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Effect of solid olive mill waste on the CO_2 sequestration in prunings, fruit and soil in an olive (Olea europaea) grove

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Despite the wide diffusion of olive (Olea europaea L.) cultivation, knowledge about the contribution of the olive groves to atmospheric CO_2 fixation and their potential role in mitigating global warming is still scarce. Olive groves can represent important sinks for atmospheric CO_2, although the determination of the amount of CO_2 fixed by the olive trees is complicated by the fact that a consistent amount of biomass is annually removed from the grove (fruits and, often, also prunings). Further, the amount of C stocked in the soil of an olive grove under different soil management systems is not well known.

A field trial was carried out in a rain-feed olive grove in Central Italy to evaluate the effect of the solid olive mill waste (SOMW) amendment on the amount of prunings (which were chopped and left on the soil) and fruits, and on the soil organic C content. From 2006 to 2013, during spring, some plots were amended with 150 kg per plant (50 t ha-1) of air stabilized SOMW, deriving from a three-phase oil extraction system. Not-amended plots were considered as control. During each vegetative season, prunings (subdivided into leaves and wood) and fruits were collected from all plots, dried and weighted. The C content of fruits and prunings was calculated by multiplying the dry weight by the Carbon Fraction (CF) suggested by IPCC 2003 (Intergovernmental Panel on Climate Change). The soil organic C content was determined on soil samples randomly collected by auger (0 - 20 cm depth) within each plot. The bulk density (needed to express the C content in the upper soil layer as t ha-1), was determined on soil samples collected by cylindrical steel cores.

The results obtained after eight years of field trial have shown that in the considered conditions the amendment of the olive grove soil with SOMW led to a increase of both olive yield and vegetative activity (prunings) of the olive tree (on average, about +16%). Further, 10,6 % more organic C was accumulated in the upper soil layer of the treated soil with respect to the control. In conclusion, our findings have shows that the use of SOMW as amendment in the olive groove, other than recycling an oil-extraction by-product that could represent an environmental problem, has a double positive effect through increasing plant biomass and production, and enhancing soil organic C content.