# Corn Yield Response to the Use of a Nitrification Inhibitor with Anhydrous Ammonia

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## Summary
Nitrification inhibitors are used to delay the nitrification process, reducing nitrogen (N) loss. The increase of nitrogen fertilization efficiency could promote greater corn grain yields and reduce environmental losses. The objective of this study was to evaluate corn response to the use of a nitrification inhibitor in corn grain. The study was carried out at four locations (Manhattan, Scandia, Rossville, and Ashland, KS) during 2017 and 2018 crop seasons. There was corn response to N fertilization, but no differences in corn yield were observed when anhydrous ammonia was treated with nitrification inhibitor at these site-years.

## Introduction
Nitrogen is an essential element for plant growth and reproduction. After it is applied as fertilizer on soil, N changes its chemical form, continually being subjected to critical processes of loss. Nitrification is an important step in the N cycle in soil promoted by the biological oxidation of ammonium to nitrite and nitrate. Conversion of this ammonium ($NH_4^+$-N) to nitrate ($NO_3^-$-N) increases nitrogen leaching due to the mobility of $NO_3^-$-N, and can be lost from the plant rooting zone (Wiederholt and Johnson, 2005). Nitrification proceeds rapidly in warm, moist, well-aerated soils.

Nitrification inhibitors are chemicals that slow down or delay the nitrification process, thereby decreasing the probability that large losses of nitrate will occur before the fertilizer nitrogen is taken up by plants (Nelson and Huber, 2001). The objective of this study was to evaluate the response from the use of a nitrification inhibitor on corn grain yield.

## Procedures
The study was carried out at four locations (Manhattan, Scandia, Rossville, and Ashland, KS) during 2017 and 2018 crop seasons. Treatments were: 1) N fertilizer without nitrification inhibitor (control), and 2) N fertilizer treated with nitrification inhibitor. Anhydrous ammonia was applied in four rates 0, 100, 150, and 200 lb/a. The experimental design was in randomized complete blocks with 4 repetitions. Experimental plots were 10-ft wide × 60-ft long. Chlorophyll meter measurements (SPAD) were taken at the V2, V4, V8, V12, and R1 corn growth stages. Soil samples were taken at the

same growth stages at the soil depth of 0–24 inches and submitted on the same day to the K-State Research and Extension Soil Testing Laboratory for $NO_3^-$-N and $NH_4^+$-N analysis. The two central rows of each plot were machine harvested. Grain weight was recorded and adjusted for 15.5 % moisture.

# Results

## *SPAD Measurements and the Relationship with $NO_3$-N and $NH_4$-N in the Soil*

The SPAD measurements have high correlation with N content in the tissue (Ma et al., 1994). During the corn season there was a gradual increase in the SPAD values with a posterior decrease at the R1 growth stage. Similarly, soil $NO_3$-N showed an increase during corn growing season in most sites, suggesting important contribution of this N form for corn N nutrition (Figure 1). Therefore, SPAD measurements showed higher correlation with soil $NO_3$-N than soil $NH_4$-N.

## *Corn Yield Response to N Fertilization and Nitrification Inhibitors*

Nitrogen fertilizer application increased corn yield (N fertilizer vs. the check); however, corn response among N rates was not statically significant in this study (Figure 2). The optimum N rate across all locations was at 117 lb N/a (Figure 2). Furthermore, no differences in corn yield were observed when anhydrous ammonia was treated with a nitrification inhibitor at the locations for this study (Figure 3). It is likely that N loss potential was low for these locations/years, resulting in no yield difference with the use of nitrification inhibitors.

# References

Ma, B.L., M.J. Morrison, and H.D. Voldeng. 1994. Leaf Greenness and Photosynthetic Rates in Soybean. Crop Science Society of America 35:1411–1414.

Nelson, D.W. and D. Huber. 2001. Nitrification inhibitors for corn production. National Corn Handbook. Iowa State University Extension, NCH55.

Wiederholt, R. and B. Johnson. 2005. Nitrogen behavior in the environment. North Dakota State University Extension Service, Fargo, ND 58103.

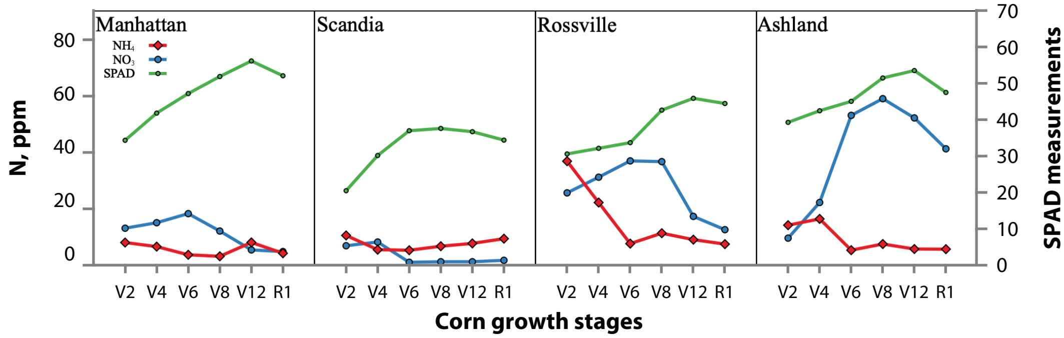


**Figure 1. Chlorophyll meter measurements (SPAD), soil nitrate ($NO_3$-N), and ammonium ($NH_4$-N) during corn growing season in Manhattan, Ashland, Rossville, and Scandia, KS.**

