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Can compost increase grain yield more than inorganic fertiliser in maize-sorghum rotational systems in southwestern nigeria?

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Abstract

This study explored the potential yield-enhancing effects of compost and biochar in maize-sorghum rotational systems of southern Nigeria. To this end field trials were conducted on maize (*Zea mays* L.), followed by sorghum (*Sorghum bicolor* Moench.) to study residual treatment effects in the 2023 and 2024 cropping seasons in Ibadan, Nigeria. The experimental design was a split-plot, randomised complete block design, with six nutrient sources replicated four times. Composts made from poultry manure (PM), broadleaves (BL+PM), grasses (GR+PM), cassava peels (ME+PM), NPK and an untreated Control were main plot treatments into which +/- biochar application was nested as subplots.

In 2023, the maize grain yield of PM (1767 kg ha^{-1}) was 44 % higher ($p < 0.01$) than average maize grain yields of control, BL+PM and ME+PM. Maize amended with biochar attained 49 % (1682 kg ha^{-1}) ($p < 0.01$) higher grain yields than those without biochar. Maize grain yield in 2024 had a nutrient source and biochar interaction: in PM+BC (3335 kg ha^{-1}) and NPK+BC (2985 kg ha^{-1}) grain yields were 78 % higher ($p < 0.01$) than all other treatments. In 2023 and 2024, nutrient source influenced sorghum grain yield: sorghum amended with PM and BL+PM yielded three-times higher ($p < 0.01$) than control plots in 2023. In 2024, the grain yield of sorghum fertilised with PM was 27 % higher ($p < 0.01$) than the average of BL+PM, ME+PM and the control. In 2023 and 2024, biochar amendment increased sorghum grain yield by an average of 74 % compared with the no-biochar treatment.

Rainfall use efficiency (RUE) of maize displayed a nutrient source and biochar interaction, with PM+BC in 2023 and 2024 being 74 % ($p < 0.05$) and 69 % ($p < 0.01$), respectively, higher than other treatments. In 2024, fertiliser use efficiency (FUE) of maize fertilised with NPK was 4-fold higher ($p < 0.01$) than FUE of other nutrient sources. Biochar-amended maize plants had a 50 % higher FUE ($p < 0.01$) than no-biochar-amended maize plants.

We conclude that amending poultry manure with biochar increased the yield of maize and sorghum, thus recommend the production and inclusion of biochar in organic soil amendments.

Keywords: Agricultural residues, integrated fertiliser management, organic fertiliser, soil amelioration, sustainable farming

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