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Effects of organic carbon sequestration strategies on soil enzymatic activities

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Greenhouse gases emissions can be counterbalanced with proper agronomical strategies aimed at sequestering carbon in soils. These strategies must be tested not only for their ability in reducing carbon dioxide emissions, but also for their impact on soil quality: enzymatic activities are related to main soil ecological quality, and can be used as early and sensitive indicators of alteration events.
Three different strategies for soil carbon sequestration were studied: minimum tillage, protection of biodegradable organic fraction by compost amendment and oxidative polimerization of soil organic matter catalyzed by biometic porfirins. All strategies were compared with a traditional agricultural management based on tillage and mineral fertilization. Experiments were carried out in three Italian soils from different pedo-climatic regions located respectively in Piacenza, Turin and Naples and cultivated with maize or wheat. Soil samples were taken for three consecutive years after harvest and analyzed for their content in phosphates, ß-glucosidase, urease and invertase. An alteration index based on these enzymatic activities levels was applied as well.
The biomimetic porfirin application didn't cause changes in enzymatic activities compared to the control at any treatment or location. Enzymatic activities were generally higher in the minimum tillage and compost treatment, while differences between location and date of samplings were limited. Application of the soil alteration index based on enzymatic activities showed that soils treated with compost or subjected to minimum tillage generally have a higher biological quality. The work confirms the environmental sustainability of the carbon sequestering agronomical practices studied.