ORGANIC CONSERVATION AGRICULTURE

AGRIBIOCONS

TRANSFER AND ADAPTATION OF THE ORGANIC CONSERVATION AGRICULTURAL MODEL IN THE CULTIVATION SYSTEMS OF THE MARCHE REGION (ITALY)

Project financed by the RDP MARCHE 2014 - 2020, Sub-measure 16.1 - Support for the creation and operation of EIP Operational Groups Action 2 "Financing of Operational Groups" - ID 29182

È TEMPO DI AGRICOLTURA

PSR MARCHE 2014-2020
Unione Europea / Regione Marche
PROGRAMMA DI SVILUPPO RURALE 2014-2020
FONDO EUROPEO AGRICOLO PER LO SVILUPPO RURALE: L'EUROPA INVESTE NELLE ZONE RURALI

Unione Europea

MINISTERO DELLE POLITICHE AGRICOLE ALIMENTARI E FORESTALI

REGIONE MARCHE

BACKGROUND

INTRODUCTION

AGRIBIOCONS is a project financed by Measure 16.1 - Support for the creation and operation of Operational Groups of the EIP
Action 2 "Financing of Operational Groups" of the RDP Marche Region 2014-2020 (EAFRD funds).

The acronym AGRIBIOCONS stands for Conservative Organic (Biological) Agriculture. The farms involved in the project apply some of the principles of **organic conservation agriculture**, in the belief that agricultural soil is a vital resource to be preserved, protected and regenerated.

PROJECT DESCRIPTION

The AGRIBIOCONS project is designed to **promote and implement agricultural techniques and technologies for soil conservation management in organic farms**.
The proposed agricultural model aims at:

- conserving the "soil" resource and improving its physical, chemical and biological fertility;
- introducing and adapting to hilly environments, such as those in the Marche region, innovative machinery to optimise soil conservation management;
- proposing new management opportunities for an active agriculture in the mitigation of climate change;
- increasing the competitiveness of organic farms.

The proposed agricultural system is based on four key principles:

- **crop rotation efficiency;**
- **insertion of cover crops;**
- **intercropping;**
- **minimum tillage without inverting soil horizons.**

The innovation transfer and implementation process was supported by a soil dynamics monitoring process that, in addition to traditional soil surveys and chemical and physical analyses, also saw the use of ad hoc designed prototypes for the direct measurement of soil erosion.

OBJECTIVES

- Preservation of the soil and improvement of its physical, chemical and biological fertility;
- Introduction of conservative and soil-improving tillage and cultivation techniques in the organic farming system;
- Introduction of innovative machinery in the management of organic sowing and cover crops;
- Introduction and dissemination of technological tools and information support;
- Increase in the competitiveness of organic farms;
- Education of farmers in the participatory approach of the Operational Group;
- Validation of a more complete organic farming model to be spent on the market thanks to an even more sustainable and healthy agri-food product.

PROJECT PARTNERS

Società Agricola Biologica Fileni S.r.l., project leader.
The Fileni group is an Italian leader in the production and marketing of organic chicken. Through the Società Agricola Biologica Fileni, it directly produces part of the raw materials for the company's farms. In fact, the company's agricultural sector consists of around 500 hectares of land where cereals, protein crops and polyphitic meadows suitable for poultry feed are cultivated, exclusively under organic methods.
Società Agricola Agri Blu by Zingaretti and Soci S.S. A company in Apiro (Italy) dedicated to the cultivation of cereals and other arable crops. In the AGRIBIOCONS project, it has invested in the purchase of indispensable and functional machinery for the conservative organic farming model.
AEA S.r.l. A company belonging to the Loccioni Group, which for over 50 years has been designing measurement and control systems to improve the quality, safety and sustainability of processes and products. In the AGRIBIOCONS project, the company developed a prototype device to measure soil erosion.
ARCA S.r.l. Benefit. Founded in 2016 by entrepreneurs Bruno Garbini, Giovanni Fileni and Enrico Loccioni, the company offers consultancy in organic conservation farming, promoting the simultaneous application of the principles of crop diversification, reduced tillage and soil cover. In addition, the company has consolidated experience in the field of dissemination and knowledge transfer.

Università Politecnica delle Marche.
The Department of Agricultural, Food and Environmental Sciences carries out research, teaching and contracting activities in various subject areas. Within the AGRIBIOCONS project, experimental activities involved the areas of Soil Science (Pedology group) and Agricultural Genetics. Field activities included the soil characterisation of soils, the installation of measuring instruments and data processing necessary for the validation of the bio-conservative agricultural model, as well as the experimentation of legume-cereal intercropping.

