COMPARING WATER AND NITRATE MOVEMENT IN THREE DIFFERENT CORN PRODUCTION SYSTEMS USING HYDRUS-1D

Josh Andrews, Zack Sanders, David Radcliffe, and Nicholas Hill

AFFILIATION: Department of Crop and Soil Sciences, University of Georgia, Athens, GA 30602
REFERENCE: *Proceedings of the 2017 Georgia Water Resources Conference*, held April 19-20, 2007, at the University of Georgia

A HYDRUS-1D model was used to evaluate water and nitrate movement in three different corn production systems. Corn grown in the southern Piedmont requires 200 to 250 kg ha-1 of nitrogen annually (Raun et al., 1999) and can require up to 0.87 cm (Lee et al., 2015) of water per day, making groundwater systems susceptible to nitrate pollution due to high nitrogen and water demands by the corn crop. Three different cover cropping and fertilization treatments were simulated for 2015 and 2016: annual cereal ryegrass with 150 kg ha-1 N, annual crimson clover with 100 kg ha-1 N, and a white clover living mulch with 50 kg ha-1 N. Water content was measured at 16 and 30-cm depths below the corn row using time domain reflectometers (TDRs) and soil nitrate samples were taken at 0-16 and 75-cm depts. 2015 and 2016 were considered model calibration and validation periods, respectively. A water and nitrate flux model was created for each treatment and were evaluated using root mean square error (RMSE), mean error (ME), and R-squared (R2). Water uptake and flow models (RMSE 0.049 - 0.070) show small variations in total crop uptake among treatments in the same year, but larger differences between years, supporting research conducted by Sanders et al. (unpublished). Water flux below the root zone (>1 m) varies among treatments due to differences in initial water contents at planting. NO3--N leaching models (RMSE 0.120 – 0.767) show greater leaching in 2015 than in 2016 for all treatments due to greater rainfall and irrigation. The models also show a difference in nitrate leached below the root zone due to differences in timing of N application, with the crimson clover cover crop with 100 kg ha-1 N generally leaching the greatest amount of NO3--N below the root zone.

Program reference: 1.4.29