Field Research Book

2018 Edition

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Welcome to the first edition of the Field Research Book provided by Bayer U.S. - Crop Science.

At Bayer, we take pride in delivering innovation to our farmer customers that helps address challenges, and improves profitability in a sustainable way. We recognize that adopting new technologies can be risky for farmers. Farmers need to know that a new product will perform on their farms, under their management practices. This book can serve as a tool for you as you plan for the future. Within these pages, you'll find agronomic research data developed by the Technology Development and Agronomy team. We hope this research will provide you greater confidence in our current products, and our product pipeline.

The Technology Development and Agronomy organization is focused on defining placement and management recommendations of our products and systems to help ensure that our customers get the most out of the technology. We understand the importance of local data to address local issues, that's why we have over 225 people conducting field research across hundreds of locations conducting numerous research trials. These trials are setup to test our vast product offerings across a wide range of environments. We analyze the data with a team of scientists to unlock insights, and to develop our product and system recommendations. This book highlights some of the findings gathered by our organization during the 2017 growing season, and provides further understanding into how our products perform, and how you can manage for maximum profitability.

The Technology Development and Agronomy Organization is dedicated to helping farmers address their agronomic issues, and we anticipate this book will serve as another tool for you as you prepare for the 2019 season by providing you new insights that you can apply to your farm.

We welcome your feedback. Let us know what additional research would be valuable to your farm, what challenges you face and how we can improve to better serve you. We cannot be successful without the success of our customers.

Thank you for your support and we wish you success in 2019.

John Chambers
North America Regional Market Development Head
Bayer U.S. - Crop Science


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ANSWER
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How to Use This Book

The reports that follow provide helpful insights from Bayer Technology Development and Agronomy about production practices or management tools that may be beneficial to your operation. The book is primarily arranged by crop in this order: corn, cotton, then soybean.

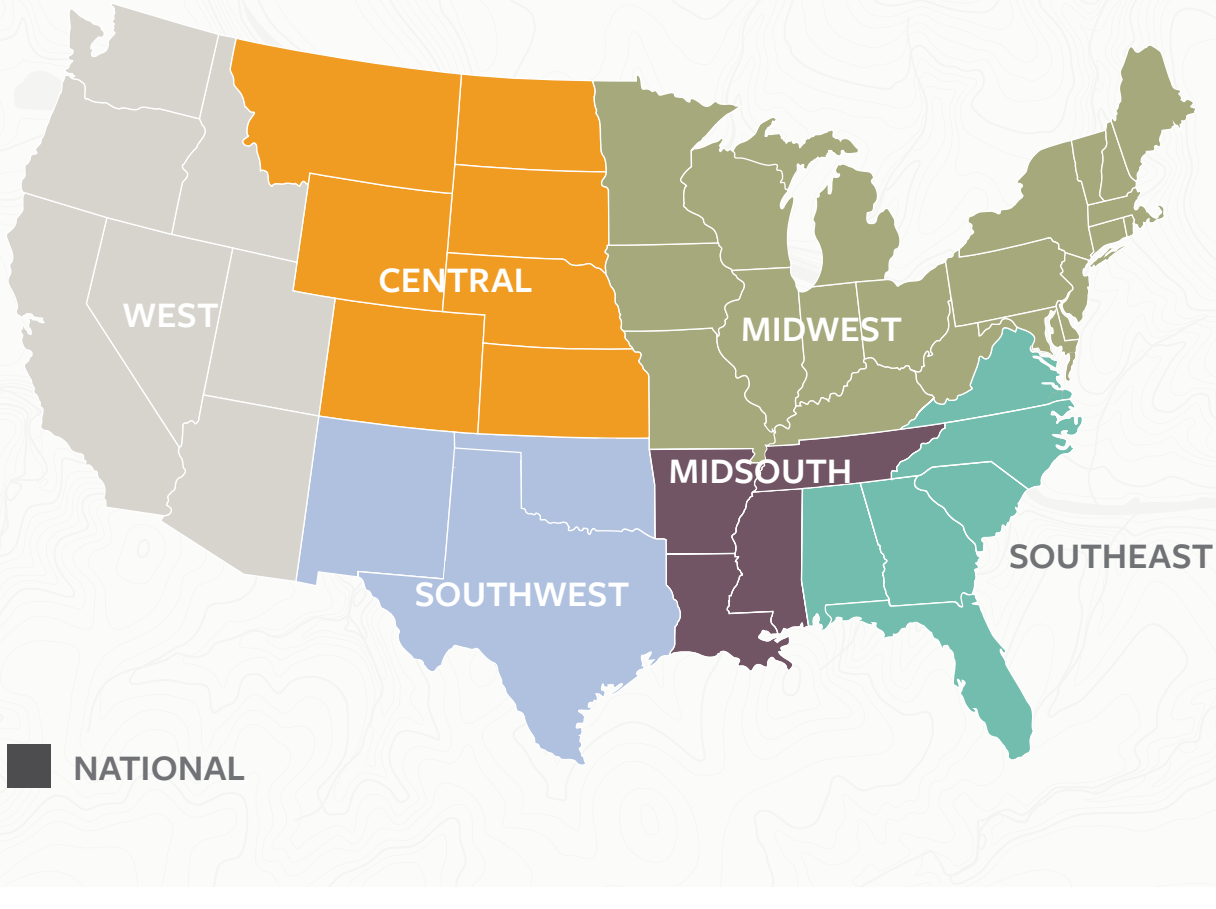
Category:

Each report is then tagged with one of these icons to quickly show you what it's about.

Topic and Region:

There's a wide range of diversity represented in these research reports, so to offer you even more insight, the colored tabs also identify a topic and region where the research took place. The map below shows you specific regions.

Region Map:



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Corn Research

Corn Product Yield Advancements

SUSTAINABILITY SPOTLIGHT

Today, plant breeding provides the foundation for seed science. Plant breeding techniques also help contribute to the incredible efficiency of modern agriculture. A breeder's goal is to find solutions for many different regions, soil types, and climates. They use their knowledge of seed genetics to make selections that combine the best features of two parent plants.

TRIAL OVERVIEW >

- Corn products are being commercialized at a fast pace as Monsanto's robust breeding pipeline delivers new products that are designed to increase yield potential and decrease the risk of issues like disease, lodging, and poor emergence. Products may only be on the market for three to five years before they are replaced with a new advancement.
- This study was designed to address the question of whether more recent products are significantly better than older products under the growing conditions on the Great Plains.

TABLE 1. CORN PRODUCT DETAILS

Newer corn products	Year of launch	Trait package	Older corn products	Year of launch	Trait package
110RM-A	2016	SSRIB	113RM-B	2006	CONV
114RM-A	2016	SSRIB	111RM-A	2007	VT3
110RM-B	2013	SSRIB	113RM-C	2011	VT3PRIB
113RM-A	2017	SSRIB	106RM-B	2011	SSRIB
106RM-A	2016	SSRIB	110RM-C	2001	CONV
114RM-B	2013	SSRIB			

CONV = Conventional, SSRIB = SmartStax® RIB Complete® corn blend, VT3 = YieldGard VT Triple®, VT3PRIB = Genuity® VT Triple PRO® RIB Complete® corn blend

RESEARCH OBJECTIVE >

- To evaluate the performance of older corn products (released between 2001 and 2011) and more recent corn products (released between 2013 and 2017) under two irrigation treatments and two seeding densities.

LOCATION	SOIL	PREVIOUS CROP	TILLAGE TYPE	PLANTING DATE	HARVEST DATE	POTENTIAL YIELD/ACRE	PLANTING RATE/ACRE
Gothenburg, NE	Hord silt loam	Soybean	Strip tillage	05/08/2017	10/24/2017	250 bu/acre	28,000 and 36,000 seeds/ acre

Corn Product Yield Advancements

SITE NOTES >

- The study was a split-plot design with irrigation as the whole plot and seeding rate as the subplot and had four replications.
- Eleven corn products were utilized with RMs ranging from 106 to 114 (Table 1).
- Two irrigation treatments were utilized: 100% full irrigation (FI) to meet the evapotranspiration needs of the crop and 25% of FI, amounting to 9.2 and 2.7 inches of irrigation, respectively.
- The number of barren plants and plants that died prematurely were counted in each plot prior to harvest.

UNDERSTANDING THE RESULTS >

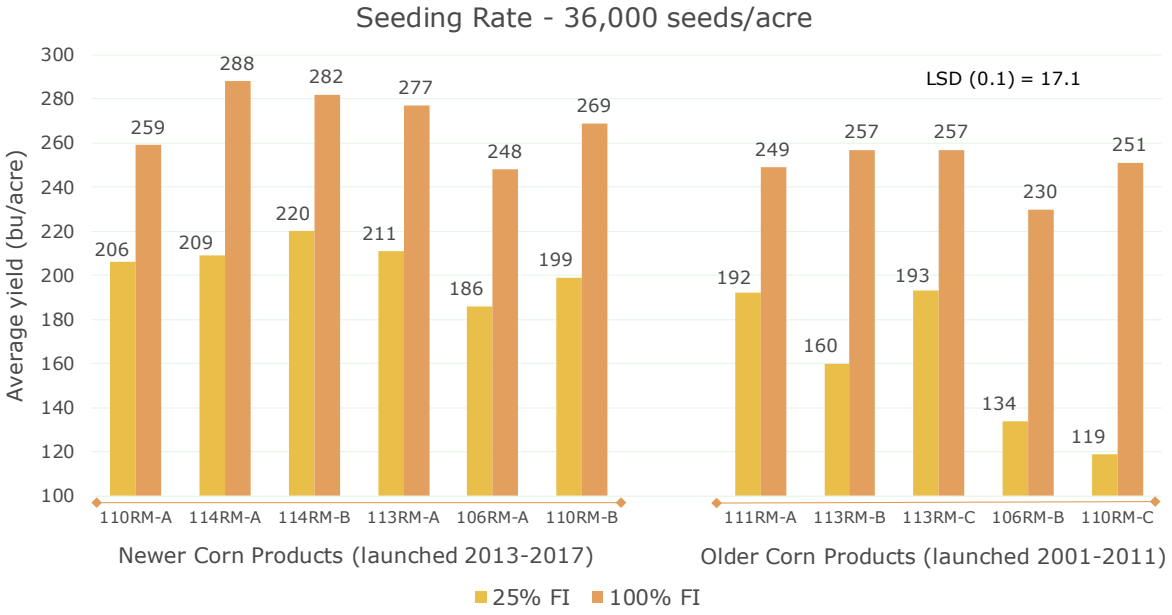


Figure 1. Yields by irrigation treatment at the 36,000 seeds/acre seeding rate

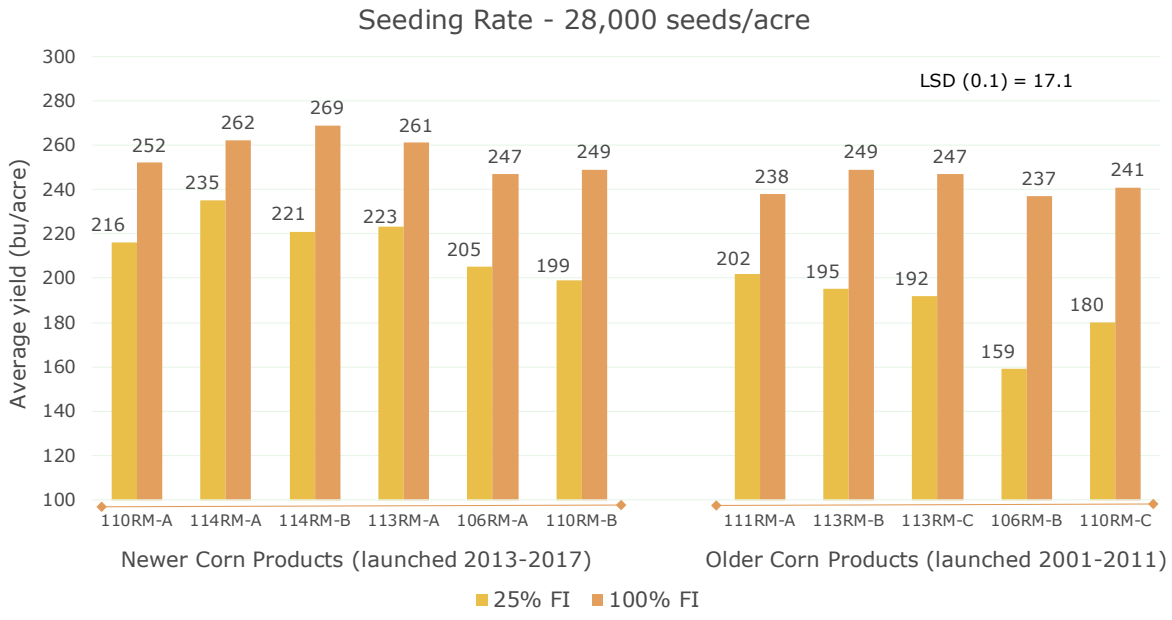


Figure 2. Yields by irrigation treatment at the 28,000 seeds/acre seeding rate

Corn Product Yield Advancements

Figure 3. Comparison of ears from the newer (bottom, launched between 2013-2017) and older (top, launched between 2001-2011) corn products

- Overall, average yield was higher for the newer corn products compared to the older corn products at the 100% and 25% FI treatments.
- The newer corn products tested yielded more at higher seeding rates regardless of irrigation environment.
- Corn product stability improved for the newer products in both seeding rates. This is highlighted in the 25% FI environment in which the older 110RM-C product yielded 119 and 180 bu/acre at the 36,000 and 28,000 seeds/acre seeding rate, respectively, while the newer 110RM-B product yielded 199 and 199 bu/acre at the 36,000 and 28,000 seeds/acre seeding rate, respectively. In this example, the newer corn product had higher yields overall and did not have a significant reduction in yield at the higher seeding rate like the older corn product did.
- There was an interaction between corn product, seeding rate, and irrigation environment for barren plants and plants that died prematurely. The general trends across seeding rates and irrigation environments were that:
  - Newer corn products had less barren plants, ranging from 0.6 to 1.8 barren plants/plot compared to the older corn products that had 1.4 to 6.5 barren plants/plot.
  - Newer corn products had less plants that died prematurely, ranging from 0.3 to 0.8 dead plants/plot compared to older corn products that ranged from 0.8 to 6.3 dead plants/plot.

WHAT DOES THIS MEAN FOR YOUR FARM?

- Farmers can be confident that newer corn products will likely perform better than older corn products across different irrigation environments and seeding rates. Proper placement of these products will provide a better opportunity for farmers to realize higher yield potential.
- Significant improvement has been made in the ability of the newer corn products tested to yield more in water-limited environments compared to older corn products. This is visually demonstrated in Figure 3 in which ears were collected from 17 feet of row for the newer 110RM-B product (bottom) and the older 110RM-C product (top) in the 25% FI treatment. The newer product had larger ears and a greater number of completely filled ears compared to the older product. This likely stems from the newer product's ability to better pollinate under stressful conditions.

Corn Product Performance Influenced by Seeding and Irrigation Rate

TRIAL OVERVIEW >

- Managing irrigated corn production is intensive and demanding as farmers try to extract value out of every input.
- There are many interactions in the field that impact yield potential, including seeding rate, irrigation environment, and corn product. This study was designed to evaluate the interaction of these factors on the yield potential of different corn products.

RESEARCH OBJECTIVE >

- Evaluate the effect of different seeding rates under full and limited irrigation on corn product yield potential to aid producers in selecting the optimal corn products and planting populations for the irrigation environment on their farm.

LOCATION	SOIL	PREVIOUS CROP	TILLAGE TYPE	PLANTING DATE	HARVEST DATE	POTENTIAL YIELD/ACRE	PLANTING RATE/ACRE
Gothenburg, NE	Hord silt loam	Corn	Conventional	05/07/2017	11/01/2017	240 bu/acre	24K, 30K, 36K, and 42K

SITE NOTES >

21 corn products were tested with RM ranging from 105 to 116.

- Two irrigation rates were used:
  - 100% full irrigation (FI) to meet the evapotranspiration demands of the crop (totaling 6 inches)
  - 50% of FI (totaling 3 inches)
- Irrigation treatments were applied using a variable rate irrigation system.
- The study design was a split-split plot with irrigation as the whole plot, corn product as the first split, and planting density as the second split.
- Watermark granular matrix soil moisture sensors were installed before tassel to track soil moisture.
- Weeds were controlled uniformly across the study and no fungicides or insecticides were applied.

UNDERSTANDING THE RESULTS >

- There was a general trend across corn products for higher yields at the 36,000 or 42,000 seeds/acre seeding rates.
  - For the 100% FI treatment, 42,000 seeds/acre provided the highest yield potential.
  - For the 50% FI treatment, 36,000 seeds/acre provided the highest yield potential.
- The response of some corn products differed from the generalized trend. For example, the 114RM-B product yielded the highest at 30,000 seeds/acre at both irrigation rates.

Corn Product Performance Influenced by Seeding and Irrigation Rate

WHAT DOES THIS MEAN FOR YOUR FARM?

- Farmers should select corn products that have shown good performance in the seeding rate and irrigation environments on their farm.
- Producers should work with their local seed sales team to identify how their branded corn products performed in this study.

TABLE 1. CORN PRODUCT PERFORMANCE INFLUENCED BY SEEDING RATE AND IRRIGATION

Corn product	Seeding Rate (seeds/acre)				Average
	24K	30K	36K	42K	
	------- Average yield (bu/acre) -------				
105RM-A	**200**	**207**	**216**	**214**	**209**
100% FI	202	217	217	230	216
50% FI	196	187	214	182	195
105RM-B	**202**	**215**	**225**	**231**	**218**
100% FI	207	232	231	248	229
50% FI	198	197	219	214	207
106RM-A	**197**	**214**	**231**	**232**	**218**
50% FI	197	214	231	232	218
106RM-B	**202**	**206**	**226**	**225**	**215**
100% FI	202	223	235	243	226
50% FI	201	190	217	208	204
108RM-A	**206**	**220**	**215**	**210**	**213**
100% FI	213	235	233	229	228
50% FI	198	204	196	192	197
108RM-B	**209**	**240**	**232**	**225**	**226**
100% FI	217	247	239	253	239
50% FI	200	232	224	197	213
109RM	**194**	**214**	**213**	**225**	**212**
100% FI	211	237	231	252	233
50% FI	176	192	194	199	191
110RM-A	**210**	**230**	**240**	**235**	**229**
100% FI	219	245	261	253	245
50% FI	201	215	218	217	213
110RM-B	**205**	**227**	**233**	**235**	**225**
100% FI	208	228	235	242	228
50% FI	203	227	231	228	222
110RM-C	**194**	**206**	**209**	**209**	**204**
100% FI	196	209	198	212	204
50% FI	192	203	220	206	205
112RM-A	**193**	**205**	**205**	**202**	**201**
100% FI	183	204	219	194	200
50% FI	203	206	191	210	202
112RM-B	**205**	**220**	**230**	**214**	**217**
100% FI	218	234	249	229	232
50% FI	192	206	210	198	202
112RM-C	**203**	**232**	**228**	**228**	**223**
100% FI	211	247	251	265	243
50% FI	194	218	205	191	202
113RM-A	**204**	**232**	**231**	**225**	**223**
100% FI	212	239	240	243	233
50% FI	196	226	222	207	213
113RM-B	**187**	**204**	**199**	**194**	**196**
100% FI	179	213	211	199	200
50% FI	196	195	188	189	192
113RM-C	**207**	**223**	**208**	**223**	**215**
100% FI	219	246	233	263	240
50% FI	195	200	183	184	190
113RM-D	**210**	**220**	**240**	**219**	**222**
100% FI	207	212	230	216	216
50% FI	213	228	250	222	228
114RM-A	**220**	**234**	**244**	**249**	**237**
100% FI	237	260	253	268	255
50% FI	203	208	235	231	219
114RM-B	**212**	**241**	**234**	**240**	**232**
100% FI	222	253	246	252	243
50% FI	202	230	221	227	220
115RM	**223**	**244**	**256**	**261**	**246**
100% FI	232	247	259	274	253
50% FI	214	241	252	249	239
116RM	**233**	**257**	**260**	**262**	**252**
100% FI	234	265	271	294	262
50% FI	232	250	249	245	244
Average	**206**	**224**	**228**	**227**	**221**

Impact of Irrigation Environment on Corn Product Performance

SUSTAINABILITY SPOTLIGHT

In the latest irrigation systems, these sensors are even helping deliver certain levels of automation. After rainfall, they can suggest revising scheduled irrigation—by either holding off, or reducing the amount of water applied to the field. This valuable data enables farmers to use only what is needed, and not a drop more.

