SANCHOSTHIRST (ID 34)

Cover cropS (CC) ANd soil health and climAte CHaNge adaptatiOn in Semiarid woody crops. THe RemOte SensIng and furTHer scenaRIoS projecTions

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Project partners

Country	Organization
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France	French National Institute for Agriculture, Food and Environment (INRAE)
Spain	Instituto Madrileño de Investigación y Desarrollo Rural, Agrario y Alimentario (IMIDRA)
Italy	University of Sassari
France	AgroParisTech
Poland	Silesian University of Technology / Politechnika Śląska

Summary

Traditional tillage (TT) in woody crops in the Mediterranean environment is a paradigmatic example of the effect of unsustainable management on soil degradation due to erosion and the loss of organic carbon (SOC), nutrients, and biodiversity. The use of cover crops (CC) increases the SOC and produces a cascade of benefits in soil structure, water storage, or biodiversity. However, in semi-arid areas, farmers are reluctant to use CC. To involve them, research must clearly highlight the current state of degradation of soils in woody crops and the feasibility, with pros and cons, of CC as a sustainable management practice.

This project is based on four pillars:

1. Deepen the knowledge of agro-ecosystem functions in woody crops with TT and CC. For this purpose, farms with soils managed by different practices will be used to test the following functions:

Carbon sequestration will be carried out with an innovative approach, considering the source and dynamics of SOM, inferred by 13C and 14C analysis. This approach will reveal the age of SOC at different soil depths, providing important insights into C sequestration efficiency. The stability of SOM will be inferred by visible spectroscopy analysis for determining the aromaticity of the degree of maturation.

Microbiological activity plays a crucial role in C dynamics. It is related to ecosystem services such as gene pool (provisioning) and nutrient cycling (supporting). The effects of agronomic practices have received very little attention in this regard. β-glucosidase activity, linked to fungi and bacteria, will be used for this purpose.

The water content changes (regulating services), the most important reason for rejecting the use of CC, will be considered, studying the effects of CC on soil moisture, and water status in vines and olive trees.

Yield in vineyards and olive trees (provisioning services) with and without CC will be measured.

2. A global perspective of ecosystem services provided by CC will be obtained by the identification and quantification of the ecosystem services indicators and the development of a composite indicator through a fuzzy logic procedure.

3. Improving Remote sensing tools by considering disturbing factors that have been found to affect the spectral response (texture, roughness, iron oxide compounds). This research will help to reduce the uncertainty of SOC and water content predicted by models obtained with satellite imagery.

Monitoring soil conditions will be performed in 30 to 40 active farms including field sampling campaigns and Sentinel-2 acquisitions. Normalized spectral indices; geostatistical methods; regression model approaches, and thermal and radar backscattering models will be used.

4. Temporal modeling to describe future scenarios of doing business as usual will be done using the STICS (SimulateurmulTIdisciplinaire pour les Cultures Standard) model, although requiring many parameters it has already been tested under different climates and managements. Experimental farms will provide information for modeling.

Strong emphasis will be placed on raising awareness and encouraging its adoption. Over the project, a high-quality video documentary will be produced to be disseminated on different platforms and TV channels in different languages. Sampling, results, and opinions of farmers and researchers will be gathered. The potential and limitations of CC in semi-arid areas will be revealed.

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