Using SOIL CARBON MANAGER- a soil organic carbon simulation model- to evaluate various soil-crop-climate scenarios for the long-term change of organic carbon in soils of Greece

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ABSTRACT

Soil organic matter is a priority topic in current soil management. Soil mismanagement practices of the past resulted in significant decreases of soil organic carbon (SOC), through erosion, leaching and other forms of loss. Soil conservation is given high legislation status and more strict and effective measures are currently required by State Agencies from farmers. The new reformed Common Agricultural Policy of EU to be effective in 1-1-2014 integrates major components of environmental protection which aim to initially reduce and desirably to increase the soil organic carbon content of topsoils in earth. Many simulation models exist to evaluate or describe the nature of organic matter decomposition in a short or long run. However, most of the models require highly specific data inputs and have not been extensively validated. Furthermore almost all of them have not been transferred down to the “farmers level” or used extensively by Agricultural Extension Services as advisory tools.

A major problem of soils in Greece in the low content of soil organic carbon and also the decreasing trend observed in the last decades, due to natural and anthropogenic causes. This phenomenon will further accentuate the desertification process currently being in alert levels. The aim of this paper is to evaluate the long-term change of soil organic carbon in representative soils of Greece, as affected by production management activities and various weather scenarios considering trends in the climate change, using SOIL CARBON MANAGER, a simulation model.

This model predicts SOC changes under winter rainfall farming systems, for a range of soil types and climatic conditions and major crop species. From a starting level of SOC, the program estimates annual carbon input from crop and pasture growth, and losses from degradation of carbon pools in the soil.

The program calculates an annual carbon balance over a selected time period, for individual pools and a total for all pools. Soil Carbon Manager is based on extensive scientific investigation into farming systems and has brought together relevant knowledge from long term trials and laboratory investigations. This model requires only a minimum amount of soil, plant and climatic data to run and the user can add or access more detail information if needed. It is very friendly user and it is used very effectively in Perrotis College, to teach interactively the soil organic matter dynamic and aspects of effective management practices to sustain the productivity of a given soil-atmosphere continuum.

The simulations outlined important trends in short and long term in changes along a variety of production practices and management and crops and foraging, and suggested integrated production schemes to optimize and sustain levels of soil carbon in long term. It may become a simple but effective tools for farmers, students, researchers and other end users and can be integrated in further validation efforts in EU. One important aspect of using this model is to integrate it with applications of Precision Agriculture in establishing soil management zones of organic matter.

Keywords: soil carbon manager, simulation model, sustainable practices, management zones