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Influence of Organic and Inorganic Soil Amendments on Temporal Improvement of Formation of Soil Aggregates in *Eleusine coracana* Cultivated soil

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Abstract

Soil aggregation is related to biological, physical, and chemical activities in soil. Agriculture-based soil amendments may encompass hydrophobic properties that interfere with soil aggregation. This study examined the influence of soil amendments and their hydrophobicity on soil aggregation in *Eleusine coracana*-grown soil. Cattle manure (CM), hydrophobic leaf litter (*Casuarina equisetifolia*, CE), biochar from CE (BC_{CE}) (450 ℃, 20 minutes), and quick lime (CaO) were mixed with sieved surface soil (3% CM, 3% CE, 3% BC_{CE} and 1% CaO in air-dry weight basis). The control was primarily surface soil (Rhodudults with grass-dominated vegetation). The study involved five treatments (triplicated), including the control. The hydrophobicity was examined using the water drop penetration time (WDPT) test. Initially, CM and CE-added samples were slightly repellent, while control, BC_{CE}, and CaO-added samples were non-repellent. The samples were filled into the polybags (3750 g per bag) and moistened up to 80% of the soil's field capacity. Sprouted *E. coracana* seeds were transplanted in polybags, and the moisture content was maintained by adding water (first 2 weeks: once every 4 days; after two weeks: twice a week). After 10 weeks, formed aggregates were separated by sieving. The percentage of total aggregate formation was calculated as the total soil in a polybag (air-dry basis). The highest and the lowest aggregate formation were recorded in the CE-amended sample (21.4%) and BC_{CE}-added sample (4.1%), respectively. The CE and CM-amended samples (slightly repellent mixtures) showed significantly higher aggregate formation compared to the control ($p<0.05$). The BC_{CE}-added sample showed the lowest aggregate formation despite biochar being a soil improvement agent. The exact mechanism for the reduced aggregation by BC_{CE} has not been fully addressed; it can be related to the presence of sodium, which discourages flocculation. Future studies considering various soil amendments and biochar applications would provide a more comprehensive understanding.

Keywords: hydrophobicity, soil aggregates, soil amendments

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