Impact of 4R Management on Crop Production on Tile Drainage Plots

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Corn belt corn and soybean producers increasingly are challenged to maximize crop production while addressing the contributions farm practices make to Gulf hypoxia. Based on the need for nitrate-N reductions in surface water systems to meet water quality goals, new management practices are needed to reduce nitrate-N losses at minimal cost and maximum economic benefits. This 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. Due to the dry conditions in 2021 and 2022 there were few water samples.

Site Description and Treatments

The project objectives are being implemented at a drainage facility in northwest Iowa, near Sutherland. The site had tile drainage installed in 2013. In 2014, the study site was uniformly cropped, with treatments implemented for the 2015 growing season. The site has 32 individual subsurface drained plots for drainage water quality evaluation. Drainage lines from individual plots are directed to separate collection sumps where drainage is diverted for water sampling.

Each treatment is replicated four times. Treatments consist of corn-soybean rotation with each phase of the rotation present each year. New treatments were implemented in 2021 (Table 1). These new treatments allow for evaluating timing and rate on crop yield and nitrate-N loss. For Treatment 3 a target of 80 lbs.N/acre was planned preplant but 110 lbs.N/acre was actually applied in 2021 and 80 lbs.-N/acre was applied in 2022. In-season N application was planned for this treatment if model predictions indicated a need. In 2021, due to dry conditions, no additional N was applied, while in 2022 an additional 30 lbs.-N/acre was applied. As a result, total N application for Treatment 3 was 110 lbs.N/acre in both years.

Table 1. Current treatments at the northwest Iowa tile drain water quality study site, 2021-2022.

Treatment Number	Tillage	Nitrogen Application Time	Total Nitrogen Application Rate (lb. N/acre)*
1	Conventional tillage**	Spring (Anhydrous Ammonia)	200
2	Conventional tillage	Spring (Anhydrous Ammonia)	MRTN (140)
3	Conventional tillage	Split with variable N at sidedress (80-110 lb./acre of N as Anhydrous preplant plus in-season agrotrain treated urea)	Based on model
4	Conventional tillage	None	0

*For corn plots only. The 140 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). (MRTN as of 4/6/2021)
**Fall chisel corn stalks with spring disk/field cultivate, and spring disk/field cultivate soybean stubble.

Results and Discussion

Crop yield information from 2021 and 2022 is summarized in Table 2. There was greater than a 60-bushel yield increase in 2021, and 50-bushel yield increase in 2022 with the use of N fertilizer. While there were absolute corn yield benefits of additional N application, there was not a statistically significant difference in Treatments 1-3. This will continue to be analyzed in future years and the economics of the additional N application will be assessed.

The project also is evaluating nitrate-N loss with drainage and this information will be summarized in subsequent progress reports.

Table 2. Crop yields (bushel/acre), 2021 and 2022.

Treatment	Corn*		Soybeans	
	2021	2022	2021	2022
1	211a	168a	64a	62a
2	202a	168a	73a	58a
3	197a	166a	67a	51a
4	133b	113b	67a	61a

*Means with the same letter in the same crop are not significantly different, P=0.05.

Acknowledgements

Funds for establishing the drainage facility were provided by the Iowa State University Department of Agronomy Endowment. This work would not be possible without the support and dedication of the Northwest Research and Demonstration Farm staff.