Management Practices for Optimizing Yield and Productivity in Corn

Trial Objective

- Optimizing farm productivity requires the efficient and sustainable use of farm inputs and management practices, such as the choice of corn product, seeding rate, soil fertility, seed treatment, and pest management, that ultimately determine profitability.
- This study was conducted to evaluate the economic impact of different management inputs and practices on corn yield and profitability.

Research Site Details

Location	Soil Type	Previous Crop	Tillage Type	Planting Date	Harvest Date	Potential Yield (bu/acre)	Seeding Rate (seeds/acre)
Huxley, IA	Clay loam	Soybean	Strip tillage	04/30/2018	09/28/2018	225	33K, 38K

- Two corn products were used for this trial:
  - A 110-day relative maturity SmartStax® RIB Complete® corn blend product
  - A 114-day relative maturity SmartStax® RIB Complete® corn blend product
- Each product was planted at a regional standard rate of 33,000 (33K) seeds/acre and a higher rate of 38,000 (38K) seeds/acre.
- The trial was carried out in 30-inch row spacing, six rows per treatment, with two replications.
- Management practices that were tested: choice of corn product, seeding rate, seed treatment, additional nitrogen, and fungicide application. These practices were compared in incremental stair-step treatments (Table 1).

Table 1. Treatments used in the trial with their associated costs.

Treatments	Input	110 RM Cost ($/acre)	114 RM Cost ($/acre)
33K	33,000 seeds/acre	$ -	$ -
33K+Q	QuickRoots® Dry Planter Box Corn (Q), $6.19/acre	$6.19	$6.19
33K+Q+N	Side dress 32% UAN at V5 growth stage (N)	$16.54	$16.54
33K+Q+N+F	Fungicide application at VT/R1 growth stage (F)	$48.54	$48.54
38K	Additional 5,000 seeds/acre	$25.50	$26.13
38K+Q	QuickRoots® Dry Planter Box Corn (Q), $7.19/acre	$32.63	$33.26
38K+Q+N	Side dress 32% UAN at V5 growth stage (N)	$42.98	$43.61
38K+Q+N+F	Fungicide application at VT/R1 growth stage (F)	$74.98	$75.61

Management Practices for Optimizing Yield and Productivity in Corn

- All treatments received a maximum return to nitrogen (MRTN) rate of 140 lb of nitrogen/acre in the form of 32% urea ammonium nitrate (UAN) in the spring during the strip-till operation. In the "N" treatments, an additional 45 lb/acre of UAN was side dressed at the V5 growth stage.
- All seed was treated with the Acceleron® Seed Applied Solutions ELITE offering, consisting of fungicide, insecticide, and nematicide with Enhanced Disease Control (EDC) for the control of early- to mid-season diseases caused by *Fusarium, Rhizoctonia,* and *Colletotrichum*.
- In the "Q" treatments, QuickRoots® Dry Planter Box Corn, a microbial seed inoculant, was added as a dry planter box formulation for enhanced nutrient availability.
- In the "F" treatments, Delaro® 325 SC fungicide was applied at the VT/R1 growth stage.
- Mnimal levels of gray leaf spot and northern corn leaf blight were observed at the trial site.

Understanding the Results

- The early RM product produced higher yields than the late RM product in all treatments except for the 38KQNF treatment (Figures 1 and 2).
- There was a minimal yield response to QuickRoots® Dry Planter Box Corn in the early RM product, but a 4-6 bu/acre yield improvement in the late RM product at both seeding rates (Figures 1 and 2).
- In general, for the early RM product, the addition of inputs did not substantially improve yields at the higher seeding rate. At the standard seeding rate, additional nitrogen produced the highest yield response (Figure 1).
- For the late RM product, yield increased incrementally with the addition of inputs at the higher seeding rate. At the standard seeding rate, QuickRoots® Dry Planter Box Corn and additional nitrogen improved yields but not fungicide (Figure 2).

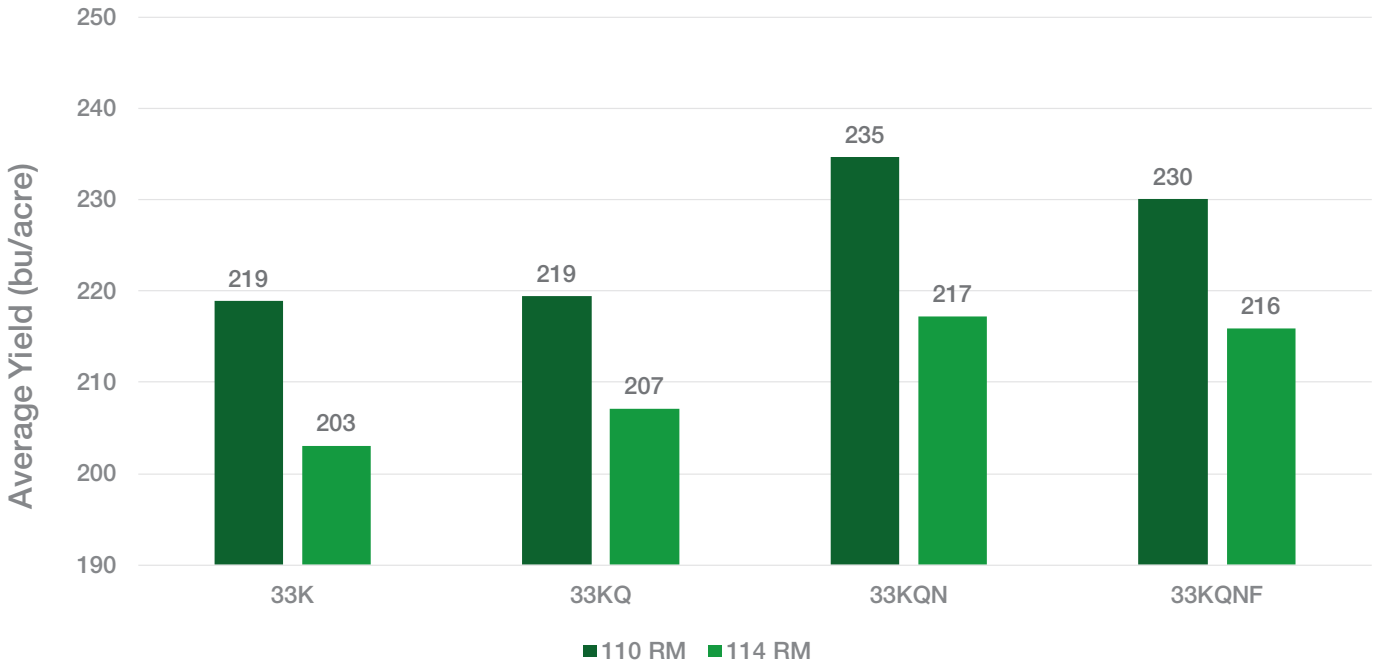

Figure 1. Yield response of two corn products to production inputs at the standard seeding rate.

