Agroforestry system composed of soybean and poplar trees (Nicola Dal Ferro)

Agroforestry system (Italy)

Sistema agroforestale su terreni agricoli

DESCRIPTION

Silvo-arable systems for production of annual crops on tree plots

Agroforestry systems (AS) are the mixed cultivation of annual crops and trees in a single field. Historically, agroforestry has been used as a land management system that allowed the integration and diversification of productivity while maintaining the ecosystem biodiversity and diversifying farm landscape. Over the last fifty years the number of trees in agroecosystems in Italy was reduced of 75% due to the advent of intensive cropping systems and mechanisation, with significant changes to agriculture and landscape. In recent years, re-introduction of silvo-arable systems in the Veneto region have been supported as an agri-environmental measure of the Rural Development Programme (RDP) to improve sustainable land management.

Purpose of the Technology: Tree and crop production in the same area are compatible and combine environmental and economic benefits. As a result, ASs have been proposed to the farmers with the aim of reducing environmental impacts and energy inputs as well as improving biodiversity and agricultural landscape.

Establishment / maintenance activities and inputs: Agroforestry systems are adjusted to the needs of modern and sustainable agriculture and farmers who adopt this technology take advantage of higher ecosystem biodiversity, incomes and labour diversification, lower energy inputs and reinforcement of natural pest control. The systems are managed with low tree intensity (50-100 trees/ha) and large planting systems (up to 14 m in the row and 40 m inter-row) in order to simplify mechanisation of field practices, depending on machinery and cultivated crops.

Natural / human environment: Adopting agroforestry systems achieves several environmental benefits that have been widely demonstrated worldwide: regulation of nutrient cycling and adsorption of nonpoint source pollution (phytoremediation) thanks to the effect of deep rooting systems; reduction of soil surface erosion and sedimentation in rivers and lakes, improvement of micro-climate conditions, soil and ecosystem biodiversity. Reforestation of agroecosystems was recommended by Kyoto Protocol to mitigate global warming. Finally, agrisilviculture systems improve socio-cultural aspects as they contribute to differentiate and enrich the agricultural landscape.

LOCATION

Location: 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. 1-10 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

Agroforestry system composed of maize and poplar trees (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
- [x] 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: Yes - Agroforestry

Cropland

- Annual cropping: cereals - maize, legumes and pulses - soya, wheat, oak
- Tree and shrub cropping: tree nuts (brazil nuts, pistachio, walnuts, almonds, etc.)

Number of growing seasons per year: 1

Forest/ woodlands Tree types: Grevillea robusta, Populus species

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

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

biological degradation - Bh: loss of habitats

water degradation - Hp: decline of surface water quality

SLM group

- agroforestry
- improved ground/ vegetation cover

SLM measures

vegetative measures - V1: Tree and shrub cover

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:

Most important factors affecting the costs

- 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

The establishment of SLT is the most determinate factor affecting the costs, particularly soil preparation and mulching.

Establishment activities

1. System planning (Timing/ frequency: None)
2. Tillage and soil preparation (Timing/ frequency: None)
3. Tree planting and fertilisation (Timing/ frequency: None)
4. Mulching (Timing/ frequency: None)

Establishment inputs and costs

Specify input	Unit	Quantity	Costs per Unit (Euro €)	Total costs per input (Euro €)	% of costs borne by land users
Labour					
System planning	ha	1.0	102.0	102.0	
Tillage and soil preparation	ha	1.0	102.0	102.0	
Tree planting and fertilisation	ha	1.0	127.0	127.0	
Mulching	ha	1.0	1220.0	1220.0	
Equipment					
Tillage and soil preparation	ha	1.0	254.0	254.0	
Plant material					
Seedlings	ha	1.0	175.0	175.0	
Fertilizers and biocides					
Fertilizer	ha	1.0	21.0	21.0	
Total costs for establishment of the Technology				**2'001.0**	
Total costs for establishment of the Technology in USD				*2'501.25*	

Maintenance activities

1. Pruning, replanting, additional irrigation, weed control (Timing/ frequency: None)
2. Crop management (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
Labour					
Pruning, replanting, additional irrigation, weed control	ha	1.0	250.0	250.0	
Crop management	ha	1.0	850.0	850.0	
Total costs for maintenance of the Technology				**1'100.0**	
Total costs for maintenance of the Technology in USD				*1'375.0*	

NATURAL ENVIRONMENT

Average annual rainfall

- [ ] < 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

Agro-climatic zone

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

Specifications on climate

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?
- [ ] Yes
- [ ] No

Occurrence of flooding
- [ ] Yes
- [ ] No

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
- [ ] 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
- [x] 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)
- [ ] 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
wood production	decreased	increased
product diversity	decreased	increased
expenses on agricultural inputs	increased	decreased
diversity of income sources	decreased	increased

Socio-cultural impacts

health situation	worsened	improved
cultural opportunities (eg spiritual, aesthetic, others)	reduced	improved
recreational opportunities	reduced	improved
SLM/ land degradation knowledge	reduced	improved
Improved livelihoods and human well-being	decreased	increased

The technology is recognized by the EU CAP as a system of high ecological and social value due to increased biodiversity, improved rural landscape and environmental quality. However, the technology has been little adopted in Veneto region due to scarce technical expertise and very

few fundings, resulting in a limited improvement of livelihoods and human well-being.

Ecological impacts

water quality	decreased	increased
surface runoff	increased	decreased
soil cover	reduced	improved
nutrient cycling/ recharge	decreased	increased
soil organic matter/ below ground C	decreased	increased
biomass/ above ground C	decreased	increased
plant diversity	decreased	increased
habitat diversity	decreased	increased
emission of carbon and greenhouse gases	increased	decreased

Off-site impacts

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

COST-BENEFIT ANALYSIS

Benefits compared with establishment costs

Short-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

CLIMATE CHANGE

Gradual climate change

annual temperature increase: not well at all — very well

Climate-related extremes (disasters)

drought: 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%
- [ ] 11-50%
- [ ] > 50%

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

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

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

- [ ] Yes
- [ ] 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

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

- improves water and soil quality

  How can they be sustained / enhanced? spread over larger territories and integration with other sustainable land practices (e.g. conservation agriculture, cover crops etc.)
- enhances agro-ecosystem biodiversity

  How can they be sustained / enhanced? improve connecting corridors between habitats
- income generation and diversification opportunity

  How can they be sustained / enhanced? stimulation of alternative markets

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

- Increases difficulties in handling machinery Improvement of technical knowledge and planning
- Increases establishment costs Increase funding for implementation

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

- excessive shading for crop production lower tree density and enlarge inter-row; improve system design
- high investment and income reduction in the short-term economic support
- low efficacy due to short-term cycles of the technology and replacement with traditional cropping systems improve the effectiveness of subsidies to keep the technology in the log-term

REFERENCES

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Full description in the WOCAT database
https://qcat.wocat.net/en/wocat/technologies/view/technologies_1230/

Linked SLM data
Approaches: Rural development programme in the Veneto region https://qcat.wocat.net/en/wocat/approaches/view/approaches_2598/
Approaches: Carbon farming https://qcat.wocat.net/en/wocat/approaches/view/approaches_2607/

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