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Tillage intensification affects AMF diversity, SOC and enzymatic activities within soil aggregates at various scales

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Long-term agricultural management may change soil C sequestration and alter soil organic matter content, structure and biological activity. The objective of this study was to investigate the impact of tillage and N fertilization within a field experiment with a soybean/wheat rotation, originally established in 1982 in Central Italy.

Treatments were ploughing at 30-cm depth (P30) and minimum tillage (MT) in combination with two N fertilizer rates to wheat, 0 (N0) and 200 kg N ha-1 (N200). In spring 2016, soil samples were collected from the 0–15 and 15–30 cm soil layers. Bulk density (BD), NH4-N and NO3-N concentration were assessed. After wet-sieving fractionation, SOC, total N and available P, enzymatic activities and AMF diversity were assessed in both bulk soil and microaggregates within macroaggregates (mM). AMF diversity was characterized by SSU-ITS-LSU fragment.

At both soil layers, BD did not vary between tillage intensities, but was 7% higher in N200 than N0. At 15-30 cm depth, the proportion of mM was 21% higher in MT than P30, while no differences were detected in the surface layer. Tillage did not change soil total N and available P, whereas N fertilization affected NH4-N (15%) and NO3-N (28%) concentration at both soil layers. SOC, enzymatic activities and AMF diversity in bulk soil and in mM changed in P30 respect to MT.

Our results showed co-occurrence patterns in SOC, enzymatic activities and AMF diversity of bulk soil and mM fraction, suggesting that the contribution of soil biota to C sequestration within aggregates varied with tillage.

Keywords: tillage intensification, soil fertility, soil aggregates, AMF community diversity, soil enzymatic activity