

Is Biochar a Panacea for Sustainable Soil Fertility Management? : A Systematic Evaluation of Compost and Biochar Amended Soils

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Although short-term impacts of biochar application on soil fertility have been studied extensively, information on their medium- and long-term effects are meager. Hence, it is premature to conclude that biochar application is a sustainable soil fertility management technology. This study was carried out to evaluate medium-term impact of biochar application on soil fertility in a corn growing Alfisol using a systematic approach which integrate nutrient availability, fixation of nutrients and plant growth. Soil (Typic Rhodustalfs) was collected from an ongoing field experiment after three years of its establishment. Four treatments: NPK fertilizers only (CF), single application of 17 Mg of Rice husk biochar (RHBC) or Corn cob biochar (CCBC) per hectare with CF, and repeated application of 10 Mg of compost per hectare with CF, were selected for this study. Except Cu and Mg, the availability of P, K, S, and Zn were less than the optimum levels in all treatments. Available Cu contents were significantly ($P < 0.05$) higher in RHBC amended treatment. Fixation study revealed that the amount of P added to achieve the optimum levels in CCBC+CF treated soils were high (62 mg/kg) although not statistically different ($P > 0.05$) from other treatments (38-46 mg/kg). Sorghum (*Sorghum bicolor* L) plants were grown in small cups using the missing element technique to evaluate the plant availability of nutrients in different treatments. Nitrogen is the most limiting nutrient in all treatments while both P and Zn were deficient in CCBC amended soil. Application of K and S did not significantly increase the plant growth in any treatment, probably due to their marginal deficiency. We concluded that RHBC and CCBC are not capable of increasing plant available nutrient contents more than compost amended or CF applied soils by the end of three years when they are applied at rates used in this experiment.

Keywords: Alfisol, Biochar, Compost, Nutrient availability, Soil fertility evaluation

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