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CONTEXT

Currently the productivity of some European cropping systems is maintained artificially by increasing production factors like mineral fertilizers or pesticides, using heavy machinery highly energy consuming and improving the technologies in order to mask the loss of productivity resulting from soil quality degradation.

SoilCare is an European H2020 project that aims to identify and test cropping that improve soil quality but also increase the profitability and sustainability of the agriculture in Europe.

PROBLEM

The study areas of Portugal are located in the Baixo Mondego valley, mainly dedicated to monoculture of irrigated corn grain. Production is highly specialized and intensive based on expensive production factors as mineral fertilizers to compensate the important soil nutrients exportation after harvesting. These practices don't promote soil quality improvement in term of fertility, structure or biodiversity and it ends up leaving the soil poor and unstructured. Currently an alternative technique to mineral fertilizer, the amendment with urban sludge, is use by some farmers of the region. Nevertheless, this practice is the focus of many controversies and stakeholders identified it as a peremptory technique to be tested.

METHODOLOGY

The study started in April 2018 and aims to assess and to compare soil fertility parameters evolution of 2 trial fields, one field fertilized every spring since 3 years with urban sludge's and a control field fertilized exclusively with conventional mineral amendments.

Two sample campaigns were realized during the year 2018, the first one before seeding and second one after harvesting.

At each campaign, 46 soil samples was taken at two depths : 0-15cm and 15-30cm)

In the laboratory, a set of soil quality parameters were analyzed: Ph (H₂O and KCl), Organic Matter content, Total Nitrogen, Available P₂O₅, K₂O, Exchange bases: Calcium, Magnesium, Potassium, Sodium) and heavy metals.



STUDY SITE

Study areas are located in the Mondego lower valley, an alluvium plane situated in Central Portugal. The valley is roughly east-west oriented and 40 km long (from the Coimbra city to the estuary near Figueira da Foz) and bordered by gently sloping hills. The floodplain cover about 15.000 ha of fertile land and have traditionally been used for irrigated agriculture. In 1970 started the hydro-agricultural exploitation project of the Mondego Valley that concerns about 12.300 ha (total irrigation perimeter).

The entire valley is between 0 and 25 meters above sea level. Soils are modern alluvial soils, with a texture from silt-loam to sandy-clay-loam. Climate is Mediterranean, characterized by rainy winters and dry summers, more precisely a Csa climate under the Köppen climate classification, " Hot-summer Mediterranean climate ". The annual average temperature is 16.1°C, with smooth variations. The annual average precipitation is 922 mm, essentially concentrated between October and March.

PRELIMINARY RESULTS

Soil Sampling campaign point to a significant increase of many indicators of soil quality for trial field with urban sewage sludge amendment

- Ph (H₂O and KCl) and organic matter content of soil are significantly higher for urban sludge amendment.
- Available Phosphorus and Potassium concentration in soil are extremely high for sludge trial field particularly in Spring for phosphorus and Autumn for potassium.
- Exchangeable bases Ca²⁺ is also significantly higher for urban sludge amendments.
- In term of heavy metal, the concentration in soil is slightly higher for sludge experiment that for the control but stays lower than maximum concentration authorized by law.
- In term of production yield, the Hurricane Leslie in October 2018 destroyed completely the field and it was impossible to proceed to production estimation.



Element	Sludge composition (dry) mg.kg ⁻¹	Sludge Amendment kg.ha ⁻¹	Heavy metal Sludge g.ha ⁻¹	Control Field mg.kg ⁻¹	Urban Sludge Field mg.kg ⁻¹	Heavy metal Soil Limit mg.kg ⁻¹ 5,5<ph<7
Cadmium Cd	1,9	20000	38	1,6	2,3	3
Copper Cu	550	20000	11000			100
Lead Pb	65	20000	1300	28,1	33,9	300
Chromium Cr	78	20000	1560	16,5	21,8	200
Mercury Hg	0,55	20000	11			1,5

