

HYDRUS-1D simulation of nitrogen dynamics in rainfed sweet corn production

ABSTRACT

Nitrogen loss from agricultural fields results in contamination of ground and surface water resources due to leaching and runoff, respectively. Nitrogen transport dynamics vary significantly among agricultural fields of different climates, especially in the tropical climate. This study intended to evaluate the rainfall impact on nitrogen distribution and losses under tropical rain-fed conditions. The study was carried out in a sweet corn field for two growing seasons at the Malaysian Agricultural Research and Development Institute (MARDI) research field. The HYDRUS-1D numerical model was used to simulate nitrogen transport dynamics in this study. The observed nitrogen concentrations were used for calibration and validation of the model. Total nitrogen input to sweet corn was 120 kg/ha for both seasons. Nitrogen losses through surface runoff and leaching were dominating pathways. Surface runoff accounted for 35.3% and 22.2% of total nitrogen input during the first and second seasons, respectively. The leaching loss at 60 cm depth accounted for 4.0% (first season) and 18.5% (second season). The crop N uptake was 37.5% and 24.9% during the first and second seasons, respectively. Nitrate was the dominant form of N uptake by the crop that accounted for 83.6% (first season) and 78.5% (second season). The HYDRUS-1D simulation results of nitrogen concentrations and fluxes were found in good agreement with observed data. The overall results of simulation justified the HYDRUS-1D for improved fertilizer use in the tropical climate.

Keyword: Rain-fed conditions; Nitrogen transport; Contamination; Runoff and leaching losses; HYDRUS-ID simulation