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Impact of Different Types of Soil Amendments and Their Hydrophobicity on Soil Aggregate Formation

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Abstract

Soil aggregate formation is a combined action of soil's physical, chemical, and biological activities. Soil hydrophobicity is a phenomenon that influences various physicochemical and biological processes in soils. It may thereby influence the formation of soil aggregates. Soil hydrophobic conditions are influenced by various organic and inorganic materials. There is a possibility for soil amendments utilized in agriculture to induce hydrophobic properties in soils, subsequently influencing soil aggregate formation. This study aimed to examine the impacts of soil amendments on aggregate formation using four amendments, namely cattle manure (CM), hydrophobic leaf litter (*Casuarina equisetifolia*, CE), biochar produced from CE leaf litter (BC_{CE}), and quick lime (CaO). Sieved (<2 mm) surface soil was mixed with 3% of CM, CE and BC_{CE} and 1% of CaO. Surface soil (no amendment) was used as the control. There were five treatments, including the control, and the treatments were triplicated. The prepared mixtures were moistened up to 80% of the field capacity and incubated under laboratory conditions. The moisture content was maintained by spraying water on moisture-loss basis at 7-day intervals. The formed aggregates were separated, and weights of the total aggregates were recorded at 5, 10, 20 and 30 weeks of incubation periods using separate sets of samples (N=60). The 3% CE amended soils showed the highest total aggregate formation at each measurement (5.00%, 6.95%, 6.70% and 6.27% at 5, 10, 20 and 30 weeks, respectively). Only the 3% CE amendment showed significantly higher aggregate formation than the control at 5 and 10 weeks after incubation. Both 3% CE and 1% CaO amended samples showed significantly higher aggregate formation than the control at 20 and 30 weeks after incubation ($p<0.05$). Results revealed that the addition of hydrophobic litter material enhanced the formation of soil aggregates. Hydrophobic organic components in CE might be the reason for the enhanced aggregate formation at each time interval. Besides the hydrophobicity, inorganic ions, especially Ca^{2+}, increased soil aggregate formation. Further experiments are necessary to identify exact phenomena related to hydrophobicity and aggregate formation, considering different types of amendments and longer periods.

Keywords: Aggregate formation, Hydrophobicity, Soil amendments