EXTERNAL CONSULTANTS

- University of Udine - Researcher Dr. Agr. Gemini delle Vedove
- Dr. Agr. Stefano Bortolussi

DEMONSTRATION FIELDS

The AGRIBIOCONS project is implemented through 7 demonstration fields in the Marche region (central Italy), made available by organic farms for a total area of 26 hectares.

The farms well represent the geo-morphological diversification of the regional territory, as they are located in valley floor, irrigated and non-irrigated, medium-low and medium-high hill areas.

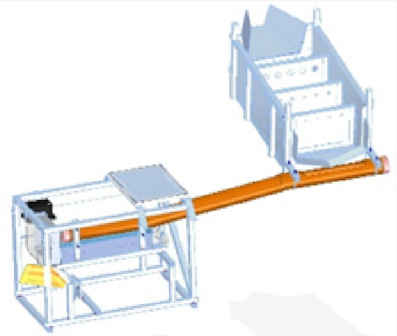
ACTION 1
TECHNOLOGICAL INNOVATION

RESPONSIBLE PARTNER: AEA SRL

Action 1 involved the development of a **prototype six-soil erosion meter**. The project specifications were defined by the AEA company together with the Pedology Group of the Marche Polytechnic University. The prototype consists of two modules.

The first module is used to collect water from a drain and let it decant through a series of passages in three successive stilling basins. After a rainfall has caused water to flow into the drains with solids transport, the soil deposited in the tanks must be collected, dried and weighed in the laboratory.

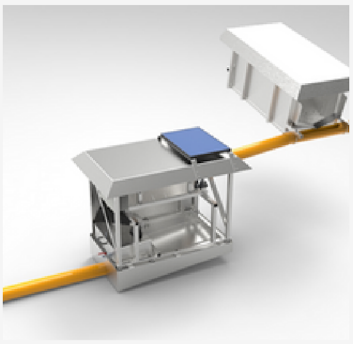
The second module is used to measure the water flow rate. The measurement is carried out by means of an oscillating tank, which, once filled with approximately 15 litres of water, tilts back to the vertical position. An electronic card counts the number of tilts and the time between each one, making it possible to measure the water flow rate and its total quantity. The discharged water is sampled with a 100cc glass and subsequently analysed in the laboratory.
It is possible to establish the sampling frequency through software. The system is powered by a solar panel.



The electronic board consists of a data acquisition and control module and a communication module. The whole is housed inside a watertight box. The acquired data is transmitted via GSM signal (with a specific SIM for IoT), using the standard MQTT protocol and stored in the Loccioni server, using an already available architecture for IoT, called MyLeaf.
From this database, the data of interest can be extracted and analysed.

As part of the AGRIBIOCONS project, a total of 6 prototypes were produced and installed in the field in 2020. The devices are used to measure and compare erosion in traditional biological and conservative biological management systems.

In addition to these devices, probes were used to measure soil temperature, humidity and salinity, and weather stations to acquire direct field data on temperature, humidity and rainfall.



ACTION 2
AGRONOMIC FIELD TRIALS

RESPONSIBLE PARTNER : ARCA SRL BENEFIT

Action 2 consists of the **transfer and adaptation of the organic conservation farming model** on 7 farms in the Marche region, in the center of Italy.

The experimental design involves a direct comparison between areas managed according to traditional organic farming principles and areas managed according to bio-conservative farming principles, i.e:

- Organic regime
- Crop rotations & associations
- Minimum tillage
- Use of cover crops

The two types of soil management, targeting the same cash crop, are tested in adjacent plots with similar soil characteristics.

The agronomic project was differentiated in relation to the cultivation and technical-managerial characteristics of each farm. Therefore, cultivation paths (rotations, intercropping and cover crops) were designed for each farm, differentiated in relation to the specific soil, climate and technical-management characteristics.

Soil tillage
The implementation of the model involved the definition and adoption of a fleet of machines capable of satisfying the principles of conservation tillage. Passive machines were therefore used, not driven by power take-off, with the possibility of multiple uses and the ability to work on different types and conditions of soil and residues.

