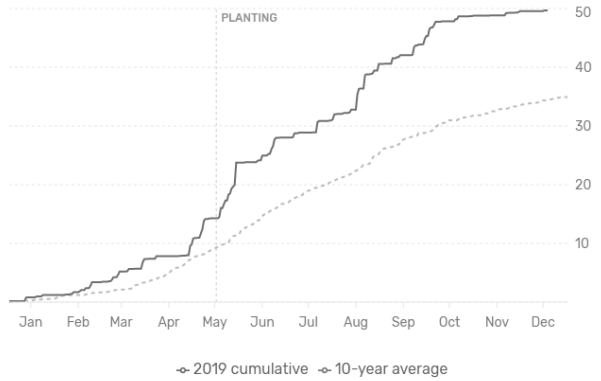
Determining Optimum Nitrogen Rate on Corn

Study ID: 0416147201904
County: Richardson
Soil Type: Marshall silty clay loam 2-5% slopes; Marshall silty clay loam 5-12% slopes, eroded
Planting Date: 5/16/19
Harvest Date: 11/4/19
Seeding Rate: 33,000
Row Spacing (in): 30
Variety: Hoegemeyer® 8529 AM™
Reps: 5
Previous Crop: Soybean
Tillage: No-Till
Herbicides: ***Pre:*** 28 oz/ac WeedMaster®, and 29 oz/ac glyphosate on 4/16/19 ***Post:*** 2.25 qt/ac Keystone® NXT, 5.3 oz/ac Callisto®, and 32 oz/ac glyphosate on 6/1/19
Seed Treatment: Poncho® 1250 + VOTiVO® and Raxil®
Foliar Insecticides: None
Foliar Fungicides: 10 oz/ac Headline AMP® on 7/29/19
Fertilizer: 114 lb/ac 0-0-60, 22 lb/ac gypsum, and variable rate 11-52-0 (155 to 255 lb/ac in research blocks) on 4/15/19; 1.0 gal/ac CoRoN® on 7/29/19
Irrigation: None
Rainfall (in):



Introduction: The objective of this study was to utilize precision ag technology to conduct on-farm research on nitrogen rates on a field with contour farming and terraces. A variable rate nitrogen prescription was developed to apply five blocks of five nitrogen rates on the go as anhydrous ammonia was being applied (Figure 1). Plots were approximately 300' long by 30' or 60' wide and matched the direction of planting, fertilizing, and harvesting. The field received anhydrous ammonia on April 10, 2019 at 7" depth with strip-till following a previous crop of soybeans. As-applied fertilizing maps were used to evaluate the accuracy of fertilizer application. The field also received a variable rate application of 11-52-0 on April 15, 2019, with N contribution in the research blocks ranging from 17 lb N/ac to 28 lb N/ac; therefore, values in the results table and graph reflect the total N applications of 113 lb N/ac, 143 lb N/ac, 174 lb N/ac, 202 lb N/ac, and 234 lb N/ac. Corn was planted on May 16. The field experienced erosion and silting from heavy rains in May. Corn stands were evaluated with aerial imagery and areas with N plots were only minimally impacted.

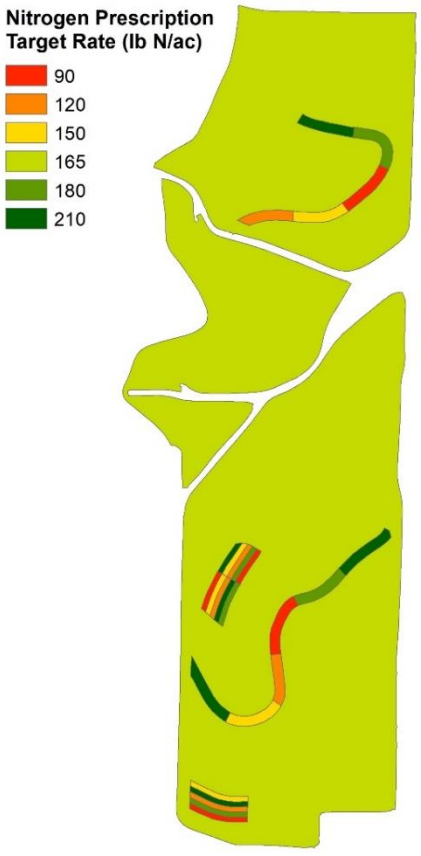


Figure 1. Nitrogen prescription map (lb N/ac)

Throughout the growing season multispectral imagery was collected using a DJI™ Inspire 2 drone equipped with a MicaSense® RedEdge™ 5-band sensor. Imagery was obtained on June 29, July 20, July 28, and August 4. The normalized difference red edge (NDRE) index was calculated for each flight date. The objective of collecting drone imagery was to: 1) evaluate the potential of using imagery of varying nitrogen rate blocks applied with variable rate technology to direct in-season N management, 2) determine how low the lowest N rate needs to be to detect differences soon enough to make a timely in-season application, and 3) relate NDRE values for varying nitrogen rates to crop yield at the end of the season.

