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SUSTAINABLE WATER AND CARBON MANAGEMENT IN TREE CROPS: A POSSIBLE CONTRIBUTION TO CLIMATE CHANGE MITIGATION

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Agriculture contributes to climate change through greenhouse gas (GHG) emissions and is affected by climate change because the main weather variables (temperature, precipitations) are influential on crop cycle. At global level there are needs to reduce the GHGs sourced by agriculture and adapt its food-production system to cope with climate change. In fruit tree crops there are evidences that sustainable management practices (e.g. no-tillage, supply of organic fertilizers, mulching of pruning residues and cover crops) can increase soil organic carbon (SOC) stock, which contributes to mitigate increasing atmospheric CO_2 emissions. At the same time, sustainable management is able to recover soil fertility (e.g. high SOM, microbial biomass), increase yield and improve water use efficiency at farm scale through improved soil water holding capacity. Analysis of use of water and carbon resources at farm scale could contribute to the design of practices with no (or minimum) impact on environment. Carbon (C) and water (W) footprints (F) are being used to indicate the impacts of the C and W use by production systems. This paper reports the effects of multi-year application of sustainable orchard management practices under Mediterranean environment on soil microbial biomass, SOC and irrigation water in various tree crops (e.g. olive, peach). Results reveal that sustainable fruit orchards acted as C "sink", while the conventional (tilled, mineral fertilizers, no organic inputs) one acted as C "source". The long term of adoption of sustainable agricultural practices increased SOC, soil microbial biomass and biodiversity. Data on improved yield under sustainable management are also reported. At sustainable fields, the increased SOC stock promoted the soil hydraulic conductivity and in turn its water holding capacity which was, for example, about 1,000 m^3 ha^{-1} (at2 m depth, olive grove) higher than that of conventionally managed plot. Through the optimization of K_c and irrigation scheduling, and the application of regulated deficit irrigation (RDI) during post harvest the seasonal irrigation volume was reduced of about 1,500 m^3ha^{-1} (30%). Implication of the environmentally friendly orchard management practices within the circular economy is also discussed.

Keywords: irrigation, mineral nutrition, soil carbon, circular economy