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Quality compost and soil quality

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The 75% of soils in Mediterranean Europe shows an Organic Matter (OM) content lower than 2%, whilst the minimum OM level requested for a sustainable soil utilisation ranges between 2.5 and 3%. Supply of OM plays a major role in the structural improvement of the Mediterranean soils. In this context, the use of quality compost is particularly important. We define "quality compost" the material deriving from the composting process of the organic fraction of source-segregated municipal wastes, containing hazardous substances below the limits indicated by the national laws. The aim of this work was to evaluate the effects of quality compost on soil Carbon dynamics and structure of different soils, typical of cultivated areas of Tuscany.

Compost (30 t/ha) was added to the soil before the seeding for two years in succession. At the end of the second year the organic C content showed an increase of about 20% in the compost treated soil if compared with untreated one.

The possible arrangement of OM into the soil aggregates architecture was evaluated by means of a low-temperature ashing procedure under oxygen plasma. In this procedure, the oxidant efficiency of oxygen depends only on the physical accessibility of the substrate. Data show that only a small part of added organic C is still easily accessible, while most of organic C has been incorporated into the soil, at a protection level similar to that of the pre-existing organic C.

The influence of newly incorporated organic C on soil structure has been investigated from three different points of view: i) water stability of aggregates, to evaluate if the added OM can avoid dispersion of soil particles, due to rainfall events or runoff or water action. ii) soil cracking, to evaluate if the OM addition can make easier the reaggregation of dispersed materials. iii) porosity and pore size distribution of undisturbed

aggregates to evaluate the modifications of soil architecture and spatial arrangements of particles and aggregates.

The compost treatment significantly increased the water stability of soils with a higher percentage of clay, due to the stronger interaction between finer mineral constituents and added OM. After compost treatments the cracking pattern was modified. From few large cracks present in samples with no OM added, a longer network of finer cracks developed in compost treated samples, indicating a good structural resilience. This dispersion-aggregation dynamics affected also the crust formation. Field measurements showed that in compost treated soils the penetrometer resistance of crusts is 20% lower after the first year and 30% lower after the second year. A significant increase of total porosity was observed in clay soils treated with compost, due to an increase of storage or transmission pores. Thus, these soils were characterised by more favourable conditions for development and growth of root systems.

Overall data show that quality compost is able to improve both organic C content and structure of Tuscan soils with time. Soil sequestration of Carbon alone, by means of best practice in agriculture and forestry, can achieves the necessary net Carbon emissions reduction in the early part of the 21st century. Nevertheless, C increase in agricultural soils does not produce “sequestration credits” under the Kyoto Protocol, due to difficulty in verifying that C is actually being sequestered and maintained in soils. The analytical approach utilised in this study could result in setting up a methodology to acknowledge “carbon credits” to farmers, for an economic reward of doing their best to maintain and increase the OM content in soils.