Yield monitor data were collected at the end of the growing season and post-processed to remove errors with Yield Editor software from the USDA. Additionally, yield data points that correspond to areas where the fertilizer application rate was more than 15% above or below the target rate were eliminated.

Results:

Anhydrous Ammonia Prescription Rate (lb N/ac)	Total N Rate (lb N/ac)	Moisture (%)	Yield (bu/ac)†	lb N/bu grain	Marginal Net Return‡ ($/ac)
90	113	17.6 B	217 C	0.52 E	798.56 B
120	143	17.8 AB	231 B	0.62 D	844.56 A
150	174	17.5 B	233 AB	0.75 C	843.48 A
180	202	17.9 A	241 A	0.84 B	867.44 A
210	234	18.0 A	240 A	0.97 A	855.18 A
P-Value	-	0.002	<0.0001	<0.0001	0.001

*Values with the same letter are not significantly different at a 90% confidence level.
†Yield values are from cleaned yield monitor data. Bushels per acre adjusted to 15.5% moisture.
‡Marginal net return based on $3.83/bu corn and $0.28/lb N ($452/ton anhydrous).

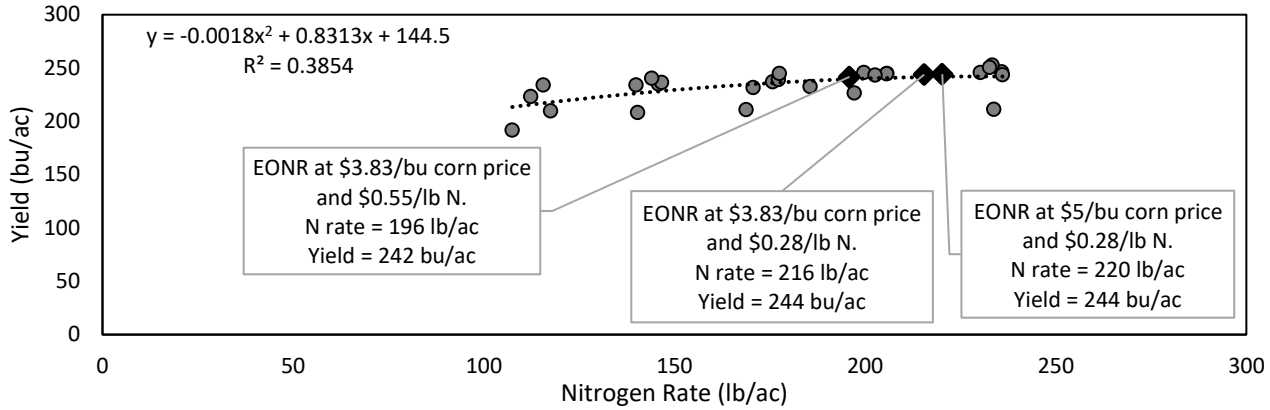


Figure 2. Yield versus nitrogen rate with economic optimum nitrogen rates (EONR) indicated at three price points.

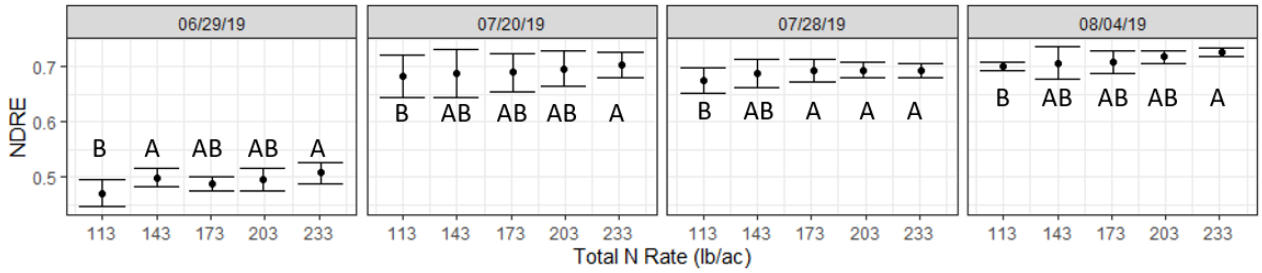


Figure 3. Normalized difference red edge (NDRE) index values for five nitrogen rates across four imagery dates with standard deviation indicated with bars. Significance letters apply within date; data points with the same letter are not significantly different at a 90% confidence level.

Summary:

- At this year's corn price of $3.83/bu and N price of $0.28/lb N, the economic optimum N rate was 216 lb/ac and yielded 244 bu/ac (Figure 2).
- Analysis of NDRE imagery showed the 113 lb N/ac treatment had lower NDRE values than higher N rates on several dates and as early as June 29, indicating this imagery could be used to guide in-season N applications. Lower NDRE values for the 113 lb N/ac rate were reflected in significantly lower yields.

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