2021 FIELD RESEARCH BOOK

FEATURING 2020 RESEARCH RESULTS

DEKALB ASGROW DELTAPINE

Welcome to the Third Edition of the Bayer Crop Science Field Research Book.

On behalf of the entire Market Development Team at Crop Science, thank you for staying safe and raising the vital crops needed for a safe and sustainable food supply in 2020.

At Crop Science, our single focus is on your success and that of your operation. In Market Development, we are committed to helping our farmer customers learn more about our full product portfolio and how it can best meet the unique needs of their individual farming operations.

To that end, this year's Field Research Book takes the results from field trials across the United States – in both large and small plot formats – to give you the best data to make informed decisions about what may work best for your specific needs.

Just like you, we have a strong focus on winning genetics, integrated weed and pest management, efficiency, and effectiveness. In short, we try to anticipate everything you can experience on your farm to help you navigate each and every year as successfully, sustainably and profitably as possible.

The team and I hope you will find this research summary valuable. As always, we'd welcome any feedback you have and thoughts on what you'd like to see in the next edition.

Thank you again for your business and here's to a successful 2021.

John Chambers
Head of North America Market Development
Bayer Crop Science

FIELD RESEARCH REPORTS

HOW REPORTS ARE ORGANIZED

The reports in this book are arranged by crop: corn, soybean, and cotton. Each report is also tagged with one of these icons to quickly show you what it's about.

National Systems Protocol Disease Management

Trial Objective

Corn is confronted with several serious disease threats during the season. Managing these diseases with the use of seed and foliar fungicide treatments is essential to maintain yield potential. The objectives of these trials include:

- Evaluate the efficacy of seed treatments and foliar fungicides on reducing yield loss due to Fusarium Crown Rot, stalk health issues and other corn diseases.
- Communicate the value that native disease tolerance, seed applied solutions, and foliar fungicides bring to disease risk management systems.

Research Site Details

Experiment Description	# Locations Planned	# Locations Harvested	Tillage Type
2020-01-76-34	40	35	34

- A total of 58 corn products were included from national and regional brands.
- The experimental design was a single replication with large strips.
- Two seed treatments were evaluated (Acceleron® Seed Applied Solutions ELITE and Acceleron® Seed Applied Solutions BASIC); known as Elite and Basic for the remainder of the report.
- Four blocked fungicide treatments were evaluated at different plant growth stages - Untreated (UNT), V5 stage only (V5), both V5 and R1 stages (V5R1) and R1 stage only (R1).

Understanding the Results

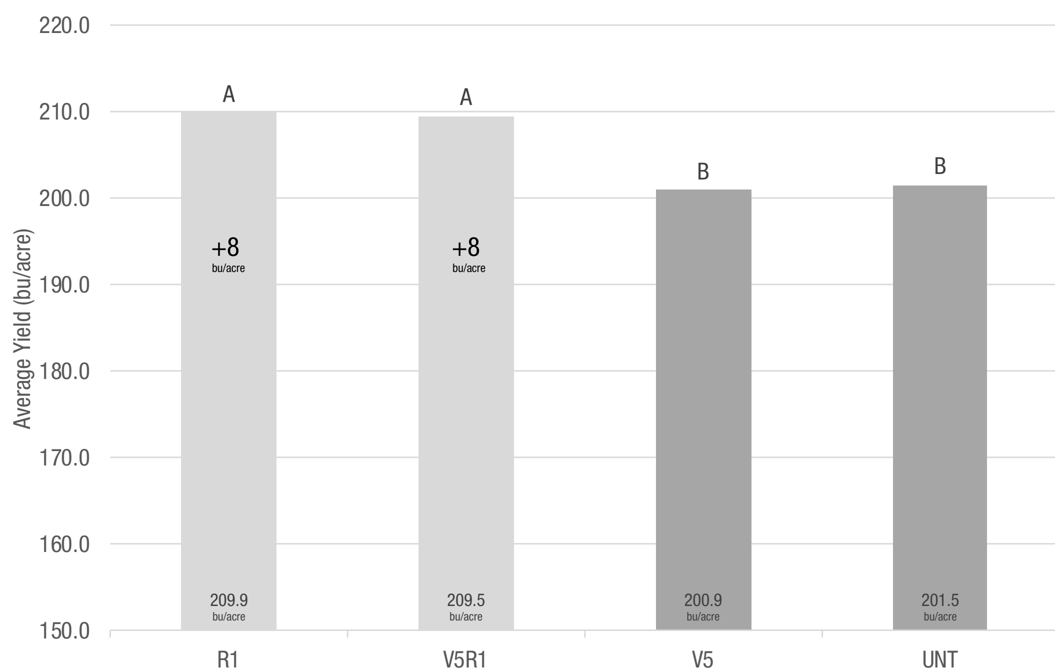

Figure 1. Average yield response to different fungicide application timings across all regions, seed treatments and corn products.

National Systems Protocol Disease Management

Broad Acre Yield Across Locations

- Across all locations, V5 was the only application that does not seem to contribute to yield potential.

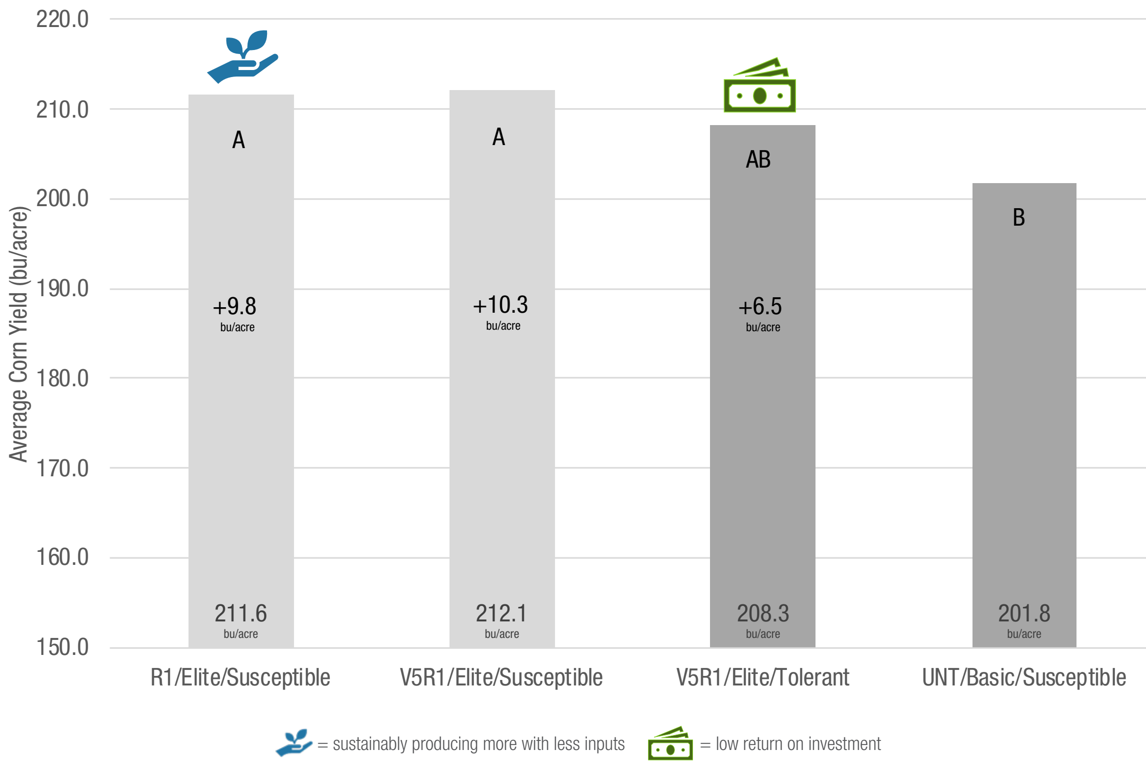

Figure 2. Comparison of different fungicide application systems across all regions.

Systems Comparison

- R1/Elite/Susceptible yielded 10 bu/acre better versus Untreated/Basic/Susceptible (Low input system).

Regional Results

Eastern Corn Belt: 4 locations

- R1 only block yielded 8 bu/acre higher than Untreated.
- R1/Elite Susceptible package yielded 21 bu/acre higher than Untreated/Basic Susceptible (Low inputs system).

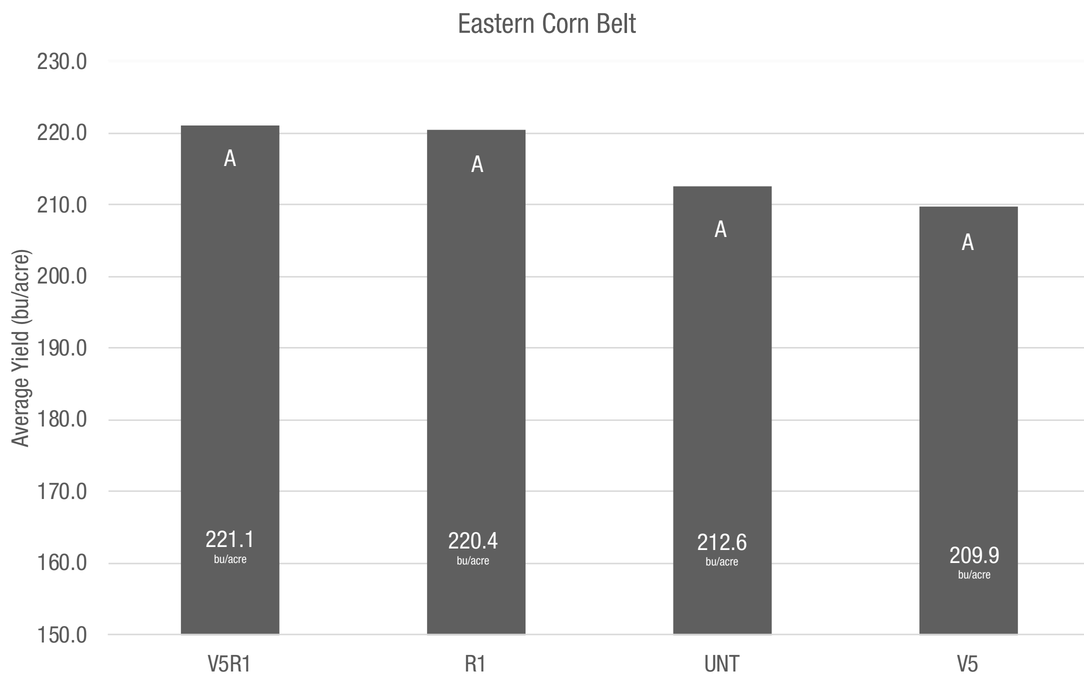

Figure 3 A. Comparison of corn yield responses to timing of fungicide applications evaluated on a regional basis across the Eastern Corn Belt.

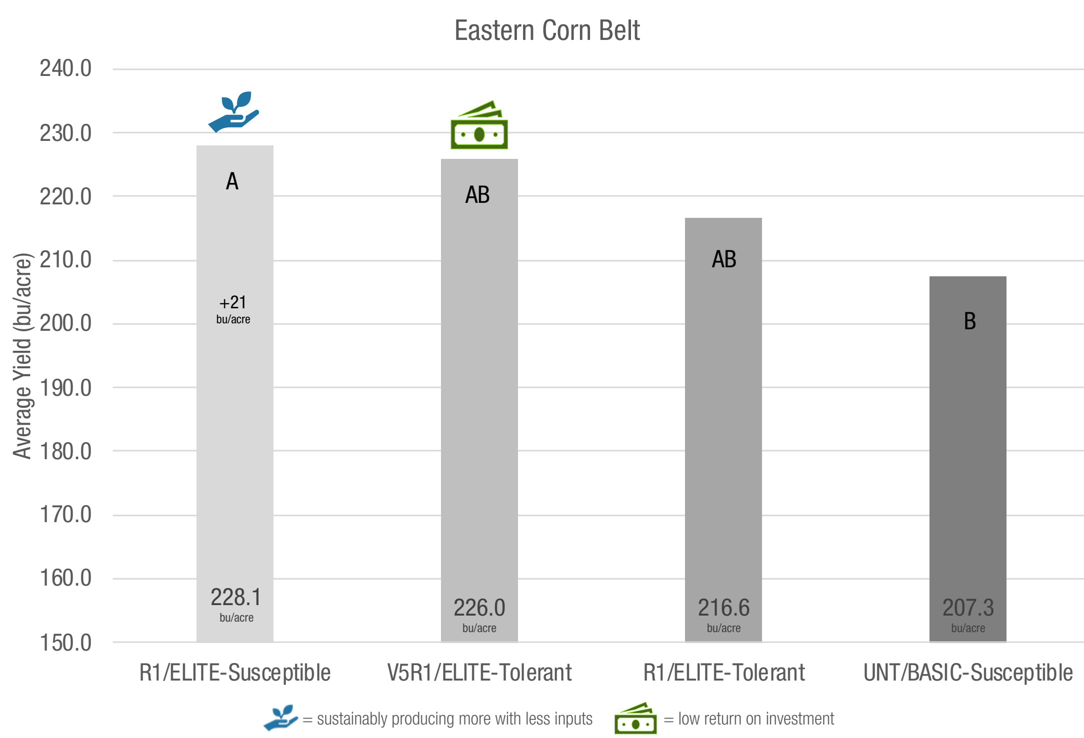

Figure 3 B. Comparison of fungicide systems trials (including seed treatments, germplasm and foliar fungicide applications) evaluated on a regional basis across the Eastern Corn Belt.

South/East Coast: 5 locations

- No significant difference between application timings vs Untreated block but V5R1 application showed 10 bu/acre advantage over Untreated.
- V5R1/Elite Tolerant package (High Inputs) yielded 10 bu/acre higher than Untreated /Basic Susceptible (Low inputs system).

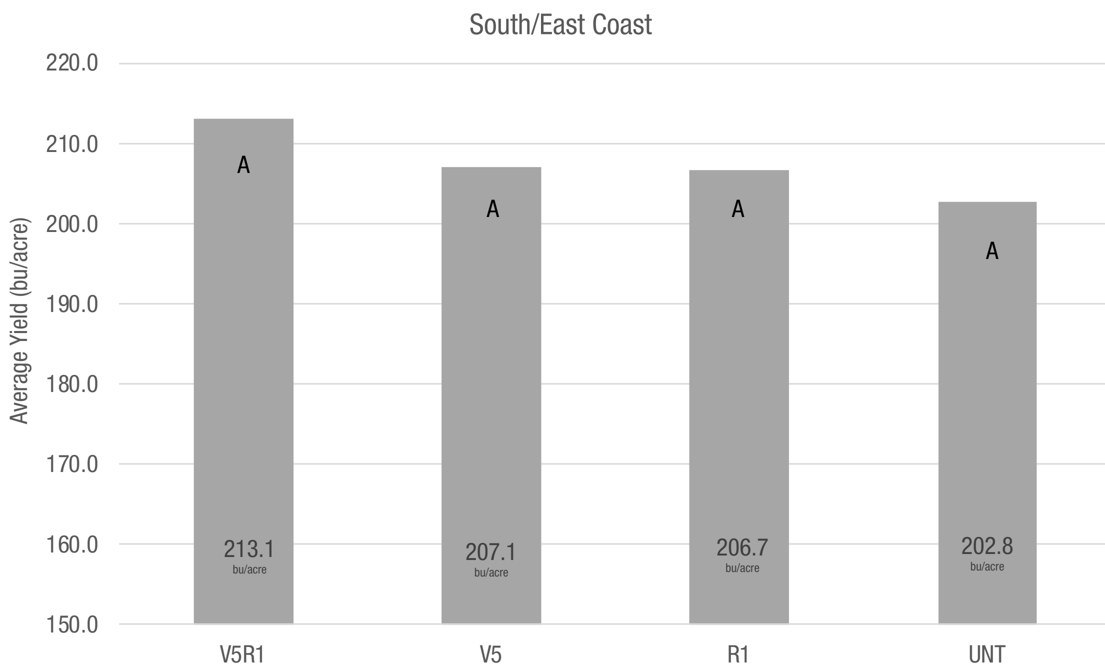

Figure 3 C. Comparison of corn yield responses to timing of fungicide applications evaluated on a regional basis across the South/East Coast.

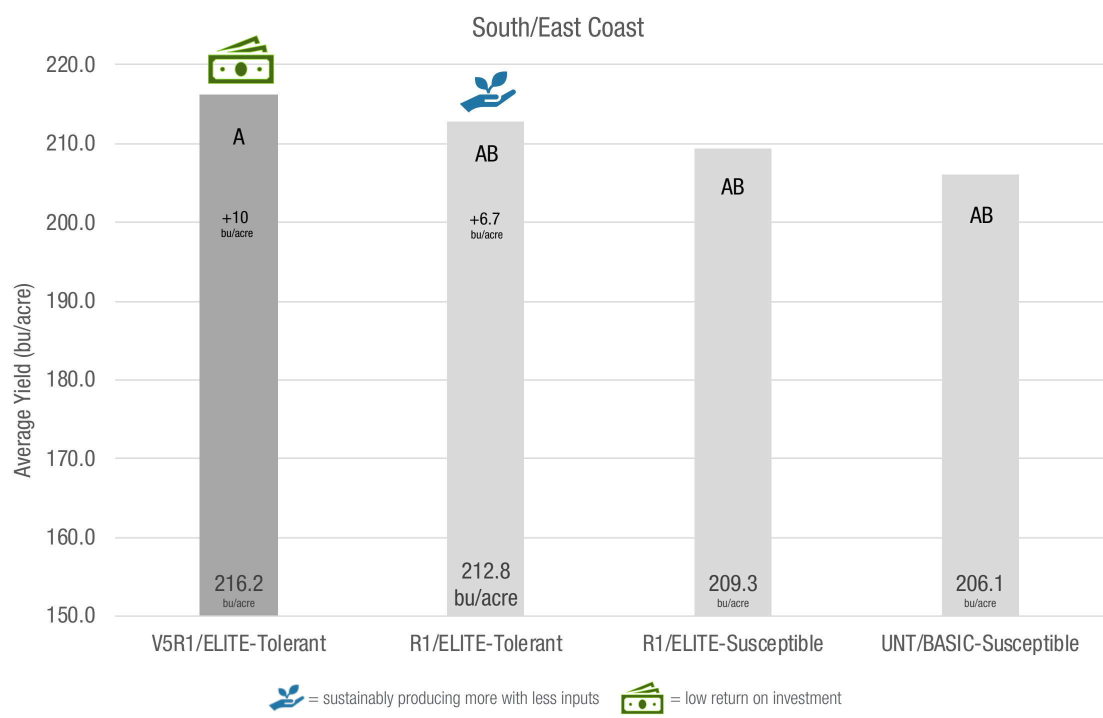

Figure 3 D. Comparison of fungicide systems trials (including seed treatments, germplasm and foliar fungicide applications) evaluated on a regional basis across South/East Coast.

Central Plains: 7 locations

- R1 and V5R1 showed significant yield advantage over V5 only block.
- R1/Elite Susceptible package yielded 6 bu/acre higher than Untreated/Basic Susceptible (Low inputs system).

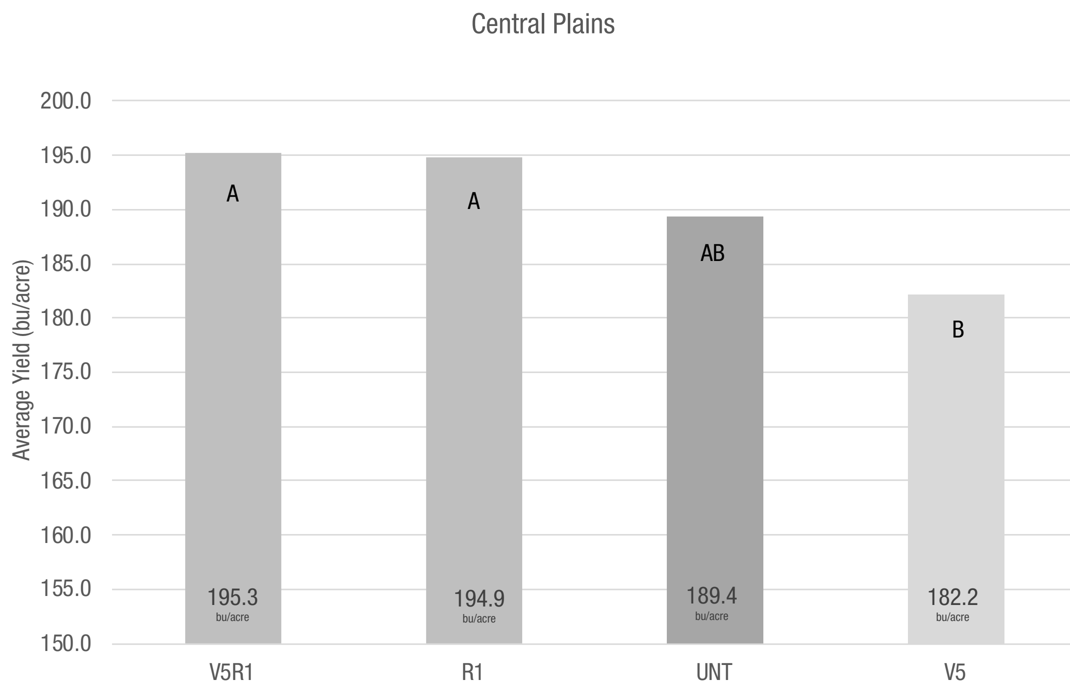

Figure 3 E. Comparison of corn yield responses to timing of fungicide applications evaluated on a regional basis across the Central Plains.

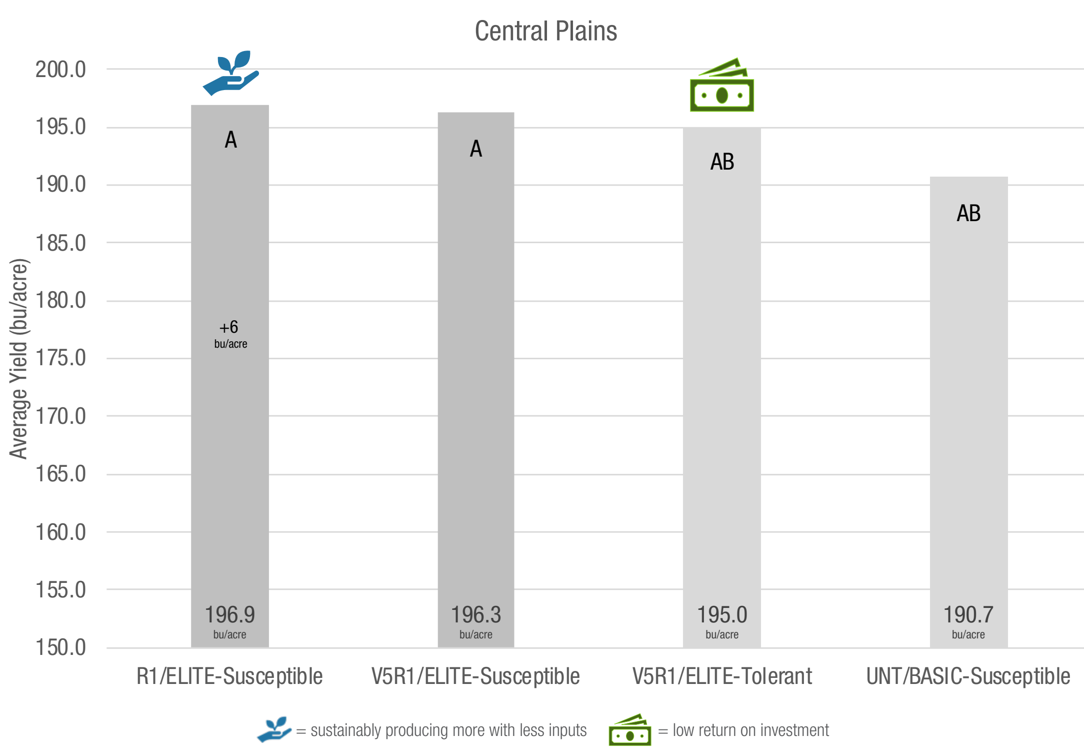

Figure 3 F. Comparison of fungicide systems trials (including seed treatments, germplasm and foliar fungicide applications) evaluated on a regional basis across the Central Plains.

Illinois: 5 locations

- *R1 only and V5R1 yielded 19-20 bu/acre higher than Untreated block.
- *R1/Elite Tolerant package yielded 30 bu/acre higher than Untreated/Basic Susceptible (Low inputs system).

*Statistically non-significant differences

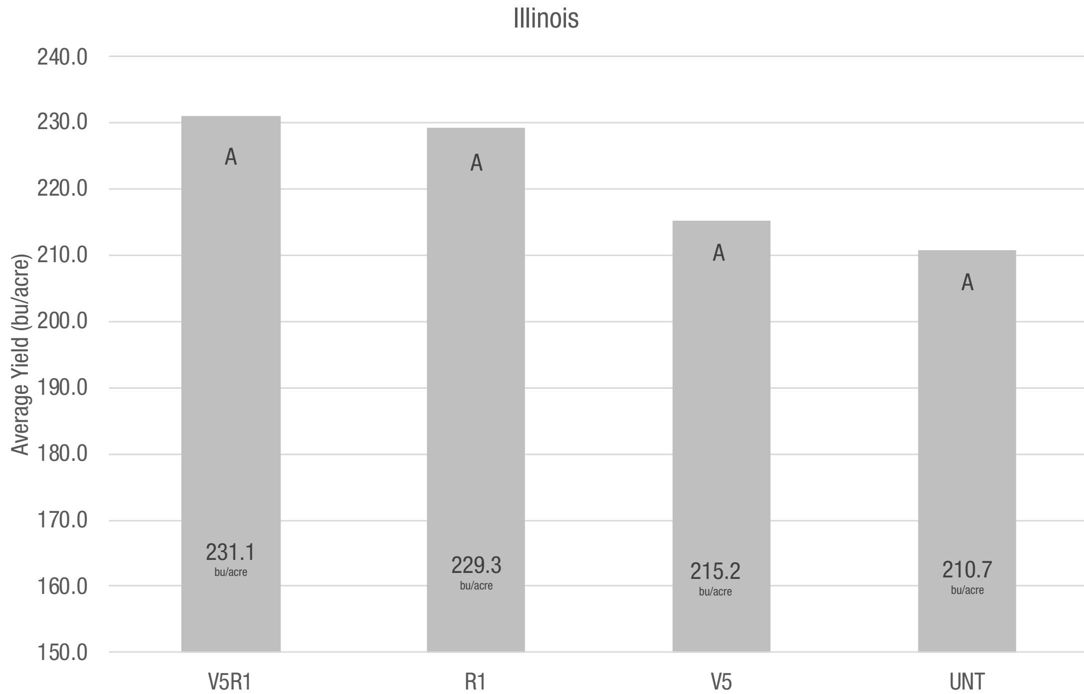

Figure 3 G. Comparison of corn yield responses to timing of fungicide applications evaluated on a regional basis across Illinois.

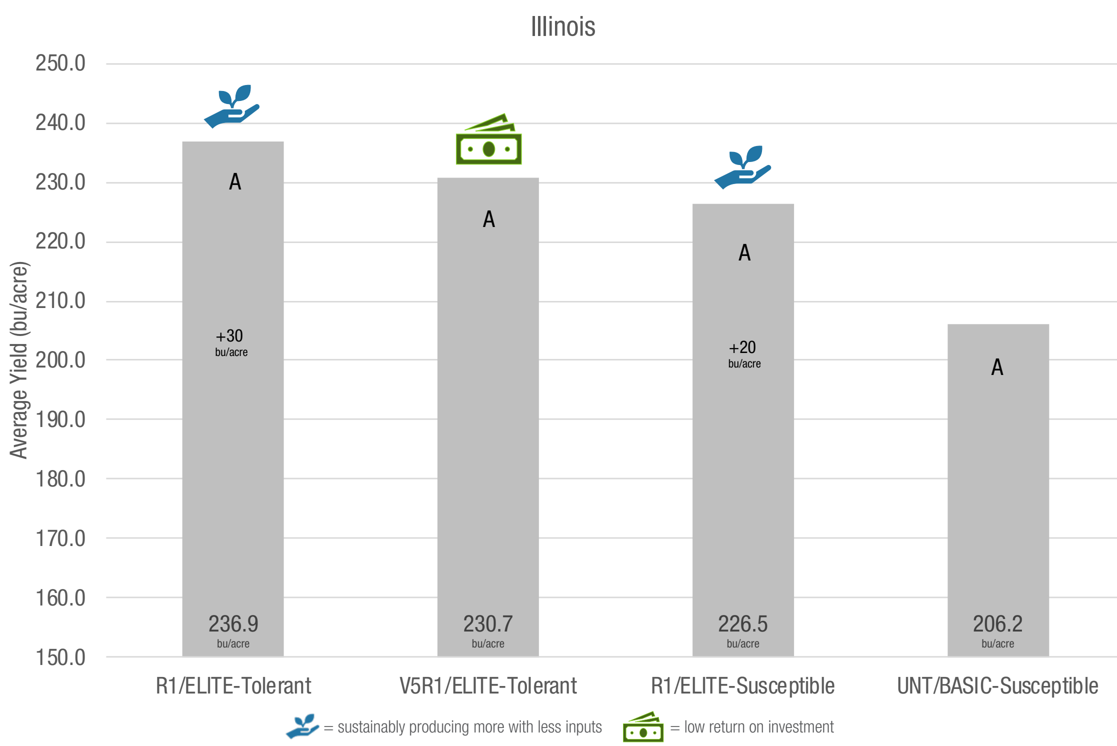

Figure 3 H. Comparison of fungicide systems trials (including seed treatments, germplasm and foliar fungicide applications) evaluated on a regional basis across Illinois.

Midwest: 4 locations

- *R1 only and V5R1 application showed 9-10 bu/acre advantage over Untreated.
- *Both R1/Elite Susceptible and V5R1/Elite Susceptible packages yielded 17 bu/acre higher than Untreated/Basic Susceptible (Low inputs system).

*Statistically non-significant differences

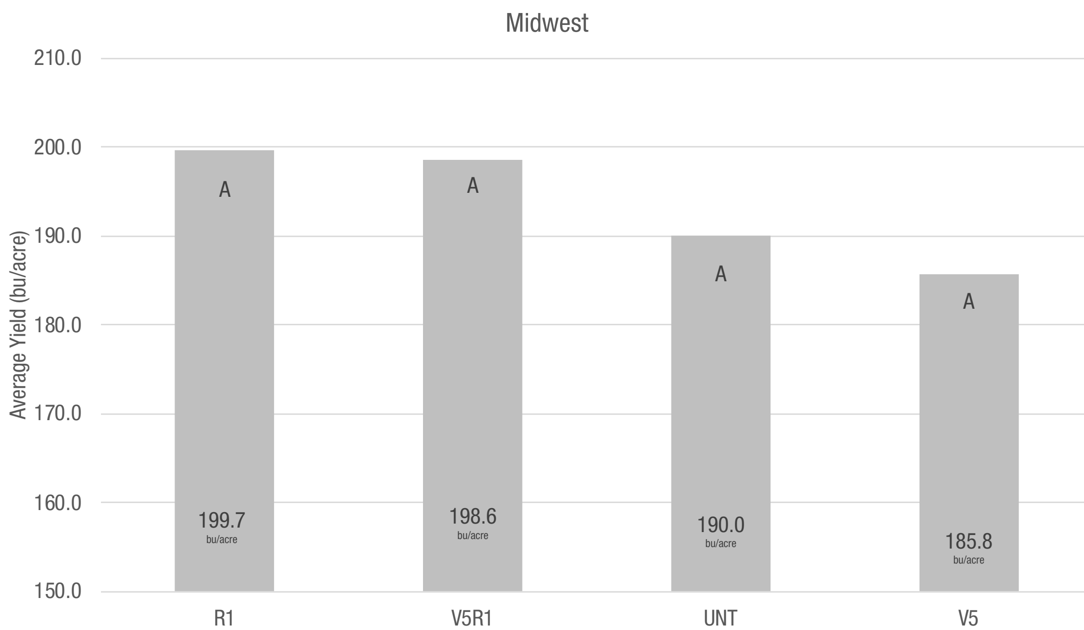

Figure 3 I. Comparison of corn yield responses to timing of fungicide applications evaluated on a regional basis across the Midwest.

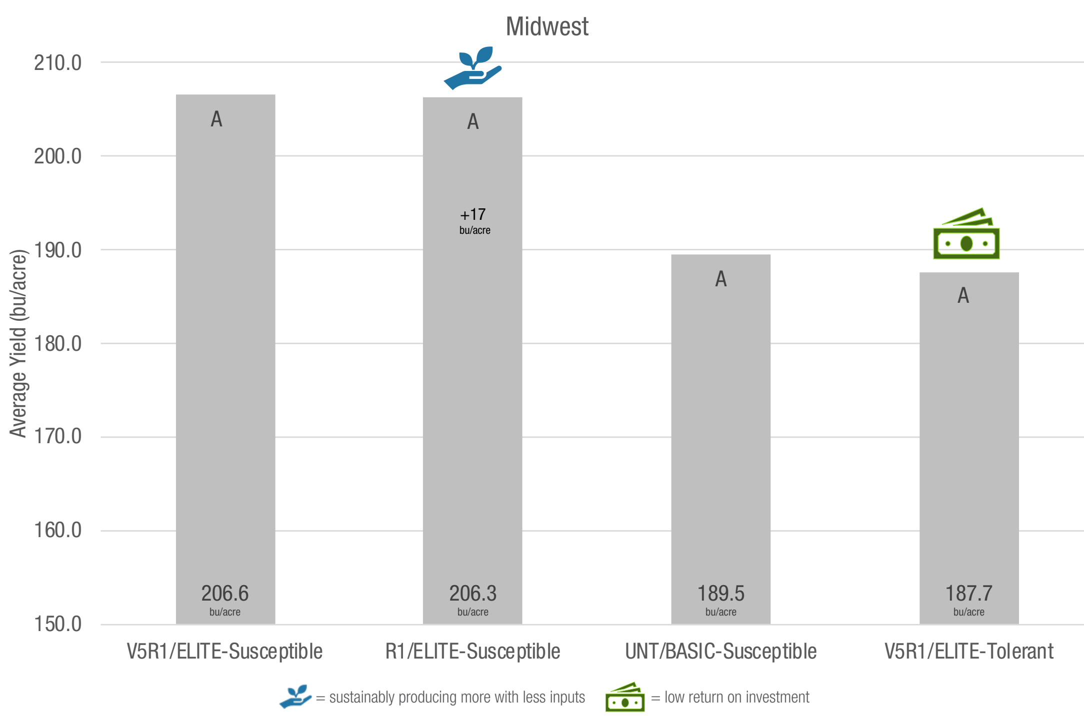

Figure 3 J. Comparison of fungicide systems trials (including seed treatments, germplasm and foliar fungicide applications) evaluated on a regional basis across the Midwest.

Northern Plains: 3 locations

- *R1 and V5R1 blocks yielded 4-5 bu/acre better than Untreated.
- *R1/Elite Tolerant yielded 9 bu/acre higher than Untreated/Basic Susceptible (Low inputs system).

*Statistically non-significant differences

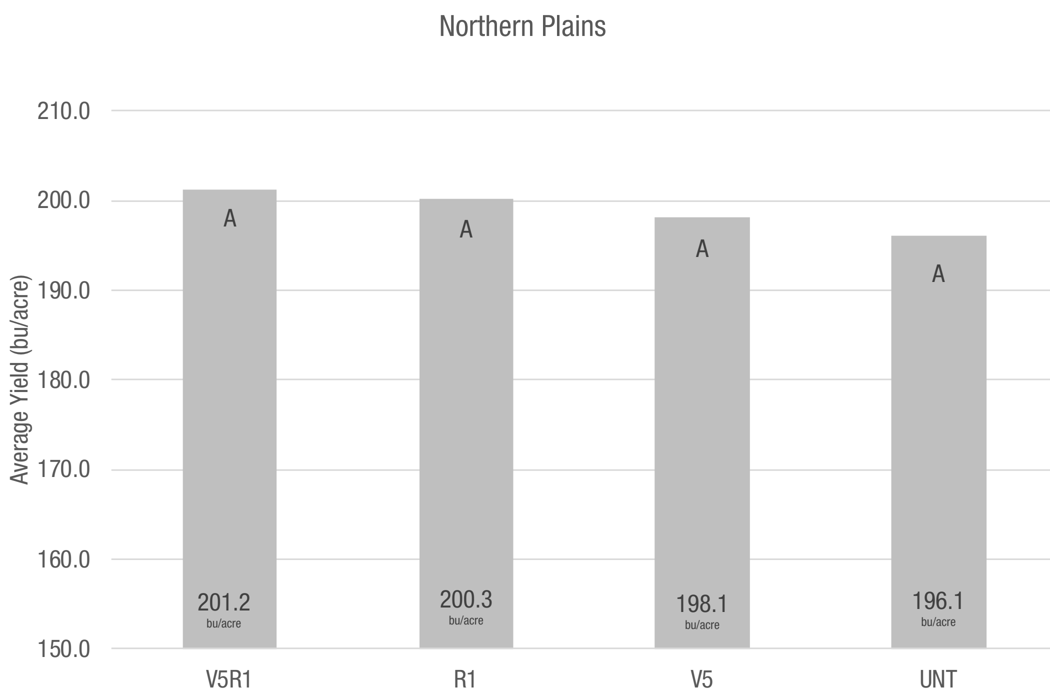

Figure 3 K. Comparison of corn yield responses to timing of fungicide applications evaluated on a regional basis across the Northern Plains.

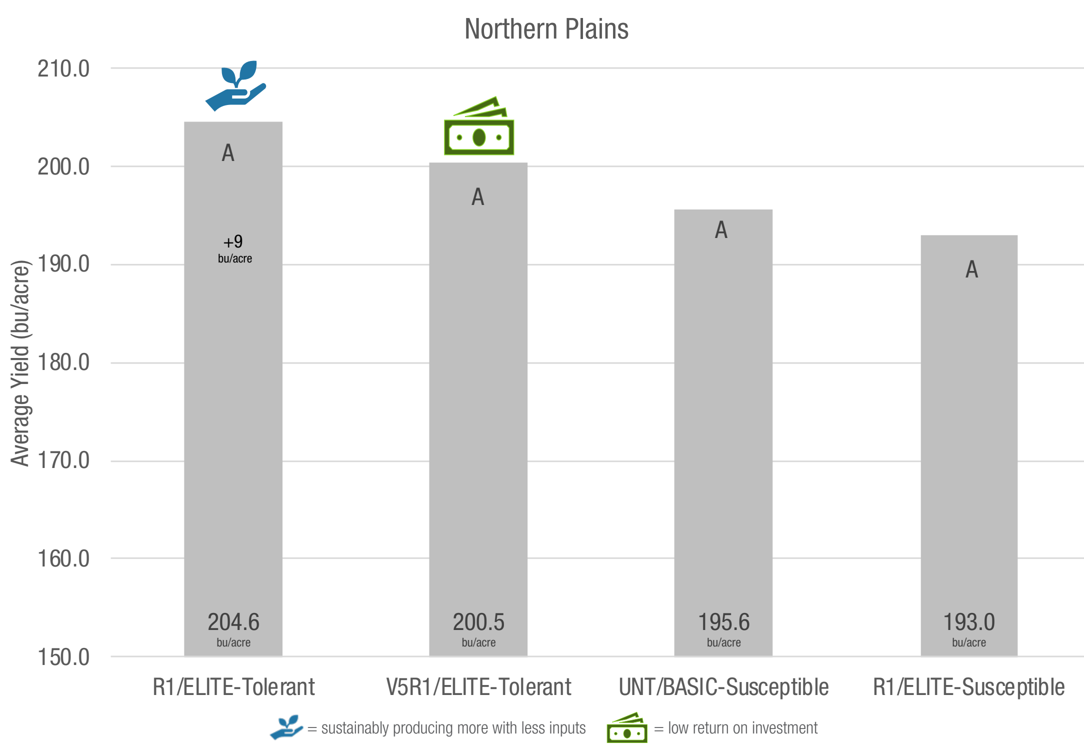

Figure 3 L. Comparison of fungicide systems trials (including seed treatments, germplasm and foliar fungicide applications) evaluated on a regional basis across the Northern Plains.

National Systems Protocol Disease Management

Key Learnings

- In this trial, both R1 and V5R1 blocks had lower foliar disease severity ratings and better staygreen when comparted to the Untreated block.
- Corn products with higher susceptibility to foliar and stalk diseases showed better yield response to R1 applications.
- Overall, across all locations yield data supports very little to no value from additional V5 applications.
- V5 only applications showed mixed results compared to Untreated block with three regions showing 2-5 bu/acre yield increases and four regions showing a 3-7 bu/acre yield decreases. These results suggest that there might be a regional fit for V5 applications.

Legals

Nebraska Corn Performance with Delaro® Brand Fungicides

Trial Objective

- Delaro® brand fungicides offer broad spectrum disease control with multiple modes of action with activity against corn diseases. They also promote healthy, dark green leaves for improved photosynthesis and increased plant stress resistance for full yield potential.
- Delaro® Complete fungicide includes a third active ingredient for consistent disease control.
- The objective of this trial was to observe the effects of Delaro® 325 SC fungicide and Delaro® Complete fungicide on corn yield potential at a field-level scale.

Research Site Details

- All applications were independently applied (by aerial applicator), and grower harvested.
- Growers provided yield data generated by combine yield monitors.
- Delaro® 325 SC fungicide or Delaro® Complete were compared to an untreated check with no fungicide in large field demonstrations in eastern and central Nebraska.
- All applications were made from the VT to R3 corn growth stage as a single application. Delaro 325 SC was applied at a rate of 8 oz/acre and Delaro Complete was tested as 8 oz. of Delaro and 2 oz. of Luna® Privilege per acre.

Understanding the Results

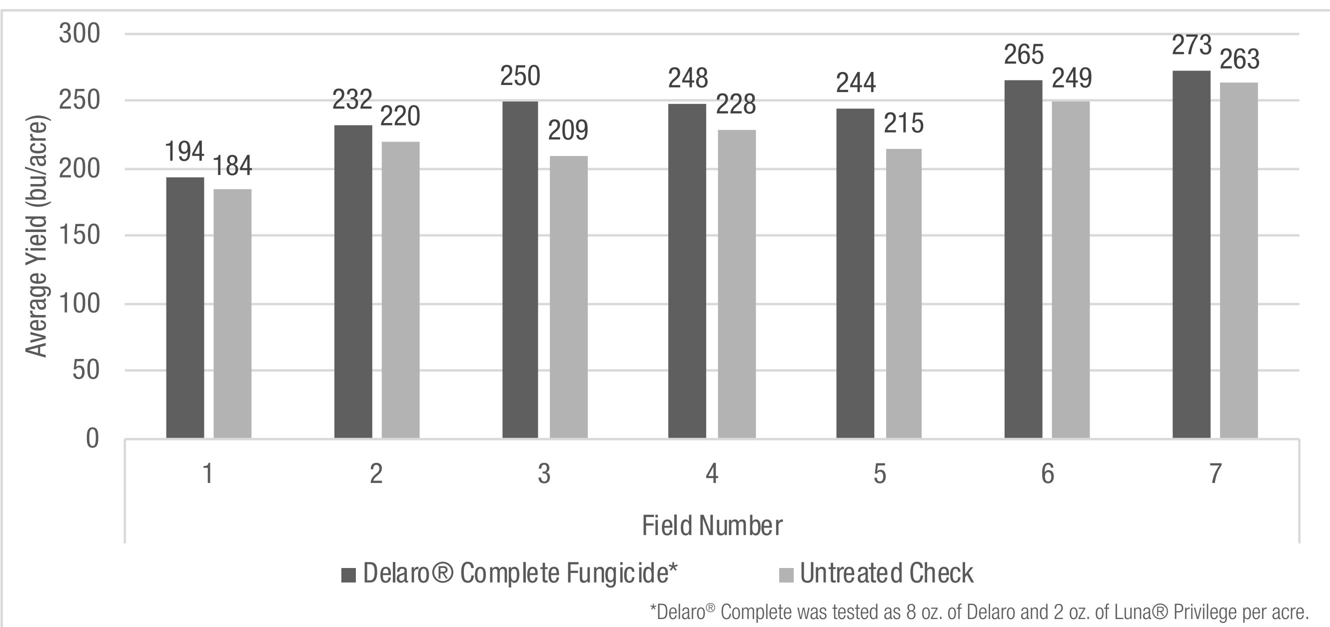

Figure 1. Average corn yield from Delaro® Complete fungicide applications at the VT to R1 growth stages at seven locations in eastern and central Nebraska. A 20 bu/acre average advantage for corn treated with the fungicide compared to the untreated check.

Nebraska Corn Performance with Delaro® Brand Fungicides

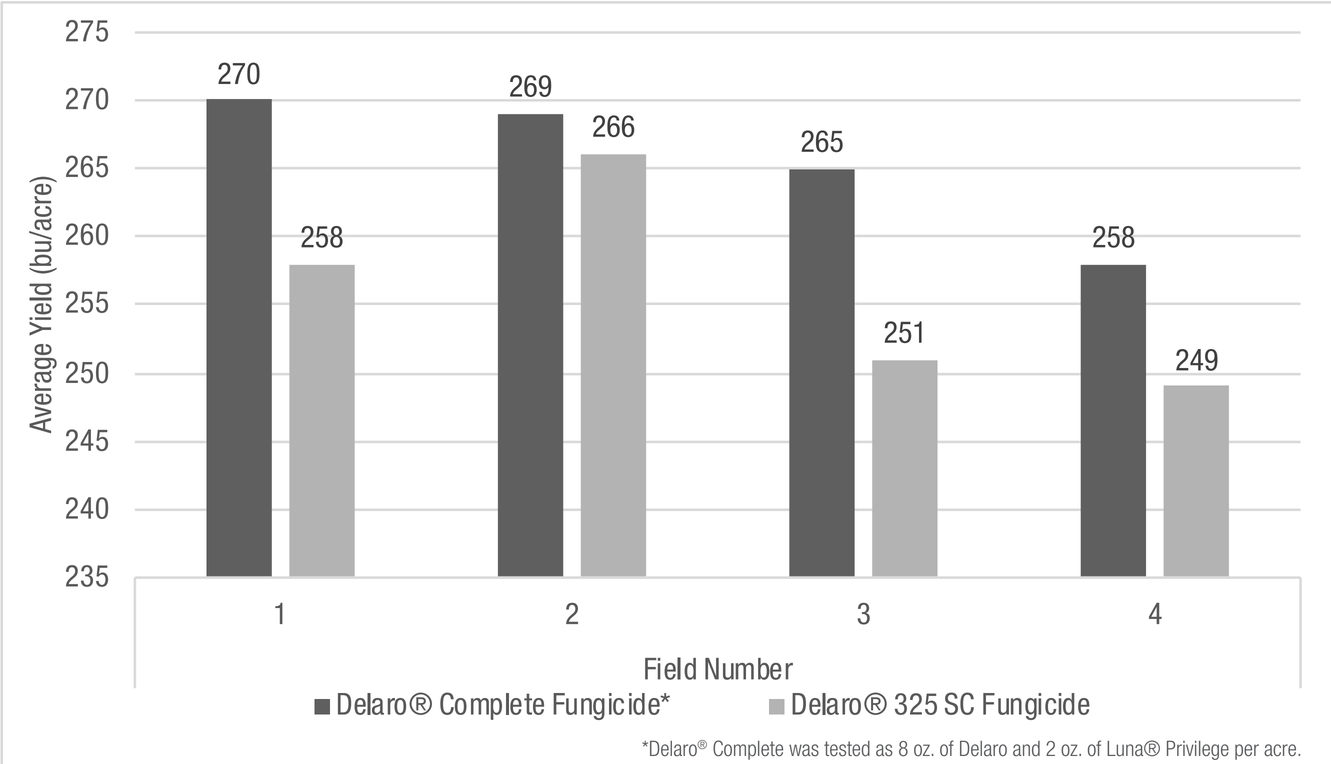

Figure 2. Average corn yield from Delaro® Complete fungicide and Delaro® 325 SC fungicide applied at the VT to R1 growth stages at four locations in eastern and central Nebraska. A 10 bu/acre average advantage for corn treated with Delaro Complete fungicide compared to Delaro 352 SC fungicide.

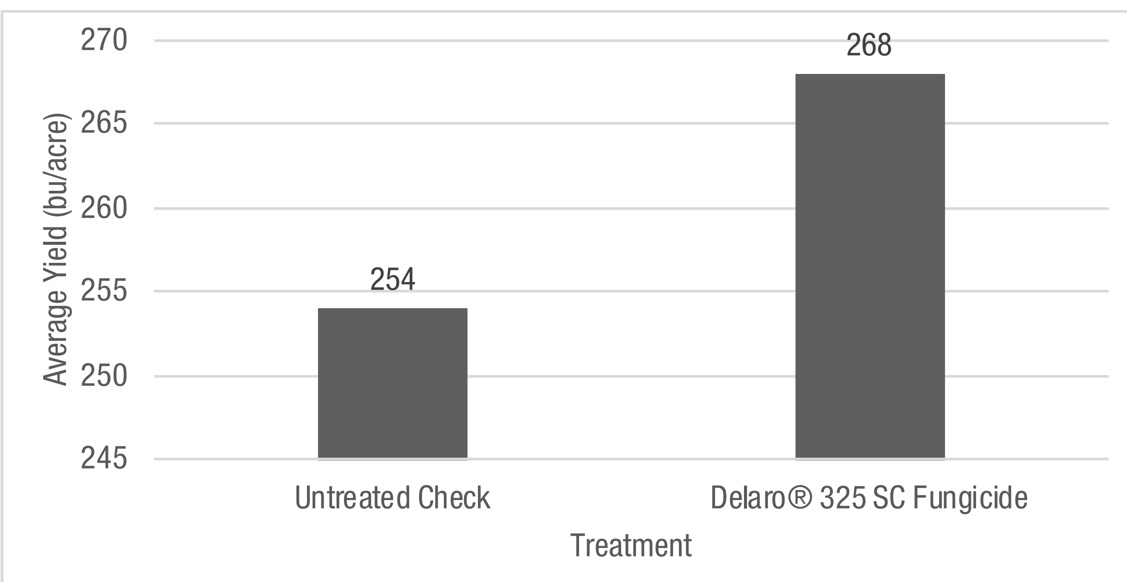

Figure 3. Average corn yield from a Delaro® 325 SC fungicide application at the VT to R1 growth stage. A 14 bu/acre average advantage for corn treated with the fungicide compared to the untreated check (average of 14 corn products from the 2020 Nebraska Corn Yield Demonstration Trials).

Nebraska Corn Performance with Delaro® Brand Fungicides

- For this demonstration, average yield increased over the untreated check by 20 bu/acre when Delaro® Complete fungicide was applied.
- The average yield of corn treated with Delaro® Complete fungicide had a 10 bu/acre advantage over corn treated with Delaro® 325 SC fungicide.
- The average yield of corn treated with Delaro® 325 SC fungicide was 14 bu/acre greater than the untreated check.

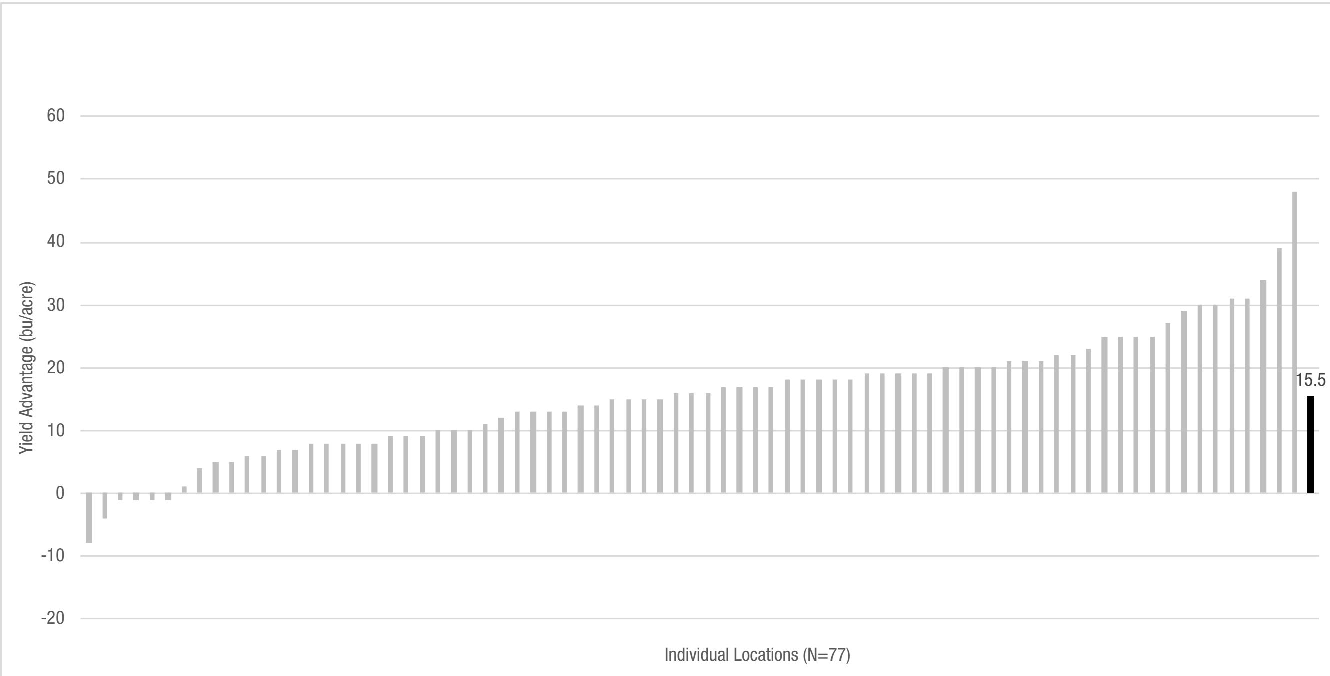

Figure 4. Preliminary national data (77 locations to date) demonstrated corn treated with Delaro® Complete fungicide* averaged a 15.5 bu/acre increase compared to an untreated check, which translates to a consistency rating of 92%. *Delaro® Complete was tested as 8 oz. of Delaro and 2 oz. of Luna® Privilege per acre.

Figure 5. Corn on August 27, 2020 in small plot trials at Carmi, Illinois. Plot on the left was untreated and plot on the right sprayed with Delaro® brand fungicides at the VT growth stage. Image courtesy of Dr. Jason Bond, Southern Illinois University.

Nebraska Corn Performance with Delaro® Brand Fungicides

Key Learnings

- Average yields increased at these locations when Delaro® Complete fungicide or Delaro® 325 SC fungicide were applied to corn at the VT to R3 growth stage compared to an untreated check.
- Applications of Delaro® Complete fungicide or Delaro® 325 SC fungicide can help improve overall plant health when applied to corn (Figure 5).
- Increased average yields are observed with a fungicide application to corn throughout Nebraska and in the Midwest Corn Belt.

Legal Statements

The information discussed in this report is from a multiple 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.

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.

ALWAYS READ AND FOLLOW GRAIN MARKETING AND ALL OTHER STEWARDSHIP PRACTICES AND PESTICIDE LABEL DIRECTIONS. Not all products are registered in all states and may be subject to use restrictions. The distribution, sale, or use of an unregistered pesticide is a violation of federal and/or state law and is strictly prohibited. Check with your local dealer or representative for the product registration status in your state. Tank mixtures: The applicable labeling for each product must be in the possession of the user at the time of application. Follow applicable use instructions, including application rates, precautions and restrictions of each product used in the tank mixture. Not all tank mix product formulations have been tested for compatibility or performance other than specifically listed by brand name. Always predetermine the compatibility of tank mixtures by mixing small proportional quantities in advance. Delaro® is a registered trademark of Bayer Group. All other trademarks are the property of their respective owners. For additional product information call toll-free 1-866-99-BAYER (1-866-992-2937) or visit our website at www.BayerCropScience.us. Bayer CropScience LP, 800 North Lindbergh Boulevard, St. Louis, MO 63167. 6005_R11_20

Delaro® 325 SC Fungicide Applications on Corn

Trial Objective

- Fungicide applications are an in-season management decision that can provide value but deciding how often to apply a fungicide can be complicated.
- The objective of this trial was to look at the impact of single or multiple Delaro® 325 SC fungicide applications across several corn products.

Research Site Details

Location	Soil Type	Previous Crop	Tillage Type	Planting Date	Harvest Date	Potential Yield (bu/acre)	Seeding Rate (seeds/acre)
Gothenburg, NE	Hord silt loam	Sorghum	Strip tillage	4/30/20	10/31/20	250	36,000

- Experimental design was a split-plot with four replications per treatment. Fungicide application treatments correspond to the entire plot and the corn germplasm was the sub-plot Three corn products were paired with two Delaro® 325 SC fungicide application programs and one non-treated check (Table 1).
- Corn was sprinkler irrigated with a total of 10 inches of irrigation applied in addition to 12 inches of rain received during the growing season.
- It was a relatively dry end to the growing season and minimal fungal disease development was found in the trial.
- Fertility applied included
  - 70 lb phosphorus (P)/acre, 15 lb sulfur (S)/acre, and 27.5 lb nitrogen (N)/acre band applied with strip till on 4/26/20,
  - 100 lb N/acre applied by stream bar on 4/28/20, and
  - 15 lb S/acre and 90 lb N/acre applied with 360 Y-DROP® applicators on 6/26/20.
- Weed control consisted of a pre-emergence application of
  - 3.0 oz/acre Balance® Flexx herbicide, 2.0 pt/acre Harness® brand herbicide, 1 qt/acre Atrazine 4L herbicide, and 1 qt/acre Roundup PowerMAX® herbicide on 5/1/20,
  - Followed by a post-emergence application of 3.0 oz/acre Laudis® herbicide, 3 pt/acre Warrant® herbicide, and 24 oz/acre Moxy® 2E herbicide on 6/10/2020.
- Greensnap, shelled corn weight, and harvest moisture were collected at harvest as a measure of product and fungicide application performance.

Delaro® 325 SC Fungicide Applications on Corn

Table 1. Treatment information including corn product and Delaro® 325 SC fungicide application rates and timing.					
Treatment	**Corn Product Relative Maturity (RM)**	**Corn Growth Stage at Fungicide Treatment**	**Fungicide**	**Rate**	**Application Timing (Date)**
1 2 3	112-RM 109-RM 113-RM	Non-Treated	None	Not Applicable	Not Applicable
4 5 6	112-RM 109-RM 113-RM	V5 + VT	Delaro® 325 SC fungicide	4 oz/acre	V5 (6/10/20)
			Delaro 325 SC fungicide	8 oz/acre	VT (7/24/20)
7 8 9	112-RM 109-RM 113-RM	VT	Delaro 325 SC fungicide	8 oz/acre	VT (7/24/20)

Understanding the Results

Table 2. Trial treatments and resulting average yield (bu/acre) and percent greensnap.				
Treatment	**Corn Product - RM**	**Corn Growth Stage at Fungicide Treatment**	**Average Yield (bu/acre)**	**Greensnap (%)**
1	112-RM	Non-Treated	251.0	5.9
2	109-RM		240.9	18.0*
3	113-RM		235.2	7.5
4	112-RM	V5 + VT	251.7	4.3
5	109-RM		254.7	7.2*
6	113-RM		254.0	6.2
7	112-RM	VT	248.1	5.6
8	109-RM		247.4	10.9*
9	113-RM		251.6	7.4
*Indicates an interaction between the fungicide treatment and corn product. Least significant difference (LSD) (0.1) = 4.3.				

Delaro® 325 SC Fungicide Applications on Corn

- Analysis showed that one of the corn products had a different greensnap response to Delaro® 325 SC fungicide treatment as detailed in Table 2.
- The 109-RM corn product had a lower percent greensnap with Delaro® 325 SC fungicide applied at the V5+VT growth stage.
- Analysis showed the 109-RM corn product had a positive response to fungicide application with Delaro® 325 SC by exhibiting reduced greensnap (Table 2) compared to non-treated control treatment.
- Overall, average yield was increased in this irrigated trial with the Delaro® 325 SC fungicide application at VT compared to non-treated control.
- The average yield of corn with Delaro® 325 SC fungicide program applied at V5+VT growth stages was significantly higher than the non-treated check plots.
- Greensnap mostly occurred in the late vegetative growth stage around V15 to V16 with a severe thunderstorm in the early hours of July 10, 2020.

Figure 1. Typical evidence of greensnap at the end of the season. Damage originated from high winds during a storm in mid-July 2020. Most snap occured at or one node above the main ear.

Key Learnings

- In this specific field trial, the VT fungicide application complemented with early fungicide application (V5) increased yield by 11 bu/acre across all corn products in a low disease environment.
- A fungicide application can improve plant health and potentially reduce yield loss.
- Farmers should work with their local Bayer sales team member to decide if a fungicide application of Delaro® 325 SC could be beneficial to their corn production acres.

Legal Statements

Delaro® 325 SC Fungicide Effect on Corn Product Yield

Trial Objective

- Fungicide application in corn can help prevent disease and promote plant health which can result in increased yield potential.
- The objective of this trial was to determine the yield effect of Delaro® 325 SC fungicide application on thirty corn products.

Research Site Details

Location	Soil Type	Previous Crop	Tillage Type	Planting Date	Harvest Date	Potential Yield (bu/acre)	Seeding Rate (seeds/acre)
Gothenburg, NE	Hord silt loam	Soybean	Strip-till	5/1/20	11/5/20	250	36,000

- This study was setup up as a split-plot design with four replications.
  - Fungicide application was the whole plot and corn product was the sub-plot (10-ft wide and 20-ft long).
  - Delaro® 325 SC fungicide was applied at 8 oz/acre at the VT growth stage, and no fungicides were applied to the untreated checks. Application occurred on 7/26/2020.
  - Thirty corn products with a range of relative maturity (RM) from 101 to 120 RM were used in this trial.
- Fertilizer applications included:
  - 4/16/2020- 70 lb phosphorus/acre, 15 lb sulfur(S)/acre, and 27.5 lb nitrogen (N)/acre applied with strip tillage,
  - 4/28/2020- 100 lb N/acre applied with a stream bar,
    6/26/2020- 90 lb N/acre and 15 lb S/acre applied with 360 Y-DROP® applicators.
- Weeds were controlled with herbicides and no other pesticides were applied other than the Delaro 325 SC fungicide treatment.
- Test weight, moisture, and total shelled weight were collected to calculate yield.
- Yield was corrected to a standard of 15% moisture content.
- Precipitation late in the season was minimal (0.51 inch in August and 0.5 inch in September) which resulted in unfavorable conditions for disease development.

Delaro® 325 SC Fungicide Effect on Corn Product Yield

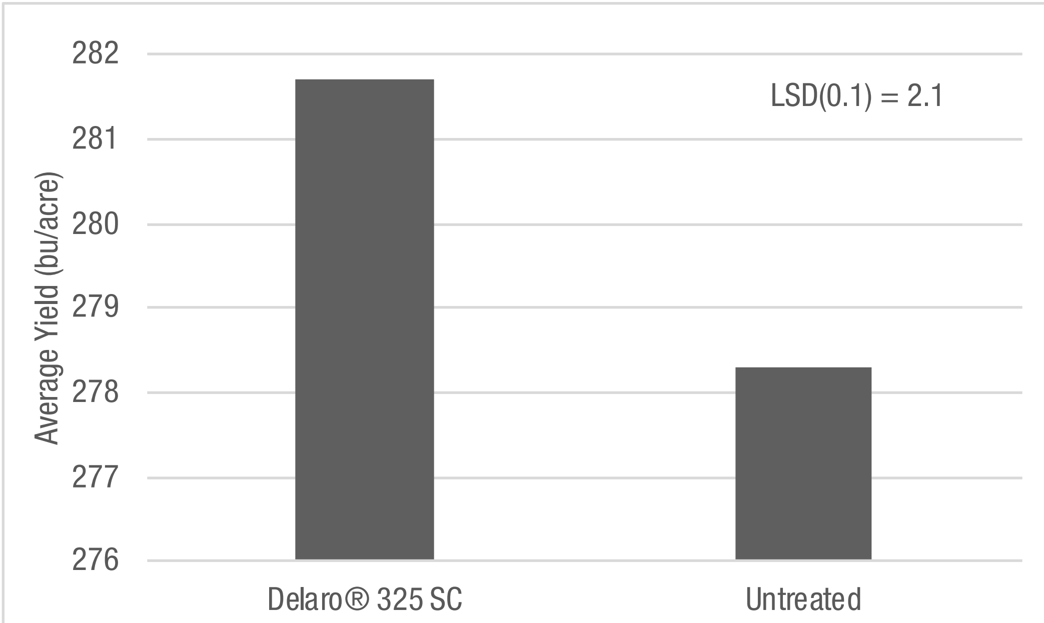

Figure 1. Average corn yield across products with a Delaro® 325 SC fungicide applied at the VT growth stage and the untreated check.

Understanding the Results

- At this location, the corn products treated with the Delaro® 325 SC fungicide application had a significantly greater average yield than corn products that did not receive an application.

Key Learnings

- For this trial, fungicide application increased the average yield by 3.4 bu/acre across all corn products in a low disease environment. A fungicide application can help prevent disease and potentially reduce yield loss compared to untreated crops.
- Farmers should work with their local Bayer sales team member to decide if a fungicide application of Delaro® 325 SC fungicide could be beneficial to their corn production acres.

Legal Statements

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ALWAYS READ AND FOLLOW PESTICIDE LABEL DIRECTIONS. 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.

Standability and Yield Potential of DEKALB® 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. Further increases beyond this threshold negatively impacts yield and/or economic return for the product.[1,2] Defining the seeding rate threshold for a corn product is difficult as it's highly affected by management practices and the environmental conditions during the growing season.
- However, knowing this threshold is critical as it forms the basis upon which other management practices are based.
- The objective of this trial was to evaluate the yield potential and standability of DEKALB® corn products to seeding rate.

Research Site Details

Location	Soil Type	Previous Crop	Tillage Type	Planting Date	Harvest Date	Potential Yield (bu/acre)	Planting Rate (seeds/acre)
Scott, MS	Silt loam	Soybean	Conventional	5/1/2020	9/17/2020	250	17,500 22,500 27,500 32,500 37,500 42,500

- All weed control, insect control, and irrigation inputs were applied per local standards.
- Eight DEKALB® corn products were planted on bedded single rows with 38-inch row spacing at 17,500, 22,500, 27,500, 32,500, 37,500, and 42,500 seeds/acre.
  - » DKC65-95 brand, VT Double PRO® Technology
  - » DKC65-99 brand, Trecepta® Technology
  - » DKC66-18 brand, VT Double PRO® Technology
  - » DKC67-37 brand, SmartStax® Technology
  - » DKC67-44 brand, VT Double PRO® Technology
  - » DKC67-94 brand, Trecepta® Technology
  - » DKC69-99 brand, Trecepta® Technology
  - » DKC70-27 brand, VT Double PRO® Technology
- 240 lb of nitrogen was applied as 32% liquid UAN.
- The trial was conducted as a single replicate strip plot and each plot was approximately 0.6 acre.
- All data was collected using Precision Planting® 20/20 SeedSense® via Climate Fieldview™ Platform. Yields were corrected to 15.5% in the analysis.

Standability and Yield Potential of DEKALB® Corn Products to Seeding Rate

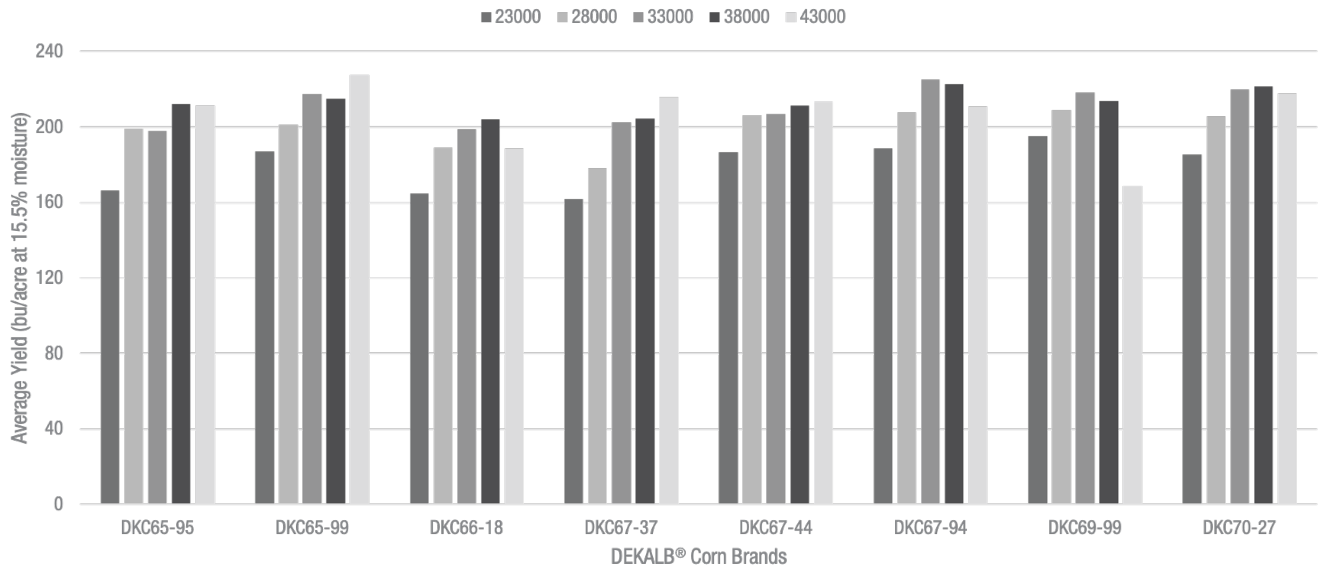

Figure 1. Average yield of DEKALB® corn brands in 2020 at Scott Learning Center by seeding rate.

- Not all products in this demonstration responded the same to seeding rate in either yield or standability. Individual product response to increasing seeding rate varied across corn products but followed an upward trend in average yield (Figure 1). Generally, corn seeding rates are most favorable in the 33,000 to 38,000 range for most of the tested products in this demonstration.
  - Across all corn products, the return on investment (ROI) for a 10,000 seeds/acre increase in seeding rate was $10.54/acre (Table 1).
  - Of the eight products tested, six of them responded favorably to higher seeding rates with a range of $9.00 to $56.00/acre for a 10,000 seeds/acre increase in seeding rate (Table 1).
  - The average ROI for these six products was $20.42/acre over seed costs (Table 1).
  - The remaining two products showed either lodging issues or little yield response to increasing seeding rate. This led to a negative average ROI of -$19.10/acre for greatly increasing seeding rate (Table 1).
  - It is important to note that while these returns on investment are from one season of data, the average yield results based on seeding rate are similar to other SLC research in previous years.

Standability and Yield Potential of DEKALB® Corn Products to Seeding Rate

Table 1. Economic effect of seeding rate on corn productivity. Average gross income was adjusted for seed cost using an estimated $3.75 per 1,000 seed across all corn products, and corn price at $3.50/bu.

DEKALB® Corn Brand	Corn Seeding Rate (seeds/acre)					28,000 vs 38,000 Average Yield Difference (bu/acre)	Value at Grain Price $3.50/bu	Cost (per 10,000 seeds)	Net Return on Investment for 28,000 vs 38,000 seeds per acre
	23,000	28,000	33,000	38,000	43,000				
DKC65-95	166.5	199.1	198.2	212.3	211.2	13.2	46.21	37.50	8.71
DKC65-99	187.3	201.3	217.5	215.0	227.5	13.8	48.20	37.50	10.70
DKC66-18	164.6	189.0	198.8	204.1	188.7	15.1	52.69	37.50	15.19
DKC67-37	162.0	178.0	202.4	204.6	215.9	26.6	92.98	37.50	55.48
DKC67-44	186.6	206.0	207.0	211.5	213.4	5.5	19.29	37.50	-18.21
DKC67-94	188.7	207.8	225.0	222.5	211.2	14.8	51.69	37.50	14.19
DKC69-99	195.0	209.0	218.2	214.0	168.9	5.0	17.52	37.50	-19.98
DKC70-27	185.6	205.7	219.7	221.7	218.0	15.9	55.75	37.50	18.25
All Corn Products	179.5	199.5	210.9	213.2	206.8	13.7	48.0	37.50	10.54

Key Learnings

- Knowing the optimal seeding rate of a corn product can help maximize yield potential.
- Our observations at Scott Learning Center showed that corn products can and do respond favorably to higher seeding rates. However, high plant populations can result in lodging and exacerbate harvest difficulties. Conversely, full yield potential may not be realized with lower than optimal seeding rates.
- Growers should carefully evaluate each new corn product planted for its response to population in both standability and yield with multiple years and locations used for reference.
- Seeding rate should be adjusted based on field yield potential levels and soil types, as well as the potential return on investment.
- The cost of seed corn is one of the largest variable input costs for most corn growers.[3] Minimizing that cost includes wise selection of seeding rates. This research can help growers evaluate DEKALB corn product seeding rates for their operations.
- Contact your local Field Sales Representative or Technical Agronomist for planting recommendations for the current situation and year.

Sources

[1] Fromme, D.D., Spivey, T.A., and Grichar W.J. 2019. Agronomic response of corn (Zea mays L.) hybrids to plant populations. International Journal of Agronomy. Vol 2019. https://doi.org/10.1155/2019/3589768.

[2] Nielsen, R.L., Camberato, J., and Lee, J. 2019. Yield response of corn to plant population in Indiana. Agronomy Department. Purdue University. http://agry.purdue.edu.

[3] Langemeir, M.R., Dobbins, C.L., Nielsen, R.L., Vyn, T.J., Casteel, S., Johnson, B. 2019. Purdue crop cost and return guide. Purdue Extension. ID-166-W. http://ag.purdue.edu.

Websites verified 09/29/2020

Standability and Yield Potential of DEKALB® Corn Products to Seeding Rate

Legal Statements

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ALWAYS READ AND FOLLOW PESTICIDE LABEL DIRECTIONS. B.t. products may not yet be registered in all states. Check with your seed brand representative for the registration status in your state.

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. 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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Before opening a bag of seed, be sure to read, understand and accept the stewardship requirements, **including applicable refuge requirements for insect resistance management,** for the biotechnology traits expressed in the seed as set forth in the Monsanto Technology/Stewardship Agreement that you sign. By opening and using a bag of seed, you are reaffirming your obligation to comply with the most recent stewardship requirements.

Dryland Corn Production Systems in a Tough Environment

Trial Objective

- Successfully managing dryland corn requires a well-planned system to achieve the best results with limited moisture.
- This research trial compares DEKALB® brand corn products and Bayer herbicide products to Pioneer® brand corn products and associated herbicide products in a dryland environment.

