Integrated production in the olive groves

Agricultural system of production using farming techniques ensuring sustainable agriculture producing oil and olives from high-nature value region.

Summary

With the integrated production program, sustainable agriculture in Andalusia has been promoted. The statistics offered by the regional government show that participation in this measure has been increasing over the past few years. Specifically, in the olive grove sector, there is a lot of competition. “Integrated production" provides the farmer with a sustainability brand that is usually linked to a better market price. The contract can be made directly with the administration or through cooperatives that manage various farms (minimum 5). As added value, the use of earth observation techniques allow the monitoring of Soil Organic Carbon (SOC) under different crop management increasing the soil quality and the mitigation of climate change impacts

Objectives

- Preservation of soil conservation and biodiversity associated.
- Monitoring Soil Organic Carbon under different crop management
- Improving visibility of integrated production as a system provider of multiple lasting AECPGs.

Problem description

The regional administration provides information on the use and application of different amendments based on expert knowledge and pest risk forecasts. The objective was to obtain a product of both environmental and social quality by granting the integrated production brand. The different crop management have different impact on soil organic carbon. The evaluation process is based on Carbosoil model, developed with 16 soil types and more than 1600 soil profiles in order to predict the soil capacity for carbon sequestration in Mediterranean areas. The novelty in the present case study is developing a control-carbon soil map at a detailed scale for the 0-25 cm soil section, and identifying the impact of crop management on soil organic carbon through earth observation techniques. For that, olive groves under different soil types and crop management will be selected and monitored for estimate the crop management impact on soil organic carbon.

Data and Facts - Contract

Participation:

Number of farms: 55 000; Area of implementation: Currently, more than 500,000 hectares; Other participants: 377 operators (Technician, APIS (Integrated Agriculture Production Groups))

Involved parties: The contracting parties are the participating farmers, coming mainly from the ASAJA network. Another involved part is the regional administration and APIs (Integrated Agriculture Production Groups). Sometimes, cooperatives are also involved, providing a better price to the farmers for their product.

VALUE CHAIN

PUBLIC GOODS

Soil quality (and health)

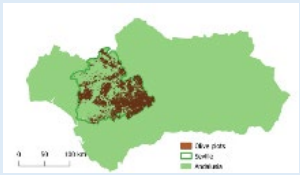
Climate regulation-carbon storage

INDIRECT EFFECTS

Climate regulation, biodiversity, rural viability and vitality

LOCATION

SPAIN



CONTRACT

The contract covers the area declared under integrated production for 5 years. To do this, it must be integrated into an integrated production association (APIs) and follow the management recommendations and requirements during the contractual period. The recommendations are advised by expert personnel and pursue the environmental and economic sustainability of production.

Contract conclusion:
Online platform

Payment mechanism:
Product price

Funding/Payments:
Farmers don't receive economical benefits or payment, it is a distinctive brand that later in the market usually gets a better price.

Length of the contract:
5 years extendable

Start of the program:
1995
End: still running

PRODUCT

A product badge obtained in a sustainable way is granted

Data and Facts - Contract

The benefits for land managers or farmers: Better prices in the market and reduction of inputs and food safety. In the end, the final product reaches the consumer in form of high quality and sustainably produced oil or olives.
The benefits for administration: Maintaining of soil quality.
Management requirements for farmers: The Integrated Production Regulation establishes a series of prohibited, mandatory and recommended practices based on different threats:
- erosion: plantation following contours or terraces and terraces, strip cultivation or the use of plant covers in the streets of the olive grove and reduction of tillage.
- Plantation: use of certified seeds or seedlings and a recommended plantation framework of 200-300 olive trees/ha without excluding higher density plantations.
- use of fertilizers and amendments: dose taking into account the olive variety, age, density, cup volume, vegetative development, soil fertility level, nutritional status and contributions from rainwater, irrigation water, mineralization of organic matter, etc.
- phytosanitary: application of phytosanitary products following the recommendations of risk assessment and the establishment of economic thresholds of losses developed by APIs.
- irrigation: drip irrigation is recommended as the main irrigation system. Regarding the calendar, the use of the methodology proposed by FAO is recommended, using recommended crop coefficients. Recommendation of the use of the accumulated water reserve in the soil during the rainy season and the use of deficit irrigation strategies, taking into account the critical moments of the olive tree. In the case of the use of purified wastewater, a continuous bacteriological analysis (once a month) should be performed, to ensure that the permitted thresholds are not exceeded.
- harvesting: the use of any of the olives collection systems existing in the market is allowed, provided that the quality of the fruit is maintained, avoiding contact with the soil and its subsequent sweeping, such as tarpaulins or nets.
- training: the Integrated Production Regulation encourages the training of all personnel involved in the application of this standard, and contemplates the obligation to possess the pesticide card. It also establishes the conditions that agricultural holdings must maintain (irrigation water, storage of phytosanitary products, etc.) and cleaning and safety measures.
Controls/monitoring: Each year monitoring/certification of the management is carried out through the registration of documentation, control of the plot, etc.

