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Impact of Biochar Addition on Nitrification and CO_2 Evolution from an Acid Palexerult

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Abstract

Biochar amendment to soil has been proposed as a means to increase soil fertility and also carbon sequestration. However, its effect on soil nitrogen (N) and carbon (C) cycles is poorly understood especially in acid soils. A short-term (60 days) incubation experiment was carried out to investigate C and N mineralisation in an acid Palexerult from SW Spain after application of biochar (B), pruning waste compost in two different stages of maturity (30 days old; C1 and 6 months old; C2) and their mixtures, where 50 % of C was provided by B and 50 % by C1 and C2, respectively (C1B and C2B). Simultaneously, greenhouse assay for agronomic performance of perennial ryegrass was set up. Soil respiration was monitored throughout the study and microbial biomass, ammonium N (NH_4^+-N) and nitrate (NO_3^--N), water soluble C (WSC), N (WSN), soil pH and electrical conductivity (EC) were determined after one month and at the end of the incubation. The results showed that soil respiration was significantly higher in compost-amended treatments, resulting in 19 and 14 % loss of added carbon in form of C1 and C2, respectively, while only 9.8 % of C added as biochar was mineralised. Nitrogen mineralisation slightly decreased after biochar amendment respect to control, however, C1B resulted in higher mineralisation than C1 application where mineral N was immobilised. Aboveground biomass production of ryegrass was increased by all treatments with no significant difference between compost and biochar amendments. Our results indicate that combination of compost with biochar could maintain the crop production while decreasing CO_2-C losses by mineralisation and potential nitrate losses by leaching. Further field studies would be necessary to acquire a better understanding of the effects of biochar on N and C cycles.

Keywords: Acid soil, biochar, carbon mineralisation, nitrogen mineralisation

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