

Clay, Organic Matter, and Wetting Effects on Splash Detachment and Aggregate Breakdown under Intense Rainfall

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The binding and cementing potentials of clay and organic matter (OM) and the weakening effect of wetting are important in the stability of soil aggregates. They can therefore influence aggregate breakdown (AB) and splash detachment (SD), which are initial steps in the erosion process. We investigated the interactive effects of clay and OM on AB and SD under various wetting rates (WR) and antecedent moisture contents (AMC) using six agricultural soils from Trinidad. The selection criteria for the six soils were based on three levels of clay; low (<20%), medium (20–45%) and high (>45%) and two levels of OM; low ($\leq 3\%$), and high (>3%). Samples were prewetted with mist at slow (7.5 mm h^{-1}) and fast (75 mm h^{-1}) WR to AMC of 0.5 of field capacity (FC) and FC and exposed to intense simulated rainfall of 120 mm h^{-1} . The sensitivity of a sample to disruption under varying wetting conditions and intense rainfall depended on the level of combination of clay and OM in the sample. Increase in clay beyond the medium level without raising OM to high level strengthened disruptive forces and increased the proportion of microaggregates. The AB and SD of the medium clay-high organic matter (McHom) soils were significantly lower than their high clay-low organic matter (HcLom) counterparts irrespective of WR and AMC. This implies that a threshold clay content exists beyond which an accompanying increase in OM is required to mitigate detachment mechanisms and erosion under intense rainfall.

Abbreviations: AB, aggregate breakdown; AMC, antecedent moisture content; ANOVA, analysis of variance; CEC, cation-exchange capacity; ESP, exchangeable sodium percentage; FC, field capacity; HcLom, high clay-low organic matter; HcHom, high clay-high organic matter; KE, kinetic energy; LcLom, low clay-low organic matter; LcHom, low clay-high organic matter; McLom, medium clay-low organic matter; McHom, medium clay-high organic matter; OM, organic matter; SD, splash detachment; WR, wetting rate.