

Biochar for soil management: effect on soil available N and soil water storage

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Introduction

Soil management practices for improving soil moisture storage and nutrients are needed to increase food production in smallholder agriculture. In a field studies at Soil Research Institute, Kumasi Ghana, (6°40'N, 1°40'W), a control treatment, five inorganic fertilizer combinations (P₃₀K₆₀, N₆₀ P₃₀K₆₀, N₁₂₀P₃₀K₆₀, N₁₈₀P₃₀K₆₀ and N₂₄₀P₃₀K₆₀) and four biochar rates + inorganic fertilizer (2 t ha⁻¹ Biochar + N₆₀ P₃₀K₆₀, 4 t ha⁻¹ Biochar + N₆₀ P₃₀K₆₀, 6 t ha⁻¹ Biochar + N₆₀ P₃₀K₆₀ and 8 t ha⁻¹ Biochar + N₆₀ P₃₀K₆₀) were assessed for their effect on soil moisture storage, soil available nitrogen and crop yield. The test crop was okra. The experimental design was Randomized Complete Block Design with three (3) replicates. Extractable nitrate and extractable ammonium was analysed using colorimetric method (Anderson and Ingram 1993, ICRAF, 1995).

Results and Discussions

Biochar amendments increased soil moisture relative to sole inorganic fertilizer application by 14%. Biochar + inorganic fertilizer at 0-15 cm soil depth increased available nitrate concentration by 85% but decreased ammonium-N concentration by 71% relative to sole inorganic fertilizer. Inorganic fertilizer (P₃₀K₆₀) resulted in more than 100% increase in okra fresh fruit yield relative to the control.

Addition of 60 kg N ha⁻¹ to P₃₀ K₆₀ caused 23% decline in okra fresh fruit yield but showed 60% more okra fresh fruit yield compared to the control. Inorganic N rate 120, 180, 240 kg N ha⁻¹ combined with P₃₀K₆₀ caused an average okra fresh fruit yield decline of 74%. Biochar + inorganic fertilizer on the other hand, showed superior okra fresh fruit yield. The added benefit of biochar amendment to okra fresh fruit yield ranged from 8.6% to 43%.

Conclusions

Biochar combined with inorganic fertilizer has tremendous potential to address food insecurity through soil moisture improvement and soil N availability.

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¹ Anderson, J.M; Ingram, J.S.L. 1993. Tropical Soil Biology and Fertility: A handbook of methods. CAB International, Wallingford, UK.

² ICRAF, 1995. Laboratory Methods for Soil and Plant Analysis. Version 1.1. Nairobi.