Effects of Nitrogen Application Timing on Corn Production and Soil Quality (Project

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Study Design

This research was designed to evaluate in-season corn development, grain yield, nutrient use efficiency, and soil microbial activity using different N management systems at 3 locations (Lamberton, Waseca, and Becker, MN). At each location, the treatments were:

- 2 treatments with fall application of N at 100 and 125% of the University of Minnesota (U of M) recommended N rate
- 2 treatments with spring pre-plant application of N at 100 and 125% of the recommended rate
- 2 treatments with a 2-way split application with N applied at 75 and 100% of the U of M recommended rate, with the first application at planting and the second sidedressed at the V6 corn stage
- 3 treatments with a 3-way split application with N applied at 50 and 75% of the U of M recommended rate, with the first application at planting, the second at the V6 corn stage, and the third at the silking corn stage
- A control with no N applied

2016 Results

At Becker, all fertilization strategies showed to increase corn grain yield compared with the control plots. However, the fall application had much lower yields than any spring or spring/split applications. Average corn grain yield for the fall applications was 144 bu/ac; spring application averaged 215 bu/ac; spring/split applications averaged 219 bu/ac; and the control averaged 78 bu/ac. Corn grain yield increased as the number of split application increased. Spring application of the recommended rate had yield of 201 bu/ac while grain yield with the two-way split was 233, and with the three-way split was 250 bu/ac. These results show that splitting N application more than two times is the most effective way to apply N in irrigated sandy soils in MN

At Lamberton, all fertilization strategies showed to increase corn grain yield compared with the control plots. Average corn grain yield for the fall applications was 234 bu/ac; spring application averaged 234 bu/ac; spring/split applications averaged 219 bu/ac; and the control averaged 100 bu/ac. At Lamberton, it was found that the recommended rates were not the highest yield, suggesting that in 2016 higher N was needed for optimum yields than the recommendations. However, when the same rates were compared, the recommended rate treatments, the two and three-way split application also had higher grain yields than the fall application. The yields were 231 bu/ac, 237 bu/ac, and 235 bu/ac for the spring, spring two-way aplit and spring three-way split, respectively the fall N application was 222 bu/ac. Reducing N rates by 75% of recommended rates lead to a decrease in yield, however, applying 75% of the recommended rates (219 bu/ac) led to yields similar to those observed with the fall recommended rate (222 bu/ac).

At Waseca, all fertilization strategies showed to increase corn grain yield compared with the control plots. Average corn grain yield for the fall applications was 186 bu/ac; spring application averaged 214 bu/ac; spring/split applications averaged 200 bu/ac; and the control averaged 97 bu/ac. At Waseca, it was found that the recommended rates were as good as the 125% of the recommended rates. Grain yields for the equivalent N application rates were 213 bu/ac, 208 bu/ac, and 212 bu/ac for the spring, spring two-way aplit and spring three-way split, respectively the fall N application was 180 bu/ac. Reducing N rates by 75% of recommended rates lead to a decrease in yield, however, applying 75% of the recommended rates (204 bu/ac) led to yields greater than those observed with the fall recommended rate or 125% of the recommended rate (180 and 193 bu/ac).

In summary, in 2016 splitting N application at all locations had the greatest yields when equivalent N rates were compared. At Becker and Waseca, the split application led to best yields observed even when compared with the Fall application and spring application. At Lamberton, similar yields were observed for the spring application regardless of split of full application at once.