



Effect of humic acids on the stability and porosity of re-formed soil aggregates

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Erosion processes destroy soil aggregates and, in some extreme cases, may completely remove the topsoil. A rapid re-formation of water-stable aggregates should then occur to avoid further losses and to restore soil functionality, but aggregation would depend on field conditions and on soil cementing agents. In this work, we investigated the effects of the addition of humic acids and of one cycle of wetting and drying on aggregation and on the physical properties of soil re-formed aggregates. The first horizons of two alpine soils were discarded to simulate a total topsoil removal, and the second ones of each profile, similar in organic matter amounts, but different in clay, were incubated for two weeks. At the end of the incubation period, the samples were fractionated by dry sieving into the <2, 2-5 and >5 mm diameter classes, and the stability and porosity were determined. The wet-dry cycle alone induced aggregation, and the higher the clay contents, the larger the re-formed aggregates. This effect was however amplified by the addition of humic acids that enhanced the formation of the largest units. The >5 mm fraction was, nevertheless, extremely unstable and contained up to 57% of water-stable microaggregates; lower contents were instead found in the smallest size aggregate fractions. After 10 minutes of wet-sieving the percentage of stable aggregates ranged from 61 to 86.5 in the different size classes. The breakdown caused by slaking was low: 1.7 and 6.2% for the <2 mm and 2-5 mm aggregates, respectively, indicating that the major loss-inducing process was water abrasion, and water stability was found to decrease with increasing aggregate size. No differences caused by humic acids were found. The pore size distribution was in the aggregate size classes and influenced by the sample treatment: the <2 mm aggregates showed a lower presence of >3 μm voids, and a higher amount of <0.1 μm pores than the 2-5 mm aggregates, and the addition of humic acids increased the average size of the pores. In laboratory conditions, we observed a fast formation of aggregates, influenced both by the properties

of the soils and by the addition of humic acids. The tendency of soil particles to cohere into aggregates in the presence of humic acids induced a more open soil structure with larger aggregates and larger sized pores, but with a lower resistance to rupture. In short time term, therefore, humic acids played an important role in the process of aggregation, but resulted less effective in stabilising the re-formed aggregates.