TRIAL OVERVIEW >

- There are many different irrigation environments across the Great Plains. In some areas, water applications are restricted by pumping capacity or by allocation, but there are still many fully-irrigated fields.
- Farmers need information on how corn products perform in various irrigation environments to help them choose the best products for their fields.

RESEARCH OBJECTIVE >

- This study was set up to evaluate corn product performance in various irrigation environments.

LOCATION	SOIL	PREVIOUS CROP	TILLAGE TYPE	PLANTING DATE	HARVEST DATE	POTENTIAL YIELD/ACRE	PLANTING RATE/ACRE
Gothenburg, NE	Hord silt loam	Corn	Conventional	05/07/2017	11/01/2017	240 bu/acre	34,000 seeds/acre

SITE NOTES >

- Four irrigation rates were used: 100% full irrigation (FI) to meet the irrigation needs of the crop, 70%, 50%, and 20% FI.
- The irrigation rates were achieved using a variable rate irrigation system installed on a linear move overhead sprinkle system.
- Rainfall amounted to: May 2.53 in., June 0.75 in., July 1.52 in., August 3.63 in., and September 2.4 in., totaling 10.83 in.
- 15 corn products were tested with RM ranging from 101 to 116.
- The study design was a split plot with irrigation rate as the whole plot with two replications.
- Weeds were uniformly controlled across the study and no insecticides or fungicides were applied.

TABLE 1. IRRIGATION TREATMENTS

Irrigation treatment	Irrigation amount	Total moisture (irrigation + precipitation)
	------- Inches -------	
100% FI	6.0	16.83
70% FI	4.2	15.03
50% FI	3.0	13.83
20% FI	1.2	12.03

Impact of Irrigation Environment on Corn Product Performance

UNDERSTANDING THE RESULTS >

- As expected, corn product performance was impacted by irrigation rate with higher yields observed under 100% FI, indicating that water stress reduced yield.
  - On average, 70% FI yielded 93% of the 100% FI treatment.
  - On average, 50% FI yielded 89% of the 100% FI treatment.
  - On average, 20% FI yielded 75% of the 100% FI treatment.
- The corn products that provided consistent performance across irrigation treatments were 105RM-A, 110RM-B, and 113RMA (highlighted in Table 2).
- Corn product 106RM-A had consistent performance at the 70% and 50% FI treatments, but yield decreased significantly at the 20% FI treatment when compared to 100% FI (noted in Table 2).
- Corn product 116RM had a high yield at the 100% FI treatment, but had reduced yields at the other irrigation treatments.
- This product should be well suited for fully-irrigated ground.

TABLE 2. CORN PRODUCT PERFORMANCE AFFECTED BY IRRIGATION ENVIRONMENT (AVERAGE OF THE TWO REPS)

Corn product	Yield 100% FI (bu/acre)	70% FI		50% FI		20% FI		Product average (bu/acre)
		Yield (bu/acre)	% of 100% FI	Yield (bu/acre)	% of 100% FI	Yield (bu/acre)	% of 100% FI	
101RM	178	142	80	148	83	111	63	**145**
105RM-A	218	198	91	210	97	209	96	**209**
105RM-B	231	209	90	201	87	160	69	**200**
106RM-A	237	240	101	211	89	156	66	**211**
106RM-B	238	229	96	190	80	166	70	**205**
108RM	231	214	93	186	81	168	73	**200**
109RM	234	210	90	198	85	174	74	**204**
110RM-A	242	233	96	208	86	181	75	**221**
110RM-B	210	225	107	191	91	188	89	**206**
112RM-A	245	224	91	242	99	178	73	**222**
112RM-B	243	225	92	222	91	178	73	**223**
113RM-A	230	216	94	228	100	207	90	**220**
113RM-B	209	205	98	189	90	156	74	**190**
114RM	249	237	95	214	86	159	64	**215**
116RM	259	218	84	225	87	208	80	**227**
Treatment average	**230**	**215**	**93**	**204**	**89**	**173**	**75**	

WHAT DOES THIS MEAN FOR YOUR FARM?

- As new corn products come to the market, this type of research provides valuable information on the correct placement of these products to provide the best opportunity for a successful crop.
- Branded information to identify these corn products can be acquired from your local Monsanto seed sales team.

Corn Product Response to Irrigation Management

TRIAL OVERVIEW >

- Farmers use a variety of irrigation management practices to irrigate their corn crop based on the water availability of their irrigation systems. There may be limitations on the amount of water that can be pumped by the well or the irrigation water may need to be shared across multiple crops.
- Regardless of the reason, farmers would like to know how corn products respond to different irrigation management strategies.

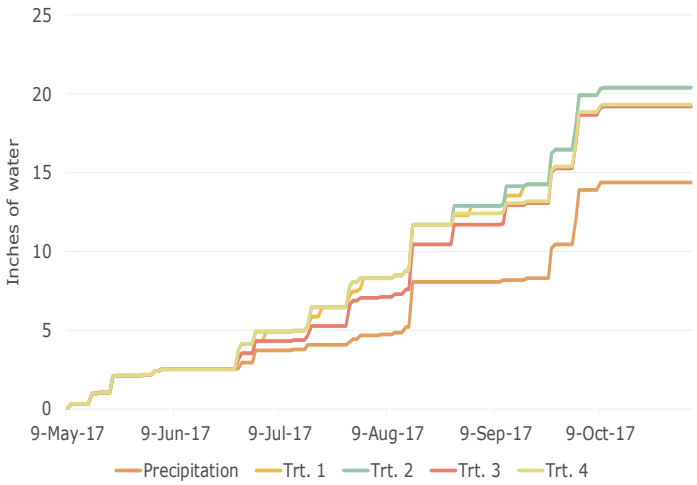


Figure 1. Precipitation and irrigation accumulated in each treatment throughout the growing season

RESEARCH OBJECTIVE >

- The study evaluated the impact of different irrigation management strategies on multiple corn products.

LOCATION	SOIL	PREVIOUS CROP	TILLAGE TYPE	PLANTING DATE	HARVEST DATE	POTENTIAL YIELD/ACRE	PLANTING RATE/ACRE
Gothenburg, NE	Hord silt loam	Corn	Conventional	05/07/2017	10/27/2017	240 bu/acre	34,000 seeds/acre

SITE NOTES >

- 22 corn products with RM ranging from 100 to 114 were planted on irrigated, conventional-tilled ground previously planted to corn.
- Four different irrigation treatments were applied:
  - Treatment 1: 100% full irrigation (FI) to meet the evapotranspiration demands of the corn crop; 10 applications of 0.6 in/pass totaling 6.0 in.
  - Treatment 2: 100% FI; 5 applications of 1.2 in/pass totaling 6.0 in.
  - Treatment 3: 60% FI early (up to V16) followed by 100% FI late; 5 applications totaling 4.72 in.
  - Treatment 4: 100% FI early followed by 60% FI late (after R2); 5 applications totaling 4.92 in.

Corn Product Response to Irrigation Management

- The trial was set up as a randomized split-plot with irrigation treatment as the whole plot and corn product as the subplot with 4 replications.
- Weeds were controlled uniformly across the study and no insecticide or fungicide applications were needed.

UNDERSTANDING THE RESULTS >

- Corn products performed differently in the irrigation treatments. Some corn products lost a significant amount of yield if they were stressed early. Other corn products showed no difference in yield across the irrigation treatments.
- Corn product performance was classified into five categories based on yield:
  - A) Avoid early-season water stress
  - B) Avoid late-season water stress
  - C) Consistent response across all irrigation treatments
  - D) Handles late-season water stress
  - E) Prefers 0.6 inch/pass applications and handles late-season water stress

Figure 2. Corn product examples for the five irrigation management categories

Corn Product Response to Irrigation Management

TABLE 1. CATEGORIZATION OF THE DIFFERENT CORN PRODUCTS BASED ON AVERAGE YIELD IN THE DIFFERENT TREATMENTS.

Category A	Category B	Category C	Category D	Category E
106 RM	113 RM-A	110 RM-A	105 RM-A	112 RM-B
112 RM-A		110 RM-B	112 RM-C	111 RM-A
105 RM-B		113 RM-B	103 RM	
109 RM-A		114 RM-A		
114 RM-B		100 RM		
111 RM-B		113 RM-C		
108 RM-B		104 RM		
		111 RM-C		
		108 RM-A		

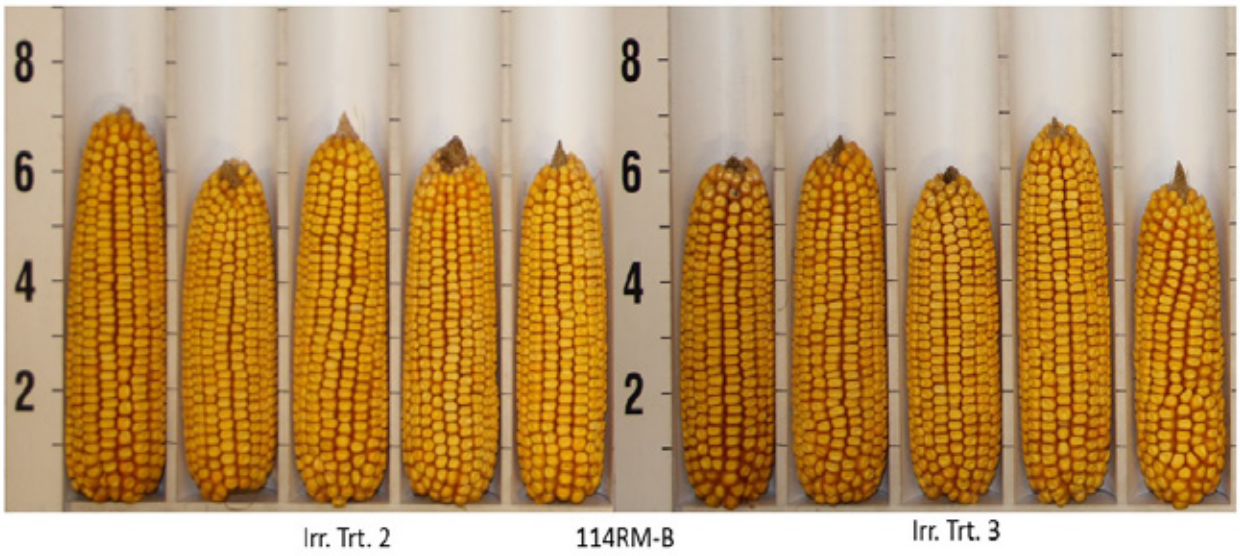


Figure 3. Corn ears from the 114 RM-B corn product.

Corn Product Response to Irrigation Management

Figure 4. Corn ears from the 104 RM corn product showing performance across treatments.

- A majority of corn products fell into category A, where the product had a negative response to early-season stress, or category C, where the product had a consistent response across irrigation treatments (Figures 3 & 4).
- The lone corn product in category B was unique as all other corn products could handle late-season stress.
- For categories D and E, there were some slight differences, but the corn products in both categories had high yields when the corn product was exposed to late-season stress. The corn products in category E also yielded higher when 0.6 inch of water was applied per pass compared with all the other categories.

WHAT DOES THIS MEAN FOR YOUR FARM?

- Corn products do respond differently to different irrigation management strategies.
- Producers should work with their local seed sales team to identify a corn product that will work with their irrigation system.
- Ask your agronomist how their branded corn products performed in this study.

Corn Seed Product Response to High pH Soils

TRIAL OVERVIEW

- High pH soil is generally classified as having a pH of 7.6 or higher and may be caused by several different factors including excess lime, high soluble salt concentration, and high nitrate-nitrogen concentration.
- In Western Kansas and Eastern Colorado, excess lime from high calcium carbonate concentration in the soil parent material is the factor contributing to high pH soils which are found on eroded sidehills and cut areas in fields.
- Corn seed products often respond differently in high pH soils as some products are more tolerant to these conditions while others may be susceptible.
- Crops growing in high pH soils may express iron deficiency chlorosis (IDC). IDC symptoms include overall pale-yellow color, leaf interveinal chlorosis, and stunted growth.1 Also, the availability of key nutrients to the crop may be reduced in high pH soil conditions.

RESEARCH OBJECTIVE

- The objective of the trial was to evaluate the visual response of corn products planted in neutral pH (5.8 to 7.5) soils and high pH (7.6+) soil conditions. Improved product characterization allows for better product placement to help maximize yield potential.

LOCATION	SOIL	PREVIOUS CROP	TILLAGE TYPE	PLANTING DATE	HARVEST DATE	POTENTIAL YIELD/ACRE	PLANTING RATE/ACRE
Bethune, CO	Silt loam	Soybean	Strip-till	05/06/2017	11/04/2017	220 bu/acre	34,000 seeds/acre
Burlington, CO	Silt loam	Corn	Strip-till	05/07/2017	11/05/2017	220 bu/acre	34,000 seeds/acre
Bethune, CO	Silt loam	Corn	Strip-till	05/07/2017	11/04/2017	220 bu/acre	34,000 seeds/acre

SITE NOTES:

- Nine corn brand blend seed products were planted in two separate blocks in the same field at each location.
- One block had a neutral pH soil (5.8 – 7.5 pH) and one block had a high pH soil (7.6+). Soil pH was determined by collecting 28 soil samples on a grid pattern for each soil pH block at each location.
- Soil pH range for the Bethune, Colorado site planted after soybean was 6.0 to 8.7. Soil pH range for the Burlington, Colorado site was 7.5 to 8.3. Soil pH range for the Bethune, Colorado site planted after corn was 5.8 to 8.4.
- Each block contained two replications of the set of corn brand blend seed products.
- A visual color rating was taken at the V8 (8 visible leaf collars) growth stage. The color scale ranged from a very dark green which was rated 2 to a pale-yellow color that was rated 8. These ratings were then broken into three separate seed product placement recommendations: Highly Recommended, Recommended in Most Situations, and Use with
- Appropriate Management for high pH soil field conditions.

Corn Seed Product Response to High pH Soils

UNDERSTANDING THE RESULTS

brand blend products	Neutral pH Average Yield (bu/acre)	High pH Average Yield (bu/acre)
A	208.2	191.3
B	242.8	194.9
C	207.4	189.4
D	223.4	200.5
E	224.5	191.9
F	232.9	193.7
G	215.9	199.2
H	237.2	221.3
I	236.4	225.4

Use with Appropriate Management — Highly Recommended

Figure 1. Brand blend product yields and recommendations for neutral pH soil and high pH soil conditions.

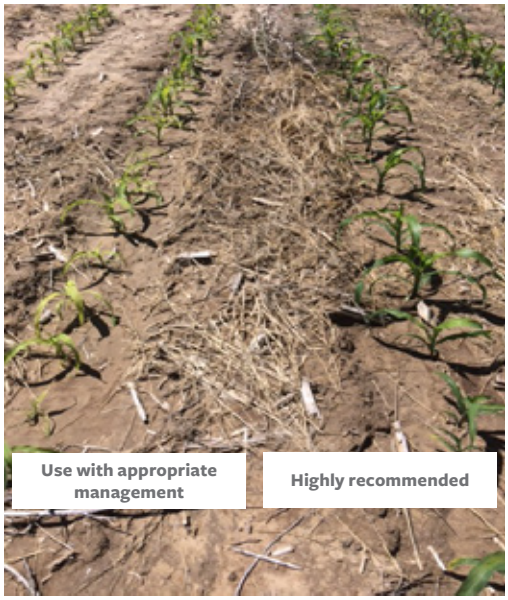


Figure 2. IDC symptoms (left) and IDC tolerant products (right) in high pH soil conditions.

- All brand blend products did not exhibit any visual IDC symptoms when planted in neutral pH soil conditions.
- Five brand blend products (A, E, F, G, I) handled high pH soil conditions very well; maintaining a dark-green, healthy plant color.
- Three brand blend prodcts (C, D, H) handled the high pH soil conditions reasonably well but were slightly paler in color compared to being planted in neutral pH soils.
- Product B brand blend should be used with caution when planting in high pH soils.
- High pH soils at the demonstration sites had issues with eroded top soil, topography, and irrigation runoff which also impacted yield potential. These additional factors make a true "1 to 1" yield comparison only based on soil pH levels difficult to achieve.

WHAT DOES THIS MEAN FOR YOUR FARM?

- High pH soils are typically found in areas with eroded top soil and topography changes that make a direct yield comparison of how various seed products perform under high pH soils versus neutral pH soil conditions difficult to achieve. Producers may want to keep this in mind when making product comparisons on their farm.
- The importance of selecting a corn seed product that can tolerate high pH soil conditions can vary due to the proportion of acres in each field that have high pH soils. For example, a field that is primarily comprised of high pH soils, selection of an IDC tolerant product will be key, whereas in a field comprised of only 1% high pH soils, seed product selection for IDC tolerance is less important.

Corn Seed Product Response to High pH Soils

- Corn seed product IDC tolerance by visual color rating is impacted by soil pH but can also be influenced by other factors such as soil temperature, nutrient availability, and nutrient uptake. Producers should assess all potential causes when assessing product performance under high pH soil conditions.

SOURCES

1 White, D.G. 1999. Compendium of corn diseases, third edition. 1999. The American Phytopathological Society, APS Press.

2 Kaiser, D.E., Lamb, J.A., and Bloom, P.R. 2011. Managing iron deficiency in soybean. AG-FO-08672-A. University of Minnesota Extension. http://www.extension.umn.edu/. Web

sources verified 11/29/17. 171026102202. 112917DLB

The Impact of Corn Seed Size and Shape on Yield Potential

TRIAL OVERVIEW >

- Every year, farmers must turn their attention to the seed they will be planting.
- Many farmers prefer a particular seed size and/or have had issues with a particular seed size in the past. However, as planters have improved in their ability to handle many different seed sizes, the question arises, "Does seed size and shape impact yield and stands?"

RESEARCH OBJECTIVE >

To determine if corn product seed size and shape has an impact on seedling emergence and yield.

LOCATION	SOIL	PREVIOUS CROP	TILLAGE TYPE	PLANTING DATE	HARVEST DATE	POTENTIAL YIELD/ACRE	PLANTING RATE/ACRE
Gothenburg, NE	Hord silt loam	Corn	Strip tillage	04/21/2017	10/24/2017	270 bu/acre	34,000 seeds/ acre

SITE NOTES >

- The following seed shapes and sizes were used in the study: AF (medium flats) 34.5 lb. unit, AF 40.0 lb. unit, AR (medium rounds) 43.0 lb. unit, AF2 (large flats) 48.5 lb. unit, and AR2 (large rounds) 59.0 lb. unit.
- A 110 RM SmartStax® RIB Complete® corn blend product was used.
- The study was conducted as a randomized complete block design with five treatments and six replications.
- Corn was seeded with a precision plot planter at a depth of 2.25 inches.
- Emergence stand counts were taken at five dates: May 11, 12, 13, 15, and 22, 2017.
- During the growing season, final stand count, barren plants, green-snapped plants, and the number of plants that died prematurely were recorded.
- Weeds were controlled uniformly throughout the season and no insecticides or fungicides were needed to control insects or diseases.

UNDERSTANDING THE RESULTS >

- No difference was observed in the number of barren plants, green-snapped plants, or plants that died prematurely between the different seed sizes.
- There were some differences in initial corn emergence between the different seed sizes, especially between the May 11 and May 12 stand counts (Figure 1), but the emergence numbers taken on May 22 were similar to the final stand count numbers reported in Table 1.
- There was a slight reduction in final stand counts when using the larger seed size.

