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The long-term effects of the management of a forest soil on its carbon content, microbial biomass and activity under a semi-arid climate

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ABSTRACT

Terracing of soil is a reforestation practice well established in South-eastern Spain (semi-arid climate), because it increases plant growth by means of run-off reduction. This is a crucial factor because in this zone the climatic conditions (especially the scarce rainfall) impede plant development. In this work, the influence in the long-term (13 years) of two types of physical management (terracing and strip planting) in the reforestation of a mountainside with Pinus halepensis Millar, together with the addition of an organic amendment (produced from municipal refuse), was evaluated by means of different biochemical and microbiological parameters, including those related to the size and general activity of microbial populations, such as microbial biomass C (MBC), basal respiration, ATP, dehydrogenase activity and hydrolase activities. Also, the study of labile C fractions (water-soluble C, WSC) provided information regarding the metabolic potential of the soil microorganisms. Three-way ANOVA showed that organic amendment significantly increased general microbial activity and carbon fractions. Strips produced, in the long-term, only a slightly positive effect on the microbial activity. The results indicate that terracing, if not accompanied by the addition of organic matter, impacts negatively on the soil microbiological characteristics, as reflected in the lower general microbial activity (ATP, basal respiration and dehydrogenase activity) and the lower specific microbial activity (B-glucosidase, protease and phosphatase activities) detected in the non-amended terraces in comparison with a natural area with no intervention. However, in the amended plots, it was the terraces which had higher BAA-protease and B-glucosidase activities than the strips. Microbial biomass C, basal respiration and dehydrogenase activity showed higher values in amendment treatments than in unamended treatments. These results allow us to conclude that terracing in semi-arid areas where water is scarce is a good reforestation practice but it should be accompanied by organic amendment because otherwise these techniques can have a negative effect on soil microbiological and biochemical properties.

1. Introduction

The influence of the soil management regime on the quality of agricultural systems has been studied widely due to the economic repercussions that could result from soil degradation. However, few studies have focused on the impact of the management regime on the quality of soils in forest ecosystems. Soil management is sustainable only when the quality is

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