Management Practices for Optimizing Yield and Productivity in Corn

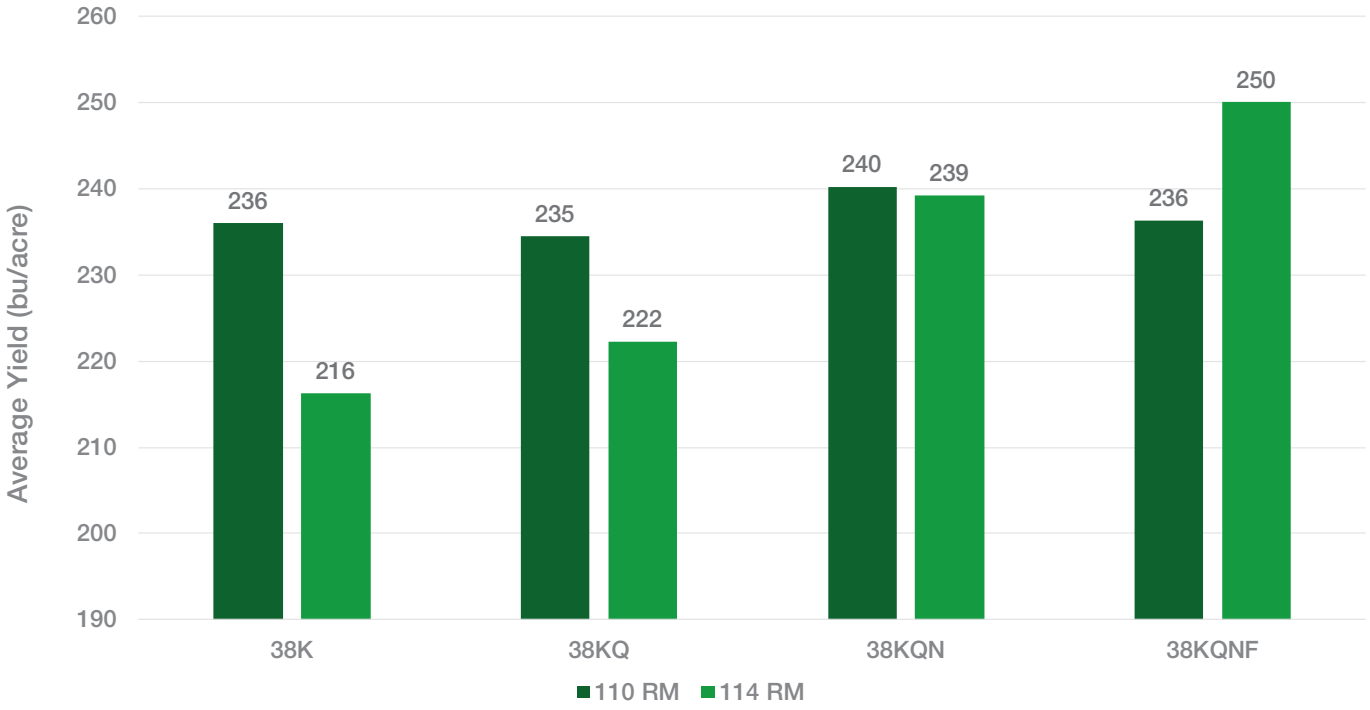

Figure 2. Yield response of two corn products to production inputs at the higher seeding rate.

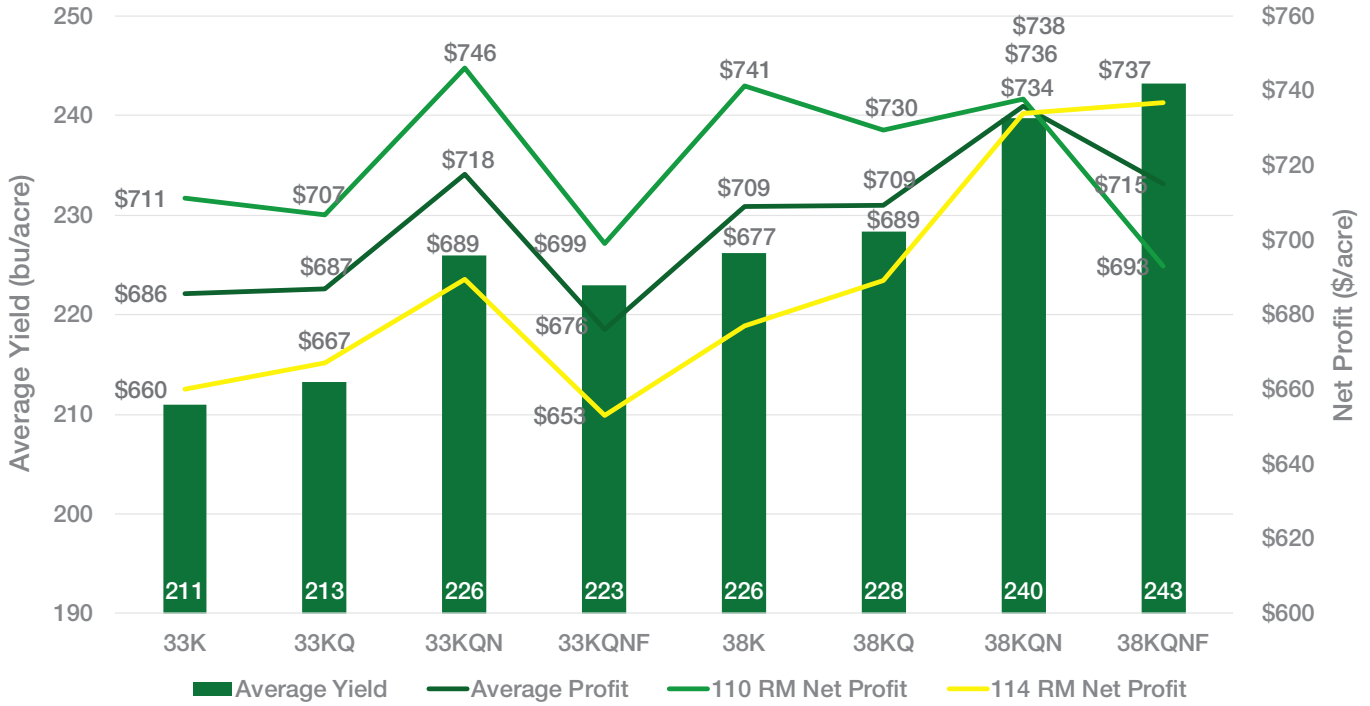

Figure 3. Average yield and economic impact of corn products in response to production inputs. Corn price was set at $3.25/bu.