The Impact of Corn Seed Size and Shape on Yield Potential

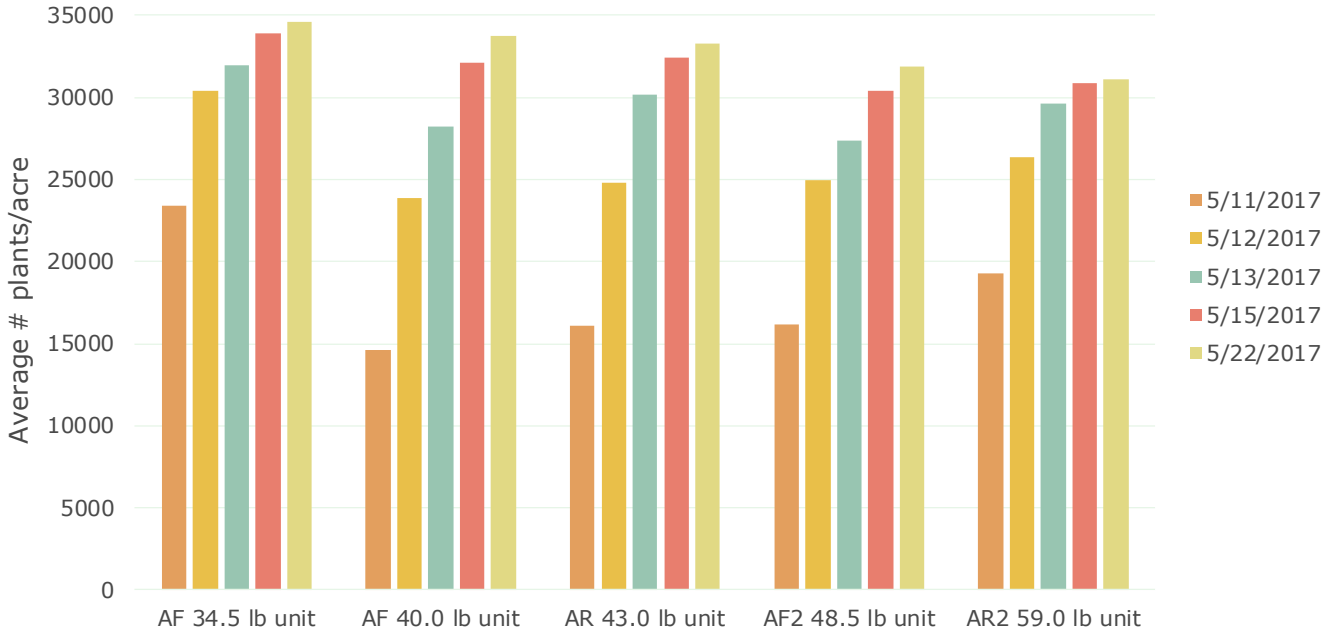


Figure 1. Average number of plants per acre counted on the five different dates

Figure 2. Plot photos: AF 34.5 lb. unit (left), AR 43.0 lb. unit (middle), and AR2 59.0 lb. unit (right).

The Impact of Corn Seed Size and Shape on Yield Potential

TABLE 1. IMPACT OF SEED SIZE ON YIELD AND FINAL STAND COUNT.

Seed Size	Average Yield (bu/acre)	Final Stand (plants/acre)
AF 34.5 lb unit	269.5	34,881
AF 40.0 lb unit	266.0	33,827
AR 43.0 lb unit	263.9	34,101
AF2 48.5 lb unit	268.6	33,173
AR2 59.0 lb unit	264.7	31,870*
LSD (0.1)	NS	1,641

**The larger seed may not have been planted properly by the planter. NS = non-significant.*

WHAT DOES THIS MEAN FOR YOUR FARM?

- This was a limited study evaluating seed size from one corn product at one location with six replications. However, the results from this study indicate that there was no difference in yield performance between the various seed sizes.
- For additional information on this subject, please read the Spotlight, The Impact of Corn Seed Size on Yield Potential.

High Input Corn Management

TRIAL OVERVIEW

- Every year, farmers question which inputs will give the highest return on their investment. To assist farmers with these decisions, a high input corn study was set up to evaluate the potential benefits of various inputs.

TABLE 1. TREATMENT LIST

Treatment	Fertility	Planting density (seeds/acre)	Fungicide
Normal management (NM)			
Base NM	180 lb/acre N at planting with coulter 60 lb/acre P, 25 lb/acre S, and 0.5 lb/acre Zn at planting with strip tillage	32K	None
Increased planting density	180 lb/acre N at planting with coulter 60 lb/acre P, 25 lb/acre S, and 0.5 lb/acre Zn at planting with strip tillage	**38K**	None
Reduced fertility (S and Zn)	180 lb/acre N at planting with coulter 60 lb/acre P at planting with strip tillage **No S or Zn applied**	32K	None
Split N application	**100 lb/acre N applied pre-plant with strip tillage, 80 lb/acre N sidedress injected at V7** 60 lb/acre P, 25 lb/acre S, and 0.5 lb/acre Zn at planting with strip tillage	32K	None
Added fungicide	180 lb/acre N at planting with coulter 60 lb/acre P, 25 lb/acre S, and 0.5 lb/acre Zn at planting with strip tillage	32K	**10 fl oz/acre Headline® AMP applied at VT**
Intensive management (IM)			
Base IM	Split N: 160 lb/acre N applied pre-plant with strip tillage, 80 lb/acre N sidedressed at V7 90 lb/acre P, 25 lb/acre S, and 0.5 lb/acre Zn applied with strip tillage	44K	10 fl oz/acre Headline® AMP applied at VT
Decreased planting density	Split N: 160 lb/acre N applied pre-plant with strip tillage, 80 lb/acre N sidedressed at V7 90 lb/acre P, 25 lb/acre S, and 0.5 lb/acre Zn applied with strip tillage	**38K**	10 fl oz/acre Headline AMP applied at VT
Reduced fertility	Split N: 160 lb/acre N applied preplant with strip tillage, 80 lb/acre N sidedressed at V7 90 lb/acre P applied with strip tillage **No S or Zn applied**	44K	10 fl oz/acre Headline AMP applied at VT
N applied all upfront	**240 lb/acre N applied with strip tillage** 90 lb/acre P, 25 lb/acre S, and 0.5 lb/acre Zn applied with strip tillage	44K	10 fl oz/acre Headline AMP applied at VT
No fungicide	Split N: 160 lb/acre N applied pre-plant with strip tillage, 80 lb/acre N sidedressed at V7 90 lb/acre P, 25 lb/acre S, and 0.5 lb/acre Zn applied with strip tillage	44K	**None**

Highlighted text indicates difference from previous treatment.
N = nitrogen, P = phosphorus (P_2O_5), S = sulfur, Zn = zinc

RESEARCH OBJECTIVE >

- To determine which inputs maximize irrigated corn yields and economic return.

LOCATION	SOIL	PREVIOUS CROP	TILLAGE TYPE	PLANTING DATE	HARVEST DATE	POTENTIAL YIELD/ACRE	PLANTING RATE/ACRE
Gothenburg, NE	Hord silt loam	Soybean	Strip tillage	04/20/2017	10/26/2017	280 bu/acre	32K, 38K, 44K

High Input Corn Management

SITE NOTES >

- This study consisted of low input (normal management, NM) and high input (intensive management, IM) base treatments with different inputs added or removed (Table 1).
- Three corn products were assessed: one 116 RM corn product and two 114 RM corn products. Each product was tested with each treatment totaling 30 treatments.
- Treatments were randomized with four replications.
- Weeds were managed uniformly across the study and no insecticide was applied.
- Soil test: organic matter 3.0%, pH 6.6, nitrogen (N) - 40 lbs/acre residual in 2 ft., phosphorus (P) - 39 ppm MP3, sulfur (S) - 26 ppm, zinc (Zn) - 2.0 ppm.
- Plants that died prematurely, green-snapped plants, stalk-lodged plants, and root-lodged plants per plot were recorded prior to harvest.

UNDERSTANDING THE RESULTS >

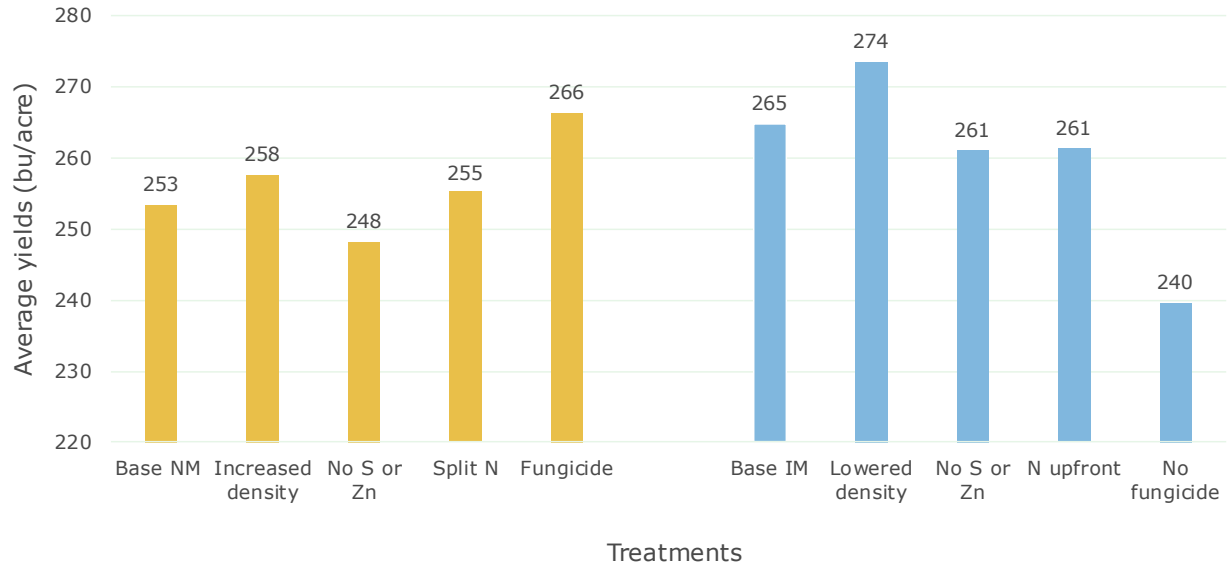


Figure 1. Average corn yields in the different treatments

YIELDS >

- Individual corn products did not respond differently to treatments so results are summarized across treatments.
- A fungicide application at VT provided the most value in terms of yield.
  - When added, the fungicide application increased yield by 13 bu/acre over the base NM system.
  - When the fungicide application was removed from the base IM system, yields decreased by 25 bu/acre.
  - A fungicide application at VT also increased yields in 2015 and 2016 demonstration trials as documented in previous Learning Center Reports.

High Input Corn Management

- Neither the split N application nor additional S and Zn significantly affected yields.
  - In a 2015 Learning Center Report, adding S and Zn increased yields.
  - In a 2017 Learning Center Report, a split application of N increased yield when applied through a subsurface drip irrigation system.
  - The soil in this trial had relatively high fertility levels based on the soil test, indicating that corn products may not respond much to additional fertility.
- Across the different seeding rates, 38,000 seeds/acre provided the best performance.
  - In a 2016 Learning Center Report, the 44,000 seeds/acre rate increased yield significantly.

PLANT QUALITY >

- No differences were observed across treatments for green-snapped plants, plants that died prematurely, or stalk-lodged or root-lodged plants.

ECONOMICS >

- When using current corn prices of $3.00/bu, the treatment that provided the highest return over investment was the NM plus fungicide treatment. If corn prices increase, this treatment would continue to provide the greatest economic advantage up to a corn price of $9.00/bu.
- For the IM options, the IM without fungicide treatment would cost the farmer close to $140/acre relative to the NM plus fungicide treatment.

WHAT DOES THIS MEAN FOR YOUR FARM?

- Farmers should consider using a fungicide application at the VT growth stage as it has consistently provided value across multiple corn products and multiple years.
- Increasing seeding rate can increase yield and provide more value to the farmer as long as the seeding rate is increased on an appropriate corn product. Please consult your local seed sales team for individual corn product seeding rate recommendations.
- The value of other inputs, such as a split N application or additional S and Zn, have been more variable over the years.

Management Strategies for Improving Success in Dryland Corn Systems

SUSTAINABILITY SPOTLIGHT

No-till farming leaves the soil undisturbed. This practice allows residues on the surface of the ground to naturally decompose and build more topsoil to minimize erosion, and help manage weeds. In addition, no-till can sequester as much as 0.5 metric tons for carbon per year, helping to combat climate change.

TRIAL OVERVIEW >

- The success of dryland corn production depends upon the environment and management strategies employed by the farmer. The availability of soil moisture on rainfed acres is always a big driver of yield.
- Dryland farmers have no control over how much moisture the environment provides through rainfall; however, they can significantly influence how much moisture is retained by the soil, is available to the crop, and how that limited water can directly impact yield.

TABLE 1. DRYLAND CORN TREATMENTS

Treatment	Planting date	Tillage	Corn products	Weed control	Seeding rate (seeds/acre)
Poor management	6/09/17	Conventional tillage	111RM RRC2	Basic weed control program*	21,000
Early planting	**5/13/17**	Conventional tillage	111RM RRC2	Basic weed control program	21,000
Improved weed control	5/13/17	Conventional tillage	111RM RRC2	**Enhanced weed control program****	21,000
No tillage	5/13/17	**No tillage**	111RM RRC2	Enhanced weed control program	21,000
Insect protection traits	5/13/17	No tillage	**111RM VT2PRIB**	Enhanced weed control program	21,000
DroughtGard® Hybrids corn blend product	5/13/17	No tillage	**114RM DGVT2PRIB**	Enhanced weed control program	21,000
Increased population	5/13/17	No tillage	114RM DGVT2PRIB	Enhanced weed control program	**24,000**

Highlighted text indicates difference from previous treatment.
*Basic weed control program: PRE - 1 lb/acre atrazine; POST – 0.5 lb/acre atrazine + 0.25 lb/acre 2,4-D ester + 32 oz/acre Roundup PowerMAX® herbicide.
**Enhanced weed control program: PRE – 32 oz/acre Roundup PowerMAX herbicide + 0.5 lb/acre 2,4-D ester + 0.02 lb/acre saflufenacil; POST- 1 lb/acre atrazine + 2.5 pt/acre Harness® Xtra herbicide + 0.09 lb/acre mesotrione + 32 oz/acre Roundup PowerMAX herbicide.
RRC2 = Roundup Ready® Corn 2, VT2PRIB = VT Double PRO® RIB Complete® corn blend, DGVT2PRIB = DroughtGard® Hybrids with VT Double PRO® RIB Complete® corn blend

Management Strategies for Improving Success in Dryland Corn Systems

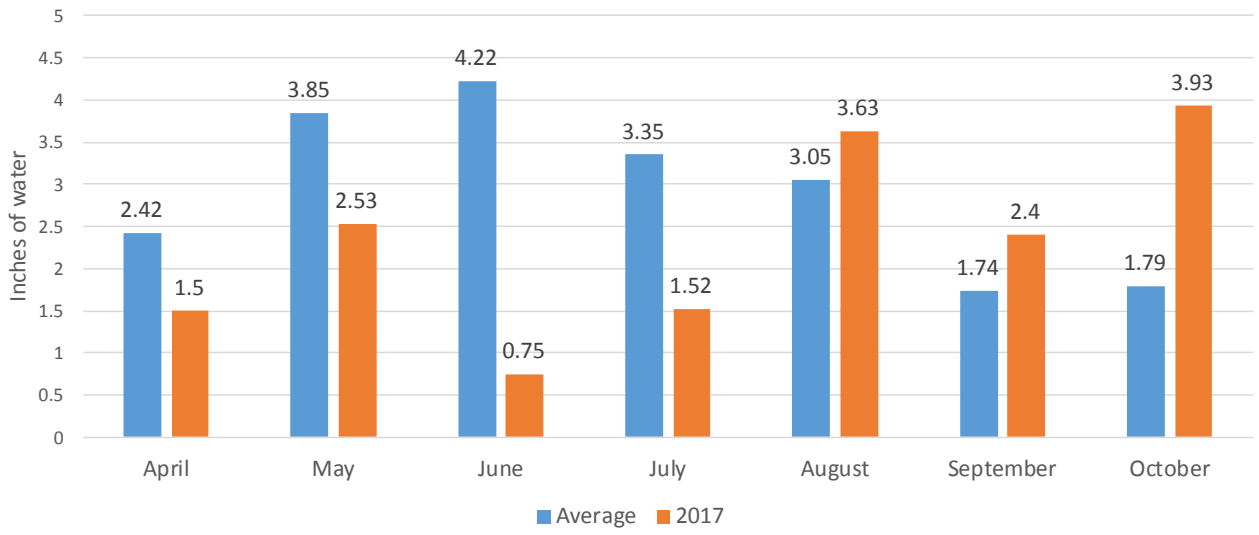


Figure 1. Precipitation in 2017 and average precipitation at the Gothenburg Learning Center, Gothenburg, NE

RESEARCH OBJECTIVE >

- A multi-factor study was initiated to evaluate the additive effects of various management components to manage water and help farmers produce high-yielding corn in a dryland system.

LOCATION	SOIL	PREVIOUS CROP	TILLAGE TYPE	PLANTING DATE	HARVEST DATE	POTENTIAL YIELD/ACRE	PLANTING RATE/ACRE
Gothenburg, NE	Hord silt loam	Winter wheat	Conventional tillage, no tillage		11/16/2017	175 bu/acre	1,000 and 24,000

SITE NOTES >

- This study consisted of various dryland management practices that can help improve yields and soil water retention.
- Subsequent treatments included the previous treatment plus an additional treatment creating a building block approach (Table 1).
- The study was a randomized complete block design with four replications.
- No insecticides or fungicides were applied.
- The number of barren plants, dropped ears, and lodged stalks per plot were assessed prior to harvest.

