Organic Waste Amendment as Strategy for Fixing Carbon and Combating Soil Degradation in Semiarid Areas

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EXTENDED ABSTRACT

Wastes and soil degradation are an important issue in EU policy. New proposal directives in soil protection (COM (2006) 232) and treatment of residues (Directive 2008/98/EC) have shown the interest of European countries in both fields. Special interest is in EU southern countries. Some Mediterranean areas are amenable to erosion processes and organic matter loss, due to the rough conditions such as scarce and intense rainfalls, and high temperatures. On this subject organic wastes have been successfully used in improving soil properties and in the bioremediation of degraded soils (Ros et al, 2003, Bastida et al., 2008, Téjada et al, 2009). However, there is a lack of information on the role played by the nature of such organic wastes in soil C fixation and bioremediation processes. The aim of this work was to establish the influence of different organic amendments, differing in the nature and stability of their organic matter, on soil C fixation and the microbiological properties of a degraded soil from south-east Spain. For this purpose a degraded soil was amended at 90 t ha⁻¹ (dry weight) with the following organic wastes: (sewage sludge (SS); compost of sewage sludge (cSS); pruning wine wastes (PW); compost of pruning wine wastes (cPW); and compost of farmyard manure (cFYM), and then incubated for 9 months under controlled conditions. Chemical, biochemical and biological parameters were measured at 0, 90, 180 and 270 days to study the evolution of the soil properties with the amendment. Among these parameters, carbon fractions are of great interest but also those parameters related to soil biological processes such as microbial biomass, basal respiration or enzymatic activities, indicative of soil microbial activity. All treatments increased soil carbon fractions (total organic carbon and water soluble carbon) and showed higher values than the control 9 months after the amendment (Figure 1.a). cPW was the material that most contributed to increase soil C pool due to its lower mineralization along the incubation period (8 %). A positive correlation between total organic carbon and all biochemical parameters was found. Soils amended with vegetal residues (PW, cPW) and urban wastes (SS, cSS) showed the highest values for microbial parameters at the beginning of the experiment (Figure 1.b.). The values of these parameters decreased with the incubation time and the decrease was more notorious in the soils treated with urban wastes. This fact is explained by the more lignocellulosic nature of the vegetal residues (from pruning wastes), in comparison with the urban wastes with a high content of easily degradable compounds. However, PW showed more quantity of water soluble carbon than the composted residue, which leaded to a major initial C degradation and production of CO₂ (Figure 1). Along all the experimental period, soil enzymatic activities (β-glucosidase, phosphatase, urease, glycine aminopeptidase) in the amended soils remained higher than in the unamended soil, except for SS and cSS, which showed lower values of...
urease activity than the unamended soil (Figure 2.b.), probably due to a feed-back inhibition of the enzyme as a result of the high content in ammonium derived from organic matter degradation (Kajewska, 2009). These results demonstrate the positive effect of the amendments from organic wastes to improve degraded soil quality and the suitability of lignin-rich materials to increase the pool of organic carbon in the soil. In addition, the organic amendments constitutes a nutrient source, which is used by microorganisms contributing to activate the biogeochemical cycles of such important nutrients for ecosystem functioning as C, N and P. Results confirm that the use of appropriate organic wastes as degraded soil amendment can be a suitable solution for the dual problematic of degraded soils and organic waste production, and a medium to accumulate C in soils under semiarid climate.

![Figure 1](image1.png)

**Figure 1.** a) Total organic carbon (TOC) and b) basal respiration (Resp)

![Figure 2](image2.png)

**Figure 2.** Soil enzymatic activities: a) β-Glucosidase and b) urease.

REFERENCES


Proposal for a directive of the european parliament and of the council establishing a framework for the protection of soil and amending directive 2004/35/EC
