EGU22-10997
https://doi.org/10.5194/egusphere-egu22-10997
EGU General Assembly 2022

The LANDSUPPORT best practices tool identifies optimized solutions for the health of agricultural soils

Alessia Perego[1], Marco Acutis[1], Marco Botta[1], Tommaso Tadiello[1], Giuliano Langella[2], Fabio Terribile[2], Marialaura Bancheri[3], and Angelo Basile[3]

[1]University of Milan, Department of Agricultural and Environmental Sciences, Milan, Italy (alessia.perego@unimi.it)
[2]University of Naples Federico II, Department of Agricultural Sciences, Portici, Italy
[3]National Research Council, Institute for Mediterranean Agricultural and Forestry Systems, Portici, Italy

In the LANDSUPPORT project (H2020-RUR-2017-2/No. 774234), we have developed a web-based "Best Practices tool" that runs on the fly (https://dev.landsupport.eu/template.html) to identify optimized solutions for enhancing soil fertility and reducing nitrate leaching. The tool works at a regional scale (average area of approximately 2500 km^2) in three case studies (Marchfeld – Austria, Campania Region – Italy, Zala County – Hungary) with a what-if scenario approach. The tool is dynamically linked to the ARMOSA process-based model, which simulates at a daily time step many combinations of farming systems (conservation, organic, conventional), crops, nitrogen fertilization rates, tillage solutions, crop residues management (up to 2520 combinations). ARMOSA simulates crop growth, soil water dynamics, nitrogen and carbon cycling.

The tool is meant to be applied by public authorities, such as regional environmental agencies, to find the best solutions out of feasible management practices according to the overall goal (e.g., increase in soil organic carbon stock, reduction of nitrate leaching) or by farmers who want to evaluate the crop production under current and optimized management.

The user defines the region of interest (ROI). To this ROI the tool automatically associates the soil profiles, having properties (texture, initial soil organic carbon, bulk density) described for each horizontal layer.

For a given region of interest within the case study being characterized by specific soil properties, the user sets the combination of agronomic practices with the interface: climate scenario (20 years), crops, system, fertilization rates, residues management, tillage, and the use of cover crops. The user-friendly interface hides the high complexity of the soil and crop processes which are simulated by ARMOSA, which has many crop and soil parameters. Parameters have been calibrated using the dataset available in the project and in previous studies.

For each of the simulated soils and scenarios, the tool returns the mean annual value of (1) the crop yield, (2) the nitrate leaching at the bottom of the soil profile, and (3) the change of the soil organic carbon stock in the upper soil layer (0-0.4 m). The tool also provides the value of the synthetic "best practices index" (I_{BP}) that is computed as a linear combination of the three variables

and the weights that the user dynamically assigns to each of the variables according to the specific goal (e.g., increase in soil organic carbon). The user can then sort by descending order the I_{BP} values to identify the most suitable solutions (i.e., combinations of practices). The mean value of I_{BP} is plotted in charts for each of the simulated combinations.

Due to the link to the ARMOSA process-based model, the tool offers the great opportunity of a close representation of actual and optimized cropping systems with the possibility of further applications at a larger scale (e.g., European scale), in other regional case studies, and in tailored scenarios in which the user enters her/his own data of soil properties and climate.