Intercropping
Intercropping is the simultaneous cultivation, on the same plot of land, of two or more plant species.
In two of the seven demonstration sites, agronomic trials were set up to evaluate the advantages of intercropping grain legumes with soft wheat compared to pure cultivation.
The intercropping of field bean (Vicia faba minor) and protein pea (Pisum sativum) with common wheat (Triticum aestivum) represents an opportunity to protect biodiversity, ecosystem services and soil functionality, aimed at obtaining higher production (cash crops) per unit area.

ACTION 3
MONITORING AND QUALITATIVE-TECHNOLOGICAL ASSESSMENTS

RESPONSIBLE PARTNER: UNIVPM

Action 3 consists of technical **monitoring** of field trials, using different methodologies.

VISUAL SOIL ASSESSMENT (VSA) and VISUAL PLANT ASSESSMENT (VPA)
Visual Soil Assessment (VSA) and Visual Plant Assessment (VPA) are based on the visual estimation of some "key" soil properties and plant performance that are evaluated with indices established according to codified parameters for each crop (FAO, 2008). These evaluation approaches allow soil and plant changes to be monitored in an expeditious manner in order to be able to attribute the qualitative class of soil suitability to a given crop. These methods were adopted to estimate and compare the effects of the two crop managements practised by the AGRIBIOCONS project: traditional organic vs. bio-conservative. In support of the VSA and VPA carried out over the course of the crop cycle for the years 2019/2020 and 2020/2021, an in-depth analysis of the soils was also carried out through pedological sampling and the estimation of their main physical-chemical characteristics.

EROSION
The tipping-bucket system, realised in collaboration between the D3A Pedology group (UNIVPM) and the technical staff of the Loccioni group (A.E.A. company), makes it possible to measure the real soil loss due to water erosion by means of a sampling and run-off measurement system. Six prototype devices have been installed in a small agricultural basin representative of the hilly reality in the Marche region in Sant'Urbano (Apiro, Italy), equally divided between the agronomic managements (biological and bio-conservative) envisaged by the AGRIBIOCONS project. Thanks to the eroded sediment and run-off water collected with these devices, it has been possible to quantify both the quantities of solid and liquid material and the nutrient content lost following intense rainfall events. The monitoring carried out in 2019, 2020 and 2021 showed a variable loss of solid and liquid material in the biological and bio-conservative management, and considerable amounts of nitrogen (more abundant in the corralled water than in the sediment) flowing into the downstream watercourse.

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ACTION 4
DISSEMINATION OF PILOT PROJECT RESULTS

RESPONSIBLE PARTNER: ARCA SRL BENEFIT

Action 4 consists of the **dissemination of the project's activities and results** through a variety of communication channels and tools.

WEBSITE www.arca.bio/agribiocons

SOCIAL NETWORK Facebook, Instagram, Linkedin (#Agribiocons)

DIVULGATIVE MATERIALS such as videos, roll-ups, brochures, publications

EVENTS

FINAL RESULTS

The adoption of the organic conservative model during the 3-year field trial, produced the following results:

- **Comparable crop yields** between BIO (organic) and BIO+ (organic conservative management)
- **Higher average costs in BIO+** of about 250€/ha/year due to the cultivation of cover crops
- **Expected agronomic and economic benefits** in the long term (higher crop yields and lower costs).

Regarding the measurement of soil erosion, on the other hand, the results showed a marked difference in the amount of material and elements lost between BIO and BIO+ management in the years of monitoring. In particular:

- The **amount of water corralled in BIO exceeds that lost in BIO+ by 16742 L/ha**; while the difference in total nitrogen is 22 kg/ha
- **Sediment eroded in BIO exceeds that lost in BIO+ by 4536 kg/ha** and so does total organic carbon by 51845 kg/ha, total nitrogen by 9502 kg/ha and available phosphorus by 83912 kg/ha.

FINAL RESULTS

As for the **evaluation of soil status**, the VSA and VPA showed a **different suitability of soils**, attributing **better quality scores to soils cultivated with wheat and field beans**, and worse ones cultivated with sorghum and sunflower.

The pedological approach allowed the observation of characteristics such as **depth**, **colour**, **degree of structure**, **roots**, etc. In the samples taken by horizons, i.e. the different soil layers, texture, pH, total organic C, total N and available P were measured.

The trends in physico-chemical properties between the crop years were found to be very **variable and fluctuating**. When comparing the soil properties in BIO and BIO+ of the same crop year, these showed better results in some farms in BIO management, in others in BIO+. However, the **values of total organic C, total N and available P tended to be low**.

Soil degradation morphologies

CONTACTS

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