Charcoal and Selected Beneficial Microorganisms: Plant Trials and SEM Observations

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Pilot studies on various charcoals, from a variety of sources and produced at different pressures and temperatures, suggest that the contribution of charcoal to soil fertility and plant growth is a complex combination of nutrient retention and microbial interaction.

Plant trials with charcoal, established in 2006, included *Pinus radiata*, *Solanum tuberosum*, *Pisum sativum*, *Brassica oleracea*, *Cucumis sativus*, *Lactuca sativa*, *Lycopersicon esculentum*, *Zea mays*, *Trifolium repens*, *Lolium perenne*, *Triticum aestivum*, *Abutilon hybridum*, *Viola tricolor* var *hortensis*, *V. cornuta*, *Narcissus tazetta*, *Freesia armstrongii* and *Dahlia excelsa*. Charcoals made from various hard and soft-woods, bamboos, bark, corn stover, and mixtures of these, were used with and without selected 'beneficial micro-organism' formulations.

The results of these trials and SEM studies on the charcoals used in these studies, together with the initial results of an SEM study on charcoal micro-organism interactions will be presented and discussed in the context of the structural basis of the influence of charcoal on nutrient retention and soil microbiology.

Field Maize Yield and Yield Determining Factors for Four Years Following Biochar Application on a Colombian Savanna Oxisol

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Biochar, when used as a soil amendment, has repeatedly shown to increase crop productivity. However, the mechanisms that underlie such increases have yet to be explained. This talk will report findings from a four-year field study on an Oxisol of the Oriental savannas of Colombia. Maize was grown each year with optimal fertilization, after a single biochar application in late 2002. Biochar application of 20 Mg ha^{-1} increased maize yield by 22, 23 and 58% in 2004, 2005, and 2006, respectively. Nutrient contents in biomass and soil, crop root density and soil hydrology data will be presented in order to explain the yield increase and determine the nature of the durable beneficial effects of biochar on crop growth.

Slash and Char as Alternative To Slash and Burn—Soil Charcoal Amendments Maintain Soil Fertility and Establish a Carbon Sink

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The aim of the presented research was to examine the use of charcoal in agricultural practice and management of a highly weathered Xanthic Ferralsol in Amazonia. This presentation summarises the results of a doctoral theses, comprising field and laboratory experiments. The influence of charcoal and condensates from smoke (pyroligneous acid, PA) on the microbial activity was assessed. Various field trials assessed the effect of charcoal, organic, and inorganic fertilization. In a field trial, 15 different amendment combinations based on equal amounts of applied C in chicken manure, compost, charcoal, and forest litter were tested during four cropping cycles.

When PA or fresh charcoal was applied the microbiological parameters increased linearly and significantly with increasing concentrations. Long-lasting soil fertility improvement due to organic fertilization and a synergistic effect if both charcoal and mineral fertilizer were applied was observed in a field experiment. Charcoal doubled grain production if fertilized with NPK in comparison to the NPK-fertilizer without charcoal.

Soil charcoal additions reduced exchangeable soil aluminium (Al) significantly. Mineral fertilized soils amended with charcoal and TP soils had a significantly higher potential for microbial population growth coupled with a low microbial respiration in absence of an easily degradable C source. These results reflect the relatively high biodegradable OM content of primary forest topsoil but low available nutrients, in contrast to refractory TP SOM with high available soil nutrient contents.

Total 15N recovery (in soil, crop residues and grains) was significantly higher on charcoal (18.1%), charcoal plus compost (17.4%), and compost (16.5%) treatments in comparison to only mineral fertilized plots (10.9%).

Preservation of Woods in Forest Acid Soil by Addition of Biomass Charcoal

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Forest decline caused by acid deposition has become a serious problem of global concern. It is mentioned that sulfuric acid originated from fossil fuel is one of causes bringing blighted wood in forest. Harmful effects of the acid deposition include increase in toxic metallic ions such as Al^{3+} and Fe^{3+} ions and decrease available symbiosis micro-organisms to tree growing. Biomass charcoal was sowed in the acid soil around trees in order to preserve them. The pH of charcoal is dependent on the carbonization temperature; the pH of carbon carbonized at 650°C was around 9. It was expected that the sowed carbon powder can neutralize acid soil to lead to decreasing the ions concentration in the soil and to increasing the micro-organism concentration. It was found that the proliferation of the micro-organisms was enhanced on and in the charcoal as a medium.