Management Practices for Optimizing Yield and Productivity in Corn

- In both corn products, the higher seeding rate out-yielded the standard rate across all treatments (Figure 1 and 2).
- In terms of economic value, the early RM product was more profitable than the late RM product at all treatment levels, except when fungicide was applied at the higher seeding rate (38KQNF) (Figure 3).
- The most profitable treatment in this trial was the early RM product planted at the standard rate with QuickRoots® Dry Planter Box Corn and additional nitrogen (33KQN) (Figure 3).
- At each treatment level, the yield difference between the two seeding rates was substantial enough for the higher rate to be more profitable than the standard rate. This is true for both corn products (Figure 3).
- For the late RM product, the treatment with the most inputs (38KQNF) produced the highest yield and the highest profit (Figure 3).
- Profit per acre was calculated by multiplying total yield of the treatment by $3.50 minus the inputs selected for each treatment.

What Does This Mean for Your Farm?

- Corn products respond differently to farm inputs. Environmental factors during the growing season highly affect the yield response to inputs.
- Inputs like nitrogen will continue to provide positive yield responses and economic gains if it is used within the MRTN range for the region.
- Yield response to fungicides can be highly variable and depends on the growing season. It's unclear why there wasn't a consistent yield response to fungicide in this trial as there were minimal levels of gray leaf spot and northern corn leaf blight at the trial site.
- Where feasible, growers are encouraged to plant more than one corn product. This provides a good risk management strategy for their operation. They should also have a discussion with their trusted agronomists on how well a corn product of interest performs under different growing conditions and management practices.

Legal Statements

Yield Response of Corn Products to Seeding Rate

Trial Objective

- Research has indicated that corn yield has a positive correlation with seeding rate until a threshold is reached, beyond which yield decreases. Defining the seeding rate threshold for each corn product is difficult as it's highly affected by management practices and the environmental conditions during the growing season.
- However, knowing the threshold is very critical, as it forms the basis upon which other management practices, such as nitrogen rate, are based.
- The objective of this study was to determine the yield response of corn products to different seeding rates.

Research Site Details

Location	Soil Type	Previous Crop	Tillage Type	Planting Date	Harvest Date	Potential Yield (bu/acre)	Seeding Rate (seeds/acre)
Huxley, IA	Clay loam	Soybean	Strip tillage	04/30/2018	10/04/2018	240	32K, 36K, 40K

- Each corn product was planted at 32,000, 36,000, and 40,000 seeds/acre.
- The trial was carried out in 30-inch row spacing, 3 rows/seeding rate, and 200-ft long strips.
- An application of 140 lb/acre of 32% UAN was applied in the spring as informed by the Climate FieldView™ platform.
- Weed management consisted of a pre- and post-emergence program and was applied across all plots.

Understanding the Results

Table 1. Average performance of DEKALB® corn brand blends across all three seeding rates.

Corn Brand Blend	Harvest Population (seeds/acre)				Average Grain Moisture (%)	Average Yield (bu/acre)	Average Yield Ranking
	32K	36K	40K	Average			
DKC50-08RIB	29	33	35	32.3	17.1	213.7	17
DKC51-38RIB	28	33	38	33.0	16.7	217.2	15
DKC54-38RIB	32	33	37	34.0	17.2	233.2	6
DKC54-74RIB	31	35	40	35.3	16.1	224.9	12
DKC55-53RIB	31	36	39	35.3	16.7	212.7	18
DKC55-84RIB	33	36	40	36.3	16.2	213.7	16
DKC57-97RIB	28	35	38	33.7	16.9	228.4	11
DKC58-06RIB	32	37	39	36.0	17.4	231.7	8
DKC58-34RIB	31	34	40	35.0	17.9	233.3	5
DKC60-87RIB	32	35	38	35.0	18.3	236.3	4
DKC61-98RIB	31	36	37	34.7	17.2	229.6	10
DKC62-20RIB	31	36	38	35.0	17.1	224.1	13
DKC62-52RIB	31	35	37	34.3	17.5	237.4	3
DKC62-78RIB	32	37	39	36.0	17.0	222.6	14
DKC63-21RIB	31	33	40	34.7	17.0	229.7	9
DKC63-57RIB	28	36	36	33.3	18.8	239.9	2
DKC64-34RIB	33	33	38	34.7	19.8	233.0	7
DKC66-75RIB	28	31	35	31.3	19.7	247.6	1

