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Field Experiment on a Tropical Andosol in Karagwe, Tanzania Using Organic Wastes from Bioenergy Provision and Ecological Sanitation

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Abstract

Because of high phosphorus (P) fixation, Andosols regularly require P amendments to guarantee high crop production and sustainable land use. Further they tend to accumulate organic carbon (C) and thus they can act as CO₂ sinks for C-sequestration. Ecological sanitation and bioenergy production, such as anaerobic digestion and pyrolysis or microgasification, can contribute to local nutrient and carbon recycling. Soils can be amended with compost, urine, biogas slurry or CaSa-compost (containing biochar and sanitised human excreta) to replenish nutrients and to guarantee sustainable crop production. A practice-oriented field experiment was conducted to assess five amendments' short term effects on crop productivity, plant nutrition and soil properties on tropical Andosol in Karagwe, Tanzania. Seven intercropped local plant species were planted on 9 m² plots with five repetitions arranged in a latin rectangle. Differences in biomass production were related to the availability of water and nutrients in the soil. The amendments did not change the plant-available water in the soil significantly. Therefore, differences in crop yield and plant nutrition could be related to nutrient availabilities from the soil alone. Biogas slurry, compost and CaSa-compost increased the aboveground biomass of *Zea mays* by about 140, 154 and 211 % respectively as compared to the unfertilised control treatment. Plots amended with biogas slurry, compost and CaSa-compost yielded about 2,630, 3,180 and 4,400 kg ha⁻¹ air-dry maize grains respectively compared to 1,100 kg ha⁻¹ on the control plots. Nutrient balancing revealed that 20 % of the applied P was taken up by plants. Only the amendment of CaSa-compost significantly increased plant-available P concentrations (from 0.5 to 4.4 mg kg⁻¹) in the top-soil compared to the untreated control. We conclude that the used amendments are applicable and effective to sustain fertility and productivity of the local Andosol. Especially CaSa-compost contributes to mitigating P-scarcity and acidification.

Keywords: Biogas slurry, composted biochar, crop nutrition, ecological sanitation, field experiment, hydraulic properties, soil chemistry, soil improvement, Terra Preta practice, waste as resource