Research Site Details

Location	Soil Type	Previous Crop	Tillage Type	Planting Date	Harvest Date	Potential Yield (bu/acre)
Gothenburg, NE	Cozad silt loam	Sorghum	No tillage	5/8/2020	11/2/2020	200

- The study design was a randomized complete block with 12 treatments and four replications.
- Four DEKALB® brand corn products and two Pioneer® brand corn products were planted at 16,000 and 22,000 seeds/acre, to simulate the lower and upper range of dryland seeding rates in the area. From Gothenburg, seeding rates trend lower as you move west and higher as you move east.
- The previous crop was grain sorghum to provide a drier environment to stress the dryland corn systems.
- Treatments 1 through 8 were planted to DEKALB® brand corn products and received a pre-emergence herbicide application of Balance® Flexx herbicide (0.125 qt/acre), Harness® Xtra 5.6L herbicide (2 qt/acre), Roundup PowerMAX® herbicide (1 qt/acre) and AMS (17 lb/100 gal), and a V6 application of DiFlexx® herbicide (0.25 qt/acre), AAtrex® 4L herbicide (0.5 qt/acre), Roundup PowerMAX herbicide (1 qt/acre) and AMS (17 lb/100 gal).
- Treatments 9 through 12 were planted to Pioneer® brand corn products and received a pre-emergence herbicide application of Cinch® ATZ herbicide (2.25 qt/acre), Sterling Blue® herbicide (0.125 qt/acre), Durango® DMA® herbicide (1.1 qt/acre) and AMS (17 lb/100 gal), and a V6 application of Sterling Blue herbicide (0.25 qt/acre), AAtrex 4L herbicide (0.5 qt/acre), Durango DMA herbicide (1.1 qt/acre) and AMS (17 lb/100 gal).
- The pre-emergence herbicide application occurred on 5/9/2020, and the V6 application occurred on 6/30/2020.
- Fertility applied with a Chafer fertilizer stream bar included 20 lb nitrogen/acre, 50 lb phosphorus/acre, 11 lb sulfur/acre on 4/14/2020 and 150 lb nitrogen/acre applied 4/27/20.
- No other pesticides were used in this trial.
- 2020 was a dry year with below average precipitation during the growing season particularly during grain fill. Precipitation was 5.18 inches in May, 1.56 inches in June, 4.19 inches in July, 0.51 inches in August, and 0.5 inch in September.
- At harvest, yield was collected as a measure of system performance.

Dryland Corn Production Systems in a Tough Environment

DEKALB® DKC61-54RIB brand blend @ 16,000 seeds/acre

Pioneer® brand P1197AM @ 16,000 seeds/acre

DEKALB® DKC61-54RIB brand blend @ 22,000 seeds/acre

Pioneer® brand P1197AM @ 22,000 seeds/acre

Figure 1. System comparison of DEKALB® DKC61-54RIB brand blend and Pioneer® brand P1197AM corn ears from 8.7 feet of row. Ears close together are from same plant. Bayer Crop Science, Gothenburg Water Utilization Learning Center, Gothenburg, NE in 2020.

Dryland Corn Production Systems in a Tough Environment

Understanding the Results

- For this trial, three of four DEKALB® brand products planted at 16K seeds/acre yielded statistically greater than the Pioneer® brand products planted at the same rate. DEKALB® DKC51-25RIB Brand Blend yielded statistically the same as Pioneer® brand P0157AM.
- Three out of four DEKALB® brand products planted at the 22K seeds/acre produced statistically greater yields than the Pioneer® brand products planted at the same seeding rate. DEKALB® DKC51-25RIB Brand Blend yielded the same as both Pioneer® brand products planted at 22K seeds/acre.

Table 1. Average yield of corn products at two seeding rates.

Treatment	Corn Product	Seeding Rate (seeds/acre)	Average Yield (bu/acre)
1	DEKALB® DKC51-25RIB Brand Blend	16K	149.3
2	DEKALB® DKC58-34RIB Brand Blend	16K	168.1
3	DEKALB® DKC61-54RIB Brand Blend	16K	177.3
4	DEKALB® DKC64-25RIB Brand Blend	16K	154.7
5	DEKALB® DKC51-25RIB Brand Blend	22K	161.7
6	DEKALB® DKC58-34RIB Brand Blend	22K	172.9
7	DEKALB® DKC61-54RIB Brand Blend	22K	193.1
8	DEKALB® DKC64-25RIB Brand Blend	22K	191.3
9	Pioneer® brand P0157AM	16K	134.4
10	Pioneer® brand P1197AM	16K	125.0
11	Pioneer® brand P0157AM	22K	154.8
12	Pioneer® brand P1197AM	22K	153.4
			LSD (0.1) = 16.4

Dryland Corn Production Systems in a Tough Environment

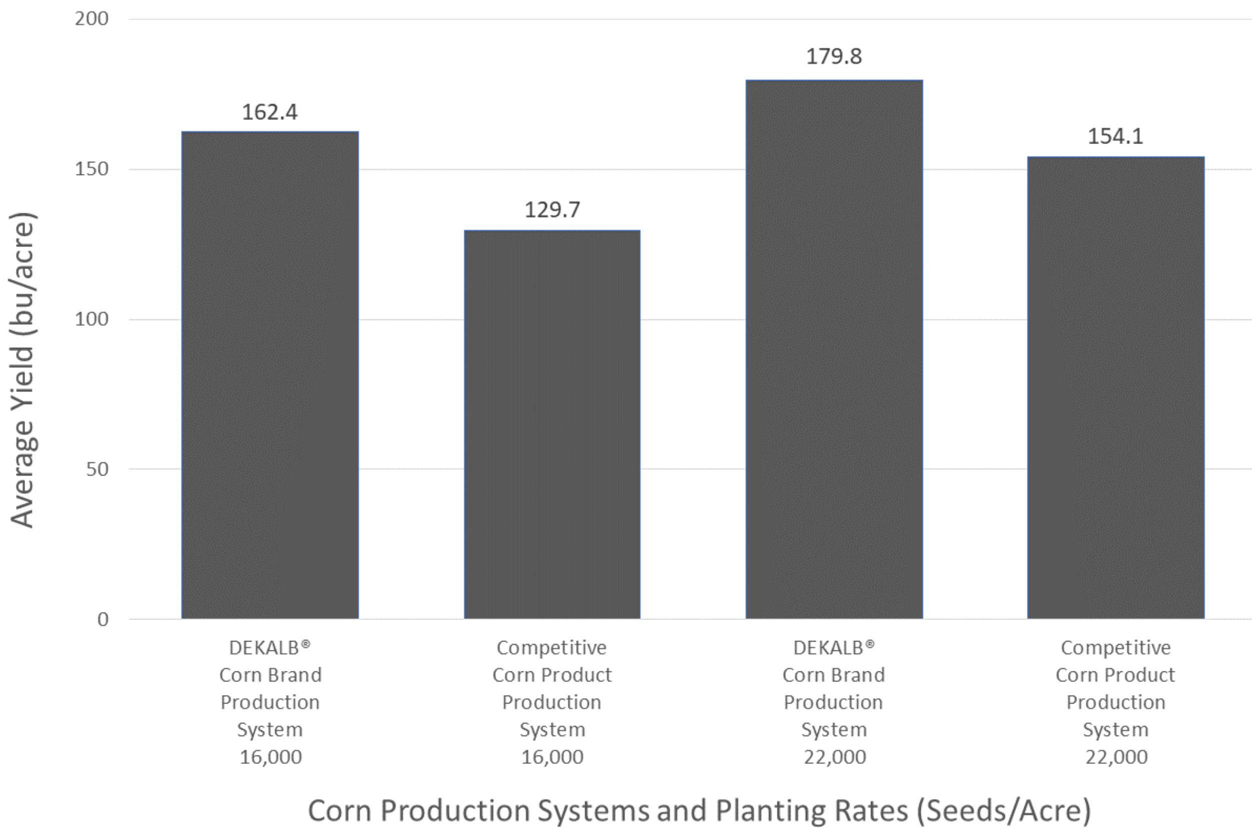

Figure 2. Dryland system yield comparison between DEKALB® Brand Blend products and Pioneer® brand Optimum® AcreMax® products at the Bayer Crop Science, Gothenburg Water Utilization Learning Center, Gothenburg, NE in 2020.

- For this trial, the DEKALB® corn brand production system had an average yield advantage of over 30 bu/acre at a planting rate of 16,000 seeds/acre and over 25 bu/acre at 22,000 seeds/acre (Figure 2).
- Returns, based on the yield advantage, a seed cost of $250/80K unit, and $3.80/bu for commodity corn showed a DEKALB® corn brand advantage of $143/acre for 16,000 seeds/acre and $116/acre for 22,000 seeds/acre over the Pioneer® brand Optimum® AcreMax® corn production system.
- Increasing the seeding rate by 6,000 seeds/acre improved the yield in both the DEKALB® corn brand production system and the Pioneer® brand Optimum® AcreMax® corn production system.
- The increase in seeding rate also improved the return/acre for both systems when the seed cost was set at $250/80K unit of seed and a corn price of $3.80/bu.
- For every dollar spent on seed, moving from 16,000 seeds/acre to 22,000 seeds/acre returned $3.53 in the DEKALB® corn brand production system.

Dryland Corn Production Systems in a Tough Environment

Key Learnings

- Improving profitability potential on dryland acres is a key revenue driver on many farms. It is also an uncertain one because precipitation plays a much larger part in yield potential than it does for fully irrigated acre.
- 2020 was a below average season in terms of precipitation with very low rainfall totals during the grain fill period in August and September.
- In the tough environment, the DEKALB® corn brand dryland corn production system outperformed the Pioneer® brand Optimum® AcreMax® corn production system at both seeding rates.
- For this trial, increasing the seeding rate from 16,000 seeds/acre to 22,000 seeds/acre provided better average yields and returns in a year when precipitation was limited.

Legal Statements

The information discussed in this report is from a single site, 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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Insect Resistance Management
Planting Refuges, Preserving Technology

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DEKALB® Corn Products for High pH Soils

Trial Objective

- A high soil pH is generally classified as having a soil pH of 7.6 or higher and could have the characteristics of excess lime, high soluble salt concentration, and high nitrate-nitrogen concentration.
- In Western Kansas and Eastern Colorado, excess lime from high calcium carbonate concentrations in the soil parent material is the source of the high pH, which is found on eroded sidehills and cut areas in fields.
- Corn products can respond differently to high pH soils, from tolerant to non-tolerant. Products that are non-tolerant usually express iron deficiency chlorosis (IDC) with symptoms including yellow leaves, interveinal chlorosis, and stunted growth.
- Key nutrients, including iron, are tied up in high pH soils and not available to the plant.
- Better product characterization allows for better product placement to help maximize yield potential.
- The objective of this study was to determine the visual response of corn products to soil pH and yield potential in moderate pH (6.6 to 7.5) and high pH (7.6+) soils.

Research Site Details

Location	Soil Type	Previous Crop	Tillage Type	Planting Date	Harvest Date	Potential Yield (bu/acre)	Seeding Rate (seeds/acre)
Oakley, KS	Silt loam	Corn	Strip tillage	5/12/20	10/22/20	235	30K

- For this trial, 68 commercial and experimental corn products of varying relative maturities (RMs) were planted in two separate blocks in the same field. One block had a soil type with a high pH (7.6-8.1) and the other block was planted in a soil with a neutral pH (6.6-7.5).
  - 35 products had RMs ranging from 103- to 107-day and were grouped as 105 RM.
  - 33 products had RMs ranging from 108- to 113-day and were grouped as 110 RM.
- Nine of these products were DEKALB® brand blend corn products; only the results of the DEKALB products are shown in this report.
- A visual color rating of the foliage was taken at the V8 and VT growth stage:
  - very dark green = 2
  - pale-yellow color = 8
- For each pH block, the average yield of each product was compared to the average yield of all products within the RM group.
- Each trial was replicated in a high pH zone and a moderate pH zone in the same field at each block location.
- Soil pH was determined by grid sampling each trial area at a 1/10th acre density.
- Trial was planted on a site that was previously planted in corn and a soil-applied insecticide was included across the trial to help control western corn rootworm.

DEKALB® Corn Products for High pH Soils

Understanding the Results

- There was no visual difference among products when planted in neutral pH soils (data not shown).
- Average yields in this trial were less than expected this year and may have been a result of excessive heat and drought conditions.
- Across the nine DEKALB® products tested, the average yield of the 105RM group was 5.8 bu/acre less than the average yield of the 110RM group in the high pH block.
- Products in 110 RM group yielded on average 3.1 bu/acre more than the products in in the 105 RM group when planted in the neutral pH block. In optimal growing conditions, longer RM products generally have greater yield potential.
- DKC56-15RIB Brand Blend had green, healthy plant color at the V8 and VT growth stages and yielded greater than similar RM products on high pH soils and is highly recommended for high pH soils.
- DKC60-87RIB Brand Blend and DKC61-40RIB Brand Blend had lower than average visual appearance but yielded greater than similar RM products on high and neutral pH soils. These products are recommended for most situations for high pH soils.
- DKC53-27RIB Brand Blend and DKC54-64RIB Brand Blend had above average visual ratings but slightly below average yields to comparable RM corn products. These products are recommended to use with caution on high pH soils.
- DKC55-54RIB Brand Blend had lower than average visual appearance but yielded greater than similar RM products on high and neutral soils. Based on previous years data DKC55-54RIB Brand Blend is not recommended for high pH soils.
- DKC59-81RIB Brand Blend, DKC60-67RIB Brand Blend, and DKC62-98RIB Brand Blend had average to below average visual appearance and below average yields. It is recommended to use these products with caution on high pH soils.

Figure 1. Visual example of an 8 and 2 rating at the V8 growth stage.

DEKALB® Corn Products for High pH Soils

Table 1. Average yield of corn product compared to average yield of relative maturity group.

		High pH						Neutral pH			
Hybrid	Relative Maturity (RM)	Average Yield (bu/acre)	% Moisture	RM Average Yield (bu/acre)	Delta to RM Group	V8 Visual Score	VT Visual Score	Average Yield (bu/acre)	% Moisture	RM Average Yield (bu/acre)	Delta to RM Group
DKC53-27RIB Brand Blend	105	142.2	15.7	147.4	-5.2	3.3	3.0	182.4	16.5	206.1	-23.7
DKC54-64RIB Brand Blend	105	137.3	15.2	147.4	-10.1	3.8	3.3	208.4	16.9	206.1	2.3
DKC55-54RIB Brand Blend	105	155.1	16.6	147.4	7.7	5.0	5.0	225.3	17.9	206.1	19.2
DKC56-15RIB Brand Blend	105	155.2	14.2	147.4	7.8	3.5	2.5	220.5	18.2	206.1	14.4
DKC59-81RIB Brand Blend	110	139.3	16.7	153.2	-13.9	4.3	4.8	216.8	18.3	209.2	7.6
DKC60-67RIB Brand Blend	110	131.6	16.9	153.2	-21.6	5.5	5.0	205.1	17.1	209.2	-4.1
DKC60-87RIB Brand Blend	110	150.0	16.5	153.2	-3.2	4.5	4.9	204.4	18.1	209.2	-4.8
DKC61-40RIB Brand Blend	110	155.3	16.1	153.2	2.1	4.0	4.5	216.2	17.6	209.2	7.0
DKC62-89RIB Brand Blend	110	133.2	16.9	153.2	-20.0	4.0	4.0	232.8	18.0	209.2	23.6
Average		**144.4**	**16.1**	-	**-6.3**	**4.2**	**4.1**	**212.4**	**17.6**	-	**4.6**

Key Learnings

- High pH soils are typically found in areas with eroded top soil and topography changes, which make it difficult to compare yields between neutral and high pH areas of the field. Producers need to keep this in mind while making yield comparisons on their own farm.
- The importance of selecting a product able to tolerate high pH soils varies based on soil pH level and the proportion of high pH soil acres in each field.
- Corn product pH tolerance was indicated by a visual color rating, but color expression can also be influenced by other abiotic factors such as soil temperature, nutrient availability, and nutrient uptake. Producers should assess all potential problems when assessing product performance under high pH soils.

Legal Statements

Tailoring Irrigated Corn Systems with Seed, Weed, and Disease Management

Trial Objective

- Decisions about what pest management system in corn is the best can be difficult with limited information comparing weed and disease control options.
- The objective of this study was to evaluate yield effects of combining DEKALB® brand corn products, weed control, and disease control from Bayer compared to a competitive system.

Research Site Details

Location	Soil Type	Previous Crop	Tillage Type	Planting Date	Harvest Date	Potential Yield (bu/acre)	Seeding Rate (seeds/acre)
Gothenburg, NE	Hord silt loam	Sorghum	Strip till	4/30/20	10/31/20	260	36,000

- This study was setup in a split-plot design with three replications. The weed and disease control systems were the whole plot, and corn products were the sub-plot.
- The Bayer corn system included three DEKALB® brand corn products paired with three Bayer pesticide application programs.
- The competitive corn system included one competitor corn product paired with a competitive pesticide application program.
- Table 1 contains details of the weed and disease control products used in the study, as well as the application timing when the products were applied.
- A total of 10 inches of sprinkler-irrigation was applied in addition to the 12 inches of rain received during the growing season.
- Fertility application included:
  - » 70 lb phosphorus/acre, 15 lb sulfur (S)/acre, and 27.5 lb nitrogen (N)/acre banded with strip till on 4/26/20,
  - » 100 lb N/acre applied with a streamer bar on 4/28/20, and
  - » 15 lb S/acre and 90 lb N/acre Y-drop applied with 360 Y-DROP® applicators on 6/26/20.
- Average yield of each corn system was calculated from shelled corn weight, moisture, and test weight.

Tailoring Irrigated Corn Systems with Seed, Weed, and Disease Management

Table 1. Treatment descriptions including applications and timings.

Treatment (#)[1]	Corn Product Brand Blend	Corn System	Pesticides Used	Rate	Application Timing (Date)
1 2 3	DKC61-40RIB DKC63-90RIB DKC70-27RIB	1	Corvus® herbicide Roundup PowerMAX® herbicide Atrazine 4L herbicide Ammonium sulfate (AMS)	0.125 qt/acre 1 qt/acre 1 qt/acre 17 lb/100 gal	Pre-emerge (5/1/2020)
			Delaro® 325 SC fungicide DiFlexx® herbicide Roundup PowerMAX herbicide AMS	0.125 qt/acre 12 fl oz/acre 1 qt/acre 17 lb/100 gal	V5 (6/10/20)
			Delaro 325 SC fungicide	0.25 qt/acre	VT (7/24/20)
4 5 6	DKC61-40RIB DKC63-90RIB DKC70-27RIB	2	Corvus herbicide Roundup PowerMAX herbicide Atrazine 4L herbicide AMS	0.125 qt/acre 1 qt/acre 1 qt/acre 17 lb/100 gal	Pre-emerge (5/1/2020)
			DiFlexx herbicide Roundup PowerMAX herbicide AMS	12 fl oz/acre 1 qt/acre 17 lb/100 gal	V5 (6/10/20)
			Delaro 325 SC fungicide	0.25 qt/acre	VT (7/24/20)
7 8 9	DKC61-40RIB DKC63-90RIB DKC70-27RIB	3	Balance® Flexx herbicide Atrazine 4L herbicide Roundup PowerMAX herbicide AMS	0.125 qt/acre 1 qt/acre 1 qt/acre 17 lb/100 gal	Pre-emerge (5/1/2020)
			DiFlexx herbicide Roundup PowerMAX herbicide AMS	12 fl oz/acre 1 qt/acre 17 lb/100 gal	V5 (6/10/20)
			Delaro 325 SC fungicide	0.25 qt/acre	VT (7/24/20)
10	Pioneer® Brand corn product P1379AM	4	Resicore® Herbicide Durango® DMA® herbicide AMS	1.25 qt/acre 1.09 qt/acre 17 lb/100 gal	Pre-emerge (5/1/2020)
			Resicore® Herbicide Durango® DMA® herbicide AMS	1.25 qt/acre 1.09 qt/acre 17 lb/100 gal	V5 (6/10/20)
			DuPontTM Aproach® Prima fungicide	0.1875 qt/acre	VT (7/24/20)

[1]Treatments 1 through 9 use Bayer Crop Science corn and pesticide products. Treatment 10 uses competitor corn and pesticide products.

Table 2: Treatment average yield results.

Treatment	Corn Product	Corn System	Average Yield (bu/acre)
1	DKC61-40RIB Brand Blend	1	258.7
2	DKC63-90RIB Brand Blend	1	258.5
3	DKC70-27RIB Brand Blend	1	267.3
4	DKC61-40RIB Brand Blend	2	247.6
5	DKC63-90RIB Brand Blend	2	260.6
6	DKC70-27RIB Brand Blend	2	248.1
7	DKC61-40RIB Brand Blend	3	262.1
8	DKC63-90RIB Brand Blend	3	254.4
9	DKC70-27RIB Brand Blend	3	262.9
10	Pioneer® Brand corn product P1379AM	4	251.6

Tailoring Irrigated Corn Systems with Seed, Weed, and Disease Management

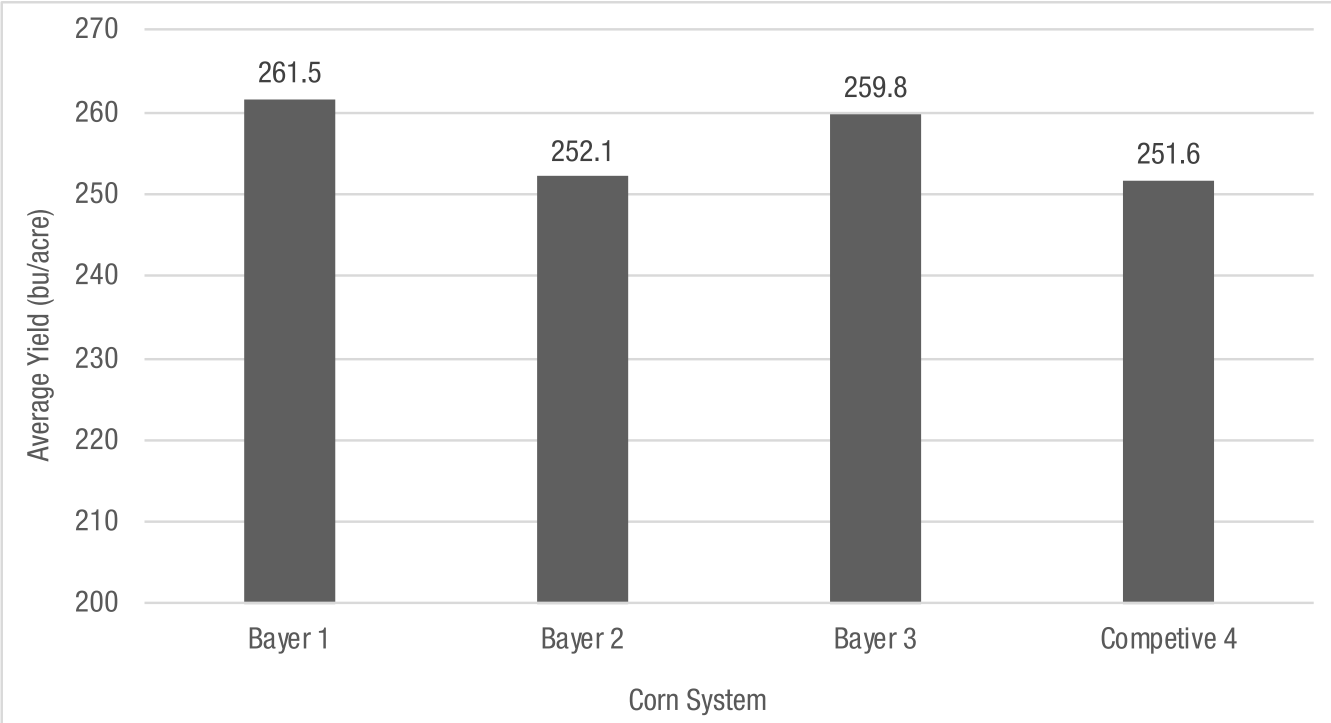

Figure 1. Average yield response by corn system.

- There were no significant yield differences between systems; however, the Bayer systems (Systems 1, 2, and 3) produced a higher average yield than the competitive system in the trial (Figure 1).
- The highest average yield in this trial was from Corn System 1, which included two applications of Delaro® 325 SC fungicide applied at V5 and R1 growth stages.
- Corn System 3 included a Delaro 325 SC fungicide application at VT growth stage. This system had slightly lower average yields than Corn System 1.
- Corn System 2 was treated with Delaro 325 SC fungicide plus Corvus® herbicide at the VT growth stage. This system had the lowest average yield of the Bayer systems.

Key Learnings

- Evaluating complete systems of corn products, herbicides, and disease management tools can be difficult because there are a limited number of system combinations that can be addressed in a given trial.
- The four systems researched here are all viable systems currently used in irrigated corn production.
- There may be some value in multiple fungicide applications, as observed in Corn System 1.
- Corn System 3 provided a good combination of corn, herbicide, and fungicide products that produced high average yields for this trial.
- In summary, farmers should work with their local DEKALB® brand team member to identify which corn product, weed control option, and disease control option provides the best opportunity for success in a given field.

Tailoring Irrigated Corn Systems with Seed, Weed, and Disease Management

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Effect of Irrigation System on Corn Yield

Trial Objective

- Irrigation is a common practice in Central Nebraska and research is constantly being performed to improve its efficiency. Irrigation system design could have an impact on the amount of water absorbed by plants versus water lost to evaporation.
- The objective of this study was to determine the effect of irrigation system, Dragon-Line® drip-line tubing versus standard sprinkler drop nozzles, on corn yield.

Research Site Details

Location	Soil Type	Previous Crop	Tillage Type	Planting Date	Harvest Date	Potential Yield (bu/acre)	Seeding Rate (seeds/acre)
Gothenburg, NE	Hord silt loam	Corn	Strip-till	5/1/20	10/28/20	250	35,000

- This study was designed to compare yields from corn irrigated with either a standard irrigation sprinkler drop nozzle with a rotating deflector to Dragon-Line® drip-line tubing. There were three replications of each treatment.
  - Six inches of irrigation were applied in six, 1-inch irrigation applications.
- The study used a 109 RM corn product.
- Fertility included 100 lb nitrogen (N)/acre applied using a Chafer Fertilizer Stream Bar on 4/27/20, and 90 lb N/acre and 15 lb sulfur/acre applied using a 360 Y-DROP® applicators on 6/26/20.
- Weeds were controlled as necessary and no other pesticides were used.
- Total shelled weight, test weight, and moisture content were collected to calculate yield.

Effect of Irrigation System on Corn Yield

Figure 1. Dragon-Line® drip-line irrigation tubes between corn rows.

Understanding the Results

- There was no significant difference in yield between irrigation type (Figure 2).
- Dragon-Line tended to drift towards one row of corn rather than irrigate directly in between each row (Figure 1). The standard deviation within plots was greater for plots irrigated using Dragon-Line compared to standard nozzles (Table 1). This indicates some corn rows within the Dragon-Line plots received excess irrigation, while other rows did not receive enough or full irrigation.

Effect of Irrigation System on Corn Yield

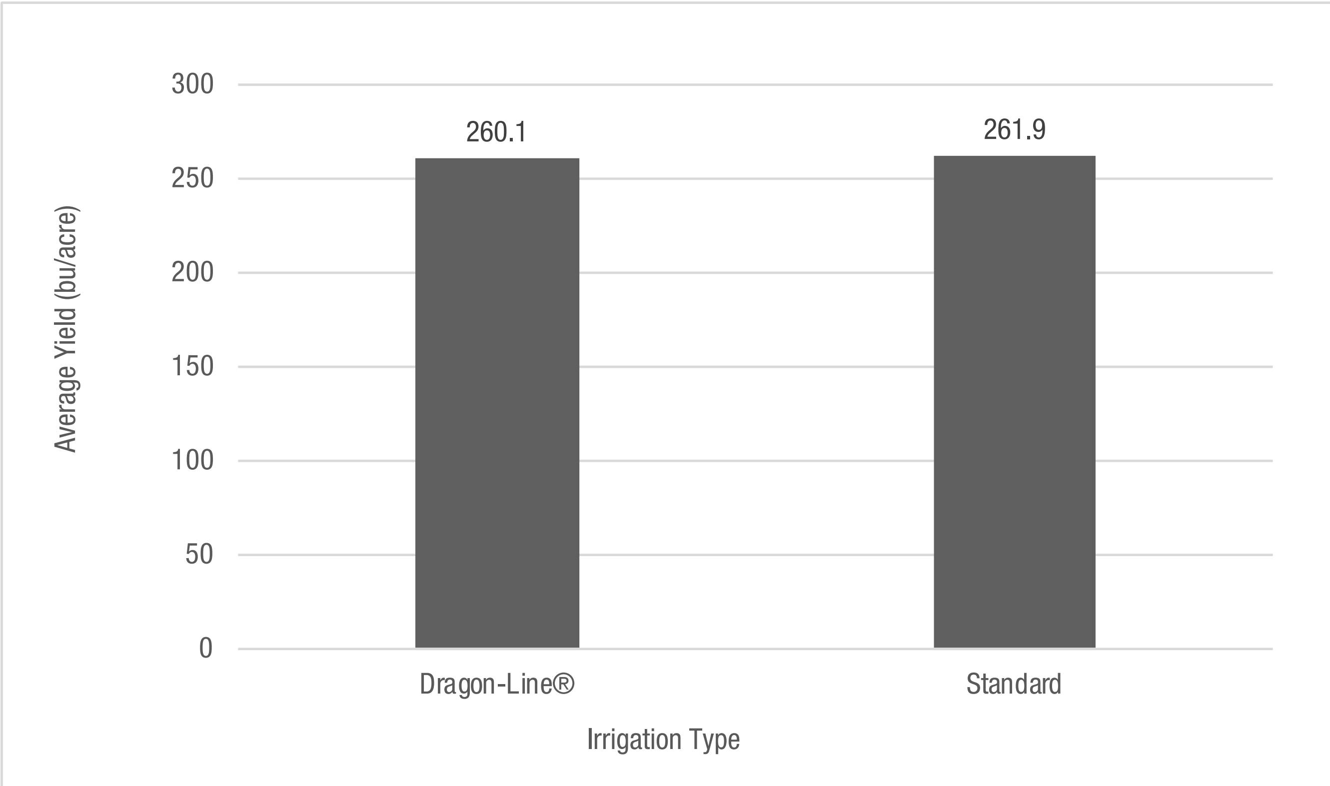

Figure 2. Average corn yield from plots receiving irrigation via a Dragon-Line® drip-line tubing or a standard sprinkler nozzle.

Table 1. Standard deviation of average yield between the rows of standard sprinkler nozzles and Dragon-Line® drip-line tubing.

Treatment (plot)	Standard (101)	Dragon-Line (102)	Dragon-Line (201)	Standard (202)	Standard (301)	Dragon-Line (302)
Standard deviation	6.6	9.4	8.6	5.2	6.3	10.1

Key Learnings

- The water use efficiency of irrigation systems can be a key component in a production system, and this study found that the Dragon-Line and standard irrigation nozzles produced the same corn yields. While Dragon-Line may have greater variability between rows, the variability did not influence overall yield.
- A producer should choose the irrigation system that maximizes production and profitability for each field.

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Limited Irrigation Water and the Impact on Greensnap

Trial Objective

- Greensnap is a challenge in the western corn belt because severe thunderstorms, often with high winds, are common throughout the growing season.
- The thunderstorms frequently coincide with the period of rapid growth between V12 and R1 which is around two weeks prior and up to silking.
- Many factors can influence greensnap including corn product, temperature, growth stage, growth rate, fertility, wind speed, herbicide applications, fungicide applications, and even soil moisture. This variability can cause parts of one field to greensnap unacceptably, and another to be okay under seemingly similar conditions.
- This trial investigates the impact of early season irrigation management on greensnap.

Research Site Details

Location	Soil Type	Previous Crop	Tillage Type	Planting Date	Harvest Date	Potential Yield (bu/acre)	Seeding Rate (seeds/acre)
Gothenburg, NE	Hord silt loam	Soybean	Strip tillage	5/7/20	11/6/20	270	36,000

- The study was setup in a split-plot design with four replications. Irrigation treatments were the whole plot, and corn products were the sub-plot.
- Thirty corn products were planted in four irrigation environments that simulate different irrigation strategies.
- All corn was sprinkler irrigated with a linear machine that had variable rate irrigation (VRI) installed to allow variable applications to the trial.
- Table 1 contains details of the irrigation strategies used.
- The growing season was relatively dry. Irrigation was started on 7/4/20 and terminated on 9/22/20 with a total of seven passes.
- This trial was not managed to full irrigation because of some mechanical challenges with the irrigation system. Full irrigation would have been 10 inches on the season, and this trial was managed at about 70% of full irrigation on the year.
- A severe thunderstorm on 7/10/20 caused corn to greensnap in the trial.
- Fertility applied was 70 lb phosphorus/acre, 15 lb sulfur (S)/acre, and 27.5 lb nitrogen (N)/acre banded with strip till on 4/7/20, 100 lb N/acre applied with stream bar on 4/23/20, and 15 lb S/acre and 90 lb N/acre applied with 360 Y-DROP® applicators on 6/26/20.
- Weed control consisted of a pre-emergent application of 3.0 oz/acre Balance® Flexx herbicide plus 2.0 pt/acre Harness® herbicide plus 1 qt/acre atrazine 4L and 1 qt/acre Roundup PowerMAX® herbicide on 5/1/20 followed by a post-emergent application of 3.0 oz/acre Laudis® herbicide plus 3 pt/acre Warrant® herbicide and 24 oz/acre Moxy® herbicide on 6/10/20.
- Greensnap ratings were taken and corn grain yields were collected at harvest. Greensnap ratings were taken on a 1-9 scale with 1 representing no plants snapped and 9 representing 90% to 100% of plants snapped in the plot.

Limited Irrigation Water and the Impact on Greensnap

Table 1. Irrigation treatment information.				
Treatment	Description	Application Rate/Pass	Season Total	Percent of Full Irrigation
100% Trial Irrigation	Maximum trial irrigation applied to trial	1 inch	7.0 inches	70%
50% of Trial Irrigation	Trial Irrigation reduced by 50% with VRI	0.5 inch	3.5 inches	35%
60% Trial Irrigation to V16 100% after V16	Irrigation reduced during vegetative growth and returned during the reproductive stages.	0.6 inch before V16 and 1.0 inch after V16	5.8 inches	58%
100% Trial Irrigation to R2 and 60% after R2	Full trial irrigation in vegetative stages and reduced irrigation from the early reproductive stage onward.	1.0 inch before R2 and 0.6 inch after R2	5.8 inches	58%

Understanding the Results

- After the 7/10/20 storm, greensnap was observed in the trial and severe in some treatments (Figure 1).
- Analysis showed a lower greensnap rating in the irrigation treatments where irrigation water was more limited early in the growing season (Table 2).
- Irrigation applications were made to all treatments one day prior (7/9/20) and six days prior (7/4/20) to the thunderstorms. The treatments with higher snap ratings had 2 inches of irrigation applied in the week before the storm, and the treatments with lower snap ratings received 1 inch (50% Trial Irrigation) and 1.2 inches (60% Trial Irrigation to V16 and 100% after V16).
- When looking at specific products, the pattern of more greensnap with higher early irrigation water application and less greensnap with lower early irrigation water application held true across corn products that had low, moderate, and high potential for greensnap (Figures 2, 3, and 4).
- The treatments with lower irrigation water were likely water stressed at the time of the storm and had decreased turgor pressure which can lower the risk of greensnap.

Table 2. Greensnap rating by irrigation treatment.	
Irrigation Treatment	Greensnap Rating
100% Trial Irrigation (TI)	2.4
50% of Trial Irrigation	1.9
60% Trial Irrigation to V16 100% after V16	1.8
100% Trial Irrigation to R2 and 60% after R2	2.3
LSD P=0.1	0.23

Figure 1. Greensnap as noted by the plants that are missing tops at or just above the ear node (see circle). Photo taken on 7/28/20 showing some of the brown tops still hanging on to the corn stalk (see arrow).

Limited Irrigation Water and the Impact on Greensnap

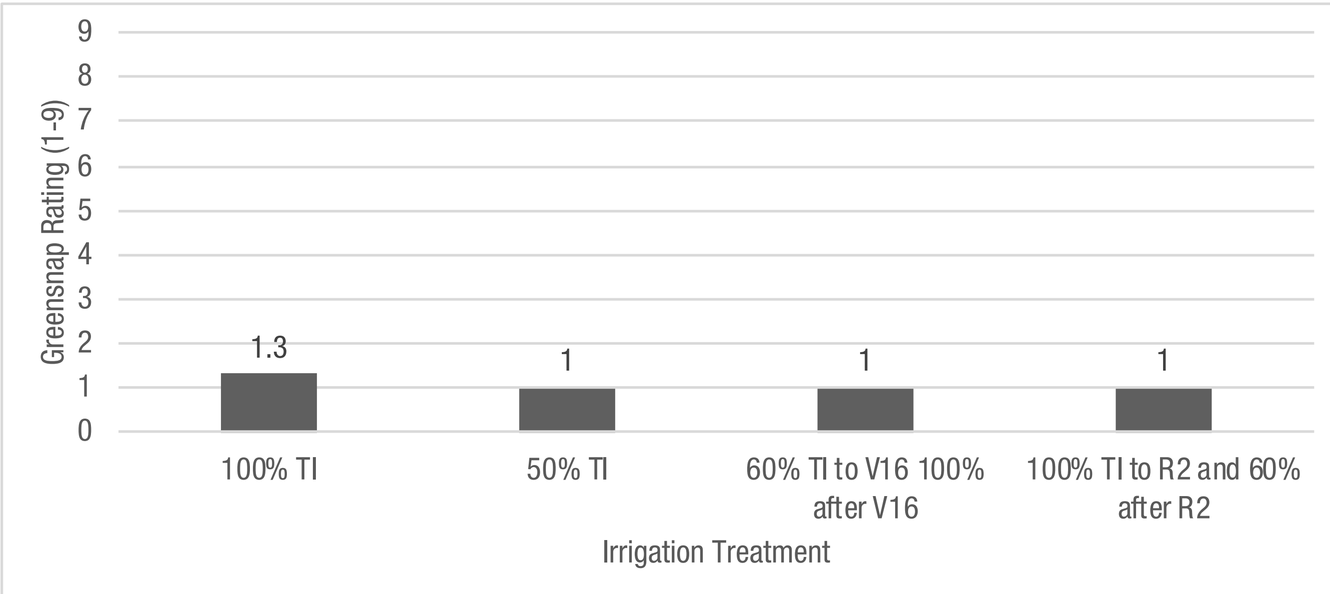

Figure 2. Impact of irrigation treatments on corn product with high greensnap tolerance ratings where 1 is excellent and 9 is poor.

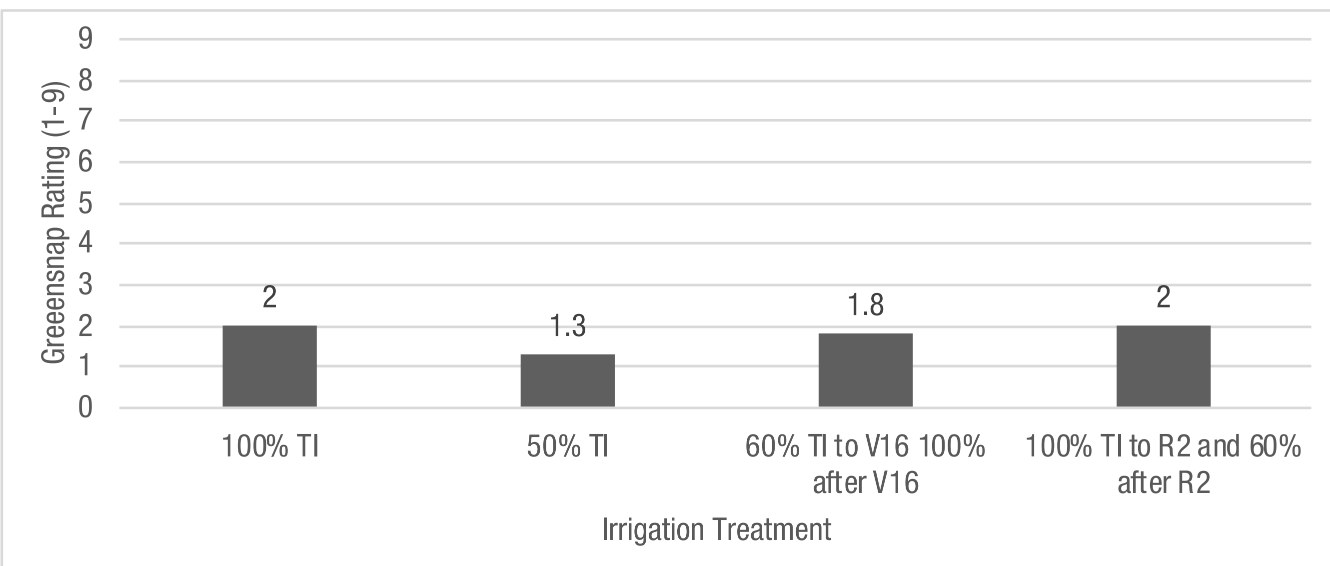

Figure 3. Impact of irrigation treatments on corn product with moderate greensnap tolerance ratings where 1 is excellent and 9 is poor.

Limited Irrigation Water and the Impact on Greensnap

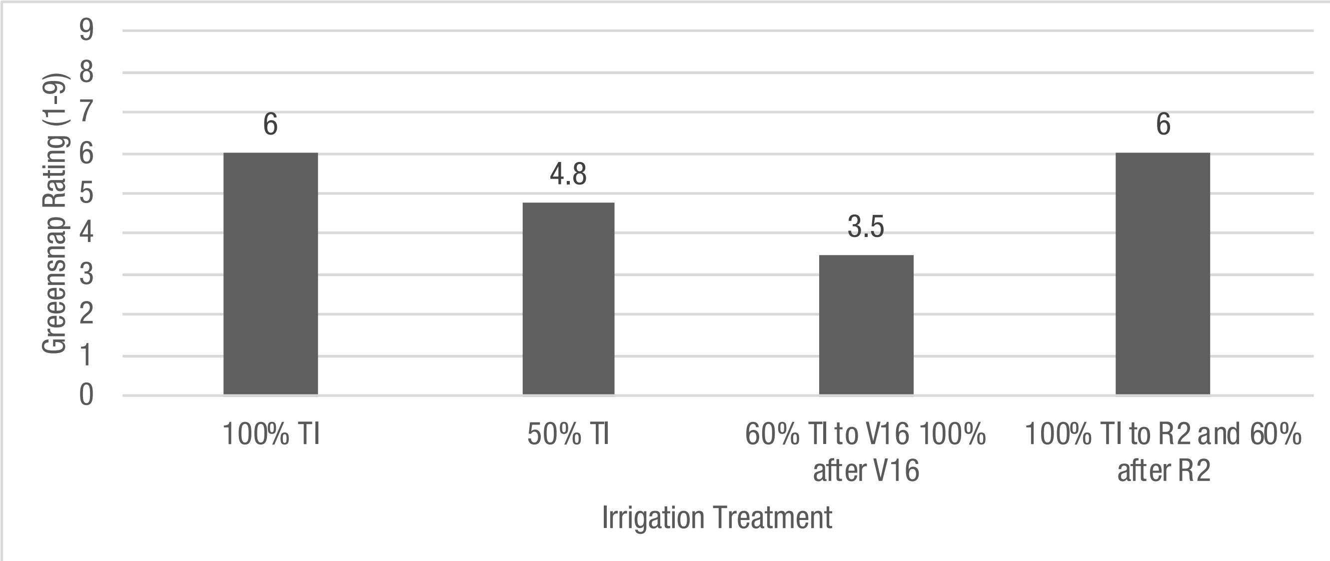

Figure 4. Impact of irrigation treatments on corn product with low greensnap tolerance ratings where 1 is excellent and 9 is poor.

Key Learnings

- Greensnap is a challenge to corn production everywhere, but it is one that is especially common on the Great Plains.
- The best managed and best looking corn fields seem to be the ones most affected by greensnap in a given event, and there are many factors that can enhance it.[1]
- Irrigation supplied to the crop can be one of those factors where doing a better job of meeting plant requirements can cause higher greensnap amounts.
- When scouting fields after a storm, pay attention to environmental factors that may have increased corn greensnap vulnerability. Don't write off a corn product if there is greensnap in one environment because variation in the growing environment can play a large role in what happened in one environment. Instead, look across multiple environments and discuss product greensnap tolerance with your local Bayer seed representative.

Source

[1] White, M. and Pope, R.O. 1998. Green snap opinions vary. Integrated Crop Management News. 2283. http://lib.dr.iastate.edu/cropnews/2283.

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DEKALB® Corn Product Response to Irrigation and Population

Trial Objective

- Across western Kansas and Colorado, the ability of farmers to irrigate is being limited either due to reductions in pumping capacity or restrictions on the amount of water producers can pump over a certain time frame. Therefore, it is imperative that Bayer evaluates corn products under varying irrigation rates to provide better corn product recommendations.

Research Site Details

Location	Soil Type	Previous Crop	Tillage Type	Planting Date	Harvest Date	Potential Yield (bu/acre)	Seeding Rate (seeds/acre)
Yuma, CO	Sandy loam	Corn	Strip till	5/15/20	10/23/20	250	Variable
Bethune, CO	Sandy loam	Soybeans	Strip till	5/07/20	10/8/20	220	Variable
Mingo, KS	Silt loam	Soybeans	Strip till	5/5/20	10/20/20	240	Variable

- At three testing locations, four DEKALB® corn products were planted at 24,000, 32,000, 36,000, 40,000, 44,000 and 50,000 seeds/acre under 100% FI (full irrigation meeting the evapotranspiration needs of the crop). And at 50% FI (half of the full irrigation rate per irrigation), the same five DEKALB corn products were planted at 18,000, 28,000, 32,000, 36,000, 40,000, and 48,000 seeds/acre.
- Yuma, CO received 7.5” of rainfall throughout the growing season.
- Bethune, CO received 10.1” of rainfall throughout the growing season.
- Mingo, KS received 11.8” of rainfall throughout the growing season.
- FI treatments received an average additional 8.1 inches of irrigated water per acre during the growing season across the three testing locations.
- Each corn product and seeding rate was replicated twice per irrigation treatment.
- Each location was irrigated with a variable rate center pivot system with nozzles placed within the crop canopy.

DEKALB® Corn Product Response to Irrigation and Population

Table 1. Average yield of DEKALB® corn products tested by seeding rate and irrigation treatment.

	50% Full Irrigation			100% Full Irrigation		
DEKALB® Brand Blend	Seeding Rate (seeds/acre)	Average Yield (bu/acre)	Average Yield/ Thousand Plants	Seeding Rate (seeds/acre)	Average Yield (bu/acre)	Average Yield/ Thousand Plants
DKC59-81RIB	18000	114.5	6.4	24000	223.2	9.3
DKC59-81RIB	28000	118.9	4.2	32000	209.2	6.5
DKC59-81RIB	32000	124.4	3.9	36000	230.8	6.4
DKC59-81RIB	36000	154.3	4.3	40000	242.1	6.1
DKC59-81RIB	40000	169.6	4.2	44000	220.1	5.0
DKC59-81RIB	48000	199.3	4.2	50000	207.3	4.1
DKC61-98RIB	18000	189.7	10.5	24000	210.5	8.8
DKC61-98RIB	28000	154.8	5.5	32000	237.9	7.4
DKC61-98RIB	32000	200.8	6.3	36000	228.3	6.3
DKC61-98RIB	36000	154.5	4.3	40000	246.8	6.2
DKC61-98RIB	40000	151.4	3.8	44000	211.6	4.8
DKC61-98RIB	48000	140.5	2.9	50000	210.9	4.2
DKC62-20RIB	18000	141.6	7.9	24000	218.7	9.1
DKC62-20RIB	28000	156.1	5.6	32000	233.1	7.3
DKC62-20RIB	32000	184.7	5.8	36000	224.2	6.2
DKC62-20RIB	36000	159.0	4.4	40000	213.9	5.3
DKC62-20RIB	40000	172.0	4.3	44000	217.6	4.9
DKC62-20RIB	48000	174.2	3.6	50000	205.9	4.1
DKC63-91RIB	18000	115.5	6.4	24000	227.8	9.5
DKC63-91RIB	28000	166.9	6.0	32000	229.9	7.2
DKC63-91RIB	32000	192.6	6.0	36000	217.6	6.0
DKC63-91RIB	36000	207.9	5.8	40000	250.4	6.3
DKC63-91RIB	40000	196.0	4.9	44000	205.2	4.7
DKC63-91RIB	48000	140.4	2.9	50000	231.9	4.6
	Average	**161.6**	**5.2**		**223.1**	**6.3**

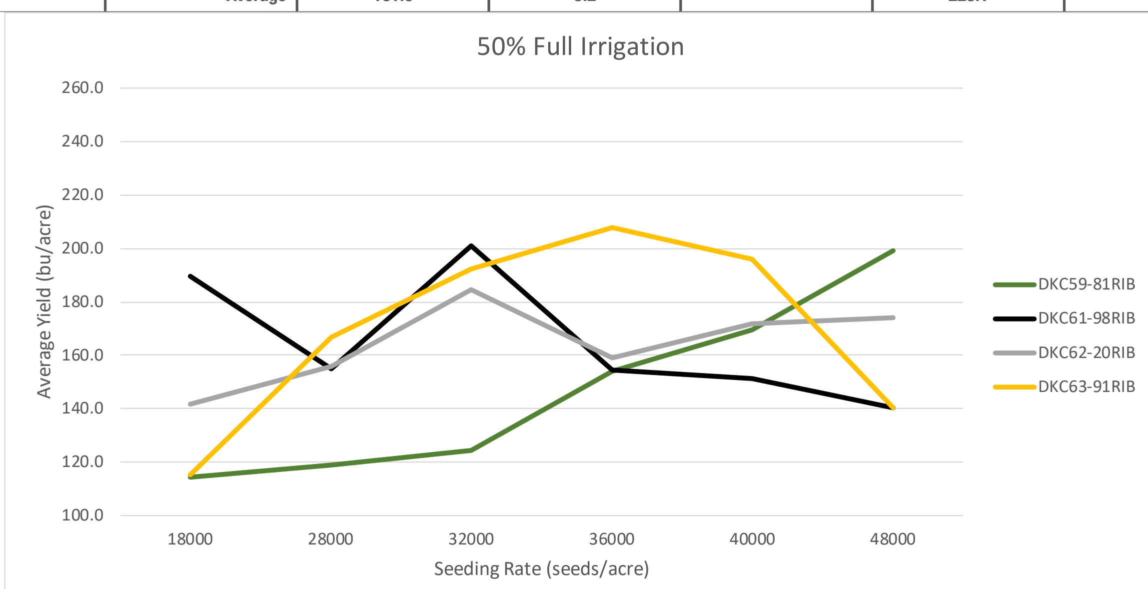

Figure 1. Average corn product yield by seeding rate at 50% full irrigation.

DEKALB® Corn Product Response to Irrigation and Population

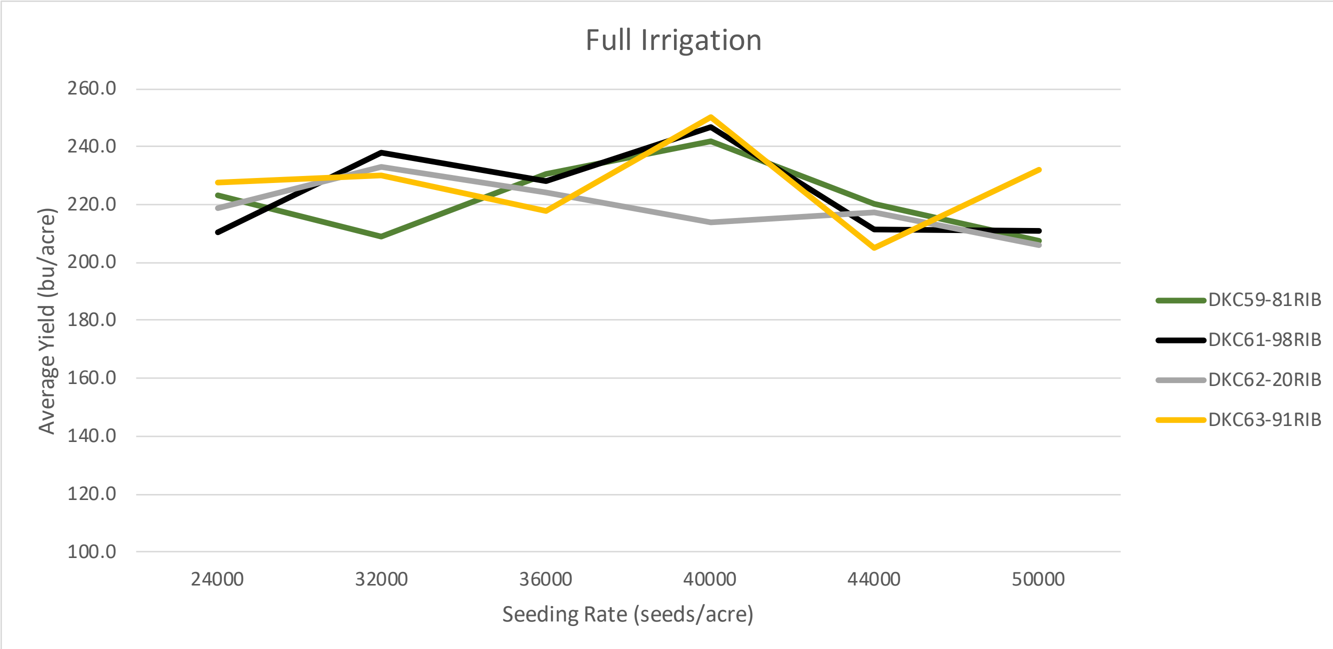

Figure 2. Average corn product yield by seeding rate at 100% full irrigation.

Understanding the Results

- Average yield per thousand plants (YTP) was highest at the lower seeding rates for each irrigation treatment. For this trial, maintaining the YTP around the 6.5 to 8 bushels per thousand plants obtained the highest potential yield for that corn product in a particular growing environment.
- Across all corn products and planting rates the extra 8.1 inches of irrigation applied to the FI treatment yielded an extra 61.5bu/acre, 223.1 bu/acre average at full irrigation and 161.6 bu/acre at half irrigation.
- Across all products at the 50% FI rate, maximum average yield was achieved at the 36,000 seeds/acre seeding rate (168.9 bu/acre) and at the 100% FI rate maximum average yield was achieved at the 40,000 seeds/acre seeding rate (238.9 bu/acre).

Key Learnings

- Corn products respond differently when planted to different seeding rates and under drought stress.
- Producers should discuss with their seed supplier when selecting what corn products and planting rates would best fit the seasonal potential rainfall and irrigation capacity.

DEKALB® Corn Product Response to Irrigation and Population

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Insect Resistance Management
Planting Refuges, Preserving Technology

Before opening a bag of seed, be sure to read, understand and accept the stewardship requirements, **including applicable refuge requirements for insect resistance management,** for the biotechnology traits expressed in the seed as set forth in the Monsanto Technology/Stewardship Agreement that you sign. By opening and using a bag of seed, you are reaffirming your obligation to comply with the most recent stewardship requirements.

DEKALB® Brand Corn Silage Evaluations

Trial Objective

- Bayer has always had a focus on breeding and selecting corn products that are focused for the silage acre. The expansive growth of dairies in Colorado has resulted in an increase in the demand for local corn silage data.
- In the past, generating local corn silage data has presented difficult logistical challenges from trying to harvest small plots with large commercial silage choppers, or data quality issues of having to hand cut 20ft of row and processing the corn plants through a wood chipper.
- Our local research team came up with a pilot program to test these silage focused corn products in our local region utilizing available resources in the area, to meet the needs of our local customers.

Research Site Details

Location	Soil Type	Previous Crop	Tillage Type	Planting Date	Harvest Date	Potential Yield (tons/acre)	Seeding Rate (seeds/acre)
Yuma, CO	Sandy loam	Corn	Strip tillage	5/12/20	9/14/20	25	34,000

- Six DEKALB® corn products were selected to test for yield (tonnage) and quality.
- Each plot was 100 feet long by 4 rows wide, with weight and quality samples taken only on the center two rows.
- A one-row pull behind silage chopper was used to harvest these trials. A material sample diverter was developed and attached to the chute which allowed for multiple samples to be taken throughout the trial to ensure proper mixing of material and present a more representative silage sample.
- A set of weigh scales was installed onto a pull behind side dump wagon which allowed for measuring the forage tonnage.
- Harvest began when products were approximately half milk line and approximately 65% whole plant moisture on average.
- Silage samples were collected and sent to a third-party laboratory for quality analysis.

Figure 1. Single row silage chopper.

DEKALB® Brand Corn Silage Evaluations

Understanding the Results

Table 1. Yield and quality of corn products in silage demonstration.

DEKALB® Brand Blend	% Moisture	% Dry Matter	% Starch	% NDF	% ADF	% CP	TFA	Sugar	2006 % TDN	Lignin% DM	Yield (tons/acre)
DKC59-07RIB	60.3	39.7	49.4	28.6	15.5	6.9	2.6	2.2	73.2	1.3	23.8
DKC64-34RIB	64.8	35.2	41.8	33.4	18.9	7.4	2.3	3.1	72.7	2.1	23.9
DKC64-44RIB	62.3	37.7	44.8	31.2	16.6	7.1	2.3	3.2	74.2	1.5	21.8
DKC66-74RIB	64.6	35.4	38.0	36.5	20.2	7.3	2.1	3.4	73.7	2.1	23.8
DKC69-16RIB	64.1	35.9	42.3	32.4	17.7	7.2	2.2	3.4	74.3	1.8	25.0
DKC70-64RIB	65.4	34.6	34.8	37.6	22.4	7.0	1.8	4.3	70.0	2.5	21.3
Average	**63.6**	**36.4**	**41.8**	**33.3**	**18.6**	**7.2**	**2.2**	**3.3**	**73.0**	**1.9**	**23.3**

DEKALB® Brand Blend	NDFD 24hr % of NDF	NDFD 48hr % of NDF	uNDF 24hr. % DM	uNDF 240hr. %DM	IVSD 7hr	2006 NEL (Mcal/lb)	NEG (Mcal/lb)	2006 Silage Milk/Ton
DKC59-07RIB	52.9	65.3	12.7	6.2	70.1	0.7	0.6	3425.0
DKC64-34RIB	50.3	61.0	15.7	8.9	71.3	0.7	0.5	3406.0
DKC64-44RIB	55.2	66.3	13.2	6.7	70.5	0.7	0.6	3495.0
DKC66-74RIB	56.3	65.8	15.2	8.1	69.9	0.7	0.5	3445.0
DKC69-16RIB	53.2	64.0	14.4	8.0	70.1	0.7	0.6	3516.0
DKC70-64RIB	50.1	59.8	17.8	10.2	70.9	0.7	0.5	3191.0
Average	**53.0**	**63.7**	**14.8**	**8.0**	**70.4**	**0.7**	**0.5**	**3413.0**

NDF-Neutral Detergent Fiber; NDFD-incremented measurement of NDF; uNDF-undigested NDF residue; IVSD 7 hr-in vitro starch remaining after 7hrs; ADF-Acid Detergent Fiber; CP-Crude Protein; TFA-Total Fat; TDN-Total Digestible Nutrients; NEL-Net Energy for Lactation; NEG-Net Energy for Gain.

- In this trial, DKC69-16RIB brand blend was the highest yielding corn product in tonnage per acre and milk per ton (25tons/acre, 3516milk/ton).
- DKC 59-07RIB brand blend had the lowest percentage of 240hr Non-Digestible fiber, which is what the animal is not able to break down for energy before it is passed through the animal as waste.
- DKC64-44RIB had the highest percentage of 48hr digestible fiber in this trial, which is the percentage of fiber that can be quickly broken down and utilized by the animal.

Key Learnings

- After successfully completing a silage testing pilot program this year, it will be expanded in 2021 by adding an additional testing location and more corn products.
- With a 11-day spread in relative maturity (RM) between corn products, the percent moisture and dry matter varied widely indicating the need for separate harvest timings for RM groups.
- Growers should consult with their local DEKALB® seed dealers for recommendations for placement of corn silage products for their area.

DEKALB® Brand Corn Silage Evaluations

Legal Statements

The Impact of Seeding Rate and Reduced Irrigation on Five DEKALB® Brand Corn Products

Trial Objective

- Determining the optimal seeding rate corn products grown under 50% full irrigation (FI) can help a farmer maximize yield potential while reducing irrigation costs.
- The objective of this trial was to compare the yields of five DEKALB® Brand products planted at six seeding rates and grown under 50% FI.

Research Site Details

Location	Soil Type	Previous Crop	Tillage Type	Planting Date	Harvest Date	Potential Yield (bu/acre)	Seeding Rate (seeds/acre)
Texas County, OK	Clay loam	Wheat	Strip till	5/8/20	10/18/20	150	18K, 28K, 32K, 36K, 40K, 48K

- Five DEKALB® brand corn products were planted at six seeding rates under reduced irrigation conditions of 50% FI in Texas County, OK.
  - The DEKALB® brand corn products were:
    - DKC59-07RIB Brand Blend
    - DKC59-81RIB Brand Blend
    - DKC60-87RIB Brand Blend
    - DKC61-98RIB Brand Blend
    - DKC63-91RIB Brand Blend
  - Seeding rates were: 18,000, 28,000, 32,000, 36,000, 40,000, and 48,000 seeds/acre.
  - The trial was irrigated with 50% FI water using zone control sprinklers.
- Total shelled weight, test weight, and moisture content were collected to calculate yield.
- Weeds were controlled uniformly, and no additional insecticide or fungicide was applied.
- Each treatment was replicated twice and only averages are reported in this report as no statistical analysis was performed.

The Impact of Seeding Rate and Reduced Irrigation on Five DEKALB® Brand Corn Products

Understanding the Results

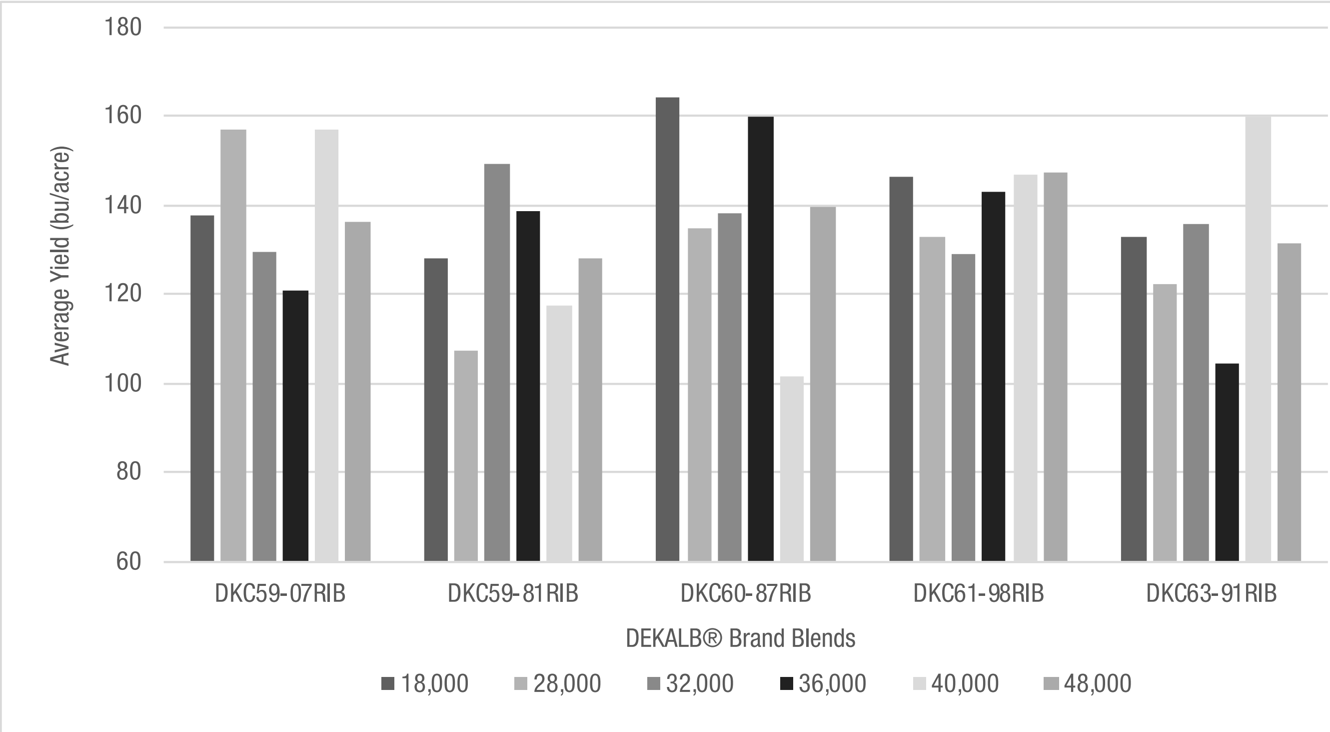

Figure 1. Average yield of five DEKALB® Brand Blend corn products planted at six seeding rates with 50% FI, Texas County, OK (2020) (2 replications).

- For this trial, DKC61-98RIB Brand Blend produced relatively consistent average yields across seeding rates, while all other DEKALB® Brand Blends responded differently to seeding rates. None of the seeding rates tested were consistent at producing the greatest yields across the five products.
- The average yields for the five DEKALB® Brand Blends ranged from 101.3 to 164.2 bu/acre under 50% FI.

Key Learnings

- Selecting the right corn product for the right field when irrigation water is limited because of either pumping capacity or water allocation is challenging. However, a corn product like DKC61-98RIB Brand Blend demonstrated a consistent yield potential across a wide range of seeding rates in a challenging, water stressed environment.
- Contact your local DEKALB® brand seed representative to help determine which corn product and seeding rate best fits your production system.

The Impact of Seeding Rate and Reduced Irrigation on Five DEKALB® Brand Corn Products

Legal Statements

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ALWAYS READ AND FOLLOW PESTICIDE LABEL DIRECTIONS. B.t. products may not yet be registered in all states. Check with your seed brand representative for the registration status in your state.

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. 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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Insect Resistance Management
Planting Refuges, Preserving Technology

Before opening a bag of seed, be sure to read, understand and accept the stewardship requirements, **including applicable refuge requirements for insect resistance management,** for the biotechnology traits expressed in the seed as set forth in the Monsanto Technology/Stewardship Agreement that you sign. By opening and using a bag of seed, you are reaffirming your obligation to comply with the most recent stewardship requirements.

Dryland Corn Seeding Rate Effect on Product Yield

Trial Objective

- The objective of this study was to determine the seeding rate for multiple DEKALB® brand corn products that resulted in the greatest yield potential at two separate dryland locations (Scott City, KS and Sublette, KS).

Research Site Details

Location	Soil Type	Previous Crop	Tillage Type	Planting Date	Harvest Date	Potential Yield (bu/acre)	Seeding Rate (seeds/acre)
Scott City, KS	Silt loam	Corn	No till	4/28/20	10/13/20	150	12K, 16K, 20K, 24K
Sublette, KS	Silt loam	Wheat	No till	4/29/20	9/20/20	150	12K, 16K, 20K, 24K

- Four seeding rates, 12,000, 16,000, 20,000, and 24,000 seeds/acre, were evaluated with nine DEKALB® brand corn products, DKC51-25RIB, DKC51-99RIB, DKC55-37RIB, DKC55-85RIB, DKC59-82RIB, DKC61-41RIB, DKC62-53RIB, DKC63-55RIB, and DKC64-25RIB ranging in relative maturities (RM) from 101 to 114 RM.
- Each treatment was replicated four times at two locations, Scott City, KS and Sublette, KS.
- Weeds were controlled as needed.
- Total shelled weight, test weight, and moisture were collected to calculate yield.

Understanding the Results

- There was a significant interaction between corn product and seeding rate in this study.
- There was no seeding rate or corn product that consistently produced the highest average yields at either location (Figures 1 and 2). However, seven of the nine DEKALB® brand corn products at Scott and 8 of the 9 DEKALB brand corn products at Sublette had higher average yields with the 16,000, 20,000, or 24,000 seeds/acre seeding rates compared to the 12,000 seeds/acre seeding rate at both locations.
- For this trial, overall average yields were higher at the Sublette, KS location compared to the Scott City, KS location due to more rainfall at Sublette, KS during critical times of the growing season (Figures 1 and 2).

Dryland Corn Seeding Rate Effect on Product Yield

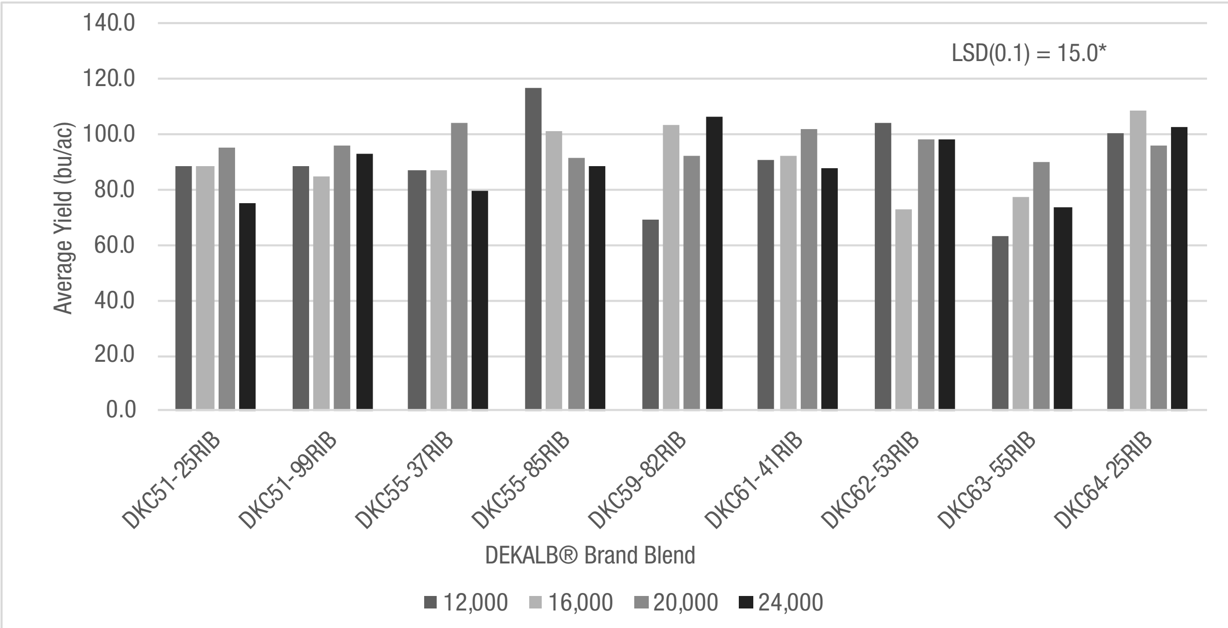

Figure 1. Average yield of DEKALB® brand corn products grown at multiple seeding rates under dryland conditions in Scott City, KS. *LSD (least significant difference) calculated as part of a larger trial containing 17 total products.

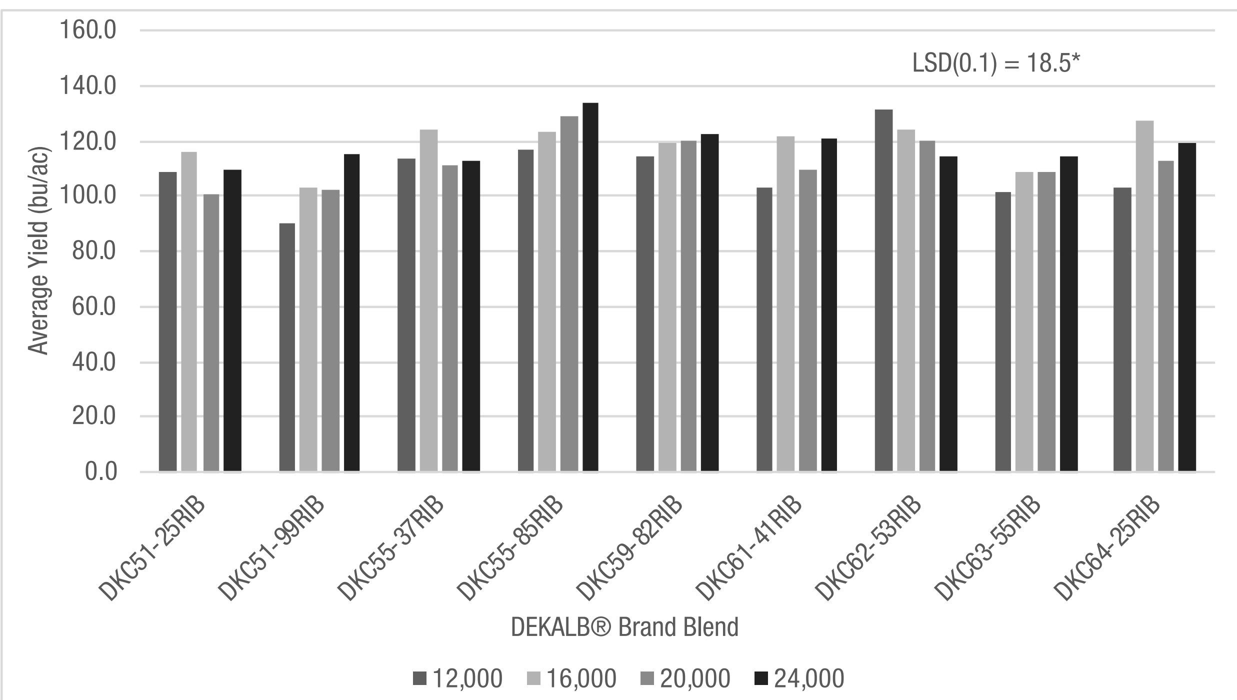

Figure 2. Average yield of DEKALB® brand corn products grown at multiple seeding rates under dryland conditions in Sublette, KS. *LSD (least significant difference) calculated as part of a larger trial containing 17 total products.

Dryland Corn Seeding Rate Effect on Product Yield

Key Learnings

- Dryland corn production can be challenging in tough, water stressed environments. In this dryland test, corn product yields were highly variable across seeding rates and locations. The testing indicated that using a seeding rate of 12,000 seeds/acre can be considered but higher yields were obtained across most of the corn products when using a seeding rate of 16,000 seeds/acre or more.
- Talk to your local DEKALB representative to determine which corn product and seeding rate best fits your production system.

Legal Statements

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Corn Product Silage Quality and Tonnage

Trial Objective

- Corn silage is an important feedstock for cattle producers across the Great Plains.
- Desirable corn products should produce high tonnage with favorable silage quality characteristics.
- The objective was to help provide insights to farmers on tonnage and silage quality of the corn products evaluated in this study.

Research Site Details

Location	Soil Type	Previous Crop	Tillage Type	Planting Date	Harvest Date	Potential Yield (bu/acre)	Seeding Rate (seeds/acre)
Gothenburg, NE	Silt loam	Soybean	Strip till	4/28/20	9/15/20	250	40K

- The study was set up as a randomized complete block with three replications.
- Seven DEKALB® corn products were evaluated.
- Corn was sprinkler irrigated. Fertility included 100 lb N/acre applied with a streamer bar on 4/27/20, followed by 90 lb N/acre and 15 lb S/acre applied with 360 Y-DROP® applicators on 6/24/20. Weeds were controlled as needed and no fungicides or insecticides were applied.
- Silage was harvested when most of the products were at approximately half-milk line using a silage chopper without a kernel processor. Total biomass was collected and weighed. A subsample of the freshly-chopped material was collected and sent to Dairyland Laboratories Inc. for silage quality analysis.
  - Two corn products (DKC66-74RIB, DKC70-64RIB) had greensnap at a high level which did not allow for silage tonnage to be calculated but a subsample was taken for silage quality analysis.

Understanding the Results

Figure 1. DKC64-44RIB Brand blend corn product at the time of cutting.

