Comparison of Nutrient Tracking Tool model output with measured tile drainage and nitrogen loss at COBS research plots

Iowa Nutrient Research Center, Iowa State University*

Methods

The NTT-RE (version 20-2) was run for research plots located at the COBS research site near Madrid, Iowa. The plots have been used to explore hypotheses examining biomass production and environmental impacts for growing corn and soybean crop rotations, continuous corn, and use of cover crops. The 11.99 acre area consist predominantly of Nicollet clay loam and Webster clay loam soils. The plots have a center tile drain at a depth of 1.2 m.

The model was set up for three distinct simulations using study site parameters from 2010 -2016. Plot treatments and simulations included: corn soybean rotation with no-till and spring split fertilizer application; continuous corn no-till with spring split fertilizer application, and continuous corn no-till with spring split fertilizer application and cover crops. Planting parameters for all treatments included a first year corn planting date of May 5th using a no-till planter 6 row with a seeding rate of 0.93 seeds/ft^2 and a second year soybean planting date of May 15th using a no-till planter 6 row with a seeding rate of 3.7 seeds/ft^2. Corn harvest was set for October 1st or 10th, while soybean harvest was set for October 1st.

Fertilizer N addition occurred with and after corn planting in spring, with 32% liquid urea-ammonium nitrate occurring as split application on May 5th at a rate of 79 lbs/acre and depth of 7.6 inches and on June 21st at a rate of either 83 lbs/acre or 97 lbs/acre. All treatments utilized no-till management. Cover crop plots had rye seed No-till Drilled on October 17th at a seeding rate of 19.6 seeds/ft^2.

The NTT simulation data for 2010 – 2016 was used for comparison to match the timing of the study conducted at the COBS research plots.

Results

Table 1. Average (±SE) observed and simulated tile drainage and N loss from 2010 to 2016. Simulations are denoted as NTT.

	Tile Drain Flow (in)		Tile Drain N Loss (lb/acre)	
	Observed	NTT	Observed	NTT
Corn/Soybean	9.0	8.4 (3.6)	14.7	12.6 (4.1)
Continuous Corn		9.2 (4.6)	11.6	13.8 (2.3)
Continuous Corn with Cover Crop		9.2 (4.6)	5.0	6.53 (0.5)

Average	9.0	8.9	10.4	10.8

*This work was completed with assistance from Dr. Ali Saleh at Tarleton State University

Average tile drain flow, tile drain nitrogen loss, and concentration were all very similar between observed conditions and the NTT-RE simulations results (table 1). It is interesting to note that both

observed and predicted tile drain nitrate-N for crop rotation with cover crop were reduced due to N uptake by cover crop and consequently lower N losses in tile drain. Over all simulations, both tile drain N loss and tile drain nitrate-N concentrations were very close to observed measurements. This similarity was more pronounced between the grand averages of all treatments. The results obtained from this comparison is also very encouraging in particularly the weather, soil, and geographical information were obtained from NTT data base. This shows the reliability of databases in NTT program.

Monitoring Site References

Helmers, M.J. 2017. Drainage water quality impacts of various in-field nutrient management practices: Comparison of biofuel systems site. Iowa State University Extension and Outreach publication.

Daigh, A.L.M., X. Zhou, M.J. Helmers, C.H. Pederson, R. Horton, M. Jarchow, and M. Liebman. 2015. Subsurface drainage nitrate and total reactive phosphorus losses in bioenergy-based prairies and corn systems. Journal of Environmental Quality, 44: 1638-1646.