

Improving management of cover crops to increase the sustainability of irrigated cropping systems

This project is included in the research line 'water and nitrogen management in cropping systems', but it also involves model validation. The project is financed by the Spanish Nacional Research Plan and will last until the end of 2017.

Summary

In irrigated cropping systems is very usual a long fall-winter fallow in between two summer cash crops; therefore, introducing cover crops (CC) to replace the fallow might increase the sustainability of irrigated areas. The use of winter CC could also provide benefits such as improving soil structure stability, water retention capacity or mycorrhization of the subsequent cash crop. In addition, cover crops residues add biomass to the soil and could be of great help to diminish problems related to low soil organic matter content in irrigated areas. Cover crops and their residues can also be managed as a tool to controlling the growth of some weeds and open the opportunity for reducing herbicides application. In Spain cover crops are rarely used except for erosion control in perennial orchards, probably because of a lack of information about their function and management. In addition there is a major concern about reducing agrochemical application to mitigate diffuse water pollution. A proper management of CC could enhance the efficiency of herbicides and nitrogen fertilizers, leading to a lower use in these cropping systems. Finally, interseeding could allow a fast establishment of CC that may help to increase the introduction of CC in arable crop rotations.

The goal of this proposal is to increase our knowledge on CC management in irrigated cropping systems so we can optimize the benefits of replacing the fallow by the CC, increasing productivity and sustainability. The specific objectives of the project are:

1. To evaluate the role of cover crops on soil quality, particularly on the ability to inoculate with mycorrhiza the subsequent cash crop.
2. To quantify the effect of CC in the soil hydraulics properties by using model inverse calibration techniques based on observed data.
3. To assess the effect CC and the management of their residues on the seed bank of the soil and the presence of weeds.
4. To use remote sensing techniques for the assessment of the crop N status and ground cover.

Relevant methodological aspects

Field experiment located in Aranjuez (Madrid), established in 2006.

Four treatment: Fallow and 2 cover crops (legume and grass). Four replications.

Size of each experimental plot: 12m x 12m



-Daily water balance are conducted based on continuous measurement of water content down to 1.3m, monitoring of meteorological conditions and water inputs.



- Nitrogen balance are conducted based on measurements of nitrogen content of soil, plant, and water. Gas emissions determination and ^{15}N isotopic techniques are used to better clarify nitrogen dynamics.



- Other determinations on cover crops and main crops are monitored (growth stage, biomass, leaf area index, and yield) to characterize the cropping systems. Modeling is used to represent and improve understanding of observed results.



-Soil quality parameters (soil organic matter evolution, aggregate stability, mycorrhiza activity, soil crust formation, water retention capacity, infiltration) are periodically measured to study the effect of cover crops over biological, chemical and physical soil properties.



- Besides that, trials of two or three years are established to analyze other aspects of cover cropping. Small plots with different species and varieties are established to compare their suitability to act as a cover crop in our conditions. Periodic measurements of soil cover, radiation interception and biomass accumulation allowed characterization and comparison among varieties.



Strategies (mixture of species, killing date) and techniques (Roller crimper, herbicides, for controlling cover crops are also compared.