Corn Product Silage Quality and Tonnage

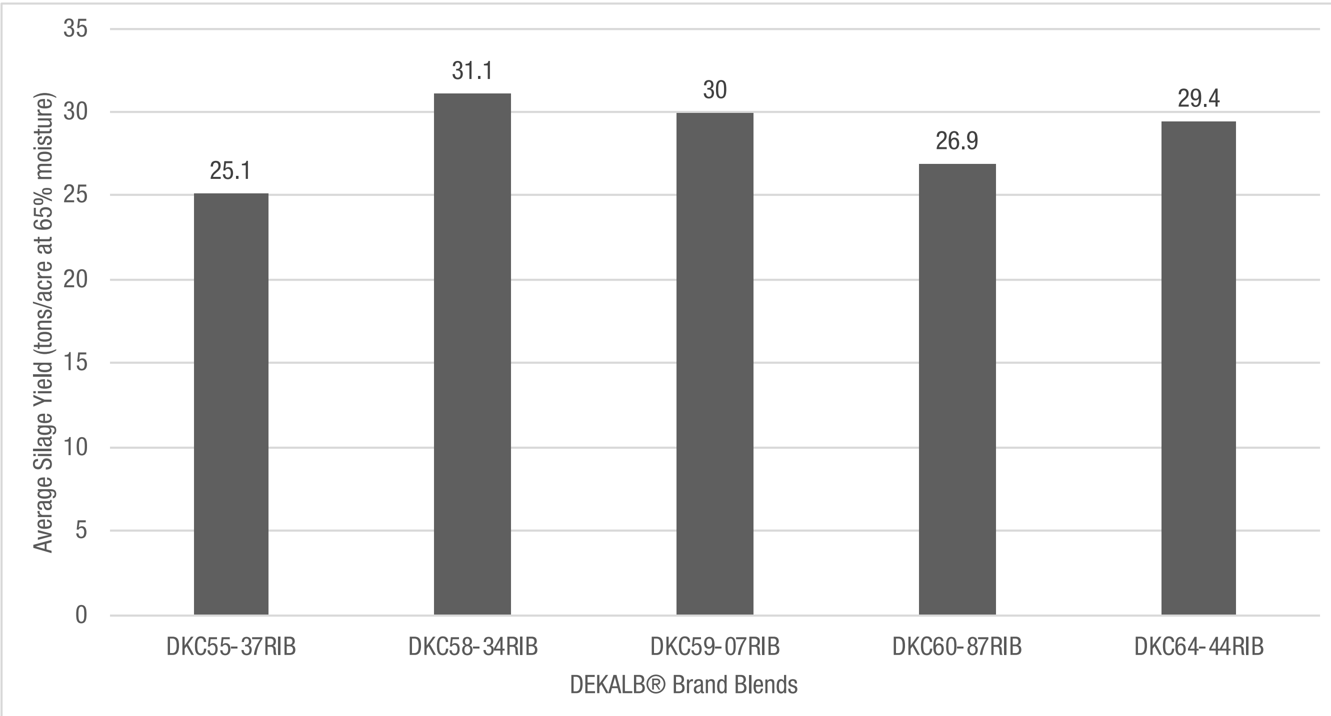

Figure 2. Average silage yield (tonnage) for corn products tested.

Table 1. Silage quality analysis metrics, performed by Dairyland Laboratories Inc.

DEKALB® Brand Blends	% DM	% Starch	% NDF	NDFD 24	NDFD 48	uNDF 24	uNDF 240	IVSD 7hr	% ADF	% CP	TFA	Sugar	% TDN	Lignin % DM	NEL	NEG	2006 milk/ton
DKC55-37RIB	35.0	37.5	36.4	45.2	55.6	19.4	12.0	66.5	22.3	8.5	2.4	3.3	69.5	3.7	0.69	0.48	3186.3
DKC58-34RIB	36.6	40.7	33.9	45.6	56.4	18.0	10.2	65.7	20.0	8.1	2.6	3.0	70.8	3.0	0.71	0.51	3284.3
DKC59-07RIB	41.1	45.5	30.2	49.8	61.6	14.5	8.0	67.7	16.8	7.4	2.7	3.6	70.5	2.2	0.69	0.55	3221.0
DKC60-87RIB	37.6	40.5	33.8	47.1	58.0	17.2	9.6	68.0	20.0	7.6	2.3	3.6	69.8	2.7	0.69	0.51	3190.3
DKC64-44RIB	37.2	40.0	32.5	50.4	61.2	15.5	8.8	66.7	18.4	8.4	2.5	4.0	72.2	2.5	0.71	0.53	3359.3
DKC66-74RIB	41.6	39.5	32.0	48.0	59.3	16.1	9.4	68.2	18.7	8.4	2.5	4.1	69.0	2.7	0.68	0.53	3117.3
DKC70-64RIB	37.4	37.2	34.5	46.6	57.1	17.8	9.9	67.4	20.2	8.0	2.1	4.5	69.8	2.9	0.69	0.51	3195.3
LSD (0.1)*	3.3	5.2	3.7	2.9	2.5	1.8	1.4	2.0	2.5	0.7	0.3	ND	1.9	0.6	0.02	0.03	149.0

DM – Dry matter; NDF – Neutral detergent fiber; NDFD – Incremented measurement of NDF; uNDF – undigested NDF residue; IVSD 7hr – In vitro starch digestibility after 7 hrs; ADF – Acid detergent fiber; CP – Crude protein; TFA – Total fat; TDN Total digestible nutrients; NEL – Net energy for lactation; NEG – Net energy for gain.

*LSD (least significant difference) calculated as part of a larger trial containing 20 total products.

- Corn product tonnage was numerically different but variability in the study did not allow for significant differences to be observed (Figure 2).
- Corn silage quality was different in all parameters tested (Table 1).
- DKC64-44RIB Brand blend and DKC58-34RIB Brand blend had the highest milk per ton for this trial.

Corn Product Silage Quality and Tonnage

Key Learnings

- Producers should work with their local DEKALB® seed sales team to identify which corn product is right for their operation.

Legal Statements

Corn Silage Response to Seeding Rate

Trial Objective

- Corn silage is a popular forage for ruminant animals because it is high in energy and digestibility.
- Maximizing tonnage, while maintaining quality, is a key factor for farmers growing corn for silage.
- The objective of this study was to determine the effect of seeding rate on corn silage tonnage and quality.

Research Site Details

Location	Soil Type	Previous Crop	Tillage Type	Planting Date	Harvest Date	Potential Yield (bu/acre)	Planting Rate (seeds/acre)
Gothenburg, NE	Hord silt loam	Soybean	Strip till	4/28/2020	9/22/2020	250	24K, 28K, 32K, 36K, 40K, 44K, 48K

- This study was designed as a randomized complete block with five replications of the seven seeding rate treatments.
- A 113-day relative maturity (RM) corn product was planted in 30-inch row spacing at 24,000, 28,000, 32,000, 36,000, 40,000, 44,000, and 48,000 seeds/acre.
- Corn was sprinkler irrigated. Fertility included 100 lb N/acre applied with a streamer bar on 4/27/20, and 90 lb N/acre and 15 lb S/acre applied with 360 Y-DROP® applicators on 6/24/20. Weeds were controlled as needed and no fungicides or insecticides were applied.
- Silage was harvested at approximately half milk-line using a silage chopper and total biomass was collected and weighed. A subsample of the freshly-chopped material was collected and sent to Dairyland Laboratories Inc. for silage quality analysis.

Understanding the Results

Figure 1. The 113RM corn product planted at 40,000 seeds/acre.

Corn Silage Response to Seeding Rate

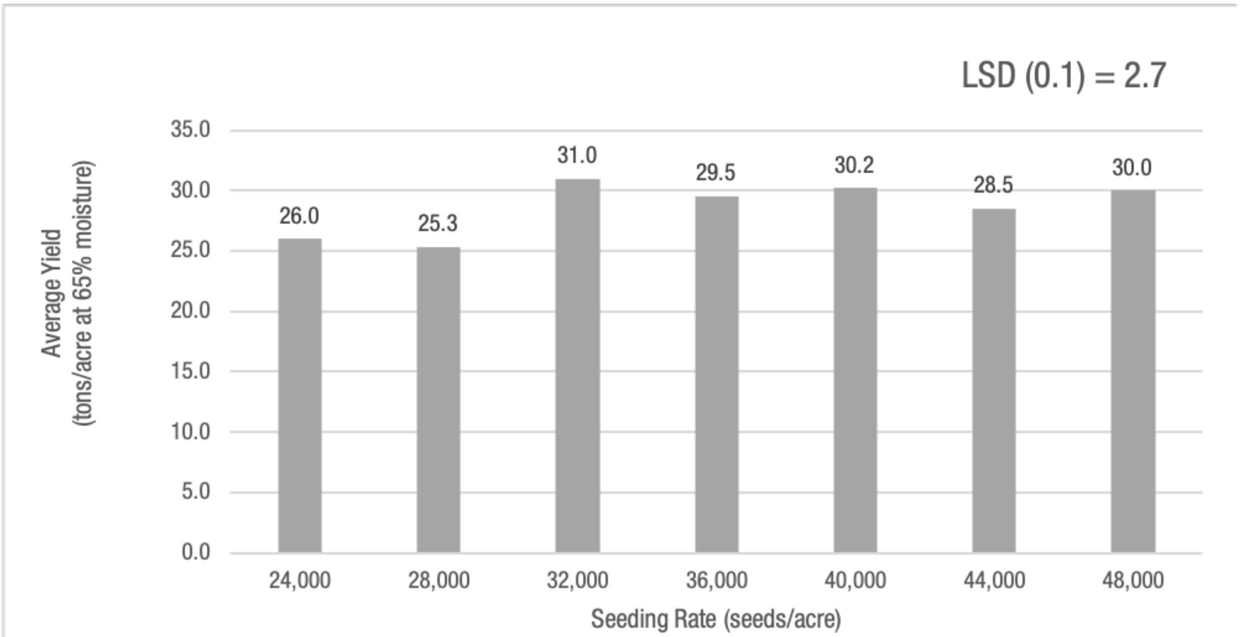

Figure 2. Average silage yield by seeding rate.

Table 1. Silage quality analysis metrics, performed by Dairyland Laboratories Inc.

Seed Rate	% DM	% Starch	% NDF	NDFD 24	NDFD 48	uNDF 24	uNDF 240	IVSD 7hr	% ADF	% CP	TFA	Sugar	% TDN	Lignin % DM	NEL	NEG	2006 milk/ ton
24k	40.5	43.3	29.3	45.4	57.7	15.4	9.3	68.5	17.5	8.7	2.5	4.6	69.6	2.7	0.69	0.54	3174.6
28k	40.2	42.1	31.1	43.4	55.3	16.9	10.8	68.4	19.1	8.7	2.3	5.4	68.3	3.1	0.67	0.52	3080.0
32k	42.5	47.5	28.2	45.4	58.2	14.6	8.1	67.7	16.5	8.3	2.6	3.4	68.2	2.3	0.67	0.55	3056.6
36k	41.5	46.9	28.8	44.7	57.2	15.2	8.6	67.7	17.2	8.2	2.6	3.4	68.7	2.5	0.67	0.55	3101.2
40k	42.6	42.4	32.3	47.0	58.2	16.5	9.9	68.6	19.3	8.2	2.6	3.3	67.3	2.9	0.65	0.52	2980.4
44k	44.1	46.2	30.2	45.9	57.7	15.6	9.3	68.4	18.5	8.2	2.7	3.1	66.2	2.8	0.64	0.54	2899.6
48k	45.4	47.1	29.8	46.0	57.8	15.4	9.3	67.9	18.1	8.3	2.7	2.9	66.3	2.8	0.64	0.54	2899.0
LSD (0.1)	1.7	3.3	2.2	2.1	1.7	1.1	1.1	0.9	1.4	0.3	0.2	0.7	0.9	0.3	0.01	0.02	70.5

DM – Dry matter; NDF – Neutral detergent fiber; NDFD – Incremented measurement of NDF; uNDF – undigested NDF residue; IVSD 7hr – In vitro starch digestibility after 7 hrs; ADF – Acid detergent fiber; CP – Crude protein; TFA – Total fat; TDN Total digestible nutrients; NEL – Net energy for lactation; NEG – Net energy for gain.

- For this trial, average silage yield was significantly higher for seeding rates at and above 32,000 seeds/acre compared to seeding rates at and below 28,000 seeds/acre. There was no significant difference in average silage yields among seeding rates greater than 32,000 seeds/acre (Figure 2). Results were different from research conducted in 2019 where the highest tonnage was observed at 48,000 seeds/acre with no significant differences in tonnage between 40,000, 44,000, and 48,000 seeds/acre (see page 29 of the 2019 Central Plains Field Research book).
- Seeding rate impact on silage quality varied in all parameters tested (Table 1). However, the planting rate of 36,000 seeds/acre resulted in significantly higher milk per ton of silage compared with the higher seeding rates of 40,000 seeds/acre or more, indicating that it was the best balance between tons/acre (quantity) and milk/ton (quality) for this study.

Corn Silage Response to Seeding Rate

Key Learnings

- Using a seeding rate of 32,000 seeds/acre provided the highest tonnage in 2020 while 48,000 seeds/acre provided the highest tonnage in 2019. Weather variability happens between years but a seeding rate below 32,000 seeds/acre consistently provided lower tonnage in both 2019 and 2020.
- Producers should work with their local seed sales team to choose a corn product and seeding rate that optimizes their production system.

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Corn Response to Tillage and Seeding Rate

Trial Objective

- Previous research conducted at the Bayer Learning Center at Monmouth, IL yielded mixed results when comparing different tillage systems.
- This trial was conducted to compare the yield response of corn under three different tillage types and two 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)
Monmouth, Illinois	Silt loam	Corn	Vertical, strip, conventional	5/2/20	10/8/20	250	32K, 42K

- Treatments consisted of three tillage systems and two seeding rates for a total of six treatments.
  - Tillage system:
    - Vertical tillage
    - Strip tillage
    - Conventional tillage (fall chisel plow followed by one pass with a soil finisher prior to planting)
  - Seeding rates:
    - 32,000 seeds/acre
    - 42,000 seeds/acre
- This study had two replications of each of the six treatments.
- Two different corn products were planted in this trial, but there were no meaningful differences observed between the corn products. Therefore, results presented are an average of both corn products.

Understanding the Results

- Although statistically insignificant, small yield increases were observed at the higher planting population in all three tillage systems.
- Vertical and conventional tillage resulted in similar yields whereas strip tillage yielded lower. This may have been the result of faster drying and warming of the soil with vertical and conventional tillage during the prolonged cool and wet conditions experienced in the spring of 2020.

Corn Response to Tillage and Seeding Rate

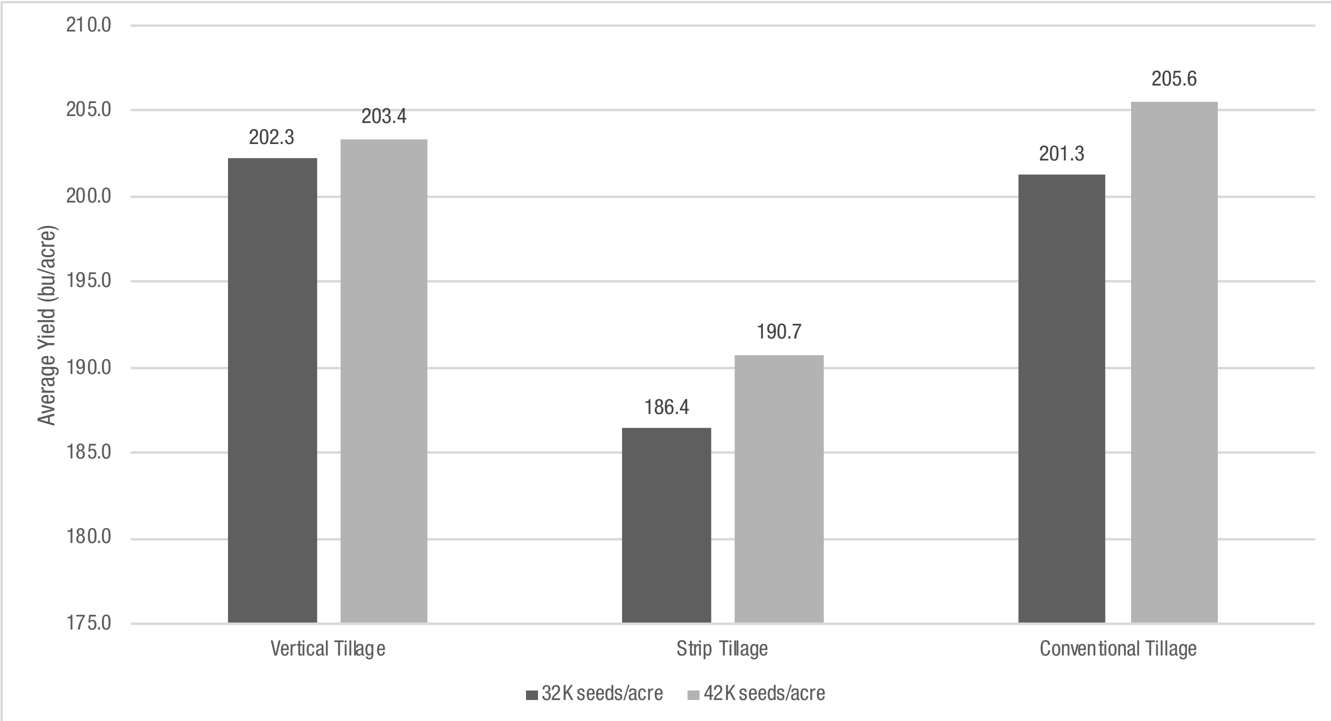

Figure 1. Average corn yields comparing three tillage systems and two seeding rates averaged across two corn products.

Key Learnings

- The interaction of soil type and environmental conditions can vary from year to year and have an effect on soil conditions at planting time.
- Some level of tillage may help to facilitate faster drying and warming of the soil in the spring.
- Consult your local Field Sales Representative or Technical Agronomist for tailored recommendations on your farm.

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Single Row Seeding Rate Differences in Corn

Trial Objective

- Previous research at the Bayer Crop Science Learning Center at Monmouth, IL would suggest the optimum seeding rate for corn is approximately 36,000 to 38,000 seeds per acre, depending on soil type and genetics.
- A study was conducted to determine if there is any advantage or disadvantage to planting different seeding rates in alternating rows compared to planting a uniform seeding rate in all rows.

Research Site Details

Location	Soil Type	Previous Crop	Tillage Type	Planting Date	Harvest Date	Potential Yield (bu/acre)	Seeding Rate (seeds/acre)
Monmouth, Il	Silt loam	Soybean	Conventional tillage	5/2/20	10/8/20	250	36K

- In this study, all plots were planted at a rate of 36,000 seeds/acre. However, there were two different seeding rate treatments:
  - — All rows evenly spaced at 36,000 seeds/acre.
  - — Seeding rate for each row alternated at 24,000 and 48,000 seeds/acre, for an average of 36,000 seeds/acre.

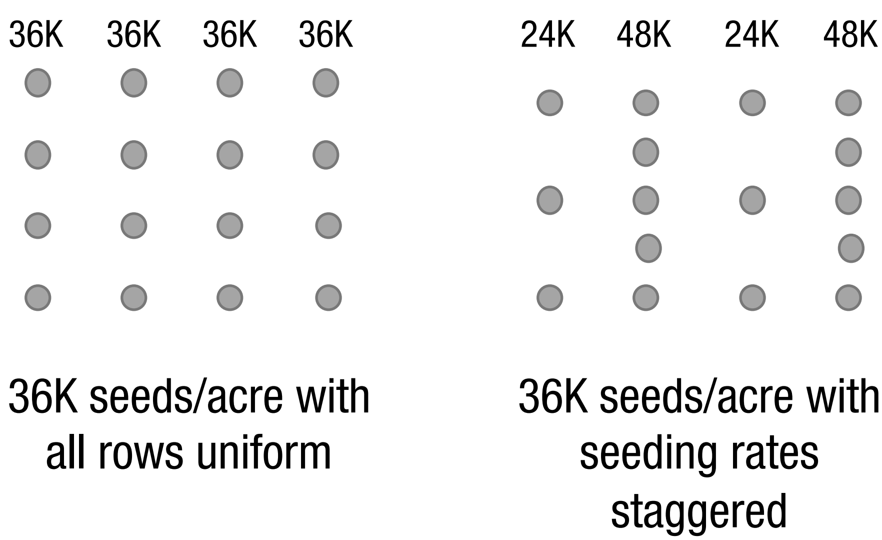

Figure 1. Graphic representation of seeding rate pattern for each treatment.

- Treatments were planted with a commercial planter equipped with individual row control precision technology.
- Each treatment had four replications.

Single Row Seeding Rate Differences in Corn

Understanding the Results

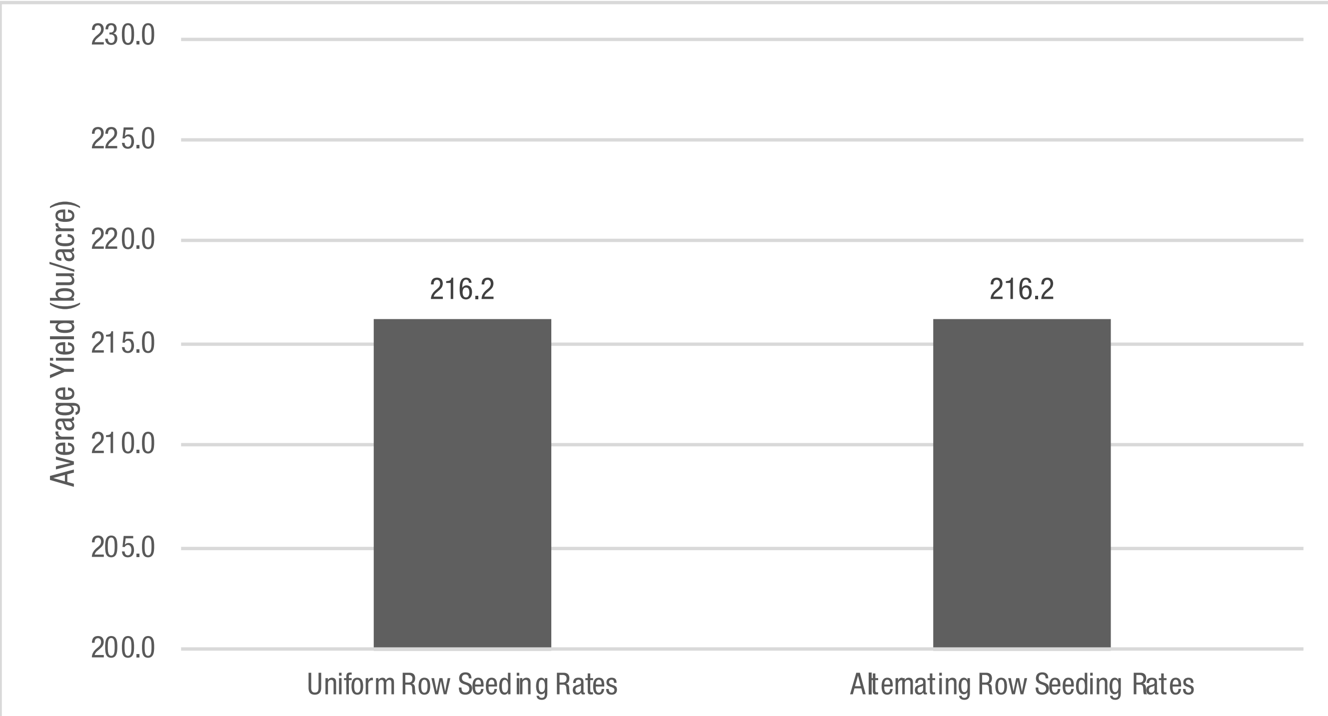

Figure 2. Average yield (bu/acre) comparison of uniform row seeding rates (36,000 seeds/acre) and alternating row seeding rates (24,000 and 48,000 seeds/acre, for an average of 36,000 seeds/acre).

- For this study, no average yield differences were observed between the two different row arrangements, as well as no differences in test weight and grain moisture.

Key Learnings

- Interestingly, it was observed that the uniform seeding rate treatment had more ears, but they were smaller. The alternating row seeding rate had fewer, larger ears. Thus, the overall average grain yield was the same.
- Soil type, fertility levels, growing conditions, and genetics may impact the results when alternating seeding rates in individual rows.
- Consult your local Field Sales Representative or Technical Agronomist for tailored recommendations to fit your farm.

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Corn Yield Response to Seeding Rate and Row Spacing

Trial Objective

- As corn products are developed to have higher yield potential and better stress tolerance, the optimum seeding rate has steadily increased.
- Previous work at the Bayer Learning Center at Monmouth, IL suggests the optimum seeding rate for most corn products is around 38,000 seeds per acre in our yield environment.
- Previous work at the Learning Center suggests row configurations narrower than 30 inches may increase stress reducing potential yield benefits at seeding rates greater than 38,000 seeds per acre.
- This demonstration was conducted to evaluate the yield response to seeding rate and row spacing.

Research Site Details

Location	Soil Type	Previous Crop	Tillage Type	Planting Date	Harvest Date	Potential Yield (bu/acre)	Seeding Rate (seeds/acre)
Monmouth, Il	Silt loam	Soybean	Conventional	6/5/20	10/27/20	250	35K, 45K

- Treatments consisted of two seeding rates and three row configurations for a total of six treatments.
  - Seeding rates:
    - 35,000 seeds/acre
    - 45,000 seeds/acre
  - Row configurations:
    - 30-inch
    - 20-inch
    - Twin rows on 30-inch centers
- Each treatment was replicated twice.

Corn Yield Response to Seeding Rate and Row Spacing

Understanding the Results

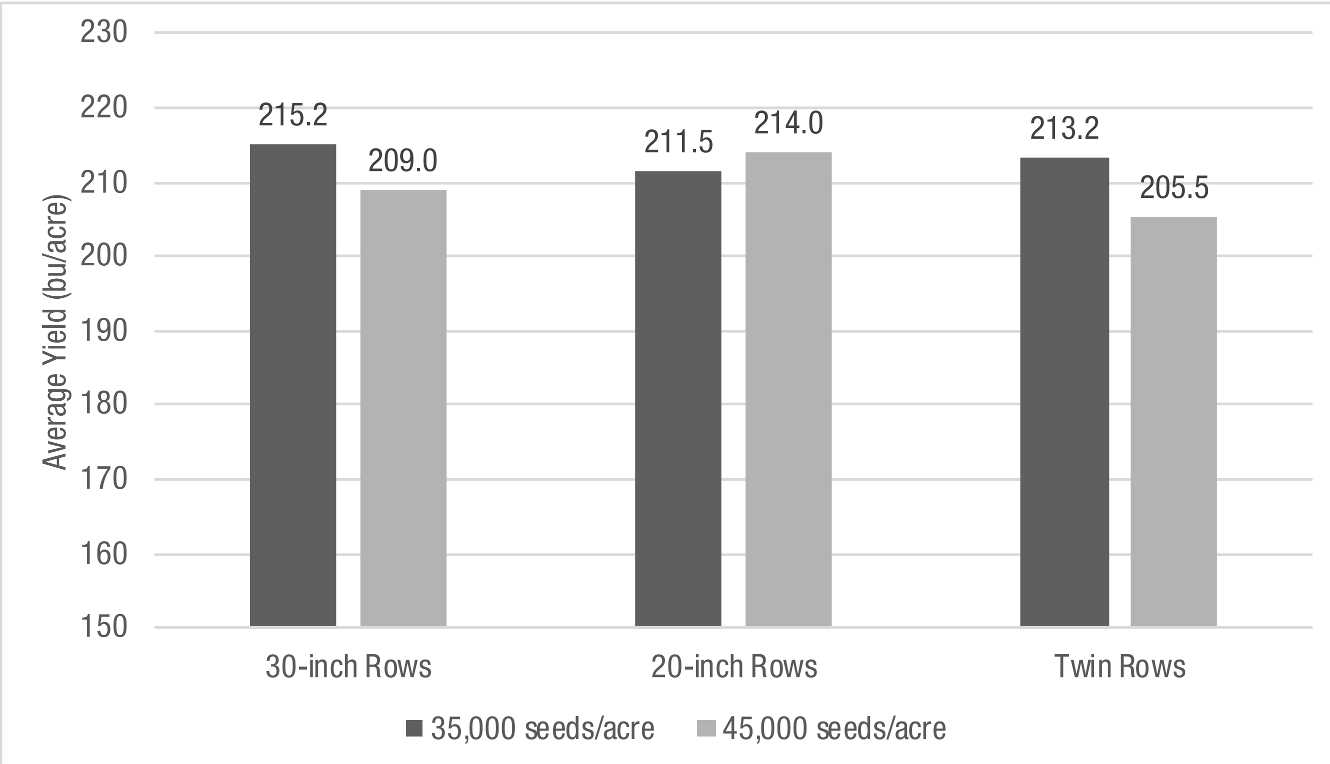

Figure 1. Average corn yield response to seeding rate and row spacing.

Key Learnings

- The results from this demonstration were contradicting to similar work at the Bayer Learning Center over the past several years:
  - Response to either seeding rate or narrower row configuration was not consistent.
  - The very late planting date and other factors may have created more plant growth limitations compared to stresses from plant density.
- The Bayer Learning Centers have generated robust data around optimum plant density for corn. Consult your local Field Sales Representative or Technical Agronomist on tailored recommendations for your specific farm.

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Corn Yield Response to Plant Row Spacing and Seeding Rate

Trial Objective

- Row spacing is usually a standardized or fixed practice in most operations. Unlike nitrogen and weed management which can be altered from year to year, most farmers don't have the luxury of switching row spacing between years. This is partly due to high capital investment in farm equipment.
- Proper row spacing allows plants to reach nutrients and avoid adverse effects of competition from neighboring plants. In Iowa, and in most regions of the Midwest, 20 inches and 30 inches are the most common row spacing configurations.
- Coupled with seeding rate, row spacing affects canopy closure, weed control, disease development, late-season plant standability, and ultimately yield potential. The objective of this trial was to assess the effects of two row spacings on corn yield potential at three different seeding rates.

Research Site Details

Location	Soil Type	Previous Crop	Tillage Type	Planting Date	Harvest Date	Potential Yield (bu/acre)	Planting Rate (seeds/acre)
Atlantic, IA	Silty clay loam	Soybean	Minimum	4/27/20	10/7/20	230	30K, 35K, 40K
Huxley, IA	Clay loam	Soybean	Conventional	5/1/20	N/A	220	30K, 35K, 40K
Storm Lake, IA	Clay loam	Soybean	Conventional	4/29/20	10/9/20	250	30K, 35K, 40K
Victor, IA	Silty clay loam	Soybean	Conventional	4/23/20	N/A	250	30K, 35K, 40K
Marble Rock, IA	Silt loam	Soybean	Strip till	4/24/20	10/1/20	200	30K, 35K, 40K

- Forty-eight corn brands were selected to represent the northern, central, and southern corn growing regions of Iowa. Huxley and Victor locations were lost due to the Derecho, and Marble Rock was lost due to environmental issues, which left us with Atlantic and Storm Lake.
- Products were planted at 30,000 (30K); 35,000 (35K); and 40,000 (40K) seeds/acre in both 20-inch and 30-inch row spacings.
- Tillage, weed and nitrogen management were the same for all products at the respective locations.
- Trials were conducted in 10 ft by 35 ft plots with three replications at Atlantic and two replications at Storm Lake (Figure 1).

Corn Yield Response to Plant Row Spacing and Seeding Rate

Understanding the Results

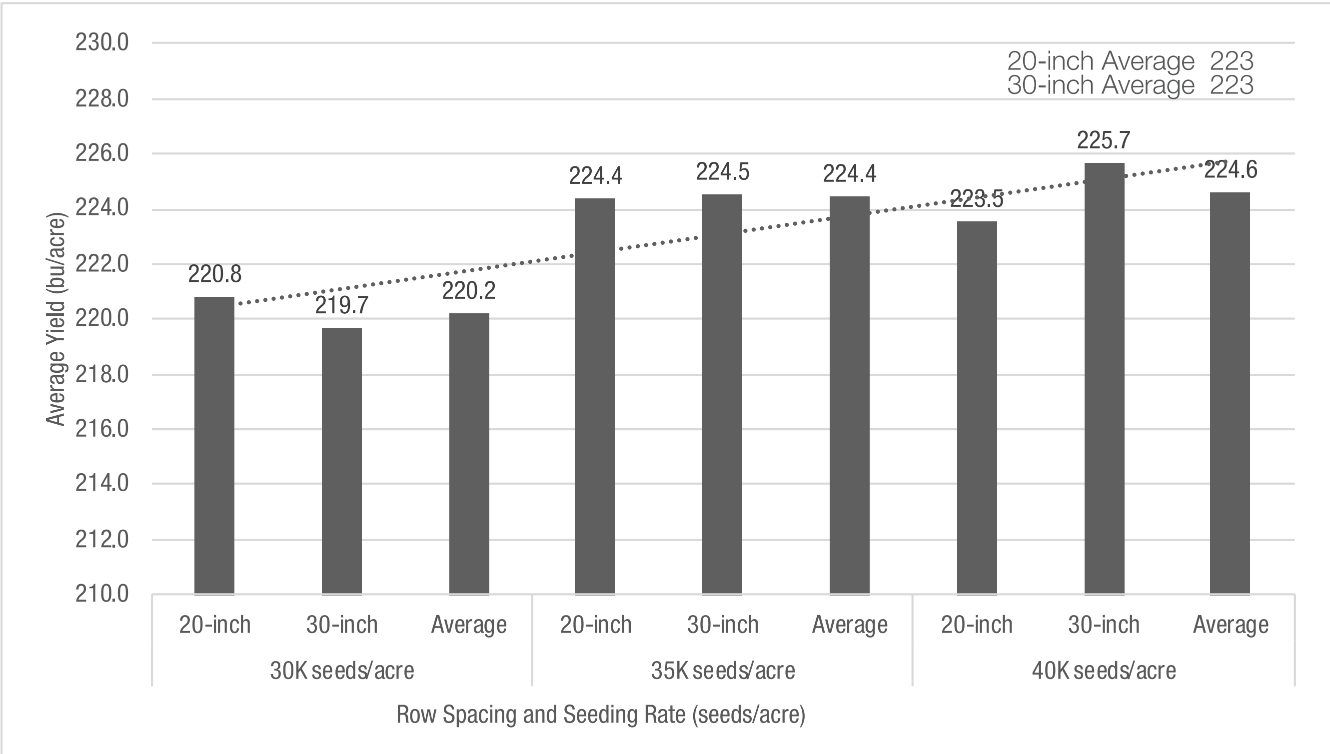

Figure 1. Effects of row spacing and seeding rate on the average yield of corn products tested. Data represents 48 products from two growing regions in Iowa. The average yield represents the overall average across locations, products, and seeding rates.

Table 1. Summary of corn product performance due to row spacing and seeding rate ('K' represents 1,000 seeds/acre).

Row Spacing	Average Grain Yield (bu/acre)			Average Grain Moisture Difference from 20-inch Rows (%)		
	30K	35K	40K	30K	35K	40K
20-inch	221	224	224	16.6	16.4	16.4
30-inch	220	225	226	17.9	17.6	17.5
Average	220	224	225	-1.3	-1.2	-1.1

- In this trial, the yield response to seeding rate at each row spacing varied greatly for various products tested.
- The 35K seeding rate had a higher average yield for both row spacings but may or may not have a positive return on seed investment.
- Overall, 20- and 30-inch row spacings yielded similarly at each seeding rate.
- Seeding rate had minimal effect on grain moisture content, but 20-inch row spacing had 1.2% less grain moisture on average across plant densities.
- The 20-inch row spacing had a win rate of 52% at the 30K seeding rate. The 30-inch row spacing had a win rate of 52% at 35K; and 54% at 40K seeding rates.

Corn Yield Response to Plant Row Spacing and Seeding Rate

Key Learnings

- In past years, each trial location carried out several row spacing trials in which 20-inch row spacing had consistently out-yielded 30-inch row spacing. However, those trials usually included a limited number of products.
- A virtue of adjusting plant configuration, 20-inch is expected to perform better than 30-inch row spacing, especially at higher seeding rates. However, a few products had better average yields at 20-inch compared to 30-inch row spacing at all seeding rates.
- Crop yield response to farm operations can be highly variable, and often significantly affected by environmental conditions during the growing season. Growers should test new products and concepts on a small scale to see how it fits in their operation.
- Growers should consult trusted agronomists and dealers when selecting the best products for their operation.

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Corn Product Characterization Response to Different Planting Populations - 2020

Trial Objective

For over a decade, Bayer has been using an innovative planter technology, the Genotype by Environment Narrative planter (GEN), to help understand and characterize corn product performance in response to plant population and location. This internally-developed tool provides the technical field teams the ability to simultaneously plant multiple corn products at different seeding rates across a field. These unique planting capabilities generate over 100,000 detailed yield observations each season across diverse growing conditions. This program provides data for our agronomy experts to optimize product performance and recommendations for all corn-growing regions in the United States. The objectives of this research were to:

- Evaluate all new Bayer corn products using seeding rates ranging from 18,000 to 50,000 seeds/acre across multiple locations in the United States.
- Provide growers with product-specific planting recommendations.
- Assess new products in as many yield environments as possible over a two-year period.
- Provide growers with insight for their specific situation and the product they selected.

Research Site Details

- This research included 123 testing locations across the United States.
- The products tested were selected by the regional field teams as important in that geography.
- Testing locations targeted diverse environments (yield environment, crop rotation, tillage practice, etc.).
- Agronomic management practices used in this study mimicked local best management practices.
- Products tested were both first-year commercial and pre-commercial corn products.
- The experimental design was a split-plot randomized complete block (RCB) with 2 replications. Corn product was the main plot and seeding rate was the sub plot.
- Small plots were used: four 35-foot rows per plot with a row width of 30 inches.
- Seeding rates were as follows:
  - Low-yielding acres: 18,000, 24,000, 28,000, 32,000, 38,000, and 44,000 seeds/acre
  - High-yielding acres: 24,000, 32,000, 36,000, 40,000, 44,000, and 50,000 seeds/acre

Corn Product Characterization Response to Different Planting Populations - 2020

Understanding the Results

- Product-specific data on the response to plant population allows for customized recommendations for new corn products specific for a grower's geography.
- Multiple years of data allow agronomists to determine the influence of weather on corn product performance. This adds to the robustness of the recommendations generated in this system.
- The relative responsiveness of a product to plant population can change depending on the yield environment and management.

Key Learnings

The information generated in this program drives innovation within Bayer while it provides data to the farmers who rely on our premium genetics to deliver top yields. The data that these trials generate help growers optimize product placement and seeding rates of Bayer corn products to maximize the return on their investment in our corn products.

- Consult with your Technical Agronomist, who has access to this data, early in the year for information on the performance of all our newest products.
- Visit our website, www.dekalbasgrowdeltapine.com and specifically, optimize your performance https://www.dekalbasgrowdeltapine.com/en-us/dekalb/tools/optimize-my-seed.html
- Visit Climate FieldView™ seed scripts at https://climate.com/2020-seed-scripts to see how this data is being used to develop specific corn product recommendations. Pairing the product-level seeding rate characterization with the specific agronomic environment of your operation can optimize your system.

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DEKALB® Brand Product Response to Soil Environments

Trial Objective

- New corn products should be evaluated for response to soil type prior to planting. Product placement for any farming operation is important to help maximize the value of the selected products for the acre planted.
- New corn products and refuge products remain a focus of our program at the Bayer Learning Center at Scott, Mississippi.
- This trial was conducted to:
  - Help evaluate the adaptation of new, existing, and refuge DEKALB® brand corn products to two radically different soil types.
  - Evaluate yield potential for new, existing, and refuge corn products from DEKALB® brand as an aid to help growers:
    - With corn product placement.
    - Remain compliant with refuge management plans.
    - Collect optimum value from DEKALB® brand corn products.
- This information is important for correctly placing products for maximum yield potential, good stewardship of biotechnology traits, maintaining compliance, and optimizing performance of DEKALB® brand products over time.

Research Site Details

Location	Soil Type	Previous Crop	Tillage Type	Planting Date	Harvest Date	Potential Yield (bu/acre)	Seeding Rate (seeds/acre)
Scott, MS	Commerce Silt Loam	Cotton	Conventional	04/28/20	09/17/20	250	37,500
Scott, MS	Sharkey Clay	Soybean	Conventional	05/06/20	09/11/20	200	37,500

- Plot design was a large block, single replicate design.
- Nitrogen was applied in-season at 240 lb/acre. All other agronomic practices were per the standards for the area.
- Soil types on which corn products were evaluated:
  - Commerce Silt Loam, SAND, CEC = 18 meq/100g
  - Sharkey Clay, CLAY, CEC = 45 meq/100g
- For each soil type, corn products were planted at a seeding rate of 37,500 seeds/acre and about 95% of the seeds emerged.
- A commercial scale planter was used.
- For this trial, 20 DEKALB® brand products were planted (Table 1).

DEKALB® Brand Product Response to Soil Environments

Table 1. DEKALB® brand corn products planted by each soil type.				
			Soil Types	
DEKALB® Brand Corn Product	Biotechnology Trait	Relative Maturity	Commerce Silt Loam	Sharkey Clay
DKC62-53	VT Double PRO® Technology	112		X
DKC62-08	SmartStax® Technology	112		X
DKC63-57	VT Double PRO® Technology	113		X
DKC64-35	VT Double PRO® Technology	114	X	X
DKC65-95	VT Double PRO® Technology	115	X	X
DKC65-99	Trecepta® Technology	115	X	X
DKC66-18	VT Double PRO® Technology	116	X	X
DKC66-75	VT Double PRO® Technology	116	X	
DKC67-37	SmartStax® Technology	117	X	X
DKC67-44	VT Double PRO® Technology	117	X	X
DKC67-94	Trecepta® Technology	117	X	X
DKC68-26	VT Double PRO® Technology	118	X	X
DKC68-69	VT Double PRO® Technology	118	X	
DKC69-16	SmartStax® Technology	119	X	X
DKC69-99	Trecepta® Technology	119	X	X
DKC70-27	VT Double PRO® Technology	120	X	X
DKC62-05	Roundup Ready® Corn 2	112		Refuge
DKC66-94	Roundup Ready® Corn 2	116		Refuge
DKC68-24	Roundup Ready® Corn 2	118		Refuge
DKC70-25	Roundup Ready® Corn 2	120		Refuge

- Harvest Information
    - Trial was harvested with a commercial scale combine.
    - Data was recorded using Precision Planting® YieldSense yield monitor.
    - Corn grain yield data were corrected to 15.5% moisture for presentation.

DEKALB® Brand Product Response to Soil Environments

Understanding the Results

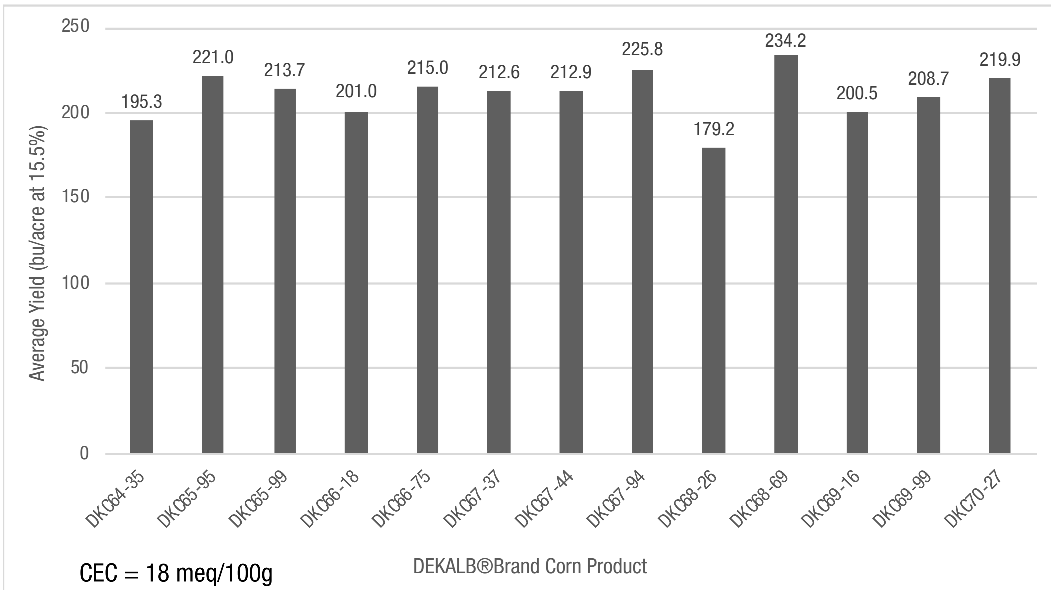

Figure 1. DEKALB® brand corn product evaluation on Commerce silt loam soil type.

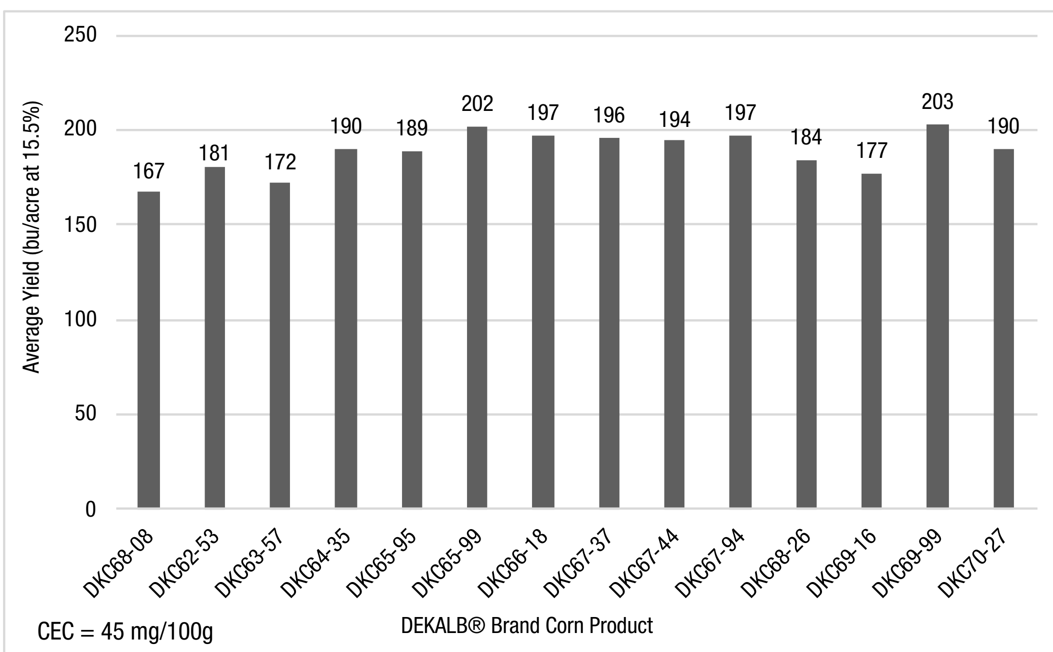

Figure 2. DEKALB® brand corn product evaluation on Sharkey clay soil type.

DEKALB® Brand Product Response to Soil Environments

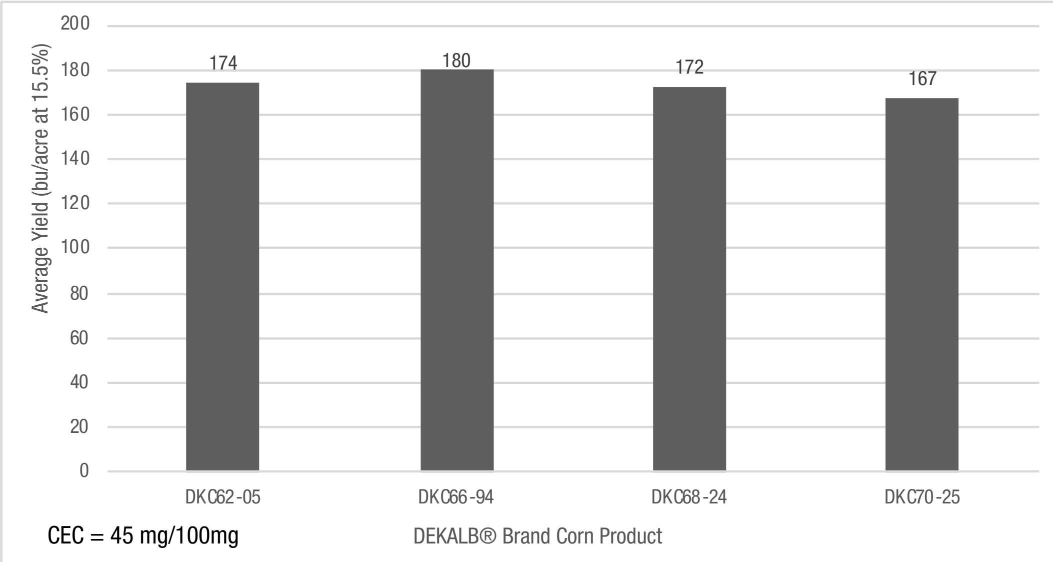

Figure 3. DEKALB® brand corn products used as refuge on Sharkey clay soil type.

Key Learnings

- Corn products should be evaluated for yield and standability response to population prior to planting.
- Differences do exist, use the correct products for your production environment.
- Please see your local DEKALB® brand seed representative for more information.

Legal Statements

Response of Corn Refuge Products to Seeding Rate

Trial Objective

All southern corn growers are required to plant a non-insect protected corn refuge if growing Bt (Bacillus thuringiensis) corn. The objectives of this trial are to:

- Evaluate the response of refuge (non-Bt) corn products to seeding rate.
- Determine the population that optimizes the yield potential and standability for each refuge corn product.
- Show growers how to optimize the performance of refuge corn products in their corn refuges.
- Encourage improved grower compliance with refuge requirements.

Research Site Details

Location	Soil Type	Previous Crop	Tillage Type	Planting Date	Harvest Date	Potential Yield (bu/acre)	Planting Rate (seeds/acre)
Scott, MS	Mixed - Clay Silt loam	Cotton	Conventional	05/02/20	09/11/20	200	23,000 28,000 33,000 38,000 43,000

- This demonstration was conducted as a non-replicated large block.
- Four DEKALB® brand Roundup Ready® Corn 2 products were planted at five seeding rates. Emergence was approximately 95% of the planted seeding rate.
  - DKC62-05 Brand
  - DKC66-94 Brand
  - DKC68-24 Brand
  - DKC70-25 Brand
- Nitrogen was applied at 240 lb/acre as 32% liquid UAN. All weed control, insect control, and irrigation inputs were applied per local standards.
- All data was collected using Precision Planting® 20/20 SeedSense® via Climate FieldView™Platform. Average yield data were corrected to 15.5% moisture in the analysis.

Understanding the Results

- Three brands in this demonstration, DKC62-05 Brand, DKC66-94 Brand, and DKC68-24 Brand increased average yield as seeding rate increased, except DKC70-25 Brand.
- Refuge corn products tested in this demonstration exhibited acceptable average yields according to expected potential yield.

Response of Corn Refuge Products to Seeding Rate

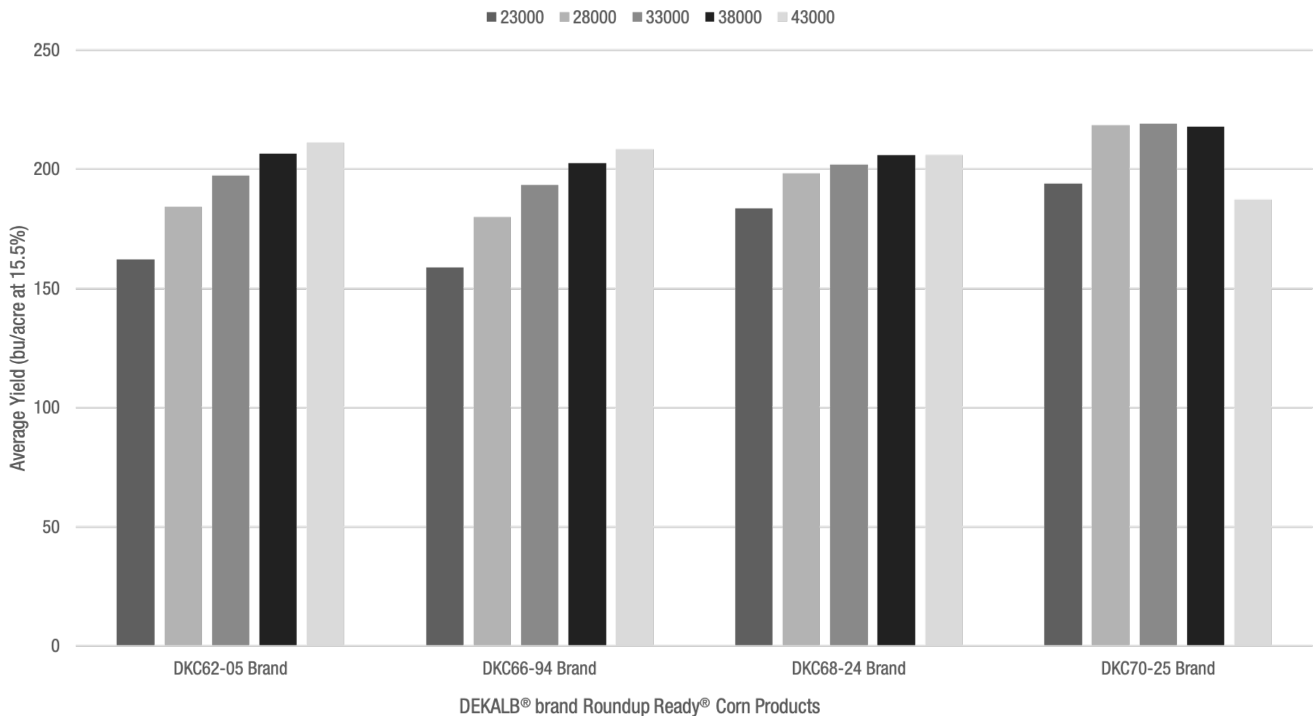

Figure 1. Response of four refuge corn brands to seeding rate (seeds/acre).

Key Learnings

- For this demonstration, refuge corn products generally produced higher yields at higher seeding rates. Seeding rates should be adjusted according to the production environment.
- Refuge corn product characteristics, yield potential, and agronomic practices are considerations when selecting refuge corn products.
- Contact your DEKALB® brand seed representative for questions about specific corn products and refuge requirements.

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Roundup Ready® 2 Technology contains genes that confer tolerance to glyphosate. Glyphosate will kill crops that are not tolerant to glyphosate. Services and products offered by The Climate Corporation are subject to the customer agreeing to our Terms of Service. Our services provide estimates or recommendations based on models. These do not guarantee results. Before making financial, risk management and farming decisions, agronomists, commodities brokers and other service professionals should be consulted. More information at http://www.climate.com/disclaimers. FieldView™ is a trademark of The Climate Corporation. DEKALB® and Roundup Ready® are registered trademarks of Bayer Group. All other trademarks are the property of their respective owners. 3013_R12

Effects of Corn Seed Placement on Yield Potential

Trial Objective

- Demonstrations at the Bayer Learning Center at Scott, Mississippi in 2018 and 2019 showed comparable yield potential for broadcast soybean production to plantings with 38-inch single, 38-inch twin, and 30-inch single row spacing.
- Wet conditions delayed corn planting in 2019, which led to growers asking the question-– Can I broadcast seed corn when I am pushed for time at planting?
- This demonstration was conducted to quantify the effect of precision corn seed placement with row-planted systems versus a broadcast planting technique.
- This study attempts to demonstrate the potential of using an alternative planting technique, like broadcast planting corn, in difficult planting conditions.

Research Site Details

Location	Soil Type	Previous Crop	Tillage Type	Planting Date	Harvest Date	Potential Yield (bu/acre)	Planting Rate (seeds/acre)
Scott, MS	Clay Silt loam	Soybean	Conventional	5/22/20	9/18/20	200	36K

- All cultural inputs (insect, weed and disease management) were per the local standards for the area with 240 lb/acre of liquid N applied early in-season via a soil application.
  - Four DEKALB® corn products were planted:
    - DKC64-35, VT Double PRO®, 114 Relative maturity
    - DKC66-18, VT Double PRO®, 116 Relative maturity
    - DKC67-44, VT Double PRO®, 117 Relative maturity
    - DKC70-27, VT Double PRO®, 120 Relative maturity
- Treatments
  - Row-planted system: 36000 seeds per acre were planted using precision corn planting equipment at two different depths:
    - ½-inch
    - 2-inch
  - Broadcast system: 36000 seeds per acre by weight were planted using a fertilizer spreader. This was determined by the seeds per pound listed on the seed bag and the land area to be seeded.
- Plots were planted as single replicate strip plots that were .10 acres each.
- Data were corrected to 15.5% moisture for analysis.
- This trial was planted late to simulate a delayed planting date situation and as such, the expected yield potential was lower than the typical expected yield for the area.

Effects of Corn Seed Placement on Yield Potential

Understanding the Results

Figure 1. Inconsistent corn emergence with broadcast seeding method.

Figure 2. Height differences between seeding depth of ½-inch (left) and 2-inch depth (right).

Effects of Corn Seed Placement on Yield Potential

- Emergence
  - Precision system: typical uniform emergence to a stand of approximately 33000-34000 plants/acre.
  - Broadcast system: Extremely variable emergence to a stand in the range of 38000-60000 plants/acre due to difficulty in accurately applying seed to the field by weight (Figure 1).
- Early Season
  - Precision system: The deeper planted (2 inches deep) appeared healthier throughout the season than either the broadcast or the ½-inch deep planted (Figure 2).
  - Broadcast system: The broadcast corn was not uniform in appearance during the season and emerged at widely varying times for about 4 weeks post planting.
- Harvest
  - Precision system: We observed a 27 bu/acre average yield increase across all corn products in this demonstration for the 2-inch deep planted corn when compared to the ½-inch deep corn.
  - Broadcast system: We observed a 56 bu/acre average increase in the 2-inch deep planted system compared to the broadcast planted corn.

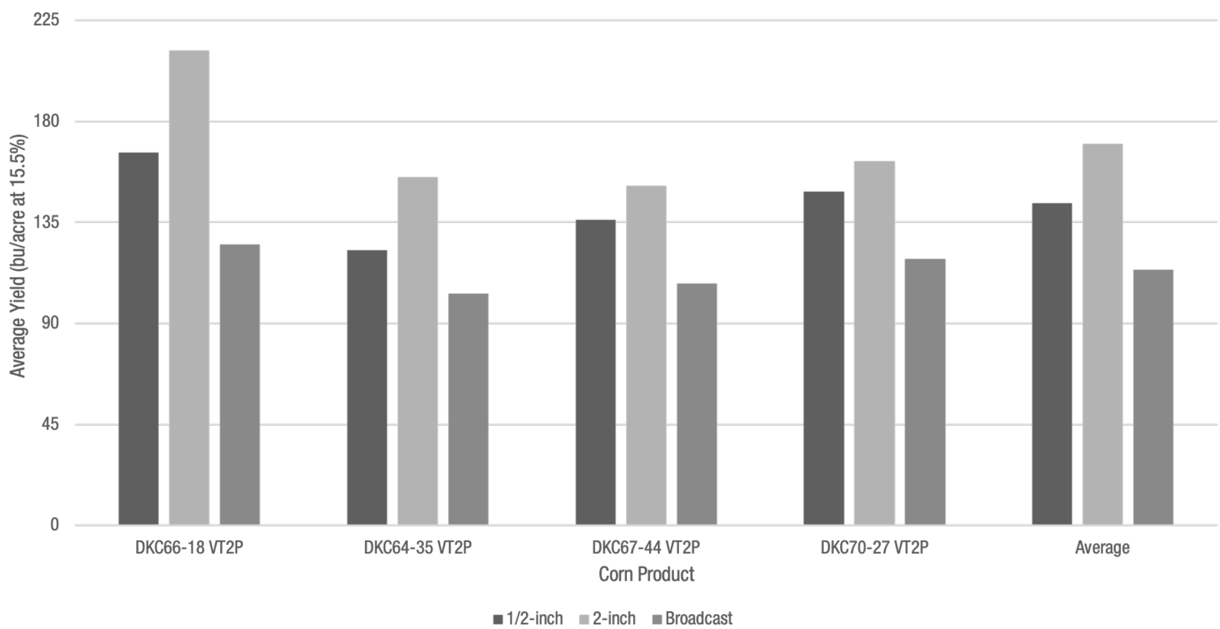

Figure 3. Average yield of all corn products and planting treatments, including average yield off all corn products across each planting treatment.

Key Learnings

- For this demonstration, precise seed placement and deeper seeding depths had a positive influence on corn yield potential. These parameters can only be established at planting.
- Under the late planting conditions at Scott Learning Center, broadcast planting of corn is not recommended, and taking the time to precision plant corn increased yield potential.

Effects of Corn Seed Placement on Yield Potential

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ALWAYS READ AND FOLLOW PESTICIDE LABEL DIRECTIONS. B.t. products may not yet be registered in all states. Check with your seed brand representative for the registration status in your state.

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. See the IRM/Grower Guide for additional information. Always read and follow IRM requirements.

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Insect Resistance Management
Planting Refuges, Preserving Technology

Before opening a bag of seed, be sure to read, understand and accept the stewardship requirements, **including applicable refuge requirements for insect resistance management,** for the biotechnology traits expressed in the seed as set forth in the Monsanto Technology/Stewardship Agreement that you sign. By opening and using a bag of seed, you are reaffirming your obligation to comply with the most recent stewardship requirements.

Roundup Ready 2 TECHNOLOGY

RESPECT THE REFUGE

Response of Corn Products to Soil Preparation, Seeding Rate, and Planting Depth

Trial Objective

- Rainy fall and spring weather patterns can result in wet soils that prevent raised beds from being prepared. Heavy spring rains can lead to deteriorated seedbed conditions for fields that were prepared in the fall. For these reasons, it is not uncommon for fields to be planted into less than ideal field conditions.
- Adequate drainage is necessary for maximum yield potential in the coastal Mid-South. Poor drainage can hamper stand establishment due to soil saturation. For this reason, preparing raised beds for planting are a common practice in the Mid-South. However, when time is tight due to weather conditions, bedding can be a step that growers are tempted to skip.
- The objective of this study was to evaluate the yield potential of corn products to different soil preparation scenarios, planting depths, and seeding rates.
  - Previous work at the Bayer Learning Center at Scott, Mississippi has shown a positive yield response to proper field preparation and deeper planting depths. Past data has shown a greater yield response to deeper planting depths for earlier, cooler planting dates.

Research Site Details

Location	Soil Type	Previous Crop	Tillage Type	Planting Date	Harvest Date	Potential Yield (bu/acre)	Seeding Rate (seeds/acre)
Scott, MS	Clay silt loam	Cotton	Various	05/4/20	9/11/20	200	32K, 37K

- Two DEKALB® brand VT Double PRO® corn products (DKC66-75 brand and DKC68-69 brand) were selected for this demonstration.
- Treatments included:
  - Two seeding rates:
    - 32,000 seeds/acre
    - 37,000 seeds/acre
  - Two planting depths:
    - 1.25 inches
    - 2.5 inches
  - Four soil preparation methods:
    - Spring disk flat and rehipped: Harrow plowed flat and rebedded in the spring (Figure 1, left).
    - Spring disk flat and plant flat: Conventional tillage without bedding performed in the spring (Figure 1, right).
    - No-till: Corn planted into standing, mown-off cotton stalks (Figure 2).
    - Reduced tillage: Stale seedbed rehipped in the spring with minimal tillage (Figure 3, left).
- All weed control, insect control, and irrigation inputs were applied per local standards on all treatments.

Response of Corn Products to Soil Preparation, Seeding Rate, and Planting Depth

Figure 1. Spring disk flat and rehipped (left) and spring disk flat and plant flat (right) soil preparation treatments.

Figure 2. No-till soil preparation treatment.

Figure 3. Reduced-till treatment of stale seedbed rehipped (left) and no-till treatment of mowed cotton stalks (right) soil preparation treatments.

Understanding the Results

- Seeding rate: Due to spring rains in 2020, most southern corn was planted late which limited yield potential. Therefore, the typical response to seeding rate was not observed in this study. In addition, both corn products are well adapted to the seeding rates used in this study and were able to optimize yield potential across the parameters tested. Because no differences were noted due to seeding rate, data was combined for the purposes of this report.

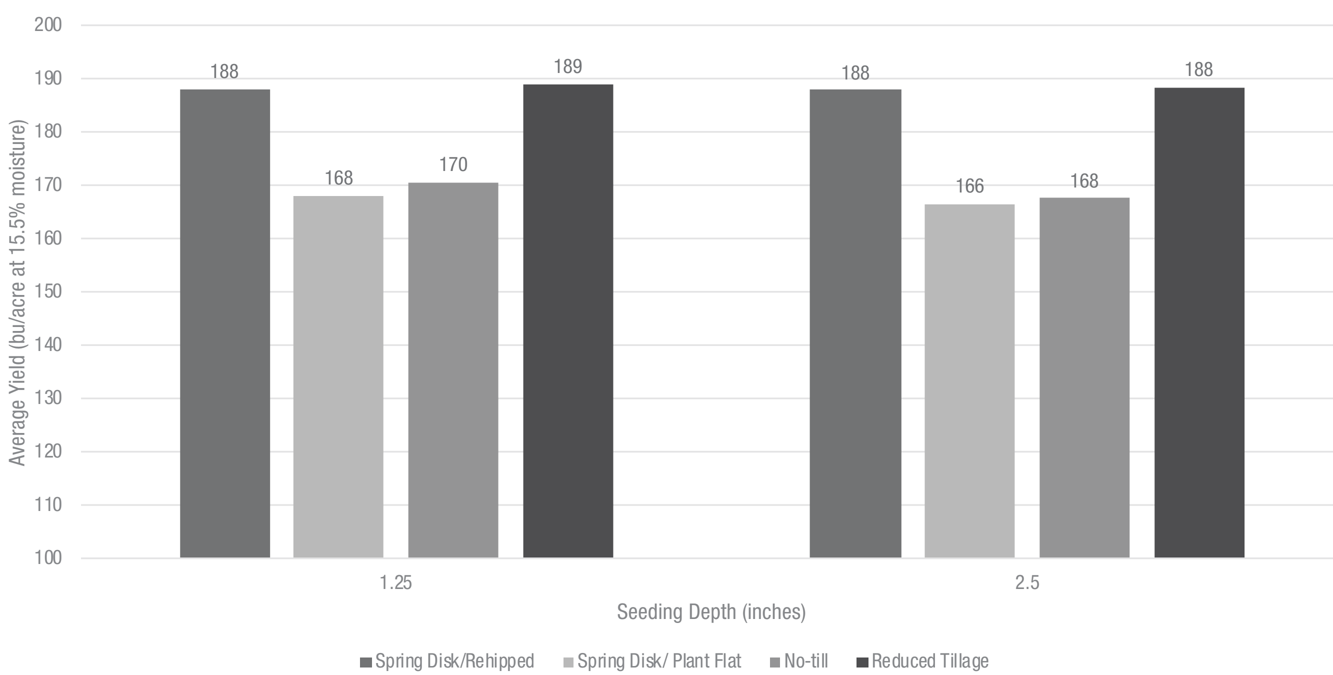

Figure 4. Average corn yield response to soil preparation and seeding depth in 2020.

Response of Corn Products to Soil Preparation, Seeding Rate, and Planting Depth

- Planting depth: There were no substantial average yield differences due to planting depth in 2020 (Figure 4). In previous demonstrations, we typically observed more of an impact from planting depth than we observed in this demonstration, which showed basically zero impact. This is likely due to not planting into cold, wet soils and not having a large predation of seed by birds. These are the two primary reasons that we typically plant corn deeper.

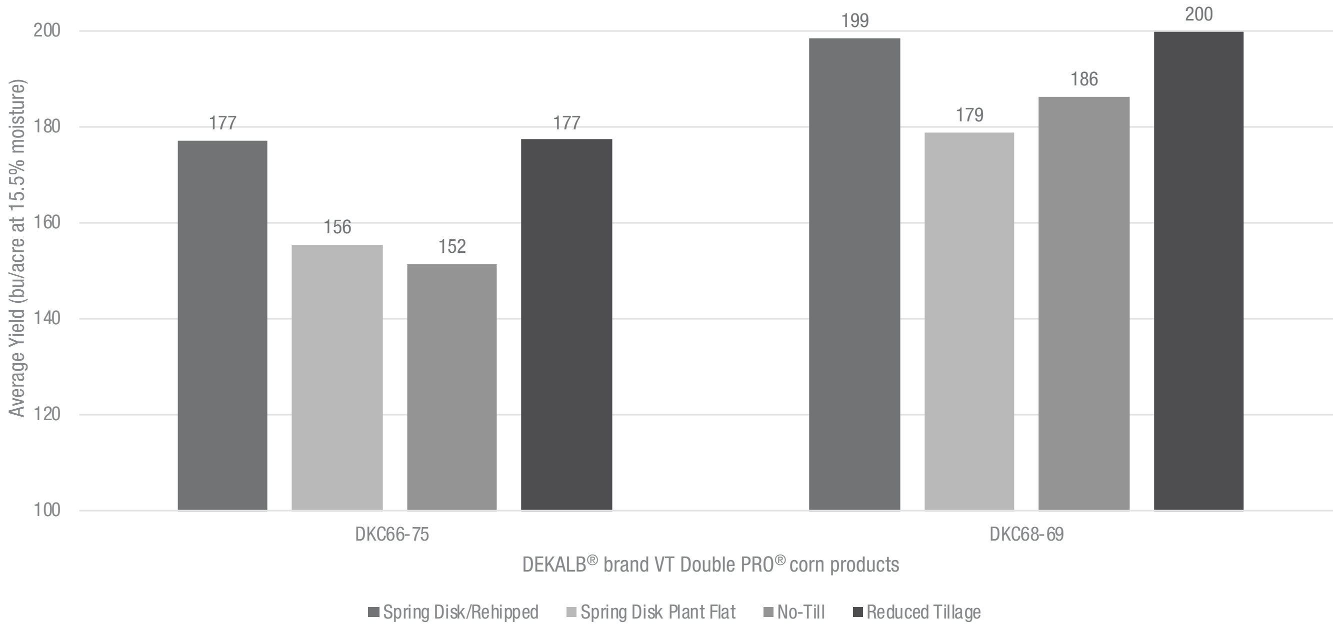

Figure 5. DEKALB® brand VT Double PRO® corn product average yield response to soil preparation in 2020.

- Corn product: The corn products in this demonstration responded differently to soil preparation method. These results highlight the importance of corn product selection and positioning them to maximize their genetic potential. The field for this study was a stressful production system and DKC66-75 Brand is not well suited for this environment.

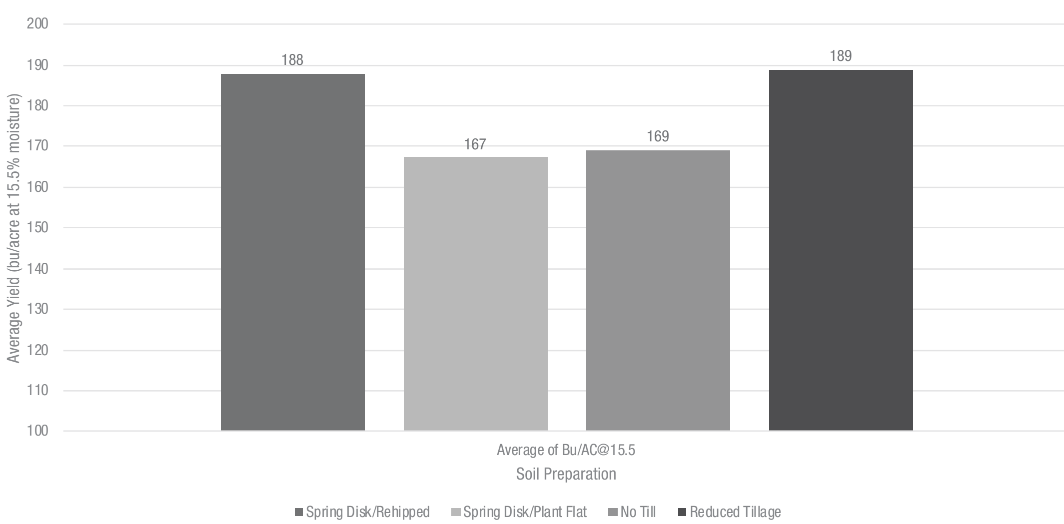

Figure 6. Average corn yield response to soil preparation in 2020.

Response of Corn Products to Soil Preparation, Seeding Rate, and Planting Depth

- Soil Preparation: In this demonstration, the reduced tillage and spring disked/rehipped systems showed average yield increases of 20 bu/acre compared to flat planted or no till treatments. This is likely due to improvements in drainage. Raised beds can help relieve seedlings from saturated soils. Observations were similar in 2019 where the no-till and flat planted system did not yield as those with beds.
- The results from 2019 and 2020 indicate an ability to reduce tillage as long as good drainage is established with the system chosen.
- For details on 2019 results, please visit https://www.dekalbasgrowdeltapine.com/en-us/agronomy/response-corn-products-to-soil-preparation-seeding-rate-and-planting-depth.html.

Key Learnings

- Corn product selection remains a very important component in maximizing corn yield potential.
- In this demonstration, planting depth did not appear to have an impact when considering tillage system, corn product or seeding rate. However, growers should remain focused on planting at recommended depths to mitigate risk of bird damage and uneven emergence.
- Seeding rate did not greatly increase yields in 2020 but yield potential may have been limited by the delayed planting date. Growers should consider corn product, planting date, soil types and maximum yield potential when selecting a seeding rate.
- The tillage system used impacted yield potential in this study. Abundant rainfall and excessive soil moisture is the most prominent factor challenging southern corn growers during the planting season. Management options like soil preparation can help improve outcomes. Growers should establish/reestablish drainage (regardless of tillage system) as needed to help optimize yield potential.

Legal Statements

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Bayer is a member of Excellence Through Stewardship® (ETS). Bayer products are commercialized in accordance with ETS Product Launch Stewardship Guidance, and in compliance with Bayer's Policy for Commercialization of Biotechnology-Derived Plant Products in Commodity Crops. Commercialized products have been approved for import into key export markets with functioning regulatory systems. Any crop or material produced from this product can only be exported to, or used, processed or sold in countries where all necessary regulatory approvals have been granted. It is a violation of national and international law to move material containing biotech traits across boundaries into nations where import is not permitted. Growers should talk to their grain handler or product purchaser to confirm their buying position for this product. Excellence Through Stewardship® is a registered trademark of Excellence Through Stewardship.

ALWAYS READ AND FOLLOW PESTICIDE LABEL DIRECTIONS. B.t. products may not yet be registered in all states. Check with your seed brand representative for the registration status in your state.

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. See the IRM/Grower Guide for additional information. Always read and follow IRM requirements.

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3013_R6_20

Yield Response to Corn Characteristics and Nitrogen Strategy

Trial Objective

- Many new corn products are developed each year as research and development pipelines aim to improve the corn portfolio and farmer choice. Farmers have a short time to become familiar with the nitrogen (N) efficiency of new corn products.
- Flex-ear corn products can adjust yield components and set more rows around on the cob, more kernels per row, or increase kernel depth if conditions are favorable. Increasing seeding rates to increase yield are recommended for fixed-ear corn products as the yield components do not change much.
- Agronomists make recommendations for corn products with high or low late-season plant health and ear flexibility. These corn characteristics may affect N uptake and allocation and impact corn yield potential. Additional information about N application can help farmers improve their N management system for individual corn products.
- The objective of this study was to evaluate corn characteristics: (1) late season plant health and (2) corn ear flex and their influence on corn yield potential with different N application strategies.

