PROGRESS REPORT

PROJECT TITLE: Irrigation management impacts on corn yield and nitrate leaching
PROJECT NUMBER: UMN code: 00092737
REPORTING PERIOD: Oct-Dec 2021
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1.) PROJECT ACTIVITIES COMPLETED DURING THE REPORTING PERIOD. (*Describe project progress specific to goals, objectives, and deliverables identified in the project workplan.*)

This project aims at evaluating the impact of different irrigation water management strategies including (1) in-field soil moisture monitoring using soil moisture sensors (T1), (2) University of Minnesota checkbook method (T2), (3) Irrigation management assistant tool-IMA (T3), and (4) crop growth model (EPIC) (T4) on corn yield and nitrate leaching. The other objective is to calculate the threshold trigger point for irrigation (comparing depletion in available soil water with soil matric potential) using Electric Resistance Sensors (watermark sensors) in coarse-textured soils.

The main goal of this quarter was to harvest the plots, remove the soil moisture sensors and lysimeters from the plots, collect plant, soil and grain samples, and send the samples to lab for analysis. We have accomplished all the above mentioned goals.

2.) IDENTIFY ANY SIGNIFICANT FINDINGS AND RESULTS OF THE PROJECT TO DATE.

The corn grain yield and irrigation amounts under each irrigation scheduling method for 2021 growing season are presented in figure 1.

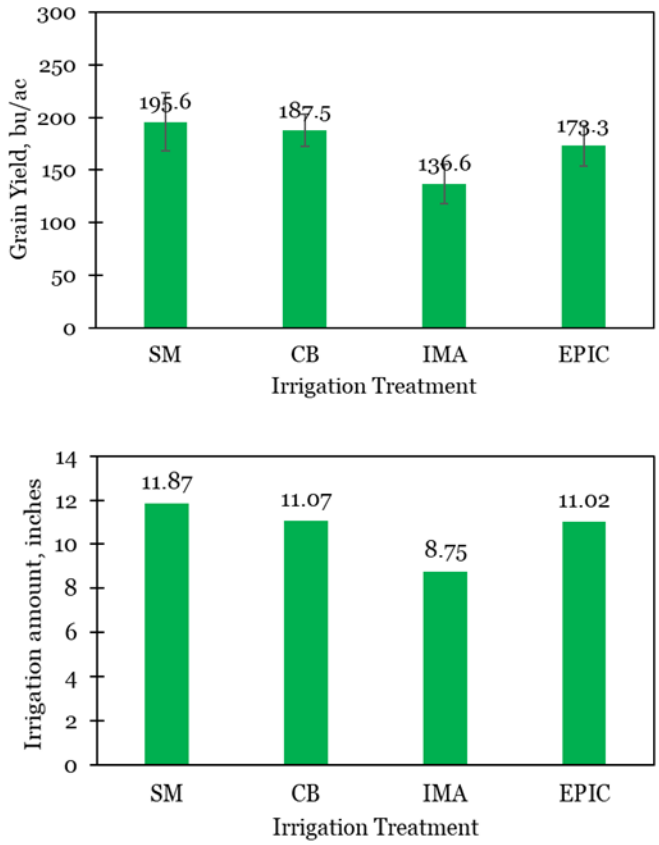

Figure 1. Grain yield and irrigation amounts under soil moisture monitoring (SM), Checkbook method (CB), Irrigation management assistant tool and EPIC crop growth model treatment.

The 2021 results suggest that it is possible to reduce the amount of irrigation water applied and amount of water lost to deep percolation by altering the irrigation scheduling method without significantly impacting corn yield. The soil moisture monitoring method in this study acts as a control as we applied irrigation in this method based on in-situ soil moisture measurements. Thus, all other methods are being compared by the soil moisture monitoring method.

The online ET based irrigation management assistant (IMA) tool recommended the lowest amount of irrigation as compared to other methods, however, unlike past two years, this year the corn yield was significantly lower under IMA as compared to other methods. The checkbook method on the other side recommended almost same amount of irrigation as in soil moisture monitoring method and produced not significantly different grain yield, thus indicting that checkbook method was efficient in recommending the irrigation amounts. However, the efficacy of any irrigation scheduling method will also be dependent on the nitrate leaching, nitrogen uptake and evapotranspiration under that irrigation treatment whose results will be presented in the final report.

In first two years of the study no significant difference was observed in measured N uptake between irrigation treatments. This might suggest that ETc was not limited by water application and all irrigation treatments recommended enough irrigation to maintain the ETc required for crop production.

Irrigation scheduling methods were observed to significantly impact NO_3-N leaching in the first two years of the study. The CB method and IMA method of irrigation scheduling resulted in significantly highest and lowest cumulative nitrate leaching respectively on average for two years (2019 and 2020) of the study. This is because CB method had significantly higher water losses and IMA method had lowest irrigation recommendations. Although both SM and CB method resulted in higher irrigation amounts, due to differences in timing of irrigation maximum nitrate loss was observed in the CB method. Precipitation was also observed as a major factor influencing nitrate leaching, the precipitation decreased from 632 mm in 2019 to 402 mm in 2020 which resulted in an 83% overall reduction in the total nitrate leaching.

3.) CHALLENGES ENCOUNTERED. (*Describe any challenges that you encountered related to project progress specific to goals, objectives, and deliverables identified in the project workplan.*)

- none

4.) FINANCIAL INFORMATION (*Describe any budget challenges and provide specific reasons for deviations from the projected project spending.*)

- No challenge was encountered.

5.) EDUCATION AND OUTREACH ACTIVITES. *(Describe any conferences, workshops, field days, etc attended, number of contacts at each event, and/or publications developed to disseminate project results.)*

- Presented research overview at Sherburne lunch and learn event. November 30th, 2021.
- Presented research overview at University of Minnesota CPM short course. December 9th, 2021.
- Presented research overview at the 2022 Ag EXPO. January 19th, 2022.