Sowing of ryegrass on a sorghum field (Nicola Dal Ferro)

Continuous soil cover on croplands (Italy)

Copertura continuativa del suolo

DESCRIPTION

Maintenance of continuous soil cover; alternating crops and cover crops as a practice to improve soil quality and reduce diffuse agricultural water pollution

Continuous soil cover on croplands in the Veneto region is characterised by growing seasonal cover crops alternated to the main crop. Continuous cover cropping has been promoted as an agri-environmental measure of the Rural Development Programme (RDP) by Veneto region to extend sustainable land management and reduce diffuse water pollution. Indeed cover crops incorporate available inorganic N that remains within the soil after harvest and reduce water erosion. The type of crop species depends on the crop succession.

Purpose of the Technology: Cover crops have been proposed to the farmers with the aim of reducing environmental impacts of traditional agricultural practices. Compared with systems that does not use cover crops, the continuous soil cover provides long-term agronomical and environmental benefits due to a reduction of negative impacts on agro-ecosystems.

Establishment / maintenance activities and inputs: The application of cover crops involves the alternation of autumn-winter cereals, rapeseed or other herbaceous crops with maize, soybean, sorghum etc. Cover crops that are sown after the main culture are neither fertilized nor treated with pesticides during growing, while at the end of the crop cycle they are buried as green manure in order to improve soil organic matter content, nutrient cycle and finally soil fertility.

Natural / human environment: Growing seasonal cover crops between annual crops have the potential to provide multiple benefits in a cropping system. Cover crops prevent water erosion and pollution as well as increase soil physical properties. Due to the effect of green manure and root growth, cover crops supply nutrients and increase soil organic matter content. They improve soil biodiversity and break pest cycles.

LOCATION

Location: Low Venetian plain of Veneto region, Italy, Italy

No. of Technology sites analysed:

Geo-reference of selected sites

- n.a.

Spread of the Technology: evenly spread over an area (approx. 10-100 km2)

In a permanently protected area?:

Date of implementation: less than 10 years ago (recently)

Type of introduction

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

Cover crop radish (Nicola Dal Ferro)

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

Cropland

- Annual cropping: cereals - barley, cereals - rye, cereals - sorghum, legumes and pulses - beans, legumes and pulses - peas, Vetch (Fabacae)

Number of growing seasons per year: 1

Water supply

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

Purpose related to land degradation

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

Degradation addressed

soil erosion by water - Wt: loss of topsoil/ surface erosion

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

biological degradation - Bc: reduction of vegetation cover, Bp: increase of pests/ diseases, loss of predators

water degradation - Hp: decline of surface water quality

SLM group

- improved ground/ vegetation cover

SLM measures

agronomic measures - A1: Vegetation/ soil cover

TECHNICAL DRAWING

Technical specifications

Continuous soil cover is here carried out with direct sowing of ryegrass on a sorghum field. Sorghum was in turn used as cover crop after harvesting of winter wheat.

Location: Low Venetian plain of Veneto region

Technical knowledge required for field staff / advisors: moderate

Technical knowledge required for land users: low

Main technical functions: control of raindrop splash, improvement of ground cover, increase of surface roughness, improvement of water quality, buffering / filtering water

Secondary technical functions: control of dispersed runoff: impede / retard, improvement of surface structure (crusting, sealing), increase in organic matter, increase in nutrient availability (supply, recycling,...), sediment retention / trapping, sediment harvesting

Cover cropping
Material/ species: e.g. barley and vetch, ryegrass, sorghum
Quantity/ density: 35 kg/ha

Green manure
Material/ species: e.g. sudan grass
Quantity/ density: 1.5-6 t/ha
Remarks: Strongly dependant on: 1) type of cover crop; 2) differentiation between summer and winter c.c.

Author: Nicola Dal Ferro

ESTABLISHMENT AND MAINTENANCE: ACTIVITIES, INPUTS AND COSTS

Calculation of inputs and costs

- Costs are calculated:
- Currency used for cost calculation: **Euro €**
- Exchange rate (to USD): 1 USD = 0.8 Euro €
- Average wage cost of hired labour per day: 21.00

Most important factors affecting the costs

Although machinery costs are the largest part of total ones, they are almost completely the same for systems adopting - or non adopting - the technology. As a result, additional seeds as cover crop and field labour for sowing are the main costs for implementation of the technology.

Establishment activities

n.a.

