deterioration - Cn: fertility decline and reduced organic matter content (not caused by erosion

SLM group

- integrated soil fertility management

SLM measures

agronomic measures - A1: Vegetation/ soil cover, A2: Organic matter/ soil fertility

management measures - M2: Change of management/ intensity level

TECHNICAL DRAWING

Technical specifications

ESTABLISHMENT AND MAINTENANCE: ACTIVITIES, INPUTS AND COSTS

Calculation of inputs and costs

- Costs are calculated: per Technology area (size and area unit: **1ha**; conversion factor to one hectare: **1 ha = 1ha = 2.47 acres**)
- Currency used for cost calculation: **Euro**
- Exchange rate (to USD): 1 USD = 0.85 Euro
- Average wage cost of hired labour per day: 150

Most important factors affecting the costs

The cost of the mushroom compost, yet this is a waste product and so could become a cheaper option.

Establishment activities

1. Spreading champost (Timing/ frequency: August)
2. Cultivating the land (Timing/ frequency: August)
3. Sowing cover crop (Timing/ frequency: August)
4. Cutting and tilling catch crop as green manure (Timing/ frequency: March)

Establishment inputs and costs (per 1ha)

Specify input	Unit	Quantity	Costs per Unit (Euro)	Total costs per input (Euro)	% of costs borne by land users
Labour					
Spreading champost	day	3.0	150.0	450.0	100.0
Cultivation	day	3.0	150.0	450.0	100.0
Cover crop sowing	day	3.0	150.0	450.0	100.0
Cutting & tilling green manure	day	5.0	150.0	750.0	100.0
Equipment					
Tractor & related attachments (already owned)	machinery	1.0			100.0
Plant material					
Cover crop	per ha	40.0	30.0	1200.0	100.0
Fertilizers and biocides					
Champost (mushroom compost)	per ha	40.0	30.0	1200.0	50.0
Total costs for establishment of the Technology				**4'500.0**	
Total costs for establishment of the Technology in USD				*5'294.12*	

Maintenance activities
n.a.

NATURAL ENVIRONMENT

Average annual rainfall
- < 250 mm
- 251-500 mm
- 501-750 mm
- ✓ 751-1,000 mm
- 1,001-1,500 mm
- 1,501-2,000 mm
- 2,001-3,000 mm
- 3,001-4,000 mm
- > 4,000 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: KNMI

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

Landforms
- plateau/plains
- ridges
- mountain slopes
- hill slopes
- ✓ footslopes
- valley floors

Altitude
- ✓ 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
- ✓ not relevant

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

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

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

Topsoil organic matter content
- high (>3%)
- ✓ medium (1-3%)
- low (<1%)

Groundwater table
- on surface
- ✓ < 5 m
- 5-50 m
- > 50 m

Availability of surface water
- excess
- ✓ good
- medium
- poor/ none

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

Water quality refers to: both ground and surface water

Is salinity a problem?
- ✓ Yes
- No

Occurrence of flooding
- Yes
- ✓ No

Species diversity
- high
- ✓ medium
- low

Habitat diversity
- high
- medium
- ✓ low

CHARACTERISTICS OF LAND USERS APPLYING THE TECHNOLOGY

Market orientation
- subsistence (self-supply)
- mixed (subsistence/ commercial)
- ✓ commercial/ market

Off-farm income
- ✓ less than 10% of all income
- 10-50% of all income
- > 50% of all income

Relative level of wealth
- very poor
- poor
- ✓ average
- rich
- very rich

Level of mechanization
- manual work
- animal traction
- ✓ mechanized/ motorized

Sedentary or nomadic
- ✓ Sedentary

Individuals or groups
- individual/ household

Gender
- women

Age
- children

- [ ] Semi-nomadic
- [ ] Nomadic

- [ ] groups/ community
- [x] cooperative
- [ ] employee (company, government)

- [x] men

- [ ] 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
- [ ] 50-100 ha
- [ ] 100-500 ha
- [ ] 500-1,000 ha
- [ ] 1,000-10,000 ha
- [ ] > 10,000 ha

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

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

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

Water use rights
- [ ] open access (unorganized)
- [ ] 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	decreased	increased
crop quality	decreased	increased
expenses on agricultural inputs	increased	decreased

Improved soil health and nutrient availability is improving crop production & quality

Improved soil health and nutrient availability is improving crop production & quality

Champost is a relatively cheap form of compost as is a waste material and means fewer more expensive inputs are required.

Socio-cultural impacts

Ecological impacts

soil moisture	decreased	increased
nutrient cycling/ recharge	decreased	increased

Improvement in water holding capacity of soil with mushroom compost addition and less moisture loss due to cover crop

Mushroom compost and cover crop integration as a green manure is recharging the soil with available nutrients

Off-site impacts

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

Soil health and nutrient availability is improving crop production and resilience.

CLIMATE CHANGE

Gradual climate change

annual temperature increase	not well at all	very well
annual rainfall increase	not well at all	very well
seasonal rainfall decrease	not well at all	very well

Season: autumn

ADOPTION AND ADAPTATION

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

- [x] single cases/ experimental
- [ ] 1-10%
- [ ] 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?

- [ ] Yes
- [x] No

To which changing conditions?

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

CONCLUSIONS AND LESSONS LEARNT

Strengths: land user's view

- Soil health and nutrient availability is improving crops production and resilience.

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

- Possibility of other waste or green manures to be utilised for local application to resource availability.
- Sustainable fertilizer option that should help reduce input costs

Weaknesses/ disadvantages/ risks: land user's view → how to overcome

- Higher cost of labour and inputs when using cover crops → Cost is unavoidable, yet benefits should outweigh cost.

Weaknesses/ disadvantages/ risks: compiler's or other key resource person's view → how to overcome

- Access to similar waste products may not be available locally if applied in other locations → Avoid large transport costs and other impacts if product is not available locally. Try a different approach.

REFERENCES

Compiler
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Reviewer
Rima Mekdaschi Studer
William Critchley
Renate Fleiner

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Resource persons
Tijmen Hoogendijk - Compiler
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Full description in the WOCAT database
https://qcat.wocat.net/en/wocat/technologies/view/technologies_5380/

Linked SLM data
n.a.

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