Research Site Details

Location	Soil Type	Previous Crop	Tillage Type	Planting Date	Harvest Date	Potential Yield (bu/acre)	Seeding Rate (seeds/acre)
Gothenburg, NE	Silt loam	Soybean	Strip-till	4/28/20	10/23/20	270	36K

- A soil test report on April 14, 2020 indicated 187 lb N/acre was recommended (33 lb N/acre in the top 2 ft of soil plus 40 lb N/acre legume credit) for a yield goal of 270 bu/acre.
- The study design was a split-plot with fertilizer as the whole plot and corn characteristics as the subplot with four replications.
  - Fertilizer Treatments:
    - Up-front N – Strip-tilled 27.5 lb N/acre on 4/8/2020 and applied 160 lb N/acre with a streamer bar (nozzles attached to a regular 30-ft sprayer) on 4/29/2020.
    - Split N - Strip-tilled 27.5 lb N/acre on 4/8/2020 and applied 40 lb N/acre with the streamer bar on 4/29/2020, followed by 120 lb N/acre applied by fertigation. The fertigation was split into 8 to 15 lb N/acre increments with applications on 7/11, 7/17, 7/21, 7/26, 7/30, 8/2, 8/6, and 8/10.
    - The study area also received 70 lb P/acre and 15 lb S/acre.
  - Corn Characteristic Treatments:
    - Late-season plant health
      - High – 105-day relative maturity (RM), 111RM, and 113RM
      - Low – 110RM, 111RM, and 113RM
    - Ear Flex
      - High – 104RM, 113RM, and 113RM
      - Low – 108RM, 109RM, and 113RM

Yield Response to Corn Characteristics and Nitrogen Strategy

- Weeds were uniformly controlled and no insecticides or fungicides were applied.
- A sub-surface drip irrigation system was used to meet the evapotranspiration demands of the crop.
- Plots were harvested with a small plot combine and total plot weight, percent moisture, and test weight were recorded.
- Average corn yields were calculated and bushel difference between split N and up-front N treatments were also reported. The average corn yield was 256 bu/acre across all treatments.

Understanding the Results

- The difference in how corn that was classified as either 'high' or 'low' for late season plant health responded to a split N or the up-front N treatments is detailed in Figure 1.
  - Corn products with "high" late-season plant health had greater yields from the split N treatment compared to the up-front N treatment. Corn products with "low" late-season plant health had no yield difference between the two N strategies.

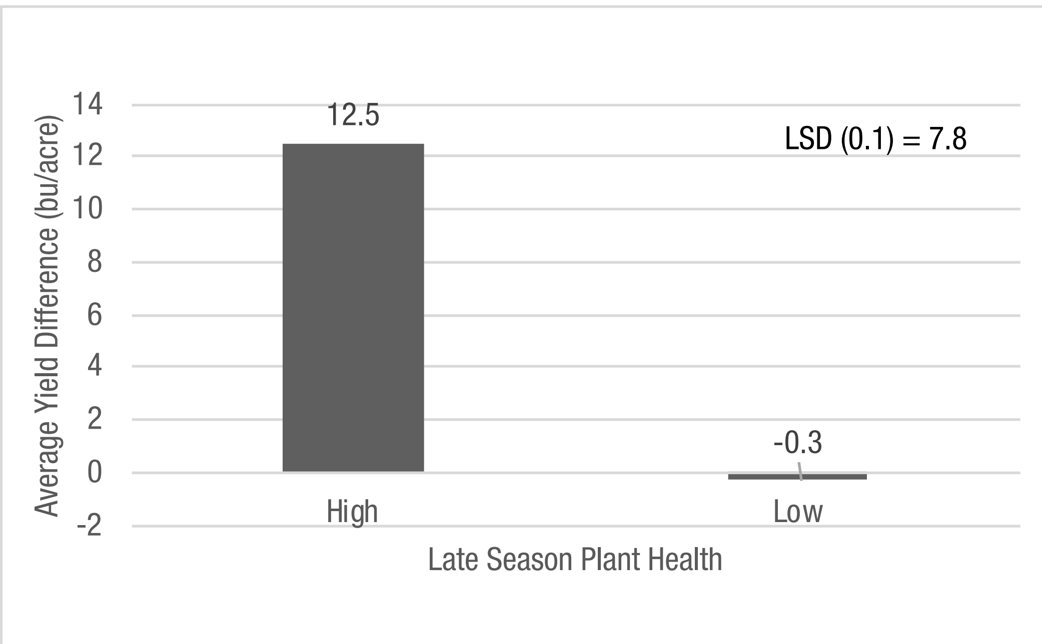

Figure 1. Response to nitrogen strategy and late season plant health: split N average yield minus up-front average yield.

- Corn was classified as a 'high' or 'low' ear flex based on its response to the split N or the up-front N treatments (Figure 2).
- Corn rated either high or low for ear flex responded similarly to N strategy with both groups having greater yields with the split N application treatment.
- On average, corn had higher average yields with split N application strategy compared to the up-front N application strategy.

Yield Response to Corn Characteristics and Nitrogen Strategy

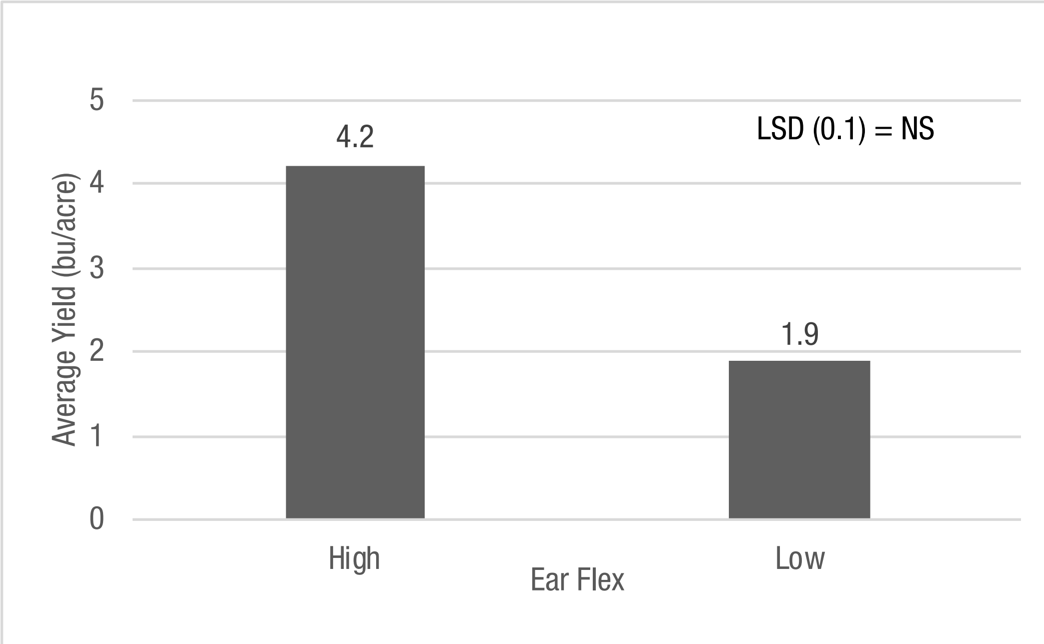

Figure 2. Response to nitrogen strategy and ear flex: split N average yield minus up-front average yield.

Key Learnings

- Corn tended to yield greater with a split N application strategy compared to N applied up-front at planting.
- This is the first year of this study so more research is needed to confirm how corn characteristics influenced yield. In the meantime, farmers may consider the following-
  - Corn with a 'high' late-season plant health score may have greater yield potential from a split N strategy compared to an up-front N strategy while there was no difference in how corn responded to N strategy with a 'low' late- season plant health score.
  - Corn yielding high with split N application had the same N strategy response regardless of ear flex rating.

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Corn Response to Nitrogen Rates

Trial Objective

- The optimum nitrogen (N) rate for corn can be difficult to determine. Inadequate N can cause a noticeable reduction in yield while excess, unused N reduces the return on N investment and can have negative environmental impacts.
- The objective of this study was to evaluate the response of corn products to different N rates.

Research Site Details

Location	Soil Type	Previous Crop	Tillage Type	Planting Date	Harvest Date	Potential Yield (bu/acre)	Seeding Rate (seeds/acre)
Gothenburg, NE	Hord silt loam	Corn	No tillage	4/30/20	11/4/20	250	36K

- The study was set up as a split-plot design with four replications.
- Four different relative maturity (RM) corn products (109RM, 111RM, 112RM, and 114RM) were evaluated under six different N rates (0, 60, 120, 180, 240, and 300 lb N/acre). Nitrogen was applied with 360 Y-DROP® fertilizer tube attachments at the V6 growth stage on 6/18/20.
- Weeds were uniformly controlled, and no insecticides or fungicides were applied.
- Grain weight and grain moisture were collected to calculate yield.

Figure 1. The yellow coloration of the corn leaves on the left (0 lb N/acre) indicate the beginning of a N deficiency compared to the dark green of the leaves to the right (60 lb N/acre).

Corn Response to Nitrogen Rates

Understanding the Results

Table 1. Residual N in the soil profile prior to 2020 N application.

2020 N Treatment (lb N/acre)	0-8-ft Depth (lb N-NO3-/acre)	8-24-ft Depth (lb N-NO3-/acre)	Total N in Top 24-ft of Soil (lb N-NO3-/acre)
0	7	8	15
60	8	10	18
120	5	8	13
180	9	17	26
240	14	17	31
300	12	27	39

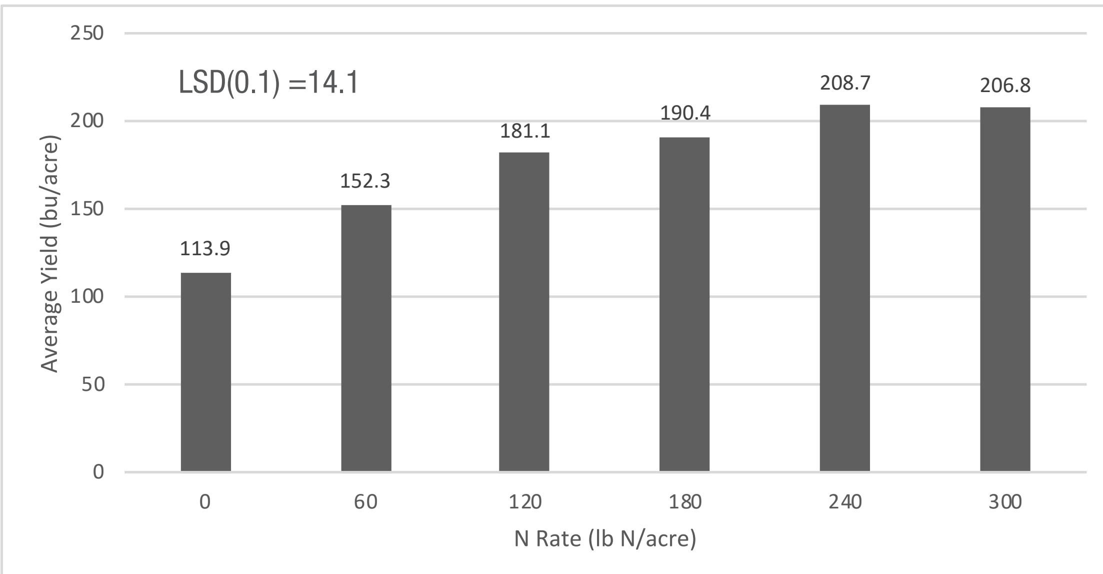

Figure 2. Average yield response to N application rates.

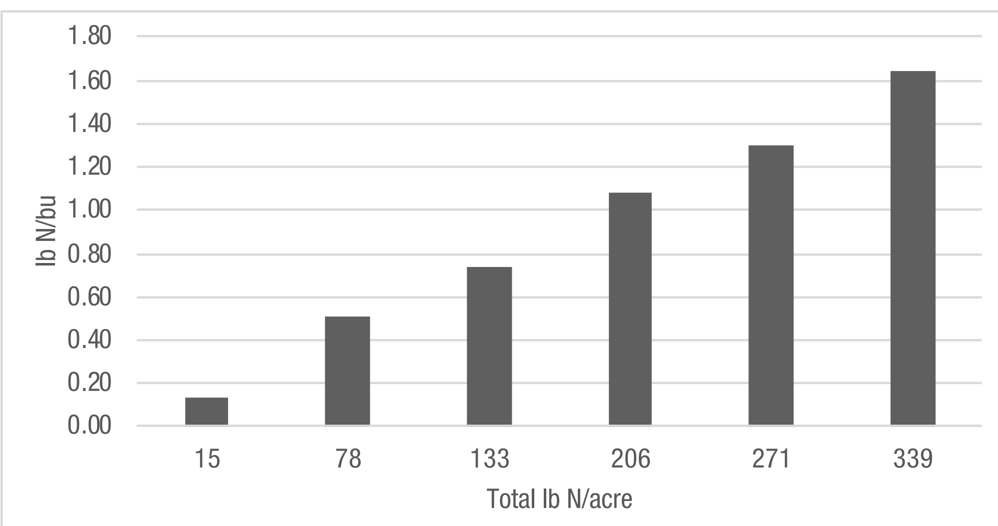

Figure 3. Pounds of N to produce one bushel of grain based on total available N per acre (including residual soil N).

Corn Response to Nitrogen Rates

Table 2. Estimated N fertilizer cost, yield revenue, and return on N investment.			
2020 N Treatment (lb N/acre)	N Fertilizer Cost ($ lb N/acre)[1]	Yield Revenue ($/acre)[2]	Return on Nitrogen Investment[3]
0	$0.00	$432.82	$0.00
60	$22.50	$578.74	$6.49
120	$45.00	$688.18	$4.86
180	$67.50	$723.52	$1.57
240	$90.00	$793.06	$3.09
300	$112.50	$785.84	-$0.32

[1]Based on cost of 32-0-0 at $240.00 per ton. Price is subject to change.
[2]Based on price of corn at $3.80 per bushel. Price is subject to change
[3]Dollars returned per dollar invested in N over previous N treatment.

- There was no N rate by corn product interaction, so data were averaged across corn products.
- The previous crop was corn which depleted the soil profile of N and other nutrients. The residual N in the top two feet of soil is shown in Table 1.
- As N rate increased, yield increased until it reached a maximum at 240 lb N/acre (Figure 2).
- The amount of N to produce on bushel of grain increased as the applied N rate increased. More N was needed to produce one bushel of grain at the higher N rates compared to the lower N rates (Figure 3).
- As N fertilizer cost increased, the return on N investment decreased. For this trial, the largest return on N investment was at the 60 lb N/acre rate and the lowest return was at the 300 lb N/acre rate (Table 2).

Key Learnings

- The law of diminishing returns is illustrated in this study with more value observed from the first 60 lb N/acre applied compared to the last 60 lb N/acre.
- Nitrogen application rates are a key factor in maximizing yield. Determining residual N in the soil in combination with a N application rate that maximizes return on N investment should be taken into consideration when developing a cost-effective fertility program.

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Using Starter Fertilizer in Corn

Trial Objective

- Previous research at the Bayer Learning Center at Monmouth, IL has not shown benefit in the ability of in-furrow starter fertilizer to result in grain yield increases in soils with adequate fertility.
- There are many different starter fertilizer products available, with varying claims of efficacy.
- The objective of this research was to evaluate a newer starter fertilizer product for corn.

Research Site Details

Location	Soil Type	Previous Crop	Tillage Type	Planting Date	Harvest Date	Potential Yield (bu/acre)	Seeding Rate (seeds/acre)
Monmouth, Il	Silt loam	Corn	Conventional	6/4/20	10/27/20	250	36K

- This trial consisted of two treatments:
  - An untreated check (UTC).
  - A starter fertilizer treatment applied in-furrow at 2.5 gal per acre with an analysis of 7-17-3 plus the following micronutrients in chelated form:
    - .07% Cu
    - .20% Fe
    - .06% Mn
    - .95% Zn
- All other conditions were the same between the two treatments.
- Soil testing at the site indicated high fertility levels.
- There were six replications in this trial.

Understanding the Results

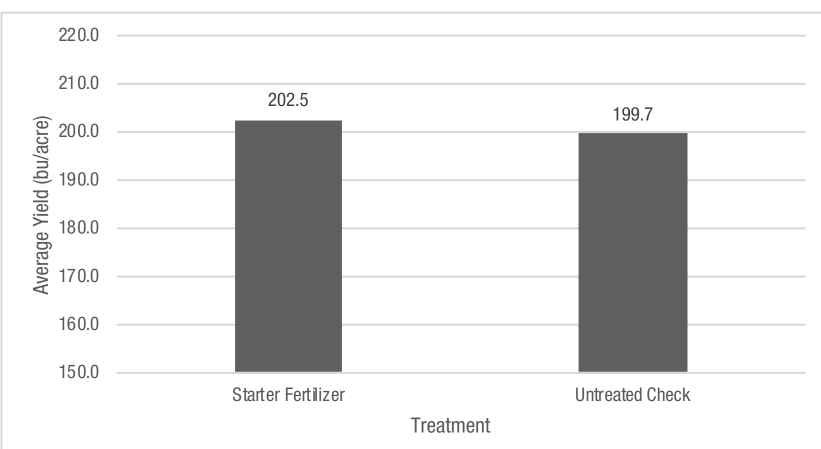

Figure 1. Effect of starter fertilizer on corn yield compared to untreated check in 2020.

Using Starter Fertilizer in Corn

- There was no significant yield difference between plots that received starter fertilizer and the untreated checks in this demonstration trial (Figure 1). This agrees with previous testing at the Bayer Learning Center at Monmouth, IL.
- The late planting date may have led to other factors being more limiting than early season nutrient availability, but these results agree with previous Learning Center results at more typical planting dates.

Key Learnings

- Results suggest that there may be little benefit to starter fertilizer applications in-furrow under the conditions of this testing. It is important to understand the conditions at planting to help with decisions on starter fertilizer in-furrow applications.
- There is some evidence in university data that starter fertilizers may provide a benefit in prolonged cool, wet soil conditions early in the season.1
- Consult your local Field Sales Representative or Technical Agronomist for tailored recommendations for your farm operation.

Source

[1] Hoeft, R. 2000. Will starter fertilizer increase yield? University of Illinois. http://bulletin.ipm.illinois.edu.

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Corn Product Response to Nitrogen Rate and Timing

Trial Objective

- Nitrogen (N) is a key input in corn production and is essential for a successful and profitable corn crop. It is also expensive and can be difficult to manage.
- Genetics may be an important factor in the optimum nitrogen rate and timing of application.
- This trial was conducted to evaluate the response of several corn products to different nitrogen management strategies.

Research Site Details

Location	Soil Type	Previous Crop	Tillage Type	Planting Date	Harvest Date	Potential Yield (bu/acre)	Seeding Rate (seeds/acre)
Monmouth, IL	Silt loam	Corn	Conventional	5/12/20	10/8/20	250	36K

- Treatments consisted of six corn products planted at 36,000 seeds/acre and three nitrogen management strategies, for a total of 18 treatments.
  - Nitrogen (N) rates and timings:
    - 180 lbs N/acre applied preplant incorporated (PPI)
    - 140 lbs N/acre PPI followed by 40 lbs N/acre side-dressed at V6
    - 180 lbs N/acre PPI followed by 40 lbs N/acre side-dressed at V6
- All nitrogen was applied as 32% UAN solution. A urease inhibitor was added to the side-dress applications.
- Plots were harvested and adjusted to 15% moisture.

Understanding the Results

- This demonstration assumes $3.53 per bushel, $.50 per pound of N, and $8.00 per acre for side dress application costs (Figure 1).
- These results would suggest that 180 lbs of N was close to the optimum nitrogen rate.
- There was a range in average yield response to nitrogen rate and side-dressing.
- With one exception, the products tested responded more positively to splitting the nitrogen application (140 lbs N/acre PPI followed by 40 lbs N/acre side-dressed at V6) compared to adding additional nitrogen beyond 180 lbs N/acre (180 lbs N/acre PPI followed by 40 lbs N/acre side-dressed at V6).
- Return over nitrogen cost generally followed the yield trend, although in some cases an increase in yield did not result in an increase in net return.

Corn Product Response to Nitrogen Rate and Timing

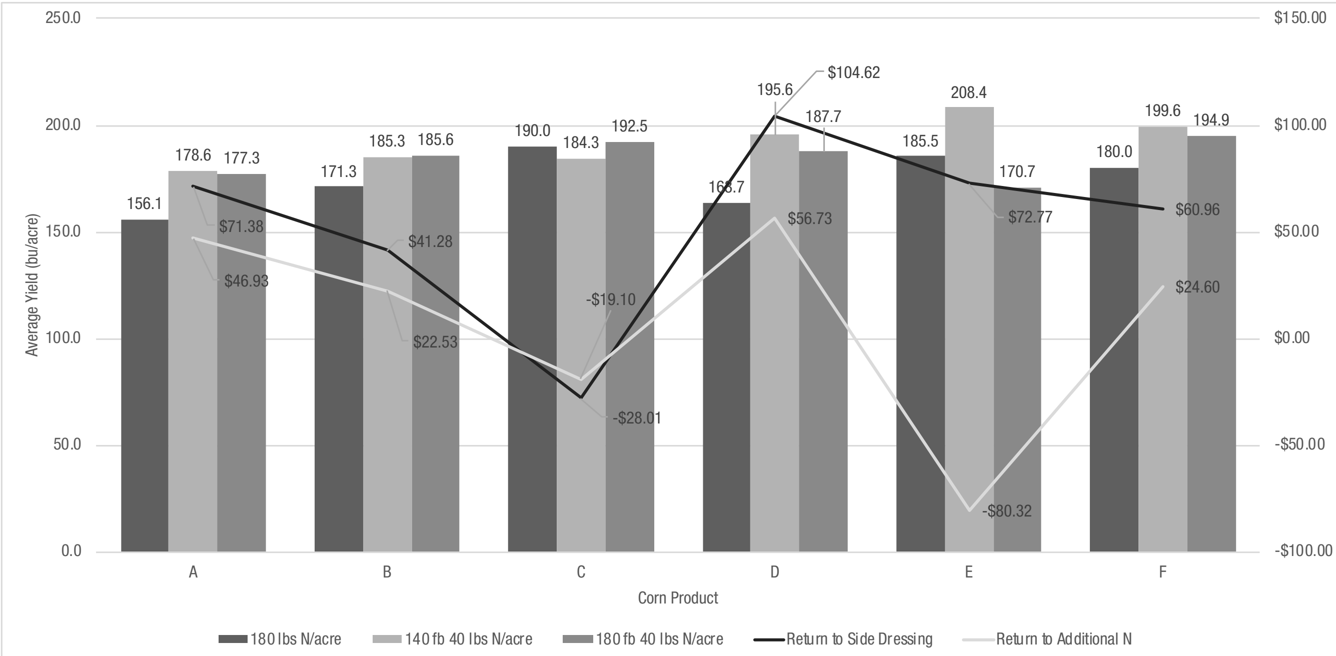

Figure 1. Average yields (bu/acre) of six different corn products at three different nitrogen rates and timings and return over nitrogen cost.

Key Learnings

- Many factors, including product genetics, soil type, weather, previous crop, tillage, can influence the yield response and profitability of a nitrogen application.
- It is important to consider yield goals and nitrogen cost when making management decisions.
- Response to nitrogen can vary from year to year. Consult your local Field Sales Representative (FSR) or Technical Agronomist for recommendations for your farm.

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Corn Product Response to Nitrogen Rate

Trial Objective

- Nitrogen (N) is an expensive yet necessary input in corn systems.
- Proper N application rates can help maximize corn yield potential and efficiency while minimizing environmental and economic losses.
- Corn products may have different responses to additional N.
- This trial evaluated the yield response of eight DEKALB® corn products to N application rate.

Research Site Details

Location	Soil Type	Previous Crop	Tillage Type	Planting Date	Harvest Date	Potential Yield (bu/acre)	Seeding Rate (seeds/acre)
Monmouth, Il	Silt loam	Soybean	Conventional	5/13/20	10/9/20	250	36K

- Treatments consisted of eight DEKALB corn products planted at 36,000 seeds/acre with three different N rates applied:
  - 0 lbs/acre
  - 120 lbs/acre
  - 240 lbs/acre
- Nitrogen in the form of 32% urea and ammonium nitrate (UAN) (32-0-0) was applied preplant and incorporated.
- Plots were harvested and adjusted to 15% moisture
- There were three replications of each treatment.

Corn Product Response to Nitrogen Rate

Understanding the Results

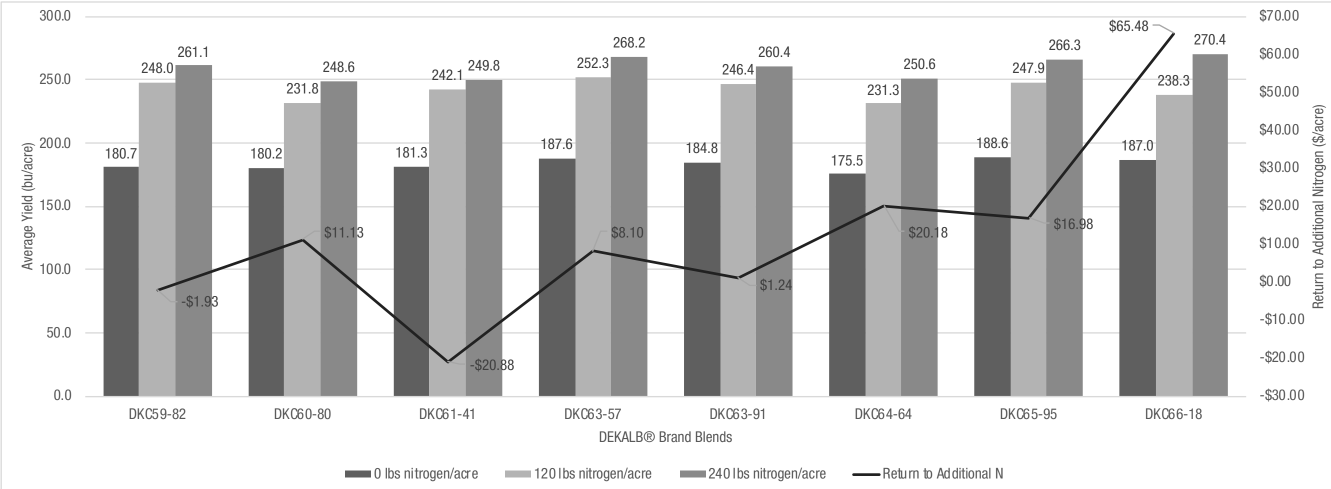

Table 1. Average yield response and return of additional nitrogen ($/acre) by corn product and nitrogen treatment (120 lbs N/acre and 240 lbs N/acre). Calculation assumes $3.53/bu corn market price and $.40/lb for N.

- Response to N rate varied by corn product.
- When factoring in N cost, increasing N rate was not always profitable.

Key Learnings

- Many factors, including product genetic background, soil type, weather, previous crop, tillage, etc., can influence the yield response and profitability potential of a N application.
- It is important to consider yield goals and N cost when making management decisions.
- Response to N can vary from year to year. Consult your local Field Sales Representative or Technical Agronomist for recommendations for your farm.

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DEKALB® Brand Corn Product Response to Nitrogen in Iowa

Trial Objective

- Nitrogen fertilization plays an important role in maximizing the yield potential of corn products.
- Nitrogen is responsible for many soil fertility and crop nutrition studies with emphasis on finding the right rate, timing, source, and placement.
- The objective of this study was to characterize the harvest intactness and yield potential of fourteen DEKALB® brand corn products to nitrogen fertilization. Nitrogen rates were selected to induce both nitrogen stress and excess nitrogen.
- Such information can assist growers in making management decisions to help maximize profitability.

Research Site Details

Location	Soil Type	Previous Crop	Tillage Type	Planting Date	Harvest Date	Potential Yield (bu/acre)	Seeding Rate (seeds/acre)
Storm Lake, IA	Silty clay loam	Soybeans	Vertical tillage	4/30/20	10/9/20	250	36,000
Atlantic, IA	Marshall silty clay loam	Soybeans	Conventional	4/22/20	10/1/20	250	36,000
Huxley, IA	Clay loam	Corn	Strip tillage	4/27/20	N/A	225	34,000

- The nitrogen rate treatments tested in this trial included:
  - Low: 30 lbs/acre for corn-soybean rotation or 50 lbs/acre for corn-corn rotation.
  - Medium: 200 lbs/acre for corn-corn rotation (Huxley only).
  - High: 230 lbs/acre for corn-soybean rotation or 240 lbs/acre for corn-corn rotation.
- All nitrogen applications were made before planting.
- Fourteen DEKALB® Brand Blend corn products were tested in this trial. Products were broken into an early maturity set (North set planted at Storm Lake and Huxley, Iowa) and a late maturity set (South set planted at Huxley and Atlantic, Iowa).
- The North Set included DKC47-54RIB Brand Blend, DKC49-44RIB Brand Blend, DKC52-18RIB Brand Blend, DKC54-64RIB Brand Blend, DKC56-65RIB Brand Blend, DKC58-64RIB Brand Blend, and DKC61-40RIB Brand Blend.
- The South Set included DKC58-64RIB Brand Blend, DKC59-81RIB Brand Blend, DKC60-80RIB Brand Blend, DKC61-41RIB Brand Blend, DKC62-89RIB Brand Blend, DKC63-90RIB Brand Blend, DKC64-64RIB Brand Blend, and DKC66-18RIB Brand Blend.
- The trial was planted using 30-inch row spacing, with four rows per treatment, and 45-foot long plots with two replications.
- The Huxley, Iowa site was in the path of the August 2020 derecho; therefore, yield data are not presented for this site.

DEKALB® Brand Corn Product Response to Nitrogen in Iowa

Understanding the Results

- Figures 1 through 14 show the pictorial characterization of the ears of each product at the Huxley trial which had nitrogen rates of 50, 200, and 240 lbs/acre. Images were taken of representative ears for each plot prior to deterioration of the plot due to the derecho storm event.
- In this trial, average grain yields were substantially higher for the high rate except for DEKALB® DKC59-81 Brand Blend in which yields were nearly the same at both nitrogen rates at Storm Lake, Iowa (Figure 15).

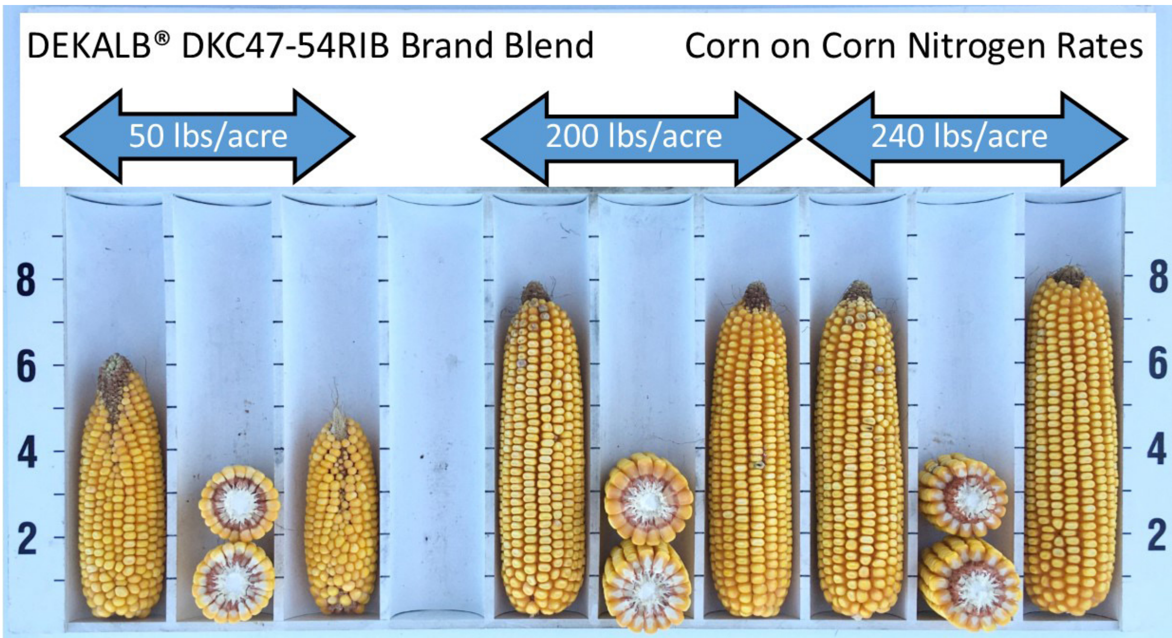

Figure 1. Ear characterization of DEKALB® DKC47-54RIB Brand Blend at three nitrogen rates at Huxley, Iowa (2020).

DEKALB® Brand Corn Product Response to Nitrogen in Iowa

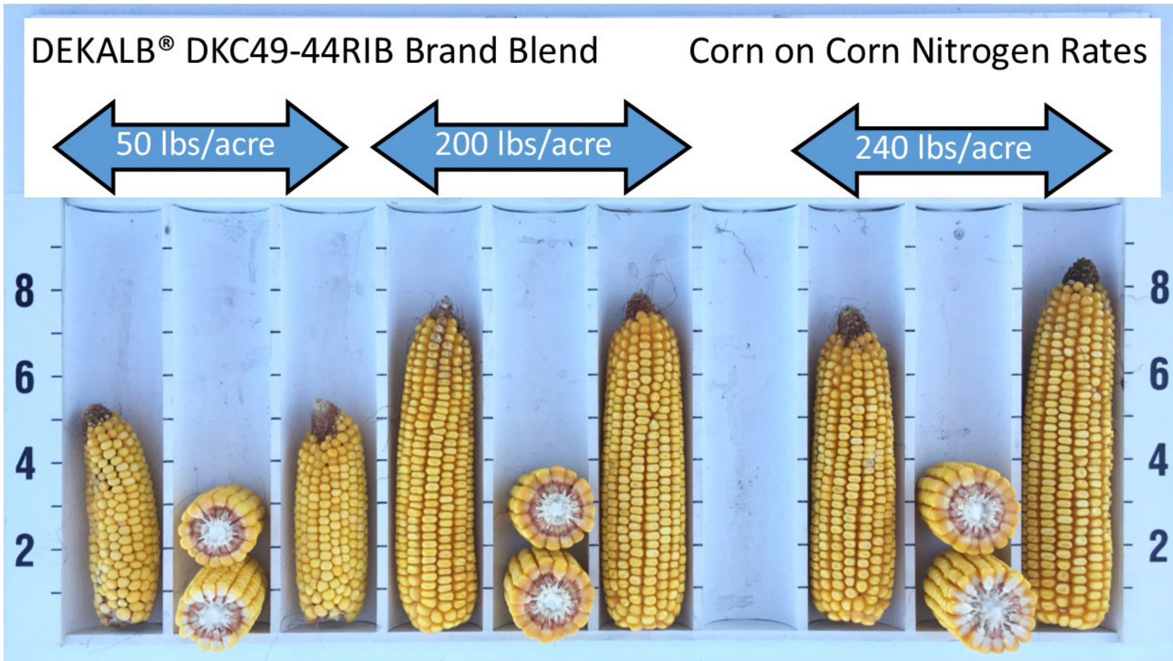

Figure 2. Ear characterization of DEKALB® DKC49-44RIB Brand Blend at three nitrogen rates at Huxley, Iowa (2020).

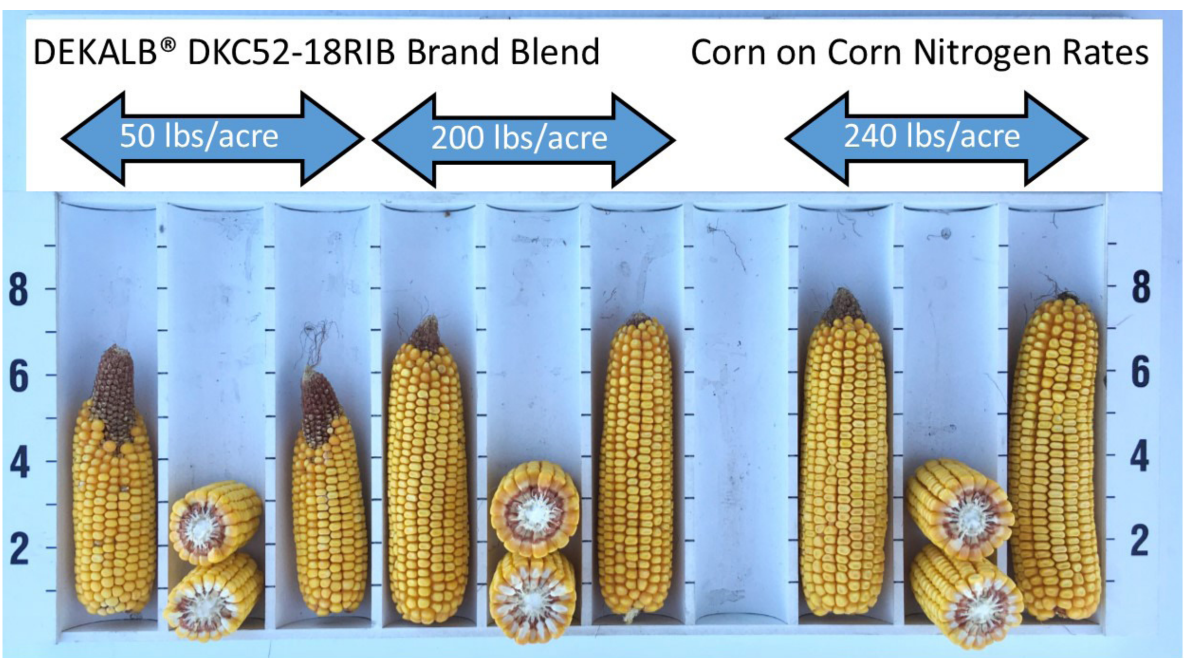

Figure 3. Ear characterization of DEKALB® DKC52-18RIB Brand Blend at three nitrogen rates at Huxley, Iowa (2020).

DEKALB® Brand Corn Product Response to Nitrogen in Iowa

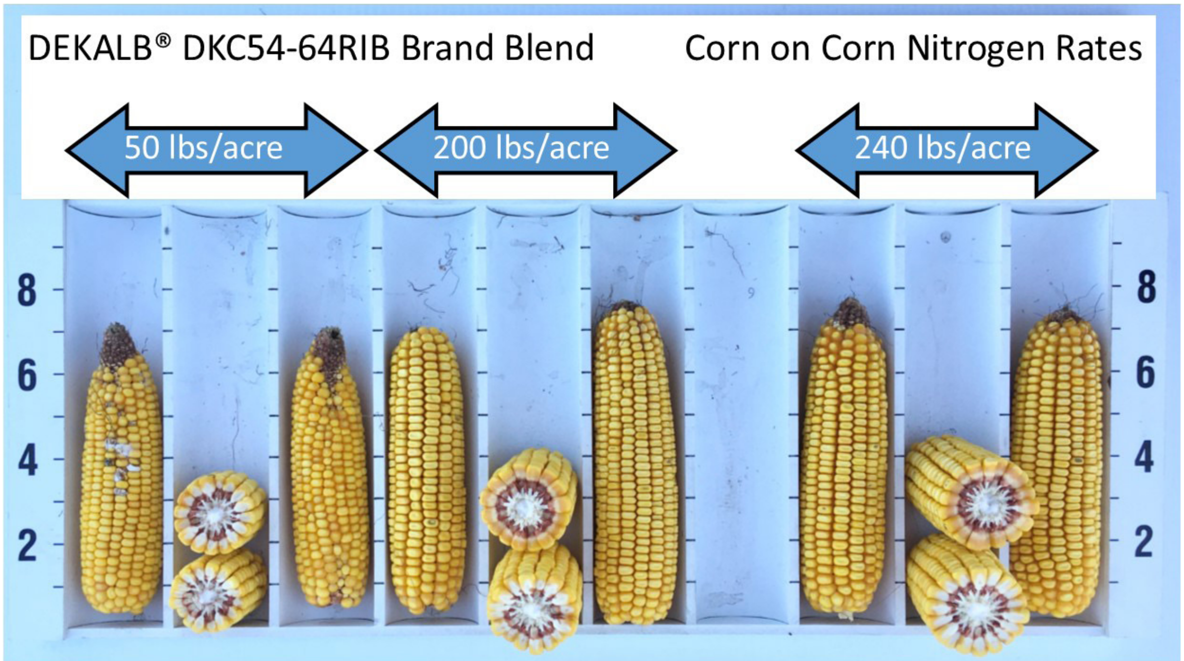

Figure 4. Ear characterization of DEKALB® DKC54-64RIB Brand Blend at three nitrogen rates at Huxley, Iowa (2020).

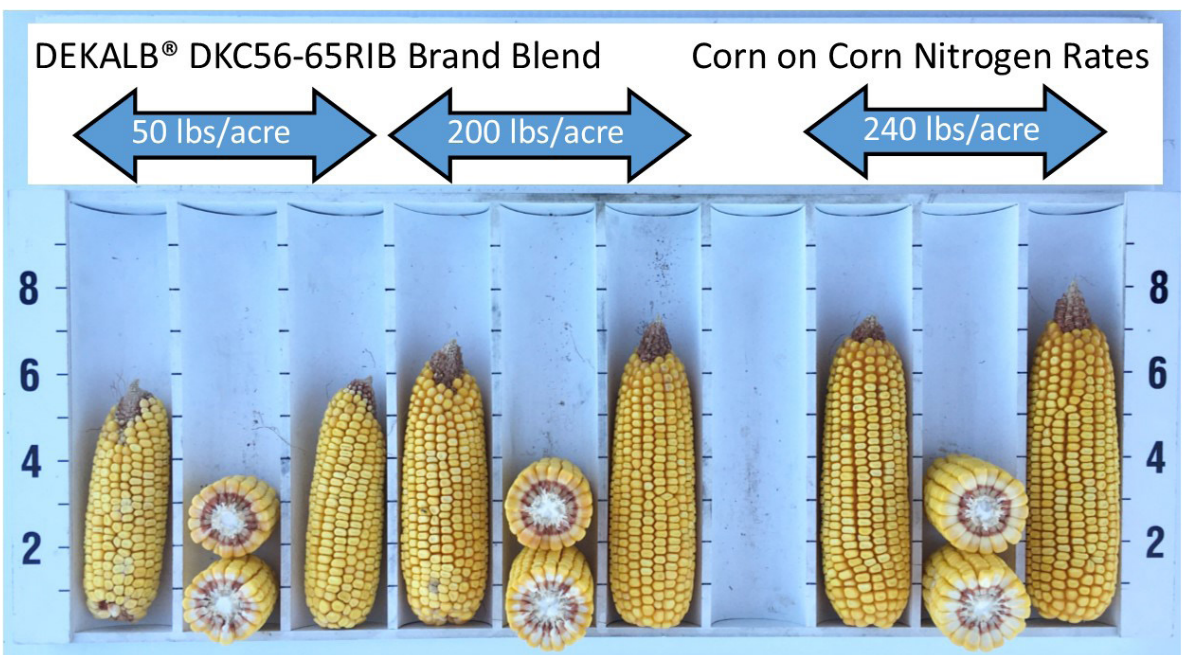

Figure 5. Ear characterization of DEKALB® DKC56-65RIB Brand Blend at three nitrogen rates at Huxley, Iowa (2020).

DEKALB® Brand Corn Product Response to Nitrogen in Iowa

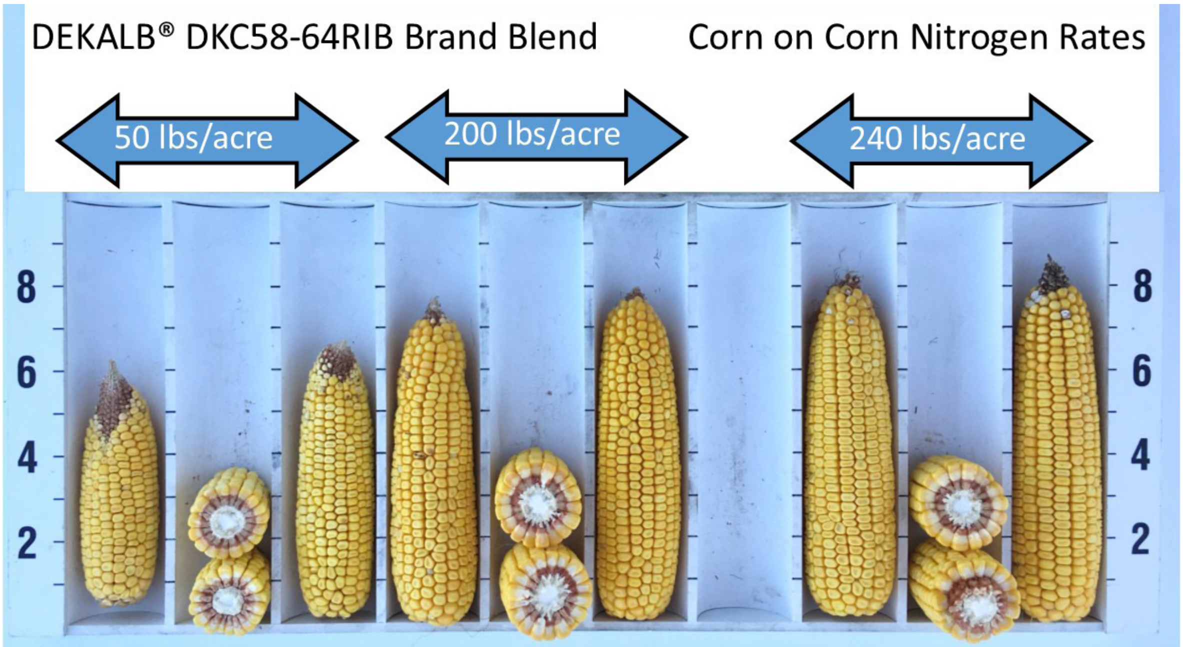

Figure 6. Ear characterization of DEKALB® DKC58-64RIB Brand Blend at three nitrogen rates at Huxley, Iowa (2020).

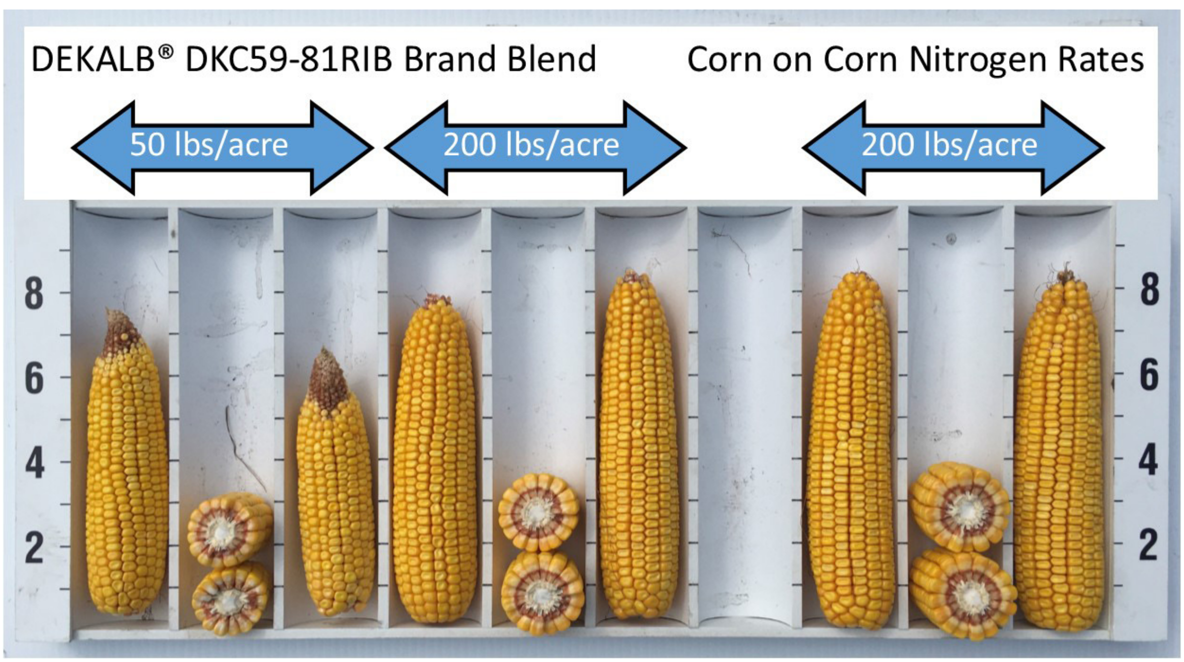

Figure 7. Ear characterization of DEKALB® DKC59-81RIB Brand Blend at three nitrogen rates at Huxley, Iowa (2020).

DEKALB® Brand Corn Product Response to Nitrogen in Iowa

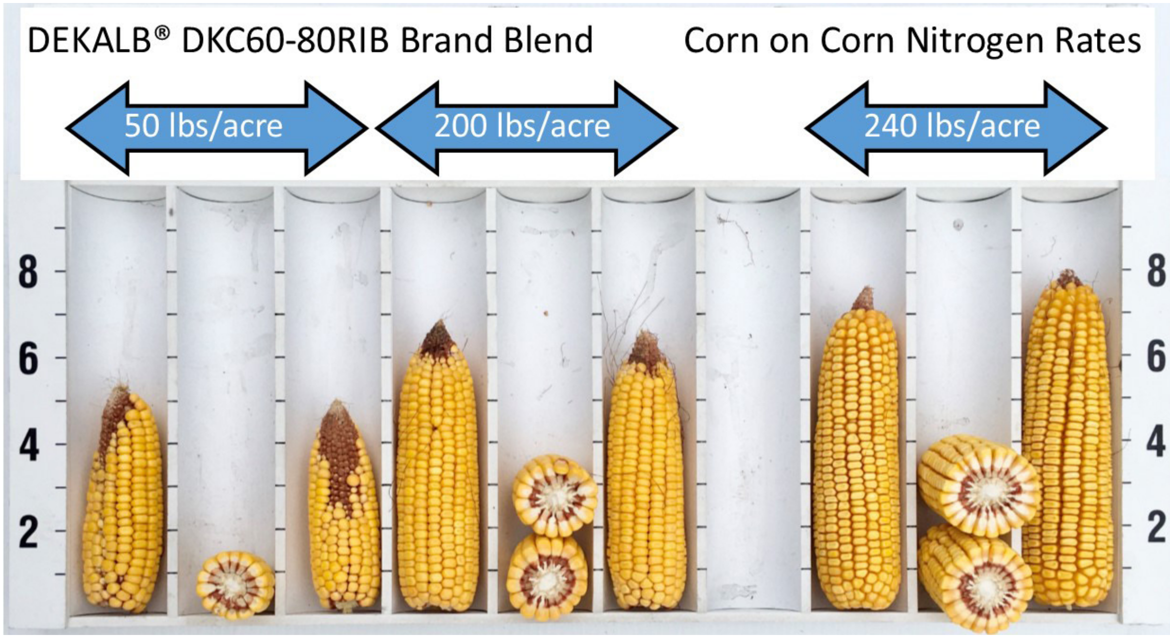

Figure 8. Ear characterization of DEKALB® DKC60-80RIB Brand Blend at three nitrogen rates at Huxley, Iowa (2020).

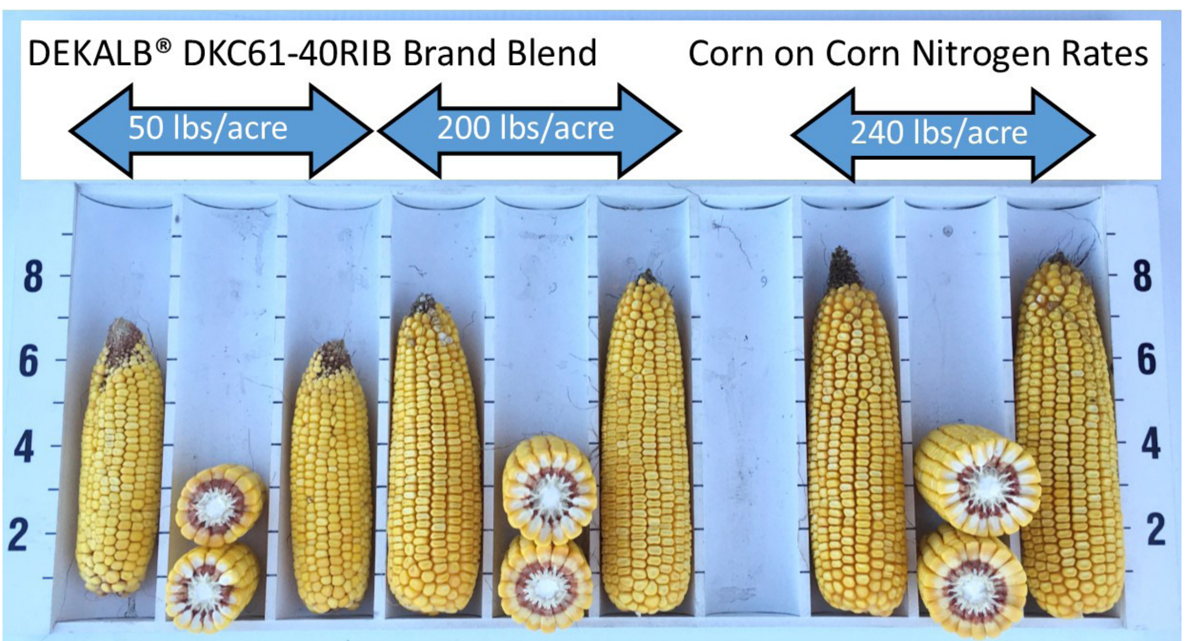

Figure 9. Ear characterization of DEKALB® DKC61-40RIB Brand Blend at three nitrogen rates at Huxley, Iowa (2020).

DEKALB® Brand Corn Product Response to Nitrogen in Iowa

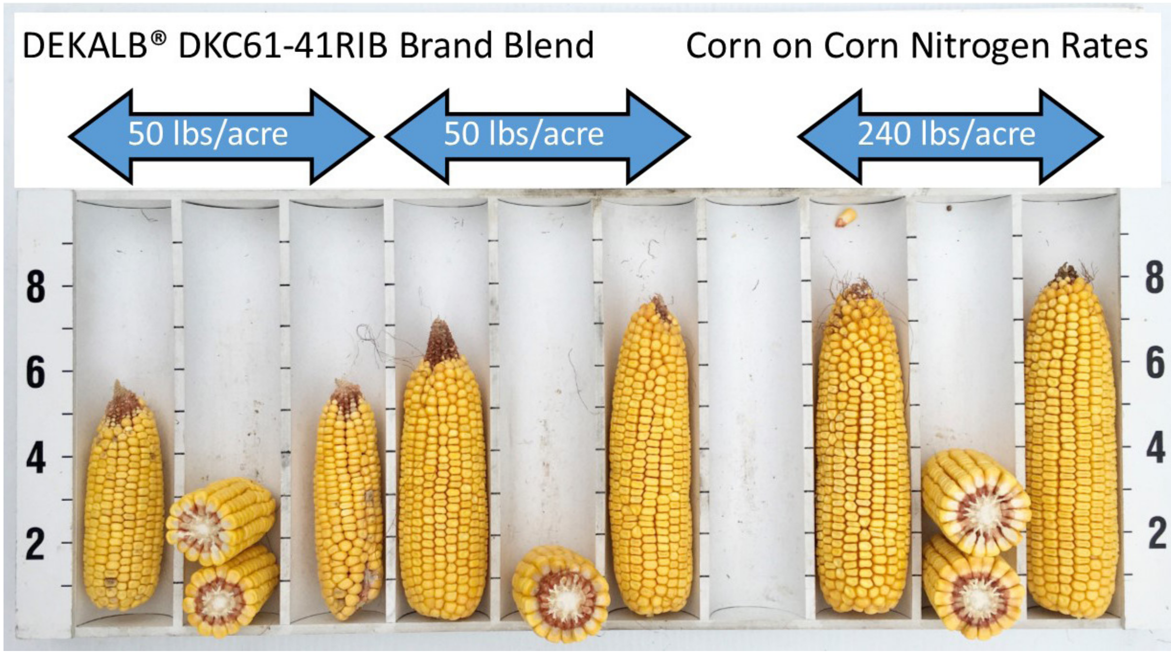

Figure 10. Ear characterization of DEKALB® DKC61-41RIB Brand Blend at three nitrogen rates at Huxley, Iowa (2020).

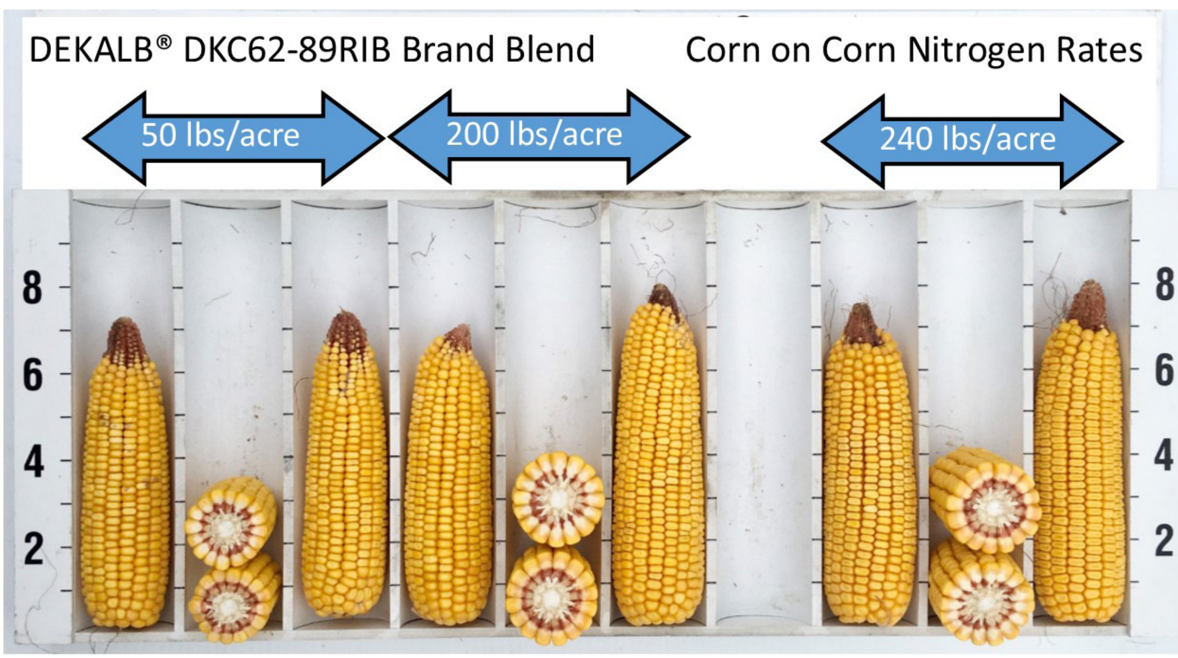

Figure 11. Ear characterization of DEKALB® DKC62-89RIB Brand Blend at three nitrogen rates at Huxley, Iowa (2020).

DEKALB® Brand Corn Product Response to Nitrogen in Iowa

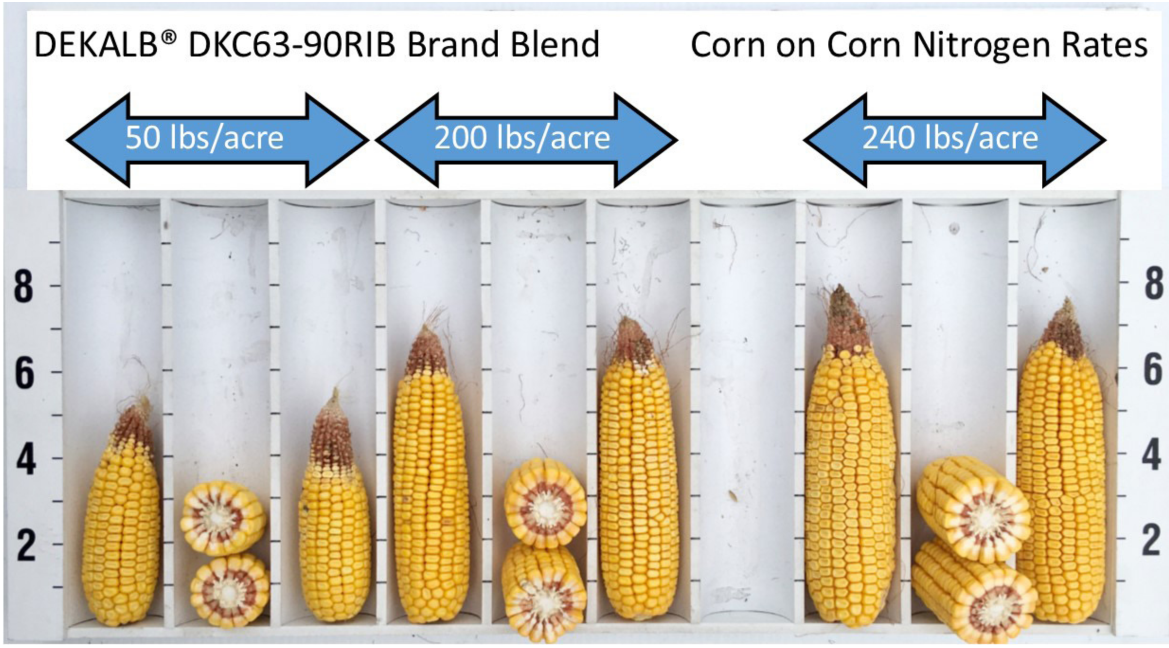

Figure 12. Ear characterization of DEKALB® DKC63-90RIB Brand Blend at three nitrogen rates at Huxley, Iowa (2020).

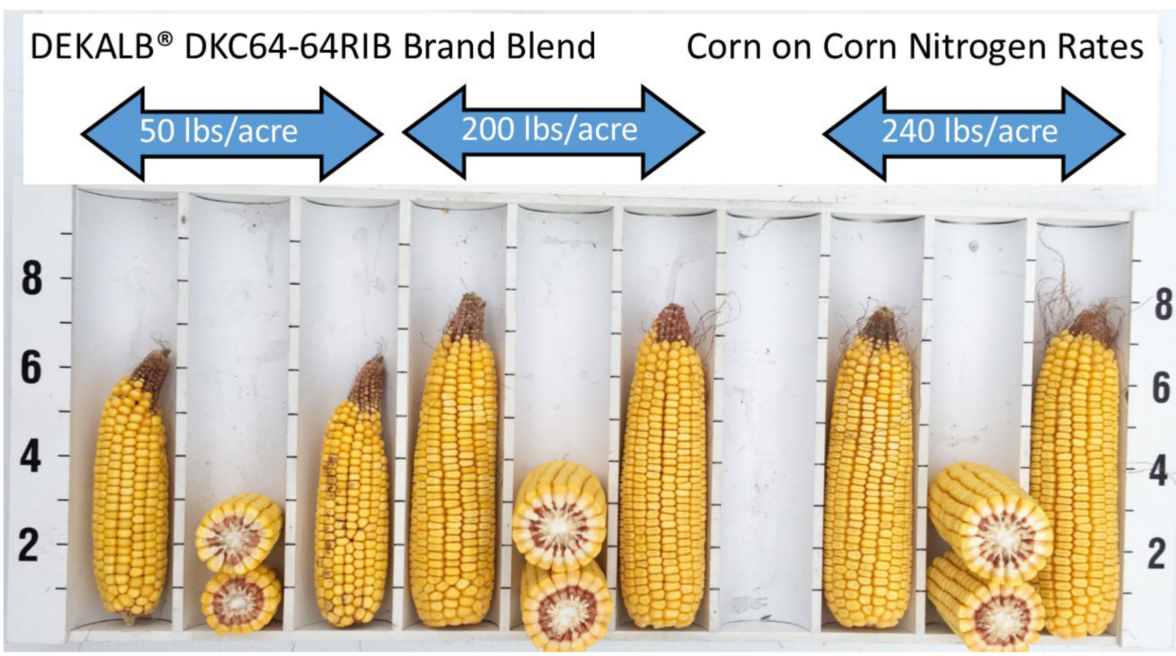

Figure 13. Ear characterization of DEKALB® DKC64-64RIB Brand Blend at three nitrogen rates at Huxley, Iowa (2020).

DEKALB® Brand Corn Product Response to Nitrogen in Iowa

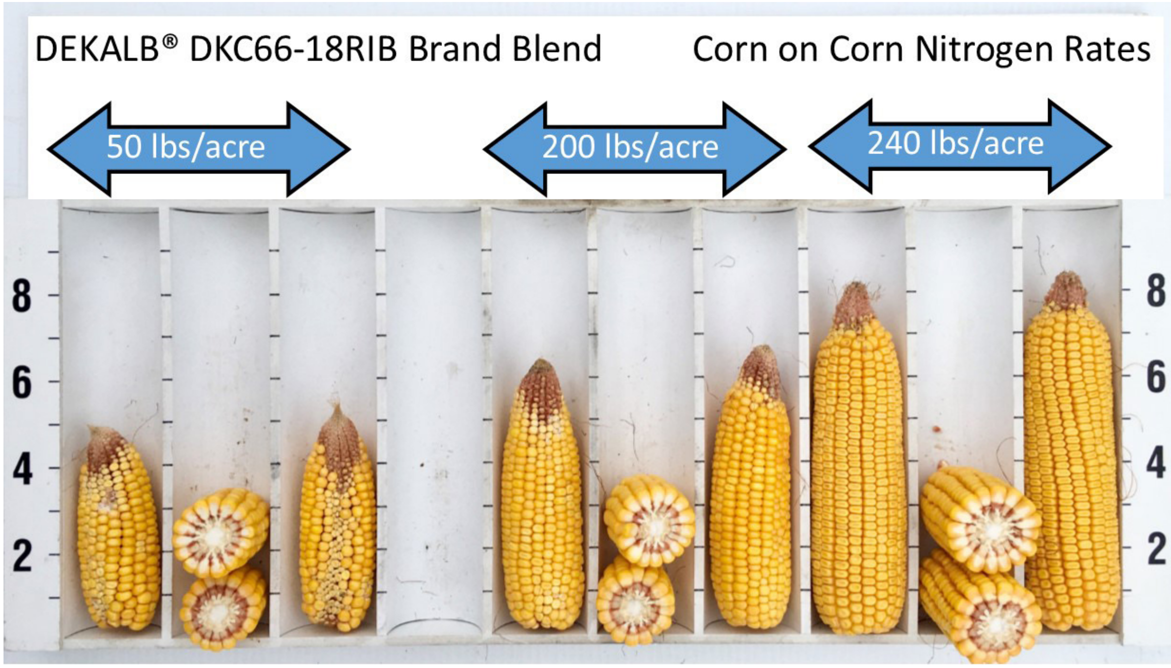

Figure 14. Ear characterization of DEKALB® DKC66-18RIB Brand Blend at three nitrogen rates at Huxley, Iowa (2020).

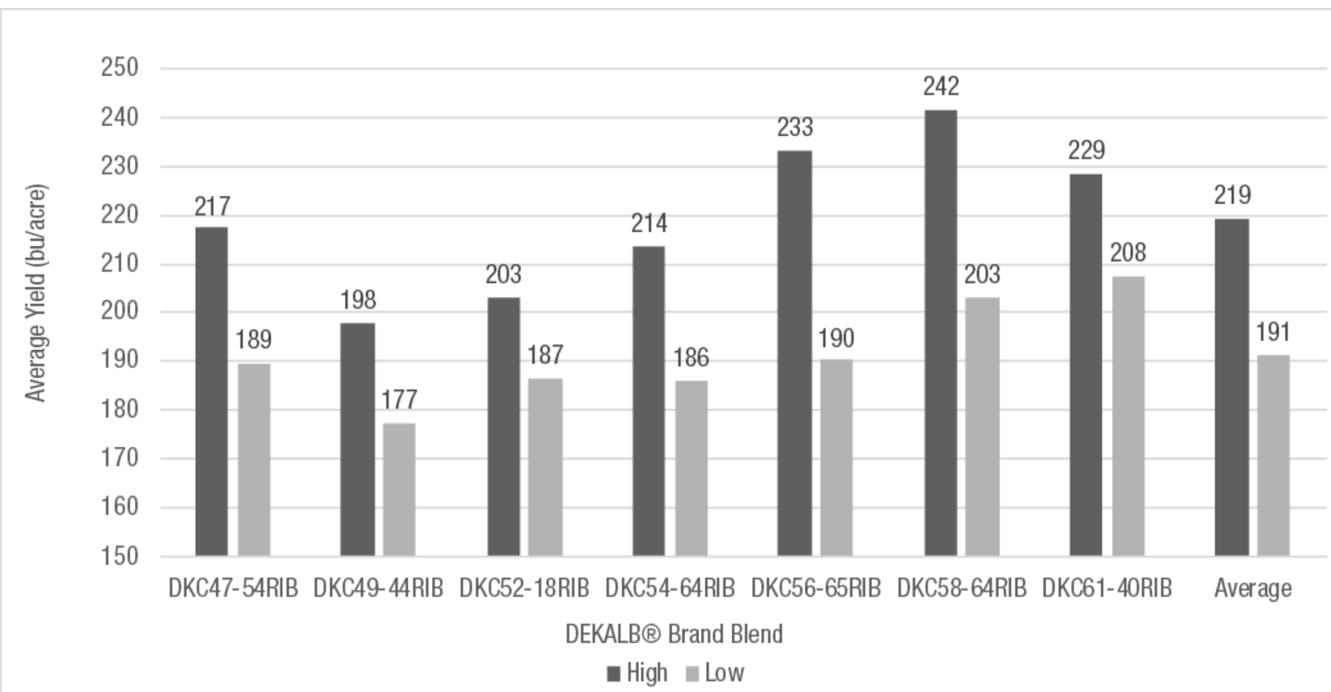

Figure 15. Average yield of early maturity DEKALB® Brand Blend corn products at 240 (High) and 50 (Low) pounds/acre of nitrogen, Storm Lake, Iowa (2020).

DEKALB® Brand Corn Product Response to Nitrogen in Iowa

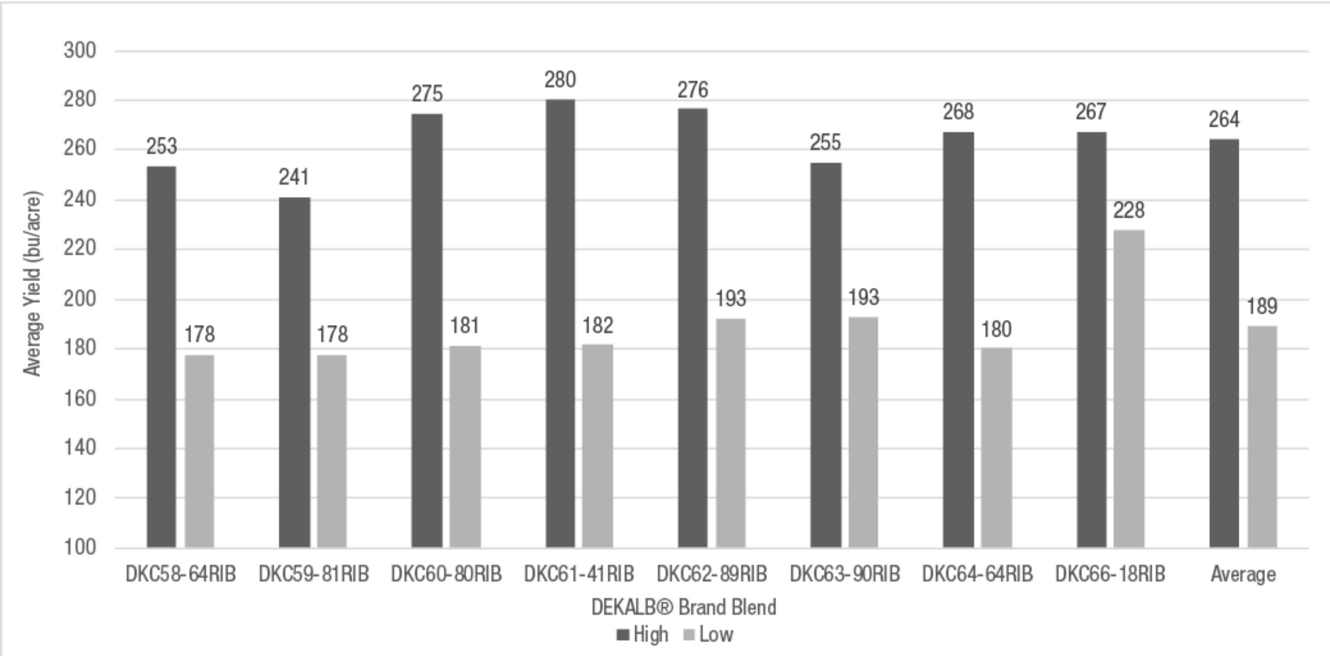

Figure 16. Average yield of DEKALB® Brand Blend corn products at 240 (High) and 50 (Low) pounds/acre of nitrogen, Atlantic, Iowa (2020).

Key Learnings

- Nitrogen status in the soil is a dynamic and complex phenomenon that is greatly impacted by the weather during the growing season, the soil type, and the inherent fertility of the soil. Thus, a plant's response to nitrogen can be complex as well.
- Even at low nitrogen rates, there were average yields of 191 and 189 bu/acre at Storm Lake and Atlantic, Iowa, respectively. This indicates the fields were of high fertility and should be sustainably managed to avoid nitrogen loss to the water system.
- At the current market trend of $0.34/lb of nitrogen and $4.00/bu for corn, a minimum of 17 bu/acre is required to pay for the difference between the low and high nitrogen rates. Therefore, all products were profitable at the Atlantic location. At Storm Lake however, high nitrogen rate was not profitable in DKC52-18RIB Brand Blend.
- Corn products respond differently to farm inputs and they should be assessed on a small scale before they are deployed for the whole farm.

DEKALB® Brand Corn Product Response to Nitrogen in Iowa

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ALWAYS READ AND FOLLOW PESTICIDE LABEL DIRECTIONS. B.t. products may not yet be registered in all states. Check with your seed brand representative for the registration status in your state.

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. 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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Insect Resistance Management

Planting Refuges, Preserving Technology

Before opening a bag of seed, be sure to read, understand and accept the stewardship requirements, **including applicable refuge requirements for insect resistance management,** for the biotechnology traits expressed in the seed as set forth in the Monsanto Technology/Stewardship Agreement that you sign. By opening and using a bag of seed, you are reaffirming your obligation to comply with the most recent stewardship requirements.

Comparing Corn Rootworm Trait Platforms

Trial Objective

- The corn rootworm complex, (Western corn rootworm, Northern corn rootworm, and Mexican corn rootworm) is commonly referred to as the 'billion-dollar pest complex' due to it's potential to adversely affect yield.
- Various companies offer several choices of corn products that contain *Bacillus thuringiensis* (Bt) proteins to control corn rootworm.
- With this is mind, the Bayer Learning Center at Monmouth, Il conducted a demonstration to compare the effectiveness of several competing pyramided corn products containing more than one Bt protein active against corn rootworm.

Research Site Details

Location	Soil Type	Previous Crop	Tillage Type	Planting Date	Harvest Date	Potential Yield (bu/acre)	Seeding Rate (seeds/acre)
Monmouth, Il	Silt loam	Corn	Conventional tillage	6/4/20	10/27/20	250	36K

- This demonstration consisted of six total treatments including three different competitive trait platforms, each containing a 5% refuge blend of a non-Bt corn product:
  - Treatment 1: a 114 RM VT Double PRO® RIB Complete® corn blend
  - Treatment 2: a 114 RM SmartStax® RIB Complete® corn blend (same genetic background as Treatment 1)
  - Treatment 3: a 113 RM SmartStax® RIB Complete® corn blend
  - Treatment 4: a 103 RM Pioneer® brand Qrome® product, P0306Q Brand
  - Treatment 5: a 103 RM Pioneer® brand Optimum® AcreMax® XTreme product, P0306AMXT Brand (same genetic background as Treatment 4)
  - Treatment 6: a 113 RM Agrisure Duracade® product, NK1354-5222 E-Z Refuge Brand
- Each treatment had two replications.
- This trial was conducted in a field area that was in its third year of corn with a prior history of rootworm feeding.

