



Dissolved organic C and N pools in soils amended with composted and thermally-dried sludge as affected by soil tillage systems and sampling depth

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Soil tillage practices exert a significant influence on the dynamic of soluble organic C and N pools, affecting nutrient cycling in agricultural systems by enhancing its mineralization through microbial activities or stabilization in soil microaggregates, which contribute to mitigate greenhouse gases emissions. The objective of the present research was to determine the influence of three different soil management systems (moldboard plowing, chisel and no-tillage) and the application of composted sludge (CS) and thermally-dried sewage sludge (TSS) obtained from wastewater treatment processes on dissolved organic C (water-soluble organic C –WSOC–, carbohydrates, phenolic compounds) and soluble N (total-N, NH₄⁺, NO₃⁻) pools in a long-term field experiment (27 years) conducted on a sandy-loam soil at the experimental station “La Higueruela” (40° 03'N, 4° 24'W) under semi-arid conditions. Both organic amendments were applied at a rate of 30 tonnes per hectare prior to tillage practices. Unamended soils were used as control for each tillage system. Soil sampling was performed two months after tillage practices at the following depths for each treatment: 0-10 cm, 10-20 cm and 20-30 cm. Results obtained for unamended soils showed that no-tillage management increased total-N, NH₄⁺ and NO₃⁻ contents at the 0-10 cm depth samples, meanwhile WSC and carbohydrates contents were larger at 20-30 cm depth samples in both moldboard and no-tillage plots. CS and TSS-amended soils presented a general increase in soluble C and N compounds, being significantly higher in TSS-amended soils, as TSS contains a great amount of labile organic C and N substrates due to the lack of stabilization treatment. TSS-amended soils under no-tillage and chisel plowing showed larger N, NH₄⁺ and NO₃⁻ content at the 0-10 cm samples, meanwhile moldboard management exhibited larger NH₄⁺ and NO₃⁻ content at 10-20 and 20-30 cm samples, possibly due to the incorporation of TSS at deeper depths (20-40 cm). CS and TSS-amended soils in no-tillage system showed the largest content of organic C pools at 0-10 cm depth samples due to less soil disturbance and the input of organic substrates with CS and TSS on soil surface. CS and TSS-amended soils under chisel plowing exhibited similar contents of soluble organic C pools at 10-20 and 20-30 cm depth samples and only TSS-amended soils increased significantly WSOC content at 0-10 cm samples. Similarly, contents of WSOC and carbohydrates in moldboard plowing were distributed more uniformly throughout the soil profile due to the turnover of soil and CS and TSS amendments into the plow layer.

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