Yield Response of Corn Products to Seeding Rate

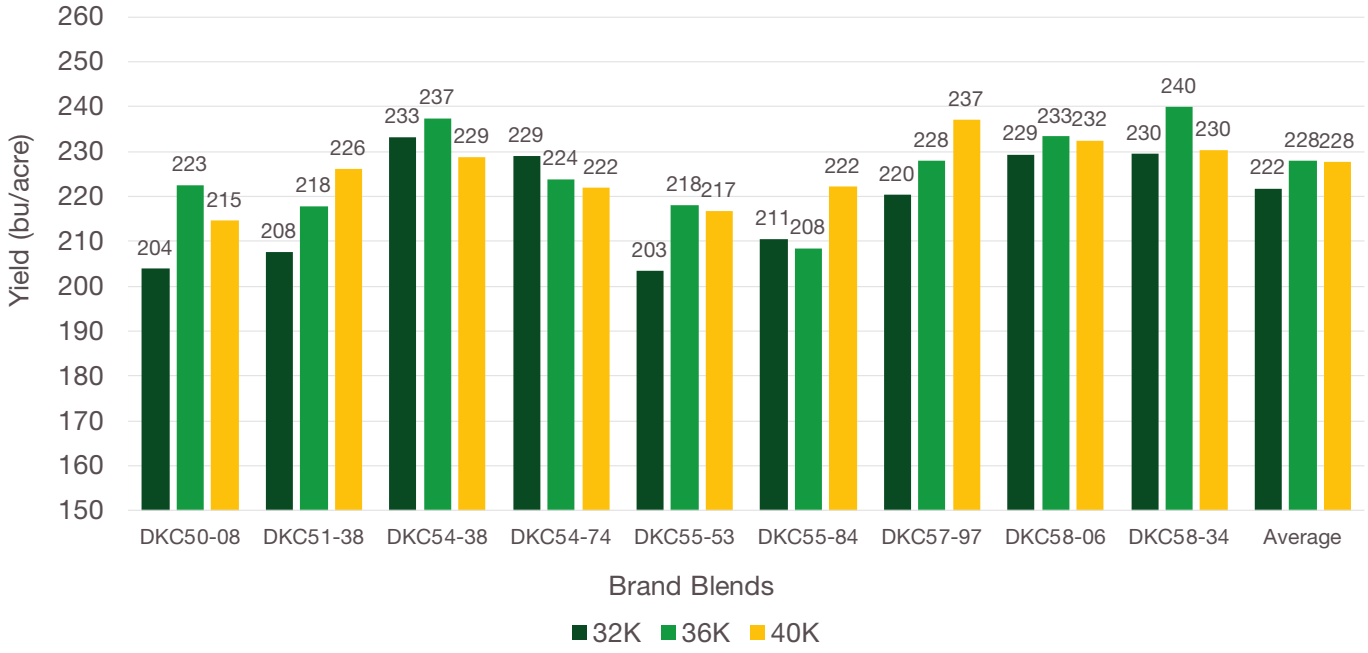

Figure 1. Yield response of DEKALB® corn brand blends (100 RM – 108 RM) to seeding rate.

Figure 2. Representative ears of DEKALB® corn brand blends (100 RM–108 RM) at the different seeding rates.

Yield Response of Corn Products to Seeding Rate

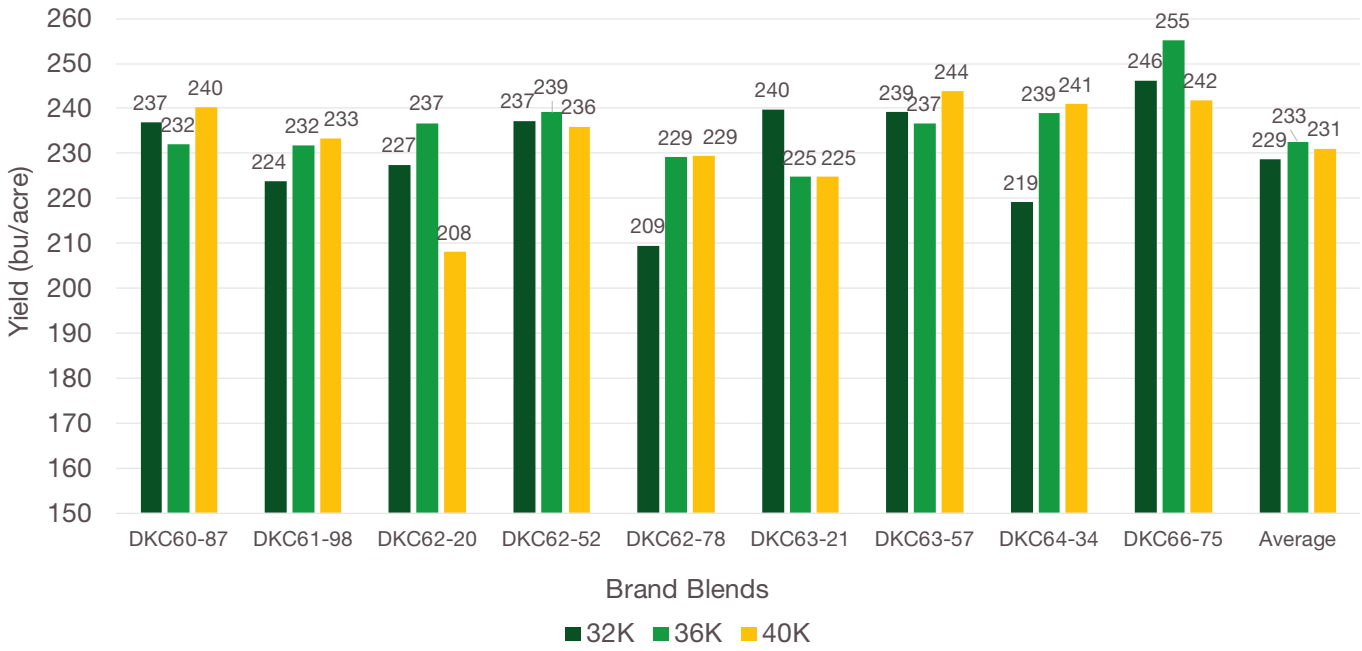

Figure 3. Yield response of DEKALB® corn brand blends (110 RM – 116 RM) to seeding rate.

Figure 4. Representative ears of DEKALB® corn brand blends (110 RM–116 RM) at the different seeding rates.

Yield Response of Corn Products to Seeding Rate

What Does This Mean for Your Farm?

- Traditionally, we consider a 5 bu/acre yield response in a 4,000 seeds/acre increment to be economical.
- Ten out of 19 corn products had an economical response from a 32,000 to 36,000 seeds/acre increase in seeding rate.
- Only three out of 19 corn products had an economical response from a 36,000 to 40,000 seeds/acre increase in seeding rate.
- This is the first year on average that the jump from 36,000 to 40,000 seeds/acre wasn't economical.
  - Several factors from this season, including nitrogen leaching after 17 inches of rain in June, may have caused the lack of yield response in the higher seeding rates.
- Contact your local DEKALB® representative when making product seeding rate decisions.

Legal Statements

Characterization of Corn Products for Their Response to Nitrogen Fertilization

Trial Objective

- Nitrogen fertilization is an integral part of corn production and is partly responsible for some of the drastic yield increases in corn production. Nitrogen is also the focus of a lot of the research in soil fertility and crop nutrition, with emphasis on finding the right rate, timing, source, and placement.
- It is important to understand how corn products respond to nitrogen fertilization. Knowing a corn product's demand for nitrogen may help avoid applying nitrogen that is not needed, which offers both an environmental and input cost benefit. Using technologies such as the Nitrogen Advisor from Climate FieldView™ may help farmers monitor and maintain the right nitrogen status throughout the growing season.
- The objective of this study was to characterize corn products for their sensitivity to different nitrogen rates. Rates were selected to induce both nitrogen stress and excess nitrogen.

