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Influence of soil water repellency on initial infiltration rate and unsaturated hydraulic conductivity of an Ultisol under *Pinus caribaea*

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Soil Water Repellency (SWR) is a major physical property of some soils that inhibit or delay the water infiltration. It is caused by hydrophobic organic substances released by plant residues, roots, or soil microorganisms. On water repellent soil surfaces, water is retained for periods that vary according to the severity of the existing water repellency. Vegetation is a major biotic factor that enhances the SWR. Plant-derived hydrophobic organic compounds released from litter decomposition and root exudates may affect soil hydrophysical properties leading to uneven wetting and fingered flow developments. Soils under *Pinus caribaea* in Haputale have already been identified to show water repellent characteristics. Influence of different SWR levels on hydrophysical properties of these water-repellent soils in Sri Lankan conditions are yet to be discovered. The objective of this study was to examine the effects of SWR on initial infiltration rate and unsaturated hydraulic conductivity (k_{unsat}) of a pine forest soil in Upcountry Intermediate zone using field and laboratory experiments. Soils were collected from ten sampling points at 0-5 cm, 5-10 cm, 10-15 cm, 15-20 cm and 20-25 cm soil depths for the determination of water repellency in the laboratory. Degree of water repellency was measured using sessile drop contact angle method. Initial infiltration rate and k_{unsat} were determined using a calibrated mini disc infiltrometer (Decagon devices, Model S, 509-332-2756, USA) in the field. Data analysis was conducted with regression analysis. Soil water contact angles were in a range of 70⁰-99⁰ on the surface and decreased with increasing soil depth (50-64⁰, 40-50⁰, 25-35⁰ and 20-30⁰ in 5-10 cm, 10-15 cm, 15-20 cm, 20-25 cm soil depths, respectively). This may be as a result of decrease in soil organic matter content as the soil depth increases. Initial infiltration rates varied in the range 100-400 cm/h, while k_{unsat} values were in the range of 1-5 cm/h. Contact angle of the surface soil (0-5 cm) showed moderate negative exponential relationship ($R^2=0.6$) with initial infiltration rate, and moderate positive logarithmic relationship ($R^2=0.5$) with k_{unsat} . Based on above findings, it can be concluded that both infiltration and k_{unsat} to have curvilinear relationships with water repellency. Reductions in infiltration can contribute to increase in surface runoff and soil erosion processes in pine forest ecosystem in Haputale. Positive relation with k_{unsat} shows the possibility of the presence of preferential flow paths. Further studies are required for identification of preferential/fingered flow patterns.

Keywords: Infiltration, pine, soil water contact angle, soil water repellency, unsaturated hydraulic conductivity

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