

Composting methods with and without biochar amendment and its effect on maize biomass production and soil properties

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Biochar with its highly porous structure has been widely recognized for its potential as a carrier material for slow release fertilizer. While the combination of biochar with mineral fertilizers has had positive agronomic and environmental impacts, effects of its combination with organic fertilizer (compost) has received less attention. Here, we focus on three different types of composting methods to produce organic nutrients from raw materials (green waste and farm yard manure): conventional composting (CC) (maturation without turning the piles), aerobic composting (AQ) (frequent turning) and bokashi composting (anaerobic lacto-fermentation). Each of these three methods was done either with biochar (BC-compost) or without. Biochar, produced from an invasive forest shrub *Eupatorium adenophorum* using a flame curtain conical soil pit kiln, was applied at 10% by volume for each BC-compost treatment. Soil-chemical and agronomic effects on maize growth of each BC-compost and compost type were investigated at two dosages (20 t ha⁻¹ and 60 t ha⁻¹) in pot trials. The organic substrates were further compared with treatments receiving mineral nutrient NPK (available nutrient equivalent to 20 t ha⁻¹ and 60 t ha⁻¹ compost) combined with biochar (3 t ha⁻¹ and 9 t ha⁻¹ biochar) or without biochar. Application of 60 t ha⁻¹ BC-bokashi showed strong and highly significant ($P<0.000001$) increases of above ground biomass production of 200% to 485% compared with the other organic and 240% to 400% compared to the inorganic substrates. Similarly, in-situ soil moisture content (% by vol.) was also significantly larger ($P<0.00001$) for the BC-bokashi compost compared with other organic and inorganic amendments. By contrast, plant growth effects did not differ significantly between conventional compost substrates (compost, BC-compost and post BC mixed), all three types of composts without biochar (both at 20 t ha⁻¹ and 60 t ha⁻¹ compost) and the inorganic amendments. Summarizing, the study revealed strong positive plant growth effects when biochar was premixed (co-composted) and post mixed with the organic compost substrates, and that enormous differences prevail between the composting methods.