Geophysical Research Abstracts
Vol. 16, EGU2014-14002-1, 2014
EGU General Assembly 2014

Short-term effects of different organic amendments on soil chemical, biochemical and biological indicators

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The limited availability of animal manure and the high cost of good quality compost lead to difficult soil quality management under organic agriculture. Therefore, it is important to find out alternative organic soil amendments and more flexible strategies that are able to sustain crop productivity and maintain and enhance soil quality.
A three years study was carried out in the experimental fields of the Mediterranean Agronomic Institute of Bari located in Valenzano, Italy. The main objective of this research is to investigate the effects of different fertility management strategies on soil quality in order to estimate the role of innovative matrices for their use in organic farming.
The experiment consists of seven treatments applied to a common crop rotation. The treatments include alternative organic amendments (1- olive mill wastewater OMW, 2- residues of mushroom cultivation MUS, 3- coffee chaff COF), common soil amendments (4- compost COM, 5- faba bean intercropping LEG, 6- cow manure - MAN) and as a reference treatment (7- mineral fertilizer COV). The soil quality was assessed before and after the application of the treatments, through biological (microbial biomass carbon and nitrogen, soil respiration and metabolic quotient), biochemical (soil enzymatic activities: β-glucosidase, alkaline phospatase, urease, fluorescein diacetate (FDA) hydrolysis), and chemical (pH, soil organic carbon, soil organic matter, total nitrogen, available phosphorous, exchangeable potassium, dissolved organic carbon and total dissolved nitrogen) indicators.
Based on the results obtained after the second year, all treatments were able to improve various soil chemical parameters as compared to mineral fertilizer. The incorporation of COF and OMW seemed to be more effective in improving soil total N and exchangeable K, while MAN significantly increased available P.
All the amendments enhance dissolved organic C, soil respiration, microbial biomass and metabolic quotient as compared to control soil. Results concerning biochemical indicators revealed that phosphatase and β-glycosidase were significantly reduced, while activities of urease and FDA were improved in all amended plots in comparison to the control, regardless of amendment type. Data demonstrated the efficiency, the high sensitivity and a quick response of the biochemical indicators in assessing soil quality changes.
As a conclusion, it is possible to emphasize that alternative and common soil organic amendments behave similarly in enhancing the chemical, biochemical and biological properties. The alternative soil organic amendments could, then, be candidates for substituting some commonly used one which are currently showing shortage in their supply and a lowering in their quality.

Keywords: Organic agriculture, Soil quality, Enzymatic activities, Olive mill wastewater, Residues of mushroom cultivation, Coffee chaff.