CAN BIOCHAR BE USED TO INCREASE THE BIOAVAILABILITY OF PHOSPHORUS IMMOBILIZED IN ANDISOLS?

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A large proportion of phosphorus (P) fertilizer applied to Andisols reacts with Al reactive surfaces and becomes unavailable for plant uptake. Up to 3 tonnes/ha of P have been locked away in intensively farmed soils. In this study we explore the possibility of mobilizing P retained in these soils through the use of biochar. The specific objectives of this study were to (i) investigate the effect of biochar application to Andisols on arbuscular mycorrhizal fungi (AMF) growth and P availability; and (ii) identify other biochar-associated mechanisms that may modify soil P availability (e.g., through changes in soil pH). For this, a root study container (RSC) technique that divided the soil into three components - root zone, rhizosphere and hyphae zone - was used. Three types of biochar were studied: two made from chipped pine (*Pinus radiata* D.Don) branches at 450°C and 550°C (BP450 and BP550) and a third one from chipped willow (*Salix matsudana* L.) branches at 550°C (BW550). Each biochar at a dose of 4.48% (w/w, which was equivalent to a field deep-banded rate of 10 t/ha) was mixed into samples of Egmont silt loam topsoil (Andisol) that contrasted in Olsen extractable P levels (4.3 and 33.3 mg P/kg referred to as LP and HP, respectively). The various combinations of LP ± biochar or HP± biochar were packed into either the upper root zone compartment, or the lower hyphae compartment of the RSC, or both. *Lotus pedunculatus* cv barsille seeds (inoculated with *Rhizobium)* were sown in the root zone soil. Abundant indigenous AMF were identified, and thus no external inoculum was introduced. The lotus shoots were harvested at regular intervals dry matter yield, P and N concentrations of plant shoots determined. Results obtained to present indicate that (i) the presence of BW550 in the root zone of the LP soil significantly (p<0.05) enhanced plant growth and P uptake; (ii) the presence of pine biochar (BP450 and BP550) in the hyphae zone of the HP soil substantially increased plant growth and P uptake (p<0.05). Once the experiment is finalized, AMF colonization on roots, hyphal length in the hyphae zone soil and P forms fractions in the rhizosphere soil will be determined. Information obtained from the present study will help reveal the mechanisms underlying the influence of biochar on P bioavailability in Andisols.

Keywords: Biochar, Andisols, Root container study, Arbuscular mycorrhizal fungi

Editor's Note: An extended manuscript has not yet been submitted for this presentation.