11th Academic Sessions
University of Ruhuna, Matara, Sri Lanka. ISSN 2362-0412

Water Stability of Model Aggregates in Relation to the Contact Angle and Wetting Rate for Japanese Surface Andisol

D.A.L. Leelamanie[1*] and J. Karube[2]

[1]*Faculty of Agriculture, University of Ruhuna.* [2]*Faculty of Agriculture, Ibaraki University, Japan*

Abstract

The major reason for the top soil erosion linked with the disruption of aggregates is identified as the rapid wetting rates of surface soils. Hydrophobicity (water repellency) is a property of soils that reduces their affinity for water and their infiltration capacity, which may help impeding the pressure buildup within aggregates, and reduces aggregate disruption. A relationship would be helpful to interpret aggregate stability considering the hydrophobicity and initial wetting rates, which will be represented with contact angle and water drop penetration time (WDPT), respectively. The purpose of this study was to develop a relationship to identify the most suited initial wetting rates to achieve the most durable stability for aggregates while preventing the floating of dry aggregates using a Japanese surface Andisol. Soil was hydrophobized using stearic acid into different hydrophobicities and the contact angle was measured using the sessile drop method. To determine the water stability of aggregates (%WSA), model aggregates were placed in a 0.5 mm sieve, immersed in water and kept overnight. The total floating time of each aggregate, was recorded. The %WSA increased as the contact angle increased with increasing stearic acid content. Aggregate floating started when the contact angle exceeds 100° and a similar trend was observed with WDPT. As the wetting rate decreased, the %WSA increased. Floating appeared when WDPT exceeded 2 s. Considering the 1 s floating as the critical point, the hydrophobicity level and the wetting rate which provide maximum %WSA was decided to be around 100° and ~2 s, respectively. Although the %WSA increased with increasing contact angle and WDPT above this level, those levels were considered not suitable considering the risk of undesirable effects of water repellency. The results revealed the most suited initial wetting rates to achieve the most durable stability for aggregates while preventing the floating of dry aggregates for the examined Japanese Andisol. This further indicates that the contact angle and wetting rate, as measured by WDPT, are closely related with the water stability of aggregates. The results further confirm that high levels of hydrophobicities would induce aggregate floating and further loss of top soil.

Keywords: *Aggregate stability, contact angle, Japanese Andisol, wetting rate*

* *leelamanie@soil.ruh.ac.lk*