Comparing Corn Rootworm Trait Platforms

Understanding the Results

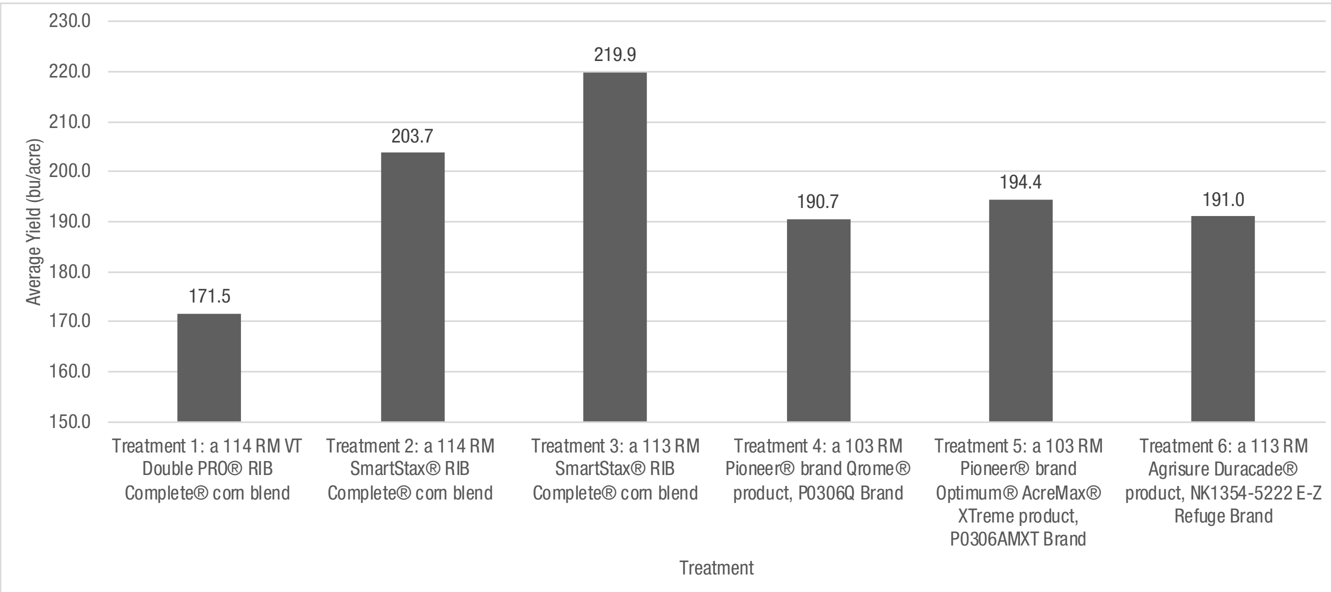

Figure 1. Average yield (bu/acre) per treatment.

- All products with CRW trait protection yielded higher than Treatment 1, which contained no trait protection for CRW.
- There are many variables affecting yield, such as genetics and RM, but in this trial both SmartStax® RIB Complete® corn blend products (Treatment 2 and Treatment 3) yielded higher than the competitive trait platforms (Treatments 4, 5, and 6).

Key Learnings

- SmartStax® RIB Complete® corn blend products contain two proteins for corn rootworm control to help maximize yield potential.
- An effective corn rootworm management program should consist of multiple best management practices. This could include an effective pyramided trait corn product such as SmartStax® Technology.
- Consult with your local Field Sales Representative or Technical Agronomist for custom tailored recommendations to fit your specific needs.

Comparing Corn Rootworm Trait Platforms

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Using 2020 Corn Rootworm Beetle Counts to Assess the Risk of Economic Injury in 2021

Trial Objective

- Monitoring of corn rootworm (CRW) beetle numbers in current corn and soybean fields can be used to help assess the potential risk of a CRW larval infestation reaching economic damage levels in corn fields during the next growing season.
- This information may help guide decisions regarding management strategies including corn product selection.
- The objective of this study was to measure adult CRW populations in corn and soybean fields in 2020 to assist in risk evaluation for 2021.

Research Site Details

Location	Soil Type	Previous Crop	Tillage Type	Planting Date	Harvest Date	Potential Yield (bu/acre)	Seeding Rate (seeds/acre)
1440 fields	Drained or well-drained	Various	Various	Various	Various	110-250	Various

- One to four Pherocon® AM non-baited trapping sites were established at 1440 field locations across the corn-growing areas of IA, IL, IN, OH, MI, WI, MN, ND, SD, NE, KS, CO, and MO (Figure 1).
- The trapping sites were installed in the interiors of corn and soybean fields that encompassed a variety of crop and management histories. Soybean fields were sampled in parts of the corn-growing area to assess the potential risk associated with the variant western CRW, which is known to lay eggs in soybean fields.
- The Pherocon® AM traps were changed at 5- to 10-day intervals for 2-8 consecutive weeks through CRW adult emergence, mating, and egg laying phases (late July through late September).
- Following each sampling interval, the counts of adult northern and western CRW beetles were recorded and used to calculate the average number of CRW beetles/trap/day by field.
- At the end of the collective sampling period, the average capture value for each field was determined and the data were used in further analysis.

Understanding the Results

Categories for CRW beetle counts are based on action thresholds (beetles/trap/day) suggested by Extension entomologists at the University of Illinois (UI) and Iowa State University (ISU) and provide the economic injury potential for the following season.[1,2]

- Less than 2 beetles/trap/day indicate a relatively low risk of economic injury.
- Greater than 1 beetle/trap/day suggests a low risk for economic injury but could indicate populations are increasing.
- Greater than 2 beetles/trap/day indicate the probability for economic injury is likely if control measures are not used.
- Greater than 5 beetles/trap/day indicate that economic injury is very likely, and populations are expected to be very high the following year.

Using 2020 Corn Rootworm Beetle Counts to Assess the Risk of Economic Injury in 2021

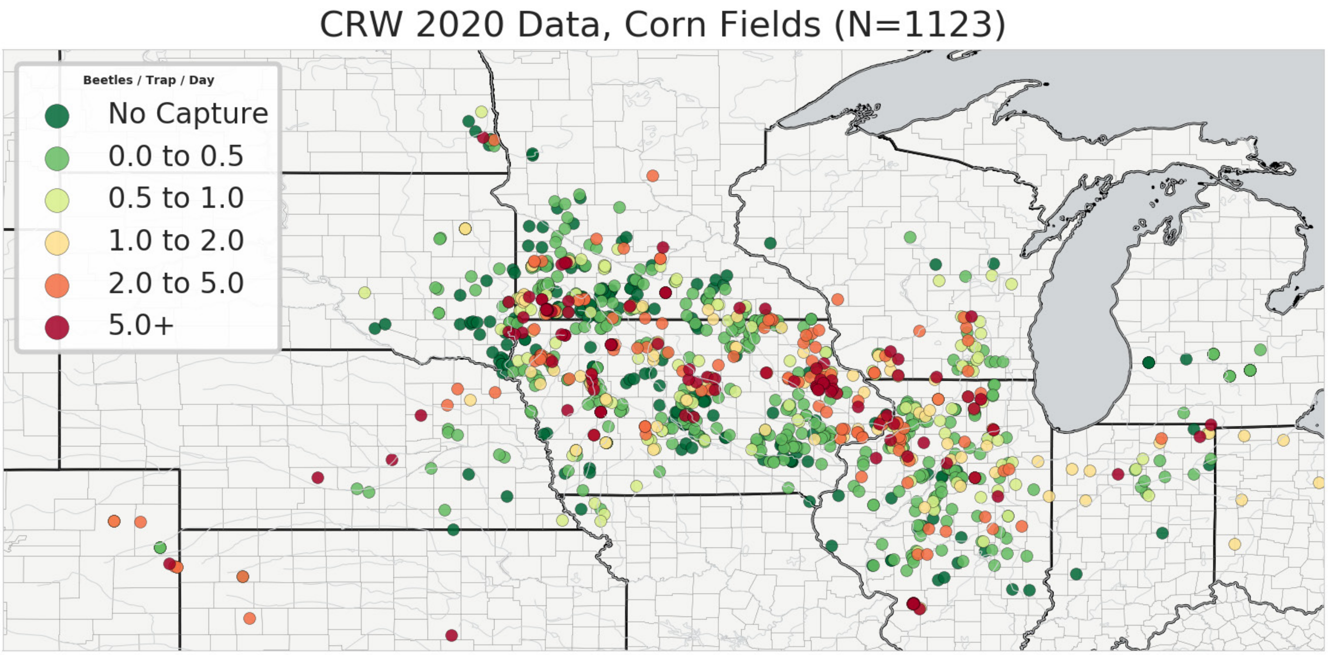


Figure 1a. Corn field locations for corn rootworm trapping in 2020.

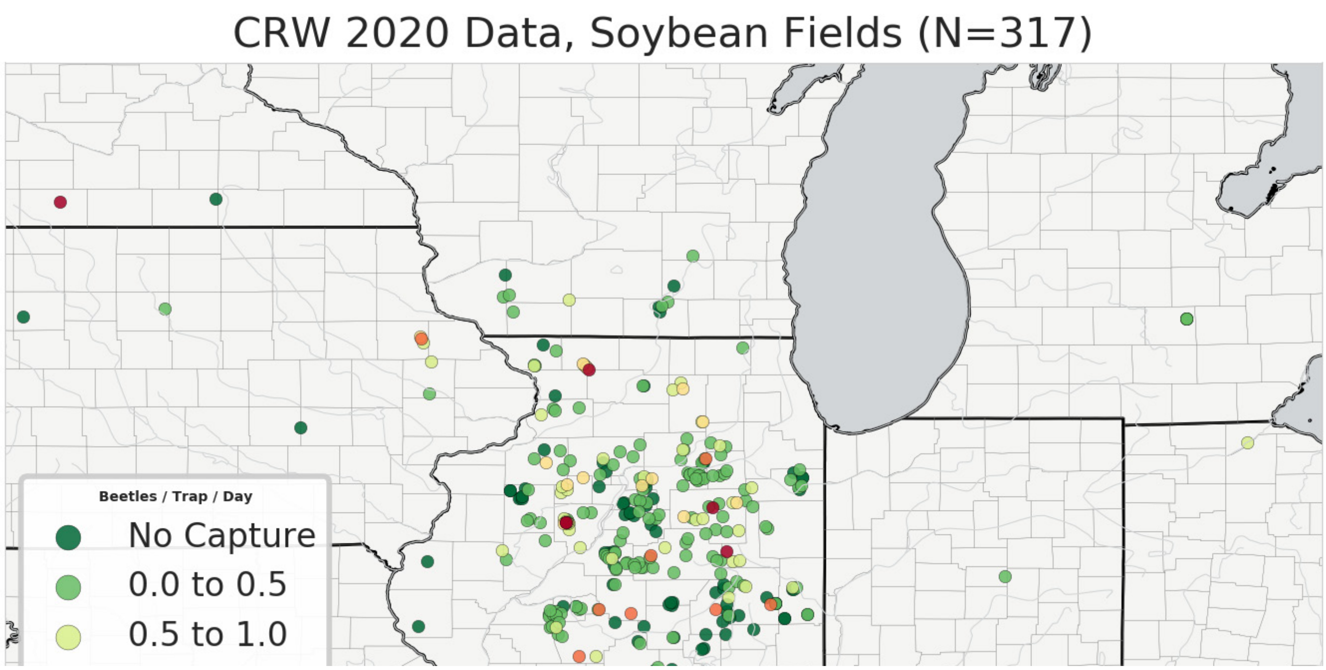
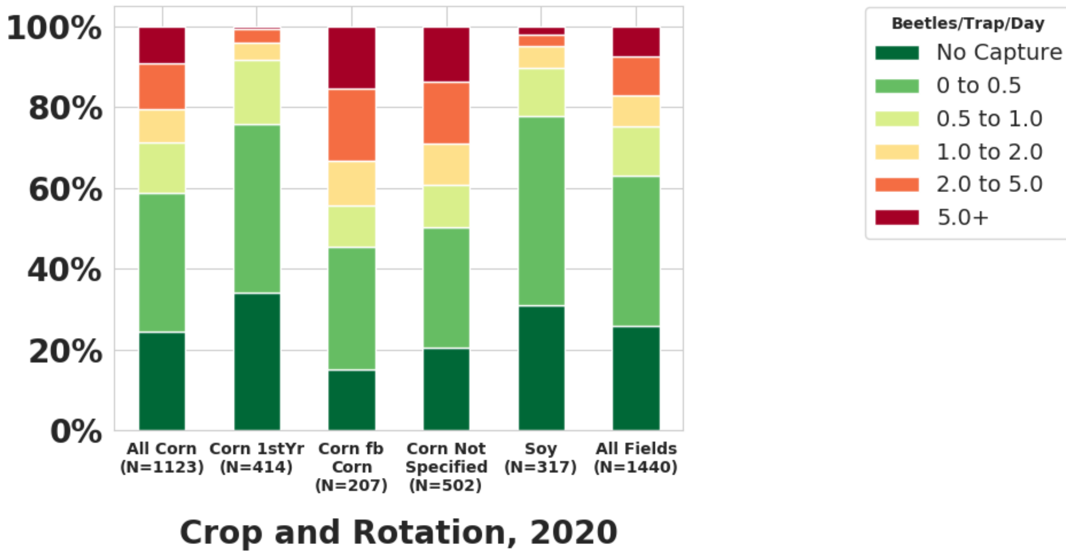


Figure 1b. Soybean field locations for corn rootworm trapping in 2020.

Using 2020 Corn Rootworm Beetle Counts to Assess the Risk of Economic Injury in 2021



(Data in this graph are the result of field trials conducted on 1440 field plots in 13 different states in 2020).

Figure 2. Overall summary of average corn rootworm beetles captured per trap per day.[1,2]

Table 1. Summary of field sampling and adult corn rootworm captures in 2020.

2020 Crop	2019 Crop	Number of Sampled Fields	Average Peak Number of Corn Rootworm Beetles/Trap/Day
Total Corn	All Rotations	1123	1.73
Corn	Soybean	414	0.42
Corn	Corn	207	2.79
Corn	Not Specified	502	2.36
Soybean	Corn	317	0.5
Corn and Soybean	All Rotations	1440	1.46

2020 CRW Beetle Survey Data

- CRW populations were variable across the corn-growing area, which suggests that environment and management affect CRW pressure.
- 22% of corn fields had counts exceeding the economic threshold of 2 beetles/trap/day.
- 8% of the corn fields were approaching threshold levels.
- Corn followed by (fb) corn had higher average maximum daily counts than first-year corn (2.79 vs. 0.42 beetles/trap/day) (Table 1).
- Of the corn fb corn fields, 33% exceeded the economic threshold while less than 3.9% of first-year corn fields exceeded the threshold (Figure 2).
- Counts from soybean fields were low, with no adults being captured in 29% of the fields and fewer than 4.7% of the fields exceeding the threshold.
- Counts of 0 were recorded in 21% of corn fields sampled.

Using 2020 Corn Rootworm Beetle Counts to Assess the Risk of Economic Injury in 2021

2020 Data Interpolation

- Point data were interpolated to estimate populations and relative risk at the landscape level.
- To account for variations in sampling density and distribution, interpolations were based on average maximum values calculated within a systematic grid applied to the estimation area.
- On a broad scale, CRW populations, and consequently 2021 risk potential, are possibly elevated in corn fields in central and southwest NE, northeast CO, northwestern KS, west, central, and east central IA, southwest WI, northern IL, central and southern MN, and southeastern ND (Figure 3).
- Corn rootworm populations are estimated to be relatively low in many parts of ND, SD, MN, IN, and central IL; however, localized hot spots can be found every year.
- CRW beetle presence in soybean fields was found to be low in most of the areas that were sampled.

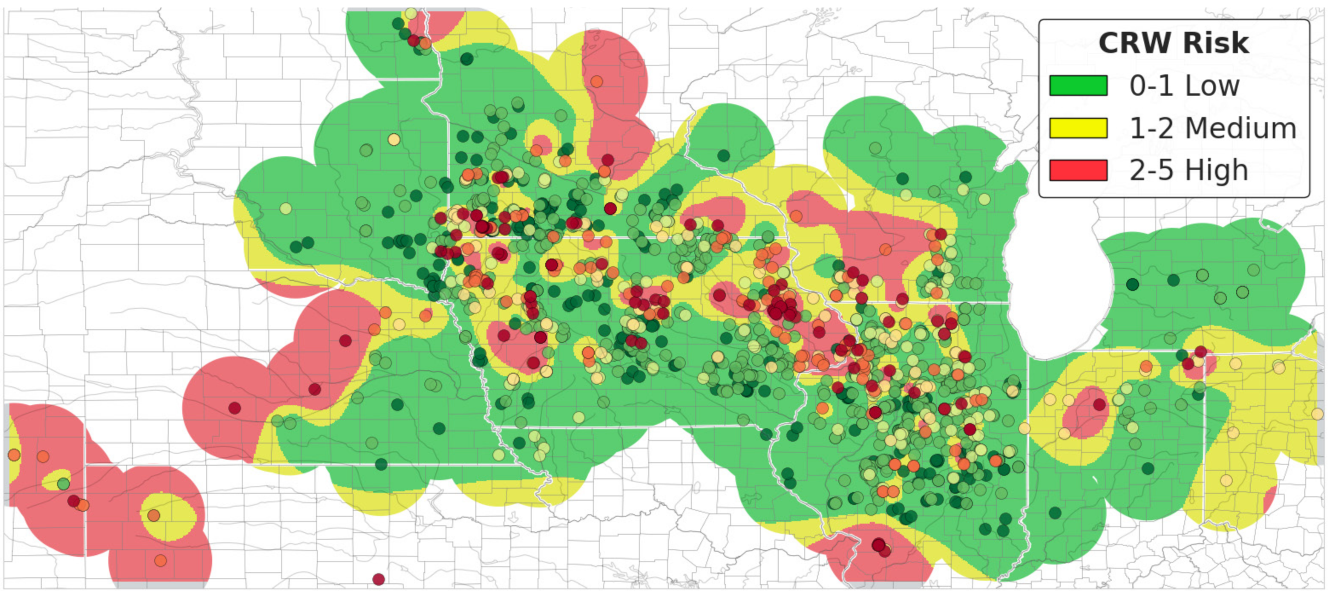


Figure 3. Estimated corn rootworm risk in 2021 using interpolated 2020 corn rootworm data from all fields sampled.

Comparison of 2019 vs. 2020 CRW Beetle Data (Figures 4a and 4b).

- Absolute comparisons between 2019 and 2020 populations should be made with limited confidence due to differences in sampling intensity and distribution. However, trends may still be reliably identified.
- Areas with large populations (i.e. “hot spots”) are generally consistent from year to year.

Using 2020 Corn Rootworm Beetle Counts to Assess the Risk of Economic Injury in 2021

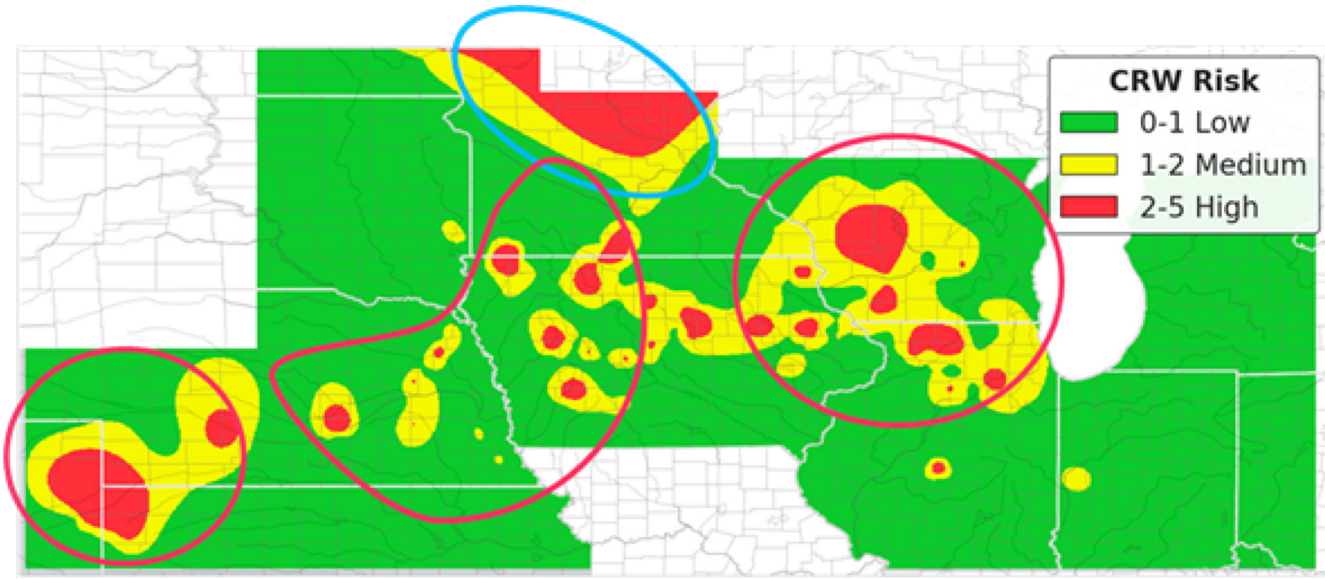


Figure 4a. Estimated corn rootworm risk in 2020 using interpolated 2019 corn rootworm counts from corn fields sampled (based on 1123 fields).

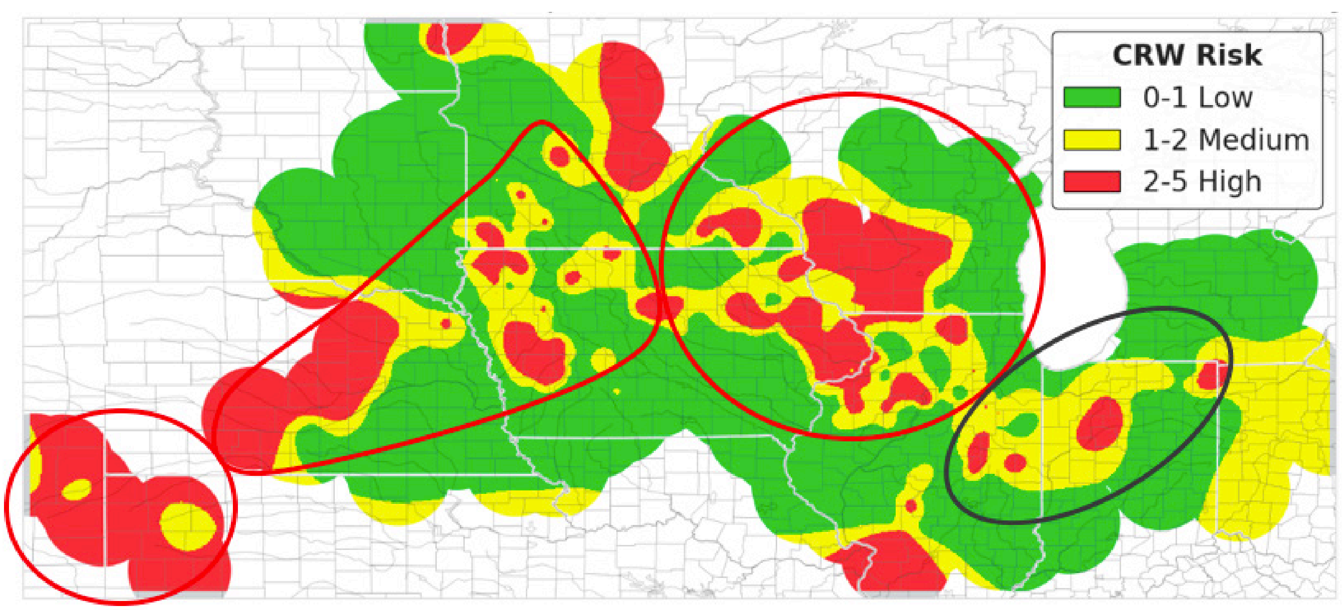


Figure 4b. Estimated corn rootworm risk in 2021 using interpolated 2020 corn rootworm counts from corn fields sampled (based on 1123 fields).

Using 2020 Corn Rootworm Beetle Counts to Assess the Risk of Economic Injury in 2021

Key Learnings

- Corn rootworm is a persistent and annual threat to yield and profit potential, making it a pest that cannot be ignored. University research has demonstrated that even a moderate level of CRW feeding can cause yield losses averaging 15% with losses of 45% or more being possible.[3]
- In the absence of site-specific data, local/regional surveys may provide insight at the landscape level and can be used to make informed decisions regarding management and product selection decisions.
- Beetle numbers and infestation geographies change. Continue to monitor present and historical data to gain information regarding CRW infestation potential. This information can be used to help prepare for the 2021 season and the selection of CRW Bacillus thuringiensis (B.t.)-protected corn products or soil-applied insecticides to protect your crop against the risk of CRW larvae damaging roots and reducing your yield potential.

Sources

[1] Western corn rootworm. Diabrotica virgifera virgifera LeConte. Extension & Outreach. Department of Crop Sciences. University of Illinois. http://extension.cropsciences.illinois.edu/fieldcrops/insects/western_corn_rootworm.

[2] Hodgson, E. and Gassmann, A. 2016. Guidelines for using sticky traps to assess corn rootworm activity. Integrated Crop Management. Iowa State University. https://crops.extension.iastate.edu/cropnews/2016/06/guidelines-usingsticky-traps-assess-corn-rootworm-activity.

[3] Tinsley, N.A., Estes, R.E., and Gray, M.E. 2012. Validation of a nested error component model to estimate damage caused by corn rootworm larvae. Journal of Applied Entomology.

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Dicamba Formulation Impact on Corn

Trial Objective

- Dicamba, a growth regulator, is an effective herbicide for early weed control in corn. However, using a dicamba formulation that doesn't contain a safener can cause brace root abnormalities (fusing) and increased stalk brittleness.[1] These injuries can lead to an increase in greensnap, root lodging, and a subsequent decrease in corn yield.
- The objective of this study was to determine the effect of safened versus unsafened dicamba products on plant health and yield of corn.

Research Site Details

Location	Soil Type	Previous Crop	Tillage Type	Planting Date	Harvest Date	Potential Yield (bu/acre)	Seeding Rate (seeds/acre)
Gothenburg, NE	Hord silt loam	Corn	Strip till	4/30/20	10/31/20	250	36,000

- The study was setup as a split-plot design with herbicide treatments as the whole plot and corn products as the sub-plot with four replications.
- The three herbicide treatments were a non-dicamba treated check, an unsafened dicamba product application, and a safened dicamba product application.
  - » The unsafened dicamba formulation was Sterling Blue® herbicide at a rate of 0.5 qt/acre.
  - » The safened dicamba formulation was DiFlexx® herbicide at a rate of 0.5 qt/acre.
- All dicamba treatments, including the non-dicamba check, were applied on 6/24/20 in combination with Delaro® 325 SC fungicide (0.125 qt/acre), Roundup PowerMAX® herbicide (1 qt/acre), and AMS (17 lb/100 gallon) at the V6 growth stage of corn.
- Five corn products were used in this study.
  - » 104 relative maturity (RM) and 107-RM corn products with growth regulator herbicide injury ratings of CAUTION.
  - » 105-RM, 109-RM and 113-RM corn products with growth regulator herbicide injury ratings of ACCEPTABLE.
- All treatments received herbicide applications of Roundup PowerMAX herbicide (32 oz/acre), Harness® herbicide (2 pt/acre), Balance® Flexx herbicide (3 pt/acre), and Atrazine 4L herbicide (32 oz/acre) on 5/1/20.
- Corn was sprinkler irrigated and fertilized with 70 lb phosphorus/acre, 15 lb sulfur (S)/acre, and 27.5 lb nitrogen (N)/acre via strip till on 4/26/20; 100 lb N/acre applied 4/28/20 using Stream Bars; and 15 lb S/acre and 90 lb N/acre applied sidedress on 6/26/20 with 360 Y-DROP® applicators.
- Shelled corn weight, moisture, and test weight were collected to calculate average yield. Corn greensnap counts were taken to determine the percent greensnap.

Figure 1. Corn product on August 17, 2020 with the safened dicamba formulation treatment of DiFlexx® herbicide.

Dicamba Formulation Impact on Corn

Understanding the Results

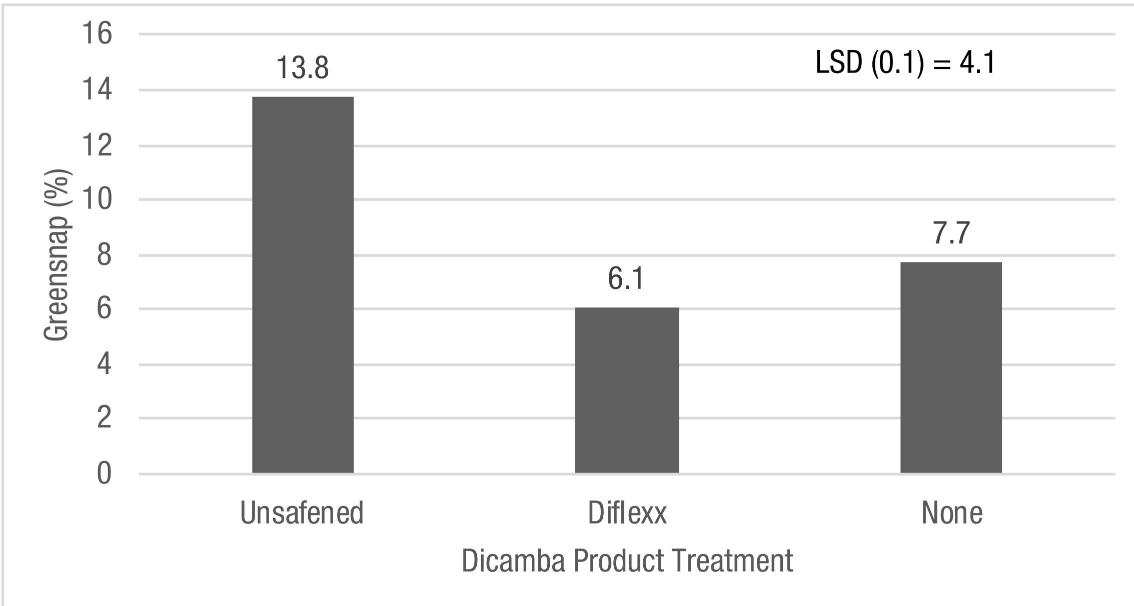


Figure 2. Average corn yield with unsafened and safened dicamba herbicide products.

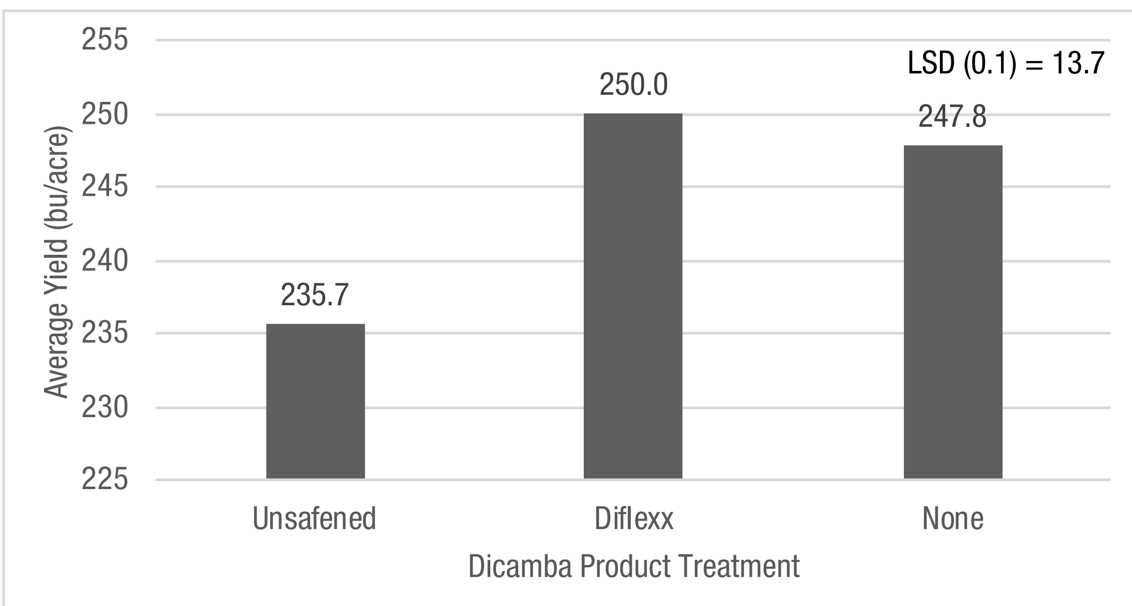


Figure 3. Greensnap percentage impact from unsafened and safened dicamba herbicide products averaged across corn products.

Dicamba Formulation Impact on Corn

Table 1. Average greensnap percentage and yield for each corn product under different dicamba herbicide formulation treatments.						
	Non-treated		DiFlexx® Herbicide (Safened)		Unsafened Dicamba	
Corn Product	Greensnap (%)	Average Yield (bu/acre)	Greensnap (%)	Average Yield (bu/acre)	Greensnap (%)	Average Yield (bu/acre)
104-RM	16.1	235.6	7.4	243.2	22.4	217.9
105-RM	12.0	243.4	12.4	243.1	18.3	224.5
107-RM	1.3	253.2	2.4	246.9	2.4	239.6
109-RM	6.2	255.2	4.3	256.8	11.1	241.0
113-RM	2.9	251.4	4.2	254.2	11.1	244.3

- For this trial, the safened dicamba formulation treatment of DiFlexx® herbicide produced an average corn yield that was significantly greater than the unsafened dicamba formulation herbicide treatment (Figure 2).
- Corn greensnap percentage was significantly higher for the unsafened dicamba formulation treatment compared to the safened DiFlexx herbicide treatment and the non-treated check (Figure 3).
- The greater percentage of greensnap in the unsafened dicamba formulation treatment was likely a result of stalk brittleness that directly reduced corn yield.
- There was little difference in percent greensnap between corn products with CAUTION and ACCEPTABLE growth regulator herbicide injury ratings (Table 1).

Key Learnings

- Unsafened dicamba formulation products can have the potential to cause corn to greensnap at a higher rate than corn treated with safened dicamba formulation products.
- Farmers are encouraged to use safened dicamba formulation products like DiFlexx® herbicide as an option for early weed control in corn to help lower the risk of crop damage and decreased yield potential that can be observed when using unsafened dicamba herbicide products.

Reference

[1] Clay, S. 2016. Chapter 42: Herbicide injury to corn. In Clay, D., Carlson, C., Clay, S., and Byamukama, E. (eds). iGrow Corn: Best Management Practices. South Dakota State University. https://extension.sdstate.edu.

Legal Statements

Effects of Fungicide and Seeding Rate on Soybean Productivity

Trial Objective

- A critical agronomic decision in soybean production is seed product selection and seeding rate. Although soybeans can compensate well at different seeding rates, soybean products can respond differently to seeding rates.
- It is important to protect established soybean plants from stressors that can reduce yield potential. The application of a fungicide can help protect soybean plants from foliar diseases and increase overall plant health for increased grain yield potential.
- Yield response from the application of a foliar fungicide can depend on seed product selection, as individual products respond differently to fungicide applications.
- The objective of this trial was to evaluate the impact of fungicide application and seeding rate on soybean productivity.

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	Corn	Strip Till	5/11/2020	10/13/2020	60	100K, 140K, 180K

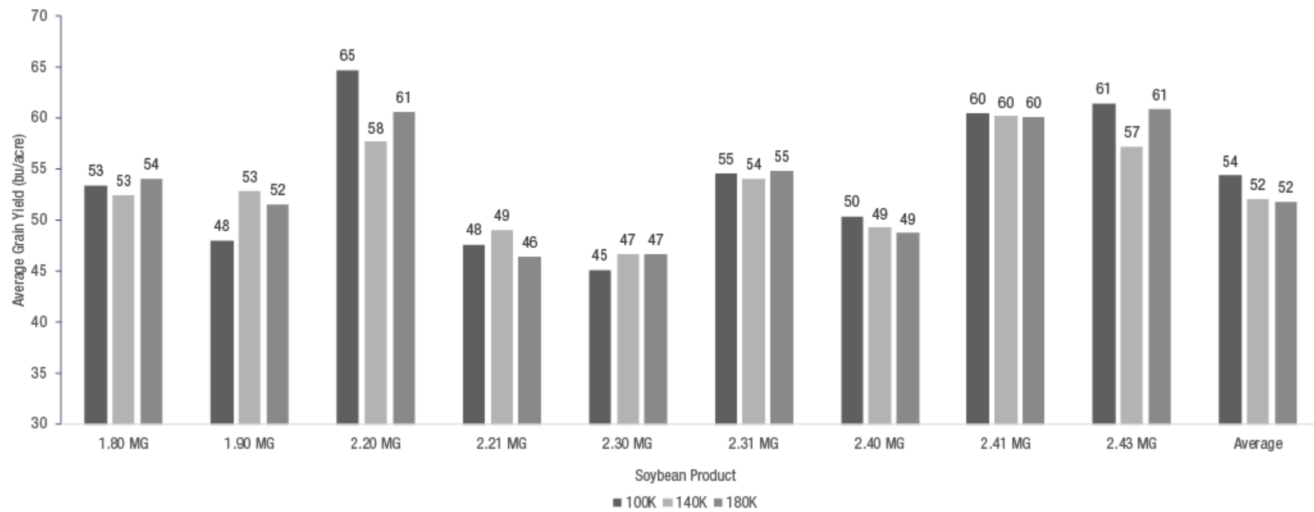
- Eighteen soybean products ranging from 1.8 to 3.5 maturity group (MG) were used for this trial.
- Each product was planted at:
  - 100,000 seeds/acre (100K)
  - 140,000 seeds/acre (140K)
  - 180,000 seeds/acre (180K)
- Soybeans were planted in 30-inch rows with two rows per treatment in 200-foot long plots.
- Delaro® Complete fungicide was foliar applied at a rate of 8 oz/acre at the R3 growth stage.
- Tillage and weed management were the same for all treatments.

Understanding the Results

- Averaged across the fungicide treatment, soybean yield response was variable across seeding rates and across the products tested (Figure 1).
  - The difference in average yield between the seeding rates for the 2.31, 2.41, and 2.81 MG soybean products was minimal, and average yields were highest at the 100K seeding rate for the 2.20 and 3.50 MG products.
  - Highest average yields were achieved at the 100K seeding rate with 11 of the 18 soybean products, 3 of the 18 products at the 140K seeding rate, and 4 of the 18 products at the 180K seeding rate.
  - Across all soybean products, average yields were highest at the 100K seeding rate and nearly the same at 140K and 180K seeding rates.

Effects of Fungicide and Seeding Rate on Soybean Productivity

- All soybean products tested had a positive yield response to fungicide application with exception of the 3.50 MG product (Figure 2). The earliest product tested (1.80 MG) had the highest average yield response of 15 bu/acre and across all soybean products test, the fungicide application had an average yield response of 9 bu/acre (Figure 3).
- The fungicide application increased average yields at all seeding rates tested (Figure 4).
- There was not a disease outbreak at the trial site. However, there were minor incidences of sudden death syndrome (SDS), frogeye leaf spot, Septoria brown spot, and Cercospora leaf blight in both the sprayed and unsprayed plots. The test site was also in the path of the derecho that hit Iowa in August of 2020.



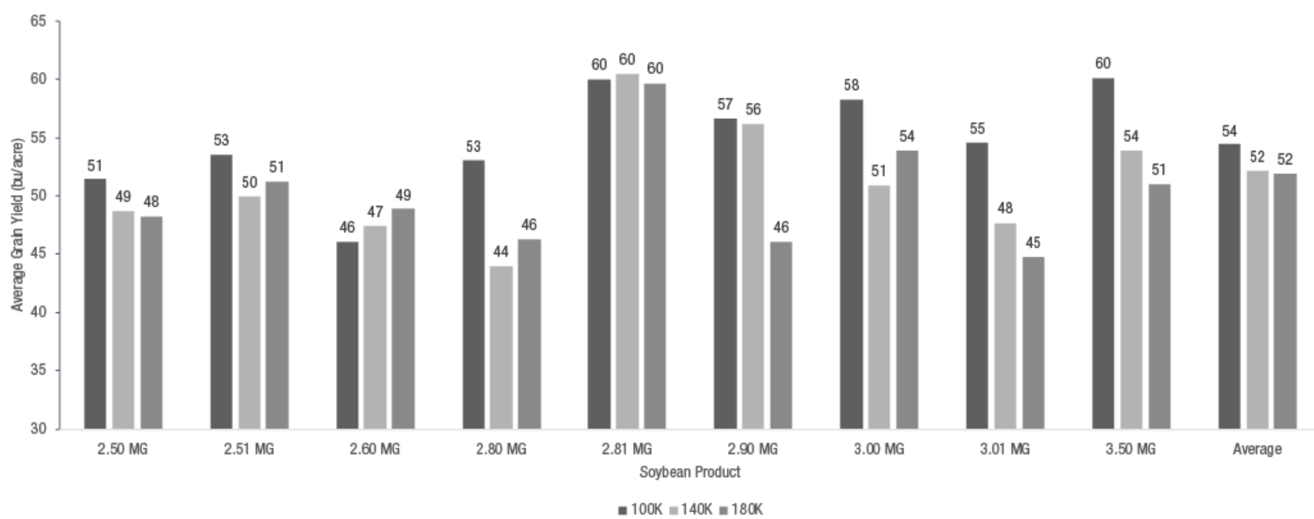
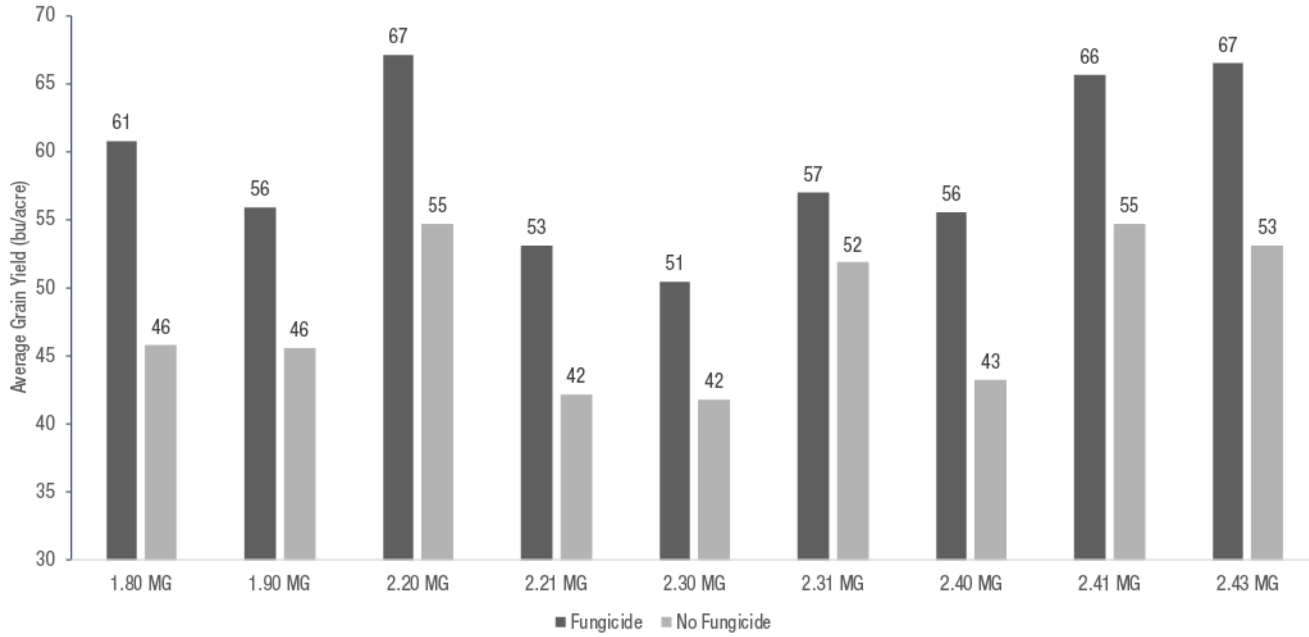


Figure 1. Average yield responses of 18 soybean products to three different seeding rates. Data represents yields averaged across fungicide applications. Average represents the average yield of all products at that seeding rate.

Effects of Fungicide and Seeding Rate on Soybean Productivity



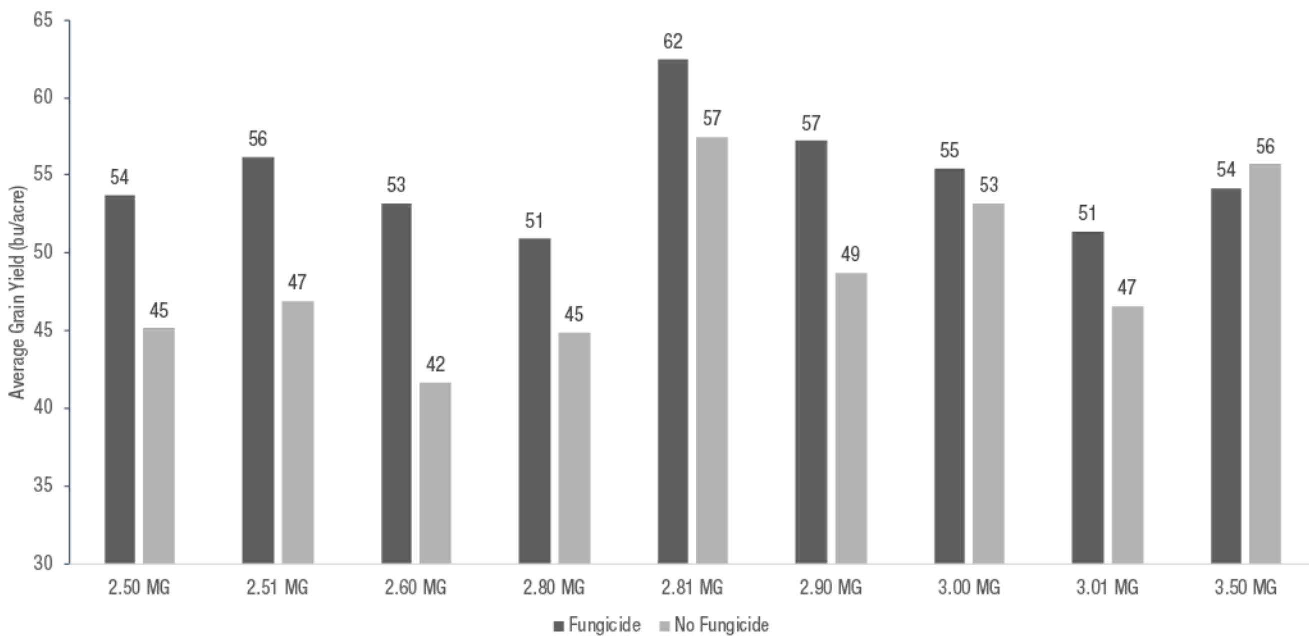


Figure 2. Effects of fungicide application on the yields of 18 soybean products. Data represents yields averaged across seeding rates.

Effects of Fungicide and Seeding Rate on Soybean Productivity

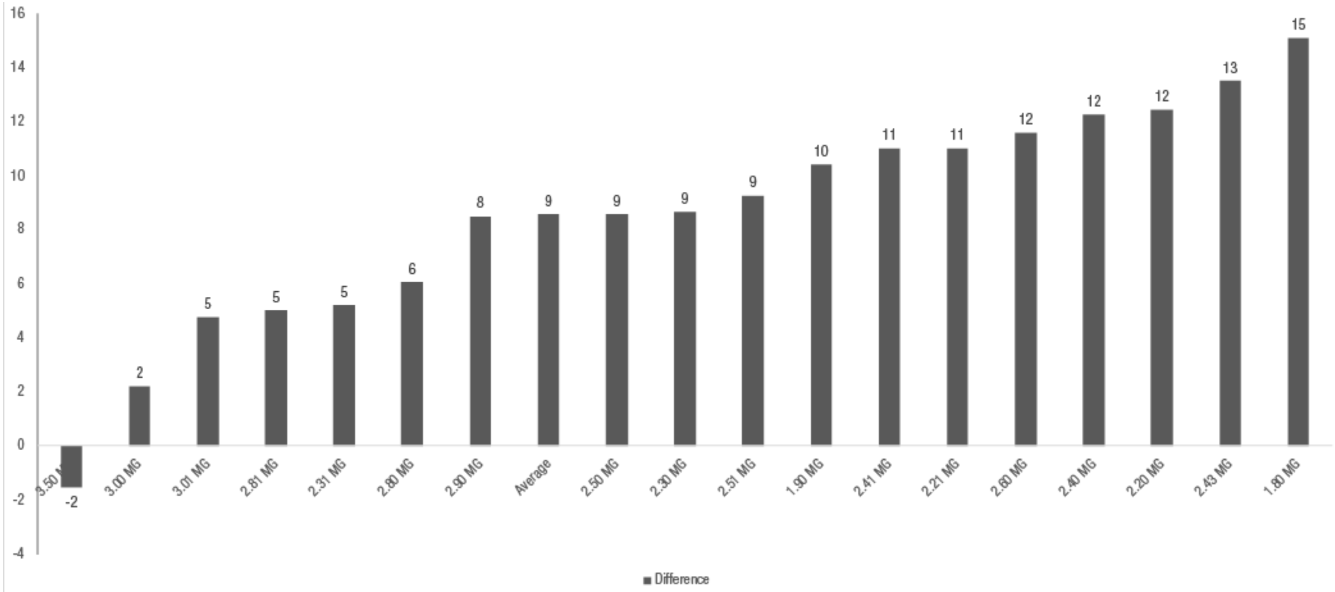


Figure 3. Effects of fungicide application on the yields of 18 soybean products. Data represents the yield difference between fungicide sprayed and unsprayed treatments averaged across seeding rates. Average represents the average yield difference of all the products.

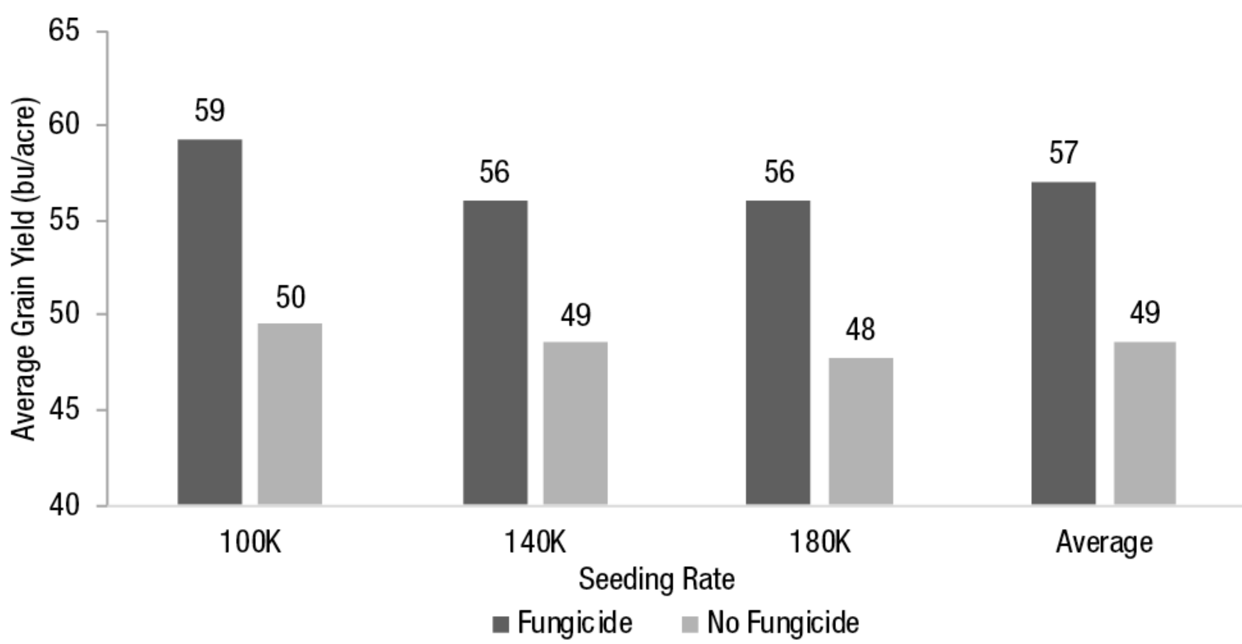


Figure 4. Summary of soybean yield response to fungicide application at three different seeding rates. Data represents yields averaged across 18 soybean products. Average represents the average yield of all products for that treatment.

Effects of Fungicide and Seeding Rate on Soybean Productivity

Key Learnings

- An average yield increase of 2 to 3 bu/acre is required to justify a 40K seeds/acre seeding rate increase in the current soybean commodity market of around $10/bushel. Under this scenario, 17 out of the 18 products tested were most profitable at the 100K seeding rate. Only one product was most profitable at the 140K seeding rate, and no product was most profitable at the 180K seeding rate.
- With the current soybean grain price around $10/bushel, a 2 to 3 bu/acre yield increase is needed to cover the cost of a fungicide application. Therefore, a fungicide application was profitable in all but one of the products evaluated in this testing. The 3.50 MG product did not respond to the fungicide application because it was a late maturing product that did not reach physiological maturity before a frost affected its yield potential.
- Crop yield response to production inputs can be highly variable and impacted by environmental conditions during the growing season. Farmers are advised to consult with their trusted crop advisors when making production input decisions.

Legal Statements

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Not all products are registered in all states and may be subject to use restrictions. The distribution, sale, or use of an unregistered pesticide is a violation of federal and/or state law and is strictly prohibited. Check with your local dealer or representative for the product registration status in your state. Delaro® is a registered trademark of Bayer Group.

Effects of Fungicide and Planting Date on Soybean Productivity

Trial Objective

- To optimize yield potential, soybean growers often plant as early as possible within the recommended planting window for the region. Such early planting; however, runs the risk of predisposing seeds and young seedlings to early-season stressors such as insects, diseases, and cool, wet soils, which can substantially affect stand establishment and overall plant and field health. To avoid these conditions, growers can plant later when soil conditions are optimal for germination and growth. Both options have effects on field performance and suitability/convenience for the whole farm operation.
- It is necessary to protect established plants from stressors that ultimately reduce yield potential. The application of a fungicide can protect soybean plants from foliar diseases and increase overall plant health, which can lead to increased grain yield.
- Yield responses observed from the application of a foliar fungicide greatly depend on seed product selection, as individual products respond differently to a fungicide application.
- The objective of this trial was to evaluate the impact fungicide application and planting date have on soybean productivity.

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	Corn	No-till	4/27/2020 5/13/2020	10/14/2020	60	140,000

- Three soybean products were used for the trial:
  - 2.0 maturity group (MG) product
  - 2.4 maturity group (MG) product
  - 2.9 maturity group (MG) product
- Each product was planted on two different dates:
  - April 27, 2020 (early planting date)
  - May 13, 2020 (late planting date)
- Delaro® Complete fungicide was applied at a rate of 8 oz/acre at the R3 growth stage.
- Trial was carried out in 30-inch row spacing, 4 rows/treatment with 5 replications.
- Tillage and weed management were the same for all treatments.

Effects of Fungicide and Planting Date on Soybean Productivity

Understanding the Results

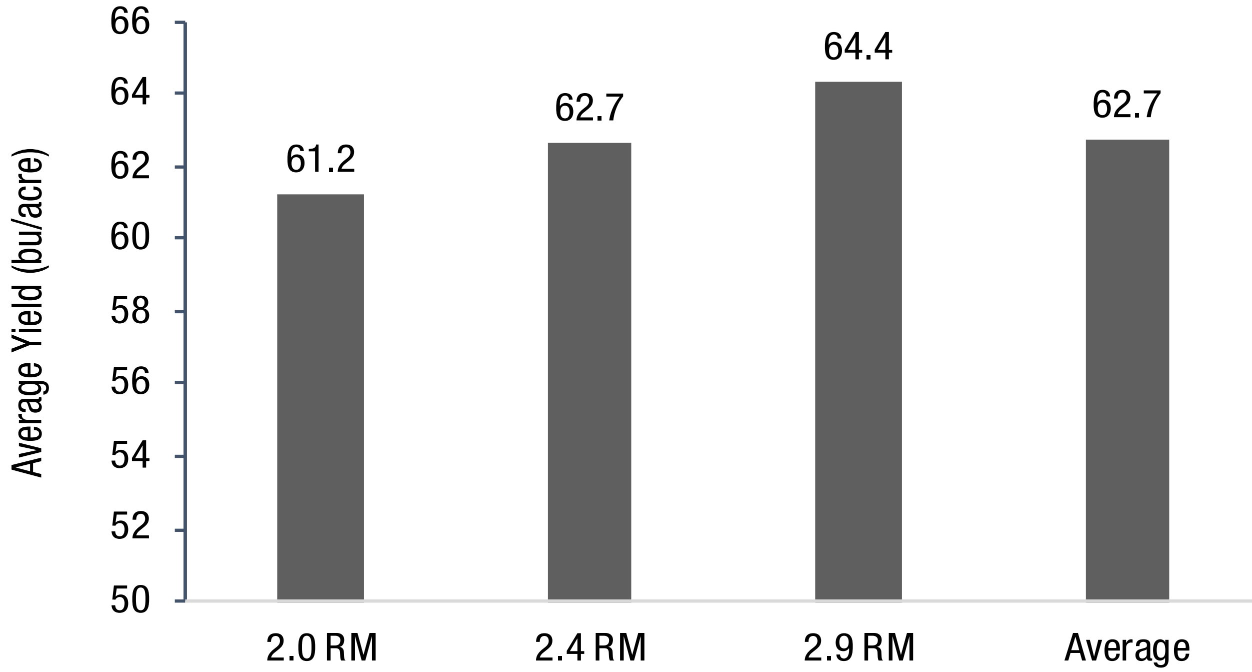

Figure 1. Yields of three soybean products averaged across planting dates and fungicide applications. Average represents the average yield of all the three products.

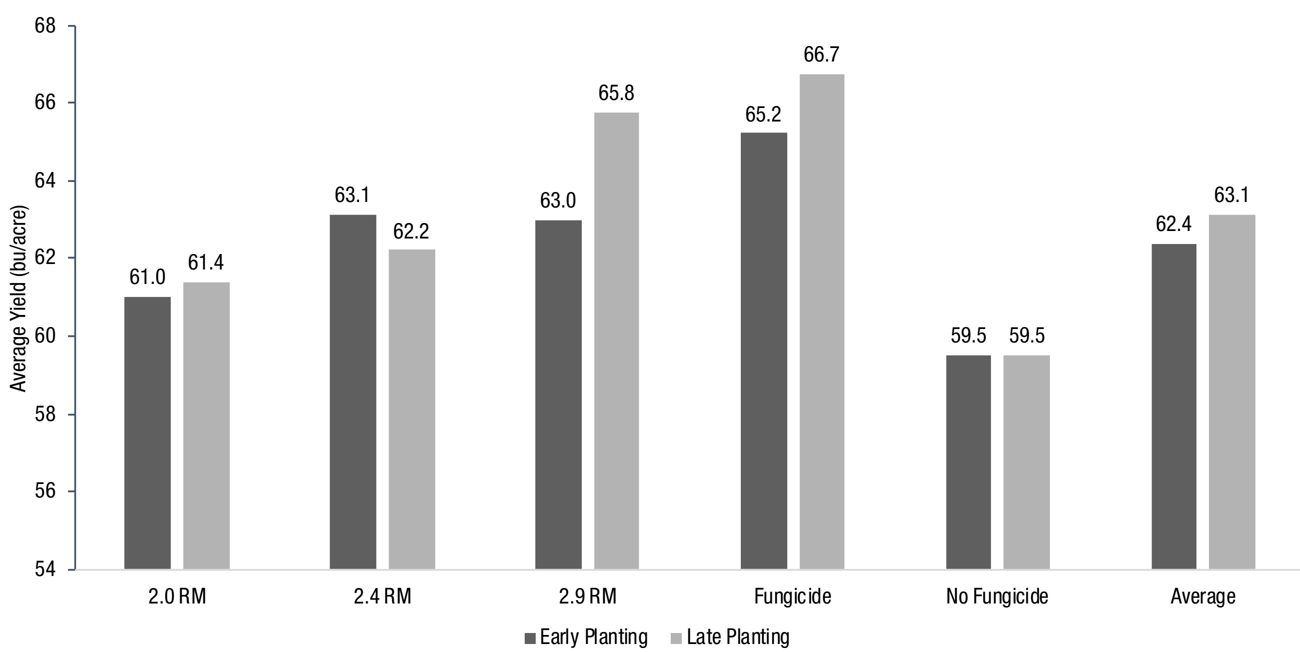

Figure 2. Effects of planting date and fungicide application on the yields of three soybean products. Data represents yields averaged across fungicide applications. Average represents the average yield of all products at that planting date.

Effects of Fungicide and Planting Date on Soybean Productivity

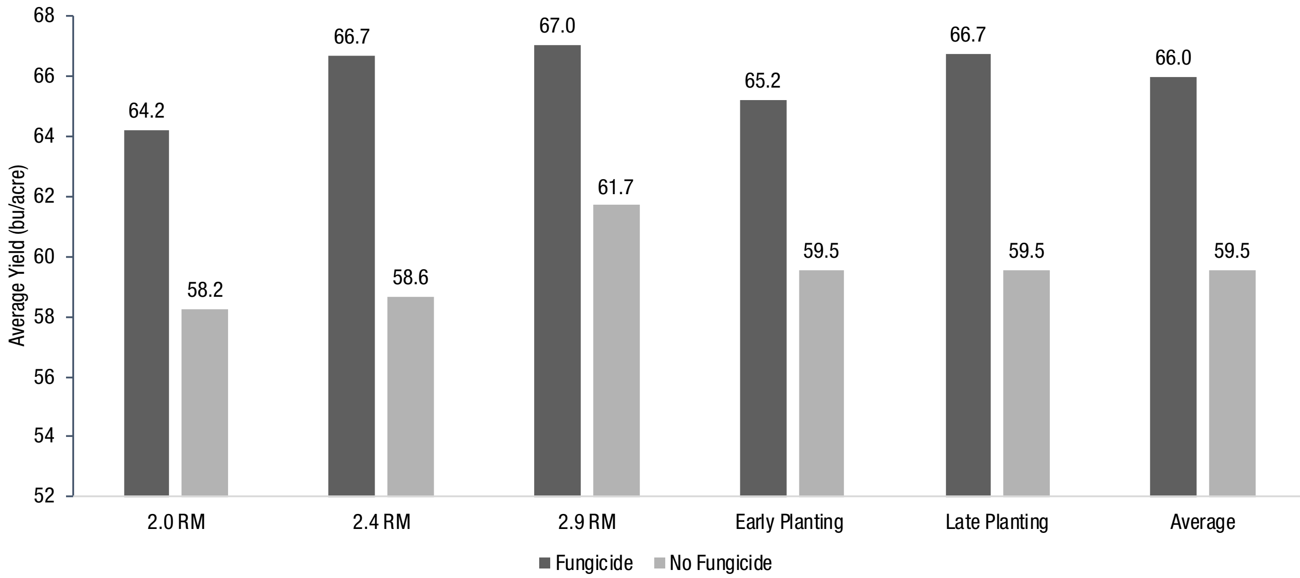

Figure 3. Effects of fungicide application on planting date and yields of three soybean products. Data represents yields averaged across the two planting dates. Average represents the average yield of all products at that fungicide treatment.

- At the trial site, yield increased as the relative maturity of products increased (Figure 1).
- Late planting date out-performed early planting date in the 2.0 RM and 2.9 RM products but not in the 2.4 RM product. On average, there wasn't much difference in yield between the planting dates (Figure 2).
- Fungicide application substantially improved yields in all the products, with an average yield gain of 6 bu/acre (Figure 3).
- Without a fungicide application, yields were the same, however, with fungicide application, late planting slightly out-performed early planting (Figures 2 and 3).

Key Learnings

- In all production regions, products within the appropriate maturity group should be selected to optimize yields. The 2.9 RM product is the full-season product selected for the trial location and yielded the highest (Figure 1).
- For this site, early planted soybeans have historically yielded higher than late planted soybeans. For this trial year, the trial location experienced cold and wet conditions after the early planting date. This resulted in protracted germination and emergence, a situation not experienced by the late planting. This, in part, may explain why early planting did not out-perform late planting this year (Figure 2).
- Over the past several years, foliar fungicides have consistently improved soybean yields at the trial site. In general, there wasn't a disease outbreak at the trial site; however, there were minor incidences of sudden death syndrome (SDS), frogeye leaf spot, Septoria brown spot and Cercospora leaf blight in both the fungicide sprayed and unsprayed plots. Also, the site was in the path of the derecho that hit Iowa in August of 2020.
- With the current grain price of about $10/bushel, a 2 to 3 bu/acre yield gain is needed to cover the cost of the fungicide application. Thus, fungicide was cost effective for all the treatments in this study.
- Crop yield response to production inputs can be highly variable, often impacted by the environmental conditions during the growing season. Farmers are therefore advised to consult their trusted crop advisors when making such decisions.

Effects of Fungicide and Planting Date on Soybean Productivity

Legal Statements

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Evaluation of Disease Management Systems in Soybean – White Mold

Trial Objective

- White mold (WM, also called Sclerotinia stem rot) is a substantial problem in the U.S. North Central soybean production region and in Canada. Caused by the fungus *Sclerotinia sclerotiorum* that overwinters in the soil, WM is often recognized by fluffy, white growth on soybean stems. WM development is favored by cool, cloudy, wet, and humid weather at first flowering. The disease is more problematic in soybeans in high-yield environments where high plant populations, narrow row spacing, and an early-closing canopy are commonly used.
- The objective of this study was to evaluate a system-based approach for WM disease management supported by genetic resistance of germplasm and foliar fungicide.
- Soybean products with varying levels of resistance to WM were evaluated under different fungicide management options.

Research Site Details

- Fields with a history of WM were selected for this study.
- Plots were planted in a split-plot design with fungicide treatment as the main plot and soybean product as the sub-plot.
- Fungicide treatments included:
  - Untreated
  - Application of Delaro® 325 SC fungicide (Group 3 + Group 11) at 8 oz/acre tank-mixed with Luna® Privilege (Group 7) fungicide at 2 oz/acre at R1
  - Application of Delaro 325 SC fungicide at 8 oz/acre tank-mixed with Luna Privilege fungicide at 2 oz/acre at R1 and R3
- Soybean products used were classified as susceptible (S), moderately susceptible (MS), moderately resistant/moderately susceptible (MR/MS), moderately resistant (MR), or resistant (R) to WM.
  - Resistant varieties were left out of most data analyses because they were unavailable or missing from 5 out of the 13 locations.
- Plots were randomized within the trial.
- WM disease ratings were taken at the R6 growth stage.
- 50 trial locations from 2019 and 2020 were planted for this study, and the data shown below is the average of the 13 locations (26%) kept for this analysis because they had moderate to high white mold pressure.

Evaluation of Disease Management Systems in Soybean – White Mold

Understanding the Results

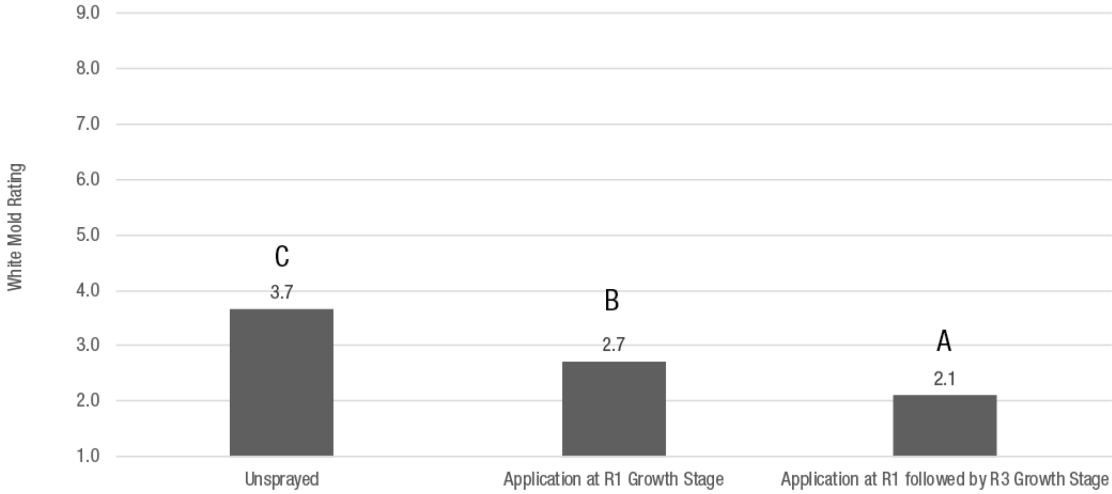

Figure 1. Average WM disease index rating for each fungicide treatment of Delaro® 325 SC fungicide tank-mixed with Luna® Privilege fungicide. WM disease index: 1 = no disease, 9 = severe disease. Mean separation letters (a, b, c) denote statistically significant differences at an alpha = 0.1.

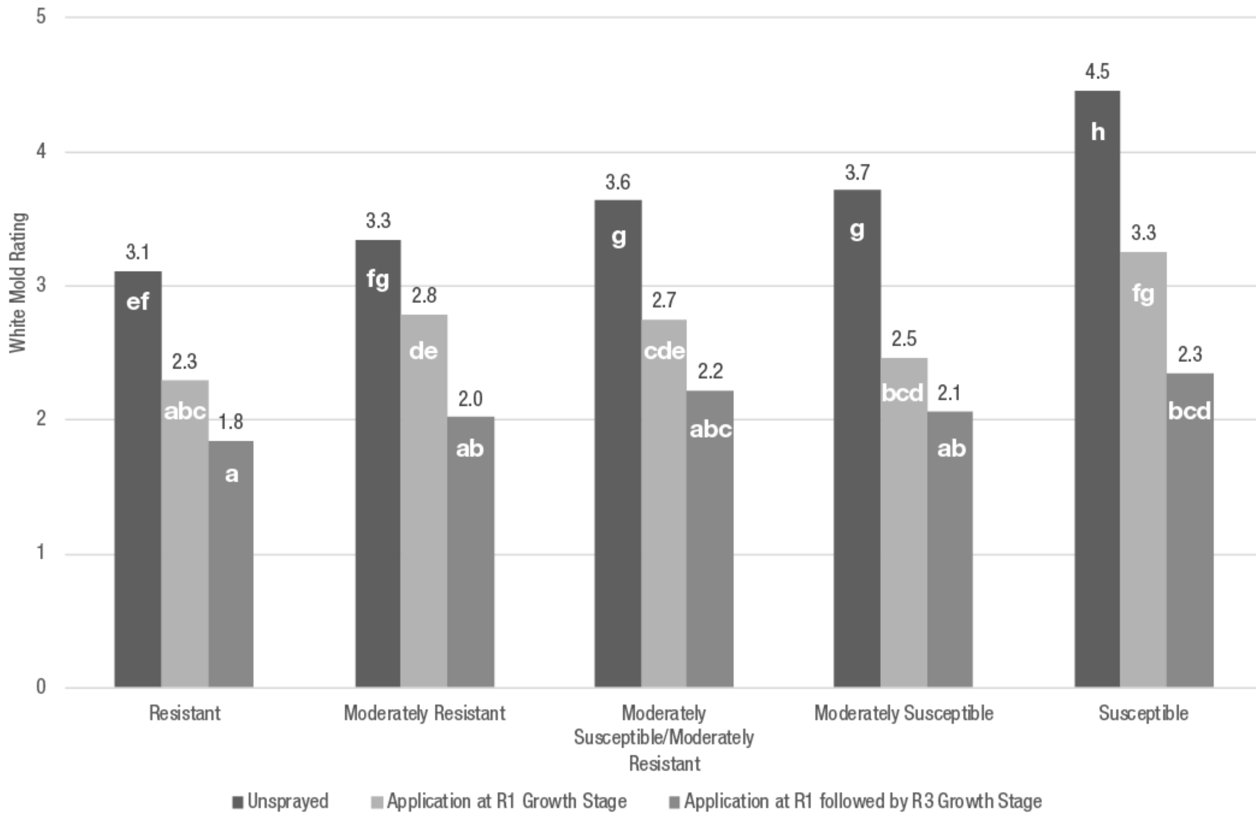

Figure 2. Average WM disease index rating by fungicide spray treatment and WM disease classification of soybean products. Fungicides: Delaro® 325 SC fungicide tank-mixed with Luna® Privilege fungicide. WM disease index: 1 = no disease, 9 = severe disease. Mean separation letters (a through h) denote statistically significant differences at an alpha = 0.1.

Evaluation of Disease Management Systems in Soybean – White Mold

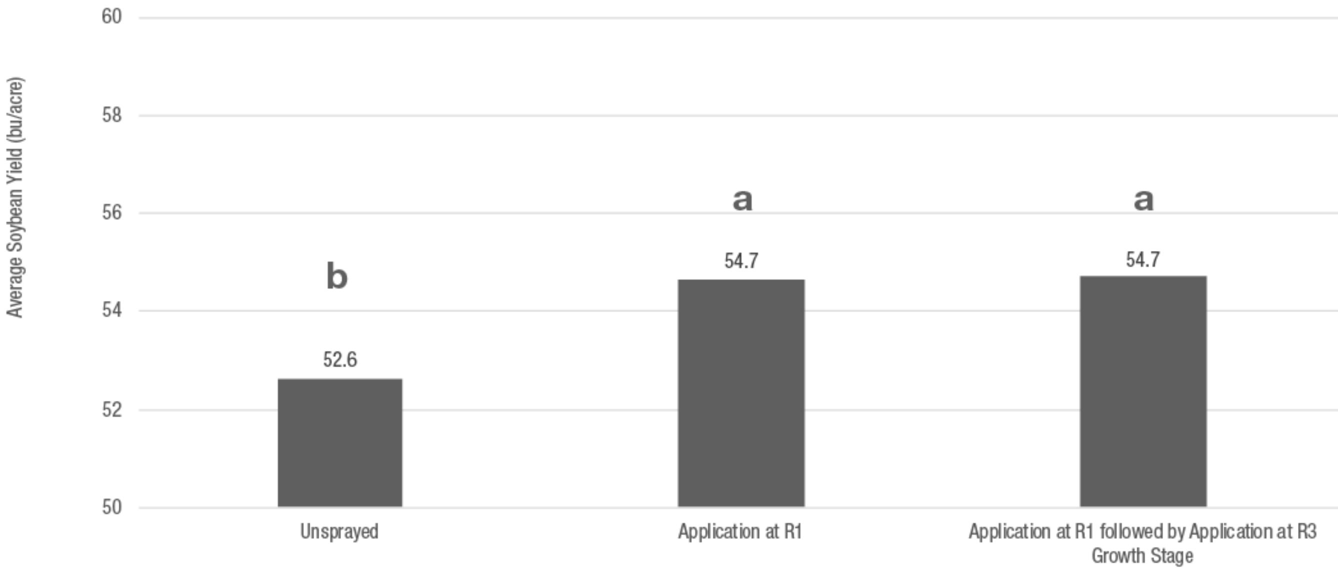

Figure 3. Average yield for each fungicide treatment across all soybean products and locations. Fungicides: Delaro® 325 SC fungicide tank-mixed with Luna® Privilege fungicide. Mean separation letters (a, b) denote statistically significant differences at an alpha = 0.1.

