Structural Stability of Humid Tropical Soils as Influenced by Manure Incorporation and Incubation Duration

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Soil erosion due to the impact of high-intensity tropical rainfall is one of the important environmental problems in the Republic of Trinidad and Tobago. Organic matter and incubation can increase soil cohesion after soil structure disruption and therefore influence aggregate stability and saturated hydraulic conductivity (K_{sat}), which are key properties in improving soil and water management. We examined the influence of manure incorporation and incubation duration on the structural stability of three tropical soils with different clay contents and mineralogies. Samples were treated with farmyard manure (FYM) at the rates of 0, 6, and 12% per dry mass of soil, brought to field capacity (FC), and incubated for 56 d at an average temperature and humidity of 26°C and 67.5%, respectively. Subsamples were taken at 14, 28, and 56 d for the determination of water-stable aggregation (WSA) and K_{sat}. We found an increase in WSA of 23 to 27% for the three soils studied when we compared the natural sample with no treatment to the largest treatment combination (12% FYM and 56-d incubation). The higher the load of FYM incorporation, the more stable the soil became with incubation. Greater improvement was found in K_{sat}, whose values increased between 50 and 700%. Also, both WSA and K_{sat} increased with incubation duration regardless of FYM level or clay content and mineralogy. This suggests that, by itself, soil incubation at FC after structural disturbance, with or without FYM incorporation, is a desirable practice that encourages particle bonding and structural improvement.

Abbreviations: EC, electrical conductivity; ESP, exchangeable sodium percentage; FC, field capacity; FYM, farmyard manure; OM, organic matter; PZC, point of zero charge; SC, sandy clay; SCL, sandy clay loam; WSA, water-stable aggregation.