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Agronomic Benefits of Biochar after its Use as Waste Water Filtration Media in a Sudano-Sahelian Soil

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Abstract

Urban agriculture is contributing significantly to food security and diversity in developing countries. It is characterised by the use of untreated waste water for irrigation of vegetable crops and consequently causes health risks for farmers and consumers. Carbonaceous materials are frequently used for water purification. Biochar, the solid residue of pyrolysis, is able to retain pathogens and harmful substances during filtration and researchers reported nutrient accumulation in water filters. In this study, we tested the hypothesis that biochar after its use in water filters has specific properties and therefore may have different effects on plant growths.

To test this hypothesis a water filter with biochar made from rice husks was constructed and fed with untreated waste water for three month. After filtration, total nutrient and carbon content, pH and electrical conductivity were assessed and compared with untreated biochar. Subsequently, a six weeks pot experiment with a sandy soil from Niger was carried out and biomass production of summer wheat, nutrient uptake, plant available phosphorus (Bray I) and mineral nitrogen in soil were measured after the experiment. As treatments we used the original biochar, filterchar (20 t ha^{-1}, each) and untreated soil as control. All treatments were tested in a fertilised and unfertilised variant and replicated five times.

The data showed a reduction of nutrients, especially phosphorus (P), during the filtration but, nitrogen (N) remained unchanged. Biomass production was highest in biochar treatment (+72 %) while filterchar (+37 %) produced lesser biomass but still higher than the control. The plants uptake of P was increased but N uptake was reduced on biochar treated soil. The soils with biochar and filterchar had higher available phosphorus content (+106 % and +52 %) but showed lower mineral N content after the experiment. Data suggested that in our study biochar effects on biomass production were likely due to a direct P fertilising effect. The fertiliser value of filterchar was reduced after filtration but still yielded higher biomass than control treatment. Field experiments should be carried out to assess filterchar effects on other soil processes such as nutrient leaching.

Keywords: Biochar, nutrient cycles, water treatment

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