Context features

Landscape and climate: No require specific conditions. The olive groves in our case study can be found under different soils (Regosols, Cambisols, Vertisols, etc) and different climate (Sub-continental Mediterranean of cold winters and sub-continental Mediterranean of warm summers).
Farm structure: Within the integrated production there are different types of farms, large or small, as well as conventional or organic. In the case study, we will focus on those farms belonging to ASAJA partners dedicated full time for the olive tree.

Evenor-Tech "Technology-Based Company focus on Solutions for Soil Use and protection"

ASAJA Sevilla "Asociación Agraria de Jovenes Agricultores"

CONSOLE

SUCCESS OR FAILURE?

A reduction in the use of chemical fertilizers and pesticides and an increase in the number of hectares dedicated to integrated production have been detected. However, we did not find quantitative data on environmental improvement.

Reasons for success:

- Societal demand: society increasingly demands high quality products which are produced in a sustainable way.
- Sustainability: practices and recommendations can extend the productive life of the plot allowing the farmer to continue cultivating for longer.
- Obtaining a better price in the market: Some brands and mills look for products that carry the badge of integrative production to be more competitive in the market.

SWOT analysis

Main Strengths

1. Relevant effort in the mechanization of cultivation practices, especially harvesting
2. Agroclimatic advantages in Andalusia for the production of olive oil
3. The olive grove is an efficient crop in the use of irrigation, achieving high productivity in deficit irrigation systems

Main Weaknesses

1. Important presence of farms in areas with orographic and edaphoclimatic limitations
2. Risk of increased use of inputs (phytosanitary and fertilizers) and resources (energy and water), derived from the possible boom of intensive olive groves
3. The erosion risk of olive groves represents one of the most important environmental risks and is one of the most widespread in the region

Main Opportunities

1. Increase in social demands for food quality associated with healthy products typical of the Mediterranean diet
2. Increase in the trend for the promotion, commercialization of the product and, above all, in its labeling, on scientifically proven healthy information
3. Development of productive systems with greater efficiency through access to new technologies

Main Threats

1. Growth in white label sales in large commercial areas
2. Relevant increase in the area of olive groves in traditionally non-producing countries (Argentina, Chile, Australia, etc.) and improvement of the productive structures of the countries of the south-east of the Mediterranean (Tunisia, Jordan ...).
3. Little consumer knowledge of the factors that determine the quality of olive oils, which leads to orient their preferences based on prices

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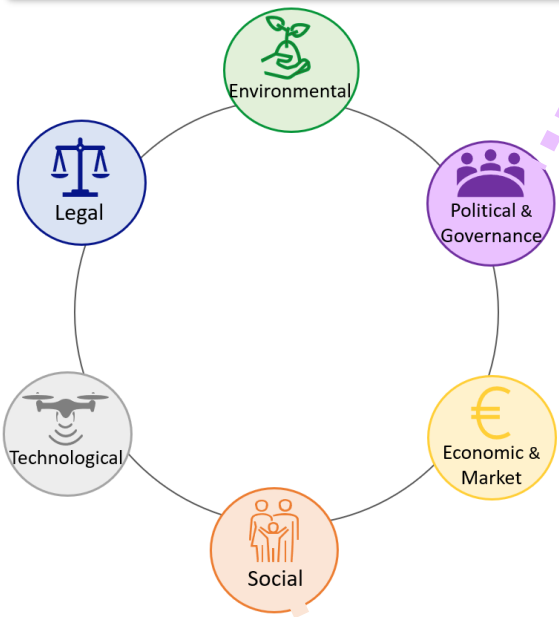
Main external factors influencing success

Political/governance, economic/market, social, technological, legal and environmental factors can all have a strong impact on the success of contract solutions. In this case study an in-depth analysis found that the following, selected factors were of specific importance.

The establishment of Integrated Agriculture Production Groups (APIs) as a success factor:

To enter the IP contract, area must be integrated into an IP association (APIs) and follow the management recommendations and requirements during the contractual period. Recommendations are advised by expert personnel, while the regional administration provides information on the use and application of different amendments based on expert knowledge and pest risk forecasts. These advisory services of the APIs set limits for pesticides, crop and soil management, etc.

