Impact of 4R Management on Crop Production and Nitrate-Nitrogen Loss in Tile Drainage

RFR-A1461

Matthew Helmers, professor
Department of Agricultural
and Biosystems Engineering
John Sawyer, professor
Department of Agronomy
Josh Sievers, farm superintendent

Introduction

Corn Belt corn and soybean producers are increasingly challenged to maximize crop production while addressing the contributions farm practices make to Gulf hypoxia. Based on the need for nitrate-N reductions to meet water quality goals, new management practices are needed to reduce nitrate-N losses at minimal cost and maximum economic benefits. This three-year field research and demonstration project is evaluating various promising N management methods and technologies by documenting the nitrate-N export and crop yield from various systems.

Site Description and Treatments

Funds provided by the Iowa State University Department of Agronomy Endowment helped to instrument the site for replicated studies of drainage water quality in 2013 (Figure 1 and 2). In 2014, the site was uniformly cropped with treatments implemented for the 2015 growing season.

The site has 32 individually subsurface drained plots for subsurface drainage water quality evaluation. Drainage lines from individual plots are directed to separate sumps within culverts where drainage is diverted for sampling. Each treatment was replicated four times. Treatments consist of corn-soybean rotation with each phase of the rotation present each year.

Samples are quantified for nitrate-N loss. Additionally, the project will document crop yield for each treatment. Grain samples will be evaluated to determine N export and assess N use efficiency.

Results and Discussion

Because the project is just getting under way, 2014 was used to establish the cropping rotation and treatments for implementation in the 2015 growing season (Table 1). Therefore, the 2015 growing season will provide the first opportunity for collection and analysis.

Acknowledgements

Funds to conduct the research are being provided by the 4R Research Fund.

Table 1. Treatments at the Northwest Iowa Tile Drain Water Quality study site.

Treatment number	Tillage	Nitrogen application time	Nitrogen application rate (lb N/acre)*
1	Conventional tillage**	Fall (anhydrous ammonia with nitrapyrin)	135
2	Conventional tillage	Spring (anhydrous ammonia)	135
3	Conventional tillage	Split with variable N at sidedress (40 lb/acre of UAN at planting plus in-season adjusted rate no later than mid-vegetative growth stage)	Yearly variable based on in-season adjusted rate
4	Conventional tillage	None	0

*****For corn plots only. The 135 lb N/acre rate is based on the Corn Nitrogen Rate Calculator output for corn following soybean in Iowa at a 0.10 price ratio (http://extension.agron.iastate.edu/soilfertility/nrate.aspx).
**Fall chisel corn stalks with spring disk/field cultivate, and spring disk/field cultivate soybean stubble.

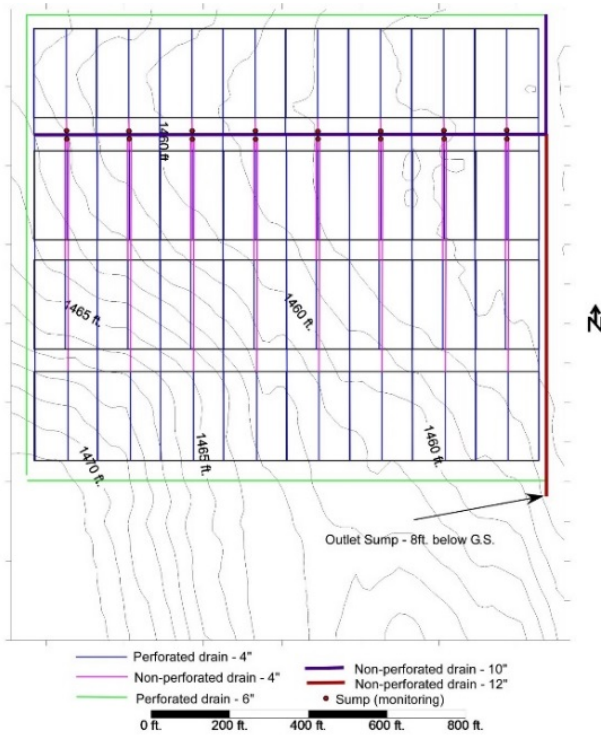

Figure 1. Drainage system layout.

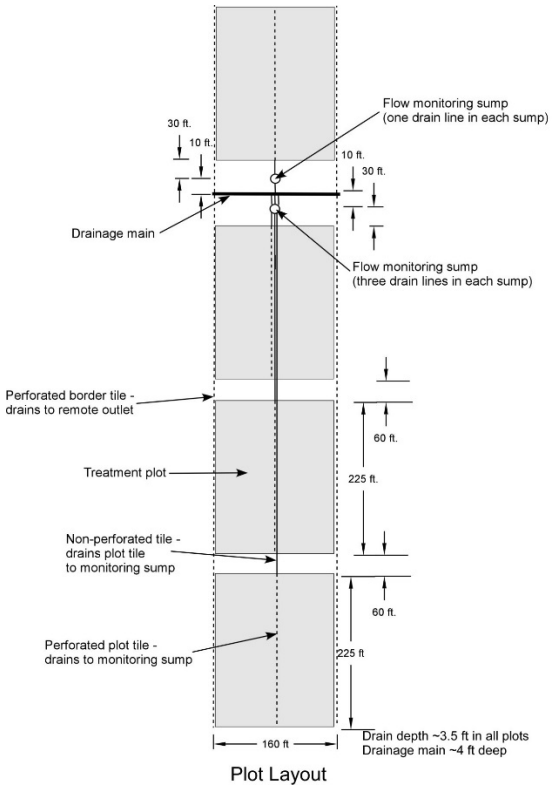

Figure 2. Plot layout of one set of four plots.