Improving degraded coastal Acrisol with biochar and compost enhances soil quality and carbon storage

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INTRODUCTION

Soils of the tropical regions of the world continue to experience soil fertility decline due to continuous cultivation. Many fertility strategies have been deployed to overcome these challenges including application of compost, manures, biochar from various materials.

There is limited studies on the impact of EFB biochar and /or compost on the physicochemical properties and on carbon fractions in different soil aggregate sizes of the coastal savannah Acrisol.

METHODOLOGY

Study location: A.G Carson Technology Village (Lat: 5°746.4088 N and Long: 1°1710.89024 W) on a Haplic Acrisol

Field experiment:

Treatments: T1 = Control, T2 = NPK ,T3 = EFB Biochar 10tons/ha, T4 = EFB Biochar 20tons/ha, T5 = EFB Compost 20tons/ha,T6 = EFB Biochar 10tons/ha + Compost 20tons/ha, T7 = EFB Biochar 20tons/ha + Compost 20tons/ha

Design: RCBD with 4 replications

Cropping history: 2 Okra cropping cycle.

Soil sampling: sampling was done in zigzag pattern at 0-0.2 m depth and composited for each treatment.

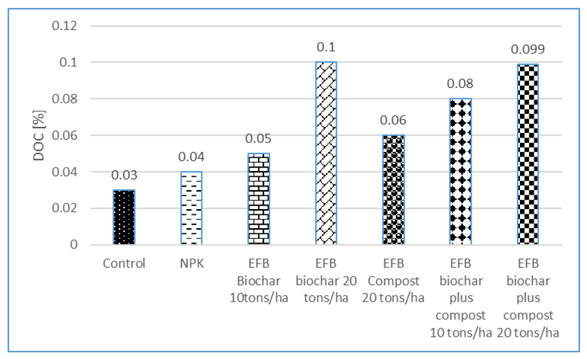
Aggregate size analysis: Modified wet sieving method (Wright and Hons, 2005)

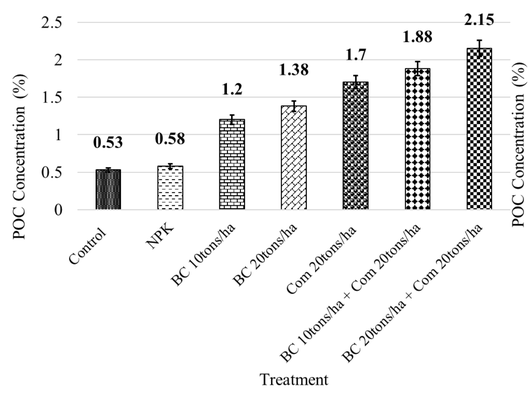
Soil physicochemical properties were determined following standard lab procedures

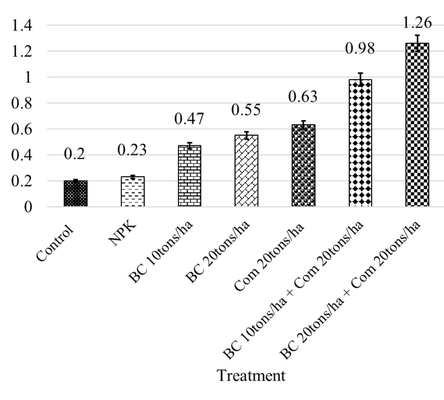
SOC fractionation: The Walkley-Black standard laboratory method (Stewart et al., 1974) was used with varying strength of H_2SO_4 for different organic carbon fractions. DOC (12 N H_2SO_4), POC (18N – 12N H_2SO_4), MAOC (24N – 18N H_2SO_4) and Recalcitrant OC (TOC-24N H_2SO_4)