Management Strategies for Improving Success in Dryland Corn Systems

UNDERSTANDING THE RESULTS >

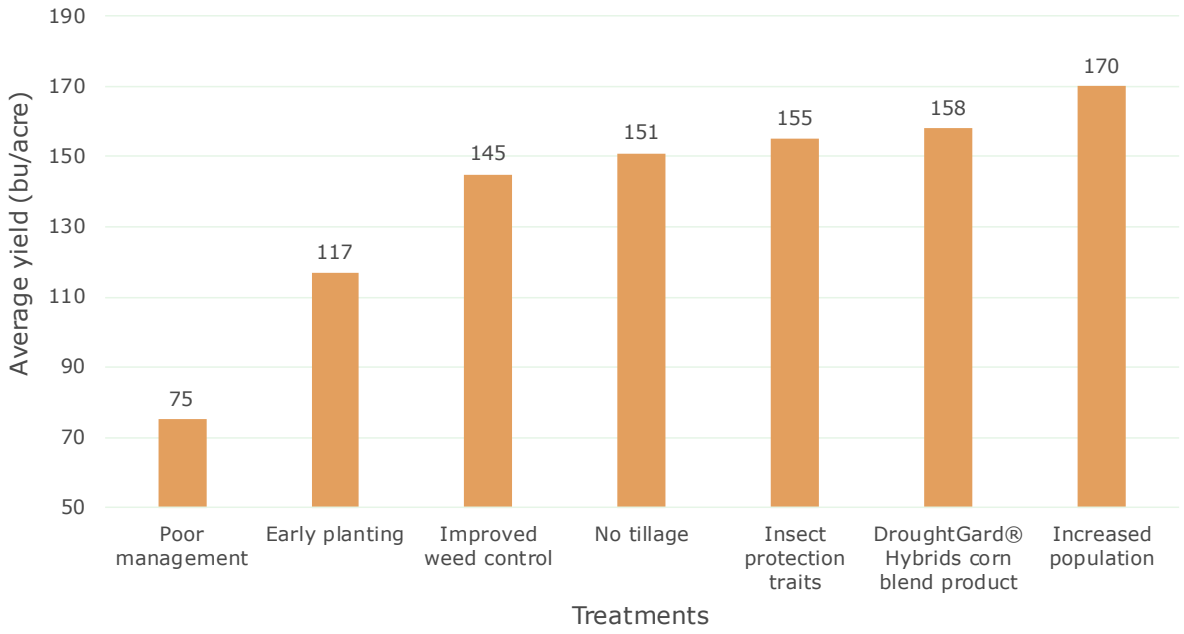


Figure 2. Average corn yield from the different treatments corrected to 15% moisture

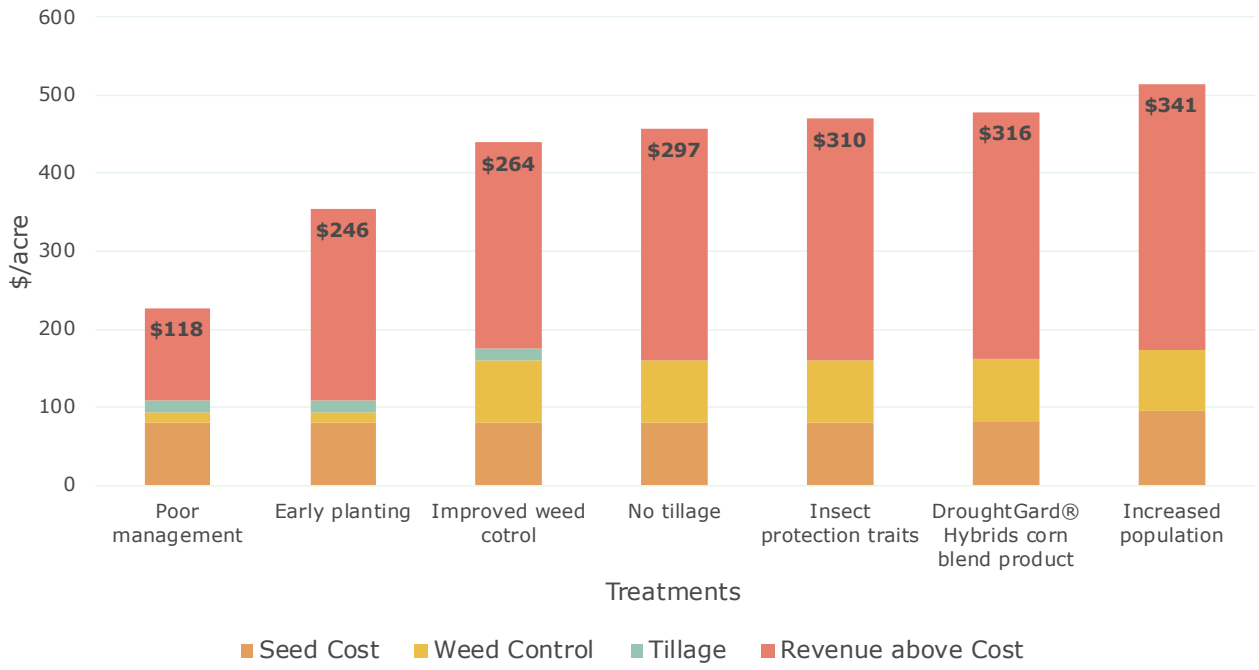


Figure 3. Input costs and net profits in $/acre for each treatment. Data labels reflect grain revenue at $3.03/bu minus the costs for seed, weed control, and tillage.

Management Strategies for Improving Success in Dryland Corn Systems

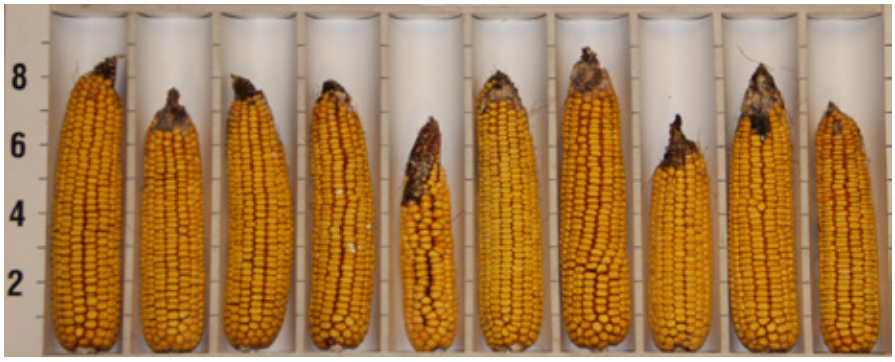


Figure 4. Corn ears from the Poor Management (top) and Increased Population (bottom) treatments

Figure 5. Excellent end-of-season weed control in the Increased Population treatment

- A significant increase in yield was observed from the earlier planting date, improved weed control, and increased population treatments (Figure 2).
  - Early planting: higher yields are typically observed from mid-May plantings compared to early to mid-June plantings. This was especially true in this case as dry conditions stressed plants early in the season due to below normal precipitation in June and July.
  - Weed control: an enhanced, layered weed control approach with a pre-emergence application with multiple modes of action followed by a post-emergence application with multiple modes of action provided the best opportunity to control weeds that compete with corn for soil moisture.
  - Increased population: the DroughtGard® Hybrids corn blend product performed well at the higher seeding rate in this challenging dryland environment.

Management Strategies for Improving Success in Dryland Corn Systems

- No differences were observed between treatments for the number of barren plants, dropped ears, or lodged stalks per plot.
- Better management not only led to higher yields, but also to higher profits in the study (Figure 3).
  - An earlier planting date increased revenue by more than $100/acre.
  - The remainder of the treatments produced smaller, yet still beneficial yield benefits.
- Weed control costs had the sharpest increase by going to a program with multiple modes of action, but revenue gains more than offset costs because of improved yields.

WHAT DOES THIS MEAN FOR YOUR FARM?

- Potential success for dryland corn systems involves managing all components of the system to maximize their benefit.
- Often, decisions in dryland fields can be more impactful than in irrigated fields because water cannot be applied to make up for moisture losses from tillage and poor weed control.
- Corn product selection and placement along with planting date and an enhanced weed control program are critical for success.

DroughtGard® Hybrids Technology Comparison

TRIAL OVERVIEW >

- Dryland/rainfed environments can be highly variable. Farmers look at the long-term weather forecast, stored soil moisture,
- and production practices to make the best decision they can on what crop will be the most viable and profitable in the environment.
- Farmers look for corn products that can adapt to and yield across a wide range of environments.
- DroughtGard® Hybrids corn products were developed for this type of situation. They combine drought-tolerant germplasm with the industry's only biotech trait for drought tolerance, which improves the ability of the corn plant to handle water stress.
- The biotech trait was released in 2012 and has been deployed in various corn products since.

RESEARCH OBJECTIVE >

- To evaluate the performance of DroughtGard Hybrids corn products compared to AQUAmax® competitive corn products in a dryland environment in south central Nebraska.

LOCATION	SOIL	PREVIOUS CROP	TILLAGE TYPE	PLANTING DATE	HARVEST DATE	POTENTIAL YIELD/ACRE	PLANTING RATE/ACRE
Gothenburg, NE	Hord silt loam	Winter wheat	No tillage	05/13/2017	11/10/2017	210 bu/acre	″22,000 seeds/acre″

SITE NOTES >

- In 2016, winter wheat yields were approximately 90 bu/acre, providing excellent residue cover for water conservation in the trial. Approximately 4 feet of stored soil moisture was available at planting amounting to about 8 inches of plantavailable water. Rainfall amounted to: May 2.53 in., June 0.75 in., July 1.52 in., August 3.63 in., and September 2.4 in.
- The study was a randomized complete block with three replications.
- Study plots were large strips - plot length was 435 feet long by 10 feet wide.
- Weeds were controlled uniformly across the study and no fungicides or insecticides were needed to control other pests.

UNDERSTANDING THE RESULTS >

- DroughtGard® Hybrids corn products had high yields in an environment that saw early-season moisture stress, with the month of June having 10 days that were 90 °F or warmer.
- All DroughtGard Hybrids products yielded more than the 111RM-COMP AQUAmax® product, and nine of the products yielded more than the 114RM-COMP AQUAmax product.
- The only DroughtGard Hybrids product that did not out yield the 114RM-COMP product was a 103RM product that had significantly less time to grow before maturing and endured a longer period of stress between the initiation of flowering and the minimal rains in late July that relieved some moisture stress.
- The top four DroughtGard Hybrids products yielded, on average, 21 bu/acre more than the competitor's products.

DroughtGard® Hybrids Technology Comparison

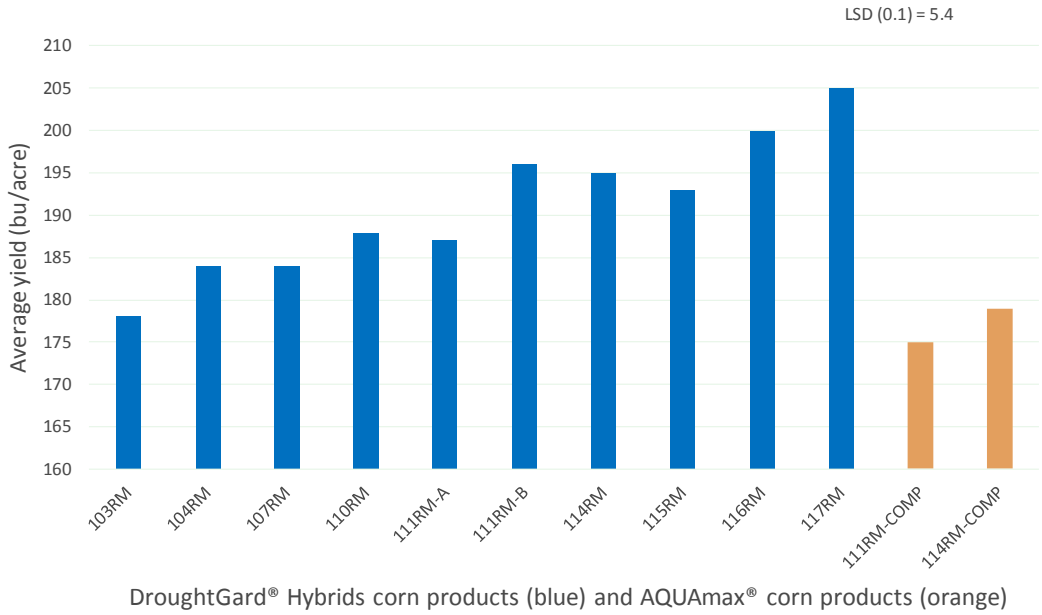


Figure 1. Average yields of DroughtGard® Hybrids corn products and competitor products

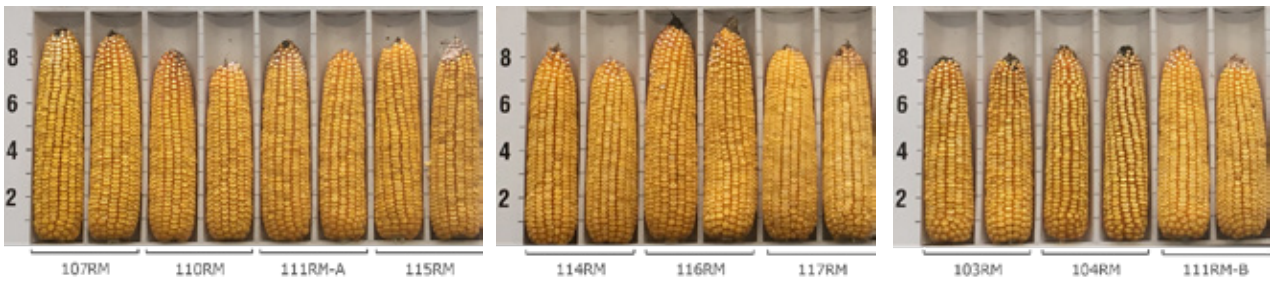


Figure 2. Images of corn ears from the different DroughtGard® Hybrids products

WHAT DOES THIS MEAN FOR YOUR FARM?

- Farmers can have confidence that DroughtGard Hybrids corn products can obtain high yields in dryland environments, protecting yield potential from a risk of yield loss from drought stress.
- Farmers should work closely with their local seed sales team to select a corn product that best fits their yield goals and management operation.

Response of Corn Products to Population

TRIAL OVERVIEW >

- As corn products enter the market, growers need guidance as to the appropriate population to plant.
- The primary questions asked by growers were:
  - If I plant more seed, will the yield potential increase?
  - If I plant more seed, will lodging potential increase?
  - What effect does population have on ear size as measured in weight per ear?

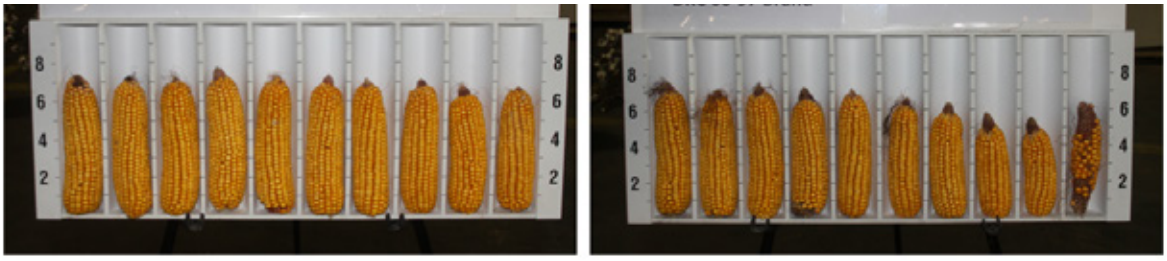


Figure 1. Average Ear Size by Population for Comparison

RESEARCH OBJECTIVE >

- The objective of this demonstration trial was to evaluate corn products for their response to population at the Scott Learning Center in Scott, MS.

LOCATION	SOIL	PREVIOUS CROP	TILLAGE TYPE	PLANTING DATE	HARVEST DATE	POTENTIAL YIELD/ACRE	PLANTING RATE/ACRE
Scott, MS	Commerce silt loam	Soybeans	Conventional	03/21/2017	08/15/2017	300 bu/acre	Various

SITE NOTES >

- Plot size was 4 rows x 450 feet (.15 acres).
- Each product was planted at populations of 28,000, 32,000, 36,000 and 40,000 seeds/acre.
- Nitrogen (N) was applied at 240 lbs/acre.
- Emergence was approximately 97-98%.
- Relative maturity of corn products planted include 112, 114, 116, 117, 118 and 120 RM.
- DATA COLLECTED:
  - 8-row feet of each plot as hand shelled for ear weight.
  - 100 kernel seed weights were recorded from each corn product x population combination at shelling.
  - Plots were machine harvested for yield.
- All other agronomic practices were per local standards.

Response of Corn Products to Population

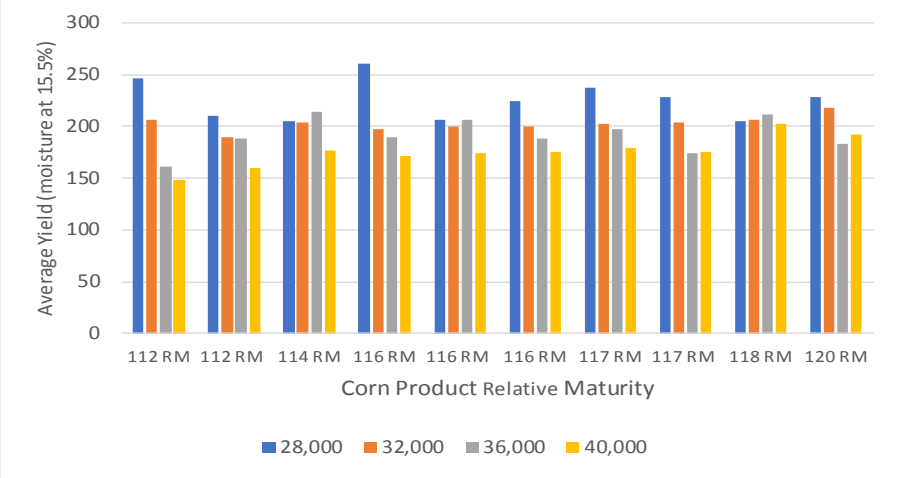


Figure 1. Average yields of DroughtGard® Hybrids corn products and competitor products.

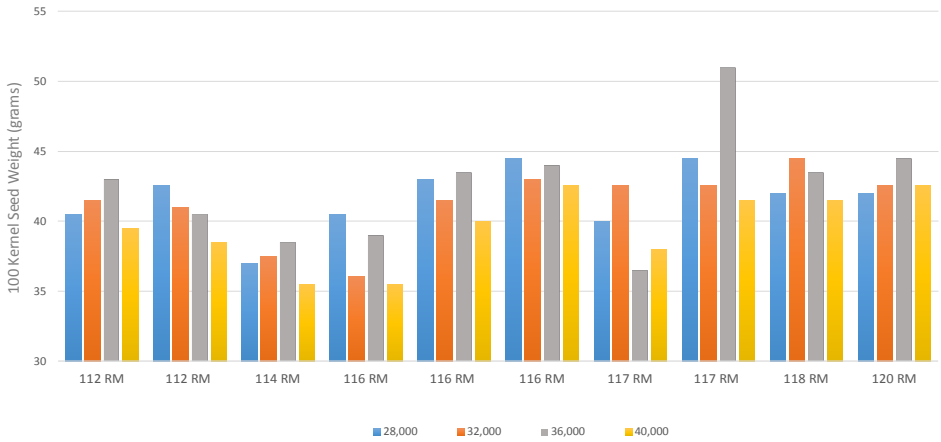


Figure 2. Response of corn products to population.

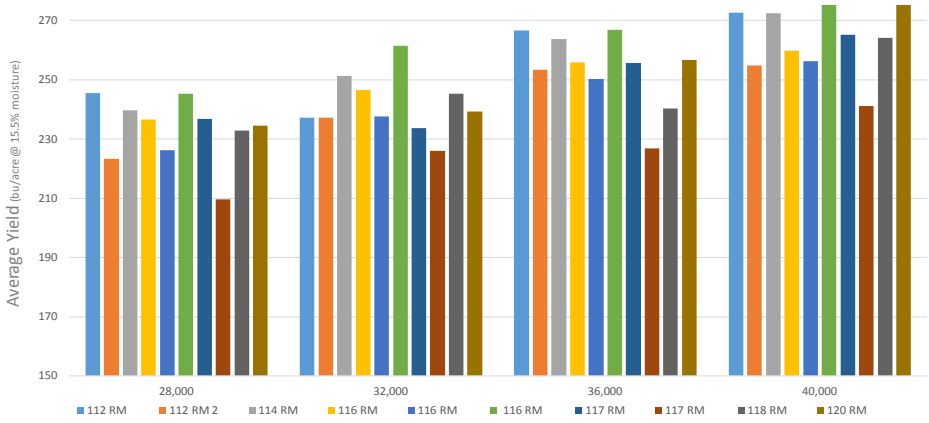


Figure 3. Average yield oforn products to yield.