Research Site Details

Location	Soil Type	Previous Crop	Tillage Type	Planting Date	Harvest Date	Potential Yield (bu/acre)	Seeding Rate (seeds/acre)
Huxley, IA	Clay loam	Soybean	Strip tillage	4/30/2018	10/04/2018	225	34K
Marble Rock, IA	Silty loam	Soybean	Strip tillage	5/17/2018	10/16/2018	220	34K
Victor, IA	Silty clay loam	Corn	Conventional	5/02/2018	9/27/2018	240	35K

- The nitrogen rates tested were:
  - Low – 30 lb/acre for the corn-soybean rotations or 50 lb/acre for the corn-corn rotation
  - Medium – 160 lb/acre (Huxley only)
  - High – 230 lb/acre
- All nitrogen applications were made before planting.
- The trial was carried out in 30-inch row spacing, with four rows per treatment, and 45-ft long plots with two replications.
- Weed management consisted of a pre- and post-emergence program.

Understanding the Results

- There was clear indication of nitrogen extremes as shown in Figure 1. Plants in the low-rate treatment showed chlorotic symptoms due to nitrogen stress, whereas those in the other treatments did not.
- Generally, grain yields increased with increasing nitrogen rate such that the low treatment had the lowest yields and the high treatment had the highest yields, except for five products at Huxley, in which the medium rate out-yielded the high rate. Also, at Marble Rock, the low rate out-yielded the high rate in DKC51-38RIB brand blend (Figure 2–4).
- Even though yields were highest at the Victor location, the biggest nitrogen response was observed at Huxley, with an average of a 124 bu/acre yield difference between the low and high rates, followed by Victor with a 49 bu/acre difference and then Marble Rock with a 46 bu/acre difference.
- The medium nitrogen rate at Huxley helped to identify products with very different nitrogen requirements, such as DKC57-97RIB and DKC62-20RIB brand blends (Figure 2).

Characterization of Corn Products for Their Response to Nitrogen Fertilization

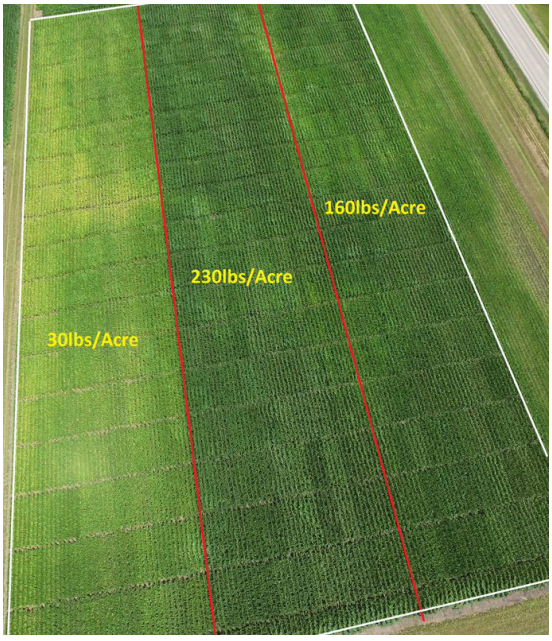

Figure 1. An aerial image of the field layout of the nitrogen trial at the Huxley, Iowa site. Attention is drawn to the difference in foliage color due to the different nitrogen rates. The photo was taken around the V12 growth stage.

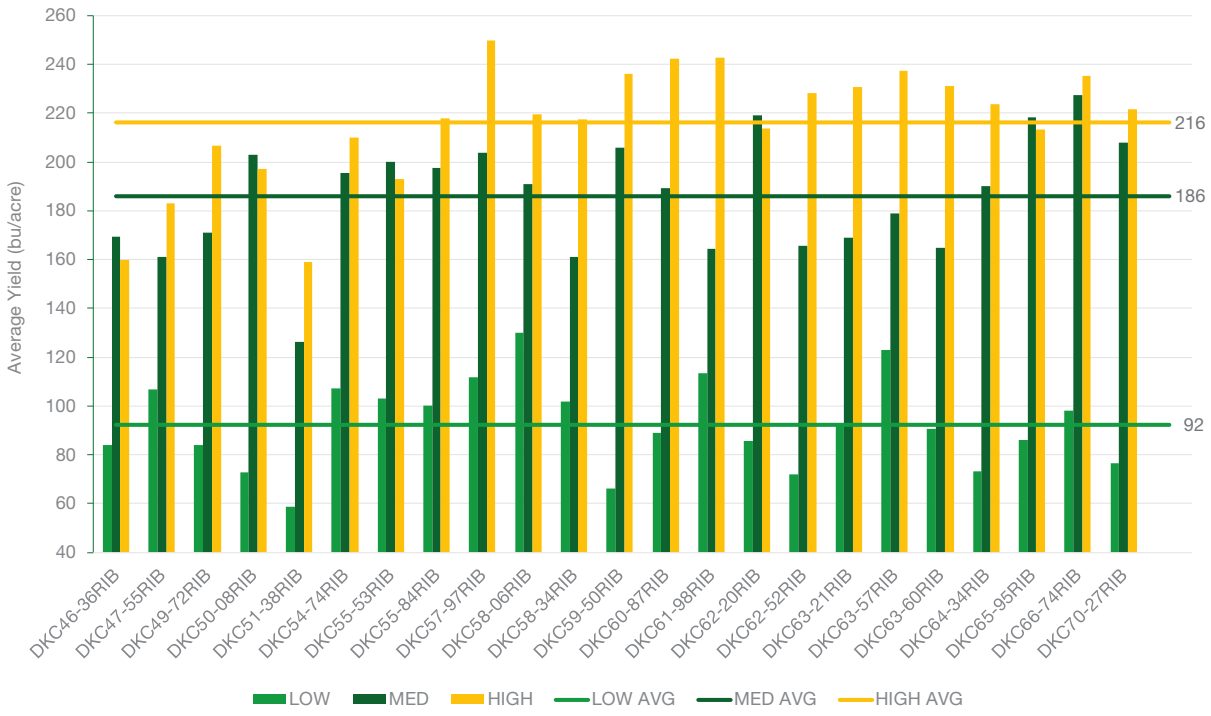

Figure 2. Performance of DEKALB® brand blends in response to different nitrogen rates at Huxley, Iowa. The horizontal lines indicate the average performance of all the products for that nitrogen rate. Low p-value < 0.05, LSD = 36 bu/acre; medium p-value < 0.05, LSD = 62 bu/acre; high p-value = < 0.05, LSD = 45.