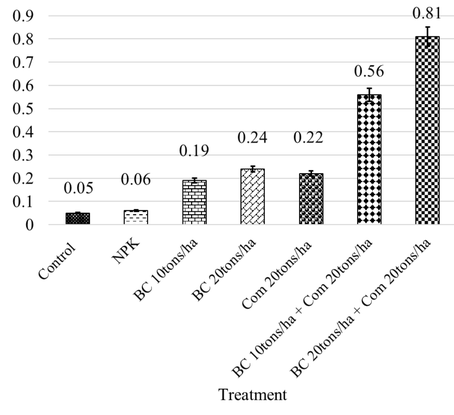
FINDINGS

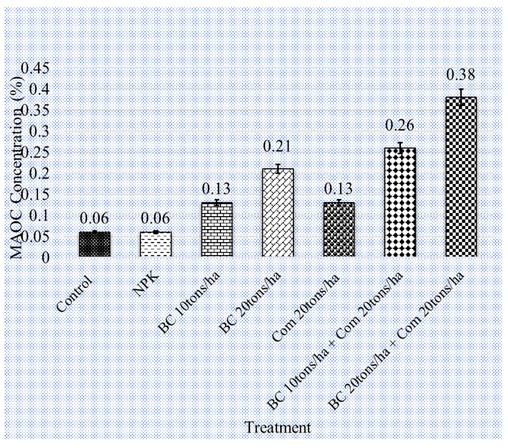
Treatment	WHC (%)	BD (g/cm^3)	pH	SOC (%)	Avail. N ($mg\ kg^{-1}$)	Avail. P ($mg\ kg^{-1}$)	ECEC ($c\ molc\ kg^{-1}$)
Control	28.3 c	1.597	5.57 b	1.07 f	158.4 a	4.82 c	3.79 b
NPK	36.6 abc	1.53	6.68 a	2.557 e	127.4 ab	6.57 c	4.84 ab
EFB 10 tons/ha	40 ab	1.503	6.69 a	3.7 c	130.4 ab	7.54 c	5.87 ab
EFB 20 tons/ha	33.3 bc	1.537	6.78 a	2.9 d	129.1 ab	72.34 b	4.76 ab
EFB Compost 20 tons/ha	41.7 ab	1.45	6.9 a	4.8 b	117.6 b	94.16 b	6.99 ab
EFB 10 tons+ Compost 20 tons/ha	45 a	1.37	6.9 a	5.97 a	119.9 b	239.14 a	7.79 a
EFB 20 tons/ha + 20 tons compost	45 a	1.37	6.9 a	5.98 a	122.3 b	240.69 a	8.2 a
Summary comments /P value (5%)	0.02	NS	<.001	<.001	0.043	<.001	0.036

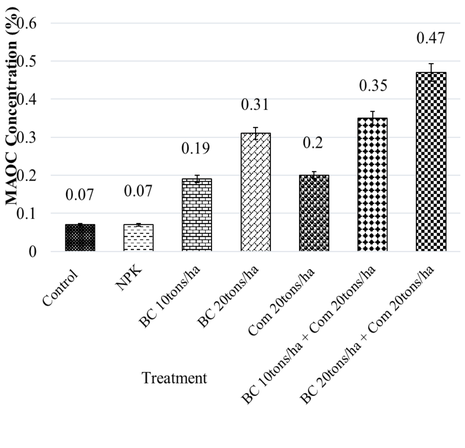


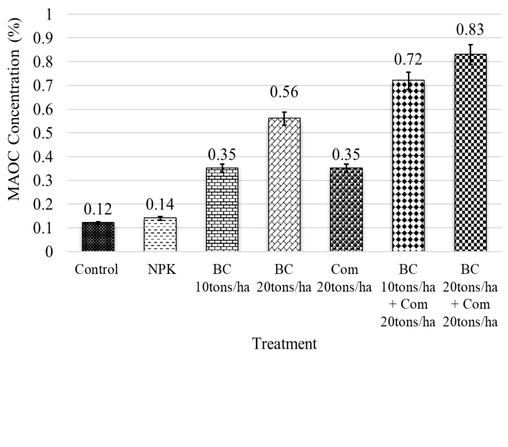












HIGHLIGHTS

- EFB Biochar @20 tons ha and EFB compost @ 20 enhanced soil quality
- POC increases with increasing soil aggregate fraction for EFB Biochar @20 tons ha and EFB compost @ 20
- MAOC reduces with increasing aggregate size fraction but MAOC remains high in EFB Biochar @20 tons ha and EFB compost @ 20 tons treatment.

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