Response of Corn Products to Population

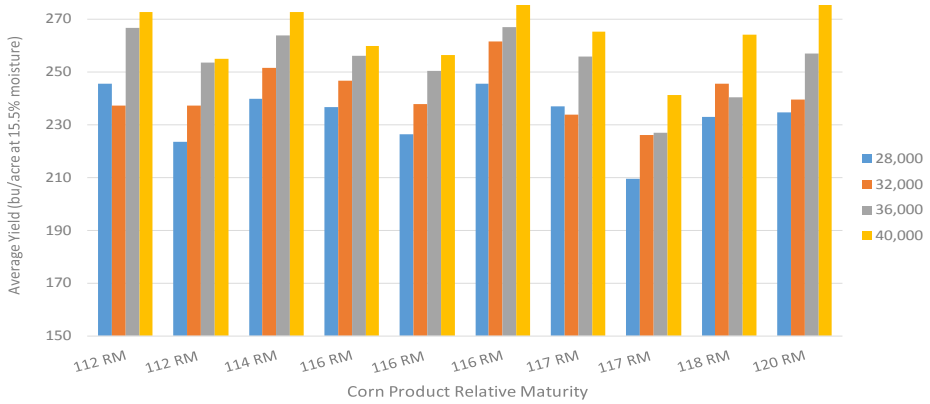


Figure 4.Response of corn products to population

UNDERSTANDING THE RESULTS >

- Most corn products responded favorably to higher plant populations with little to no lodging occurring.
- Yield potential was optimized for many of the corn products at the 36,000 kernels/acres range.
- Yields of some corn products continued to increase as populations increased.
- As indicated by ear size and yield data, corn brands vary with levels of flex in the ear.
- One of the mechanisms of flex is often demonstrated in ear weight.

WHAT DOES THIS MEAN FOR YOUR FARM?

- Newcorn products should be evaluated for yield response to different populations and what they can mean on your farm.
- In general, all corn products responded positively to higher planting populations in this demonstration.
- While some environments have increased lodging potential, many of the new corn products present the opportunity for increased yield potential with higher planting populations.
- Growers should carefully consider all factors when choosing corn products and deciding on the appropriate plant population.
- Average yield, ear weights, and 100 kernel weights point to differing ear flex potential across the range of tested corn products.

Flex Characteristics of Corn Products

TRIAL OVERVIEW >

- As new corn products enter the market, it is critical to define a recommended planting population.
- Recommendations may be affected by what we refer to as the "flex" characteristic in corn products.
- "Flex" is often referred to as a single factor; however, it is a complicated multifactor response to the growing season and conditions.
- This demonstration was conducted to provide guidance to growers about what "flex" really is and how it should be considered when planting corn products. This is a long overdue conversation.

RESEARCH OBJECTIVE >

- Evaluate five corn products for their response to planting population. Yield, ear size, and ear number (both primary and secondary) were captured during the season.

LOCATION	SOIL	PREVIOUS CROP	TILLAGE TYPE	PLANTING DATE	HARVEST DATE	POTENTIAL YIELD/ACRE	PLANTING RATE/ACRE
Scott, MS	Clay Loam	Soybeans	Conventional	03/20/2017	08/20/2017	300 bu/acre	Various

SITE NOTES >

- All agronomics were per local standards.
- Emergence was in excess of 95% in all plots.
- 240 lbs/acre of actual N were applied.
- Ear numbers and weights were taken from 8 row feet of each plot.
- Plots were approximately 0.1 of an acre each or 4 rows x 260 feet long.

WHAT IS "FLEX"?

- Multiple ears/plant - determined by spacing and light
- Rows around - determined by nitrogen (N) status and stresses at V4
- Kernels long - determined from V4 to V6/V7
- Kernels pollinated (at pollination) - number formed vs. pollinated - pollen sterility, mechanical problems
- Kernels aborted (after pollination) - stresses, fertility, light - effecs on photosynthetic capacity
- Kernel depth - fertility, heat, light stresses
- All of these factors are interactive with the corn product, year, environment

Flex Characteristics of Corn Products

UNDERSTANDING THE RESULTS >

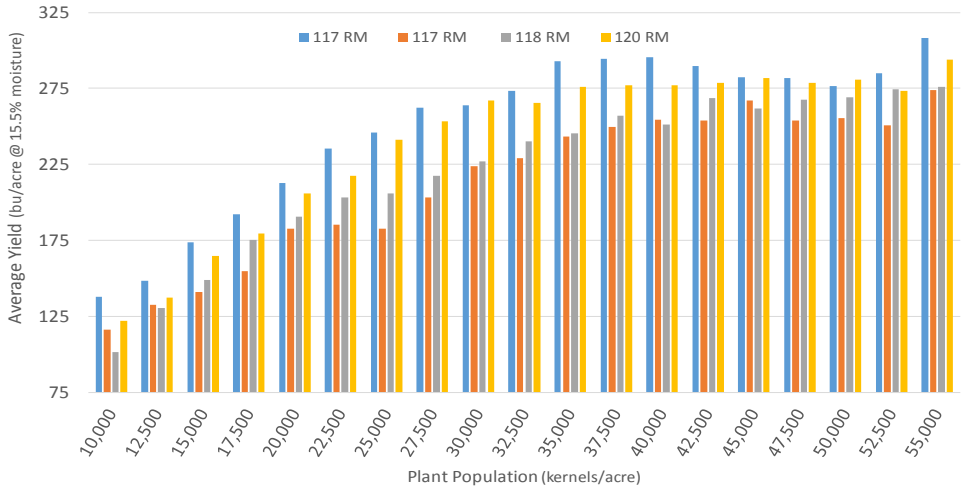


Figure 1. Average grain yield by population and corn product.

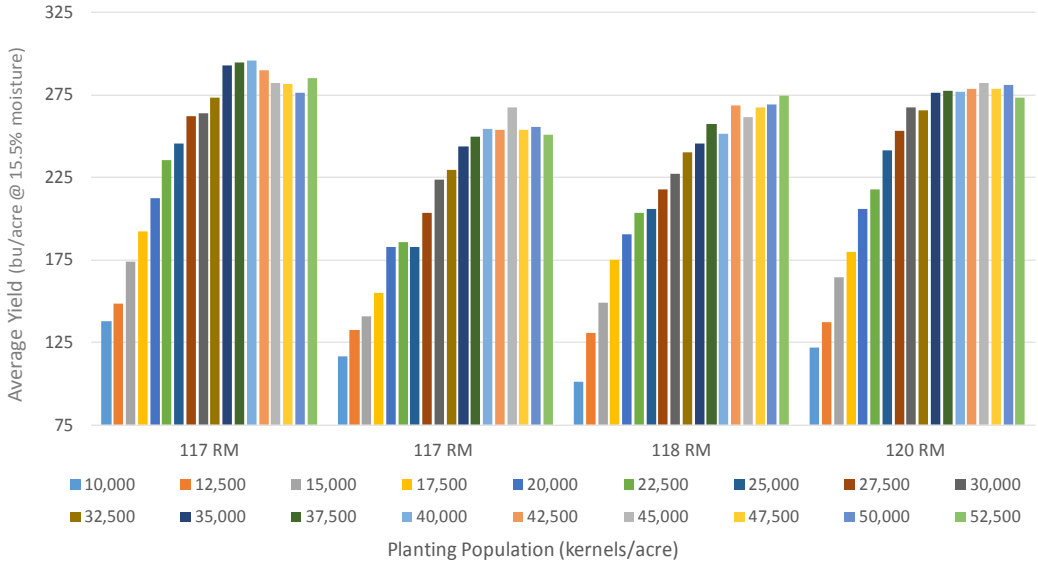


Figure 2. Average grain yield by corn product and population.

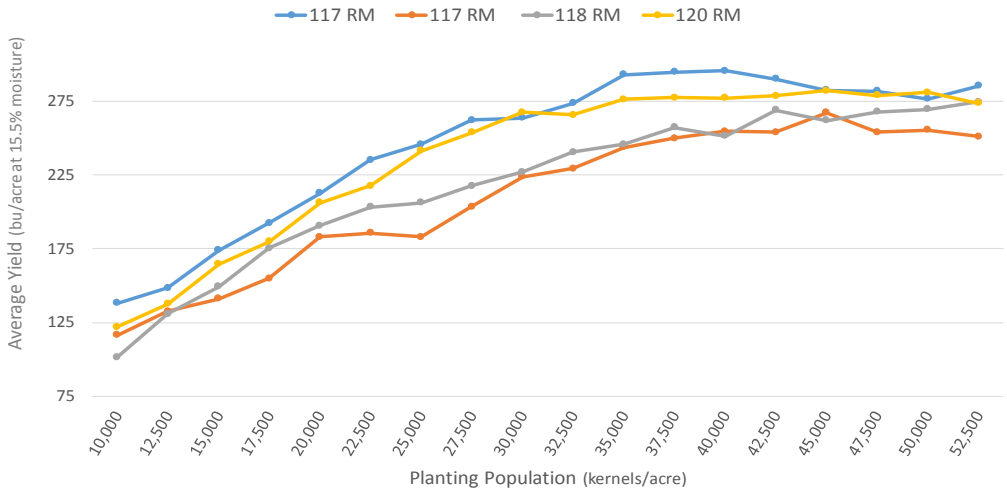


Figure 3. Effect of planting population on yield by corn product.

Flex Characteristics of Corn Products

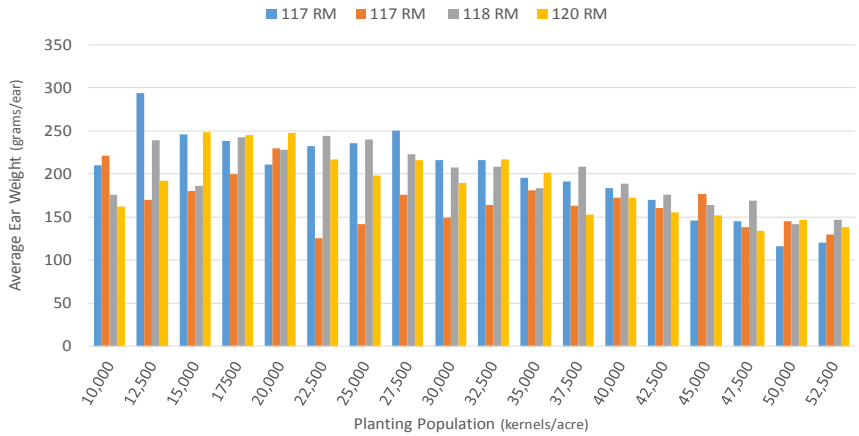


Figure 4. Average primary ear weight (grams/ear) by corn product and population.

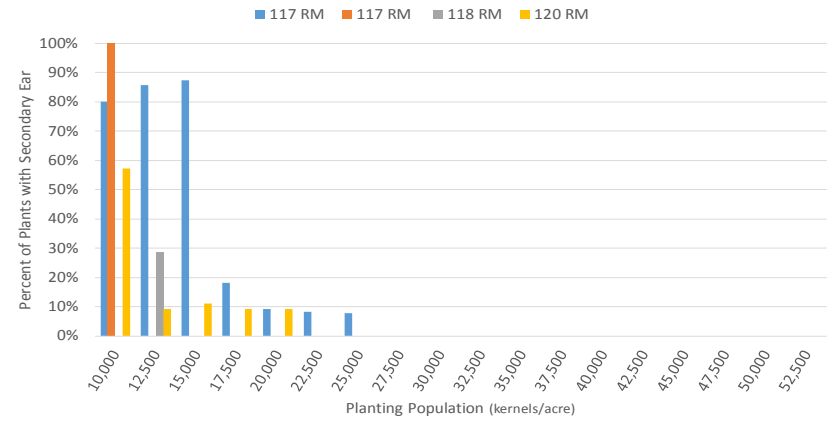


Figure 5. Percent of plants with secondary ear.

- Yield levels were extremely high (an increase of 20% compared to historical yields) during the 2017 growing season. This is likely due to mild conditions during the growing season.
- Corn products responded differentially to population. For this reason, flex information is critical to the success of a new corn product.
- Few plants had secondary ears at populations above 15,000 kernels planted/acre.
- As population increased, ear weights decreased; however, some differences were observed between corn products.
- Little yield response was observed at populations higher than the high 30,000's kernels/acre.
- Tested corn products appear to be yield optimized in the 35,000-38,000 kernels/acre range.

WHAT DOES THIS MEAN FOR YOUR FARM?

- All corn products should be carefully evaluated, considering potential responses to environment.
- "Flex" is a complicated interaction that is significantly affected by the environment.
- Reduced stands cannot be overcome with multiple ears per plant.
- In the field, 1,000 plants was worth an average of 6 bu/acre in the range of yield response. This is similar to previous results at the Monsanto Learning Center at Scott, MS.

Effects of Planting Depth on Corn Stand Establishment and Yield

TRIAL OVERVIEW >

- Accurate planting depth is directly related to even seed emergence, and is a critical aspect of creating the perfect environment for every seed.
- Across the Midwest, 1.75 to 2.25 inches is the typical recommendation for corn seeding depth. This ensures good seed-to soil contact, places seeds into adequate moisture during the planting window, and ensures the establishment of a strong nodal root system.

RESEARCH OBJECTIVE >

To evaluate the impact of planting depth on corn establishment and grain yield.

LOCATION	SOIL	PREVIOUS CROP	TILLAGE TYPE	PLANTING DATE	HARVEST DATE	POTENTIAL YIELD/ACRE	PLANTING RATE/ACRE
Huxley, IA	Clay Loam	Soybean	Conventional	05/31/2017	10/19/2017	220 bu/acre	34,000 seeds/acre

SITE NOTES >

- A 108 RM SmartStax® RIB Complete® corn blend product was used for the trial.
- Plots were planted with a 6-row John Deere® MaxEmerge® Plus planter fitted with Precision Planting® 20/20 SeedSense® and hydraulic DeltaForce® equipment.
- 165 lbs/acre of anhydrous ammonia was applied in the spring before planting.
- Treatments consisted of 3 different planting depths: 1 inch, 2 inches, and 3 inches, with 5 replications.
- Each treatment was 6-rows wide and 200-ft long in 30-inch row spacing.

UNDERSTANDING THE RESULTS

Figure 1. Corn seedlings depicting different mesocotyl lengths due to different planting depths. From left to right: 1 inch seeding, 2 inch seeding, 3 inch seeding.

Effects of Planting Depth on Corn Stand Establishment and Yield

- Yields were positively correlated with final harvest population, where the 2 inch seeding produced the most plants at harvest and the highest yields, and 3 inch seeding produced the lowest harvest population and the lowest yield.

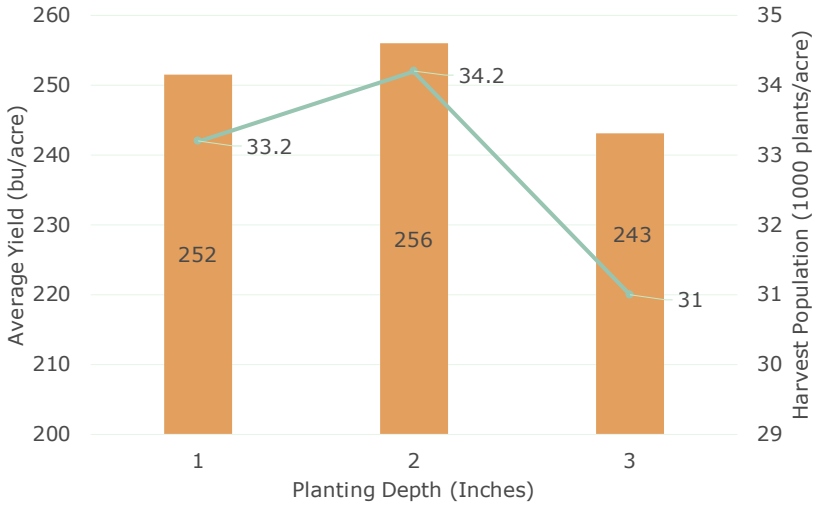


Figure 2. *Average yield and harvest population across different planting depths.*

WHAT DOES THIS MEAN FOR YOUR FARM?

- Uniform germination and emergence are required to optimize yield potential.
- Achieving this depends on planting depth and the soil conditions (particularly moisture and temperature) during and after planting.
- In dry, light textured soils, planting deeper than 2 inches may be required to place seeds where moisture levels are consistent to ensure uniform imbibition and germination.
- In heavy textured soils, as at the site of this trial, seeding depth should not exceed 2 inches. While performance of the 1 inch seeding was comparable to the 2 inch seeding this season, this may not be the case in most years.
- In most cases, planting shallower than 1 inch is not recommended.

The Effects of Row Spacing and Plant Population on Corn Yield Potential

TRIAL OVERVIEW >

- This trial was designed to provide customers in southern Iowa helpful row width comparison information, which is often limited for this region.

RESEARCH OBJECTIVE >

- To compare corn yield potential in 20- and 30-inch row width systems on later maturity corn products in Iowa.
- To help determine the yield response of higher populations within each row width system.

LOCATION	SOIL	PREVIOUS CROP	TILLAGE TYPE	PLANTING DATE	HARVEST DATE	POTENTIAL YIELD/ACRE	PLANTING RATE/ACRE
Victor, IA	Silty Clay Loam	Soybean	Conventional	04/22/2017	10/09/2017	220-260	33K, 38K, 43K

SITE NOTES >

- Six corn products of 110 to 114 relative maturity were planted in two adjacent blocks at two different row spacings and at three different planting populations within each row spacing:
  - 6-row 30-inch row spacing planted at 33,000 (33K), 38,000 (38K), and 43,000 (43K) seeds/acre
  - 12-row 20-inch row spacing planted at 33K, 38K, and 43K seeds/acre
- A variable row spacing Case IH® 1215 Early Riser® planter unit was used for all plantings at general planting depth settings.
- Both blocks received 145 lbs/acre of anhydrous ammonia in the spring. Cultural practices were identical.
- Plots were 200 feet long with 2 replications at one location.

UNDERSTANDING THE RESULTS >

- For the 20-inch row spacing, the planting population of 38K seeds/acre produced higher yields on average across products tested in 2017.
- For the 30-inch row spacing, planting populations of 38K or 43K seeds/acre produced higher yields.
- With current seed and grain prices, the rule of thumb is that a 1.5 bu/acre yield increase should pay for around 1,000 additional planted seeds/acre.

The Effects of Row Spacing and Plant Population on Corn Yield Potential

	20-inch row spacing			30-inch row spacing		
RIB Corn Blends	33K	38K	43K	33K	38K	43K
Product A	257	265	263	255	258	269
Product B	249	251	238	245	263	253
Product C	241	256	241	236	237	244
Product D	265	278	269	250	271	271
Product E	250	275	264	258	264	272
Product F	262	284	270	258	279	275

Table 1. Yields of corn products at each row spacing and planting population.

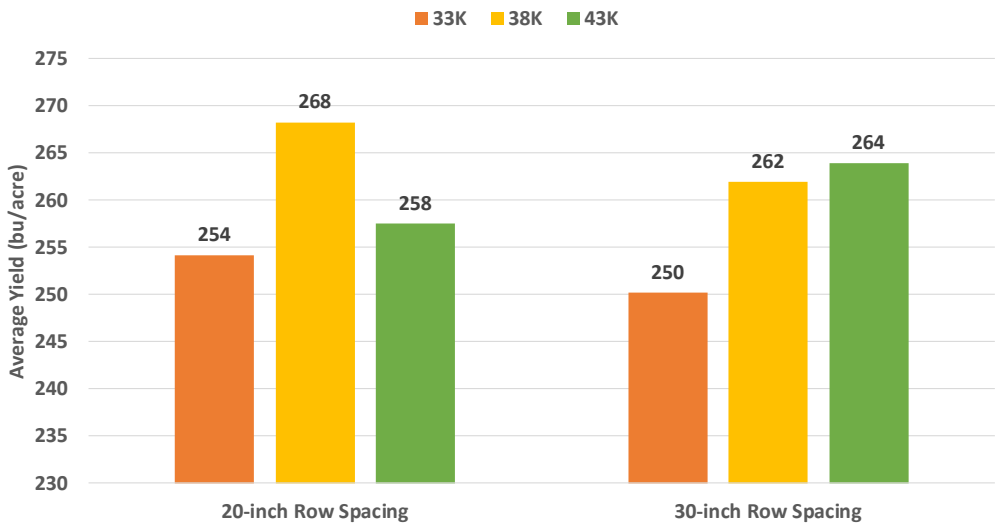


Figure 1. Corn Yields by row spacing and planting population across all products.

WHAT DOES THIS MEAN FOR YOUR FARM?

- Corn products vary in yield performance at different populations and environmental factors. Consult the local seed guide for recommended product planting rates.
- This study represents a single-site, twice-replicated demonstration.

