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Net carbon flux in organic and conventional olive production systems

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Agricultural systems are considered as one of the most relevant sources of atmospheric carbon. However, agriculture has the potentiality to mitigate carbon dioxide mainly through soil carbon sequestration. Some agricultural practices, particularly fertilization and soil management, can play a dual role in the agricultural systems regarding the carbon cycle contributing to the emissions and to the sequestration process in the soil. Good soil and input managements affect positively Soil Organic Carbon (SOC) changes and consequently the carbon cycle. The present study aimed at comparing the carbon footprint of organic and conventional olive systems and to link it to the efficiency of both systems on carbon sequestration by calculating the net carbon flux. Data were collected at farm level through a specific and detailed questionnaire based on one hectare as a functional unit and a system boundary limited to olive production. Using LCA databases particularly ecoinvent one, IPCC GWP 100a impact assessment method was used to calculate carbon emissions from agricultural practices of both systems. Soil organic carbon has been measured, at 0-30 cm depth, based on soil analyses done at the IAMB laboratory and based on reference value of SOC, the annual change of SOC has been calculated. Substracting sequestrated carbon in the soil from the emitted on resulted in net carbon flux calculation. Results showed higher environmental impact of the organic system on Global Warming Potential (1.07 t CO_2 eq. yr-1) comparing to 0.76 t CO_2 eq. yr-1 in the conventional system due to the higher GHG emissions caused by manure fertilizers compared to the use of synthetic foliar fertilizers in the conventional system. However, manure was the main reason behind the higher SOC content and sequestration in the organic system. As a resultant, the organic system showed higher net carbon flux (-1.7 t C ha-1 yr-1 than -0.52 t C ha-1 yr-1 in the conventional system reflecting higher efficiency as a sink for atmospheric CO_2 (the negative value of Net C flux indicates that a system is a net sink for atmospheric CO_2). In conclusion, this study illustrates the importance of including soil carbon sequestration associated with CO_2 emissions in the evaluation process between alternatives of agricultural systems. Thus, organic olive system offers an opportunity to increase carbon sequestration compared to the conventional one although it causes higher C emissions from manure fertilization.

Keywords: Net carbon flux, GHG, organic, olive, soil organic carbon