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Influence of Upper Layer Treatment of Gel-Forming Conditioner on Water Movement in Sandy Soils Under Sprinkler Infiltration

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Abstract *A laboratory sprinkler (rain) infiltration experiment was carried out on long stratified columns of sandy soil (Typic Torripsamments) packed to 1.50 g* cm^{-3} *bulk density to investigate the effect of gel-forming conditioner (Jalma) on wetting front advance* Z, *water distribution, and redistribution profiles under different sprinkler intensities* I *using a simple sprinkler simulator. Five concentrations of Jalma* J, *0.0, 0.25, 0.50, 0.75, and 1.0% (on dry weight basis), were uniformly applied to the upper layer (10-cm depth) at three sprinkler intensities of 1.25, 2.25, and 3.25 cm* h^{-1}. *The time required for the wetting front to reach 10-cm depth* t° *was significantly increased either by increasing* J *added to the upper layer or decreasing* I *applied on soil surface. However, the treatment of 1%* J *caused surface ponding before* Z *had advanced to 10-cm depth for the three values of* I. *A fairly uniform water profile was produced in the homogeneous soil (*J = *0%), and the constant water content as fractional volume* θ_T *was found equal to the ratio of the sprinkler intensity* I *to the velocity of the wetting front* v. *Addition of Jalma to the upper layer increased the water content in that layer, which was magnified by increasing* I, *but did not affect the value of* θ_T *in the untreated lower layer. The higher water content observed at the soil surface due to Jalma application never approached the corresponding value of the saturation water content* θ_s *under sprinkler infiltration. The experimental results revealed that the water movement in the untreated lower layer was unaffected by Jalma applied to the treated upper layer. Equations based on Darcy's law along with the physical properties of the resulted water distribution profile were derived to compute* Z *and* θ_T *under sprinkler infiltration as affected by Jalma applied to the upper layer of sandy soil. The development of water redistribution profiles indicated that the amount of water retained in the treated upper layer was much higher than that in the untreated upper and lower layers at the same corresponding redistribution times and sprinkler intensity. However, the same uniform water content* θ_T, *which was associated with* -10 *kPa matric potential on average, was approximately achieved in the untreated lower layer 3 days after sprinkler infiltration regardless of Jalma applied to the treated upper layer. In*

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