Fitting a Numerical Model for the Analysis of the Wet Bulb Dimensions by Drip Irrigation

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Abstract

Prevision of the unsaturated zone hydrodynamics is one of the most important criteria for designing efficiently localized irrigation practices. In Uruguay the design of localized irrigation has been historically based on formulations and previsions to quantify the size of the wet bulb, using different methods (analytical and numerical simulations, empirical and field tests). These methods were based on soil conditions for light and homogeneous soils, and arid climatic conditions, which are difficult to extrapolate to local soils and crops. Nowadays, is known to be common practice over irrigation because of the lack of a more accurate prevision of the shape of the wet bulb. However, there is no knowledge about the amount of deep percolating water. This research is based on the comparison of experimental results obtained from field test under controlled drip irrigation of alfalfa with the results of a numerical model that simulates unsteady hydrodynamic processes in unsaturated zone. The used code was CODE_ BRIGHT, developed by the Department of Geotechnical Engineering UPC, Barcelona, Spain. Tests were carried out modifying both the time of water application as the emitter discharges. A 1.20 m diameter and 1.20 m tall cylindrical lysimeter was built reproducing the original soil profile of the area. Each stratum was assumed to be homogeneous and axial symmetry was used to find the most efficient way to locate measuring instrumental. Percolating water volume was also measured in the experiment, placing a drainage system at the bottom of the lysimeter. The test was set up on the INIA Las Brujas facilities, using soils of the area (silty loam and silty clay loam) typical of the center-south of the country. The comparison of measured and predicted results suggests the existence of complex phenomena more based in soil structure than in soil texture, which may explain the rapid percolation observed on the initial stages of irrigation. It is necessary to develop other numerical models that represent more accurately these behavior.

Keywords: drip irrigation, unsaturated zone, soil wetting patterns dynamic