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Effects of Water Repellent Levels of Different Organic Amendments on Water Retaining Ability and Floating of Model Soil Aggregates

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Organic matter amended soil aggregates are widely used as potting media in modern agriculture, which induces soil water repellency (SWR) that may impact water retention and floating behavior. However, the impact of SWR on the water retaining ability (WRA) and floating time (FT) of organic amendment (OA) treated aggregates is still unknown. This research aims to assess the effects of different levels of SWR induced by OA-treated aggregates on the WRA and FT of artificially prepared model soil aggregates. Manure from cattle and goats, compost, and leaf litter from Casuarina equisetifolia and Swietenia mahogani were used as OA. Soil aggregates with uniform dimensions (1 cm × 1 cm ×0.5 cm) were prepared by incorporating OA at 15% on a weight basis. SWR was measured using the water drop penetration time (WDPT) test and the sessile drop contact angle method. The WRA and FT of the aggregates were measured using a mesh cup and surface floating tests, respectively. Results were analyzed statistically using descriptive statistics, analysis of variance (ANOVA), and regression models at a 5% significance level ($p < 0.05$). Aggregates prepared with C. equisetifolia and 100% soil (control) showed the highest and lowest water repellencies, respectively, based on their average WDPT (168 s, <1 s) and contact angle (80.5°, 54.77°) values throughout the study period. The water repellency of aggregates decreased gradually throughout the study period due to the decomposition of organic matter and the reduced availability of hydrophobic compounds. Aggregates treated with C. equisetifolia recorded the highest water retaining ability (20–35%) among all treatments, and the water retaining ability decreased gradually during the experimental period. However, none of the treatments showed any relationship between water retaining ability and WDPT ($R^2 < 1$) during the entire study period. C. equisetifolia-treated aggregates showed the highest average floating times (>1300 s), and floating time decreased over the experimental period. During the entire study period, floating time showed moderate to strong positive correlations with WDPT ($R^2 = 0.63$–0.84).

Keywords: Casuarina equisetifolia, Sessile drop contact angle, Soil water repellency, Water drop penetration time, Water retention