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Effect of different kinds of crop residues on aggregate-protected soil organic matter fractions.

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Organic matter content of soils determines many important soil properties, such as soil structure, fertility and water-management. To improve its fertility and quality, returning different kinds of organic matter to soil has a long historical tradition. Ameliorating of soil and enhancing its fertility by enhancing its carbon stock with organic matter incorporation (like farmyard manure, crop residues or green manure) are general practices, but the extent of the amelioration depends much on several factors such as quantity, quality of the used organic matters. Quality of soil organic matters is affected by their chemical build-up, which differs by their origin (i.e. plant species); and their decomposability is affected by particle-size, protection by soil aggregates and the extent of their association to mineral surfaces. In our paper we investigated the effect of three different kinds of organic matter incorporation on aggregate-protected organic matter fractions: (1) Maize stem (M), (2) Wheat straw (W), and (3) Maize stem & Wheat straw (MW).

Our samples were originated from Keszthely, Western Hungary, where the texture of the investigated soil is Sandy loam, the type of soil is Eutric Cambisol (soil type FAO), or Alfisol (soil type USDA).

SOM fractions might be isolated and measured by physical fractionation of soil (Cambardella and Elliott (1992), Jensen et al. (1992)).

Firstly, microaggregates were separated according to their particle-size with physical fractionation (i.e. wet sieving) (Six et al. (2000a)). Each sample was pre-treated by capillary wetting and was sieved for 2 min in an analytic sieve shaker machine with the following aperture sizes: 2 mm, 250 μm, 53 μm. Therefore 4 fractions were resulted: (1) the $>$2000 μm large macro-, (2) the 250-2000 μm small macro-, (3) the 53-250 μm microaggregates, and (4) the $<$53 μm silt and clay fraction.

Secondly, the mineral-associated OM was separated by density flotation (Six et al. (1998)) from those OM forms that do not have any significant association with mineral particles. The fine fPOM between the microaggregates was isolated from the fine sand, the intra-microaggregate POM (iPOM) and the clay & silt fraction within the microaggregates by density flotation with 1.85 g cm^{-3} sodium polytungstate (SPT) following a procedure proposed by Six et al. (1998).

Finally, we obtained five soil dry matter (DM) fractions, which contained minerals and OM. There are two fractions of unprotected OM (Coarse sand + Coarse free POM (POM: particulate OM: $<$53μm) and Light fraction (Fine free POM)), two fractions of protected OM (mineral-associated OM (Heavy fraction $<$53μm) and intra-microaggregate POM (Heavy fraction $>$53μm)) and a fifth fraction that contains only minerals (Silt + clay fraction).

Our aim was to investigate how as the different plant residues affect the organic matter distribution over several SOM fractions in order to propose re-using of crop residues to enhance carbon storage of soils and therefore increase soil fertility. The underlying results are discussed in detail in the paper.