The Value of Proper Planter Settings

STUDY OBJECTIVE >

Previous work at the Learning Center has shown the importance of even emergence in corn:

- Impact of Uneven Emergence in Corn.[1] Uneven Emergence in Corn.[2]
- Various planter attachments and settings can affect seed placement, seed/soil contact, and the quality of the seedbed.

These factors can impact the evenness of seedling emergence and stand establishment.

RESEARCH OBJECTIVE >

This trial was designed to measure the yield impact of seed firmers and properly-set row cleaners

SITE NOTES >

Four treatments were tested:

LOCATION	SOIL	PREVIOUS CROP	TILLAGE TYPE	PLANTING DATE	HARVEST DATE	POTENTIAL YIELD/ACRE	PLANTING RATE/ ACRE
Monmouth, IL	Silt Loam	Corn	No-Till	5/17/2017	10/17/2017	240+ bu/acre	36,000 seeds/acre

- Properly-set row cleaners with seed firmers.
- Properly-set row cleaners without seed firmers.
- Improperly-set row cleaners (not enough pressure) with seed firmers.
- Improperly-set row cleaners (not enough pressure) without seed firmers

The trial was replicated twice.

UNDERSTANDING THE RESULTS >

- In this trial, each missing component resulted in a loss of approximately 10 bu/acre (Figure 1).
- Both components combined resulted in a loss of approximately 20 bu/acre (Figure 1).
- Visual differences in plant stand and height were apparent throughout the season (Figures 2 and 3).

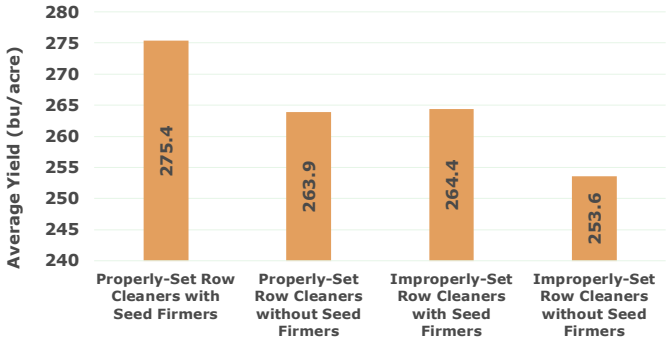


Figure 1. Value of Proper Planter Settings

The Value of Proper Planter Settings

Figure 2. *Improperly-set row cleaners without seed firmers (left) and properly set row cleaners with seed firmers (right).*

Figure 3. *Improperly-set row cleaners without seed firmers (left) and properly set row cleaners with seed firmers (right).*

WHAT DOES THIS MEAN FOR YOUR FARM?

- Accurate seed placement, good seed/soil contact, and a clean seed bed are important factors in enabling corn seedlings to establish quickly and begin growing vigorously.
- Attachments such as seed firmers can help improve seed/soil contact, leading to better establishment, even emergence, and potentially higher yields.
- Properly-set row cleaners can also provide an environment where seedlings can emerge quickly and evenly. This can have a positive impact on yield potential.

SOURCES >

[1] Impact of Uneven Emergence in Corn. 2016. https://monsanto.com/app/uploads/2017/05/impact-uneven-emergence-corn.pdf

[2] Uneven Emergence in Corn. 2016. https://vimeo.com/214841338

Effects of Planting Rate and Row Spacing on Corn Yield

TRIAL OVERVIEW >

- Optimum corn planting rates have steadily increased over time.
- As planting rates increase, narrower row configurations should be considered to increase space between plants and reduce stress.

Figure 1. Row spacings for the trial were 20-inch, 30-inch, and twin-row with 30-inch centers.

RESEARCH OBJECTIVE >

- This trial was designed to evaluate the effects of three different row spacings and three planting rates.

LOCATION	SOIL	PREVIOUS CROP	TILLAGE TYPE	PLANTING DATE	HARVEST DATE	POTENTIAL YIELD/ACRE	PLANTING RATE/ACRE
Monmouth, IL	Silt Loam	Corn	Conventional	05/18/2017	10/26/2017	240 bu/acre	35K, 40K, 45K

SITE NOTES >

- This trial was replicated twice using two corn products:
  - A 108 RM product with SmartStax® technology
  - A 114 RM product with SmartStax® technology
- Row spacings used were 20-inches, 30-inches, and twin-rows with 30-inch centers (Figure 1).
- Seeding rates within each row spacing were 35,000, 40,000, and 45,000 seeds/acre.

UNDERSTANDING THE RESULTS >

- The 20-inch and twin-row 30-inch center spacings appeared to relieve stress as planting rates increased.
- The two corn products responded similarly; however, the 108 RM product appeared to show somewhat of an increased stress tolerance in the 30-inch rows.

Effects of Planting Rate and Row Spacing on Corn Yield

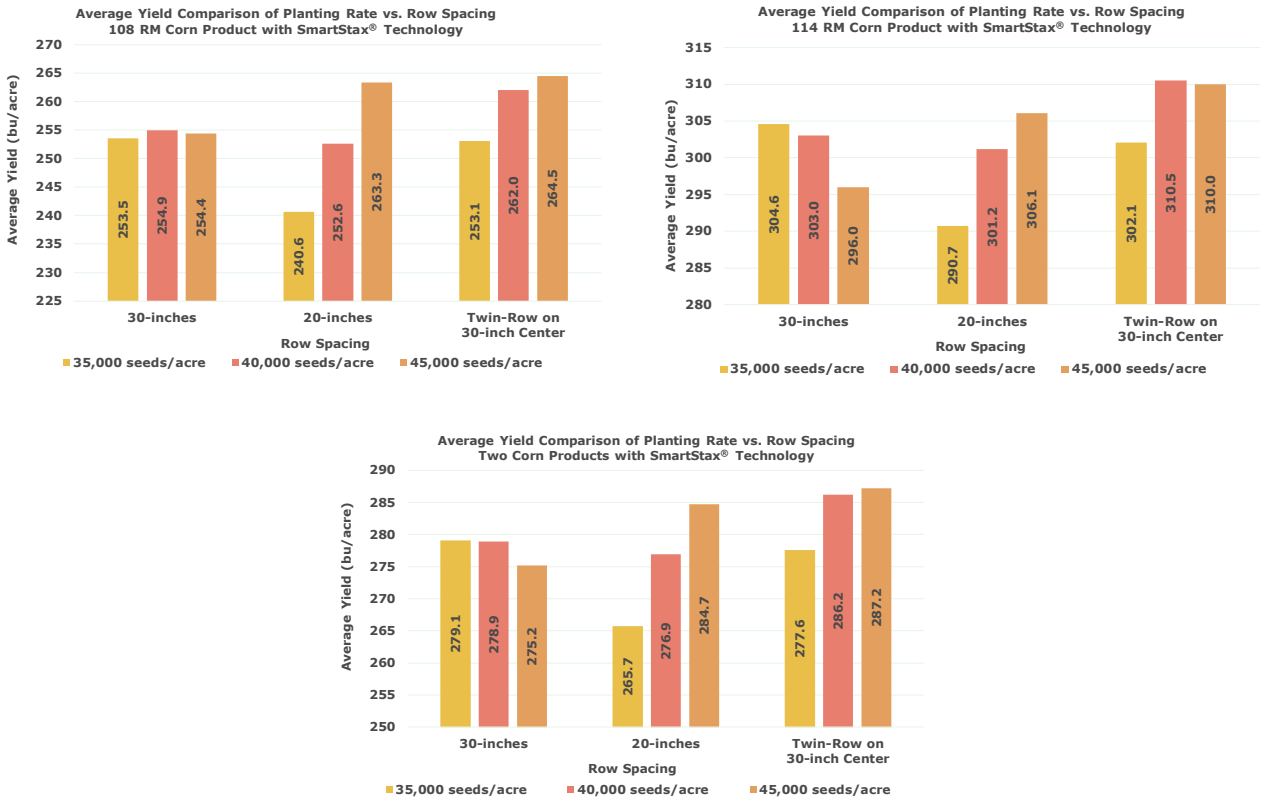


Figure 1. *Average yield of products, row spacings, and planting rates. (Top Left) 108 RM product, (Top Right) 114 RM product, and (Bottom) both products.*

WHAT DOES THIS MEAN FOR YOUR FARM?

- Row configurations narrower than 30-inch may provide some stress relief, especially at higher planting rates.
- Corn products respond differently to stress; therefore, contact your local seed representative for information on adapted corn products.

Evaluation of Cover Crop Termination Methods in Corn Production

SUSTAINABILITY SPOTLIGHT

A recent and growing trend for modern agriculture and like-minded farmers is to grow plants like radishes and clover between seasons of corn, soy, or cotton. Cover crops help prevent erosion and add nutrients back into the soil keeping it healthy, reducing erosion, and may even require less watering in future seasons. In addition, growing a cover crop can sequester as much a 0.3 metric tons of carbon per year, helping to combat climate change.

TRIAL OVERVIEW >

- In sustainable farm operations, cover cropping is an effective system to manage soil health, biodiversity, weeds, erosion, water quality, and other pests and diseases.
- Managing cover crops requires additional costs, such as: time, labor, modifications of existing operations to accommodate cover crop seeding, and termination of cover crops.
- Termination methods may change based on the type of cover crop used. Common termination methods include: chemical (herbicide application), environmental (e.g. winter kill), and mechanical (e.g. tillage).

RESEARCH OBJECTIVE >

To evaluate different cover crop termination methods for their effects on corn growth and development and final grain yield.

LOCATION	SOIL	PREVIOUS CROP	TILLAGE TYPE	PLANTING DATE	HARVEST DATE	POTENTIAL YIELD/ACRE	PLANTING RATE/ACRE
Huxley, IA	Clay Loam	Soybean	Various	05/30/2017	10/28/2017	225 bu/acre	34,000 seeds/ acre

SITE NOTES >

- A 108-relative maturity SmartStax® RIB Complete® corn blend product was used for this trial.
- The trial was carried out in 30-inch row spacing, 30 rows/treatment, in 200 ft. long strips.
- Cereal rye was drilled in the fall of 2016 after harvest.
- In the spring of 2017, 4 termination methods were compared (Fig. 2):
    1. Planting/Herbicide - planting into the cover crop, followed by herbicide application to kill the cover crop.
    2. Herbicide only.
    3. Herbicide/Tillage - herbicide application followed by tillage.
    4. Tillage only.
- Roundup PowerMAX® herbicide was applied at 32 fl oz/acre for the herbicide treatments. Application was made 2 days after planting in Treatment 1, and 48 days before planting in Treatments 2 and 3.

Evaluation of Cover Crop Termination Methods in Corn Production

- Treatments 3 and 4 fields were disked 22 days before planting, and worked with a soil finisher 2 days before planting.
- Treatments 2, 3, and 4 received pre- and post-emergence herbicide applications for weed control.
- All treatments were planted on the same day.

UNDERSTANDING THE RESULTS >

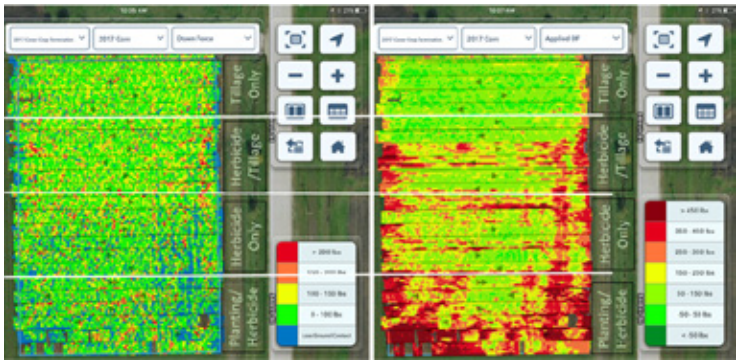


Figure 1. Climate FieldView™ maps showing down force (left) and applied down force (right) adjustments for each termination method during planting.

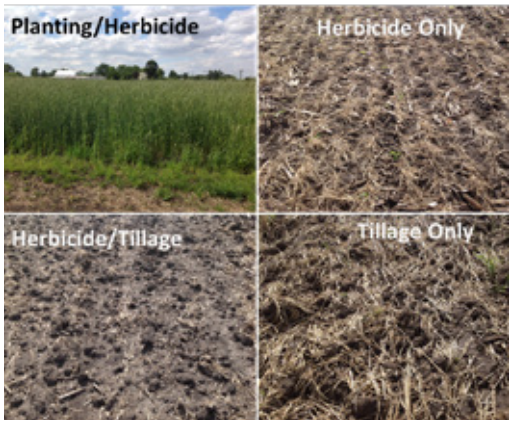


Figure 2. Field conditions of each termination method at the time of planting. The cover crop was about 5 ft. tall at the time of planting.

- More down force was needed to plant the Planting/Herbicide and Herbicide Only treatments than in the two tillage treatments. There was significantly better ground contact in the two tillage treatments than in Planting/Herbicide and Herbicide Only treatments (Fig. 1).
- Seedling emergence and vigor was inconsistent and not uniform in the Planting/Herbicide treatment, but was nearly the same for all other treatments.
- Growth and development of the plants of the Planting/Herbicide treatment were at least 4-leaf stages behind those of the other treatments (Fig. 3).
- At planting, cereal rye in the Planting/Herbicide treatment was about 5 feet tall as a result of delayed planting due to unsuitable soil/weather conditions. The tall canopy shaded the corn plants until about V10 growth stage. This could be responsible for the delayed growth and development observed.
- There was a slight treatment response to final harvest population in which the Planting/Herbicide treatment had the lowest population (Fig. 4).
- Grain moisture content was about 4% higher in Planting/Herbicide compared to the average of the other treatments.
- Average yield varied among treatments, with the Herbicide Only treatment producing the highest yield of 277 bu/acre (Fig. 4).
- Performance of the two tillage treatments (Herbicide/Tillage and Tillage Only) was nearly the same.

Evaluation of Cover Crop Termination Methods in Corn Production

Figure 3. Examples of corn growth and developmental differences as influenced by the 4 cover crop termination methods. A: young corn plants in the Planting/Herbicide treatment. B: young corn plants representative of Treatments 2, 3, and 4. C: mid-season difference between plants of Planting/Herbicide (right 3 rows) and those representative of the other treatments (left 3 rows). D: while Treatments 2, 3, and 4 were at full-anther extrusion, plants of the Planting/Herbicide treatment were at least 4-leaf stages behind.

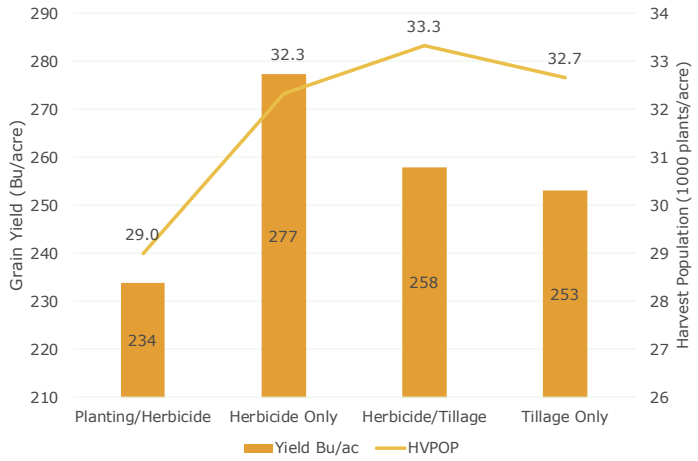


Figure 4. Effects of cover crop termination methods on corn productivity.

WHAT DOES THIS MEAN FOR YOUR FARM?

- Modifications of farm operations to include cover crops is a viable sustainability effort for growers to pursue.
- The choice of cover crop species or mixtures plays a significant role in the ease of which the system is managed.
- If planting is delayed in commercial operations, as was the case in the Planting/Herbicide treatment, cereal rye may be mowed for hay before planting.
- The Herbicide Only treatment out-yielding the other treatments is a great incentive, as this practice can easily be adopted in no-till systems.
- Growers should pay close attention to the herbicides used in their cover crop programs to avoid carryover issues.

Corn Variable Rate Seeding Using Climate FieldView™ Seed Scripting

STUDY OBJECTIVE >

Choosing the optimum planting population for a respective field environment/hybrid combination is a crucial decision when trying to optimize resources in each environment. The Climate FieldView™ advanced seed scripting tool allows growers to manage their planting populations across multiple environments within a given boundary.

RESEARCH OBJECTIVE >

To evaluate how the Climate FieldView advanced seed scripting tool can assist growers in managing their planting populations within multiple field environments when compared to a blanket rate local grower standard.

LOCATION	SOIL	PREVIOUS CROP	TILLAGE TYPE	PLANTING DATE	HARVEST DATE	POTENTIAL YIELD/ACRE	PLANTING RATE/ACRE
Exira, IA	Multiple	Soybean	No-Till	5/6/2017	11/10/2017	240 bu/acre	Variable

SITE NOTES >

- A 114RM VT Double PRO® RIB Complete® brand blend product was chosen for this farm.
- The trial was carried out in 20-inch row spacing.
- 190lbs of nitrogen (N) was applied in the spring along with a one-pass herbicide program.
- A fungicide and 12lbs foliar nitrogen were aerially applied at the VT stage.
- A yield goal of 240bu/acre, $3.30 cash price of corn, and $270 per bag of seed were the input factors used in the Climate FieldView advanced seed scripting model (Fig. 1).
- 2 years of prior yield data was utilized to build the variable rate prescription.

TABLE 1. PLANTING RATE TREATMENTS USED IN TRIAL.

TREATMENTS	DESCRIPTION
Grower Standard	Blanket 38,000 seeds/acre planting population
Advanced Seed Scripting	Climate FieldView™ advanced seed scripting tool – (Variable Rate)

Corn Variable Rate Seeding Using Climate FieldView™ Seed Scripting

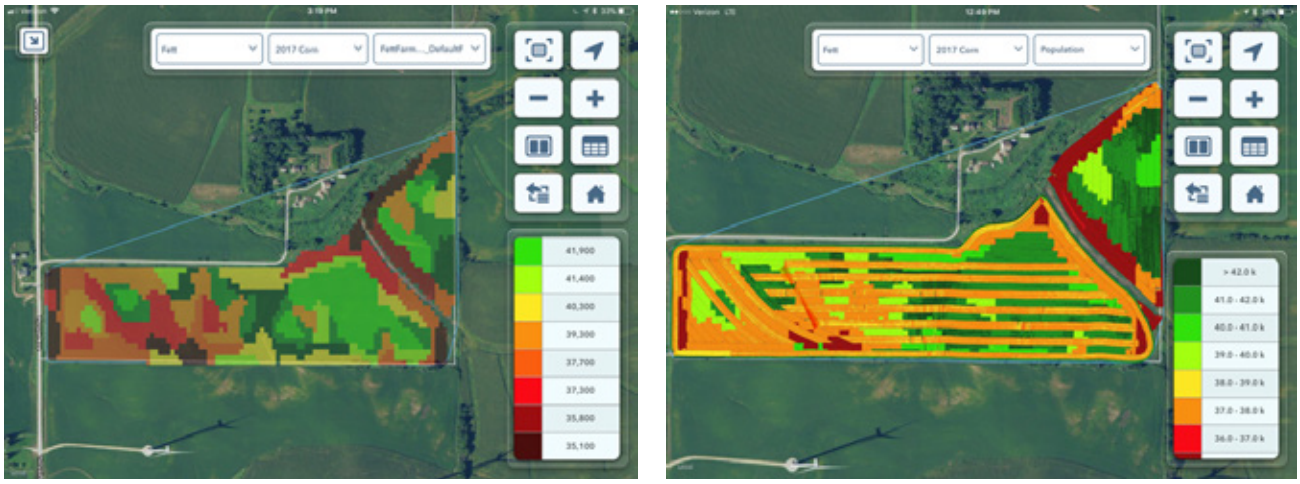


Figure 1. (Left) Screenshot of Climate FieldView advanced seed scripting map used to plant the variable rate portion of the field trial. (Right) Screenshot of Climate FieldView planting population map after the side by side comparisons were executed for the field trial.