Characterization of Corn Products for Their Response to Nitrogen Fertilization

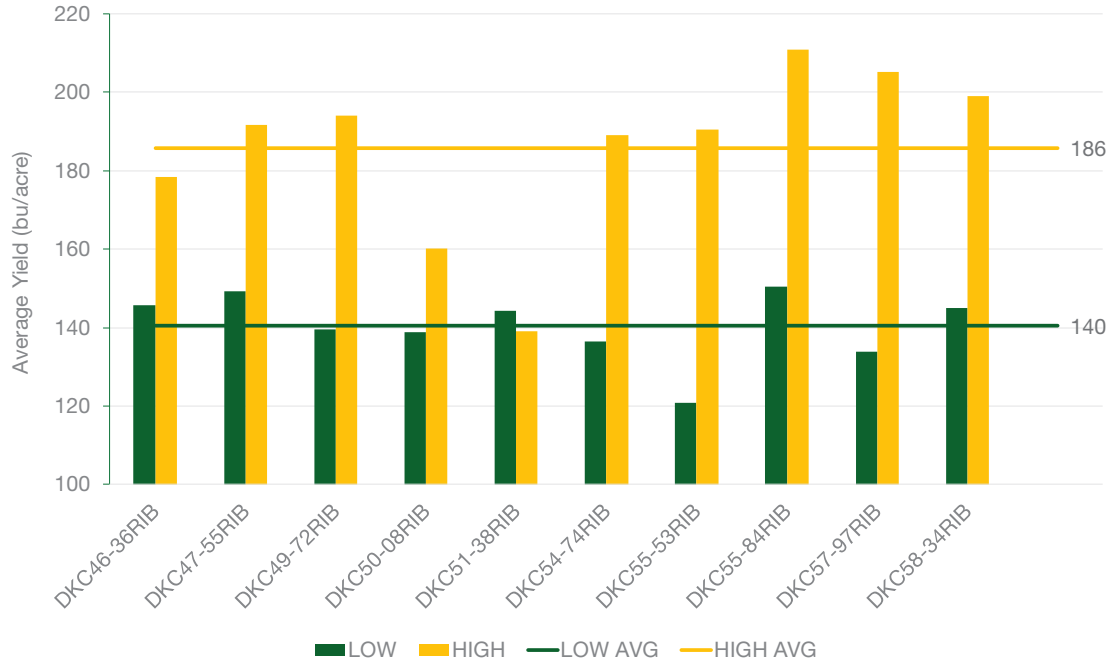

Figure 3. Performance of DEKALB® brand blends in response to different nitrogen rates at Marble Rock, Iowa. The horizontal lines indicate the average performance of all the products for that nitrogen rate. Low p-value < 0.05, LSD = 20 bu/acre; high p-value < 0.05, LSD = 44 bu/acre.

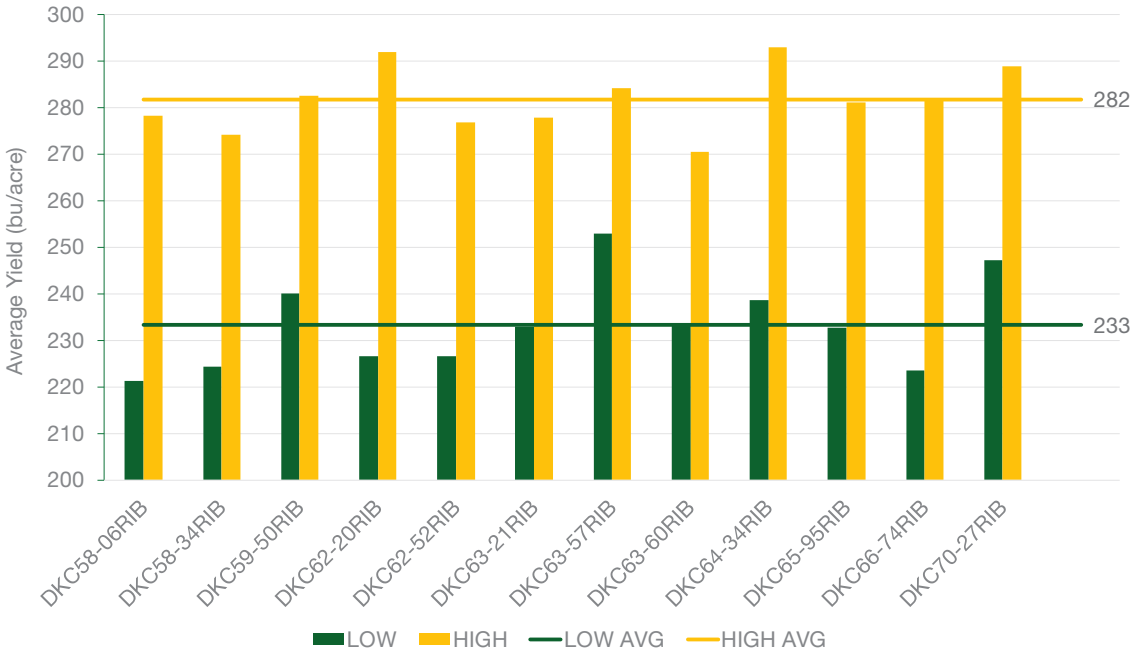

Figure 4. Performance of DEKALB® brand blends in response to different nitrogen rates at Victor, Iowa. The horizontal lines indicate the average performance of all the products for that nitrogen rate. Low p-value < 0.05, LSD = 11 bu/acre; high p-value < 0.05, LSD = 11 bu/acre.

Characterization of Corn Products for Their Response to Nitrogen Fertilization

What Does This Mean for Your Farm?

- A corn plant's yield response to nitrogen is a complex phenomenon and is substantially impacted by the weather during the growing season, the soil type, and the inherent soil fertility.
- Wet conditions in May and June at the Huxley location may have led to substantial nitrogen loss, which can increase stress on the plants. This may explain, in part, the very low yields observed at the low nitrogen rate treatment.
- The Victor location, on the other hand, presented a high inherent soil fertility which produced an average of 233 bu/acre with only 50 lb/acre of nitrogen. Such a field needs to be sustainably managed to avoid nitrogen loss to the water system.
- At the current market trend of $0.23/lb of nitrogen and $3.75/bu for corn, a minimum of 12.3 bu/acre is required to pay for the difference between the low and high nitrogen rates. Thus, all but one product, DKC51-38RIB brand blend at Marble Rock, were profitable at all locations. A minimum of 4.3 bu/acre was required between the medium and high rates at the Huxley location.
- Corn products respond differently to farm inputs and they should be tested on a small scale before they are deployed for the whole farm.

