| | |
|---|---|
| **Surname:** *Sheikhesmaeili* | **Name:** *Omid* |
| **Title:** *Modeling of Transport and Fate of Water and Nitrogen in Different Soils under Drip Fertigation* | |
| **Supervisors:** *Dr. Abd-Ali Naseri ; Dr. Hadi Moazed* | |
| **Advisior:** *Dr. Fariborz Abbasi : Dr. Khalil Azhdari* | |
| **University:** *Shahid Chamran University of Ahvaz* | **Degree:** *Ph.D.* |
| **Faculty:** *Water Science Engineering* | **Department:** *Irrigation & Drainage* |
| **Graduation date:** *14/03/2016* | **Number of page:** *149* |
| **Keywords:** *Soil Texture, Moisture Distribution, Solute Transport, Model* | |

Study of water and solute transport phenomena in different soils, especially in complex three-dimensional condition under drip irrigation is essential in order to reduce the amount of water consumption, drainage concentration and optimal management of fertigation systems. On the other hand, knowledge of the moisture and solute distribution in different soils profile is time consuming and costly field tests. So, computer simulation models can be a good alternative in response to movement and distribution issues of water and solute in soil profile. Moreover, Modeling of water and solute flow through porous media under unsaturated conditions necessitates the knowledge of soil hydraulic properties, such as water retention curve and field capacity of soil. This research, meanwhile identifying the most important factors affecting the wetting front pattern, was aimed to develop modeling of transport and fate of water and nitrogen under surface point drip fertigation in two different conditions, including field and laboratory controlled tests. Accordingly, the tests were carried out on three major soil textures of farm fields in Khuzestan province, consisting of loam, loamy sand and sandy loam with bulk density varies from 1.45 to 1.70 $gr/cm^3$ under factorial experiment with three replicates and 18 samples. Monitoring of wetting front position with time in both the physical model and experimental farm was possible using color tracer and *TDR* sensors placed at different soil depths. Then, the moisture data and measured amounts of nitrogen using the Kjeldahl method (*Standard ISO 11261*) were used for sensitivity analysis, simulation, calibration and validation of *Hydrus-2/3D* as an advanced software model. In addition, the modeling investigation led to develop *Schwartzman-Zur* model and improve the prediction accuracy of the wetting bulb pattern dimensions using the semi-empirical method through nonlinear multivariate regression analysis with regard to the initial conditions of soil moisture.

The simulation results of *Hydrus-2/3D* model showed that the extension of wetting front during the redistribution was considerably greater than irrigation. So that, in some treatments made even an increase ratio of *183.3* % in wetting depth. Investigation of nitrogen distribution in different soils revealed that nitrogen concentration in soil profile of loamy sand texture increased over time, so that four hours of fertigation event led to the transport of nitrate nitrogen according to the water distribution to 60 *cm* depth over 72 hours redistribution.

Finally, The *Hydrus-2/3D* model were evaluated graphically, as well as by statistical criteria, so that the accuracy and verifiability of the simulated results derived from calibration process were quite satisfactory ($RMSE < 0.0203$, $R^2 > 0.987$, $SE < 0.0209$ *and* $MAE < 0.017$). Therefore, the present research achievements, especially with respect to management and practical recommendations about application of *Hydrus-2/3D* model could help to engineering consultants and operators of drip irrigation system in the fields of fertigation and management of deep percolation losses in different soils.