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Efficiency of different techniques to identify changes in land use

Raúl Zornoza (1), Jorge Mateix-Solera (2), and César Gerrero (2)
(1) Universidad Politécnica de Cartagena, Spain (raul.zornoza@upct.es), (2) Universidad Miguel Hernández de Elche

The need for the development of sensitive and efficient methodologies for soil quality evaluation is increasing. The ability to assess soil quality and identify key soil properties that serve as indicators of soil function is complicated by the multiplicity of physical, chemical and biological factors that control soil processes. In the mountain region of the Mediterranean Basin of Spain, almond trees have been cultivated in terraced orchards for centuries. These crops are immersed in the Mediterranean forest scenery, configuring a mosaic landscape where orchards are integrated in the forest masses. In the last decades, almond orchards are being abandoned, leading to an increase in vegetation cover, since abandoned fields are naturally colonized by the surrounded natural vegetation. Soil processes and properties are expected to be associated with vegetation successional dynamics. Thus, the establishment of suitable parameters to monitor soil quality related to land use changes is particularly important to guarantee the regeneration of the mature community. In this study, we selected three land uses, constituted by forest, almond trees orchards, and orchards abandoned between 10 and 15 years previously to sampling. Sampling was carried out in four different locations in SE Spain. The main purpose was to evaluate if changes in management have significantly influenced different sets of soil characteristics. For this purpose, we used a discriminant analysis (DA). The different sets of soil characteristics tested in this study were 1: physical, chemical and biochemical properties; 2: soil near infrared (NIR) spectra; and 3: phospholipid fatty acids (PLFAs). After the DA performed with the sets 1 and 2, the three land uses were clearly separated by the two first discriminant functions, and more than 85 % of the samples were correctly classified (grouped). Using the sets 3 and 4 for DA resulted in a slightly better separation of land uses, being more than 85% of the samples correctly classified. These results suggest that the combination of properties of different nature is effective to show the state of soil quality, owing to the close interaction among physical, chemical and biochemical properties in soil. In addition, NIR spectra offer an integrate vision of soil quality, as they synthesize information regarding mineralogy, soil chemistry, soil biology, organic matter and physical attributes. With the DA developed with the PLFAs, the 100% of samples were correctly classified or grouped, indicating a clear impact of land management. This confirms the higher sensitivity of parameters related to soil microbial community structure to evaluate soil quality, perturbations and management. This result was expected as microbial communities respond very fast to changes in land use, faster than measurements of total microbial biomass and activity.

Key Words: Land use changes; Phospholipids fatty acids; Near Infrared Spectroscopy