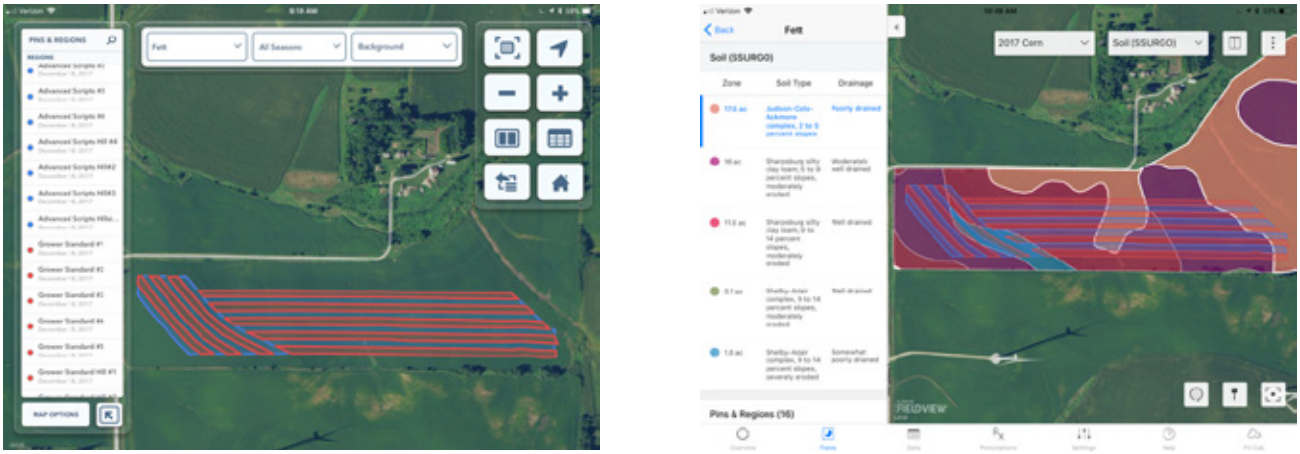


Figure 2. (Left) Screenshot of Climate FieldView Soil SSURGO map with the polygon regions used to analyze the yield results. (Right) screenshot of Climate FieldView polygon regions used to analyzed the yield data. Red regions align with the grower standard and blue regions matchup with the advanced planting prescription planting rates.

TABLE 2. REGION YIELD ANALYSIS BY PLANTING SYSTEM.

ADVANCED SEED SCRIPTING (VARIABLE RATE)				GROWER STANDARD 38,000 SEEDS/ACRE			
Regions	Acres	Avg. Yield	Total Bushels	Regions	Acres	Avg. Yield	Total Bushels
7	8.1	290.3 bu/acre	2351.4	7	7.8	287.5 bu/acre	2242.5

Corn Variable Rate Seeding Using Climate FieldView™ Seed Scripting

UNDERSTANDING THE RESULTS >

- The Climate FieldView advanced seed scripting tool recommended planting rates from 35,100 to 42,000 seeds/acre with a field average 39,300 seeds/acre (Fig. 1).
- Three different soil types were tested in the analysis with slopes ranging from 2% -14% (Fig. 2).
- The Climate FieldView advanced seed scripting system provided a 2.8bu/acre advantage when compared to the grower standard (Table 2).
- In a high yield/low stress year, variable rate results may varydepending on how aggressive your standard planting rate is.

WHAT DOES THIS MEAN FOR YOUR FARM? >

- Technologies such as Climate FieldView advanced seed scripting allow a grower to easily access multiple years of local product population data.
- Climate FieldView advanced seed scripting allows a grower to minimize their risk in tougher environments that may be over planted by a blanket grower standard rate. Standard rates also put a ceiling on yield potential in high yield environments.
- Growers are encouraged to try tools like this to help with choosing the optimum planting rates for their field environments.

Yield and Population Trends in Corn

TRIAL OVERVIEW >

- One of the most important decisions during the planning process for the upcoming planting and growing season is the choice of corn products and the planting population that provides the highest yields and/or profit.
- For the past two seasons, the Huxley Learning Center has conducted field trials with 120 corn products to understand the impact of seeding rate on yield. A summary of the data is presented in this report.

RESEARCH OBJECTIVE >

- To provide an overview of corn yield and population trends over the past two years.

LOCATION	SOIL	PREVIOUS CROP	TILLAGE TYPE	PLANTING DATE	HARVEST DATE	POTENTIAL YIELD/ACRE	PLANTING RATE/ACRE
Huxley, IA	Clay Loam	Soybean	Conventional	04/26/2017	10/17/2017	250 bu/acre	32,000 36,000 40,000
Huxley, IA	Clay Loam	Soybean	Conventional	05/10/2017	10/19/2017	250 bu/acre	32,000 36,000 40,000

SITE NOTES >

- In the 2016 and 2017 growing years, corn products ranging from 99 RM to 117 RM were planted in 30-inch row spacing in 200 ft. long strips. Each year, 60 corn products were planted at 32,000, 36,000 and 40,000 seeds/acre. The data presented in this report is the combined yield response of the 120 corn products over the 3 planting populations.

UNDERSTANDING THE RESULTS >

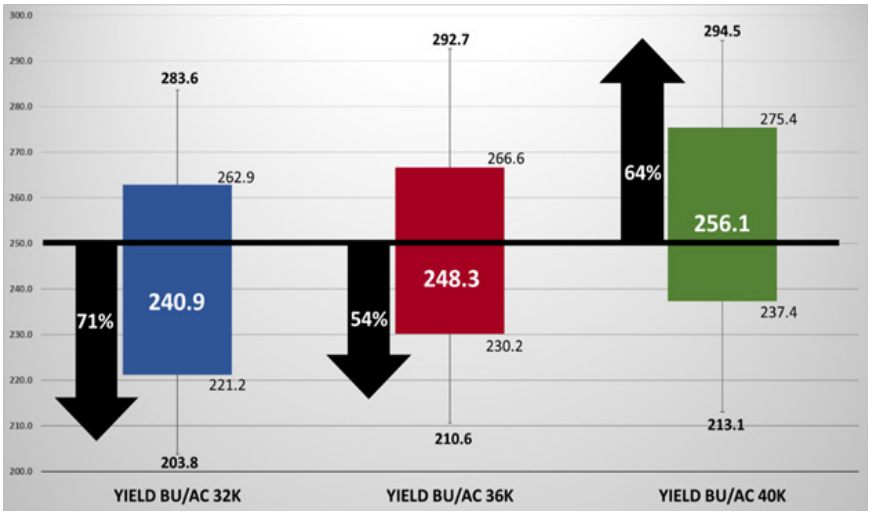


Figure 1. A Box & Whisker chart depicting a 2-year trend of average corn yield in response of planting population. The boxes represent where 75% of the data lie and the error bars represent the outlying 25% of the data. The horizontal black line marks 250 bu/acre which is the yield environment of the research site. The black arrows are risk factors that show the percentage of corn products that yield below or above the 250 bu/acre mark.

Yield and Population Trends in Corn

- Corn yield increased as planting populations increased.
- There was about 8 bu/acre yield increase from 32,000 to 36,000 seeds/acre, and another 8 bu/acre increase from 36,000 to 40,000 seeds/acre (Fig. 1).
- Increased seeding rates results in increased seed cost per acre. A general rule of thumb is that a 1-1.25 bu/acre yield increase is required for every 1,000 seeds/acre increase in seeding rate. Thus, in this summary, increasing seeding rate by 4,000 seeds/acre resulted in 3-4 bu/acre in net returns.
- The research site is a 250 bu/acre yield environment. The data indicates that increasing seeding rate is a good risk management strategy. At 32,000 seeds/acre, 71% of the products yielded below 250 bu/acre. The risk decreased to 1 in 2 products at 36,000 seeds/acre. At 40,000 seeds/acre, about 2 in 3 products yielded above 250 bu/acre (Fig. 1).
- During tough economic times, growers may want to decrease seed cost by reducing seeding rate. However, the data indicates that this may not be a safe strategy. Instead, seeding rate should be increased to minimize the down side risk.
- The 120 corn products followed the typical yield response curves as influenced by seeding rates (Fig. 2 and Fig. 3).
- Products with fixed ears typically show increased yields with increased seeding rate, whereas flex ear products maintain nearly the same yields at increasing populations. With semi-fixed ears, yields typically peak at the median population.
- More than two-thirds of the products tested had fixed ear responses, with 26% and 8% in the semi-fixed and flex ear responses, respectively.
- It is important to know the fix/flex characteristics of a corn product to know how it will respond to different seeding rates. It also provides an insight into how they will respond to stress during the growing season.

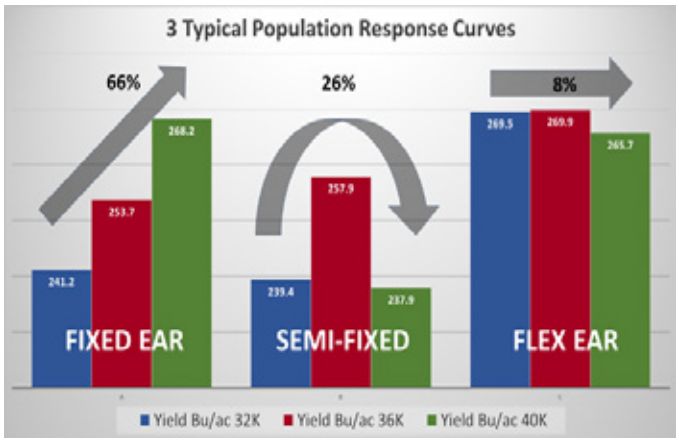


Figure 2. Three typical average corn yield response curves to planting population. Each corn product falls in one of these categories and knowing the response curve helps with seeding rate decisions.

Yield and Population Trends in Corn

Figure 3. Examples of corn products with fixed and flex ear population response curves.

WHAT DOES THIS MEAN FOR YOUR FARM?

- Every growing season is different and has a significant impact on the performance of corn products.
- 40,000 seeds/acre may not be the optimum seeding rate for every corn product, and not every field is suited for 40,000 seeds/acre in every environment. As such, it is important that growers have a good discussion with their trusted local seed representatives on how well a corn product of interest performs under different growing conditions and management practices.
- Growers are encouraged to invest in tools that help with product and seeding rate decisions. Climate FieldView™ advanced scripting options help optimize seeding rates by providing recommendations best suited for the field and yield environment (Fig. 4). This helps minimize risk by spreading planting population across the different environments in the field.

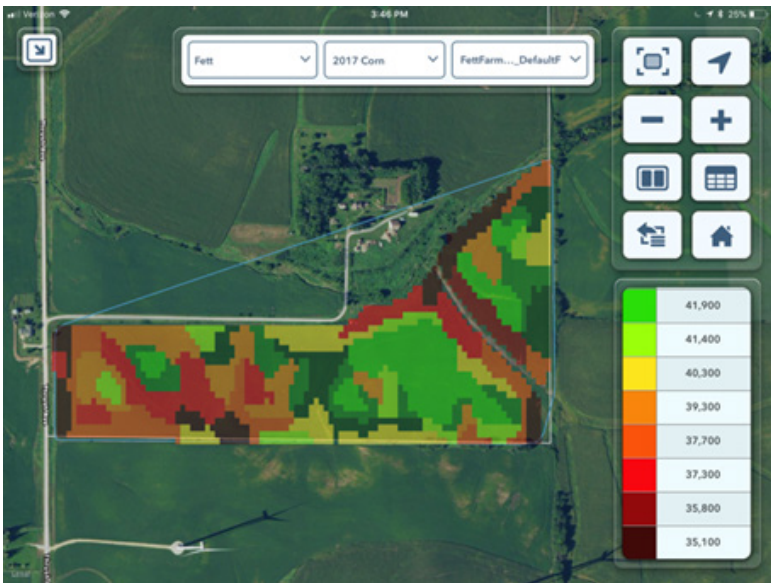


Figure 4. A seeding rate prescription for a corn field using the advanced scripting options from Climate FieldView™ Pro. The tool helps minimize risk by tailoring seeding rates to suite the yield environment.

Corn Productivity Response to Different Management Practices

TRIAL OVERVIEW

- Advancements in breeding and seed technologies have greatly improved corn germplasm.
- The influence of farm management practices on modern corn germplasm needs to be evaluated to optimize productivity.

RESEARCH OBJECTIVE

- To evaluate the impact of different management practices on corn yield and profitability.

LOCATION	SOIL	PREVIOUS CROP	TILLAGE TYPE	PLANTING DATE	HARVEST DATE	POTENTIAL YIELD/ACRE	PLANTING RATE/ACRE
Huxley, IA	Clay Loam	Soybean	Conventional	05/06/2017	10/17/2017	225 bu/acre	34,000

SITE NOTES:

- A 113-relative maturity SmartStax® RIB Complete® corn blend product was used for this trial.
- The trial was carried out in 30-inch row spacing, 6 rows per treatment, with 2 replications.
- Six different management treatments, consisting of seed treatments, nitrogen, and fungicide, were compared in incremental, stair-step treatments (Table 1).
- Acceleron® Seed Applied Solutions ELITE plus Poncho®/VOTiVO® consists of fungicide, insecticide and nematicide treatments with the Enhanced Disease Control (EDC) offering for the control of early- to mid-season diseases caused by Fusarium, Rhizoctonia and Colletotrichum.
- QuickRoots® Dry Planter Box Corn (Q) is a microbial seed inoculant that was added as dry planter box formulation for enhanced nutrient availability.
- All treatments received a MRTN of 140 lbs. of nitrogen/acre in the form of anhydrous ammonia in the spring. An additional 25 lbs/acre of nitrogen was applied in both N1 and N2.
- Headline AMP® was the fungicide used in the trial.

UNDERSTANDING THE RESULTS

- Corn yields increased as more inputs were added, such that the base treatment (E) yielded the lowest, and the treatment with the most inputs (EQN1F1N2F2) yielded the highest (Fig. 1).
- Minimal levels of gray leaf spot (GLS) and northern corn leaf blight (NCLB) diseases were observed at the research site and may explain why yield improved in the fungicide application treatments (Fig. 2).
- Yield gained by the other treatments over treatment E was enough to provide higher economic returns than treatment E; with return on investment (ROI) ranging from $25 to $54.
- Using QuickRoot[s]® Dry Planter Box Corn with a side dress nitrogen application at V5 (EQN1) provided the highest ROI at $785/acre. The addition of more inputs beyond this treatment resulted in higher yields, but these were not high enough to defray their cost.

Corn Productivity Response to Different Management Practices

TABLE 1. TREATMENTS USED IN THE TRIAL WITH THEIR ASSOCIATED COSTS.

TREATMENTS	INPUT	COST $/A
E	Acceleron Seed Applied Solutions ELITE plus Poncho®/Votivo® (E)	$ -
E+Q	QuickRoots® Dry Planter Box Corn (Q)	$ 6.38
EQ+N1	Side dress 32% UAN at V5 growth stage (N1)	$ 12.13
EQN1+F1	Fungicide application at V5 growth stage (F1)	$ 36.13
EQN1F1+N2	Side dress 32% UAN at VT growth stage (N2)	$ 41.88
EQN1F1N2+F2	Fungicide application at VT growth stage (F2)	$ 73.88

WHAT DOES THIS MEAN FOR YOUR FARM?

- Every growing season is different, and has a n impact on the performance of farm inputs.
- Corn products respond differently to farm inputs. Therefore, when selecting corn products, growers should consult with their trusted agronomists on how different corn products perform under various growing conditions and management practices.
- Growers should also make a habit of performing small-scale trials on their fields to understand how their management systems impact their operations economically.
- Growers should be aware of the early- to mid-season disease history in their growing area when selecting corn products with disease tolerance or utilizing Acceleron® Seed Applied Solutions with Enhanced Disease Control. Fungicide treatment responses vary from year to year based on disease pressure; therefore, fungicide application ROI should be considered each year depending on disease pressure and severity.

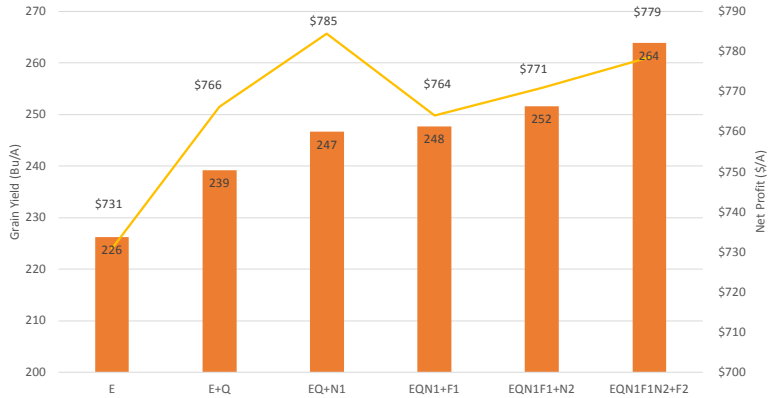


Figure 1. Average yield and net profit of different treatments.

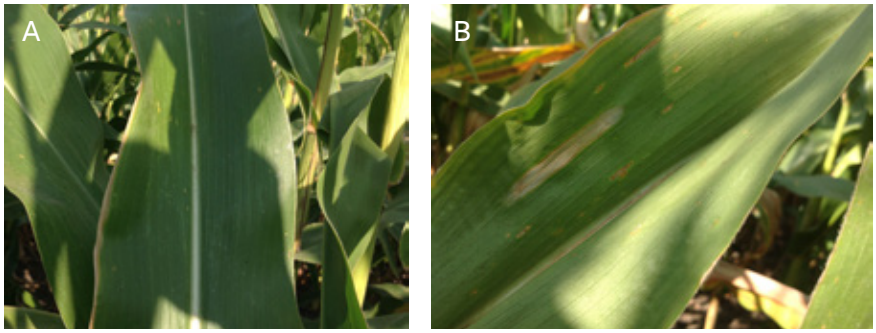


Figure 2. Minimal levels of disease were observed at the research site. A: Plants of treatment EQN1+F1 showing the absence of foliar diseases. This observation was true for the other treatments that consisted of fungicide applications. B: The treatments that did not include fungicide applications showed symptoms of northern corn leaf blight (NCLB) and gray leaf spot (GLS) diseases.

Response of Two Corn Products to Row Spacing

TRIAL OVERVIEW >

Southeastern growers often question what the optimal row spacing in corn is to maximize yield. Most growers in the southeast plant their crops with a 36-inch row spacing due to utilizing the same planter for cotton, corn and peanuts. The purpose of this research was to determine if corn yields could be increased by planting on narrower rows versus the standard 36-inch row pattern.

RESEARCH OBJECTIVE >

- The objective of this experiment was to evaluate the response of two corn products planted at three different row spacings.

