

Evaluation of soil carbon pools after the addition of prunings in subtropical orchards placed in terraces

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The amount of carbon that can be stored in a soil depends on many factors, such as the type of soil, the chemical composition of plant rests and the climate, and is also highly affected by land use and soil management. Agricultural ecosystems are proved to absorb a large amount of CO₂ from the atmosphere through several sustainable management practices. In addition, organic materials such as leaves, grass, prunings, etc., comprise a significant type of agricultural practices as a result of waste recycling. The aim of this research was to evaluate the effects of the addition of different organic prunings on the potential for carbon sequestration in agricultural soils placed in terraces.

Three subtropical orchards were sampled in Almuñécar (Granada, S Spain): mango (*Mangifera indica* L.), avocado (*Persea americana* Mill.) and cherimoya (*Annonacherimola* Mill.). The predominant climate is Subtropical Mediterranean and the soil is an Eutric Anthrosol. The experimental design consisted in the application of prunings from avocado, cherimoya and mango trees, placed on the surface soil underneath their correspondent trees, as well as garden prunings from the green areas surrounding the town center on the surface soils under the three orchard trees. Control experiences without the addition of prunings were also evaluated. These experiences were followed for three years. Soil samples were taken at 4 cm depth. They were dried for 3-4 days and then sieved (<2 mm). Total soil organic C, water-soluble soil organic C, mineral-associated organic C and non-oxidable C were analyzed and expressed as carbon pools (Mg C ha⁻¹ for total soil organic C, or Kg C ha⁻¹ for the others).

The results showed an increase of all organic carbon pools in all pruning treatments compared to the control experiences. Differences in total organic carbon pool were statistically significant between soils under avocado prunings and their control soil, and between soils under garden prunings with cherimoya and their control soil. Regarding the water-soluble soil organic carbon, low differences were shown. Differences in mineral-associated and non-oxidable organic carbon fractions were also statistically significant between soils under avocado prunings and their control soil, and between soils under garden prunings with cherimoya and their control soil. No significant differences in any organic carbon pool were founded for the soils under mango.

The climate in this area enhances mineralization processes of organic matter. Thus, both in mango soils under mango and garden prunings the organic carbon does not significantly increase compared to the control soil. In avocado soils under avocado prunings humification of organic matter predominates, probably due to differences in the biochemical structure of the prunings. Finally, organic carbon contents in soils under garden prunings compared to their respective control soils only increase in cherimoya orchard.

Our findings suggest that the addition of prunings and other organic debris may be a very useful practice for increasing the content of organic matter within the surface soil layer.

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