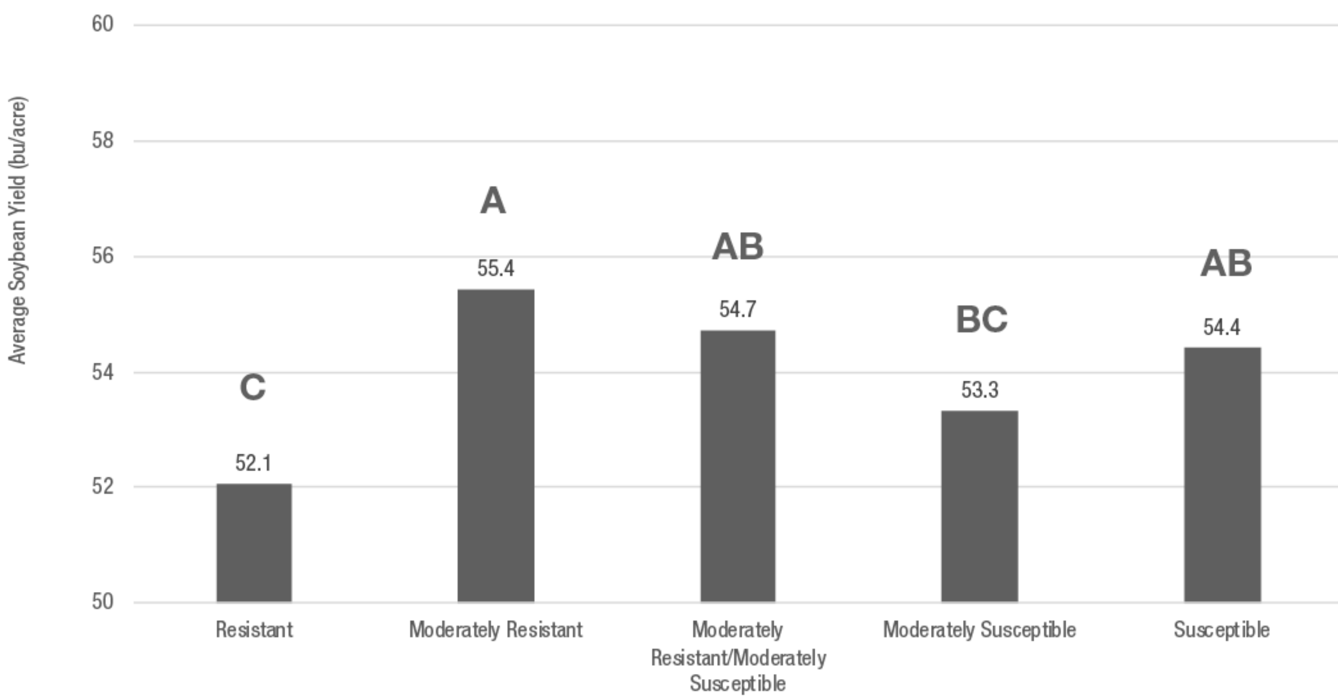

Figure 4. Average yield of treatments for each WM disease classification of soybean products. Mean separation letters (a) denote statistically significant differences at an alpha = 0.1.

Evaluation of Disease Management Systems in Soybean – White Mold

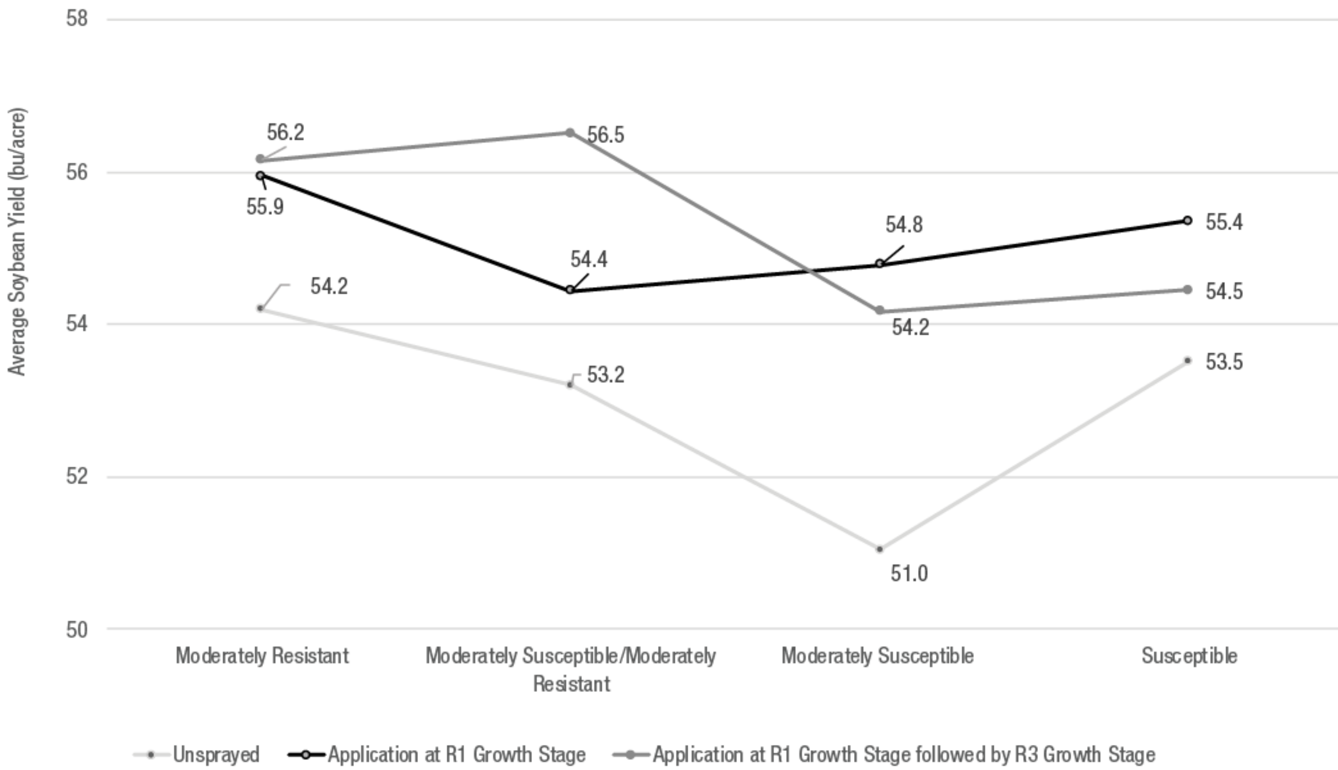

Figure 5. Average yield by fungicide treatment and WM disease classification of soybean products. Fungicides: Delaro® 325 SC fungicide tank-mixed with Luna® Privilege fungicide.

Evaluation of Disease Management Systems in Soybean – White Mold

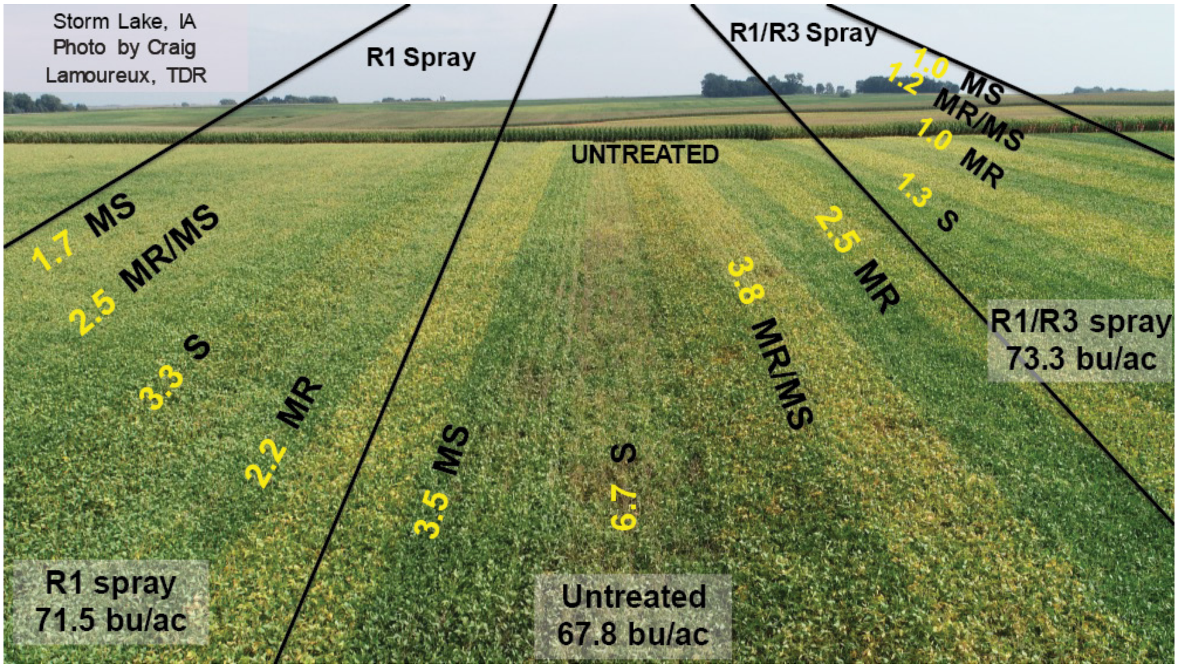

Figure 6. Aerial imagery showing visual differences of WM disease severity for each of the fungicide spray treatments and WM disease classification of products. Soybean products sprayed at R1 then followed by an R3 application yielded the highest and had the lowest WM disease index recorded in a location with relatively high WM incidence and severity (WM index numbers in yellow. WM disease index: 1 = no disease, 9 = severe disease). Fungicides: Delaro® 325 SC fungicide tank-mixed with Luna® Privilege fungicide.

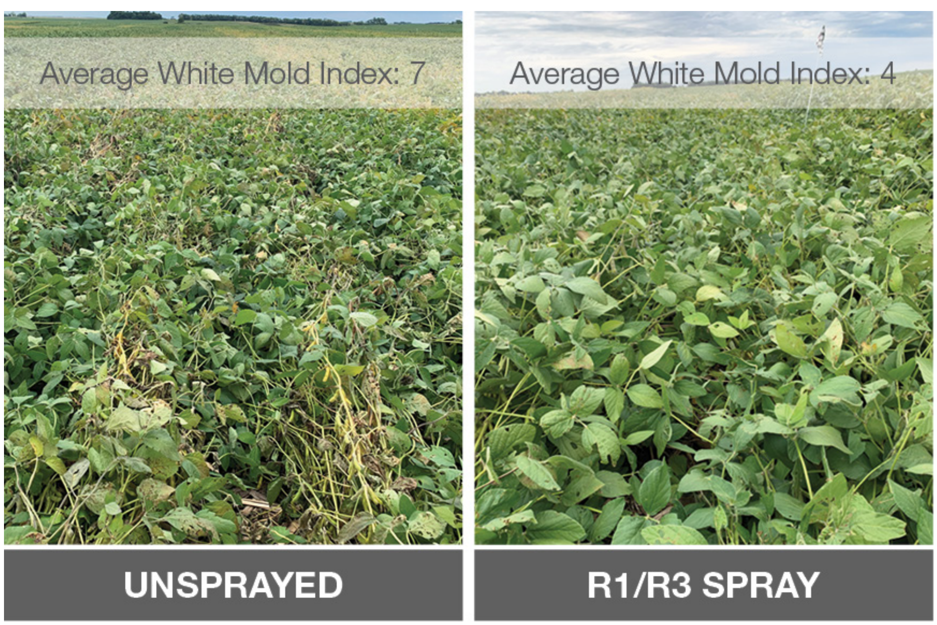

Figure 7. Side-by-side comparison of a soybean product susceptible to WM showcasing the effect of fungicide applications (R1 and R3) on WM disease control and plant health. Fungicides: Delaro® 325 SC fungicide tank-mixed with Luna® Privilege fungicide. WM disease index: 1 = no disease, 9 = severe disease.

Evaluation of Disease Management Systems in Soybean – White Mold

Key Learnings

- Within the data set, there was strong WM disease suppression in response to fungicide application, resulting in a significant advantage of more than 2 bu/acre over the unsprayed treatment.
- Within the data set, these interactions between disease classification and fungicide application at R1 growth stage were found -
  - Moderately Resistant soybean products and Moderately Resistant/Moderately Susceptible soybean products had a 1.45 bu/acre advantage with fungicide applied at the R1 growth stage compared to untreated check.
  - Moderately Susceptible soybean products and Susceptible soybean products had a 2.85 bu/acre advantage when fungicide was applied at R1 growth stage compared to untreated check.
- Yield of Moderately Resistant soybean products with fungicide applied at R1 growth stage was not statistically different than yield from other disease classes with fungicide applied at R1 growth stage.
- However, yield of Moderately Resistant soybean products with fungicide applied at R1 growth stage was numerically highest of all management systems that were untreated or had a fungicide applied at R1 growth stage.

Legal Statements

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Tank mixtures: The applicable labeling for each product must be in the possession of the user at the time of application. Follow applicable use instructions, including application rates, precautions and restrictions of each product used in the tank mixture. Not all tank mix product formulations have been tested for compatibility or performance other than specifically listed by brand name. Always predetermine the compatibility of tank mixtures by mixing small proportional quantities in advance. Delaro® is a registered trademark of Bayer Group. All other trademarks are the property of their respective owners. For additional product information call toll-free 1-866-99-BAYER (1-866-992-2937) or visit our website at www.BayerCropScience.us. Bayer CropScience LP, 800 North Lindbergh Boulevard, St. Louis, MO 63167.

Soybean Response to Late-Season Irrigation

Trial Objective

The objective of this trial was to evaluate the response of soybean to different late-season irrigation treatments.

Research Site Details

Location	Soil Type	Previous Crop	Tillage Type	Planting Date	Harvest Date	Potential Yield (bu/acre)	Planting Rate (seeds/acre)
Gothenburg, NE	Hord silt loam	Corn	Strip	5/11/2020	9/28/2020	55	160K

- This study was designed as a randomized complete block with four replications of five treatments.
- A 2.9 maturity group soybean product was planted.
- The plots were maintained under dryland conditions with no supplemental irrigation applied until August 25. A hand probe was unable to penetrate the soil to evaluate soil moisture at that time as it was extremely dry.
- Irrigation treatments consisted of the following with three total irrigation applications with each treatment (Table 1).
- Irrigation was applied using a sub-surface drip irrigation system, and weeds were controlled as needed. No fungicides or insecticides were applied.
- After August 25, only one precipitation event of 0.5 inches occurred on September 8, 2020.
- Plots were combine-harvested, and a subsample of seed from each replication was taken to determine moisture content, test weight, and total weight. Statistical analysis for Fisher's LSD was performed.

Table 1. Irrigation treatments and total water applied.

Treatment	Total Water Applied (inches)
Dryland	0
0.5-inch/week	1.5
1.0-inch/week	3.0
1.5-inch/week	4.5
2.0-inch/week	6

Understanding the Results

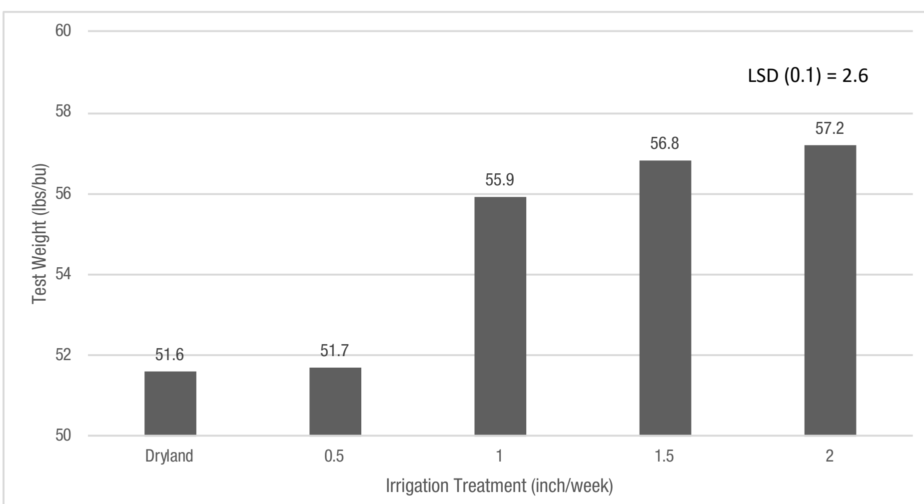

Figure 1. Impact of late-season irrigation treatments on soybean seed test weight.

Soybean Response to Late-Season Irrigation

- Irrigation treatments significantly impacted test weight with seed sampled from plants receiving the dryland and 0.5-inch/week treatments having significantly lower test weights than seed from the 1.0-inch, 1.5-inch, and 2.0-inch/week treatments (Figure 1).
- The smaller soybean seed size can be seen in the dryland and 0.5-inch/week treatments compared to 1.0-inch/week treatment in Figure 2.

Figure 2. Soybean seed size of seed sampled from plants receiving the dryland, 0.5-inch, and 1.0-inch/week irrigation treatments.

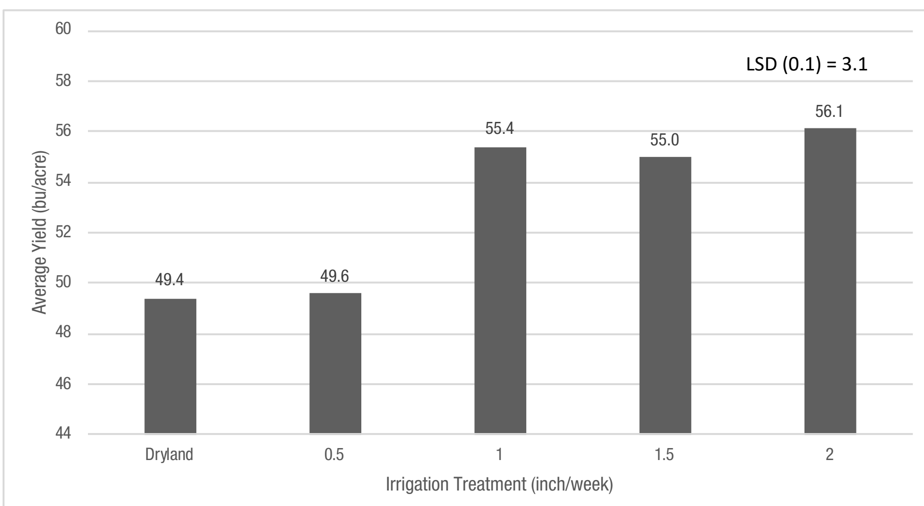

Figure 3. Impact of irrigation treatments on average soybean yield.

Soybean Response to Late-Season Irrigation

- For this trial, irrigation treatments significantly impacted average soybean yield with plants receiving the dryland and 0.5-inch/week treatments having significantly lower average yields (bu/acre) than the plants receiving the 1.0-inch, 1.5-inch, and 2.0-inch/week treatments (Figure 3).
    - For this trial, the 0.5-inch/week treatment did not provide enough water to overcome the drought stress conditions of experienced by the soybean plants.
    - Soybean plants during the R5 to R6 growth stages can use on average 0.2 to 0.25 inches of water per acre per day.[1]
- Minimal soil moisture was available to the soybean plants toward the end of August. Plants appeared drought stressed before the start of the irrigation treatments on August 25 as seen in Figure 4.

Figure 4. Stressed soybean plants before irrigation on August 25, 2020.

Key Learnings

- Based on our observations for this trial, farmers could potentially improve soybean yields by applying late-season irrigations when it is available.
    - Because soybeans use more water later in the growing season, late-season irrigation can be a strategy in areas where water could be diverted from a short-season corn product if sufficient moisture is available in the soil profile to fill-out the corn kernels.
- Significant soybean yield losses could occur in years where end of season precipitation is limited and the available moisture in the soil profile is not being actively managed. Warm air temperatures at the end of August through mid-September can also negatively impact available moisture in the soil.

Source

[1] Kranz, W.L. and Specht, J.E. 2012. Irrigating soybean. University of Nebraska-Lincoln Extension. G1367.

Legal Statements

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Performance of Asgrow® Brand XtendFlex® Soybeans Under Irrigated and Dryland Environments

Trial Objective

- The characterization of new products helps provide product placement information for consumers and Asgrow® representatives.
- The objective of this comparison was to evaluate Asgrow® brand XtendFlex® soybeans under dryland and irrigated environments.

Research Site Details

Location	Soil Type	Previous Crop	Tillage Type	Planting Date	Harvest Date	Potential Yield (bu/acre)	Seeding Rate (seeds/acre)
Gothenburg, NE	Hord silt loam	Corn	Strip till	6/1/20	10/2/20	80	160,000

- In this trial, nine Asgrow® brand XtendFlex® soybean products were grown under dryland and irrigated environments.
- This comparison used single-replication, large plots or 0.13 acres and 0.03 acres for dryland and irrigated plots, respectively.
- No statistical analysis was performed.
- The irrigated plots were sprinkler-irrigated.
- Fertility, applied with a Chafer Fertilizer Streambar on 4/14/20, included 50 lb phosphorus/acre, 11 lb sulfur/acre, and 20 lb nitrogen/acre.
- Weeds were controlled as necessary and no other pesticides were used in this study.

Performance of Asgrow® Brand XtendFlex® Soybeans Under Irrigated and Dryland Environments

Figure 1. Asgrow® AG26XF1 brand under dryland (left) and irrigated (right) environments. Bayer Research Center, Gothenburg Water Utilization Center, Gothenburg, NE (2020).

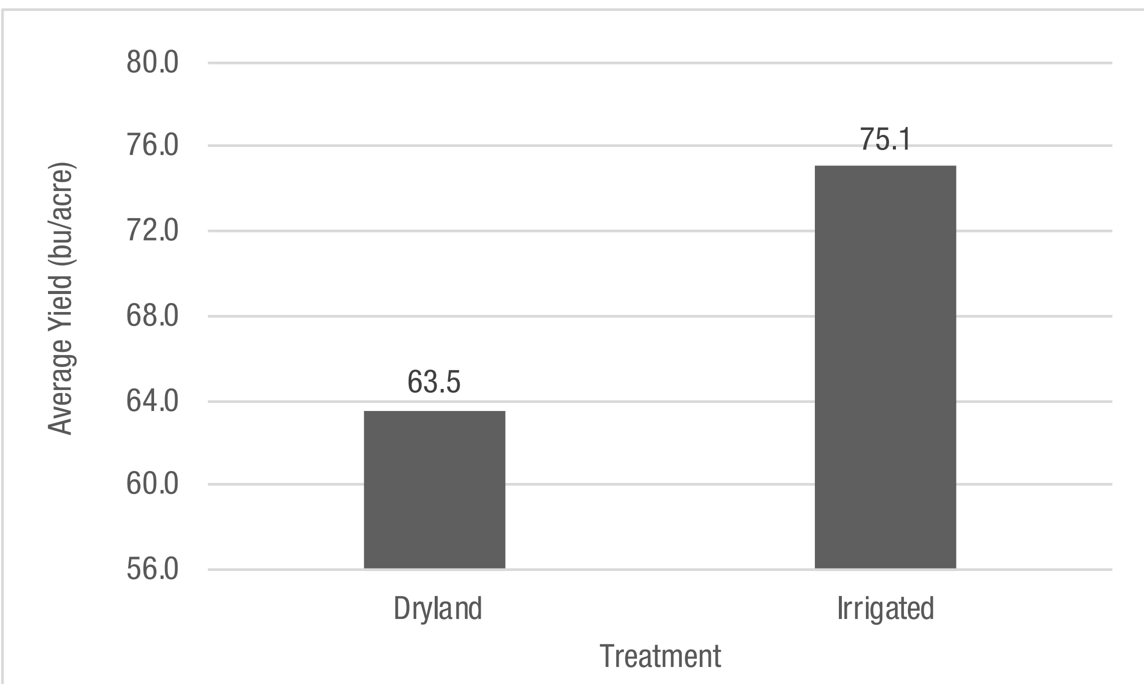

Figure 2. Average yield of nine Asgrow® brand XtendFlex® Soybeans under dryland and irrigated environments. Bayer Research Center, Gothenburg Water Utilization Center, Gothenburg, NE (2020).

Performance of Asgrow® Brand XtendFlex® Soybeans Under Irrigated and Dryland Environments

Understanding the Results

- The Asgrow® brand XtendFlex® soybeans responded positively to irrigation with an increase of 11+ bu/acre compared to the dryland environment.

Key Learnings

- This study provides an estimate for the performance of Asgrow® brand XtendFlex® soybeans under dryland and irrigated environments.

Legal Statements

XtendFlex® Soybeans and Roundup Ready 2 Xtend® Soybeans Across Irrigation Environments

Trial Objective

- Product performance across environments is one of the key evaluations made with new product releases.
- Water drives crop production on the Great Plains and understanding how XtendFlex® soybeans perform under irrigation compared to Roundup Ready 2 Xtend® soybeans is valuable information to farmers.

Research Site Details

Location	Soil Type	Previous Crop	Tillage Type	Planting Date	Harvest Date	Potential Yield (bu/acre)	Seeding Rate (seeds/acre)
Gothenburg, NE	Silt loam	Corn	No tillage	6/5/20	11/4/20	80	160,000

- Trial design was a randomized complete block with three replications of eight treatments.
- Two 3.6 maturity group soybean products with similar genetics were used in the trial:
  - XtendFlex® soybean product MG3.6XF
  - Roundup Ready 2 Xtend® soybean product MG3.6X
- Soybean plots were planted on June 5, 2020 into plots with a full soil profile in the Rainout Shelter. The Rainout Shelter prevents precipitation from reaching plots by closing over the plot area during precipitation events. However, the building is open the rest of the season to allow for normal accumulation of sunlight and heat.
- Irrigation treatments of 6, 10, 14, and 18 inches were applied through a surface drip irrigation system over an 8-week period (mid-July to mid-September).
  - Applications were split equally during that time from 0.75 inches per week in the 6-inch treatments to 2.25 inches per week in the 18-inch treatment.
- Weeds were controlled as necessary and no other pesticides or fertilizers were applied.

Figure 1. XtendFlex® soybeans and Roundup Ready 2 Xtend® soybeans planted in the Rainout Shelter at the Bayer Water Utilization Center at Gothenburg, Nebraska. Plots show variation in yellowing because of moisture stress. The shelter was closed over the plots to demonstrate how it covers the plots during precipitation events.

XtendFlex® Soybeans and Roundup Ready 2 Xtend® Soybeans Across Irrigation Environments

Understanding the Results

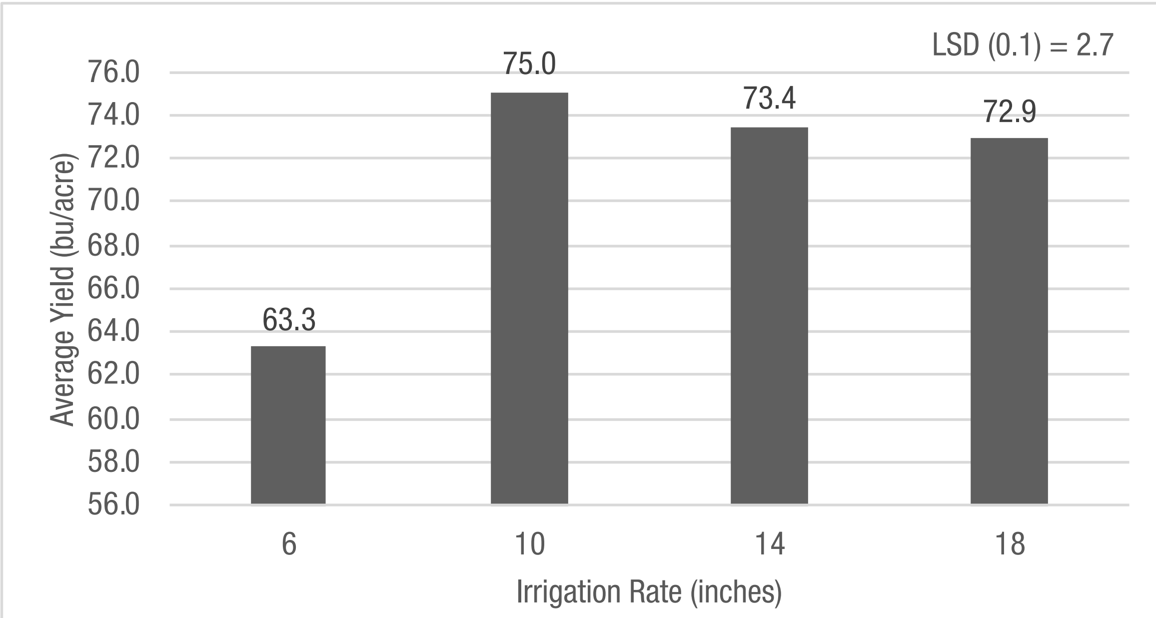

Figure 2. Average soybean yield under four different irrigation rates.

- For this trial, there was no significant interaction between irrigation rate and soybean products.
- There was no significant difference in average yield between Roundup Ready 2 Xtend® soybeans and XtendFlex® soybeans.
- Average yields from 10-, 14-, and 18-inch irrigation rates were all statistically similar, and greater than the average yield from the 6-inch rate.

Key Learnings

- The two XtendFlex® soybean products tested in this trail maintained the same yield performance as Roundup Ready 2 Xtend® soybeans across irrigation rates. This was true for the water stressed environment with a 6-inch application through fully watered treatments.
- Farmers should be confident that the yield potential of XtendFlex soybeans would be similar to the yield potential of Roundup Ready 2 Xtend soybeans of similar genetics when exposed to field conditions with varying amounts of available soil moisture.

XtendFlex® Soybeans and Roundup Ready 2 Xtend® Soybeans Across Irrigation Environments

Legal Statements

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ALWAYS READ AND FOLLOW PESTICIDE LABEL DIRECTIONS. It is a violation of federal and state law to use any pesticide product other than in accordance with its labeling. NOT ALL formulations of dicamba or glyphosate are approved for in-crop use with Roundup Ready 2 Xtend® soybeans. NOT ALL formulations of dicamba, glyphosate or glufosinate are approved for in-crop use with products with XtendFlex® Technology. ONLY USE FORMULATIONS THAT ARE SPECIFICALLY LABELED FOR SUCH USES AND APPROVED FOR SUCH USE IN THE STATE OF APPLICATION. Contact the U.S. EPA and your state pesticide regulatory agency with any questions about the approval status of dicamba herbicide products for in-crop use with Roundup Ready 2 Xtend® soybeans or products with XtendFlex® Technology.

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Roundup Ready 2 Xtend® soybeans contain genes that confer tolerance to glyphosate and dicamba. Products with XtendFlex® Technology contains genes that confer tolerance to glyphosate, glufosinate and dicamba. Glyphosate will kill crops that are not tolerant to glyphosate. Dicamba will kill crops that are not tolerant to dicamba. Glufosinate will kill crops that are not tolerant to glufosinate. Contact your seed brand dealer or refer to the Bayer Technology Use Guide for recommended weed control programs.

Planting Speed Effect on Soybean Yield

Trial Objective

- The objective of this trial was to understand the effect of planting speed on soybean yield to address claims of significant yield increases with reduced planter speed.

Research Site Details

Location	Soil Type	Previous Crop	Tillage Type	Planting Date	Harvest Date	Potential Yield (bu/acre)	Planting Rate (seeds/acre)
Gothenburg, NE	Hord silt loam	Corn	Strip tillage	5/11/2020	9/30/2020	60	60K, 120K

- Treatments consisted of three planting speeds and two seeding rates for a total of six treatments.
  - Planting speed – Planter passes were mapped using the Climate FieldViewTM Platform (Figure 1).
    - 1.5 miles per hour (mph)
    - 3.0 mph
    - 4.5 mph
  - Seeding rates
    - 60,000 seeds/acre
    - 120,000 seeds/acre

Figure 1. Speed of planter passes as reported in Climate FieldViewTM Platform.

Planting Speed Effect on Soybean Yield

- The study was setup as a randomized complete block with four replications of each of the six treatments, and all planting speed by seeding rate combinations were evaluated.
- A 2.5 maturity group soybean product was planted.
- The plots were irrigated until mid-August. After that, irrigation was decreased during late pod fill due to a mechanical issue with the lateral irrigation system.
- Weeds were controlled and no fungicides or insecticides were applied.
- Plots were combine-harvested, and a subsample of seed from each replication was taken to determine moisture content, test weight, and total weight. Statistical analysis for Fisher's LSD was performed.

Understanding the Results

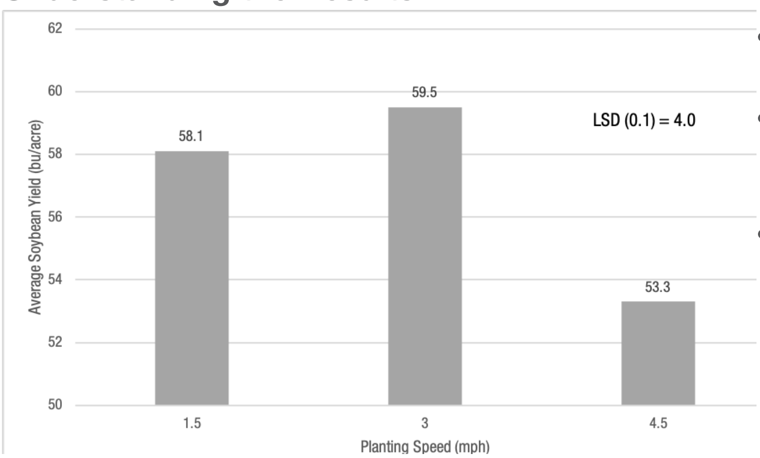

Figure 2. Average soybean yield response to planting speed across the two seeding rates.

- Neither planting speed nor seeding rate affected soybean test weight.
- There was not a significant interaction between planting speed and seeding rate on soybean yield.
- Planting speed had a significant effect on average soybean yield in this trial (Figure 2).
  - The 4.5 mph treatment had significantly lower average yield than either the 1.5 or 3.0 mph treatments.
  - The 3.0 mph treatment had the highest average yield but was not significantly different than the 1.5 mph treatment.

Key Learnings

- We observed that planting speed affected average soybean yield in this first year, single-site study.
- Further research is planned for next year. Farmers may want to consider taking these findings and trying a side-by-side comparison using the Climate FieldViewTM Platform on their farm by using the 3.0 mph planter speed compared to the planting speed they typically use.

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Potential Inputs for Soybean Production

Trial Objective

- Every year farmers evaluate which inputs they may want to use in their soybean production system to increase yield and return on investment. To help farmers with this decision, different inputs such as seeding rate, planting date, fungicide use, and fertilizer applications were evaluated for their potential impact on soybean yield.

Research Site Details

Location	Soil Type	Previous Crop	Tillage Type	Planting Date	Harvest Date	Potential Yield (bu/acre)	Seeding Rates (seeds/acre)
Gothenburg, NE	Hord silt loam	Corn	Strip tillage	5/1/2020, 5/28/2020	10/02/2020	90	160K, 220K

- The study consisted of ten treatments with five categorized as base management (BM) and five categorized as high management (HM) (Table 1). Treatments 1 and 6 were considered the base for BM and HM inputs, respectively.

Table 1. Base management (BM) and high management (HM) treatments.

				Fertilizer (Strip-Till Applied 4/22/2020)		
Treatment	Seeding Rate (seeds/acre)	2020 Planting Date	Delaro® 325 SC Fungicide (Applied 8/5/2020 at R3) (fl oz/acre)	Phosphorus (lbs/acre)	Sulfur (lbs/acre)	Nitrogen (lbs/acre)
1 BM	**160,000**	**5/28**				
2 BM	220,000	5/28				
3 BM	160,000	5/1				
4 BM	160,000	5/28	8			
5 BM	160,000	5/28		40	8.75	15.8
6 HM	**220,000**	**5/1**	**8**	**40**	**8.75**	**15.8**
7 HM	160,000	5/1	8	40	8.75	15.8
8 HM	220,000	5/28	8	40	8.75	15.8
9 HM	220,000	5/1		40	8.75	15.8
10 HM	220,000	5/1	8			

- This study was designed as a randomized complete block with four replications.
- A 2.6 maturity group soybean product was planted.
- The plots were sprinkler irrigated and weeds were controlled as needed.
- No insecticides were applied, and fungicides were applied as described in Table 1.
- Plots were combine-harvested, and a subsample of grain from each replication was taken to determine moisture content percent, test weight, and total weight.
- Statistical analysis for Fisher's LSD was performed.
- Input costs:
  - Seed at $50/140,000 seed unit.
  - Fungicide and application at $23/acre.
  - Phosphorus/nitrogen mix at $445/ton and sulfur at $275/ton.
  - These costs do not account for additional savings farmers can realize when using Bayer PLUS Rewards.*

*See program terms & conditions for full details.

Potential Inputs for Soybean Production

Understanding the Results

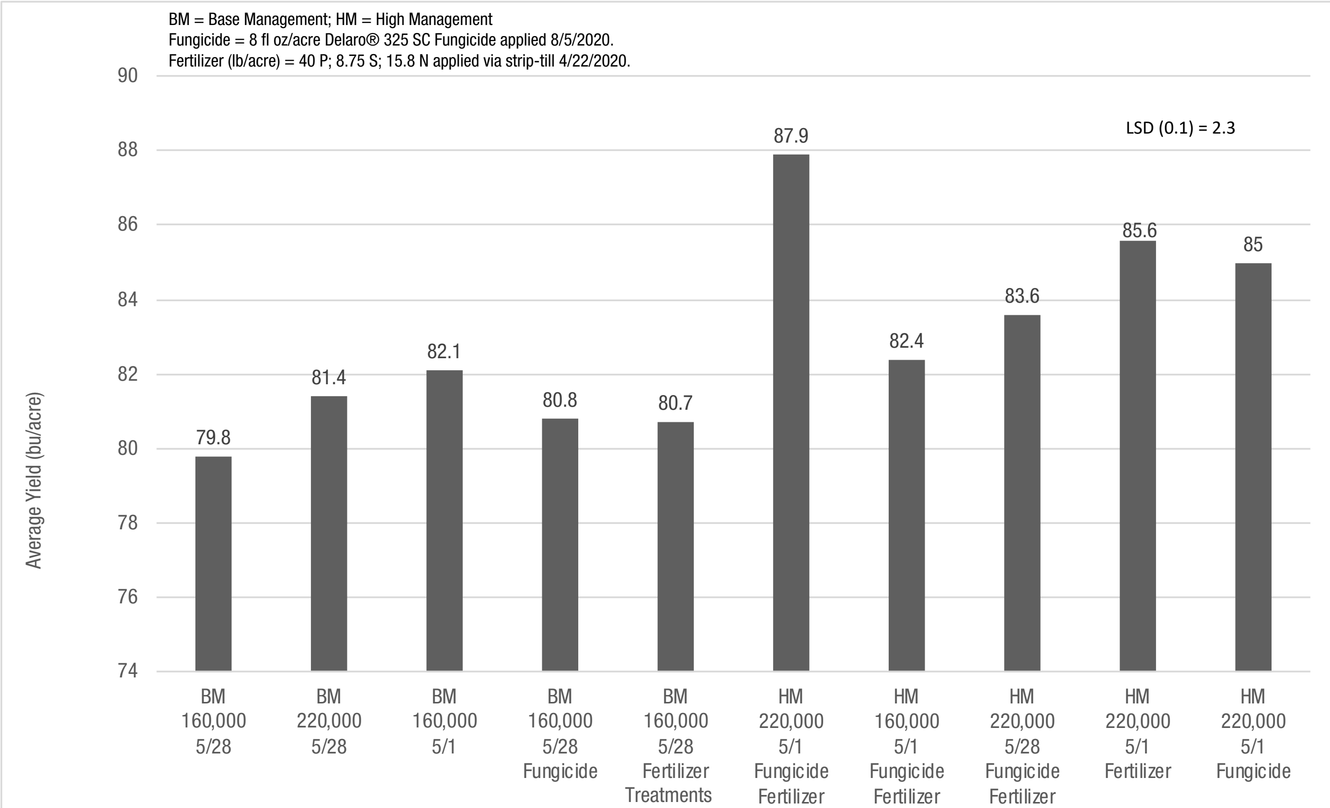

Figure 1. Average soybean yield (bu/acre) comparisons for base (BM) and high management (HM) inputs at the Gothenburg Water Utilization Learning Center in Gothenburg, Nebraska.

- The highest average yield (87.9 bu/acre) occurred with the high management treatment that had a fertilizer application via strip-till on April 22, an early planting date of May 1, and a Delaro® 325 SC Fungicide application on August 5. In this study, the higher seeding rate of 220K seeds/acre appeared to have a positive influence on yield. In previous studies at the Bayer Crop Science, Gothenburg Water Utilization Learning Center, there has been minimal yield difference between a 220K and 160K seeds/acre seeding rate as seen in an irrigated study in 20171 and a dryland study in 2018.[2]
- For the base management treatments in this study, an earlier planting date of May 1 had a significant positive impact on yield of a few bushels per acre although the positive impact on yield can be higher as seen in 2017.[1] The May 1 planted soybeans matured earlier (Figure 2).

Figure 2. Planting date impact on soybean maturity. May 28 planting on the left is just starting to turn yellow while May 1 planting on the right is about 50% mature pod.

Potential Inputs for Soybean Production

Table 2. Return of extra inputs over costs compared across different soybean commodity prices.

Treatment	Treatment Inputs	Total Extra Cost*	$8/bu	$10/bu	$12/bu
1 BM	160K, 5/28	$0.00	$638.40	$798.00	$957.60
2 BM	220K, 5/28	$21.43	$629.77	$792.57	$955.37
3 BM	**160K, 5/1**	**$0.00**	**$656.80**	**$821.00**	**$985.20**
4 BM	160K, 5/28, Fungicide**	$23.00	$623.40	$785.00	$946.60
5 BM	160K, 5/28, Fertilizer***	$30.80	$614.80	$776.20	$937.60
6 HM	**220K, 5/1, Fungicide, Fertilizer**	**$75.23**	**$627.97**	**$803.77**	**$979.57**
7 HM	160K, 5/1, Fungicide, Fertilizer	$53.80	$605.40	$770.20	$935.00
8 HM	220K, 5/28, Fungicide, Fertilizer	$75.23	$593.57	$760.77	$927.97
9 HM	220K, 5/1, Fertilizer	$52.23	$632.57	$803.77	$974.97
10 HM	220K, 5/1, Fungicide	$44.43	$635.57	$805.57	$975.57

*These costs do not account for additional savings farmers can realize when using Bayer PLUS Rewards.
**Fungicide = Delaro® 325 SC Fungicide, ***Fertilizer (lb/acre) = 40 P; 8.75 S; 15.8 N applied via strip-till 4/22/2020.

- Economic observations for this study (Table 2):
  - » Planting a soybean crop earlier doesn't have traditional input costs such as fertilizer or pesticide applications. However, depending on the growing season, there may be a cost to the entire operation associated with moving to an earlier planting because some corn may be planted later than optimum. For this scenario, there are no associated costs for the May 1 planting date as it is an easy way to potentially increase soybean yield.
  - » The high management treatment in this study had high yields, but also had the highest cost except for the HM – Early Planting treatment which had similar costs. The HM treatment becomes more profitable as the value of soybeans increase from $8 to $12/bu.

Key Learnings

- Moving the planting date from the end of May to the end of April through the first week in May is an easy no cost input that typically increases soybean yield.
- When evaluating crop inputs for high management systems, the whole system should be considered. At the Learning Center, there has been a consistent trend of putting multiple crop inputs together providing increased yield potential. This was observed this year with the high management treatment. However, determining the value of each individual input can be difficult. Year to year variations occur but understanding that inputs build on each other in the system is an important point as farmers build-out their future soybean production plans.

Sources

[1] Gothenburg Learning Center. 2017. Interaction of soybean planting date on seeding rate. Field Research Book.

[2] Gothenburg Learning Center. 2018. Influence of row width on soybean yield. Field Research Book.

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Soybean Maturity Group and Seeding Rate Effects on Yield Under Dryland Conditions

Trial Objective

- To help maximize profit potential, soybean products should be selected based on yield potential, disease and pest resistance, maturity group (MG), product traits, and plant height and standability.
- The objective of this trial was to determine the effects of soybean maturity group and seeding rate on yield under dryland conditions.

Research Site Details

Location	Soil Type	Previous Crop	Tillage Type	Planting Date	Harvest Date	Potential Yield (bu/acre)	Planting Rate (seeds/acre)
Gothenburg, NE	Cozad silt loam	Corn	No tillage	5/14/20	10/14/20	50	40K, 80K, 120K, 160K, 200K

- Treatments consisted of two soybean maturity groups (MG) and five seeding rates for a total of 10 treatments planted under dryland conditions.
  - Soybean maturity groups:
    - 2.9MG
    - 3.6MG
  - Seeding rates on 30-inch rows:
    - 40,000 seeds/acre
    - 80,000 seeds/acre
    - 120,000 seeds/acre
    - 160,000 seeds/acre
    - 200,000 seeds/acre
- The trial was setup as a randomized complete block and each treatment was replicated three times.
- Fertility included 50 lb/acre phosphorus, 11 lb/acre sulfur, and 20 lb/acre nitrogen applied using a streamer bar on April 14, 2020.
- Weeds were uniformly controlled as needed across the study.
- Soybean total weight, test weight and moisture data were collected to calculate total yield.

Soybean Maturity Group and Seeding Rate Effects on Yield Under Dryland Conditions

Understanding the Results

Figure 1. The 2.9 MG (left) and 3.6 MG (right) maturity groups planted at 120,000 seeds/acre treatments.

- There was a significant interaction between soybean maturity group and seeding rate for this research with the major difference occurring at the 40,000 seeds/acre rate (Figure 2).
  - The average soybean yields from the 2.9 MG and 3.6 MG treatment plots were similar among all seeding rates above 120,000 seeds/acre.
  - The 3.6 MG soybean product planted at 160,000 seeds/acre produced the overall highest average yield in this demonstration.
  - Plants in plots planted at the 40,000 seeds/acre rate produced the lowest average soybean yields for both soybean maturity groups.
- Lower than expected average soybean yields for this demonstration were likely the result of insufficient moisture on this dryland field. Especially dry conditions persisted from August through mid-September. Late-season soil water deficits can create stress that hastens physiological maturity (R7), resulting in reduced yield potential.

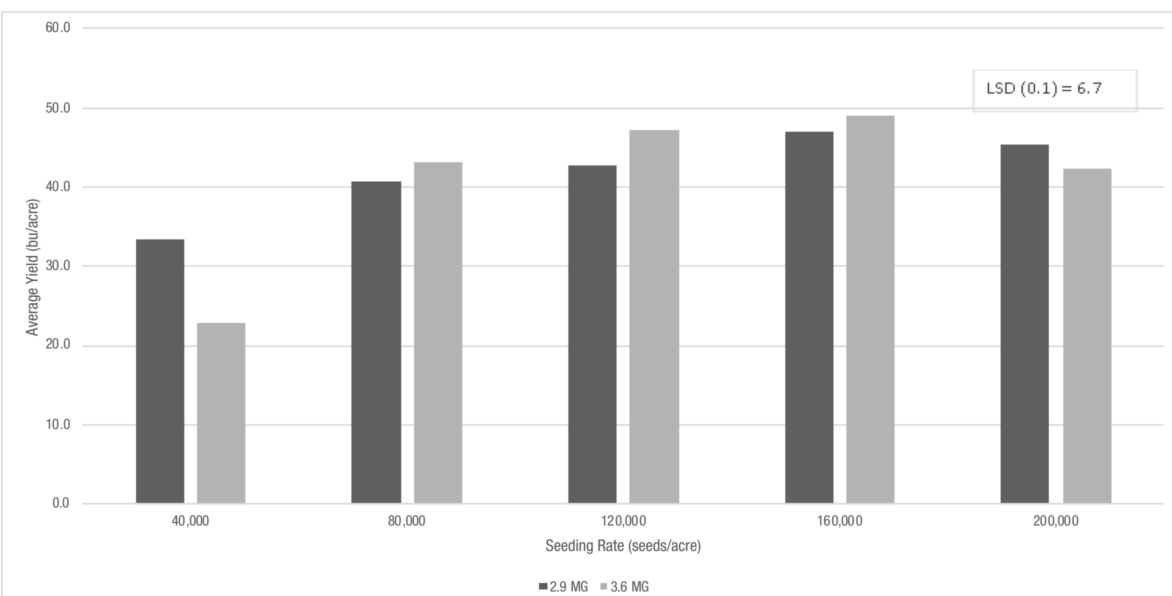

Figure 2. Effect of maturity group and seeding rate on average dryland soybean yield in 2020.

Soybean Maturity Group and Seeding Rate Effects on Yield Under Dryland Conditions

Key Learnings

- Soybean maturity group and seeding rate influenced product yield potential in this research.
- For dryland conditions in the Central Plains, this study would indicate that when planting a mid to late maturity soybean product a minimum of 120,000 seeds/acre seeding rate should be used to help maximize yield potential.

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Impact of Seeding Rate on Irrigated Asgrow® Brand XtendFlex® Soybeans

Trial Objective

XtendFlex® soybeans is a new trait platform available for farmers to plant in the spring of 2021.

The objective of this trial was to help answer questions regarding the impact of planting rate on three Asgrow® brand XtendFlex® soybean products across two planting dates.

Research Site Details

Location	Soil Type	Previous Crop	Tillage Type	Planting Date	Harvest Date	Potential Yield (bu/acre)	Seeding Rate (seeds/acre)
Gothenburg, NE	Hord silt loam	Corn	Strip till	5/20/20 and 6/12/20	10/2/20 and 10/9/20	80	40K, 80K, 120K, 160K, 200K, 240K

- This trial was a split plot design with planting date as the whole plot, seeding rate as the sub plot, and soybean product as the sub-sub plot.
- Planting dates:
  - May 20, 2020
  - June 12, 2020
- Seeding rates:
  - 40,000 seeds/acre
  - 80,000 seeds/acre
  - 120,000 seeds/acre
  - 160,000 seeds/acre
  - 200,000 seeds/acre
  - 240,000 seeds/acre
- Asgrow® soybean products:
  - AG23XF0 Brand
  - AG25XF1 Brand
  - AG27XF1 Brand
- Trial was sprinkler irrigated.
- Nutrient application included nitrogen (N), sulfur (S), and phosphorus (P): 27.5 lb N/acre, 15 lb S/acre, and 70 lb P/acre strip-till applied prior to planting.
- Weeds were controlled as needed and no additional fungicide or insecticides were used.
- The May 20 planting date was harvested on October 2 and the June 12 planting date was harvested on October 9. Total weight, test weight, and moisture content were collected to calculate yield per acre.

Impact of Seeding Rate on Irrigated Asgrow® Brand XtendFlex® Soybeans

Understanding the Results

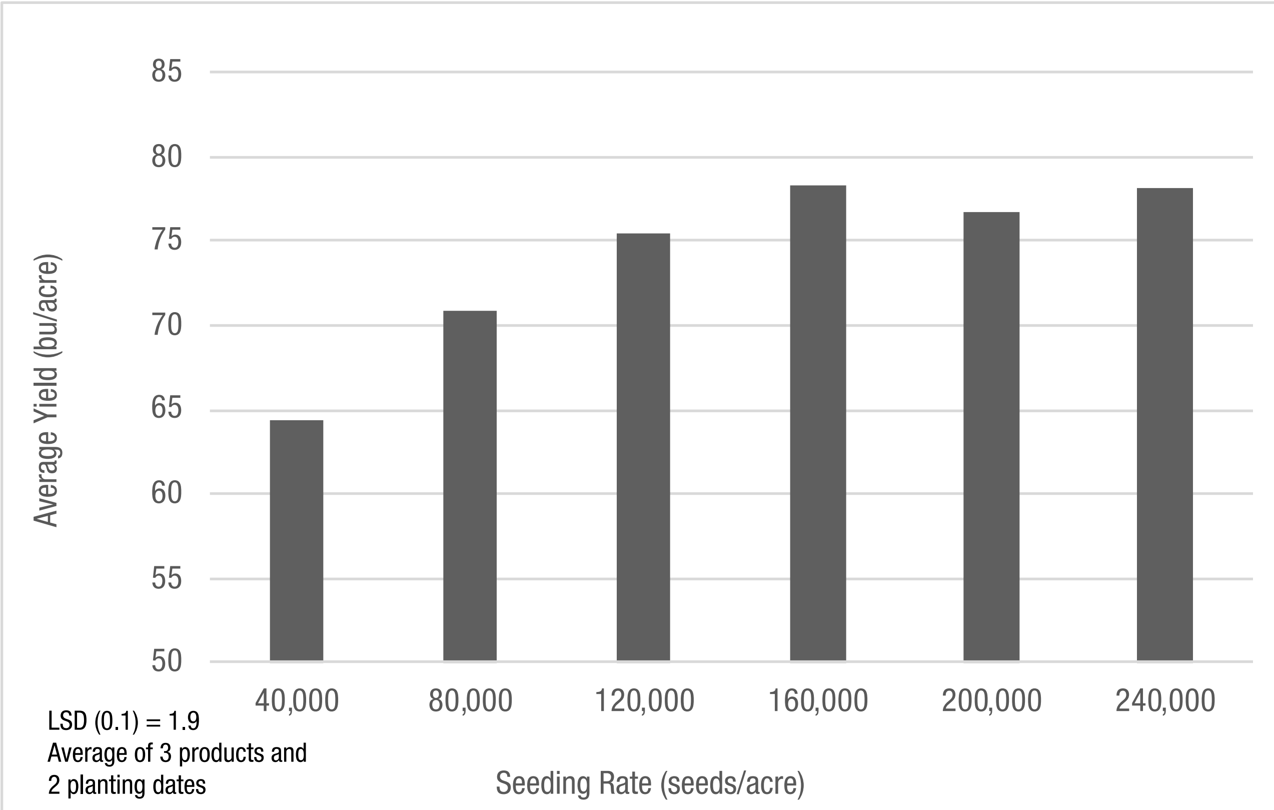

Figure 1. Average yield of three Asgrow® brand soybeans (AG23XF0 Brand, AG25XF1 Brand, and AG27XF1 Brand) planted at two planting dates (May 20 and June 12) as influenced by seeding rate.

- There was no significant interaction between seeding rate, soybean product, and planting date.
- The impact of seeding rate followed the trend of previous research where average soybean yields steadily increased from 40K to 120K seeds/acre and then leveled off (Figure 1).
- The 160K seeds/acre rate had the highest average yield with no increase in yield observed with the 200K or 240K seeds/acre rates (Figure 1).
- AG23XF0 Brand had the highest average yield at 75.5 bu/acre while the AG25XF1 Brand and AG27XF1 Brand yielded 72.1 and 74.4 bu/acre, respectively with an LSD (0.1) of 1.1.
- No difference in yield was observed from planting date with each date having an average yield of 74 bu/acre.

Key Learnings

- At this location, XtendFlex® soybeans planted around 160K seeds/acre helped maximize yield potential.
- Farmers should work with their Asgrow® brand sales and agronomic team to help identify the best adapted Asgrow® brand XtendFlex® soybean products for their production system.

Impact of Seeding Rate on Irrigated Asgrow® Brand XtendFlex® Soybeans

Figure 2. Representation of the planting date, soybean product, and seeding rates in August of 2020.

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Evaluating the Importance of Seed Treatment in Early-Planted Soybeans

Trial Objective

- By delaying soybean planting, the yield potential of the crop is decreased. University of Illinois data indicate that maximum soybean yield potential is achieved at a planting date of April 17, based on nine years of research from 2008 through 2016.[1]
- Cold soil temperatures can delay germination, increasing the risk of unprotected seeds being damaged by insects, nematodes, and soil-borne pathogens, and limiting the potential benefit of an extended growing season.
- Largely due to the widespread adoption of treated soybean seed, growers now plant soybeans increasingly earlier than ever before. For example, Illinois farmers had 31 percent of their soybean crop planted by May 3, 2020 compared to the previous five-year average of 12 percent.[2]

Research Site Details

Location	Soil Type	Previous Crop	Tillage Type	Planting Date	Harvest Date	Potential Yield (bu/acre)	Seeding Rate (seeds/acre)
Roanoke, IL	Silt loam	Corn	Conventional	4/9/19, 4/23/19, 5/7/19, 5/18/19, 6/3/19, 6/18/19	10/9/19, 10/23/19	70	140,000
Roanoke, IL	Silt loam	Corn	Conventional	3/7/20, 4/6/20, 4/20/20, 5/9/20, 6/1/20, 6/15/20	10/7/20, 10/15/20	70	140,000

- This research was conducted at the Bayer Crop Science FOCUS site in Woodford County, Illinois from 2019 to 2020 with a goal of better understanding the value of quality seed treatments when planting soybeans early.
- A single maturity group (MG) 3.6 soybean product was planted across six planting dates each year from March through June.
- Seeds in this trial were either treated with Acceleron® STANDARD seed treatment or left untreated.
- Plots in this trial were planted at a seeding rate of 140,000 seeds/acre and harvested at maturity.
- The 2019 growing season was very cool and wet through early June, leading to delayed planting for many growers. Hot and dry conditions were prevalent in July and August and excessive rainfall returned in September and October.
- In 2020, there was sufficient moisture in the early portion of the growing season, but drought conditions persisted throughout August and into early September.
- The first planting date in 2020 was on March 7. The soil temperature at planting was 33°F, and the seeds took 52 days to emerge.
- On May 8, 2020 after the first three planting dates had emerged, the air temperature dipped to 29°F overnight for several hours. This resulted in an average loss of 2.6% of seedlings across treatments and planting dates.

Evaluating the Importance of Seed Treatment in Early-Planted Soybeans

Understanding the Results

- Consistent with university research[1], soybeans planted earlier in the growing season had the highest average yield in this study, provided the seeds receive a quality seed treatment (Figure 1).
- Maximum average yield in untreated soybeans was not attained until planting after the first week of May and was an average of 13% lower in yield than treated seed when averaged across planting dates.
- One of the main drivers of yield potential is stand establishment. In the March 7, 2020 planting, roughly 66% of the planted seeds treated with Acceleron® STANDARD survived, while less than 15% survived in the untreated portion of the trial (Figure 2).

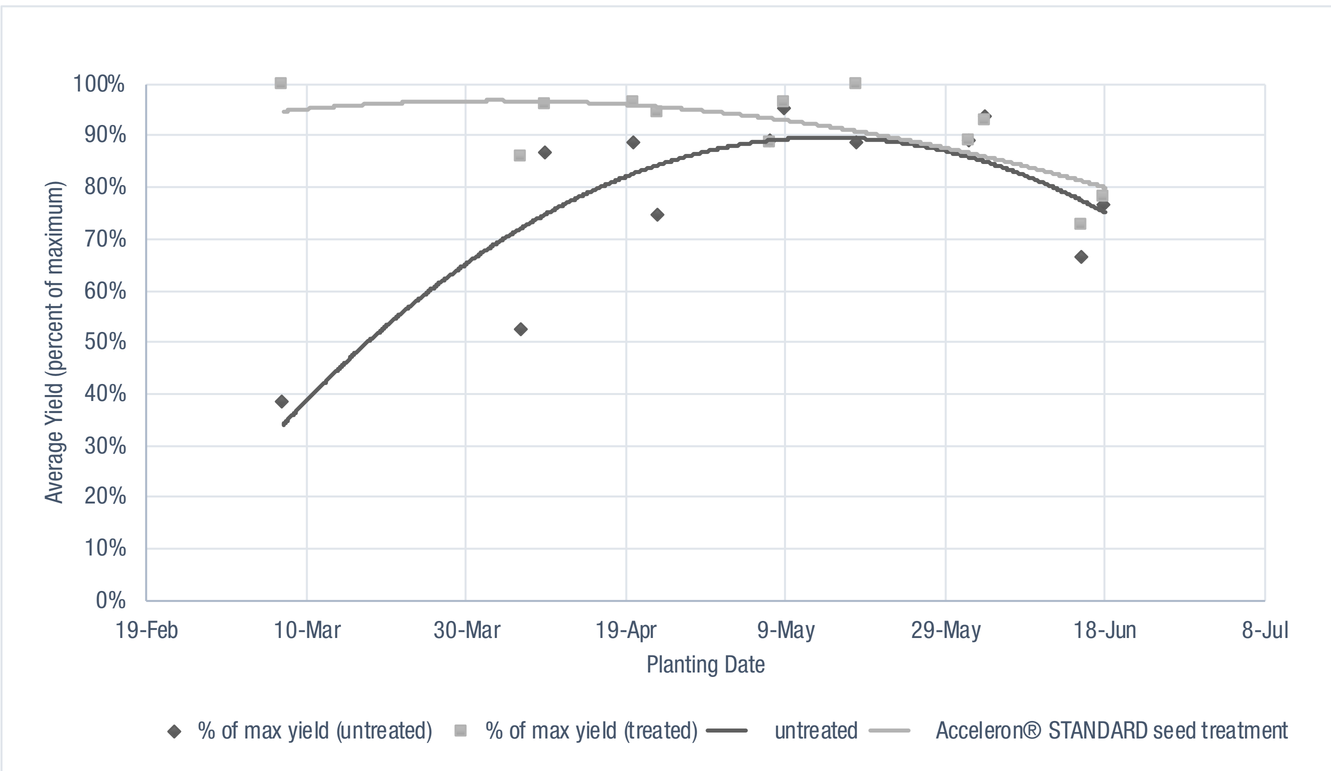

Figure 1. Effect of seed treatment on average yield by percent of maximum yield across 12 planting dates and two years, 2019 and 2020.

Evaluating the Importance of Seed Treatment in Early-Planted Soybeans

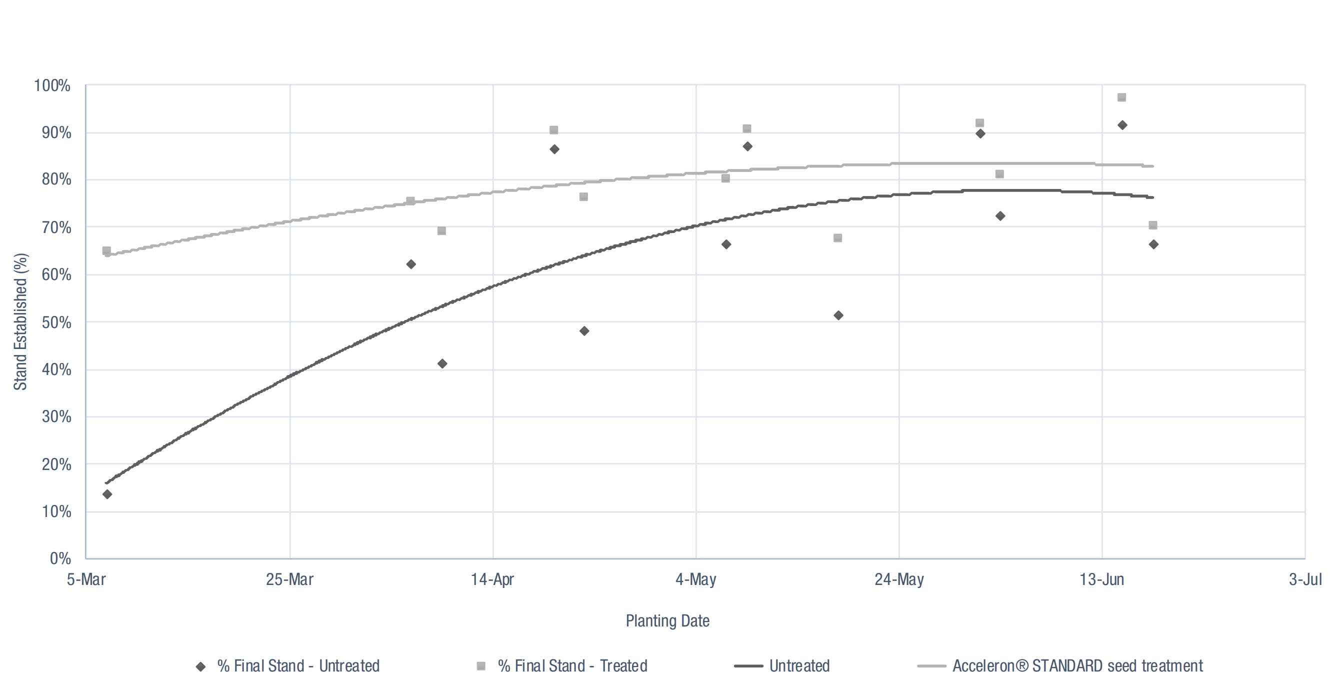

Figure 2. Percent stand established across 12 planting dates over two years, 2019 and 2020.

Key Learnings

- Ultra-early plantings over the past two seasons did not provide a large yield advantage; however, average yields from these plantings were not penalized. If soil conditions allow, treated soybean seed can be planted early while maintaining yield potential.
- At this location in 2020, treated soybean seed had the highest yielding planting date on March 7. Early-planted soybean seed, when protected with a quality seed treatment, can handle early season adversity.
- Untreated soybean seeds should be planted into ideal conditions with soil temperatures approaching 50°F to enable quick germination for adequate stand establishment. However, delaying planting into mid-May can reduce yield potential.

Sources

[1] Nafziger, E. 2016. Planting date: Corn or soybean first? The bulletin: Pest management and crop development information for Illinois. https://farmdoc.illinois.edu/field-crop-production/crop_production/planting-date-corn-or-soybean-first.html.

[2] U.S. Department of Agriculture National Agricultural Statistic Service. https://www.nass.usda.gov/Statistics_by_State/Illinois/Publications/Crop_Progress_&_Condition/.

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Influence of Seeding Rate and Planting Date on Soybean Yield

Trial Objective

- Previous work at the Bayer Learning Center at Monmouth, IL demonstrated planting date as an important factor influencing soybean yield potential.
- Depending on the year, earlier soybean planting dates may be a management practice with low-risk and high-return.
- Generally, soybean seeding rate should increase when planting occurs later in the season.
- In 2020, the Learning Center at Monmouth, IL conducted a trial to determine if seeding rate influences the average yield of soybeans across multiple planting dates.

Research Site Details

Location	Soil Type	Previous Crop	Tillage Type	Planting Date	Harvest Date	Potential Yield (bu/acre)	Seeding Rate (seeds/acre)
Monmouth, IL	Silt Loam	Corn	Conventional	4/21/20, 5/8/20, 5/11/20, 6/2/20	10/20/20	80	80K, 100K, 130K, 160K

- Treatments consisted of a 3.6 maturity group soybean product planted at four planting dates and four seeding rates for a total of 16 treatments.
- Planting dates:
  - April 21, 2020
  - May 8, 2020
  - May 11, 2020
  - June 2, 2020
- Seeding rates:
  - 80,000 seeds/acre
  - 100,000 seeds/acre
  - 130,000 seeds/acre
  - 160,000 seeds/acre

Influence of Seeding Rate and Planting Date on Soybean Yield

Understanding the Results

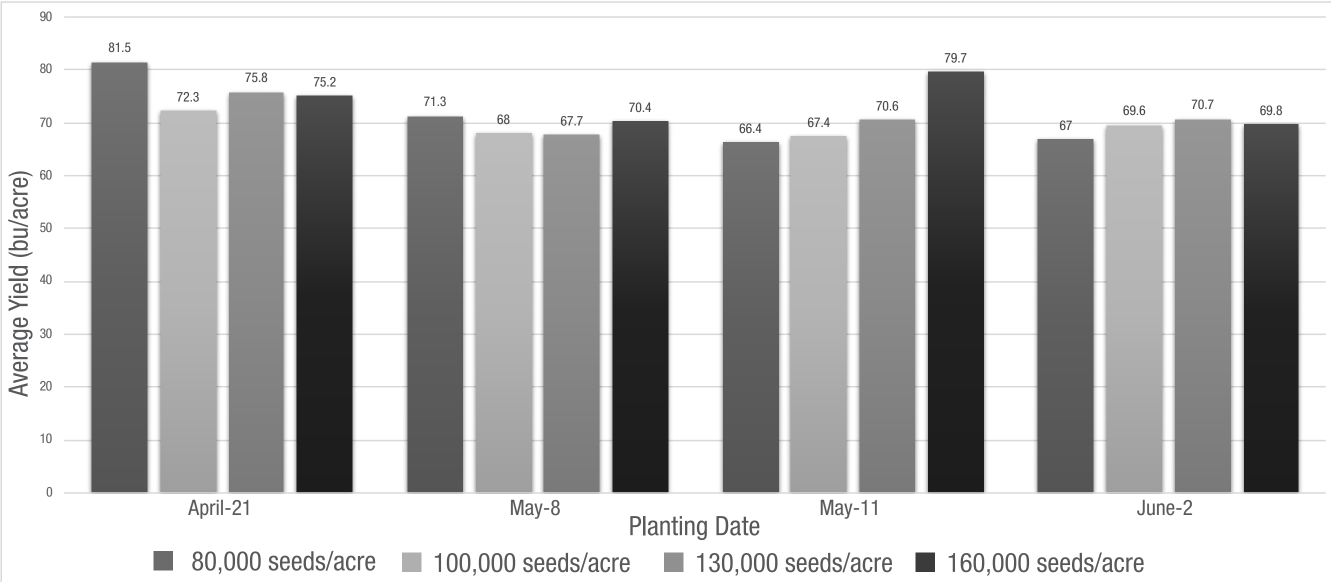

Figure 1. Effect of planting date and seeding rate on average soybean yield.

- The soybean plant is rather versatile in its growth and development. As plant population decreases, soybean plants develop additional branches and nodes to compensate for lost yield components.
- In this trial, earlier planting dates typically had greater average yields compared to later planting dates, which is in line with university recommendations as well as previous Learning Center results.
- In addition, later planting dates responded more positively to increased seeding rates. This finding is also supported by university recommendations and previous research at the Learning Center.

Key Learnings

- These results suggest:
  - Planting soybean early may help maximize profit potential.
  - Planting soybean late may require increased seeding rates to optimize yield and profit potential.
- Optimum seeding rate for soybean is highly variable from year to year. Contact your local Field Sales Representative or Technical Agronomist and discuss planting recommendations for the current situation and year.

Legal Statements

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Effect of Soybean Seeding Rate and Row Width on Agronomic Characteristics and Yield for June Plantings

Trial Objective

- Agronomists and University specialists typically recommend increasing soybean seeding rates when planting later than normal.[1]
- In late-planted soybean crops, higher seeding rates can increase the efficiency of available sunlight since later plantings have less time to grow vegetatively prior to the beginning of pod production.[2]
- Narrow rows help speed crop canopy development and can reduce weed pressure.[3]

Research Site Details

Location	Soil Type	Previous Crop	Tillage Type	Planting Date	Harvest Date	Potential Yield (bu/acre)	Seeding Rate (seeds/acre)
Roanoke, IL	Silt loam	Corn	Conventional	6/1/20	10/15/20	70	60K, 80K, 100K, 120K, 140K, 160K
Newark, IL	Silty clay loam	Corn	Conventional	6/8/19	10/25/19	65	60K, 80K, 100K, 120K, 140K, 160K
Roanoke, IL	Silt loam	Corn	Conventional	6/3/19	10/14/19	70	60K, 80K, 100K, 120K, 140K, 160K

- This trial was conducted at Bayer Crop Science FOCUS sites at Roanoke, Illinois (2019 and 2020) and Newark, Illinois (2019).
- Ten maturity group (MG) 2.2 to 2.9 soybean products were planted in June.
- Seeding rates included 60,000, 80,000, 100,000, 120,000, 140,000 and 160,000 seeds/acre.
- Four replications were planted at each location.
- The 2019 growing season was very cool and wet through early June, delaying planting for many growers. Hot and dry conditions were prevalent in July and August, and excessive rainfall returned in September and October.
- In 2020, there was sufficient moisture in the early portion of the growing season and drought conditions throughout August and into early September.
- All soybean products planted in this trial were treated with the same seed treatment.

Understanding the Results

- Although the highest average yield was achieved at a seeding rate of 160,000 seeds/acre in 30-inch rows, the most profitable configuration in this study was a seeding rate of 100,000 seeds/acre in 20-inch rows.
- The highest return on investment (ROI) occurred at a seeding rate of 160,000 seeds/acre for 30-inch rows and 100,000 seeds/acre for 20-inch rows.
- Overall, lodging scores were low; however, standability decreased as seeding rates increased.
- Overall, disease prevalence was low; however, incidence increased slightly as seeding rates increased.

Effect of Soybean Seeding Rate and Row Width on Agronomic Characteristics and Yield for June Plantings

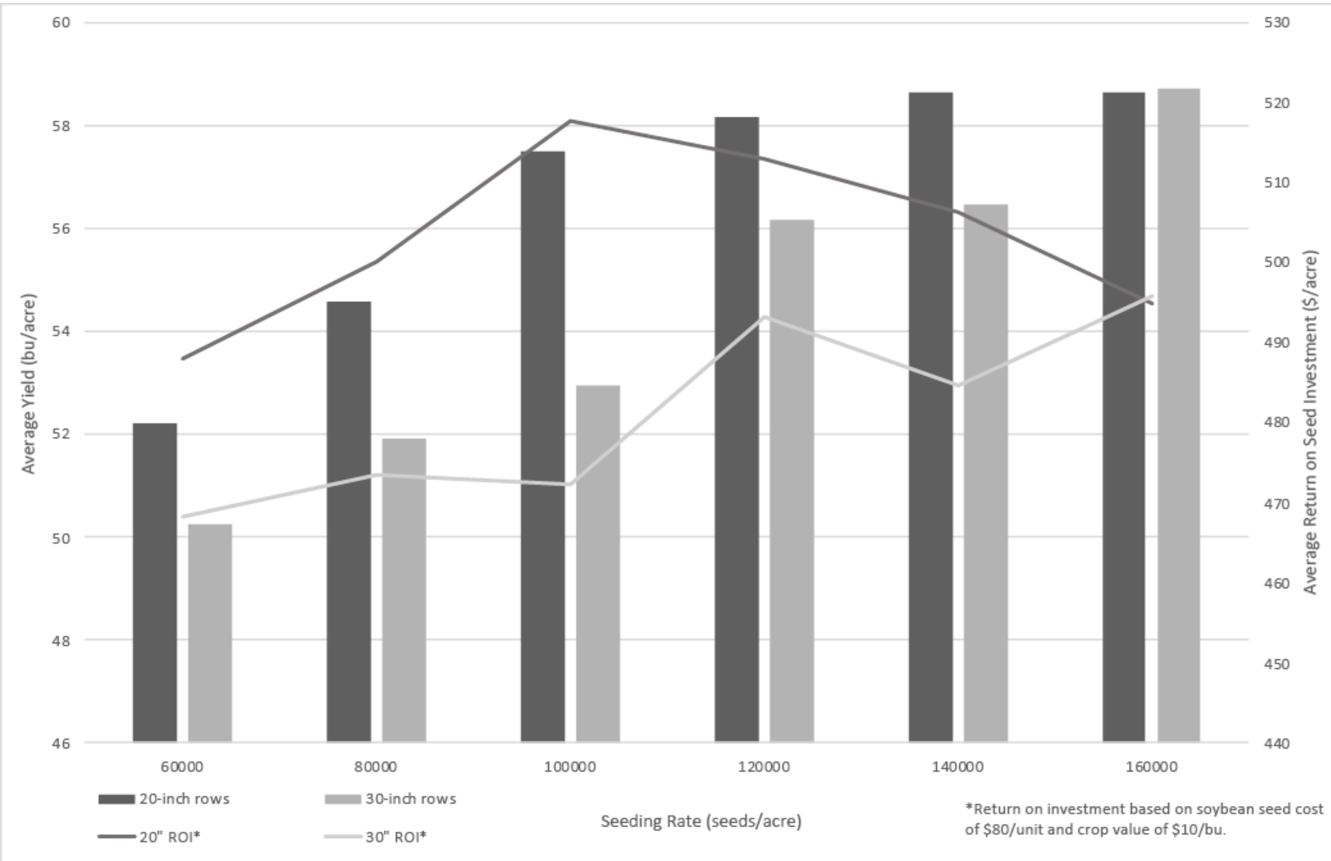

Figure 1. Average soybean yield and profitability of ten soybean products (MG 2.2 to 2.9) by seeding rate and row spacing across locations and years.