Maintenance activities

1. Cover crops: chopping (Timing/ frequency: None)
2. Main crop: seedbed preparation (Timing/ frequency: None)
3. Main crop: harrowing (Timing/ frequency: None)
4. Main crop: weed control (Timing/ frequency: None)
5. Main crop: fertilisation (Timing/ frequency: None)
6. Main crop: harvesting (Timing/ frequency: None)
7. Cover crops: sowing (Timing/ frequency: None)

Maintenance inputs and costs

Specify input	Unit	Quantity	Costs per Unit (Euro €)	Total costs per input (Euro €)	% of costs borne by land users
Equipment					
Cover crop chopping	ha	1.0	343.0	343.0	
Main crop: seedbed preparation	ha	1.0	191.0	191.0	
Main crop: harrowing	ha	1.0	63.0	63.0	
Main crop: weed control	ha	1.0	44.5	44.5	
Main crop: harvesting	ha	1.0	152.0	152.0	
Cover crops: sowing	ha	1.0	121.0	121.0	
Plant material					
Seeds main crop	ha	1.0	190.5	190.5	
Seeds cover crop	ha	1.0	191.0	191.0	
Fertilizers and biocides					
Main crop: fertilisation (fertilizer)	ha	1.0	254.0	254.0	
Main crop: weed control (biocides)	ha	1.0	125.0	125.0	
Total costs for maintenance of the Technology				**1'675.0**	
Total costs for maintenance of the Technology in USD				*2'093.75*	

NATURAL ENVIRONMENT

Average annual rainfall | Agro-climatic zone | Specifications on climate

- [ ] < 250 mm
- [ ] 251-500 mm
- [ ] 501-750 mm
- [x] 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

- [ ] humid
- [x] sub-humid
- [ ] semi-arid
- [ ] arid

Thermal climate class: temperate

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
- [ ] not relevant

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

Soil texture (topsoil)
- [x] coarse/ light (sandy)
- [x] 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%)
- [x] medium (1-3%)
- [x] 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)
- [x] good drinking water
- [ ] poor drinking water (treatment required)
- [ ] for agricultural use only (irrigation)
- [ ] unusable

Water quality refers to:

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

Occurrence of flooding
- [ ] Ja
- [ ] Nee

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

Habitat diversity
- [ ] high
- [ ] medium
- [ ] 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
- [x] rich
- [ ] very rich

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

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

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

Gender
- [ ] women
- [ ] men

Age
- [ ] children
- [ ] youth
- [ ] 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
- [ ] company
- [ ] communal/ village
- [ ] group
- [ ] individual, not titled
- [ ] individual, titled

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

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
drinking water availability	decreased	increased
irrigation water availability	decreased	increased
irrigation water quality	decreased	increased
workload	increased	decreased

Socio-cultural impacts

national institutions	weakened	strengthened
SLM/ land degradation knowledge	reduced	improved
Improved livelihoods and human well-being	decreased	increased

Ecological impacts

water quality	decreased	increased
surface runoff	increased	decreased
soil cover	reduced	improved
soil loss	increased	decreased
nutrient cycling/ recharge	decreased	increased
soil organic matter/ below ground C	decreased	increased
biomass/ above ground C	decreased	increased
pest/ disease control	decreased	increased

Off-site impacts

downstream flooding (undesired)	increased	reduced
groundwater/ river pollution	increased	reduced
buffering/ filtering capacity (by soil, vegetation, wetlands)	reduced	improved

COST-BENEFIT ANALYSIS

Benefits compared with establishment costs

Benefits compared with maintenance costs

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

Establishment costs N/A

CLIMATE CHANGE

Gradual climate change

annual temperature increase

not well at all — very well — Answer: not known

ADOPTION AND ADAPTATION

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

- 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?

- Ja
- Nee

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

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

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

- Prevents erosion

  How can they be sustained / enhanced? Maintenance of cover crop
- Improves soil fertilty, biodiversity, structure, organic matter content

  How can they be sustained / enhanced? Usage of organic fertilizations on the main crop
- Allows natural control of weeds

  How can they be sustained / enhanced? Higher seeding rate
- Improves knowledge on soil cover benefits and agroecology

  How can they be sustained / enhanced? Improve farmers' education

- Increase costs of input and management Increase awareness on long-term soil benefits and keep subsidies
- In summer seasons increases the competition for water resources improve planning and knowledge of suitable species

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

REFERENCES

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Full description in the WOCAT database
https://qcat.wocat.net/af/wocat/technologies/view/technologies_1217/

Linked SLM data
Approaches: Rural development programme in the Veneto region https://qcat.wocat.net/af/wocat/approaches/view/approaches_2598/

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Key references

- Programma di sviluppo rurale per il veneto 2007-2013, Regione Veneto, 2007. Dipartimento Agricoltura e Sviluppo Rurale.:

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