

Case Study 6: Catalonia, Spain.

REGENERATIVE PRACTICES ON RAINFED AND IRRIGATED ARABLE AGRICULTURE

Context and background



Figure 1. Location of the plots of the case study in Catalonia, Spain.

Catalonia occupies the North-eastern part of the Iberian Peninsula (Figure 1). Agricultural land represents about 750,000 ha. Catalonia has many different climates, but the most prevalent ones in agricultural areas are characterized by its low rainfall, and irrigation is needed if willing to achieve potential yield of crops. About one third of agricultural land is nowadays irrigated.

Objectives

The objective in this case study is to identify agricultural management strategies that increase soil organic carbon content in dryland cropping systems fertilized with manure and in corn-covered cropping systems.

Experimental design

There are two trials involved in this case study. They are both located in the Empordà shire (Figure 1), which has a typical temperate Mediterranean climate with hot and dry summers, with a clear minimum of precipitation in summer. The dominant soil types in the case study area can be classified as Typic Xerofluvent, calcareous, messic with sandy loam textures.

1.Reduced tillage and dairy manure to increase soil organic carbon and rainfed crop performance. In this field experiment, dairy manure or mineral fertilizer have been long applied (> 20 years) to different rainfed winter crop rotations (winter wheat and barley rotation including, or not, rape-seed in the rotation). Soil tillage has been introduced as a new factor in the trial (Figure 2).



Figure 2. Dairy manure and reduced tillage field experiment as seen in winter 2022-23



Figure 3. Cover crops and reduced tillage field experiment as seen in February 2023.

2. Cover crops and reduced tillage to increase use efficiency of nutrients and enhance soil quality in irrigated arable systems. A long-term (> 8 years) field experiment on irrigated maize fertilized with different kinds of manure -and derived products- has been resized and focused on the use of different species of cover crops (mustard, vetch and ryegrass, with mixtures among them,) after maize and on reducing soil tillage (Figure 3).

Key Innovations

This case study focuses on three of the four pillars of innovation that form part of the SIRAM:

- **Agronomical practices** to safeguard soil **quality** and **fertility**. The efficient use of manure may increase soil organic C, contributing to the mitigation of climate change and enhancing soil quality.
- **Crop varieties** with resistance towards **abiotic** and **biotic stresses**. The use of resistant varieties will improve agronomic and economic crop performance.
- **Bioeconomy** approaches to **recycle** and **valorize** waste biomasses that restore soil organic matter and have bio stimulant properties. This study aims to improve nutrient use efficiency from manure with the objective of reducing emissions and contributing to reduce the use of mineral fertilizers.

Preliminary results

Preliminarily, yield on the rainfed cereal crop (wheat in 2023) is slightly higher (10 %) for conventional soil tillage treatments than for reduced soil tillage. On the contrary, for the second year after introducing different tillage systems (barley crop, 2023-24), not yet finalized, the ear density is 37 % higher for the reduced soil tillage treatments.

For cover crops (winter), mustard mixed with vetch has shown the highest dry matter production (12.2 t/ha) with significant differences in respect to mustard alone (5.7 t/ha) or mustard mixed with ryegrass (5.6 t/ha). It shows the importance of including leguminous crops in the whole system.

For both trials, the results on soil organic carbon content due to differential agricultural practices will be available by the end of the project, in 2025.