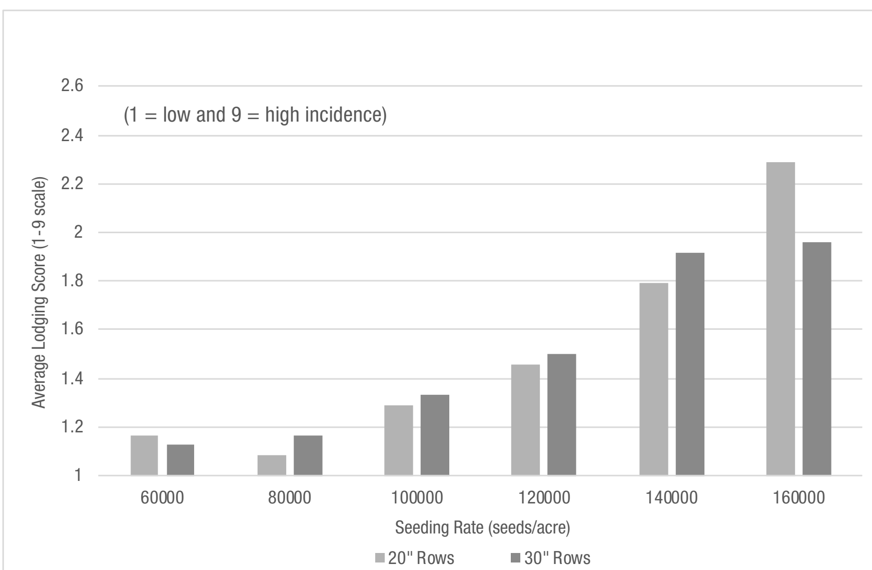

Figure 2. Lodging incidence relative to row width and seeding rate for six soybean products (MG 2.2 to 2.8) at Roanoke, IL (2020).

Effect of Soybean Seeding Rate and Row Width on Agronomic Characteristics and Yield for June Plantings

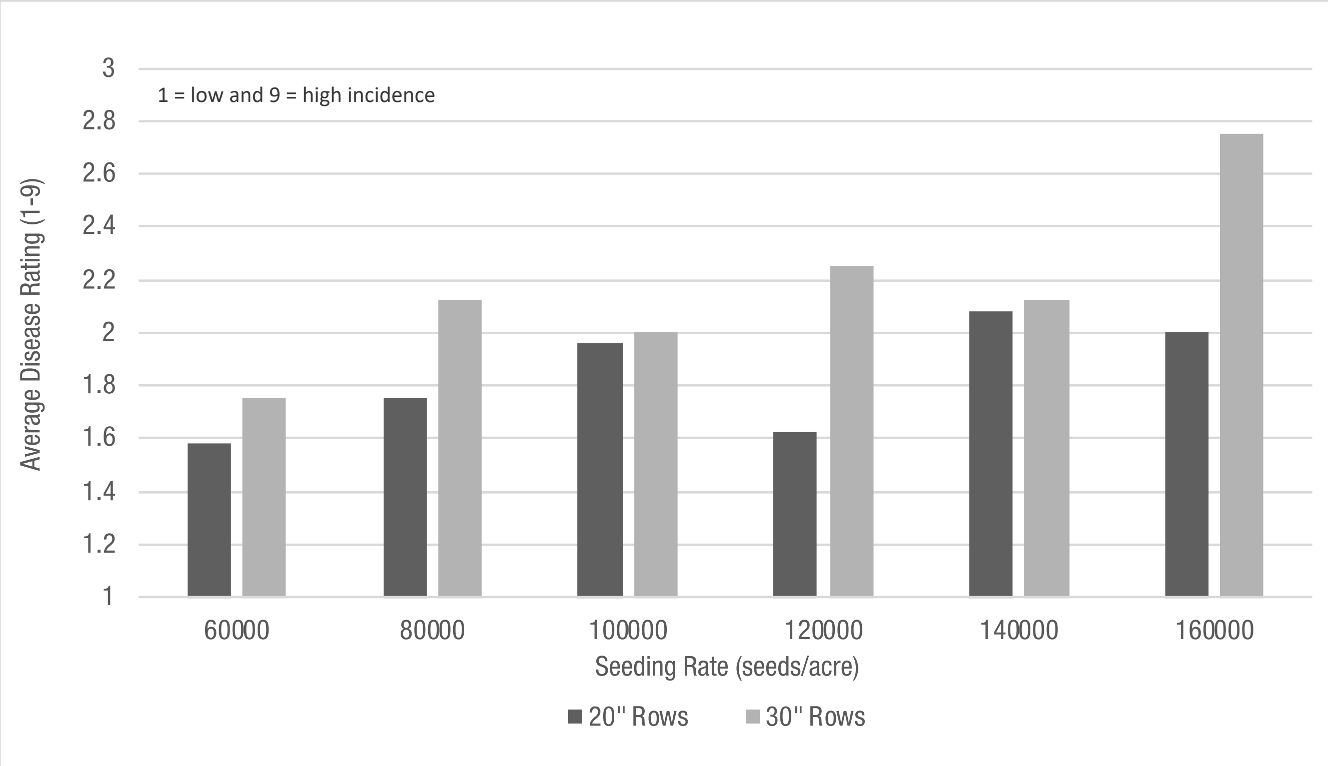

Figure 3. Average incidence of disease development (visual) by row width and seeding rate for six soybean products (MG 2.2 to 2.8) at Roanoke, IL (2020).

Key Learnings

- The results support prior studies:
  - When planting soybean seed in June in 30-inch rows, the average return on investment and yield was highest at 160,000 seeds/acre. Since this was the highest seeding rate in the study, it is possible that higher seeding rates may increase yield.
  - When planting soybean seed in June in 20-inch rows, maximum profitability was obtained by planting at a seeding rate of 100,000 seeds/acre, but yield was maximized at 140,000 seeds/acre.
  - Lodging and disease prevalence are generally less when planting late but become more problematic with increased seeding rates.

Sources:

[1] De Bruin, J.L. and Pedersen, P. 2008. Soybean seed yield response to planting date and seeding rate in the upper Midwest. Agronomy Journal. Volume 100, Issue 3.

[2] Ball, R.A., Purcell, L.C., and Vories, E.D. 2000. Optimizing soybean plant population for a short-season production system in the southern USA. Crop Science. Volume 40, Number 3.

[3] Harder, D.B., Sprague, C.L., and Renner, K.A. 2007. Effect of soybean row width and population on weeds, crop yield, and economic return. Weed Technology. Volume 21, Issue 3.

Effect of Soybean Seeding Rate and Row Width on Agronomic Characteristics and Yield for June Plantings

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Understanding the Benefits of Early-Planted Soybeans

Trial Objective

- Largely due to the widespread adoption of treated soybean seed, growers now plant soybeans increasingly earlier than ever before. For example, Illinois farmers had 31 percent of their soybean crop planted by May 3, 2020 compared to the previous 5-year average of 12 percent.[1]
- This research was conducted with a goal of understanding not only the yield impact of planting soybeans at different dates, but also the agronomic characteristics which enable early planted beans to have higher yield potential.
- The main driver of yield potential increase in early planted beans is the ability for the plants to create more nodes before flowering.[2] We measured the number of nodes created and days to flowering to better understand this interaction.

Research Site Details

Location	Soil Type	Previous Crop	Tillage Type	Planting Date	Harvest Date	Potential Yield (bu/acre)	Seeding Rate (seeds/acre)
Roanoke, IL (Woodford County)	Silt loam	Corn	Conventional	4/25/18, 5/8/18, 5/23/18	9/24/18, 10/4/18	70	140k
Auburn, IL (Sanagamon County)	Silt loam	Corn	Conventional	5/2/18, 5/22/18	9/29/18	70	140k
Monticello, IL (Piatt County)	Silt loam	Corn	Conventional	5/1/18, 5/14/18, 6/1/18	10/23/18	70	140k
Roanoke, IL (Woodford County)	Silt loam	Corn	Conventional	4/9/19, 4/23/19, 5/7/19, 5/18/19, 6/3/19, 6/18/19	10/9/19, 10/23/19	70	140k
Roanoke, IL (Woodford County)	Silt loam	Corn	Conventional	3/7/20, 4/6/20, 4/20/20, 5/9/20, 6/1/20, 6/15/20	10/7/20, 10/15/20	70	140k
Monticello, IL (Piatt County)	Silt loam	Corn	Conventional	4/8/20, 4/23/20	10/6/20	70	140k
Newark, IL (Kendall County)	Silt loam	Corn	Conventional	4/8/20, 4/23/20, 5/8/20, 5/29/20	10/15/20	65	115k

- This research was conducted at Bayer® Crop Science FOCUS sites in four Illinois counties: Kendall, Piatt, Sangamon, and Woodford from 2018 through 2020.
- Four soybean products, ranging in maturity group (MG) 2.6 to 3.6 were evaluated, although not all products were planted at every location or in every year.
- All seed was treated with Acceleron® STANDARD and ILEVO® seed treatment.
- Standard fertility and weed management practices were followed, and plots were harvested as they matured.

Understanding the Benefits of Early-Planted Soybeans

Understanding the Results

- To compare data across years, results are presented as a percentage of the maximum for the year, location, and variety. The highest average yields are attained from earlier planting, with a steady decline as the season goes on (Figure 1).
- Although it is possible for later planted soybeans to attain satisfactory yield, there is much greater yield variation than in fields which are planted earlier.
- Flowering date in soybeans is influenced by daylength and is often assumed to occur on a specific date regardless of planting date, but multiple factors combine to influence the actual date at which flowering occurs[3]. Figure 2 illustrates that the period between planting and flowering is greatly reduced when planting later.
- The earlier soybeans are planted, the more time they have to grow vegetatively and create nodes which are the foundation for yield potential (Figure 3).

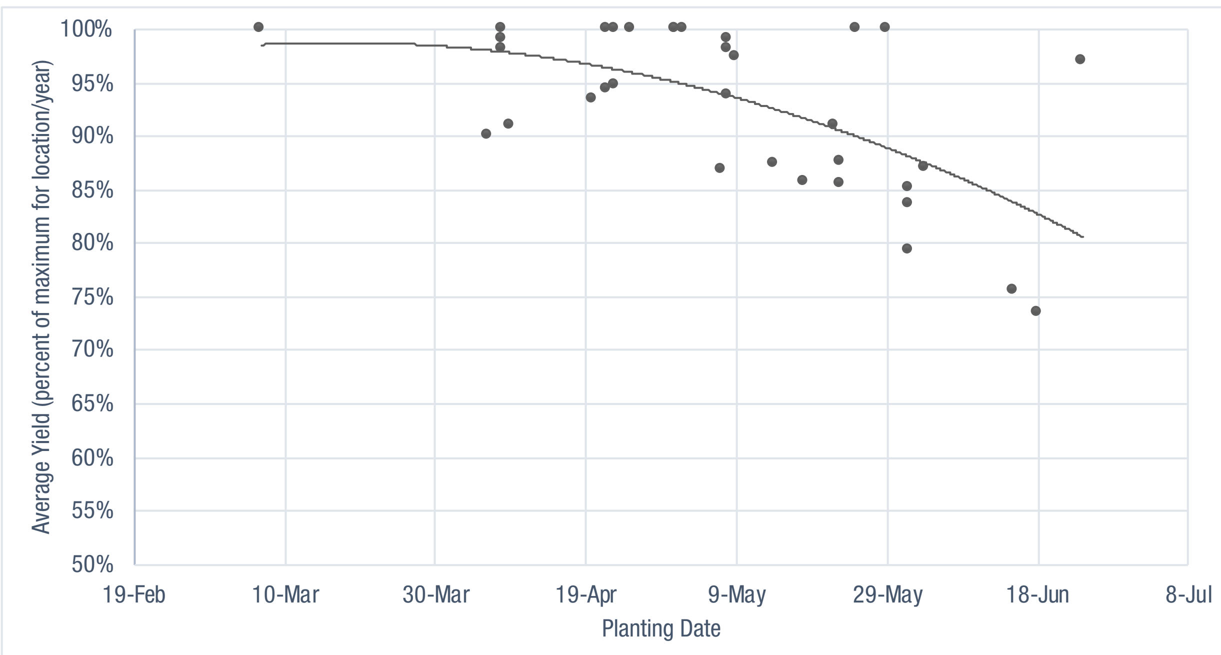

Figure 1. Average soybean yield response to planting date over three years, 2018 to 2020.

Understanding the Benefits of Early-Planted Soybeans

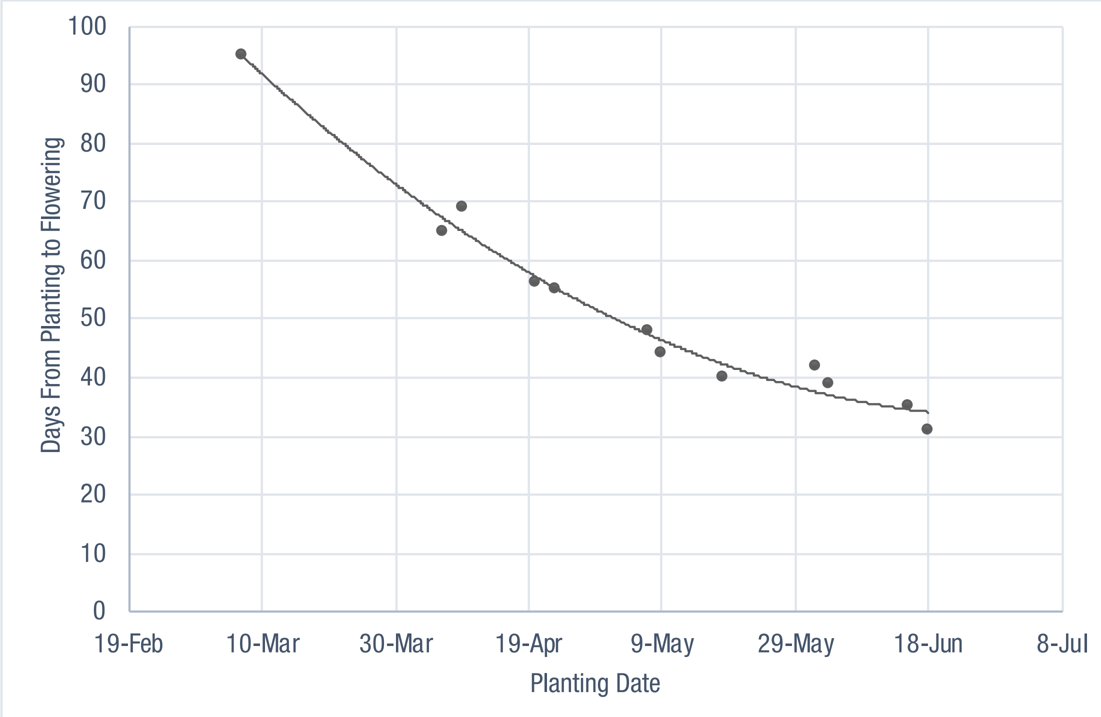

Figure 2. Average number of days from planting to flowering for a MG 3.6 soybean product based on planting date over two years, 2019 and 2020.

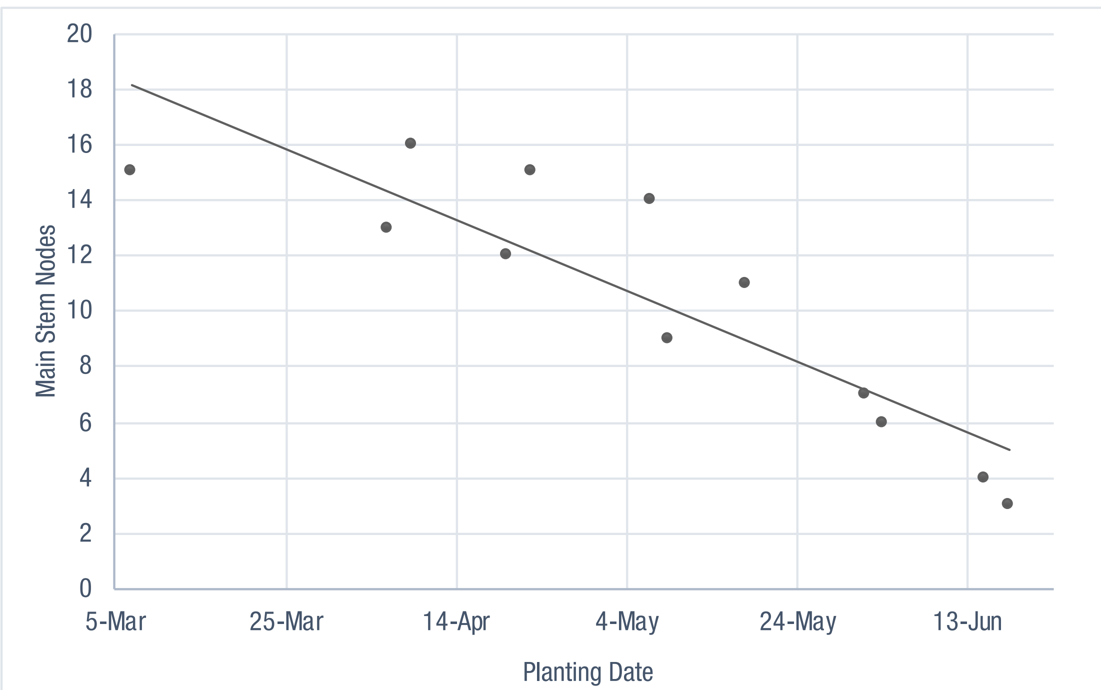

Figure 3. Effect of planting date on number of developed main stem nodes for a MG 3.6 soybean product by July, 10 over two years, 2019 to 2020.

Understanding the Benefits of Early-Planted Soybeans

Key Learnings

- Although later-planted soybeans can have satisfactory yield potential, there is more yield variation than in fields planted earlier.
- Although there is not always a large yield advantage to planting earlier, there is rarely a yield penalty. To reach maximum yield potential, it is critical that seeds are properly protected with a quality seed treatment.[4]
- Early-planted soybeans have a longer period between planting and flowering, providing higher yield potential from the development of additional nodes. Conversely, later-planted soybeans have a shorter time between planting and flowering, which can negatively impact yield potential.

Sources

[1] U.S. Department of Agriculture National Agricultural Statistic Service. https://www.nass.usda.gov/Statistics_by_State/Illinois/Publications/Crop_Progress_&_Condition/.

[2] Bastidas, A.M., Setiyono, T.D., Dobermann, A., Cassman, K.G., Elmore, R.W., Graef, G.L. and Specht, J.E. 2008. Soybean sowing date: The vegetative, reproductive, and agronomic impacts. Crop Science. Volume 48.

[3] Hu, M. and Wiatrak, P. 2012. Effect of planting date on soybean growth, yield, and grain quality: review. Agronomy Journal. Volume 104.

[4] Rees J. and Specht, J. 2020. Understanding the soybean germination process for early planted soybean decisions. https://cropwatch.unl.edu/2020/understanding-soybean-germination-process-early-planted-soybean-decisions.

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Tailored Solutions – Soybean Systems Management

Trial Objective

- Effective management of resources is required to optimize farm operations. In soybean production, decisions involving seed selection, seeding rate, soil fertility and eliminating or reducing the impact of plant stressors, effectively determine the productivity and profitability of the farm.
- Historically, soybeans have not been managed as intensively as corn, possibly resulting in sub-optimal yields and economic losses. Achieving higher yields and profits may require dedication of resources and a new approach to resource management in soybean production.
- This trial was conducted with the objective of determining the impact of production inputs on grain yield and ultimately the return on investment (ROI) in soybean production.

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	Corn	Strip till	5/11/20	10/1/20	60	110K, 140K

- Nine production systems were compared in a high management system trial in central Iowa.
- A full season, 2.9 maturity group (MG), soybean variety was used for the trial.
- Plots were planted with six rows per treatment, with 30-inch row spacing, and two replications per treatment.
- Trial details are indicated in Table 1.

Table 1. Input combinations for a systems management of soybean production in central Iowa.

Production System	Seed Treatment		Seeding Rate		Zinc	Sulfur	Nitrogen	Foliar F+I
	F + I	ILeVO®	110K	140K				
1	√			√				
2	√	√		√				
3	√		√					
4	√			√	√			
5	√			√		√		
6	√			√			√	
7	√			√				√
8	√	√	√		√	√	√	√
9	√	√		√	√	√	√	√

F = fungicide; I = insecticide; Foliar F = Delaro® Complete fungicide applied at R3 growth stage; Foliar I = Leverage® 360 insecticide applied at R3 growth stage; Zinc = 0.5 lb/acre, Axilo® was the zinc source and was applied as a starter solution during planting; Sulfur = 1 qt/acre, Ele-Max® Sulfur LC was the sulfur source and was applied at V8 growth stage; Nitrogen = 45 lb/acre urea ammonium nitrate side-dressed at R2 growth stage.

Tailored Solutions – Soybean Systems Management

Understanding the Results

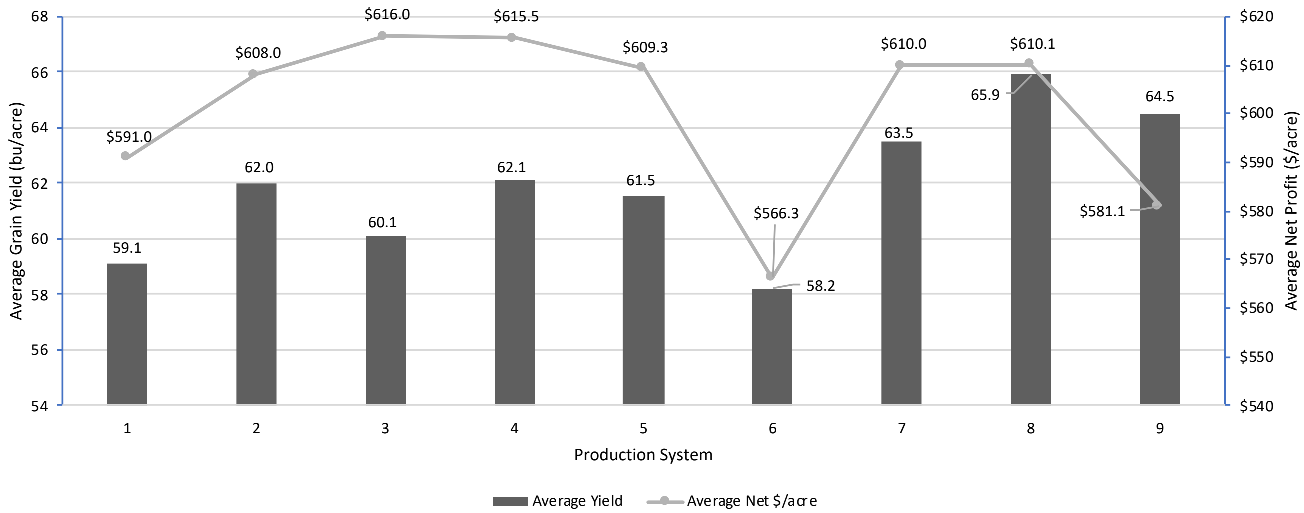

Figure 1. Effects of nine management practices on the average yield (bu/acre) and ROI ($/acre) of soybean in central Iowa. Soybean grain price was set at $10 per bushel.

- In general, average yields increased as more inputs were added to the system except in System 6 where the inclusion of nitrogen negatively impacted yield.
- In this trial, micronutrients zinc and sulfur (System 4 and System 5) improved yield as compared to System 1.
- ILeVO® seed treatment improved average yield by as much as 3 bu/acre (System 2 vs. System 1).
- Average yields were slightly better at 110K seeds/acre than at 140K seeds/acre (System 3 vs. System 1; System 8 vs. System 9).
- Foliar fungicide and insecticide applications improved average yields by as much as 5 bu/acre (System 7 vs. System 1).
- System 3 was the most economically profitable management program for this trial.

Key Learnings

- Except for nitrogen, the inputs used had a positive impact on soybean yield. However, the high input systems were not the most economically viable practices because the extra yield gained were not enough to offset their respective production costs.
- At the geographical region of the trial location (central Iowa), System 1 is considered the grower standard (the most common practice). Thus, apart from System 6 and System 9, all the other systems produced a positive ROI.
- Crop yield response to production inputs can be highly variable, often impacted by the environmental conditions during the growing season. Farmers are therefore advised to consult their trusted crop advisors when making such decisions.

Tailored Solutions – Soybean Systems Management

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Effects of Tillage Systems in Soybean Production

Trial Objective

- Tillage systems and operations have evolved over the years to meet specific production and/or environmental objectives.
- Considerations such as soil and water conservation, input costs, labor efficiency, timing of tillage, crop rotation, soil health, short- and long-term land usage, crop nutrient management, and pest management drive tillage decisions on farms.
- With improvements in tillage implements and herbicide technologies, farmers use an array of tillage options, ranging from conventional tillage to minimum tillage to no-till.
- Many farms do not use a single tillage system across the farm. Instead, a different tillage type is often deployed to meet the productivity requirement of each field and is in use for several years.
- It is necessary to periodically evaluate the continued suitability of tillage systems.
- The objective of this trial was to evaluate soybean productivity as impacted by three different tillage systems.

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	Corn	Conventional, Strip Till, No Till	05/11/20	10/05/20	60	140,000

- A 2.9 maturity group (MG) soybean variety was used for the trial.
- Trial was carried out in 15 ft x 500 ft plots, with 30-inch row spacing and four replications.
- The conventional tillage system consisted of disking followed by a soil finishing pass. The soil finisher implement comprised of a disk gang, a cultivator, and tine harrow units.
- The strip tillage system consisted of Vulcan Equipment's ZoneMaster® Strip-Till unit comprised of
  - row cleaners,
  - no-till coulters that penetrated 2 to 3 inches deep and 7 inches wide, and
  - rolling basket to break large soil clumps and smooth the soil before planting.
- All tillage operations were carried out in the spring.
- Weed management and nitrogen rate were the same across tillage systems.
- Results from similar trials carried out in 2018 and 2019 are also provided.

Effects of Tillage Systems in Soybean Production

Understanding the Results

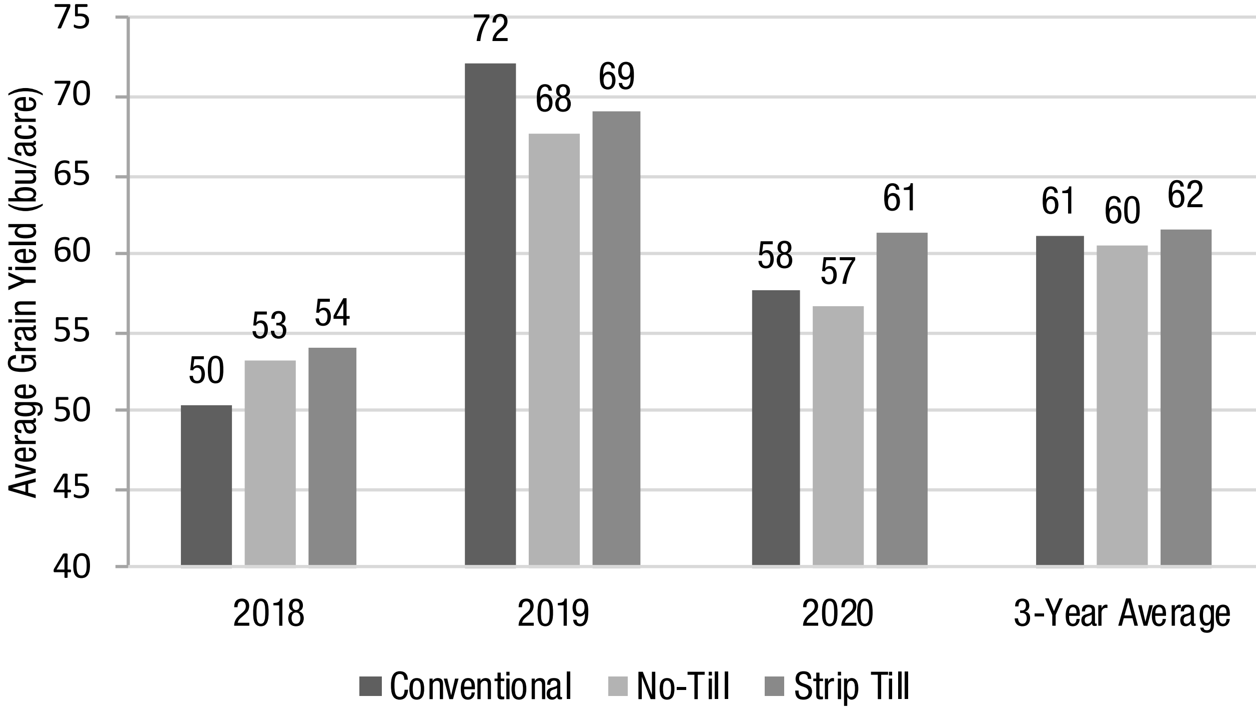

Figure 1. Soybean yield response to three tillage systems over a three-year period in central Iowa. Yield average represents the average performance of each tillage system over the three-year period.

- The average yields in 2020 were nearly the same for conventional tillage and no-till but 3 to 4 bu/acre greater in the strip-till system.
- Plant density observations before harvest (harvest population) were not significantly different between the systems. The densities were 124,400; 124,000; and 123,800 plants/acre for conventional tillage, no-till and strip-till, respectively.
- Grain moisture content after harvest was nearly the same, approximately 11 percent, for all tillage systems.
- Overall, there wasn't much yield differences between the tillage systems over the three-year period.

Key Learnings

- Crop yield response to tillage is site-specific, and often impacted by environmental factors, soil type and drainage, and the cropping sequence. Several years of research are needed to truly determine the productivity of tillage systems.
- This trial suggests tillage system type is not a major factor in soybean production at the trial location. To save on production cost; however, no-till could be recommended if an efficient weed management strategy (such as chemical control) is available.
- Generally, the right tillage type provides the best economic returns while ensuring better environmental stewardship.

Effects of Tillage Systems in Soybean Production

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Yield Observations When Shifting to Earlier Relative Maturity Soybeans

Trial Overview

- We continue to see a growing trend for soybean growers to plant "early" soybean products and manage them at a higher level with seed treatments and foliar applications of fungicide and insecticide. This phenomenon, dubbed "relative maturity (RM) shift" is becoming increasingly important in some locations.
- There are many benefits of planting "early" soybeans including, but not limited to, earlier harvest timing, earlier cover crop seeding, and risk management benefits.
- The objective of this study was to determine the yield impact of planting "early" RM soybean products compared to planting normal RM products for the location.

Research Site Detials

Location	Soil Type	Previous Crop	Tillage Type	Planting Date	Harvest Date	Potential Yield (bu/acre)	Planting Rate (seeds/acre)
Storm Lake, IA	Silty clay loam	Corn	Vertical	5/1/20	9/15/20, 9/22/20	65	150,000
Marble Rock, IA	Silt loam	Corn	Strip-till	5/2/20	10/4/20	55	150,000
Huxley, IA	Clay loam	Corn	Strip-till	5/1/20	9/30/20, 10/8/20	60	140,000
Atlantic, IA	Silty clay loam	Corn	Conventional	4/25/20	10/6/20	70	150,000
Victor, IA	Silty clay loam	Corn	Conventional	4/28/20	9/23/20, 10/8/20	65	140,000

Site Notes

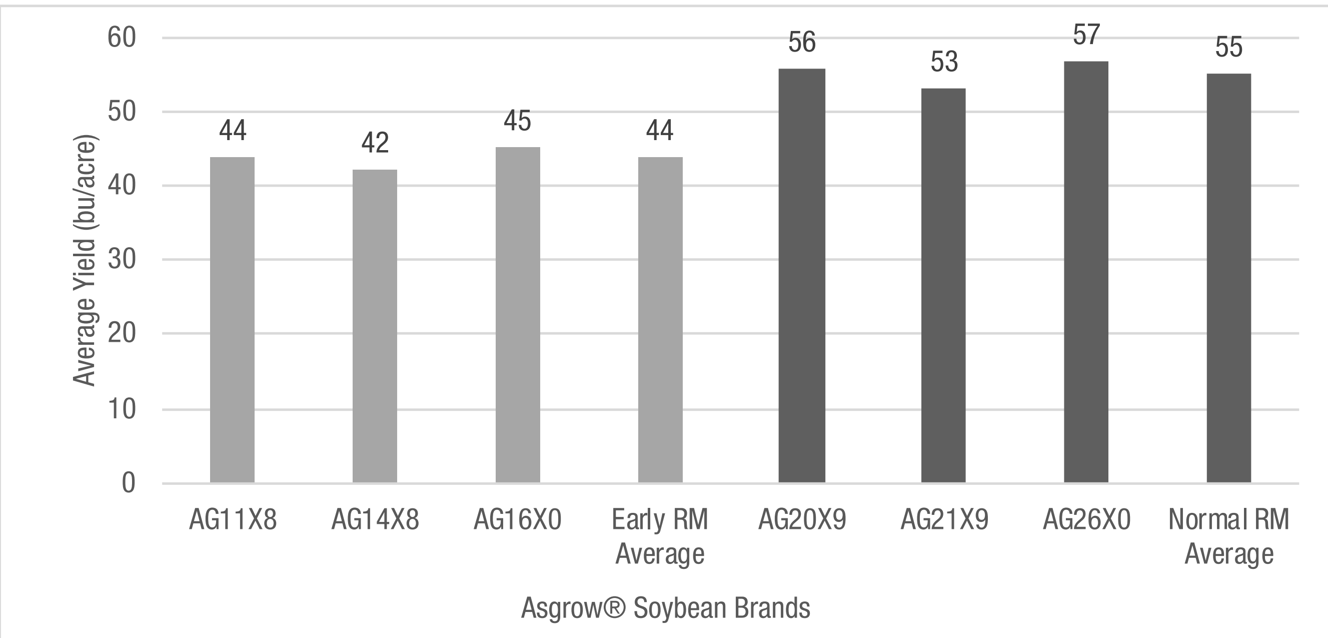
- The trial consisted of two sets – North and South.
- There were five locations planted:
  - » North set – Storm Lake, and Marble Rock
  - » South set – Huxley, Atlantic, and Victor
- • Each set consisted of three unique soybean products.
  - » 3 soybean products were considered early RM for the location:
    - * North set – 1.1 to 1.6 RM
    - * South set – 2.0 to 2.6 RM
  - » 3 soybean products were considered normal RM for the location:
    - * North set – 2.0 to 2.6 RM
    - * South set – 2.9 to 3.3 RM
  - » The 2.0 to 2.6 RM group consisted of the same three soybean products for both of the North and South sets.
- The trial included a mix of plot sizes, replications (reps), and row spacings:
  - » Storm Lake (2 reps): six row strips with 20-inch row spacing

Yield Observations When Shifting to Earlier Relative Maturity Soybeans

  - Atlantic (2 reps) and Marble Rock (3 reps): four row strips with 30-inch row spacing
  - Huxley (2 reps): six row strips with 30-inch row spacing
  - Victor (1 rep): eight row strips with 30-inch row spacing
- Average rainfall during the growing season was very low compared to long term averages with 3 to 15 inches less rainfall, depending on location.
- Marble Rock was impacted the least with 3 inches less and Atlantic the most with 15 inches less rainfall.

Understanding the Results

- With earlier planting dates in 2020 and rainfall events in September, the effects of RM selection on average soybean yield pointed to a clear yield advantage for the normal RM group.
- The North set normal RM group had an 11 bu/acre advantage over the early RM group (Figure 1) and the South set normal RM group had an 8 bu/ac advantage over the early RM group (Figure 2).



3011_R9_Figure 1 Figure 1. Relative maturity effects on the yield performance of Asgrow® soybean products North set at Storm Lake and Marble Rock, IA in 2020.

Yield Observations When Shifting to Earlier Relative Maturity Soybeans

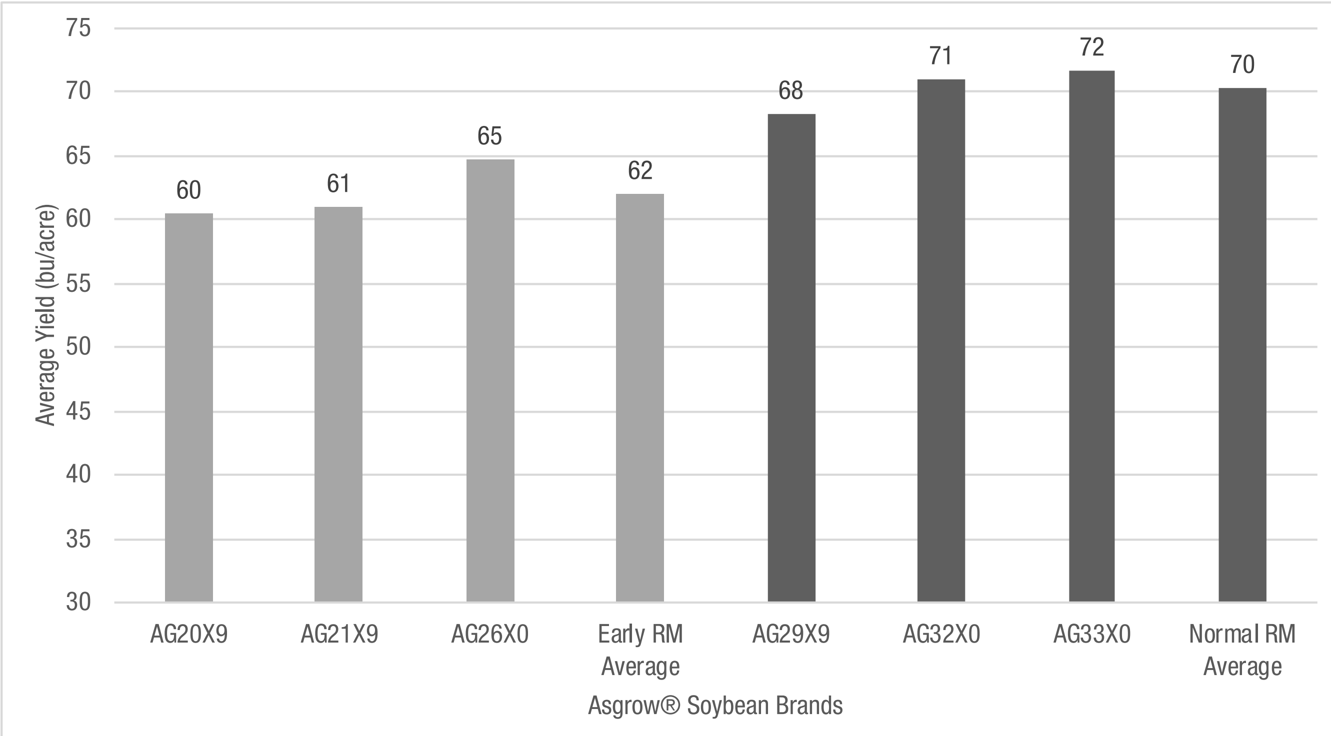


Figure 2. Relative maturity effects on the yield performance of Asgrow® soybean products South set at Huxley, Atlantic, and Victor, IA in 2020.

What does this mean for your farm?

- In 2020, early RM soybean products yielded, on average, 8 to 11 bu/acre less than normal RM soybean products and ranged between 3 to 15 bu/acre less than normal RM soybean products for both locations.
- In 2020, late season rainfall was less than ideal. The lack of adequate rainfall in July and August quickly finished off the early RM group, while the early September rains helped the normal RM group maximize pod fill.
- More research should be conducted in the genetic pipeline to better understand which soybean products can be grown south of their typical production area.
- It should be noted that a RM shift may not be applicable for every operation and any potential benefits can be defined in terms other than yield.

Legals

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Predicting Soybean Input Profitability

Trial Objective

- Soybean producers have many decisions to make regarding their inputs and agronomic system. However, benefits from different inputs are not always mutually exclusive.
- The objective of this trial is to determine the effect of high-input management systems and their individual components on soybean yield.
- Bayesian economic analysis is used to predict break-even probabilities of these high input soybean systems.

Research Site Details

	Treatment Number	FACTORS				
		Treatment	Foliar Fungicide	Foliar Insecticide	Seed Treatment	Variety Type
	1	HIGH INPUT	Delaro® Complete fungicide* @ R3	Leverage® 360 insecticide @ R3	FI***+ILeVO®**	Non-Defensive
Remove Input	2	Foliar Fungicide	None	Leverage® 360 insecticide @ R3	FI+ILeVO®**	Non-Defensive
Remove Input	3	Foliar Insecticide	Delaro® Complete fungicide* @ R3	None	FI+ILeVO®**	Non-Defensive
Remove Input	4	Seed Treatment	Delaro® Complete fungicide* @ R3	Leverage® 360 insecticide @ R3	FI	Non-Defensive
Remove Input	5	Variety Type	Delaro® Complete fungicide* @ R3	Leverage® 360 insecticide @ R3	FI+ILeVO®**	Defensive
	6	Low Input	None	None	FI	Defensive
Add Input	7	Foliar Fungicide	Delaro® Complete fungicide* @ R3	None	FI	Defensive
Add Input	8	Foliar Insecticide	None	Leverage® 360 insecticide @ R3	FI	Defensive
Add Input	9	Seed Treatment	None	None	FI+ILeVO®**	Defensive
Add Input	10	Variety Type	None	None	FI	Non-Defensive

*Delaro® Complete fungicide = Tank mix of Delaro® 325 SC fungicide (8 fl oz/acre) and Luna® Privilege fungicide (2 fl oz/acre)
**ILeVO® seed treatment rate = 0.15 mg active ingredient/seed
*** FI = Fungicide and Insecticide

Predicting Soybean Input Profitability

- Variety Type:
  - **Non-Defensive**: These products had lower disease tolerance ratings for disease(s) of concern in the trial location.
  - **Defensive**: Products identified as “Defensive” were selected for their relatively high disease tolerance ratings for disease(s) of concern in the trial location.
- Small plot dimensions approximately 10x30 ft.
- Three replications per location, and means were separated using Fisher’s LSD ($\alpha = 0.10$)
- 31 internal sites in 2021 in Iowa, Illinois, Indiana, Missouri, Kentucky, Michigan, Minnesota, Kansas, Tennessee, Arkansas, North Dakota, Nebraska, Ohio, South Dakota, and Wisconsin.
- Disease pressure, in general, was overall very low at the 31 U.S. locations in 2020.
- On a 1-9 disease intensity scale (with a value of 1 signifying no disease) the overall average from all plots were:
  - Sudden Death Syndrome = 1.1
  - White Mold = 1.0
  - Frogeye Leaf Spot = 1.1

Understanding the Results

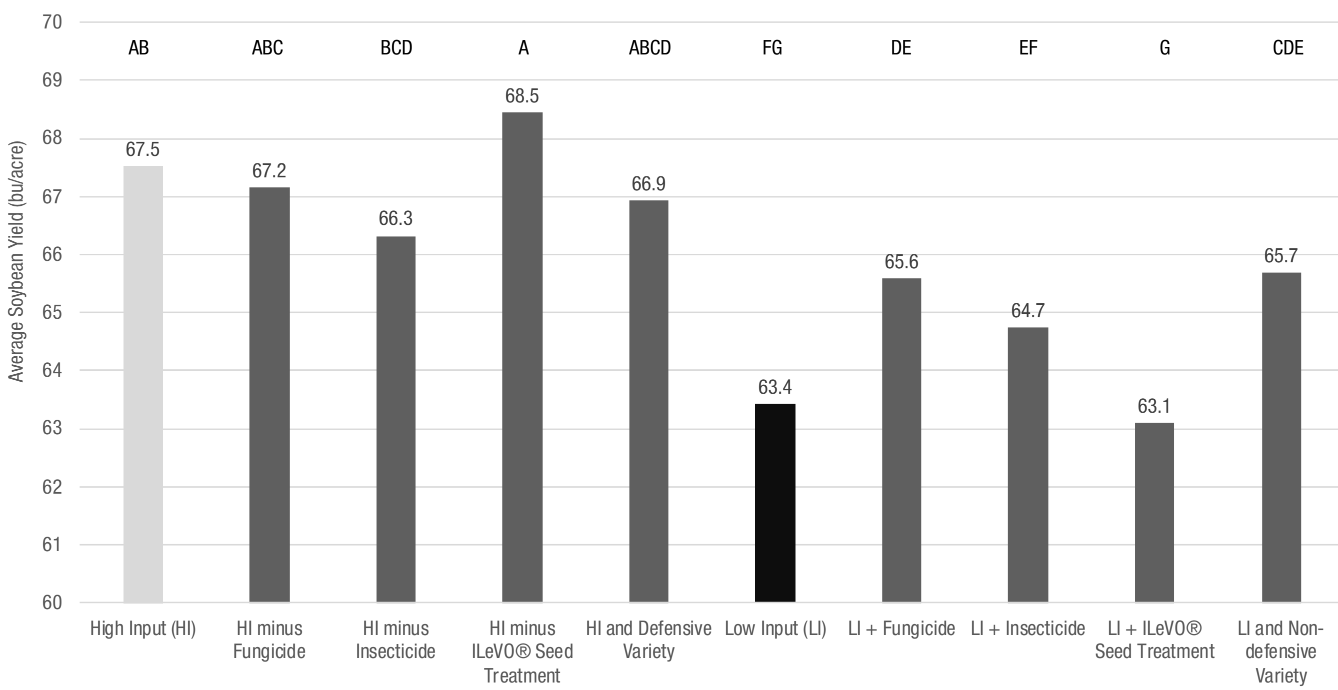

Figure 1. Average soybean yield from high and low input soybean systems.

Predicting Soybean Input Profitability

Table 1. Break-even probabilities for input systems compared to base treatment (Treatment 6) at multiple yield levels and soybean sale prices.*						
Input	Yield Level (bu/acre)					
	- - - 50 - - -		- - - 60 - - -		- - - 70 - - -	
	Soybean sale price ($/bu)					
	12	14	12	14	12	14
	----------------% probability of break-even ---------------					
High Input	81	93	94	98	98	99
High minus Fungicide	99	100	100	100	100	100
High minus Insecticide	50	69	72	85	85	92
High minus ILeVO® Seed Treatment	100	100	100	100	100	100
High (Defensive Variety)	54	76	79	90	90	96
Low + Fungicide	74	83	84	90	90	93
Low + Insecticide	91	92	92	93	93	94
Low + ILeVO® Seed Treatment	11	15	16	20	20	24
Low (Non-defensive Variety)	100	100	100	100	100	100

*Using Bayesian economic analysis to compute posterior probabilities given the means and variance from 2020 data and assumed marginal costs for inputs.

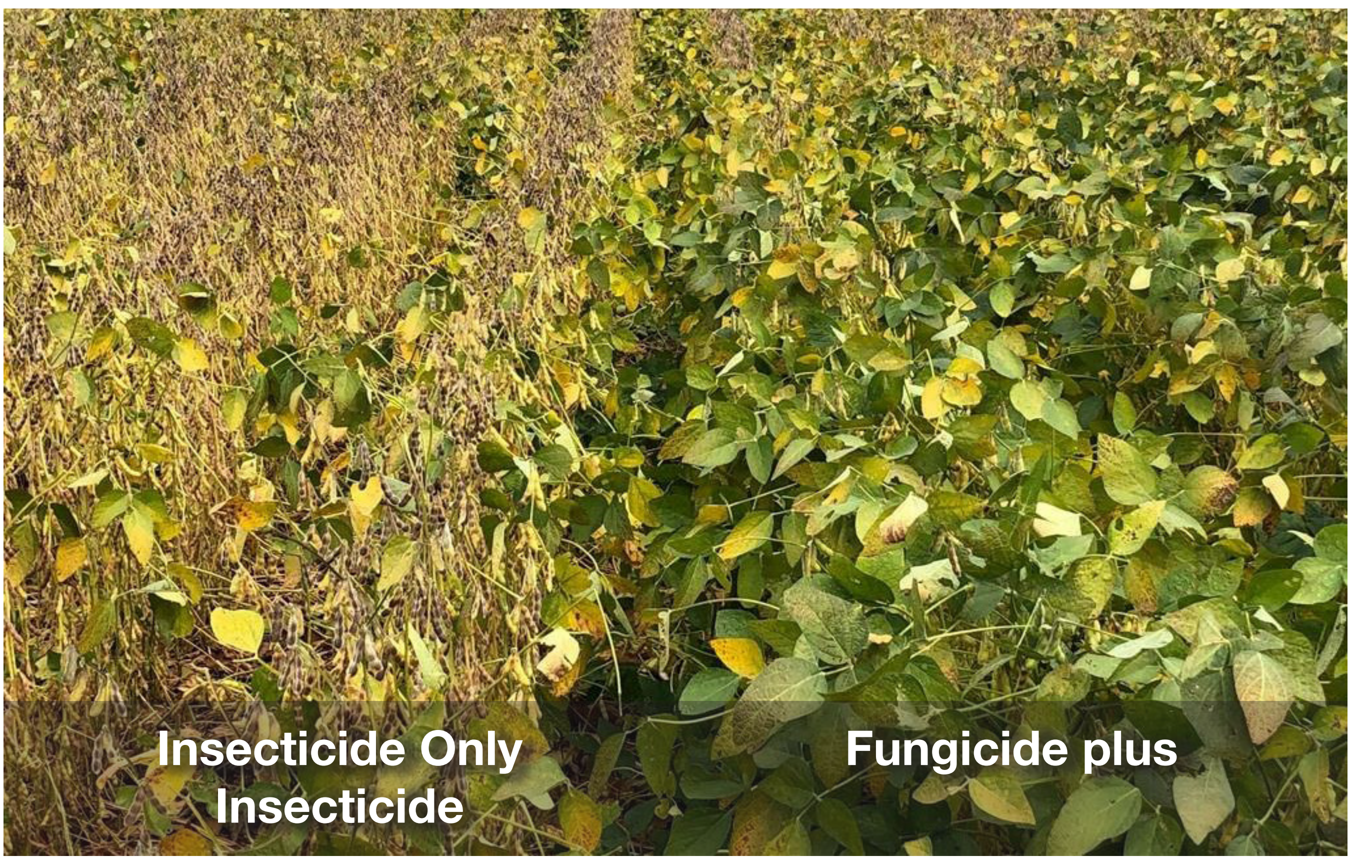

Figure 2. Side-by-side comparison of High-Input System.

Predicting Soybean Input Profitability

Key Learnings

- In these trials, the high input system (Treatment 1) had greater average yield compared to the low input system (Treatment 6) of 4.1 bu/acre.
  - Additionally, all the high input systems (Treatments 1 through 5) out yielded the base low input system (Treatment 6).
- Adding foliar fungicide (Treatment 7) increased average yield compared to low input system (Treatment 6).
- Input systems in this analysis generally have a high probability of breaking even with the soybean price and yield levels displayed in Table 1 except for the "Low + ILeVO® seed treatment" system (Treatment 9).
- More site-years are desired for this study to help make region-specific recommendations with a more robust data set. This trial will be conducted again in 2021.

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Yield Response of Asgrow® Soybean Products to Soil Type

Trial Objective

- It is important for any farming operation to consider individual soybean product adaptation to soil type when selecting soybean products. Demonstration large plot trials were conducted to evaluate the yield potential of current and new Asgrow® soybean products on silt loam and heavy clay soil types.

Research Site Details

Location	Soil Type	Previous Crop	Tillage Type	Planting Date	Harvest Date	Potential Yield (bu/acre)	Seeding Rate (seeds/acre)
Scott, MS	Commerce silt loam	Corn	Conventional	5/13/20	10/2/20	80	120K
Scott, MS	Sharkey clay	Corn	Conventional	5/13/20	10/4/20	80	120K

- Treatments consisted of 15 Asgrow® soybean brands planted in two different soil types: Commerce silt loam (SAND) with a CEC of 18 meq/100g, and Sharkey clay (CLAY) with a CEC of 45 meq/100g.
  - AG43X0 brand
  - AG44XF1 brand
  - AG45X8 brand
  - AG45XF0 brand
  - AG46X0 brand
  - AG46X6 brand
  - AG46XF0 brand
  - AG47X9 brand
  - AG47XF0 brand
  - AG48X9 brand
  - AG48XF0 brand
  - AG52X9 brand
  - AG53X0 brand
  - AG53X9 brand
  - AG55X7 brand
- The trial was conducted on single replication large plots: 0.15 acre plots.
- Seeding rate for both soil types was 120,000 and emergence on both soil types was approximately 80%.
- All weed control, insect control, and irrigation inputs were applied per local standards.
- Plots were harvested with a commercial harvest equipment and data were collected using the Climate FieldView™ Platform and Precision Planting® YieldSense™ yield monitoring systems.
- All yields were corrected to 13.5% moisture.

Yield Response of Asgrow® Soybean Products to Soil Type

Understanding the Results

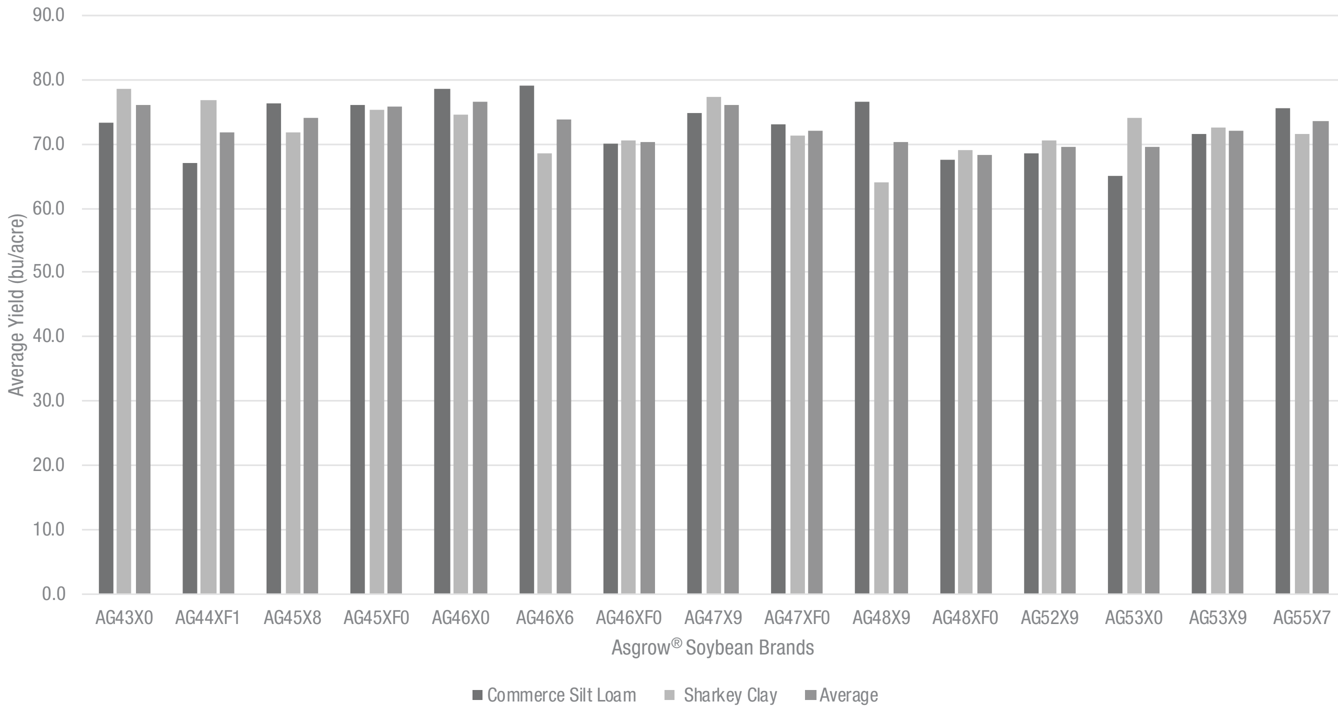

Figure 1. Average yield (bu/acre) of soybean products on two soil types (Commerce silt loam and Sharkey clay) in 2020.

- Most of the soybean products in this trial demonstrated acceptable yield potential in these production systems (Figure 1).
- The new 2021 Asgrow® XtendFlex® soybean products (AG44XF1, AG45XF0, AG46XF0, AG47XF0, and AG48XF0) were competitive with existing, well-adapted products (Figure 1).

Key Learnings

- Current and new Asgrow® brand soybeans offer growers high yield potential options. Differences exist, so selecting the proper soybean product for the production environment is important.
- Prior to placing soybean products on their farm, growers should consult with their local Bayer® seed representative to ensure proper placement regarding yield potential, disease package, and soil type adaptation for each product.

Yield Response of Asgrow® Soybean Products to Soil Type

Legal Statements

Planting Errors and Yield Compensation in Soybeans

Trial Objective

- Each planting season there are soybean fields in the South with unintentionally high plant populations due to equipment or operator planting errors.
- Previous work has shown that high populations of soybeans can be more susceptible to lodging. Soybean plants are also typically capable of overcoming many stand deficiencies including skips, missing rows and non-uniform emergence.
- This study was conducted to evaluate the effectiveness of using conventional techniques to remediate excessive seeding rate planting errors and to reinforce previous work on the compensatory ability of soybean. Two primary questions were asked:
  - Should/can overplanted soybean populations be reduced?
  - Do soybean products continue to demonstrate the ability to compensate for missing plants, skips in stands and missing rows?

Research Site Details

Location	Soil Type	Previous Crop	Tillage Type	Planting Date	Harvest Date	Potential Yield (bu/acre)	Seeding Rate (seeds/acre)
Scott, MS	Mixed Silt loam	Cotton	Conventional	5/2/20	10/2/20	80	120K, 360K

- All agronomic inputs were per local standards.
- Two Asgrow® soybean products were planted:
  - AG46X0 Brand
  - AG48X9 Brand
- Two seeding rates were used for this study:
  - Standard: 120,000 seeds/acre
  - High: 360,000 seeds/acre
- Remediation treatments were applied at three weeks post planting:
  - UTC 120K: Untreated control (UTC) planted at 120,000 seeds/acre with NO remediation treatment applied (Figure 1).
  - UTC 360K: Untreated control planted at 360,000 seeds/acre with NO remediation treatment applied (Figure 1).
  - Bed Conditioner: Planted at 360,000 seeds per acre and one pass with a conventional bed conditioner to attempt to reduce standing plant number (Figure 2).
  - Plowed: Planted at 360,000 seeds per acre and Orthman bedder run at an angle across the rows to non-uniformly reduce the standing population. Rows were rerun for irrigation and drainage. This resulted in large 3- to 4-foot skips distributed uniformly across the plot area (Figure 3).
  - Rotary Hoe: Planted at 360,000 seeds per acre and one pass with a conventional rotary hoe to attempt to reduce standing plant number (Figure 4).
  - Spray Out 1:1: Planted at 360,000 seeds per acre and a broad-spectrum herbicide applied to every other row to result in a 1:1 skip row (76-inch row spacing) (Figure 5).

Planting Errors and Yield Compensation in Soybeans

- Plots were single replicate strip plots of approximately 0.2 acre.
- Post-treatment stand counts were taken on representative plot areas to quantify stand.
- Yields were collected using commercial harvest equipment with the Climate FieldView™ Platform digital app and Precision Planting® YieldSense™ yield monitoring systems.

Figure 1. High vs standard population soybean: untreated control soybean plots planted at 120,000 seeds/acre (left) and 360,000 seeds/acre (right).

Figure 2. Bed conditioner vs high population: bed conditioner treatment (left) and untreated soybeans planted at 360,000 seeds/acre (right).

Figure 3. Soybean planted at 360,000 seeds per acre and plowed with an Orthman bedder run at an angle across the rows to non-uniformly reduce the standing population.

Figure 4. Soybean planted at 360,000 seeds per acre and remediated with one pass with a conventional rotary hoe.

Planting Errors and Yield Compensation in Soybeans

Figure 5. Soybean planted at 360,000 seeds per acre and a broad-spectrum herbicide applied to every other row to result in a 1:1 skip row (76-inch row spacing).

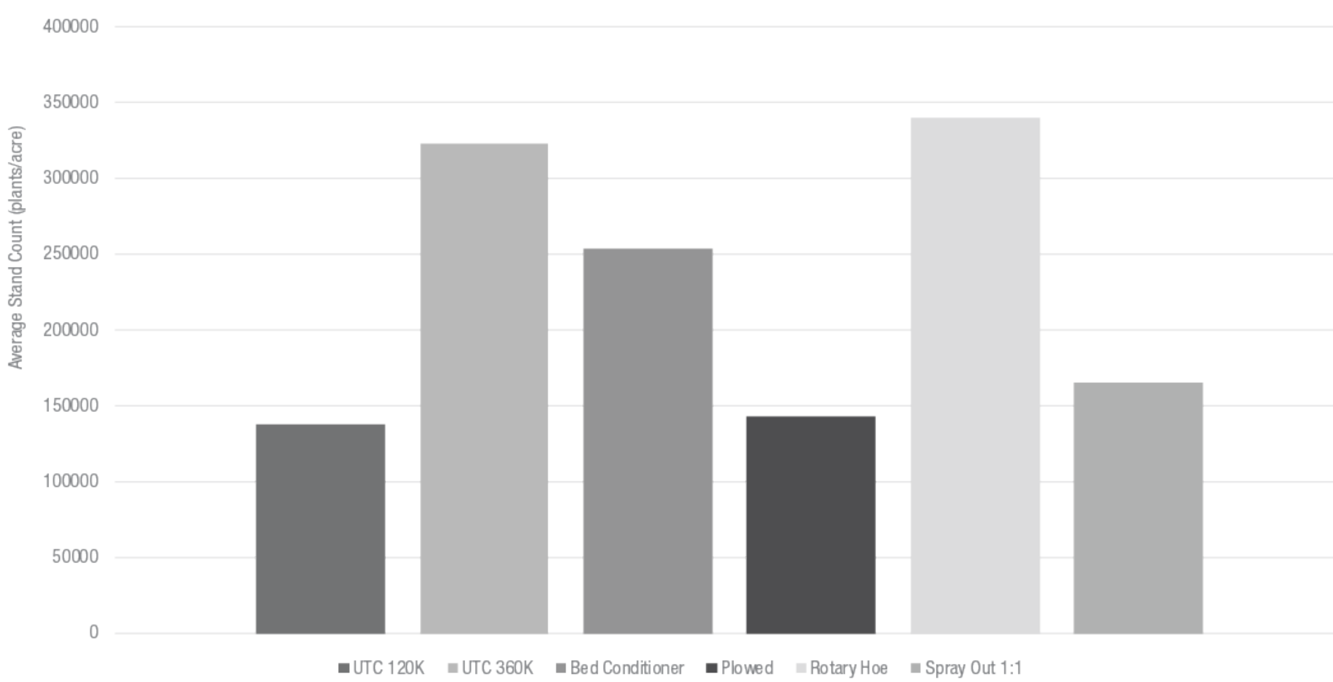

Figure 6. Effect of planter error remediation treatments on average soybean stand count in 2020.

Planting Errors and Yield Compensation in Soybeans

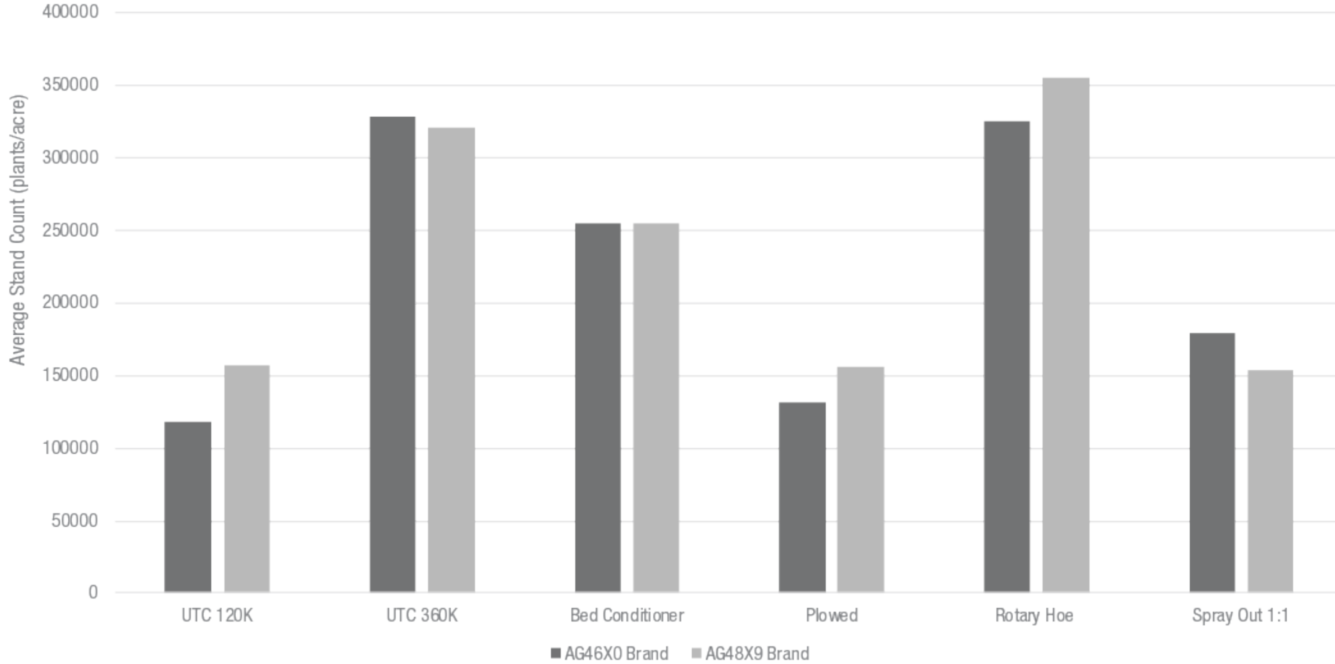

Figure 7. Effect of soybean planting error remediation treatments on stand counts of Asgrow® soybean products in 2020.

- The rotary hoe treatment did not substantially reduce standing plant populations and in some cases, increased plant population (Figures 6 and 7).
- The bed conditioner treatment reduced the stand (Figures 6 and 7) but did not increase average yield compared to the untreated control with either the standard or high seeding rates (Figures 8 and 9).

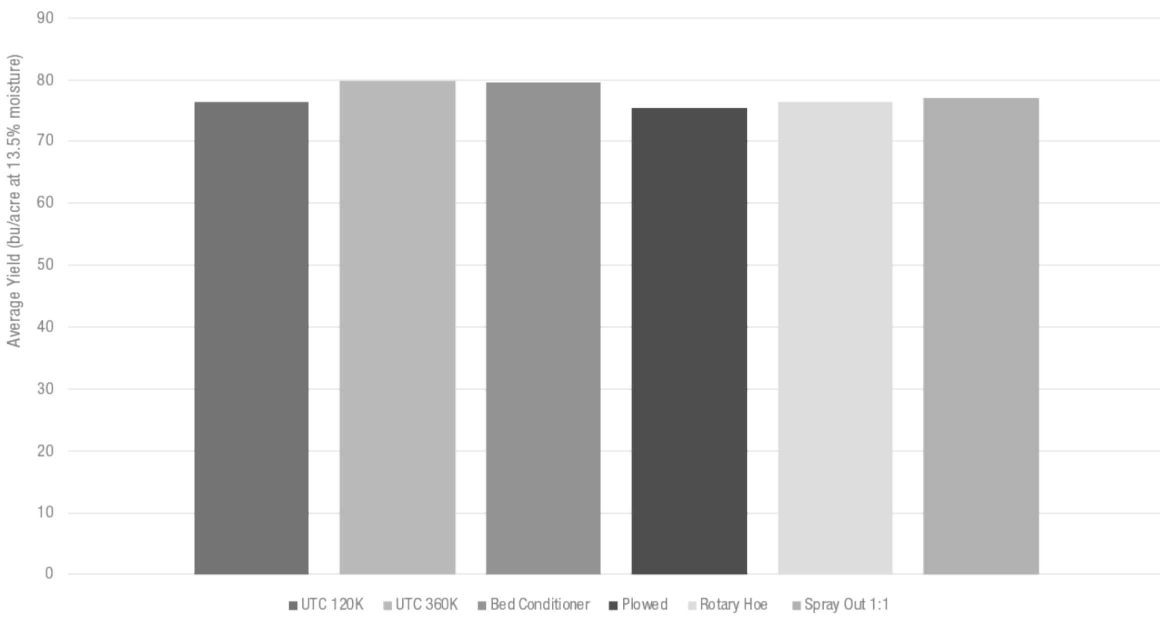

Figure 8. Average yield response of Asgrow® soybean products combined over planting error remediation treatments in 2020.

Planting Errors and Yield Compensation in Soybeans

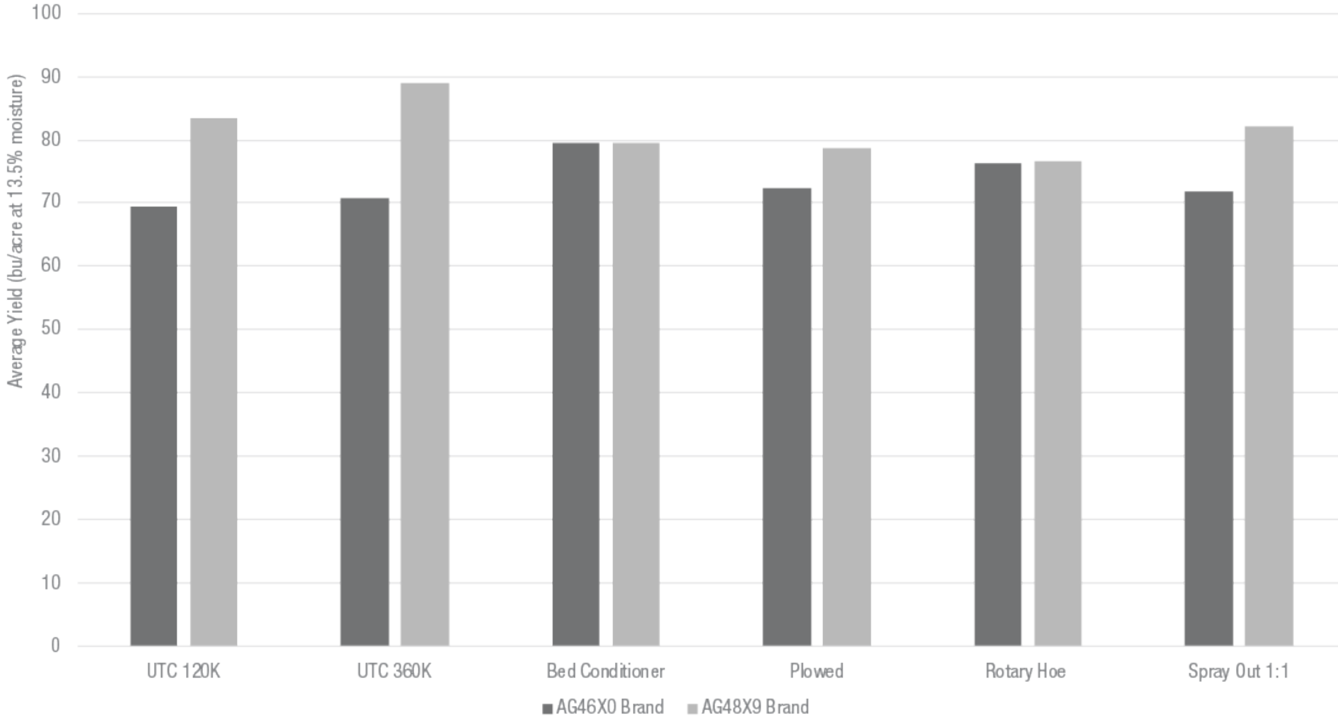

Figure 9. Response of Asgrow® soybean products to planting error remediation treatments in 2020.

- There was little difference in average yield response observed across the study (Figures 8 and 9).
- Similar to previous work, the remediated soybean plots were able to compensate for lower plant populations even with an entire row missing in the Spray Out 1:1 treatment (Figures 8 and 9).
- As in previous studies, the soybean plants were also able to almost completely compensate for 3- to 4-foot skips in the field as created in the plowed treatment (Figures 8 and 9).

Key Learnings

- None of the stand reduction treatments were necessary in this case. Despite the excessively high planting error of 360,000 seeds/acre, the soybeans were best left without remediation.
- Little yield response to population or stand variability was observed across the study. This is similar to previous results from the Scott Learning Center.
- In 2020, soybeans maintained the ability to compensate for large amounts of variability across the field whether with missing rows or large skips in this simulation.

Planting Errors and Yield Compensation in Soybeans

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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.

Roundup Ready 2 Xtend® soybeans contain genes that confer tolerance to glyphosate and dicamba. Glyphosate will kill crops that are not tolerant to glyphosate. Dicamba will kill crops that are not tolerant to dicamba. Contact your seed brand dealer or refer to the Bayer Technology Use Guide for recommended weed control programs.

Soybean Planted on Different Dates and Harvested on the Same Date

Trial Objective

- The Bayer Learning Center at Scott, Mississippi has several years of data regarding planting soybeans from widely different maturity groups on various dates ranging from early to late for our latitude.
- Many growers in the Midsouth face a dilemma in planting fields affected by flood waters. Sections of the field will typically dry earlier than others as flood waters recede. Late-planted soybeans often face major challenges from late season weather patterns (hurricanes, rainfall, and frost) as well as late season insect and disease pressure as compared to earlier planting dates. Therefore, to minimize the risk, as much of the field should be planted as early as possible.
- Questions often arise about harvest difficulties in this scenario.
  - » Can an earlier maturity group be planted later (after waters recede) and minimize harvest difficulties associated with different planting dates?
    - * Or stated another way, can two different maturity groups be planted on different dates and harvest at the same time?
  - » A single harvest date could minimize concerns with several issues including:
    - * Multiple harvest desiccation/harvest events per field.
    - * Maintaining productivity even if yields are somewhat lower by reducing production costs (insects), risk (disease, weather and harvest costs).
  - » What is the yield potential in this type of system?

Research Site Details

Location	Soil Type	Previous Crop	Tillage Type	Planting Date	Harvest Date	Potential Yield (bu/acre)	Seeding Rate (seeds/acre)
Scott, MS	Mixed Silt loam	Corn	Conventional	5/25/2020, 6/16/2020	9/8/2020 through 10/23/2020	85	120,000

- All agronomic practices were per local standards.
- 14 days prior to listed harvest dates appropriate desiccants were applied to facilitate harvest.
- All yield data was collected using commercial equipment recorded using Precision Planting® YieldSense™ yield monitoring systems and corrected to 13.5% moisture for reporting.
- Single replicate strip plot design with plot size of approximately 1 acre.
- Planting dates
  - » Single soybean product treatments
    - * May 25, 2020
    - * June 16, 2020
    - * Prepped and harvested as agronomically appropriate
  - » 50/50 treatments included 2 different soybean products planted on different dates (Figure 1).
    - * 50% on May 25 planted to later maturity groups.

Figure 1. The 50/50 treatments included two soybean products planted on two different dates and harvested on a single date.

Soybean Planted on Different Dates and Harvested on the Same Date

- * 50% on June 16 planted to earlier maturity groups.
- * Prepared for harvest and harvested on dates close the single soybean product treatments.

