Geophysical Research Abstracts
Vol. 20, EGU2018-16204, 2018
EGU General Assembly 2018

Implementation of rotation/succession as Soil-Improving Cropping Systems for corn grain and rice production. What benefits for soils and crop productivity?

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Agricultural productivity is currently maintained artificially, based in an oil-based system, where production is assured by the intensive use of heavy machinery (highly energy consuming), and by increasing the factors of production, such as fertilizers and pesticides derived from petroleum. These kind of intensive agriculture leads to severe environmental degradation and masks the loss of productivity resulting from the degradation of soil quality. However, in a context where humanity faces the main challenge of properly feed more than 9 billion people in 2050, it becomes fundamental to find new strategies and management solutions to face the future with some hope. SoilCare (nº 677407) is a research project that aims to identify and test cropping systems that improve soil quality, but also increase the profitability and sustainability of the agriculture, based on 16 study areas across Europe.
In Portugal, the study sites are located in the Baixo Mondego Region in Central mainland. The selection of the study sites and the techniques to be tested were identified through a transdisciplinary and participatory approach involving the relevant local and regional key actors.
The Baixo Mondego valley is mainly dedicated to monoculture of irrigated corn grain and flooding rice. Production is highly specialized and intensive, based intensive mineral fertilization, to supply the nutrients exportation after harvesting, and pesticides for weed and pest control resulting from extensive monoculture practices. These management practices lead to decreasing soil quality, linked to decreasing fertility and structure, and loss of biodiversity.
Through various workshops, stakeholders identified the main soil threats, as well as causes, impacts and solutions, in the Baixo Mondego Region, and discussed the benefits and limitations of relevant Soil-Improving Cropping Systems (SICS), in order to identify the ones to be tested through trials. Two SICS were selected: (i) organic rice in rotation with perennial Lucerne, and (ii) grain corn integrated in a succession of legumes (e.g. clover and pea).
Several parameters of soil quality will be monitored over 3 years of experiments, including pH, Organic Matter, Total N, P2O5, K2O, Ca, Mg, exchange bases, penetration resistance, infiltration capacity, litter decomposition rates as well as crop production indicators .
Preliminary results show the maintenance of yields despite the reduction of production factors linked to a sensitive increase in the level of soil fertility and point to the possibility to improve soil quality and productivity by implementation of rotation/succession systems.