Simultaneous Simulation of Water, Nitrate and Ammonium Transport in Soil Using HYDRUS-2D Model in Furrow Irrigated Maize

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Abstract

Transport and transformation of urea, nitrate, and ammonium in the soil take place as a sequential decay chain reactions which should be considered altogether for more precise management of water and fertilizer in agricultural farms. In this study, HYDRUS-2D model was evaluated to predict distribution of water, nitrate and ammonium under furrow and ridge during the growing period of maize. Thus, maize was planted in the treatments with nitrogen rates of 0, 150, and 250 kg ha^{-1}. The amounts of nitrogen uptake, soil water, nitrate, and ammonium concentrations during the growing season, before and after fertilization, and after harvesting were measured over different depths under ridges and furrows. Results showed suitable agreement between predicted and measured water, nitrate and ammonium distribution in soil during validation stage. NRMSE and R^2 as evaluation indexes for the predicted soil water were calculated as 0.772 and 4.37%, respectively. Besides, these indexes were calculated for the predicted ammonium concentration under furrow and ridge for all treatments and were found to be in the range of 0.645-0.798 and 14.23%-29.4%, and for the predicted nitrate concentration, they were in the range of 0.716- 0.829 and 23.57%- 25.2%, respectively. According to the results of this study, the HYDRUS model is a useful tool for management of water and fertilizer in furrow irrigation.

Keywords: Water and fertilizer management, Calibration, Solute transport.

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