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Effect of organic amendments on quality indexes in an italian agricultural soil

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Intensive agricultural practices can determine a decline in soil fertility which represents the main constraint to agricultural productivity. In particular, the progressive reduction in soil organic matter, without an adequate restoration, may threaten soil fertility and agriculture sustainability. Some soil management practices can improve soil quality by adding organic amendments as alternative to the sole use of mineral fertilizers for increasing plant quality and growth. A large number of soil properties can be used to define changes in soil quality. In particular, although more emphasis has been given in literature to physical and chemical properties, biological properties, strictly linked to soil fertility, can be valid even more sensitive indicators. Among these, soil enzyme activities and microbial biomass may provide an "early warning" of soil quality and health changes.
The aim of this work was to study the effect of preventive sterilization treatment and organic fertilization on enzymatic activities (dehydrogenase, arylsulphatase, beta-glucosidase, phosphatase, urease) and microbial biomass C in an agricultural soil under crop rotation.
The study was carried out on an agricultural soil sited in Campania region (South Italy). At the beginning of experiment sterilizing treatments to control soilborne pathogens and weeds were performed by solarization and calcium cyanamide addition to soil. Organic fertilization was carried out by adding compost from vegetable residues, ricin seed exhaust (Rigen) and straw, singly or in association.
Three samplings were performed at three different stages of crop rotation: I) September 2005, immediately after the treatments; II) December 2005, after a lettuce cycle; III) January 2007, after peppers and lettuce cycles. The soil sampling followed a W scheme, with five sub-samples for each plot. Soils were sieved at 2 mm mesh and air dried to determine physical and chemical properties; in addition a suitable amount of soils was stored at 4 °C for biological analyses. On soil samples, organic C, dehydrogenase phosphatase, beta-glucosidase and urease activities as well as microbial biomass C and fungal mycelium were assayed.
Results showed that sterilization treatments (solarization+calcium cyanamide) depressed almost all the enzymatic activities studied. By contrast their values were enhanced by the addition of compost combined with Rigen and/or straw. During the time the dehydrogenase activity strongly fell whereas slightly decreases occurred for the activity of phosphatase, beta-glucosidase and urease. Accordingly, a decrease in organic C content was measured. Conversely, arylsulphatase showed an activity increase at the second and third sampling. Microbial biomass C was improved by compost or compost + Rigen addition, in accordance with organic C trend. Normalizing the microbial biomass to the organic C content (microbial quotient) only in one plot a higher and significant value was obtained. Conversely the fungal growth was not influenced by amendment practices, rather in the time it was significantly depressed.
Data showed an ameliorant effect of organic amendments, especially when compost was combined with other ones, on chemical, biological and biochemical properties of studied soils. Further investigations related also to crop production should however be carried out to achieve a clearer and comprehensive picture of the relationships between soil quality and soil management practices.