Soil aggregate stability quantified by different methods is unaffected by rice straw biochar in the long term

Abstract

Highly weathered tropical soils are susceptible to disaggregation due to disruptive forces like water and mechanical disturbances. However, a few studies have investigated how biochar and cropping systems together affect the aggregate stability of tropical soils. This study investigated the long-term (~7 years) effect of rice straw biochar on the aggregate stability of a tropical Acrisol using the dry aggregate stability (DAS) method and SLAKES (a wet aggregate stability technique), and assessed the extent of agreement or otherwise of the aggregate stability quantified by the two methods for different treatments. Maize (Zea mays L.) and okra (Abelmoschus esculentus L.) were rotated on plots amended with rice straw biochar at rates of 0, 15, and 30 Mg ha^{-1}. Seven years after biochar amendment, bulk soil samples were collected at 0–15 cm depth for laboratory analyses. Aggregate stability was assessed by determining erodible fraction (EF) and DAS, and by quantifying the SLAKES parameters (slaking index [SI] and slaking index at 600 seconds [SI-600]). Neither biochar nor crop type or their interaction significantly changed the soil aggregate stability assessed by the two methods ($p > 0.05$). The EF and DAS weakly correlated with SI and SI-600, which could be attributed to the differences in the mechanisms underlying soil aggregate breakdown assessed by the two methods. The study highlighted that observed challenges of the SLAKES method namely, inability in some cases to detect soil aggregates and the disaggregation process could offset its advantages as a tool for rapid detection of soil structural problem areas within agricultural fields.

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