PROGRESS REPORT

PROJECT TITLE: Are increasing Maximum Return-to-Nitrogen values related to nitrogen source?
PROJECT NUMBER: Award CON000000111813; Project 00115483
REPORTING PERIOD: January-March 2025
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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.*)

The objectives of this study are to 1) evaluate whether the increase in MRTN is related to the increase use of urea over anhydrous ammonia for spring applications, and 2) explore alternatives to fall applications using polymer coated urea and subsurface banding. An additional natural outcome from this project is the generation of additional response curve data that can be added to the MRTN calculator database to make it more robust and to maintain it updated with new growing season data.

During this quarter samples were process and begun the process of chemical analysis. We also calculated yield responses to N rate and source.

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

To date, we are actively processing samples and analyzing the data collected during the growing season. I am only showing grain yield data analysis at this point.

Figure 1 shows the yield obtained with a suboptimal N rate of 90 lb N/ac. This rate was used to calculate differences due to N source and time of application at a highly responsive region (quadratic portion) of a full N rate response curve for corn yield. Thus, allowing us to have high sensitivity to detect yield differences due to treatment. All N sources applied in the fall have the same source applied in the spring except for a treatment of ESN that was broadcast and left on the soil surface only in the fall. This treatment was not used in comparing the mean yield across N sources for fall vs. spring. Another source that was not exactly the same, but it is still valid to compare is anhydrous ammonia with N serve in the fall vs. anhydrous ammonia without the nitrification inhibitor Nserve in the spring. While it is not exactly the same, this would represent a typical practice by farmers applying N in the fall or the spring (i.e. it is not likely that farmers applying anhydrous ammonia in the spring would do so with Nserve).

In Waseca, regardless of N source, the spring application outperformed the fall application by 9 to 24 bu/ac with a mean of 16 bu/ac greater yield with a spring application compared with a fall application. Similarly, in Lamberton the mean was 10 bu/ac greater in spring than fall. Though only urea/BI and ESN/BI had substantially lower yields in the fall than the spring. Anhydrous ammonia and the SSB treatments performed similarly to the spring applications. These results are consistent with previous recent studies evaluating N sources and placement methods for spring and fall.