Legal Statements

Effects of Nitrogen Rate on Corn Yield Potential

Trial Objective

- This trial was designed to help determine optimum nitrogen rates for new corn products and to demonstrate the interaction of crop inputs with specific corn products. The summary contains two years of results for some products and also results from some products grown only in 2018.

Research Site Details

Year	Location	Soil Type	Previous Crop	Tillage Type	Planting Date	Harvest Date	Potential Yield (bu/acre)	Seeding Rate (seeds/acre)
2017	Victor, IA	Silty clay loam	Soybean	Conventional	4/21/17	10/5/17	220-260	35K
2018	Victor, IA	Silty clay loam	Soybean	Conventional	4/25/18	10/3/18	220-260	35K

- Nitrogen (N) was applied at rates of 110, 140, and 170 total lb N/acre as anhydrous ammonia (NH3) in the spring 5 to 9 days before planting.
- Corn products were planted into each NH3 zone consisting of six 30-inch rows, approximately 370 ft. long.

Understanding the Results

- The two-year average yield for seven products in a corn-soybean rotation was greatest with 140 lb total N/acre.

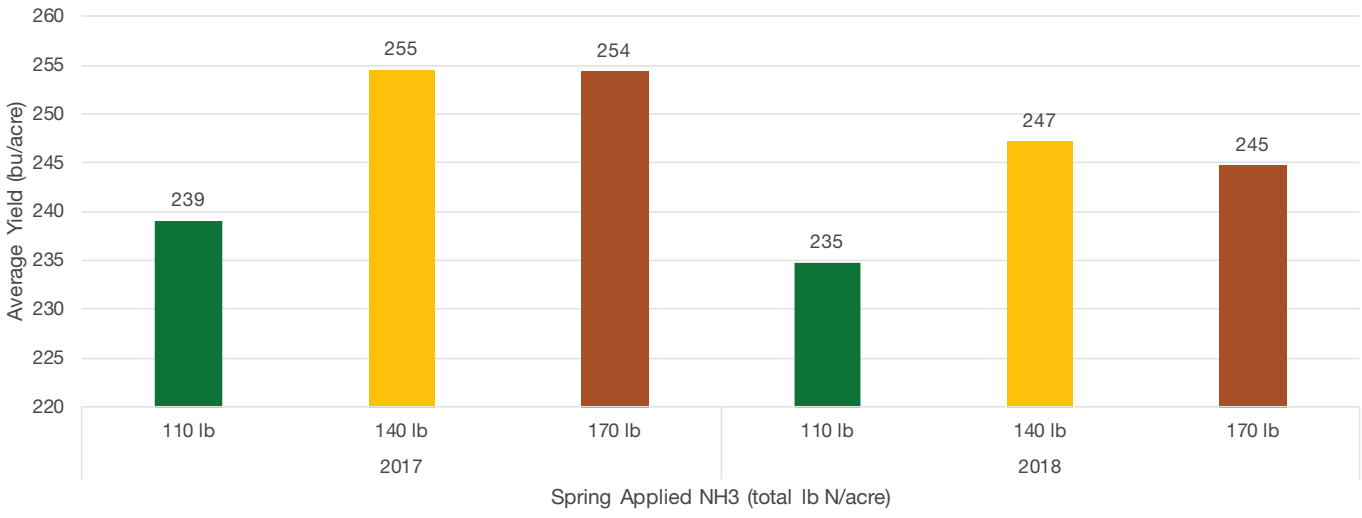

Figure 1. Average yield response of seven DEKALB® corn brand blends at three nitrogen rates over two years.

Effects of Nitrogen Rate on Corn Yield Potential

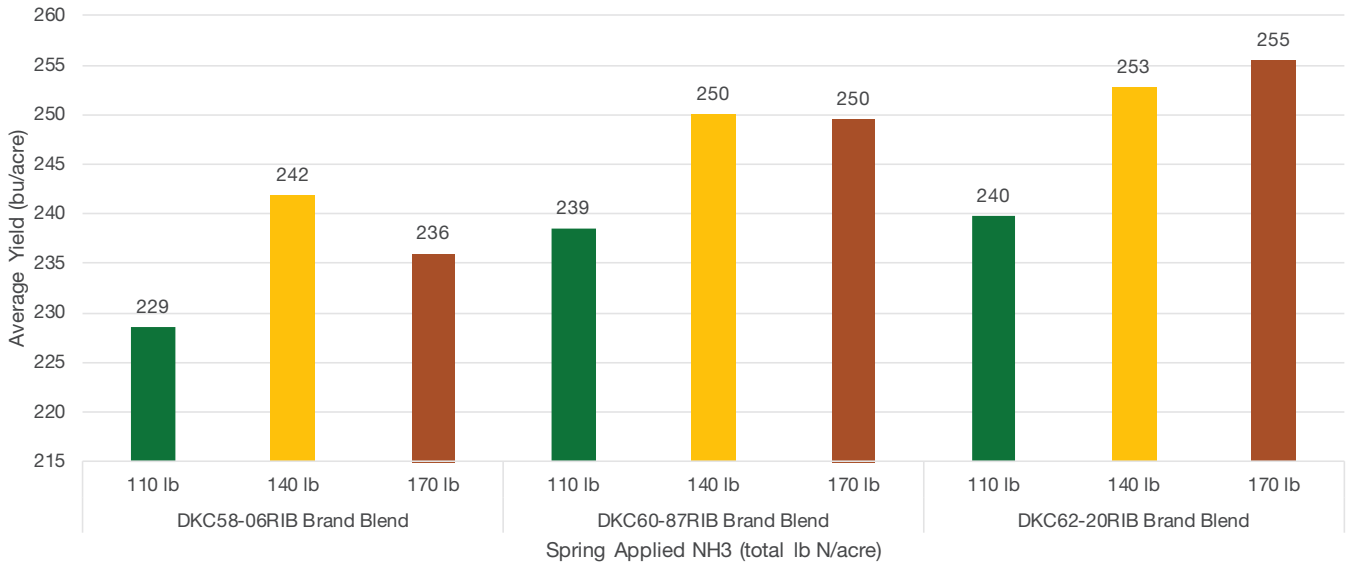

Figure 2. Two-year average yield response of three individual DEKALB® brand blends at three nitrogen rates.