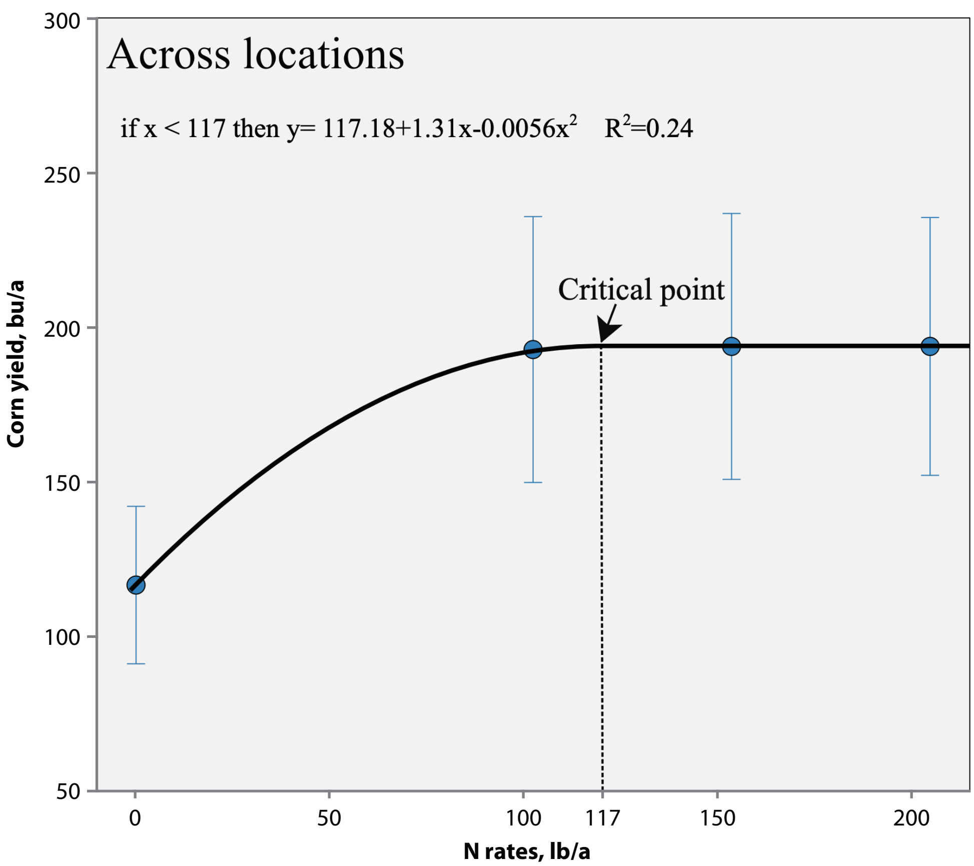


**Figure 2. Corn grain yield across locations affected by nitrogen (N) rates (lb/a). The maximum value for corn yield was 194 bu/a at the rate of 117 lb N/a.**

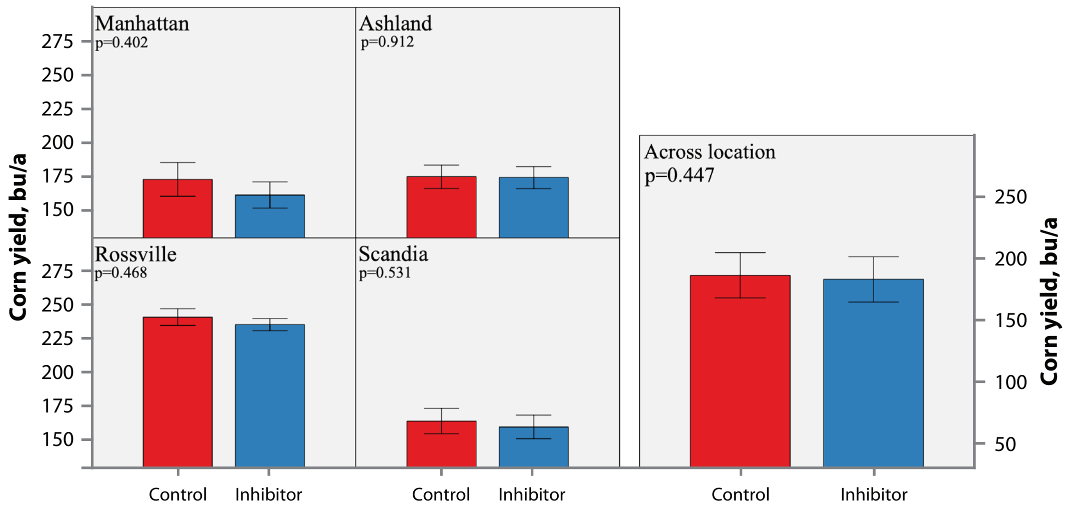


**Figure 3. Corn grain yield in Manhattan, Ashland, Rossville, Scandia, KS, and across locations as affected by the use of nitrification inhibitor at the nitrogen (N) application rate of 150 lb N/a .**