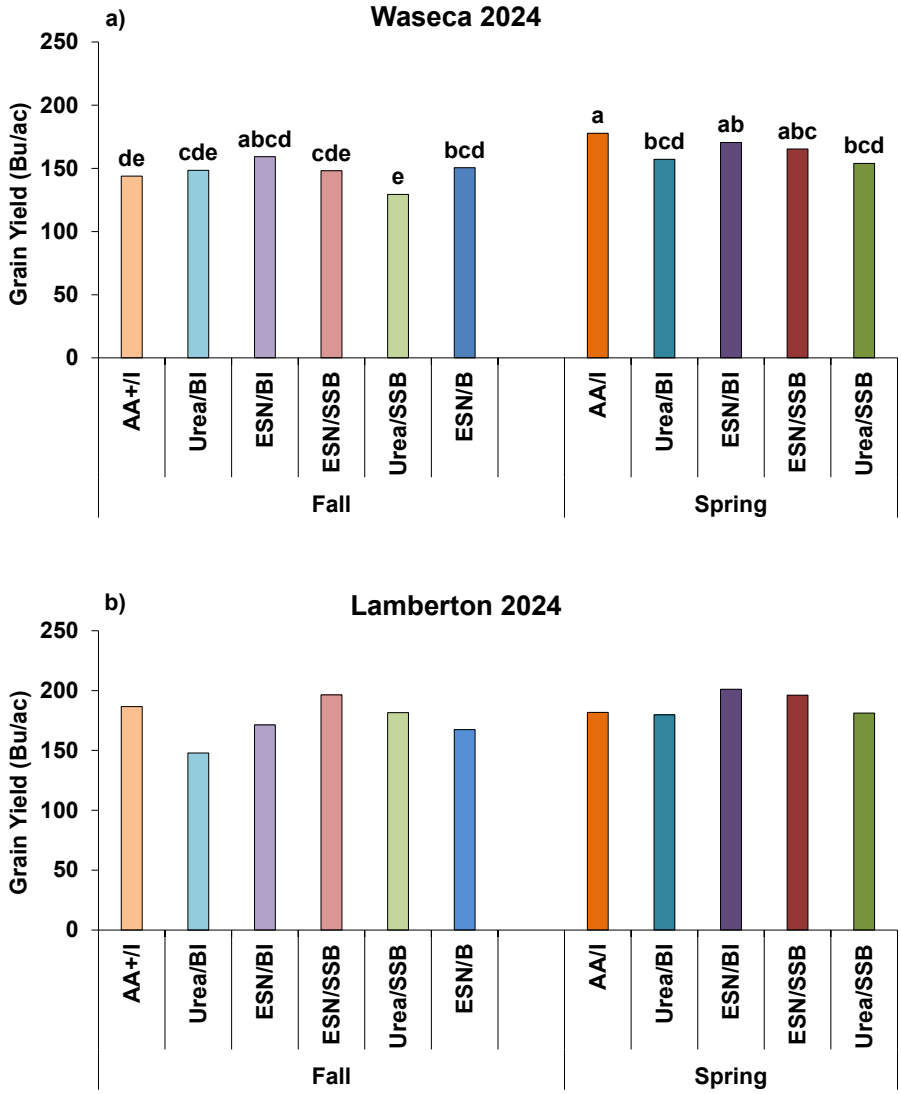

Figure 1. Corn grain yield response to N source and Ntiming applied at single N rate (90 lb N/ac) for corn-soybean (CSb) cropping system at Waseca (a), and Lamberton (b) for the 2024 growing season for injected anhydrous ammonia (AA) with (+) or without Nserve, urea and ESN as broadcast and incorporated with tillage (BI), sub-surface band 6" below the soil surface (SSB), or ESN broadcast in the fall and left on the surface (ESN/B).

Figure 2 and Table 1 shows the economic optimum N rate EONR calculated at a nitrogen price to corn price ration of 0.1, the yield at the EONR and the shape of the response for grain yield to nitrogen for spring applications of urea and anhydrous ammonia. In both locations anhydrous ammonia showed a slight benefit to urea. We suspect that the difference was not larger because of the substantial amount of rain we had in June and July. These rains likely resulted in N loss from both urea and anhydrous ammonia because by then, both sources would have nitrified. In more typical conditions, where N loss tends to occur earlier in the season, urea is generally more susceptible to loss than anhydrous ammonia because urea nitrifies faster than anhydrous ammonia.

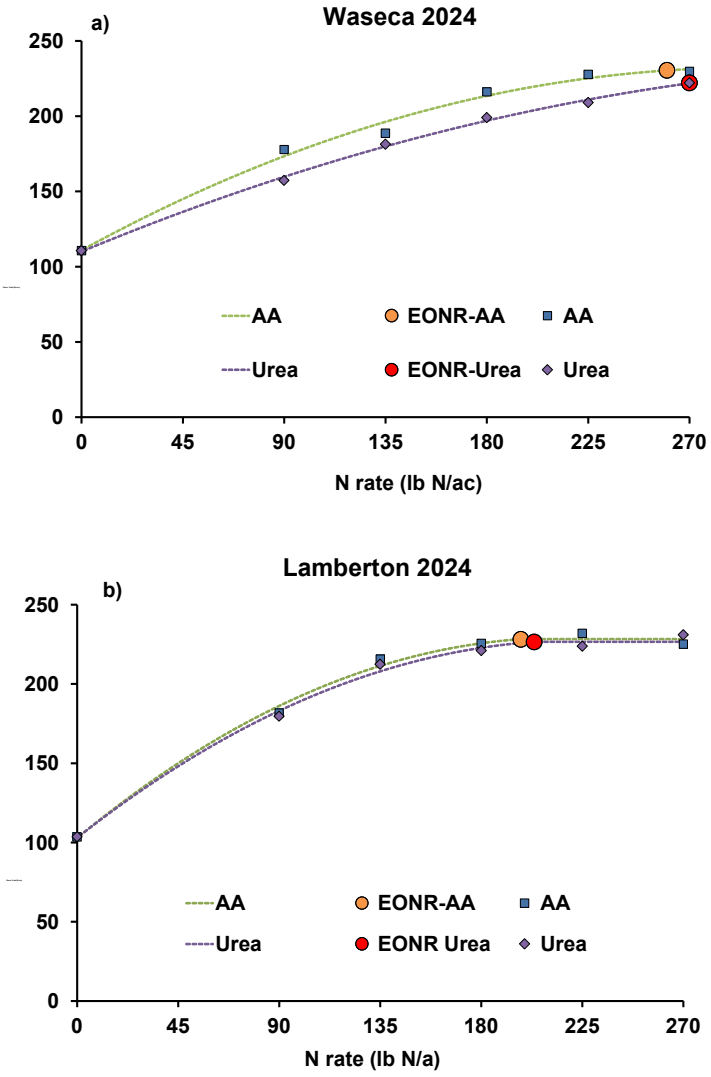

Figure 2. Corn grain yield response to N application and calculation of the economic optimum N rate (EONR) and yield at the EONR with a 0.1 N to corn price ratio for corn-soybean (CSb) cropping system at Waseca (a), and Lamberton (b) for the 2024 growing season.

Table 1. Economic optimal N rate (EONR) and the corn yield at EONR for continuous corn (CC) at Lamberton and Waseca for the 2024 growing season.

	Waseca CSb		Lamberton CSb	
N Treatments	**EONR** lb N/ac	**Yield$_{EONR}$** bu/ac	**EONR** lb N/ac	**Yield$_{EONR}$** bu/ac
AA	260	230 (Q)	198	228 (QP)
Urea	270	222 (Q)	204	227 (QP)

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

We had several slow-downs in getting samples processed and analyzed chemically.

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

None to report

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.)*

I talked about some of the preliminary results of this study at 3 extension events during this quarter.