Proper implementation of the integrated production groups (APIs) requires correct technical advice to farmers based on the acquisition of sound and up-to-date scientific knowledge through initial and continuing training, in which the technicians of the **APIs play a fundamental role**. Similar contractual relationships have been created for new crops, but they have not been successful because the APIs have not been set up correctly.



Opting for IP is more competitive:

The integrated production system in this case study encounters a very **competitive** and **intensive sector** that has significant impacts on a large number of AECPGs, such as soil and water in particular.

Participation in Integrated Farming can:

(1) on the one hand, increase the value of the oil produced by farmers and,

(2) on the other hand, optimize the use of inputs.

The guarantee of Integrated Production of Andalusia stands out in the competitive market from the products of other markets (national and international) that are not subject to the same controls, **guaranteeing better demand and higher prices.**

Therefore, farmers have voluntarily chosen this farming system, as it is the most competitive.

Young farmers are lacking:

Currently, the economy of more than 300 municipalities depends mainly on olive growing. However, 75 % of olive growers in Andalusia are older than 44 years and about 25 % are older than 64 years. Andalusian olive growing, like the entire agricultural sector in the region, shows a *lack of generational change.*

This situation is exacerbated in the peripheral rural areas by

- the progressive ageing of the population,
- the continuing lack of training among farmers,
- and the lack of interest among young people in continuing family farming.

Additional page added May 2022

CONSOLE scientific analysis – results and recommendations

Evenor-tech researchers have conducted a study to reveal the usage of digital soil mapping and its importance in predicting and spatial distribution of soil organic matter at three depths using machine learning techniques.

Research idea and question

Unlike most of Europe, Andalucía in southern Spain as a Mediterranean area still lacks digital maps of Soil Organic Carbon (SOC) content at multiple depths provided by machine learning algorithms. Currently, the Integrated Production provides a brand allowing better prices in the market. Our idea is developing a cheap approach to monitoring SOC. This approach can be used by public administration, private sector and farmers in order to reduce hot-spots checks and support the development of a new contract solutions based on results.

Methodology

Environmental covariates used in this research include nine derivatives from digital elevation models (DEM), three climatic variables and finally eighteen remotely-sensed spectral data (band ratios calculated by the acquired Landsat-8 OLI and Sentinel-2A MSI in July 2019). In total, 300 soil samples from 100 points were taken at three depths (0-25 cm, 25-50 cm, and 50-75 cm). The use of machine learning allow us identifying variables related to develop a model.

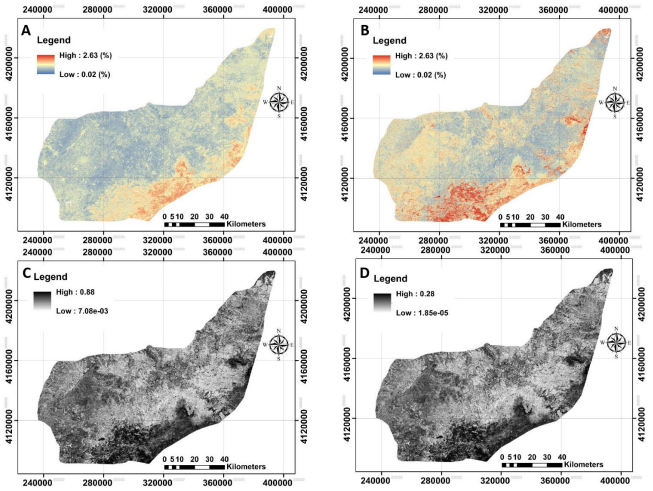


Figure 1. The provided digital maps of SOC0-25cm across the study area using RF model. A: Mean prediction (%); B: prediction of interval range (%); C: standard error map of the prediction; D: variance map of the prediction.

Main results

The integrated indices e.g., NBR_ITG, NDWI_ITG and CMR_ITG were identified as the most important covariates in prediction of SOC0-25cm (ITG=average between Sentinel and Landsat value). This study aims to reveal the usage of DSM (Digital Soil Mapping) and its importance in predicting and spatial distribution of SOC at three depths using machine learning techniques (in this case Random Forest). The terrain attributes analysis was a key step in order to obtain SOC data in middle depth. Taken together, our findings indicate the successful usage of machine learning with application of user-friendly software e.g., R programming.

Recommendations

- Promoting harmonisation and standardisation of soil data. The interoperability among data sources will facilitate the implementation of new technologies based on common parameters.
- Additional data can provide additional benefits. If we have no data on bulk density, the soil carbon storage will be not calculated to monitor the climate change impact.
- The implementation of this kind of technology will allow to consumers, farmers, policy makers, private sector and researchers check all the parameters related to result-based contract solutions in an easy and cheap way.

Additional page added June 2022