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Influence of the initial soil water content on Beerkan water infiltration experiments

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Understanding and modeling of water flow in the vadose zone are important with regards water management and infiltration devices design. Water infiltration process clearly depends on initial soil water content, in particular for sandy soils with high organic matter content. This study investigates the influence of initial water content on water infiltration in a hydrophobic sandy soil and on the related derivation of hydraulic parameters using the BEST algorithm (Lassabatere et al., 2006). The studied sandy soil has a high total organic content decreasing from 3.5% (w/w) at the surface to 0.5% (w/w) below 1cm depth. The highest TOC at surface was due to the presence of a dense biofilm and resulted in a high surface hydrophobicity under dry conditions (low initial water contents). The water infiltration experiments consisted in infiltrating known volumes of water through a simple ring at null pressure head (Beerkan method). The infiltrations were performed during three successive days after a dry period with a storm event between the first and the second day (5 mm) and another between the second and the third day (35 mm). These events resulted in an increase in initial water contents, from less than 5% for the first day to around 10% for the last day. Experiments were performed for appropriate conditions for Beerkan experiments: initial water contents below 1/4 of the saturated water content and uniform water profile resulting from water redistribution after each rainfall event. The analysis of the infiltration data clearly highlights the strong effect of hydrophobicity. For the driest initial conditions (first day), infiltration rates increased with time, whereas they decreased with time for wetter conditions. Such a decrease agreed with the principles of water infiltration without hydrophobicity. In addition, total cumulative infiltrations were far higher for the wettest conditions. Regarding hydraulic characterization, only the data obtained during the last campaign could be analyzed to derive the hydraulic parameters using BEST algorithms. The results of this study indicate that water infiltration experiments and the related hydraulic characterization must be conducted under appropriate initial hydric conditions. The understanding of water infiltration in sandy soil clogged with organic sediments or biofilm requires further investigations.

Lassabatere L., Angulo-Jaramillo R., Soria Ugalde J. M., Cuenca R., Braud I., Haverkamp, R. 2006. Beerkan Estimation of Soil Transfer parameters through infiltration experiments – BEST. Soil Science Society of America Journal, 70, 521-532.