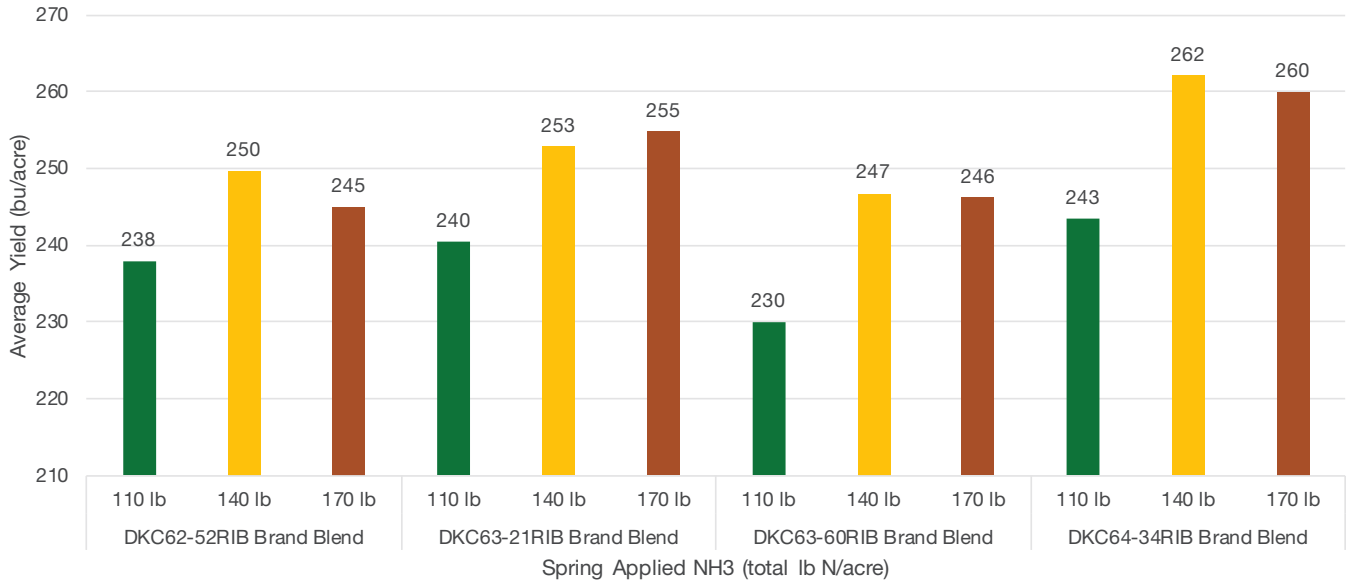

Figure 3. Two-year average yield response of four individual DEKALB® brand blends at three nitrogen rates.

Effects of Nitrogen Rate on Corn Yield Potential

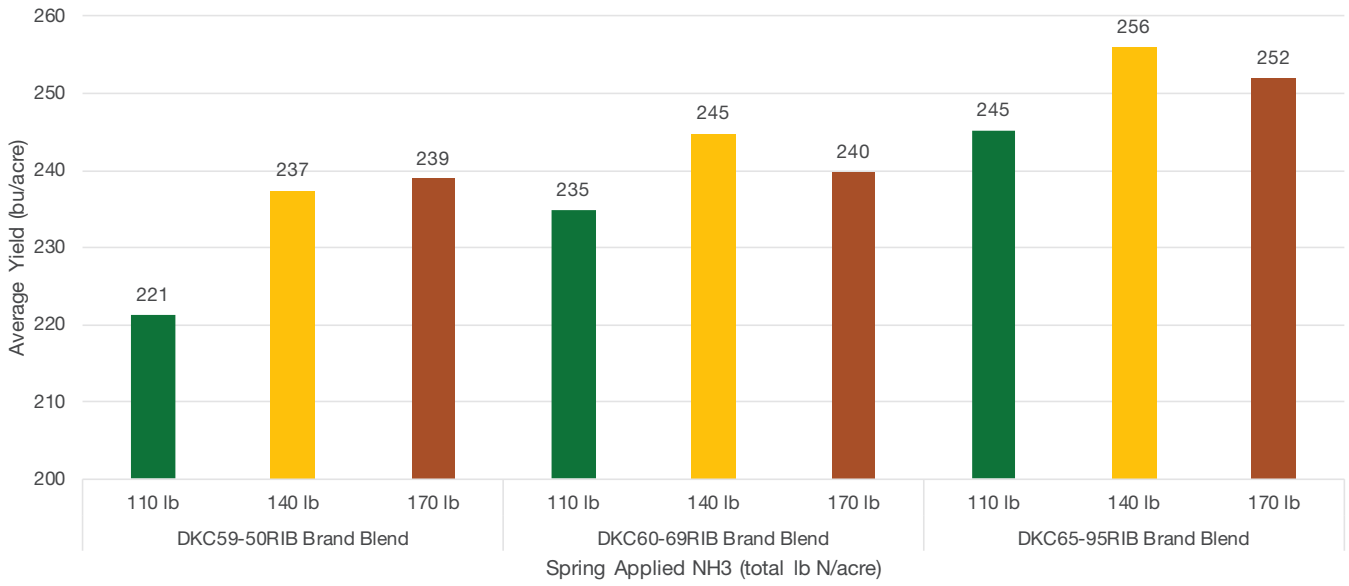

Figure 4. Yield response of three individual DEKALB® brand blends at three nitrogen rates in 2018.

What Does This Mean for Your Farm?

- The crop response to nitrogen is dependent on several variables, such as corn product, soil, and environment.
- Low nitrogen rates can limit yield potential, while excess rates are not beneficial for additional crop response and reduce the return on investment.
- The economic return to each additional unit of nitrogen will depend upon grain price and nitrogen price.

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The information discussed in this report is from a single site, non-replicated demonstration. This informational piece is designed to report the results of this demonstration and is not intended to infer any confirmed trends. Please use this information accordingly.

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IMPORTANT IRM INFORMATION: RIB Complete® corn blend products do not require the planting of a structured refuge except in the Cotton-Growing Area where corn earworm is a significant pest. SmartStax® RIB Complete® corn blend is not allowed to be sold for planting in the Cotton-Growing Area. See the IRM/Grower Guide for additional information. Always read and follow IRM requirements.

Performance may vary, from location to location and from year to year, as local growing, soil and weather conditions may vary. Growers should evaluate data from multiple locations and years whenever possible and should consider the impacts of these conditions on the grower's fields.

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