Understanding the Results

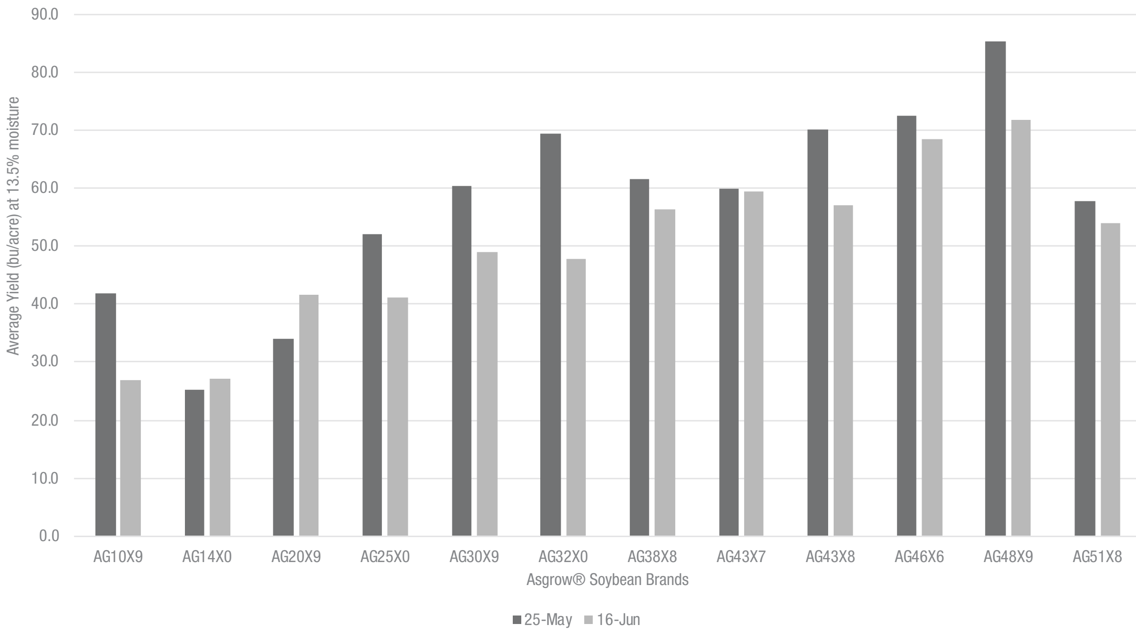

Figure 2. Effect of planting date on yield of Asgrow® soybean brands at Scott, Mississippi in 2020.

- Even though early planting was delayed by weather events during 2020, generally speaking, the earlier planting dates were yielded higher in most soybean products, which is typical for the Bayer Learning Center at Scott, Mississippi (Figure 2).
- Mid to late maturity group (MG) 4 soybean products yielded best in this study (Figure 2).

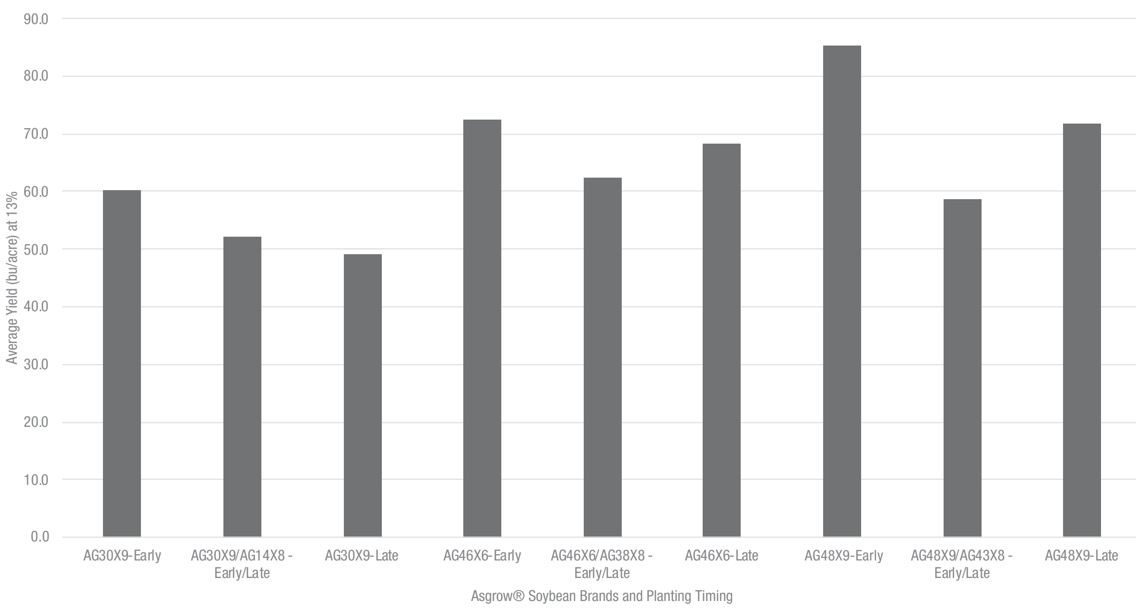

Figure 3. Effect of planting timing on yield of Asgrow® soybean brands at Scott, Mississippi in 2020.

Soybean Planted on Different Dates and Harvested on the Same Date

- For this trial, early planting of the regionally-adapted (normal) soybean products appeared to have the highest yield potential.
- When considering an early planting of a normal soybean product followed by later planting of early soybean products, growers should consider the possible risks/gains.
- In this case the timely planted/normal soybean product followed by the later planted/early soybean product showed potential, but not without a yield penalty.
- In two of the three cases presented here the timely/normal soybean planting had a higher yield than the late/early soybean planting by an average of 18.4 bu/acre or an average loss of $220/acre at a $12.00/bu market price. The potential benefit of the mixed planting would be harvest timing that could avoid the expense and trouble of moving harvest equipment to the field multiple times for harvest, but this benefit may come at a relatively high yield cost.
- In some cases, the later planted, later maturing soybean products suffered an 8.9 bu/acre yield loss or $107/acre loss. A disadvantage could be additional insect control and weather-related risks associated with a longer growing season.
- Growers should carefully evaluate these various scenarios (including how much of the field should be planted early versus late, this was a 50% mixture) and the associated decision points before selecting mixed plantings of soybean to manage harvest timing.
- This study shows there does appear to be potential to choose earlier MG soybean products for late planting of partial fields behind flood waters. Some yield reduction was observed but that would be offset by savings in late season inputs, increased yields from early planting of partial fields and decreased harvest costs (Figure 3).

Key Learnings

- Growers should take many parameters (soil type, disease pressure, crop rotation, etc.) into consideration when making decision about soybean products, planting dates and harvest timing.
- Growers should consult with their local Bayer seed representative for more information.

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Soybean Response to Foliar Feeding

Trial Objective

- Previous work at the Bayer Crop Science Learning Center at Monmouth, Illinois has shown little or no benefit from applying in-season foliar feed to soybean in fields without underlying fertility deficits.
- After receiving multiple requests to review newer products, a trial was developed to evaluate two foliar feed products in 2020.

Research Site Details

Location	Soil Type	Previous Crop	Tillage Type	Planting Date	Harvest Date	Potential Yield (bu/acre)	Seeding Rate (seeds/acre)
Monmouth, Il	Silt loam	Corn	Conventional	5/11/20	10/13/20	70	130K

- Treatments consisted of one untreated check and two foliar feed products applied at the R3 growth stage:
  - — An untreated check was included for comparison.
  - — Product 1: A solution containing 5% urea-triazone nitrogen, 20% potassium, and 13% sulfur in the potassium thiosulfate (KTS) form applied at 2 qt/acre.
  - — Product 2: A solution containing 12% slow-release nitrogen and 12% potassium applied at 1 gal/acre.
- The foliar feed applications included a surfactant at 2 fl oz/acre.
- Plots were planted in fields with adequate nutrients, as determined by soil test results.
- There were two replications of each treatment.
- Plots were harvested and adjusted to 13% moisture content.

Soybean Response to Foliar Feeding

Understanding the Results

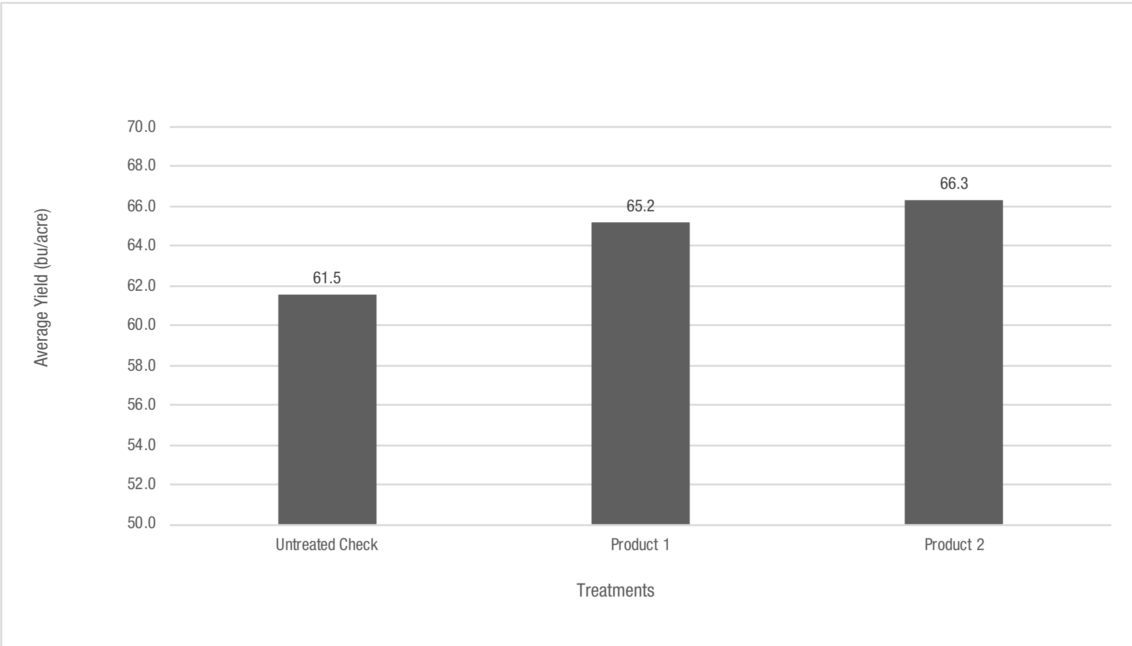

Figure 1. Yield comparison of two foliar applied fertilizer products to an untreated check. Product 1 was a solution containing 5% urea-triazone nitrogen, 20% potassium, and 13% sulfur in the potassium thiosulfate (KTS) form applied at 2 qt/acre. Product 2 was a solution containing 12% slow-release nitrogen and 12% potassium applied at 1 gal/acre.

- While yields were not dramatically different in this trial, higher yields were observed with both foliar feed products compared to the untreated check.
- No visual differences were observed in the plots.

Key Learnings

- These results are inconsistent with previous foliar feed trials conducted at the Learning Center. However, the differences in yield observed warrant further study to see if these products can benefit a soybean management system.
- Balanced soil fertility is important in any crop production system. It is important to conduct soil tests on a regular interval to evaluate any underlying fertility issues that need to be addressed.
- Consult your local Field Sales Representative or Technical Agronomist for tailored recommendations for your farm.

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Leverage 360 Insecticide for Japanese Beetle Control in Soybean

Trial Objective

- The objective of this trial is to evaluate whether leaf defoliation by Japanese beetle negatively impacts soybean yield, and to determine if there is value to applying an insecticide earlier in-season (R1/R2 stage) instead of the customary R3 stage when insecticides are applied together with fungicide applications.

Research Site Details

Location	Soil Type	Previous Crop	Tillage Type	Planting Date	Harvest Date	Potential Yield (bu/acre)	Seeding Rate (seeds/acre)
Williamsburg, IA	Silt Clay Loam	Corn	Conventional	4/26/2020	9/29/2020	60-70	140,000

- Four soybean products were used in this trial.
- This unreplicated demonstration trial consisted of a split plot design with insecticide application as the main plot treatment and variety as the sub-plot treatment.
- Trial was carried out on a 6-acre field with each treatment consisting of 0.75-acre plots.
- Leverage® 360 insecticide was applied at a rate of 2.8 oz/acre during the R1-R2 growth stage.
- Japanese beetle numbers were observed to be relatively high, and other pests minimal.

Understanding the Results

- Japanese beetles were present, and feeding was observed at the trial site (Figure 1).
- There was a 3.5 bu/acre positive yield response to when Leverage® 360 was applied at the R1/R2 stage (Figure 2) across the four varieties tested.
- There was a differential yield response of the four varieties to the application of Leverage® 360 insecticide in this trial. Insecticide application did not have a substantial yield impact in Variety 1 but a 9 bu/acre yield difference in Variety 3 (Figure 3).

Figure 1. Japanese beetle infestation and feeding of a soybean field treated with Leverage® 360 insecticide (left) compared to an untreated block (right) of the same variety. Pictures were taken 11 days after the insecticide application.

Leverage 360 Insecticide for Japanese Beetle Control in Soybean

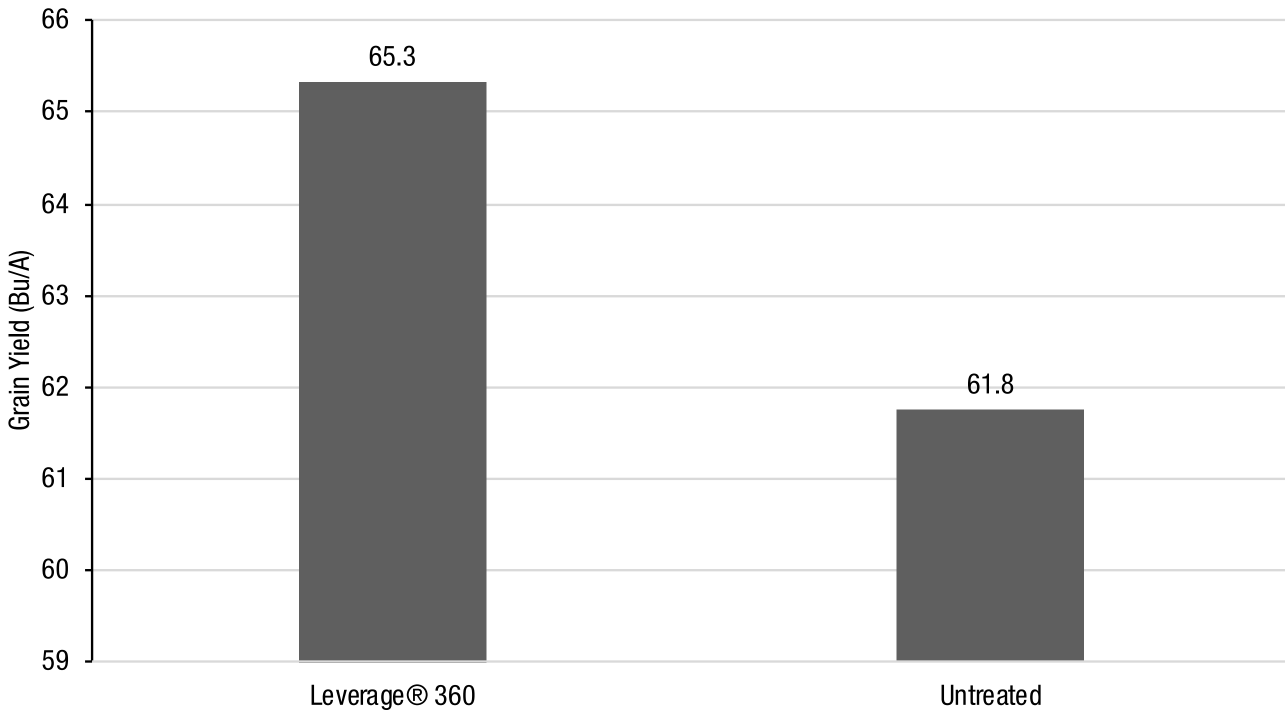

Figure 2. Average yield of soybean products with insecticide applied and untreated.

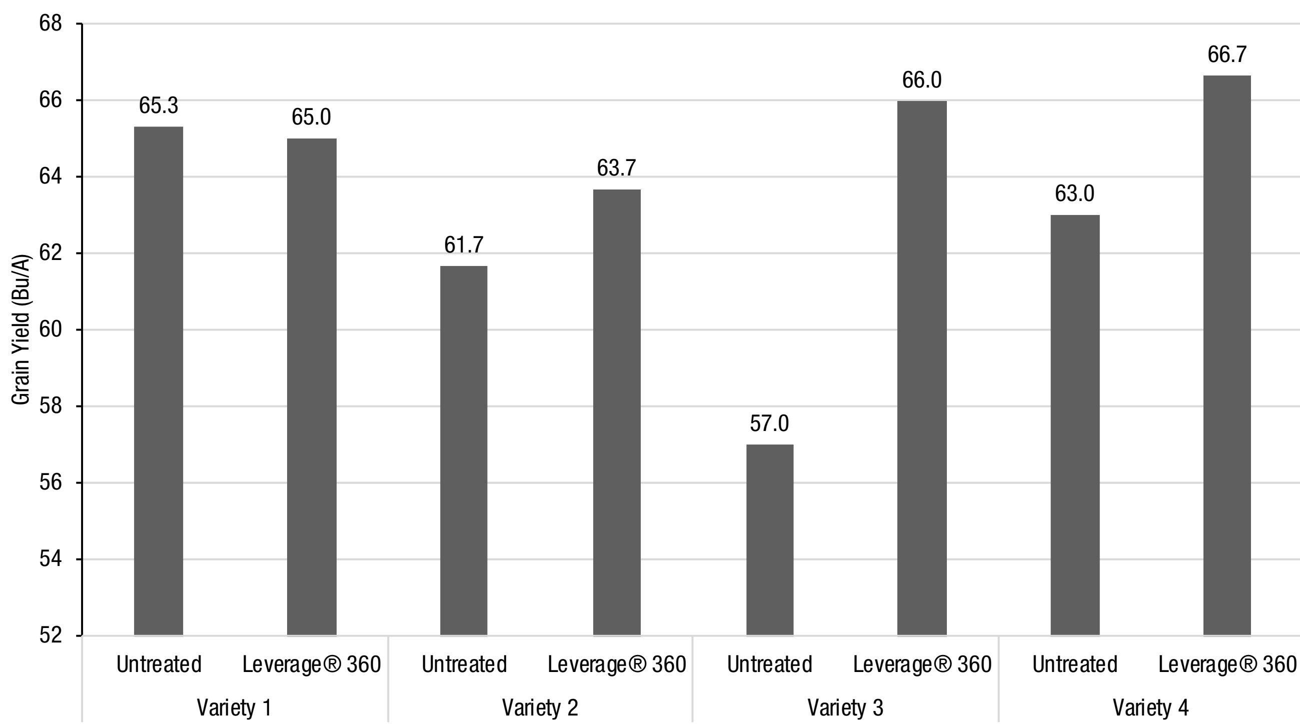

Figure 3. Average yield response of four soybean products to an insecticide treatment to control Japanese beetles.

Leverage 360 Insecticide for Japanese Beetle Control in Soybean

Key Learnings

- Japanese beetles emerge in mid-June and can feed on soybeans for one and a half to two months. University research suggests that the treatment threshold for Japanese beetle in soybeans is an average of 20% defoliation after bloom.[1] Depending on the soybean product, R3 occurs 5 to 15 days after R2. Applying insecticides at R3 can allow an extended duration for feeding and defoliation.
- This trial suggests an overall 3.5 bu/acre yield advantage if applications are made early at the R1/R2 stage. At the current operation cost of $13.32 for Leverage® 360 insecticide application and local cash price of $11.25/bu of soybeans, a 1.2 bu/acre yield increase is needed to cover insecticide costs and return an additional $25.88/acre profit. Waiting to include a beetle controlling insecticide with a fungicide application at R3 may have greater defoliation and yield reduction than if insecticide is applied earlier. An earlier application at R1/R2 can help provide a longer window of control.
- Leverage® 360 insecticide offers two modes of action, both contact and translaminar activity for rapid knockdown and residual protection.
- Growers are advised to scout individual fields by soybean product to make best management decisions due to the sporadic and localized feeding nature of Japanese beetles.

Reference

[1] Watch for Japanese Beetle Emergence. Iowa State University ICM Newsletter. June 11, 2020. https://crops.extension.iastate.edu/cropnews/2020/06/watch-japanese-beetle-emergence.

[2] Chandrasena, D., DiFonzo, C., and Wang, D. 2012. An assessment of Japanese beetle defoliation on aphid-resistant and aphid-susceptible soybean lines. Crop Science, Vol. 52: 2351-2357. Crop Science Society of America.

Legal Statements

Weed Control Comparison with XtendFlex® Soybeans

Trial Objective

- The Roundup Ready® Xtend Crop System with XtendFlex® soybeans provides growers with soybean products that have herbicide tolerance to glufosinate, glyphosate, and dicamba.
- In 2020, two herbicide tolerant soybean platforms launched, Enlist E3® soybeans and LibertyLink® GT27™ soybeans.
  - Enlist E3® soybeans confer tolerance to 2,4-D choline, glyphosate, and glufosinate that allows growers to use Enlist Duo® herbicide or Enlist One® herbicide to control weeds.
  - LibertyLink GT27 soybeans have tolerance to glyphosate, glufosinate, and isoxaflutole. To date, Alite 27® is the only group 27 herbicide product registered for use on GT27™ soybeans.
- The objective of the trial was to evaluate the three soybean systems: Roundup Ready® Xtend Crop System with XtendFlex soybeans, the Enlist™ weed control system with Enlist E3 soybeans, and the GT27™ Soybean Performance with LibertyLink G27 soybeans.

Research Site Details

Location	Soil Type	Previous Crop	Tillage Type	Planting Date	Harvest Date	Potential Yield (bu/acre)	Seeding Rate (seeds/acre)
Salina, KS	Silt loam	Corn	Conventional	05/20/2020	10/05/20	50	160,000
Gothenburg, NE	Silt loam	Corn	Strip till	05/08/2020	10/20/20	50	160,000

- Single replication demonstrations were planted on sites with very high Palmer amaranth pressure.
- Plot size was 10 by 243 feet at Salina, KS and 10 by 250 feet at Gothenburg, NE.
- Three soybean products for each weed control platform were used. The maturity groups ranged from 3.6 to 4.2 at Salina and 2.5 to 3.0 at Gothenburg.
- Herbicide application dates
  - Salina
    - Pre-emergence (PRE): May 20
    - Early Post (EPOST): June 9
    - Late Post (LPOST): July 6
  - Gothenburg
    - PRE: May 8
    - EPOST: June 18
    - LPOST: July 2
- Herbicide treatments included in Table 1, 2, and 3.

Weed Control Comparison with XtendFlex® Soybeans

Table 1. Roundup Ready® Xtend Crop System, XtendFlex® soybeans.

Herbicide Treatment	Location(s)	Rate	Unit	Timing
XtendiMax® herbicide with VaporGrip® Technology, a Restricted Use Pesticide	Gothenburg, Salina	22	fl oz/acre	PRE
Warrant® Ultra herbicide	Gothenburg, Salina	48	fl oz/acre	PRE
Drift Reducing Adjuvant (DRA)	Gothenburg, Salina	0.5	% v/v	PRE
XtendiMax herbicide with VaporGrip Technology	Gothenburg, Salina	22	fl oz/acre	EPOST
Roundup PowerMAX® herbicide	Gothenburg, Salina	32	fl oz/a	EPOST
Warrant Ultra herbicide	Gothenburg, Salina	48	fl oz/acre	EPOST
Adjuvant	Gothenburg, Salina	1	% v/v	EPOST
DRA	Gothenburg, Salina	0.5	% v/v	EPOST
Liberty® 280 SL herbicide	Gothenburg, Salina	32	fl oz/acre	LPOST
Ammonium sulfate (AMS)	Gothenburg, Salina	3	% v/v	LPOST

Table 2. Enlist™ weed control system, Enlist E3® soybeans.

Herbicide Treatment	Location(s)	Rate	Unit	Timing
Enlist One® herbicide with Colex-D® Technology	Gothenburg, Salina	22	fl oz/acre	PRE
Sonic® herbicide	Gothenburg, Salina	4	fl oz/acre	PRE
Enlist One herbicide With Colex-D Technology	Gothenburg, Salina	22	fl oz/acre	EPOST
Liberty® 280 SL herbicide	Gothenburg, Salina	32	fl oz/acre	EPOST
Dual II Magnum® herbicide	Gothenburg, Salina	16	fl oz/acre	EPOST
AMS	Gothenburg, Salina	3	% v/v	EPOST
Liberty® 280 SL herbicide	Salina	32	fl oz/acre	LPOST
AMS	Salina	2	% v/v	LPOST
Durango® DMA® Herbicide	Gothenburg	36	fl oz/acre	LPOST
AMS	Gothenburg	3	% v/v	LPOST

Table 3. GT27™ Soybean Performance System, LibertyLink® GT27™ soybeans.

Herbicide Treatment	Location(s)	Rate	Unit	Timing
Verdict® herbicide, powered by Kixor® herbicide Technology	Gothenburg, Salina	5	fl oz/acre	PRE
Durango® DMA® herbicide	Gothenburg, Salina	36	fl oz/acre	EPOST
Liberty® 280 SL herbicide	Gothenburg, Salina	32	fl oz/acre	EPOST
Outlook® herbicide	Gothenburg, Salina	12	fl oz/acre	EPOST
AMS	Gothenburg, Salina	3	% v/v	EPOST
Liberty 280 SL Herbicide	Salina	32	fl oz/acre	LPOST
Durango DMA herbicide DMA	Salina	36	fl oz/acre	LPOST
AMS	Salina	2	% v/v	LPOST

- Weed control efficacy ratings were taken on a scale of 0 to 100% with 0 indicating no control and 100% indicating compete control of the evaluated weed species.
- Weed control efficacy ratings for each system were averaged across the three soybean products for each system for each rating date.
- Yields were low at both sites due to late season moisture stress and were not reported.

Weed Control Comparison with XtendFlex® Soybeans

Understanding the Results

- The early POST (EPOST) applications were applied to soybeans at the V4 growth stage when Palmer amaranth plants were approximately 4.5 inches tall.
- The late POST (LPOST) applications were applied to all soybeans prior the R1 growth stage when Palmer amaranth plants were approximately 2-12 inches tall. A disparity in weed height was observed in this trial because the EPOST Roundup Ready® Xtend Crop System with XtendFlex® soybeans treatment performed better than the other two EPOST systems.

Table 4. Percent Palmer amaranth control for each soybean crop production system (2020).

Herbicide Treatment	Evaluation Date for Percent Palmer amaranth Control					
	Salina, KS			Gothenburg, NE		
Soybean Crop Production System	June 30 21 days after EPOST	July 17 11 days after LPOST	Near Harvest	July 2 14 days after EPOST	July 16 14 days after LPOST*	Near Harvest
Roundup Ready® Xtend Crop System treatments with XtendFlex® soybeans	82	94	97	96	98	98
Enlist™ weed control system treatments with Enlist E3® soybeans	72	70	58	90	75	70
GT27™ Soybean Performance System treatments with LibertyLink® G27™ soybeans	67	68	57	93	60	50

*Palmer amaranth was not initially controlled from the EPOST application for the Enlist™ and GT27™ systems. In addition, subsequent flushes of Palmer amaranth gave the impression of poor control across the plot due to the rapid growth of Palmer amaranth.

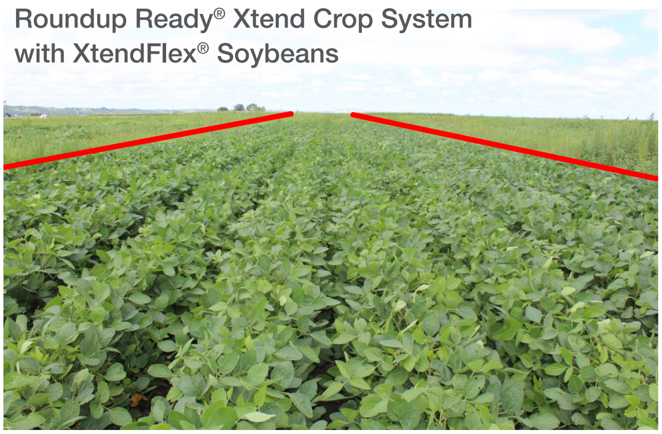

Figure 1. Images of the soybean weed control systems 26 days after late post application, July 28, 2020 at Gothenburg, NE.

Weed Control Comparison with XtendFlex® Soybeans

Key Learnings

- Early season weed control efficacy initially appeared to be similar between the three weed control systems at both sites with a small advantage for the Roundup Ready® Xtend Crop System with XtendFlex® soybeans platform.
- Differences in weed efficacy became more apparent as the growing season continued with the XtendFlex® platform showing better weed control efficacy at both the mid-season and pre-harvest observations.
- Palmer amaranth is a difficult weed for farmers to control effectively. A system like the Roundup Ready® Xtend Crop System with XtendFlex® soybeans that can help provide season-long control by layering residuals is one way to help achieve effective weed control.
- Farmers should visit with their local Bayer Crop Science Sales Representative about the possible benefits the Roundup Ready® Xtend Crop System with XtendFlex® soybeans platform can bring to their operation.

Legal Statements

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Evaluation of New Deltapine® Cotton Varieties

Trial Objective

- Each season, new Deltapine® cotton varieties are evaluated at the Bayer Learning Center in Scott, Mississippi for yield potential and growth habit. This information helps define the management practices needed to optimize the performance of existing and newly-introduced Deltapine cotton varieties.
- This study was conducted to evaluate new cotton varieties in the cotton production system at Scott, Mississippi.

Research Site Details

Location	Soil Type	Previous Crop	Tillage Type	Planting Date	Harvest Date	Potential Yield (lbs/acre)	Planting Rate (seeds/acre)
Scott, MS Highway Plot	Commerce Silt loam – 18 CEC	Corn	Conventional	5/12/2020	10/1/2020	1500	41,000
Scott, MS Buckshot Plot	Clay Silt Loam – 41 CEC	Corn	Conventional	5/10/2020	10/10/2020	1000	41,000

- Sixteen Deltapine® cotton varieties were included in this study.
  - DP 1612 B2XF
  - DP 2012 B3XF
  - DP 1614 B2XF
  - DP 1916 B2XF
  - DP 1518 B2XF
  - DP 2020 B3XF
  - DP 1522 B2XF
  - DP 1822 XF
  - DP 1823 NRB2XF
  - DP 2123 B3XF
  - DP 1725 B2XF
  - DP 2127 B3XF
  - DP 2038 B3XF
  - DP 1845 B3XF
  - DP 1646 B2XF
  - DP 2055 B3XF
- Cotton varieties were planted at both Highway and Buckshot site locations in single replicate strip plots 6 rows wide and 600 feet long, approximately 0.3 acre/plot.
- 80 lbs nitrogen/acre was applied as 32% soil applied liquid.
- Stance® plant growth regulator (PGR) was applied to all varieties, with a total of 16 oz/acre applied for the season. Application dates and rates are as follows:
  - 7/10/2020 – 4 ounces/acre applied
  - 7/17/2020 – 4 ounces/acre applied
  - 7/26/2020 – 4 ounces/acre applied
  - 8/05/2020 – 4 ounces/acre applied
- All weed control, insect control, and irrigation inputs were applied per local standards.
- Plots were harvested for yield and lint samples were ginned using research gins at Scott, Mississippi to estimate turnout.

Evaluation of New Deltapine® Cotton Varieties

- Noted weather impacts to this study include:
  - The first PGR application was delayed approximately 10 days past optimal application date due to rain on the intended day of application and repeated rain events afterwards.
  - This plot was harvested after two major hurricane events which influenced harvestability and final yield potential.

Understanding the Results

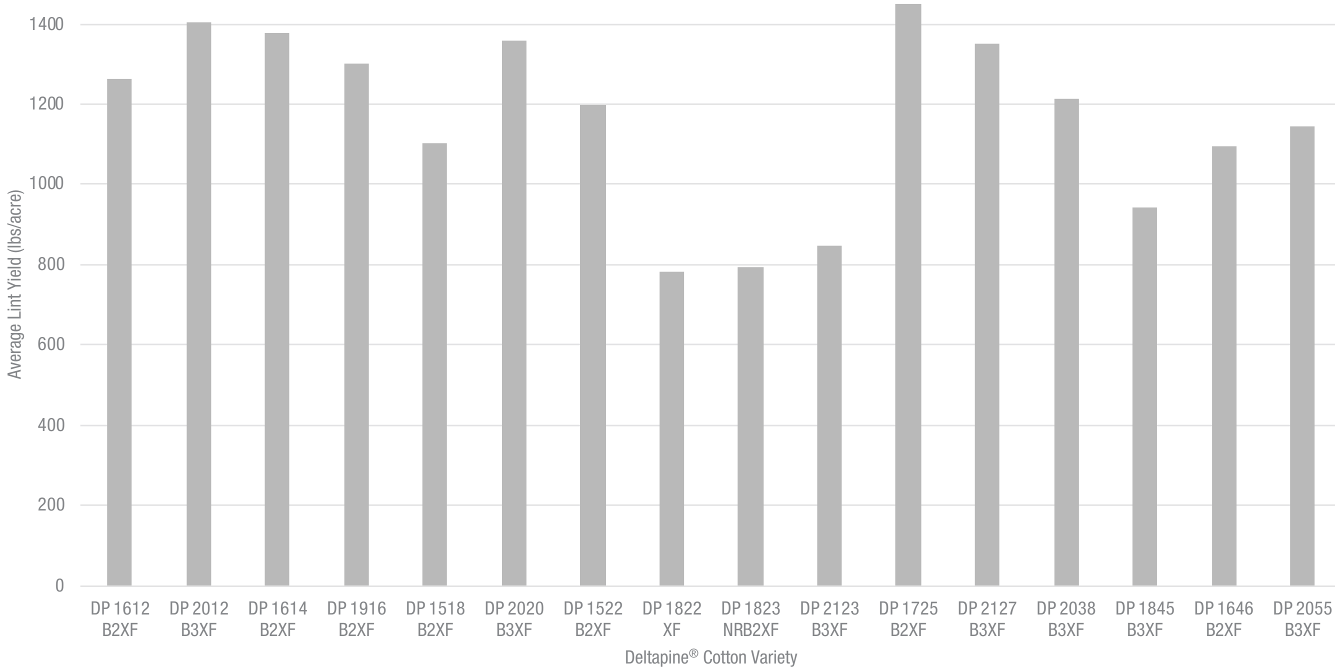

Figure 1. Calculated average lint yield (lb/acre) by cotton variety at Highway site in 2020.

- Despite weather challenges encountered in 2020, new and current commercial Deltapine® cotton varieties tested appeared to have high yield potential at both the Highway and Buckshot site locations in Scott, Mississippi (Figures 1,2).
- This trial included varieties that are not well-adapted to the growing conditions in the Midsouth.
  - DP 1822 XF is a West Texas cotton variety with no Bt traits and may have lost yield due to no protection from Lepidopteran pests.
  - DP 2123 B3XF is a Texas cotton variety and is best fit in dryland environments.
  - DP 1823NR B3XF is a root-knot nematode resistant (RKN) cotton variety and is best fit in short-season environments.
  - DP 2055 B3XF is the most full-season cotton variety in the set and may have been challenged with timely maturity.

Evaluation of New Deltapine® Cotton Varieties

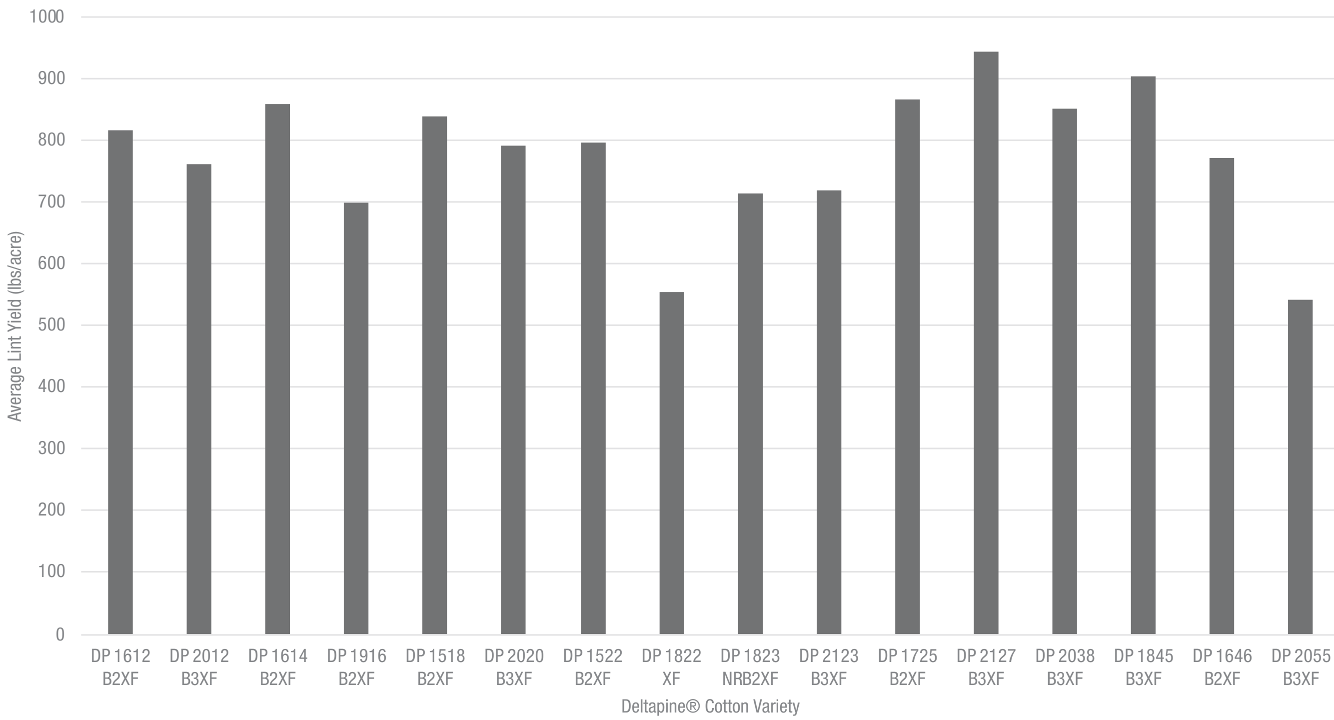

Figure 2. Calculated average lint yield (lb/acre) by cotton variety at Buckshot site in 2020.

Key Learnings

- Cotton variety selection is one of the most important management decisions a grower must make each growing season. Selecting multiple cotton varieties allows for flexibility in relative maturity, management decisions, and risk aversion.
- Evaluation of the new Deltapine® cotton varieties provides data to help growers make informed variety selection decisions.
- Consult your local Bayer representatives for further information about variety placement and management for the 2021 season.

Evaluation of New Deltapine® Cotton Varieties

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Insect Resistance Management — *Planting Refuges, Preserving Technology*

Before opening a bag of seed, be sure to read, understand and accept the stewardship requirements, **including applicable refuge requirements for insect resistance management,** for the biotechnology traits expressed in the seed as set forth in the Monsanto Technology/Stewardship Agreement that you sign. By opening and using a bag of seed, you are reaffirming your obligation to comply with the most recent stewardship requirements.

Response of Deltapine® Cotton Varieties to Plant Growth Regulator Regimes

Trial Objective

- The plant growth regulator (PGR) mepiquat chloride benefits cotton production by helping to balance vegetative growth with reproductive growth. PGR applications at the appropriate rate and timing are essential for managing cotton varieties in the coastal United States.
- Each season new Deltapine® cotton varieties are evaluated at the Bayer Learning Center at Scott, Mississippi for response to plant growth regulator applications in the productive Delta system.
- The primary objectives of this study were to:
  - » Evaluate the growth habit of new cotton products in comparison with existing Deltapine cotton varieties.
  - » Evaluate cotton variety response to mepiquat chloride application in one of three application regimes.

Research Site Details

Location	Soil Type	Previous Crop	Tillage Type	Planting Date	Harvest Date	Potential Yield (lbs/acre)	Seeding Rate (seeds/acre)
Scott, MS	Commerce silt loam	Corn	Conventional	5/12/20	10/1/18	1900	45,000

- This study was set up to encourage excessive vegetative growth in a field following corn with high fertility (120 lb/acre of actual nitrogen soil applied as 32% liquid N) and irrigation applications.
- All other agronomic inputs (weed control, insect control and irrigation) were per local standards for each treatment.
- Single replicate strip plots were planted of 6 rows x 400 feet or approximately 0.2 acre/plot.
- Application regimes of mepiquat chloride (standard 4.2% formulation) were as follows: (Table 1).
  - » An untreated check with no PGR applied.
  - » Passive regime (representing older growth management methods) – three application rates and three timings totaling 38 oz/acre applied with delayed early application on July 10, 2020 at a reduced rate.
  - » Aggressive regime- three applications at a maximum label rates at three timings totaling 48 oz/acre applied.

Table 1. 2020 passive and aggressive PGR treatment rates and application timings.

Regime	Date	PGR Rate (oz/acre)
Passive	July 10	10
	July 26	12
	August 10	16
Aggressive	July 1	16
	July 10	16
	July 26	16

Response of Deltapine® Cotton Varieties to Plant Growth Regulator Regimes

- Growth characteristics of new Deltapine® cotton varieties were evaluated as follows:
  - » End-of-season plant height measurement indicating the growth nature of the new product.
  - » Height reduction measurement from either the passively or aggressively managed treatments versus the untreated check.
  - » Representative turnouts from other trials at Scott Learning Center were used to estimate average lint yield per acre to evaluate yield effects of PGR treatments.

Understanding the Results

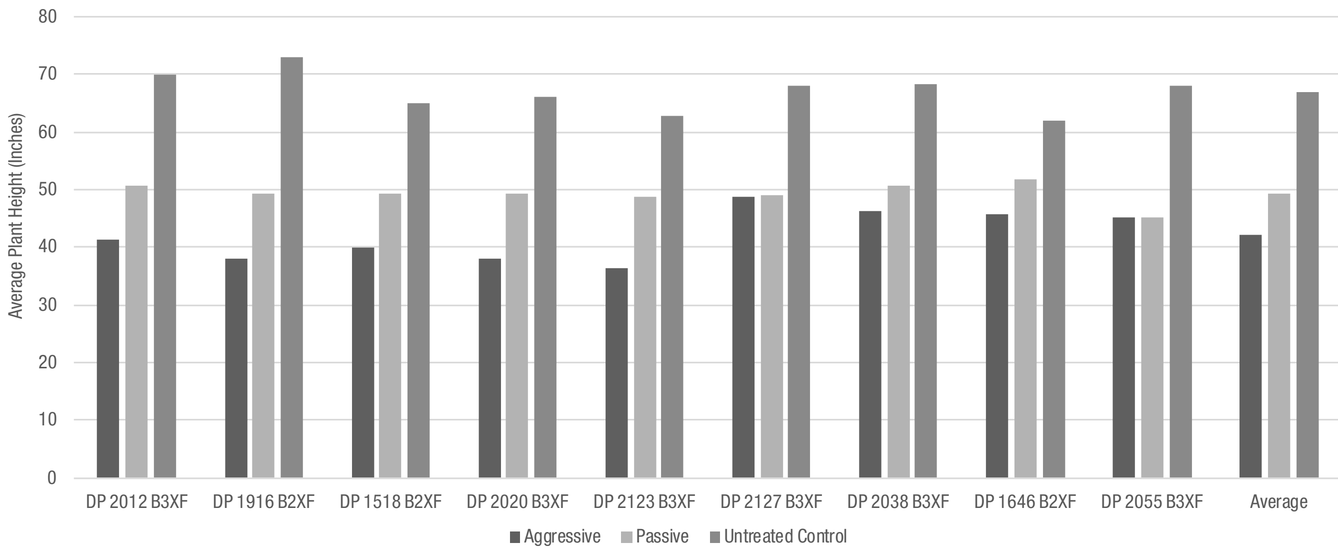

Figure 1. 2020 average cotton height by cotton variety and PGR regime.

- The untreated control treatments averaged 67 inches tall at season end (Figure 1). Passive treatments were an average of 49 inches with 18 inches reduction and the aggressive treatments were 42 inches with 25 total inches in height reduction. This echoes results from previous years.

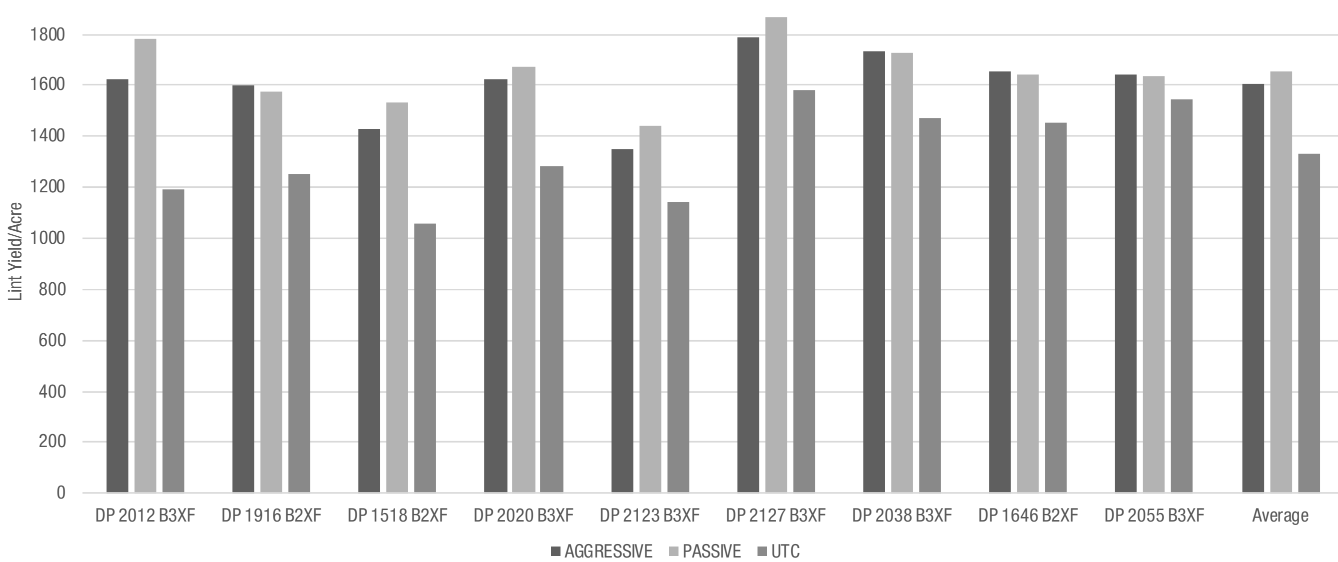

Figure 2. 2020 average cotton yield by cotton variety and PGR regime.

Response of Deltapine® Cotton Varieties to Plant Growth Regulator Regimes

- Like 2019, 2020 was not a year where an aggressive PGR approach was needed at the Bayer Learning Center in Scott, Mississippi. This is seen in both the height data and yield results; plots were generally shorter, and the untreated controls had higher yields than historical averages (Figures 1 and 2).
- On average across all cotton varieties, both PGR regimes improved yields in this trial by approximately 300 lbs/ acre compared to the untreated control (Figure 2).

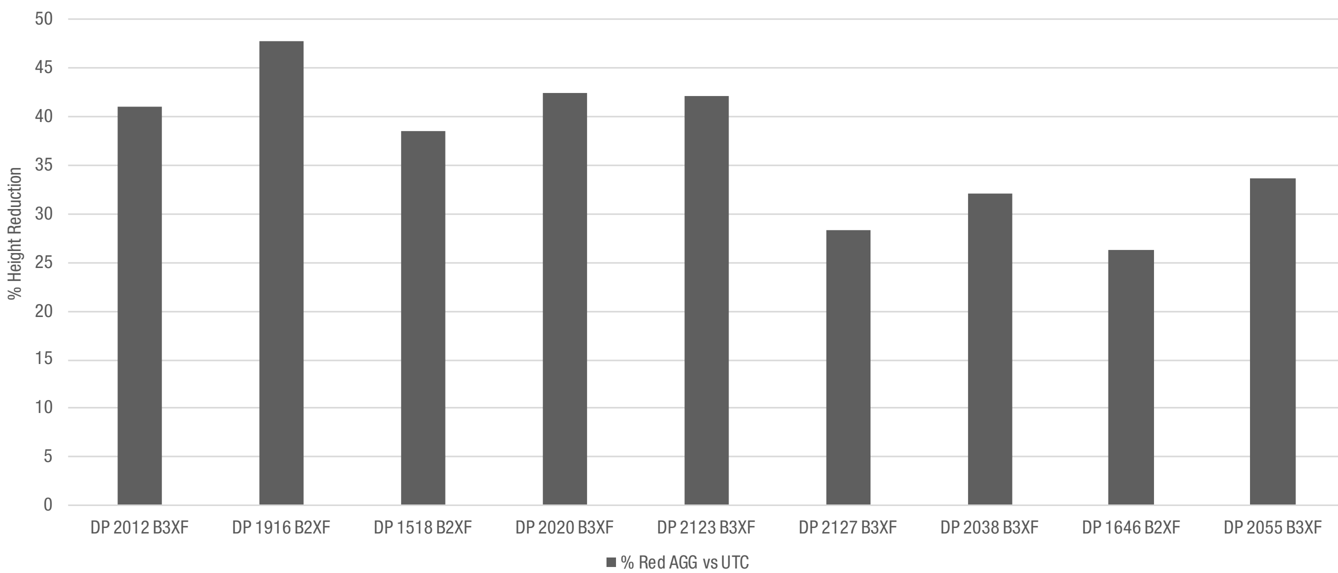

Figure 3. 2020 percent height reduction (compared to untreated control) of aggressive PGR regime on cotton varieties.

- Earlier, more determinate cotton varieties were more sensitive to higher rates and earlier timings of PGR use as measured in percent height reduction. When comparing the untreated control to the aggressive treatments, cotton variety DP 2123 B3XF and earlier demonstrated greater response to PGR rates and timings as measured in height reduction with 42% reduction in height compared to 30% in the later, less determinate varieties (DP 2127 B3XF and later) (Figure 3).

Key Learnings

- Correct PGR use is essential to optimize the growth habit of modern cotton varieties.
- Earlier maturity varieties can be more sensitive to PGR applications compared with later maturity cotton varieties. Therefore, rate and timing of early applications are more important for later maturity cotton varieties for obtaining the needed growth control. This is particularly true in high fertility environments that favor vegetative growth.
- Plant growth monitoring and understanding historical varietal response to PGR application can help determine PGR application decisions.
- These data can be useful in considering the stress tolerance associated with cotton products. Typically, cotton varieties that are more sensitive to PGR applications can be more sensitive to stress and should be considered when determining field placement. Cotton varieties that are less sensitive to PGR applications are somewhat more stress tolerant and can typically be planted into more stressful production systems.
- Consult your local Bayer representatives for more information about Deltapine® cotton variety placement and management for the 2021 season.

Response of Deltapine® Cotton Varieties to Plant Growth Regulator Regimes

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B.t. products may not yet be registered in all states. Check with your seed brand representative for the registration status in your state.

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Products with XtendFlex® Technology contains genes that confer tolerance to glyphosate, glufosinate and dicamba. Glyphosate will kill crops that are not tolerant to glyphosate. Dicamba will kill crops that are not tolerant to dicamba. Glufosinate will kill crops that are not tolerant to glufosinate. Contact your seed brand dealer or refer to the Bayer Technology Use Guide for recommended weed control programs.

Insect Resistance Management — Planting Refuges, Preserving Technology

Before opening a bag of seed, be sure to read, understand and accept the stewardship requirements, **including applicable refuge requirements for insect resistance management,** for the biotechnology traits expressed in the seed as set forth in the Monsanto Technology/Stewardship Agreement that you sign. By opening and using a bag of seed, you are reaffirming your obligation to comply with the most recent stewardship requirements.

Meta-Analysis of Deltapine® Cotton Variety Response to Plant Growth Regulators at the Bayer Learning Center at Scott, MS from 2011 through 2020

Trial Objective

- The plant growth regulator (PGR) mepiquat chloride benefits cotton production by helping balance vegetative growth with reproductive growth. PGR applications of the appropriate rate and timing are essential to the management of cotton varieties in the coastal U.S.
- Each season new Deltapine® cotton varieties from across the cotton growing region are evaluated at the Bayer Learning Center at Scott, Mississippi for PGR application response and demand in the productive Delta system.
- Differential responses to PGR applications have been observed each year among the Deltapine cotton varieties tested.
- This is a summary of Deltapine cotton variety PGR application response data from 2011 through 2020.

Research Site Details

Location	Soil Type	Previous Crop	Tillage Type	Planting Date	Harvest Date	Potential Yield (lbs/acre)	Seeding Rate (seeds/acre)
Scott, MS	Commerce/ Forestdale silt loam	Corn	Conventional	May 1 or later	Vary	1900	41,000 to 45,000

- A total of 10 to 18 Deltapine® cotton varieties were tested each season.
- These studies were set up to encourage excessive vegetative growth with strong background fertility levels, the previous corn crop, irrigation, and relatively high rates of nitrogen fertility (100 to 120 lb/acre of actual nitrogen soil applied as 32% liquid N).
- All other agronomic inputs (weed control, insect control and irrigation) were per local standards for each treatment.
- There was no PGR trial in 2014 and no passive regime in the 2016 trial.
- All PGR plots were treated with labeled but varying rates and application timings of currently available mepiquat chloride (standard 4.2% formulation). These application rates and timings were used to separate differences in Deltapine cotton variety responses and not necessarily to provide specific guidance on PGR management for an individual field, farm, or variety. Application regimes (Table 1) included:
    - » An untreated control with no PGR applied.
    - » Passively managed regime (representing older growth management methods): three application rates and three timings totaling 34 to 38 oz/acre applied per season at delayed timing.
    - » Aggressively managed regime: three applications at a maximum label rates at three timings totaling 48 oz/ acre applied per season.
- Growth characteristics of Deltapine® cotton varieties tested were evaluated by:
    - » Stand establishment: monitored for normal emergence (data not presented)
    - » Plant growth: monitored in season
    - » End-of-season plant height: 10 plants/plot measured at harvest

Table 1. Passive and aggressive PGR treatment rates and application timings.

Regime	Treatment	Number of Cotton Nodes at PGR application	PGR Rate (ounces/acre)
Passive	1	10 - 12	8 - 10
	2	15 - 17	10 - 12
	3	20 - 21	16
Aggressive	4	8 - 9	16
	5	12 - 13	16
	6	15 - 16	16

- » Height reduction from either the passively or aggressively managed treatments versus the untreated check.
- » Representative turnouts from trials at the Scott Learning Center were used to estimate lint yield/acre to evaluate yield effects of PGR treatments.

- Deltapine cotton variety sensitivity to PGRs – PGR application growth reduction was calculated as the percentage that plant height was reduced when compared to the untreated plot.
  - » Cotton varieties were then characterized by the percent growth reduction to indicate PGR sensitivity within each year as either:
  - » More Responsive – Cotton varieties considered more responsive were the top 50% of the Deltapine cotton varieties within the year tested.
  - » Less Responsive– Cotton varieties considered less responsive were the bottom 50% of the Deltapine cotton varieties within the year tested.

Understanding the Results

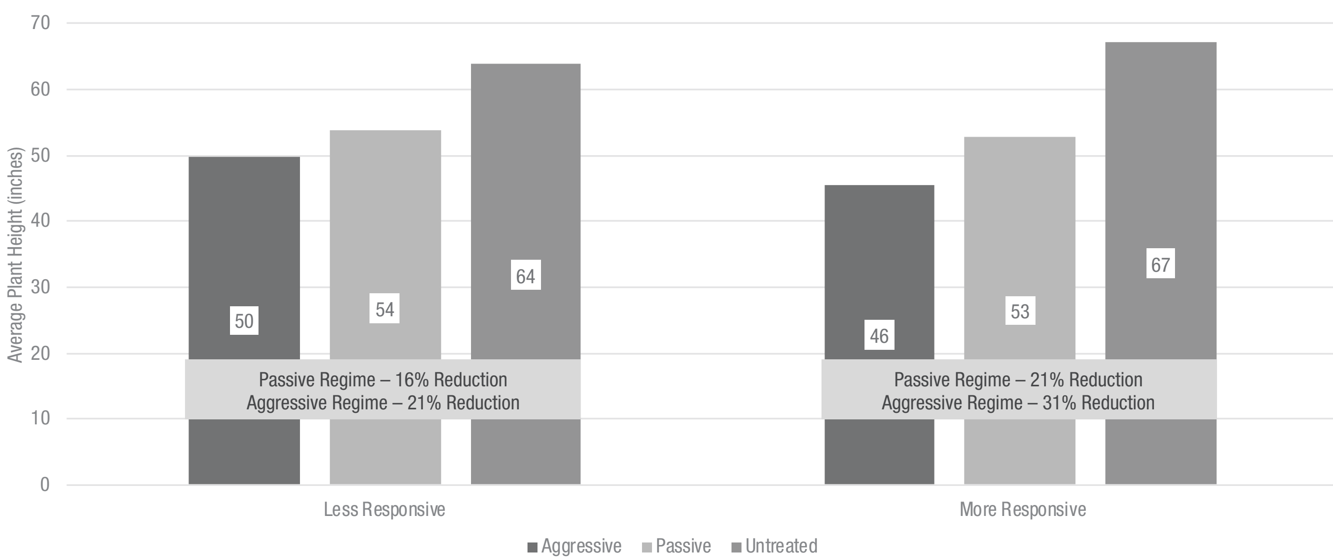

Figure 1. Average cotton plant height by PGR regime from 2011 through 2020.

- All conclusions from this data are highly interactive with the production system and environmental conditions during each growing season and should be viewed as such.
- The More Responsive cotton varieties demonstrated as much as 10% greater height reduction in the aggressive regime over the untreated checks when compared to the Less Responsive cotton varieties (Figure 1).

Meta-Analysis of Deltapine® Cotton Variety Response to Plant Growth Regulators at the Bayer Learning Center at Scott, MS from 2011 through 2020

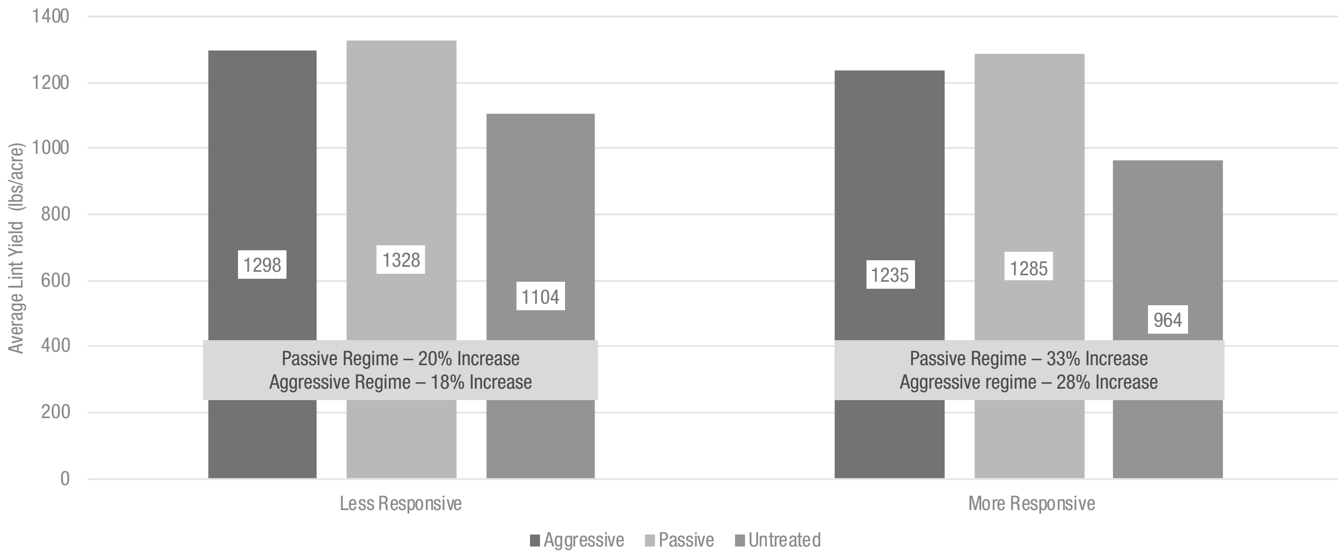

Figure 2. Average cotton yield by PGR regime from 2011 through 2020.

- The Less Responsive cotton varieties demonstrated slightly higher yield potential than the More Responsive cotton varieties in all PGR regimes (Figure 2).

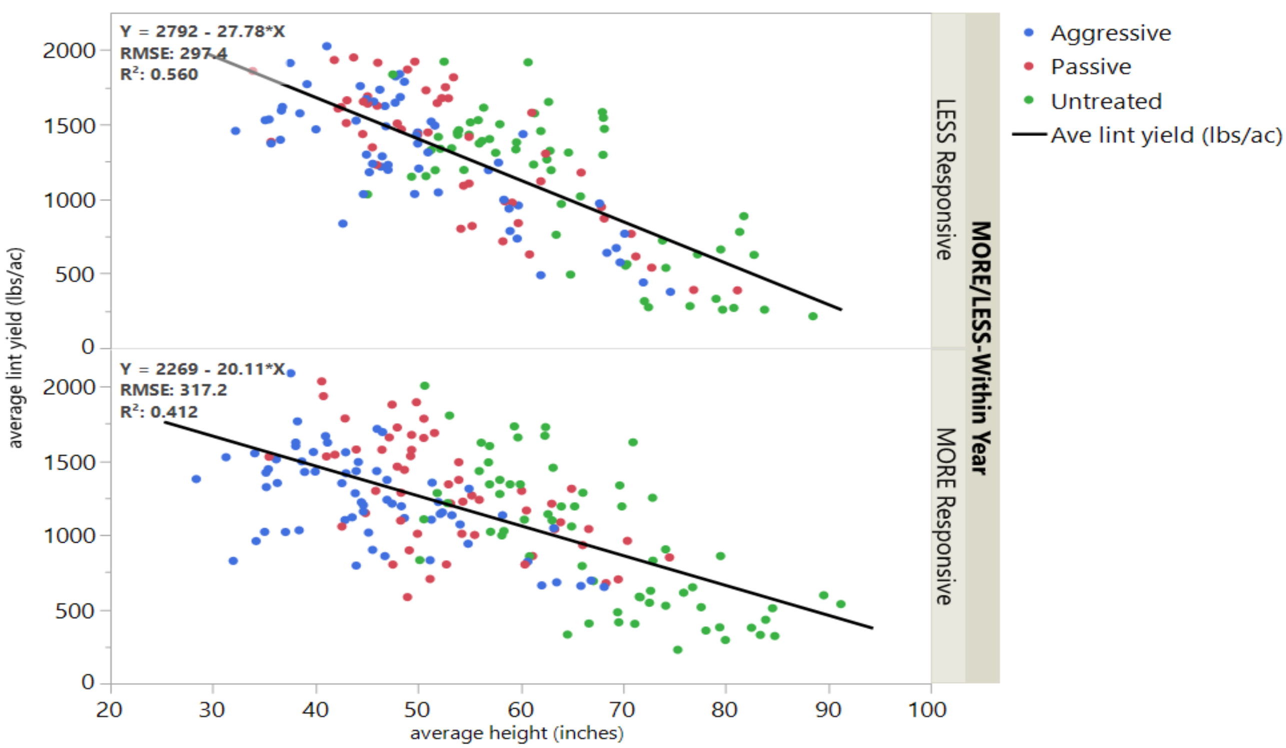

Figure 3. Linear regression of average lint yield versus average height in Less Responsive and More Responsive Deltapine® cotton varieties from 2011 through 2020 at the Scott Learning Center. (Student t-test was significant at P=0.0175).

Meta-Analysis of Deltapine® Cotton Variety Response to Plant Growth Regulators at the Bayer Learning Center at Scott, MS from 2011 through 2020

- The Less Responsive cotton varieties showed a statistically significantly greater decrease in average yield than the More Responsive cotton varieties in response to excessive height (Figure 3).
- Differences in slope between categories:
  - Less Responsive= -27.78 lbs/inch
  - More Responsive = -20.11 lbs/inch
- Approximately 15% more of the yield variability can be accounted for in height (as measured by R2) in the Less responsive cotton varieties. So, for each extra inch in height, the Less Responsive cotton varieties will lose an average additional 7.7 lbs lint yield per acre compared to the More Responsive cotton varieties.
- The yield response due to additional height is likely a function of the effect of the plant allocating energy to vegetative growth, the shading that occurs from neighboring plants, and associated fruit shed. Plants can also shade themselves as a result of excess height. An individual fruiting structure (squares particularly) is photosynthetically independent of the plant and if shaded, is more likely to shed just after bloom due to the lack of available sugar. Bolls are not independent, and the plant senses their need for sugar (to make carpals, seed and lint) hormonally. If it's not there for whatever reason, the boll will shed in the week or so after bloom. That's why this is all a big cascade of an effect. None of it occurs due to a single cause.
- When creating management plans for Less Responsive cotton varieties, early and timely applications of PGRs at appropriate rates are even more important.
- When the cotton variety sensitivity to PGR is known, a management system can be built factoring in their growth tendencies.
- To obtain optimal value from the cotton varieties and the traits they contain, this information should be considered for every cotton variety, field, and farm.

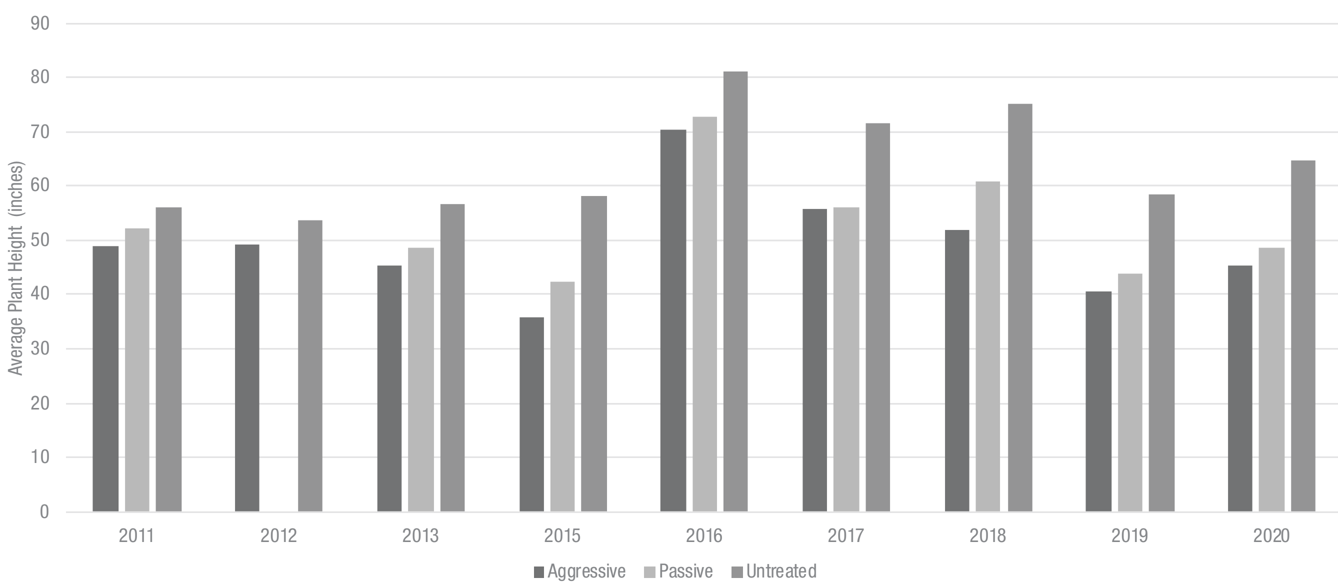

Figure 4A. Average Plant Height of Less Responsive Deltapine® cotton varieties by PGR regime from 2011 through 2020.

Meta-Analysis of Deltapine® Cotton Variety Response to Plant Growth Regulators at the Bayer Learning Center at Scott, MS from 2011 through 2020

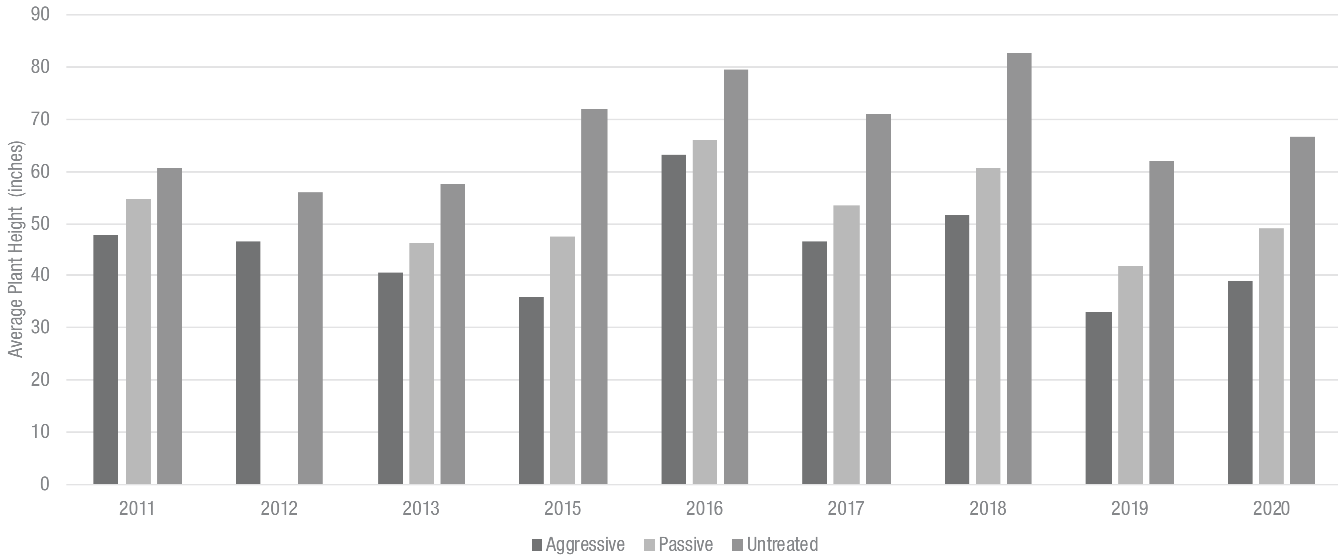

Figure 4B. Average plant height of More Responsive Deltapine® cotton varieties by PGR regime from 2011 through 2020.

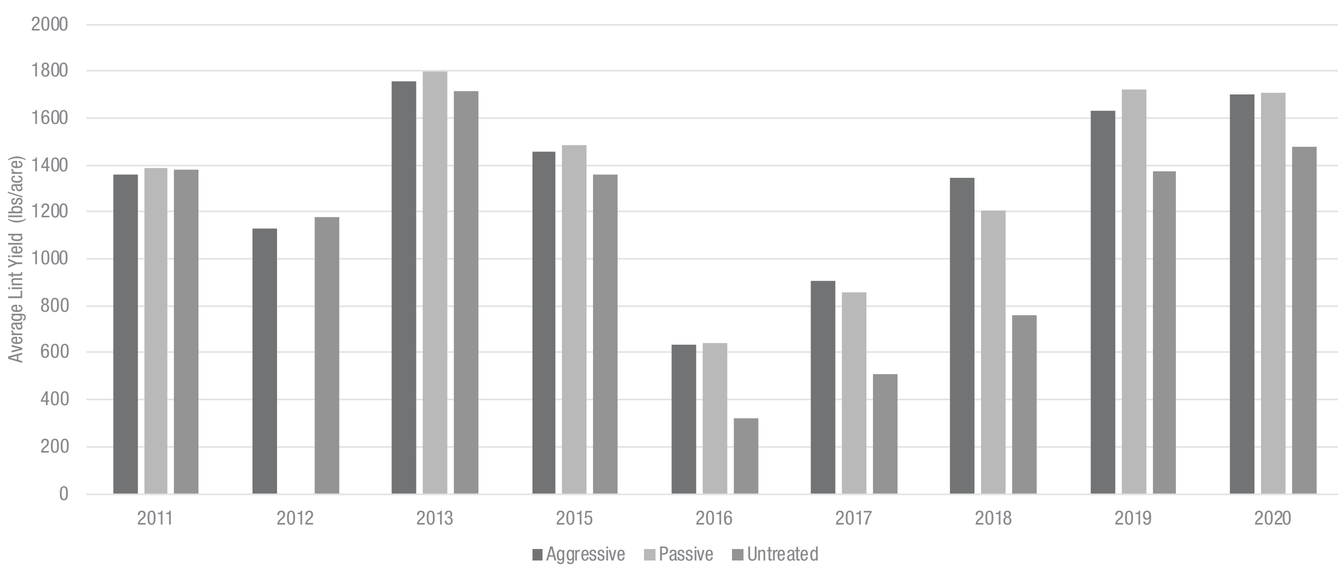

Figure 5A. Average Lint Yield of Less Responsive Deltapine® cotton varieties by PGR regime from 2011 through 2020.

Meta-Analysis of Deltapine® Cotton Variety Response to Plant Growth Regulators at the Bayer Learning Center at Scott, MS from 2011 through 2020

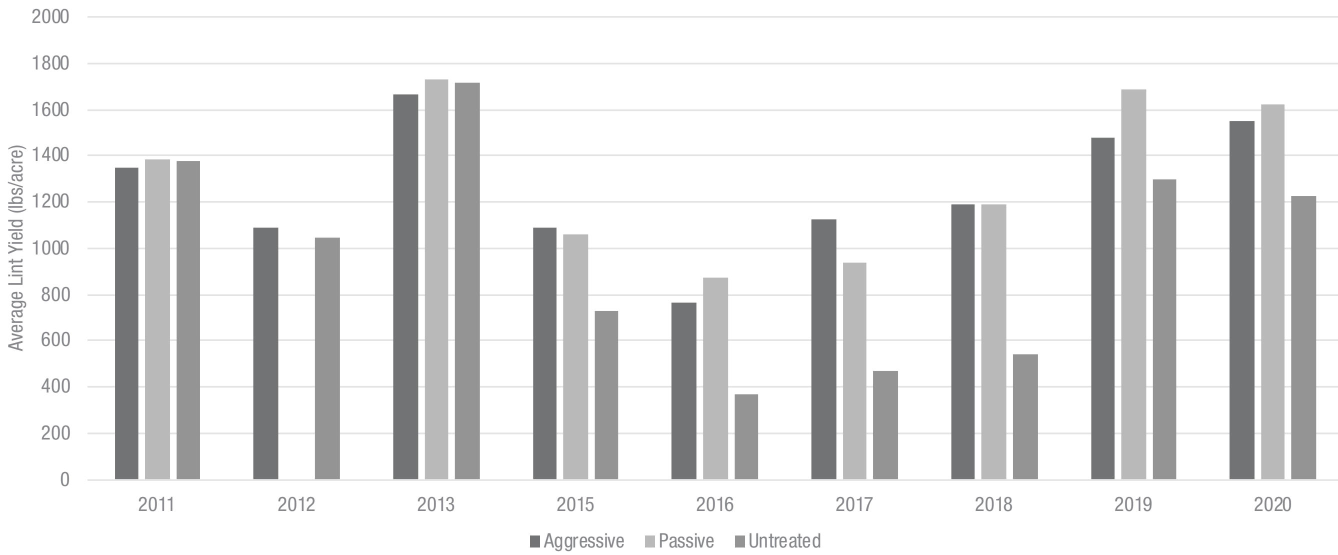

Figure 5B. Average Lint Yield of More Responsive Deltapine® cotton varieties by PGR regime from 2011 through 2020.

Key Learnings

- PGR use in cotton crops is a tool that can be used to help manage excessive vegetative development and increase yield potential.
- Significant differences exist in the response of Deltapine® cotton varieties to PGR application.
- In Less Responsive cotton varieties, the negative response to excessive growth that can occur from inadequate rates of PGR application is greater than in More Responsive cotton varieties (Figure 3).
- For this reason, understanding the PGR sensitivity of cotton varieties is essential in developing a management plan for the product planted on a given farm or field.

Legal Statements

The information discussed in this report is from a multiple site, 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.

ALWAYS READ AND FOLLOW PESTICIDE LABEL DIRECTIONS. 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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