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Physical simulation and numerical modeling of transport of atrazine from trickle irrigation

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In recent years, the use of chemigation has become a method to apply pesticides directly to the plant root zone through trickle irrigation systems. We, therefore, studied the spatial distribution of atrazine in soil under chemigation in this study. The distribution of atrazine in a sandy loam soil was monitored in a drip chemigation experiment and numerical simulations were conducted. In addition, adsorption and degradation parameters of atrazine on the test soil were obtained by batch equilibrium and batch incubation experiments. HYDRUS-2D software was used to simulate the moisture movement and atrazine transport in the soil. The mathematical model considered unsaturated, non-steady flow in a sandy loam and taking into account the adsorptive and degradable herbicide. Freundlich equation and first order kinetic equation were used to describe the adsorption and degradation of atrazine respectively. Based on the observed data obtained from a trickle chemigation device to the V-shaped soil box and result of the sensitivity analysis, the numerical model was validated and it was shown that the numerical simulation of atrazine dynamics in the soil was most sensitive to Freundlich adsorption parameters. Then the numerical model was used to analyze the effects of different initial water contents and different water application rates on the spatial distribution of moisture and atrazine in the soil.