 ISSN 2362-0412

Characteristics of Water Dependent Repellency of Soils Amended with Hydrophobic Organic Matter

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Abstract

Soil water repellency is caused by low-energy surfaces where the attraction between solid and liquid phases is weak. Water repellency is positively correlated with soil organic matter and occurs when mineral particles are hydrophobized by coatings of organic substances. Repellent soil becomes wettable when soil water content is above a critical value. The purpose of his study was to determine the water dependent repellency of pre-wetted soil samples amended with different amounts of organic matter considering the critical water content, the highest potential water repellency, and the water content at the highest potential water repellency in relation to the added organic matter content and the water repellency of the samples. A soil sample taken from the surface (Ultisol: 0–5 cm) was air-dried and passed through 1 mm sieve. Decomposed and dried plant materials (Casuarina equisetifolia allowed for decomposition for 18 months under air-dried condition) were used as the organic matter (OM) amendment. Ground OM was passed through 0.5 mm sieve and mixed with soil at contents of 1, 5, 10, 25, and 50%. Soil without OM (0% OM) was used as the control. All the samples were wetted with distilled water to approximate saturation. Then the samples were allowed to air drying and the water repellency of the samples during drying was estimated with water drop penetration time (WDPT) test. All the soil samples with OM contents ranging from 0 to 50% showed very low penetration times at approximate saturation. With gradual drying, WDPT increased gradually, except in the control (0% OM), up to a maximum level and thereafter decreased with decreasing water content. The water repellency of the control didn't show any difference and the WDPT remained continuously at a very low value. At oven dried condition, water repellency decreased to very low values. Critical water content and the OM content showed linear correlation (R2=0.9914), showing high critical water content at high OM content. The highest WDPT during drying increased with the increasing OM content (4 s at 1% OM, and 414 s at 50% OM) showing a power correlation (R2=0.9631). The water content at which the samples showed the highest WDPT increased with increasing OM content and the potential water repellency (R2 = 0.9968 and 0.9641, respectively).

Keywords: *hydrophobicity, organic matter, water dependent repellency*

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