Indian Journal of Ecology (2021) 48(1): 66-71

Manuscript Number: 3173
NAAS Rating: 4.96

Modeling Infiltration and Water Distribution Process of Layered Soils Using HYDRUS-1D

E.M. Mohammed, E.A. Alani and M.M. Abid

Northern Technical University, Mosul Technical Agricultural College, Mosul, Iraq
E-mail: esamalkaisy@ntu.edu.iq

Abstract: Laboratory experiments were conducted to investigate the infiltration and wetting front under various thicknesses of the soil layers. Two layered of Northern Iraqi soils, including a sandy loam, silty loam and loamy sand of different depths, fine texture layer over coarse texture layer and coarse texture layer over fine texture layer were evaluated. The numerical model HYDRUS-1D based on the Richards equation was applied to simulate a series of infiltration processes accumulated infiltration and wetting front, with van Genuchten hydraulic parameters. R^2 (coefficient of determination) and RMSE (root mean square error) were used to show the degree of accurate prediction between the observed and simulated data. The accumulated infiltration and wetting front affected by the sequence and thickness of soil layers. An interface existing in the layered soils, whether a fine over coarse layer or a coarse over fine layer, had a common feature of limiting downward water movement. In general, the fine soil layer eventually controls the infiltration process in both cases of fine over coarse and coarse over fine providing the waterfront pass the interface between coarse and fine layer. The HYDRUS-1D provided accurate simulation results of accumulative infiltration and wetting front depths, since the R^2 values varies from 0.9 to 0.99, between simulated and observed values. RMSE values ranged between 1.3 to 1.6 for accumulative infiltration depths and between 0.6 and 0.9 for wetting front depths. The depression in R^2 and RMSE values was observed with the increasing of upper layer depths from 5 to 20 cm. This indicates that HYDRUS-1D model was capable of accurately simulating the various infiltration processes in multilayered soils.

Keywords: Infiltration, Wetting front, Layered soil, Modeling, HYDRUS-1D