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Soil biochemical properties as affected by short- and long-term organic pollution

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In the last century, the indiscriminate release of organic pollutants into the environment has provoked serious and most often irreversible alterations of natural environmental balance. Indeed, soil contamination by highly toxic compounds has greatly increased with negative, irreversible effects on soil quality and health. Several chemical, biological and biochemical soil properties have been profoundly altered and their main effect has been the continuous lost of soil functions in sustaining the survival of living organisms. Among chemical pollutants recalcitrant compounds like polycyclic aromatic hydrocarbons, phenols and chlorophenols arrive to the soil from different anthropic sources and have high toxicity toward humans, plants and animals.

Very often, however, some wastes such as olive-mill wastewater (OMW), abundantly produced in Mediterranean countries and rich of toxic phenolic compounds, may have a considerable fertirrigation potential being also rich of both inorganic and organic useful substances. In some countries from the South bank of Mediterranean, with severe water-deficient environments, the fertirrigation of soil with OMW could represent an interesting, advantageous utilization of these wastes.

Assessing soil quality is a basic requirement for sustainable land use. When dealing with altered soils, monitoring soil status and its progressive changes gives useful information for a future land utilization. Soil biochemical activities are sensitive to several natural and human-induced changes and may provide an helpful tool to assess soil status, its quality and productivity. For instance enzymes activities represent the mediators of important soil functions and soil biochemical parameters, in general, may be used as early and sensitive indicators of soil ecological stress and restoration.

In this work a set of enzymatic activities, covering a large array of soil biochemical processes, and several biochemical parameters, such as basal respiration, microbial biomass C and N as well as the routine physical-chemical properties of soils artificially contaminated with either phenanthrene (Phe) and pentachlorophenol (PCP), as representative of PAH and chlorophenols, or crude OMW were investigated with time. Two situations were investigated: a) a soil polluted with PCP and Phe with and without amendment with compost; and b) a soil treated with two different doses of crude OMW. In both cases typical Mediterranean soils were used. The biochemical properties of a soil repeatedly exposed for a long term to huge quantities of OMW were also investigated.

The investigated parameters showed different responses to the applied disturb. Increases, decreases and no variations were observed for most of the measured properties. In general, the application and/or the presence of the polluting substance caused negative effects on the biochemical properties, as assessed by both the enzyme activities and microbial biomass. Soils, however, recovered some of their original properties at least within the investigated incubation time.

Attempts were made to find out cause-effect relationships between soils properties, enzyme activities and biochemical properties. Statistical analysis was used to quantify the strength of enzyme activities relationships versus microbiological and chemical properties.

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