LOCATION	SOIL	PREVIOUS CROP	TILLAGE TYPE	PLANTING DATE	HARVEST DATE	POTENTIAL YIELD/ACRE	PLANTING RATE/ACRE
Tifton, GA	Sandy Loam	Peanut	Strip-Till	03/17/2017	08/25/2017	250 bu/acre	34,000 seeds/ acre

SITE NOTES >

- Treatments were planted at the Regional Technology Center (RTC) in Tifton, GA.
- All agronomic practices were per local standards with fertility based on 250 bu/ acre corn yields.
- Treatments included:
  - Product A – Selected for flex ear type
  - Product B – Selected for semi-fixed ear type
- Row spacings:
  - 36-inch single row
  - 30-inch single row
  - 20-inch single row
- Plot sizes:
  - Six 36-inch rows, 150 feet
  - Eight 30-inch rows, 150 feet
  - Twelve 20-inch rows, 150 feet

UNDERSTANDING THE RESULTS >

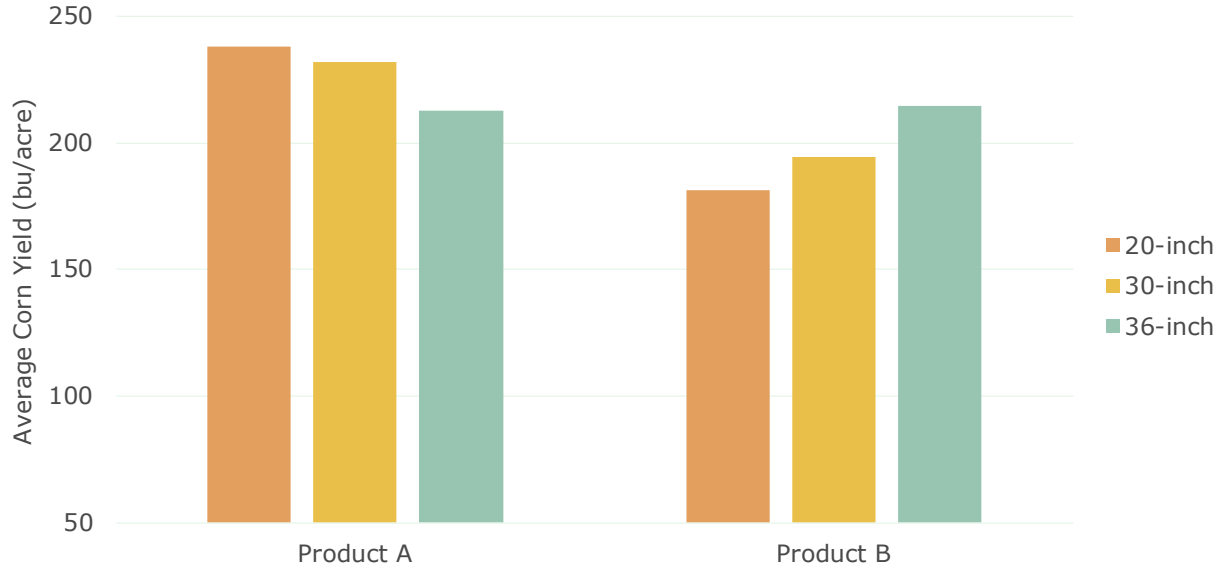


Figure 1. Average corn yield (bu/acre) by corn product and row spacing.

Response of Two Corn Products to Row Spacing

WHAT DOES THIS MEAN FOR YOUR FARM?

- Based on the demonstration results at this location, corn yields can be increased on different row spacings, but it can be dependent on the corn product selected.
  - As row width narrowed, a yield increase was observed with Product A, conversely, a yield decrease was observed with Product B.
- Keep in mind, these data are based off of a static population of 34,000 seeds/acre. Future research needs to be conducted to evaluate multiple corn products at varying populations and row spacings to help determine the yield response of different corn products to multiple row spacings.

Influence of Seeding Rate and Skip-Row Planting on Corn Grain Yield

TRIAL OVERVIEW >

- Using a skip-row planting configuration in arid environments has been a common management practice, especially for cotton.
- Skip-row planting could be a beneficial practice for dryland corn in some environments.
- Typical growing conditions in central Texas could be conducive for a skip-row planting configuration in corn.

RESEARCH OBJECTIVE >

- To determine if a 2-1 skip-row planting configuration has any advantages compared to solid planting of corn in central Texas.
- Evaluate the optimal seeding rates or planting densities of corn for skip-row compared to solid planting.

LOCATION	SOIL	PREVIOUS CROP	TILLAGE TYPE	PLANTING DATE	HARVEST DATE	POTENTIAL YIELD/ACRE	PLANTING RATE/ACRE
Hillsboro, TX	Clay	Corn	Conventional	03/15/2017	08/10/2017	120	18,000 to 36,000

SITE NOTES:

- A SmartStax® corn brand was planted at 4 seeding rates (18,000, 24,000, 30,000, and 36,000) in both solid and skip-row planting configuations.
- Solid planting was on 30-inch rows using 6-row plots.
- Skip-row planting was arranged using 6-row plots, with rows 2 and 5 unplanted.
- Skip-row populations were on a per-acre basis, meaning that the seeding rates within a row were actually 1.5 times higher than corresponding within-row rates in the solid planting treatments.

UNDERSTANDING THE RESULTS

- Solid planting of corn, at all seeding rates, out yielded skip-row planting (Figure 1).
- With the solid planting configuration, yield tended to increase as seeding rate increased up to 36,000 seeds/acre.
- With the skip-row planting configuration, there was little variation in yield across seeding rates, with 30,000 seeds/acre having the highest yield.
- Excellent growing conditions, particularly during grain fill, contributed to well above-average corn yields at this dryland location.

Influence of Seeding Rate and Skip-Row Planting on Corn Grain Yield

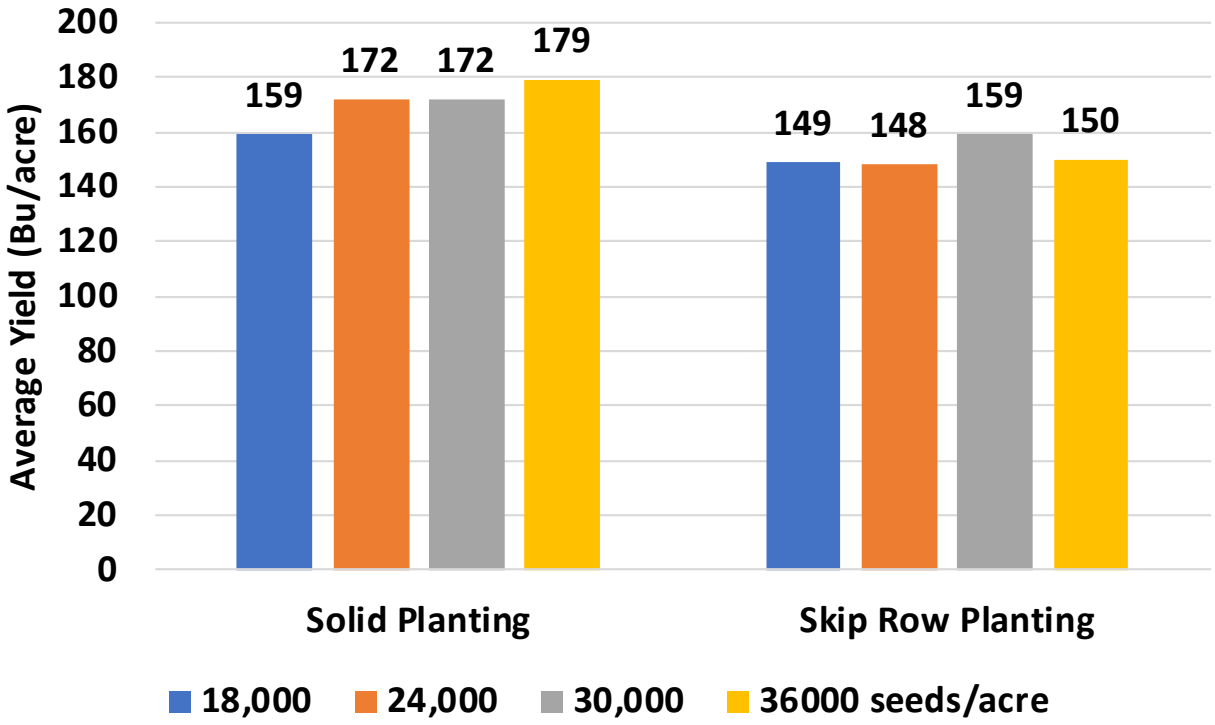


Figure 1. Corn grain yield as influenced by planting configuration and seeding rate.

WHAT DOES THIS MEAN FOR YOUR FARM?

- With excellent growing conditions and extremely low drought stress, skip-row planting may not provide an advantage over solid planting of corn.
- The SmartStax® corn brand responded well to higher seeding rates with solid planting on 30-inch rows.
- Optimal seeding rates in skip-row plantings (based on total land area) may be lower than solid planting because of the resulting excessive within-row populations.
- Additional research on skip-row planting of dryland corn is needed to determine potential advantages for this practice under drought-stress conditions.

Climate Nitrogen Monitoring Tool Support Trial

TRIAL OVERVIEW >

- Climate FieldView™ provides in-season field-level N monitoring based on fertility applications, crop stage, soil type, and weather. This tool can provide assistance to farmers to help with proper N management and nitrogen use efficiency (NUE).

RESEARCH OBJECTIVE >

This study was conducted to help build confidence in and validate the utility of Climate FieldView Nitrogen Monitoring Tool.

LOCATION	SOIL	PREVIOUS CROP	TILLAGE TYPE	PLANTING DATE	HARVEST DATE	POTENTIAL YIELD/ACRE	PLANTING RATE/ACRE
Ypsilanti, ND	Silt Loam	Corn	Minimum	05/04/2016	10/20/2016	170	32,500
Bruning, NE	Silt Loam	Soybean	Conventional	05/13/2016	10/20/2016	240	32,000
Chester, SD	Silt Loam	Soybean	Minimum	04/16/2016	10/15/2016	200	30,000
Redfield, SD	Silt Loam	Soybean	No-Till	04/28/2016	10/14/2016	200	32,000
Battle Creek, NE	Loamy Sand	Corn	Minimum	04/24/2016	10/26/2016		

SITE NOTES >

- Five locations across ND, NE, and SD. Irrigation was applied at the Bruning and Battle Creek, Nebraska locations.
- Two corn products were tested at each location. Total of 10 corn products ranging from a relative maturity of 82 to 117.
- Four N Treatments: *Check: No N applied *50 % N at planting + 50% N at growth stage V6. *50 % N at planting +Nitrogen Monitoring insights at growth stage V6. *100 % N at planting
- Nitrogen Monitoring Insights. The goal in using the Nitrogen Monitoring Tool was to determine how much N was needed and to adjust the rate so there was a surplus of 20 lbs of N available at black layer growth stage.
- N amounts were determined based on the yield goal selected for the area – 1 lb N for 1 bu/acre. Soil type, previous crop, and tillage practice are all accounted for when determining the yield goal and the amount of N to apply at individual locations.

UNDERSTANDING THE RESULTS >

- In this study, it was found that a split N application with half in the spring followed by a post application in-season when the crop is actively growing is more economical and efficient than applying 100% N at planting.
- Using the Nitrogen Monitoring Tool in combination with a split application provided the highest NUE (1.30).
- Using the Nitrogen Monitoring insights versus just a 50/50 split application resulted in applying 15 lbs less N which resulted in saving $5.50/acre with a ROI of $13.50/acre.

Climate Nitrogen Monitoring Tool Support Trial

TABLE 1. ECONOMIC RETURN OF NITROGEN TREATMENTS SUMMARIZED ACROSS ALL CORN PRODUCTS.

Nitrogen Treatment: Planting Time	Total Nitrogen Applied (lbs/acre)	Application Cost ($/acre)	Cost Nitrogen/acre	Yield (bu/acre)	Income/acre ($3.50)	Income/acre – Nitrogen Cost – Application Cost*	Nitrogen Use Effeciency (yield/ lbs N applied)	Net Return Difference from Check
0% N Applied (Check)	0	$0	$0	161.3	$564.55	$564.55	0	
50% N at Planting + 50% N POST	170	$16	$61.20	199.3	$697.55	$620.35	1.17	$55.80
50% N Planting + Nitrogen Monitoring POST	155	$16	$55.80	201.6	$705.60	$633.80	1.30	$69.25
100% N at Planting	170	$8	$61.20	194.4	$680.40	$611.20	1.14	$46.65

*Application costs, commodity prices, and fertilizer costs are based on local retail and commodity pricing and individual rates/prices may vary.

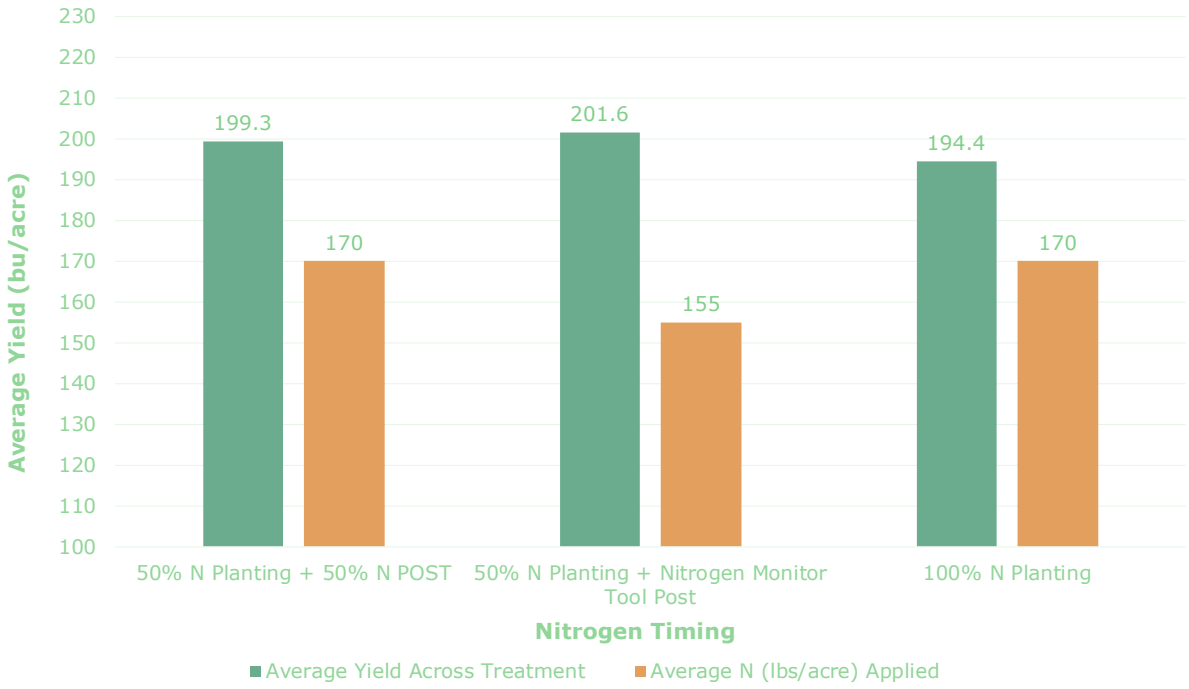


Figure 1. *Yield response to nitrogen treatment across corn product relative maturities.*

WHAT DOES THIS MEAN FOR YOUR FARM?

- Results from this trial highlight the value that Climate FieldView Nitrogen Monitoring Tool provides growers for in-season monitoring and management of corn products. In this study, similar trends of NUE and cost savings were observed across locations (3 states) with different environments, reinforcing that Climate FieldView is a wise investment for producers.
- The Nitrogen Monitoring Tool is a reliable source for predicting N needs in corn to help obtain maximum yield potential and economic return while minimizing environmental impacts.

Corn Product Response to Nitrogen Strategy

TRIAL OVERVIEW

- Questions about how corn products respond to different management strategies can be perplexing as information gleaned from discussions with neighbors about product performance may not provide a complete story as to why a corn product did or did not yield as expected.
- A study was initiated to evaluate two different nitrogen (N) application strategies on multiple corn products to help provide insight for farmers about the impact of N strategy on corn yield.

RESEARCH OBJECTIVE

- The objective of this study was to investigate if the N application strategy impacted corn products differently. Two N application strategies were used: all upfront prior to planting or fertigation over the growing season.

LOCATION	SOIL	PREVIOUS CROP	TILLAGE TYPE	PLANTING DATE	HARVEST DATE	POTENTIAL YIELD/ACRE	PLANTING RATE/ACRE
Gothenburg, NE	Hord silt loam	Soybean	Strip tillage	04/26/2017	10/24/2017	270 bu/acre	36,000 seeds/acre

SITE NOTES >

- A standard formula was used to determine N application rates:
  - N need = (yield goal * 1.1) - (soil N) - (legume credit)
  - 194 lbs/acre = (270 bu/acre * 1.1) - (63 lbs soil N in 2 ft) - (40 lbs/acre)
- N treatments were applied as all N upfront or via fertigation consisting of eight applications of 15 lbs of N/acre.
- The study was a split-plot design with N strategy as the whole plot with four replications.
- Corn products were grown under full irrigation using a subsurface drip irrigation system. Total irrigation applied to all products was 9.2 inches over the growing season.
- Barren plants, green-snapped plants, and plants that died prematurely were recorded

UNDERSTANDING THE RESULTS

TABLE 1. NITROGEN APPLICATION RATES AND TIMING ALONG WITH RESIDUAL SOIL N AND LEGUME CREDITS. NOTE THAT TOTAL N IS SLIGHTLY LOWER IN THE FERTIGATION TREATMENT.

	N application rates (lbs/acre)	
	All N upfront	Fertigation
Residual N	63	63
Strip-till N	19.3	19.3
Legume N credit	40	40
At-planting N	174.7	40.7
Fertigation N	0	120 (8 applications of 15 lbs N/acre)
Total N	297	283

Corn Product Response to Nitrogen Strategy

- Corn products responded differently to N strategy with 9 out of the 24 corn products tested having significantly increased yield in response to fertigation with a 12 bu/acre or more difference observed (Table 2).
- The positive response to fertigation was not limited to a specific RM. Instead, the response was recorded in two 105 RM products all the way to the 117 RM product.
- There was no interaction between N strategy and corn product for the incidence of barren plants, green-snapped plants, or plants that died prematurely.

WHAT DOES THIS MEAN FOR YOUR FARM?

- This research provides farmers with another question that they should ask when choosing a corn product to make sure that the product fits their management practices. Whether they apply all the N upfront or can fertigate the N over the growing season, there are corn product options that can meet their needs.
- Farmers should work closely with their local seed sales team to properly choose and place corn products to maximize environment and management potential.
- Seed sales teams can identify how their corn products performed in this trial.

Corn Product Response to Nitrogen Strategy

TABLE 2. CORN PRODUCT YIELD IN RESPONSE TO N APPLICATION STRATEGY. HIGHLIGHTED PRODUCTS INDICATE A SIGNIFICANT RESPONSE.

Corn Product	Corn Product Yield (bu/acre)		Response to fertigation (bu/acre)
	All upfront	Fertigation	
100RM-A	228	228	0
103RM-A	255	251	-4
104RM-A	235	241	6
105RM-A	225	238	13
105RM-B	236	251	15
106RM-A	267	279	12
108RM-A	257	265	8
108RM-B	245	271	26
109RM-A	264	270	6
110RM-A	254	260	6
110RM-B	268	266	-2
111RM-A	263	266	3
111RM-B	265	270	5
111RM-C	267	280	13
112RM-A	263	270	7
112RM-B	248	268	20
112RM-C	258	283	25
113RM-A	278	287	9
113RM-B	251	260	9
113RM-C	266	268	2
114RM-A	283	286	3
114RM-B	269	280	11
116RM-A	263	278	15
117RM-A	277	306	29

LSD (0.1) = 11.9

Corn Product Response to Nitrogen and High Densities

TRIAL OVERVIEW

- Every year, corn products are subjected to less-than-ideal situations in the field, resulting in stress.
- Farmers and agronomists need to know how their corn products react in stressful situations to better understand the implications on yield potential and general plant health.

RESEARCH OBJECTIVE

- This study evaluated the effect of nitrogen (N) strategy and planting density on corn product performance. The N rates utilized and the planting densities, which ranged from normal to very high, were intended to induce stress that would negatively impact yield, standability, and plant health.

LOCATION	SOIL	PREVIOUS CROP	TILLAGE TYPE	PLANTING DATE	HARVEST DATE	POTENTIAL YIELD/ACRE	PLANTING RATE/ACRE
Gothenburg, NE	Hord silt loam	Corn	Strip tillage	04/27/2017	11/10/2017	260 bu/acre	28K, 36K, 44K, 52K

SITE NOTES >

- This study was set up as a randomized complete block design with three replications.
- Six corn products with RM ranging from 110 to 116 were assessed.
- Two N treatments were assessed:
  - 120 AP: 120 lbs/acre N applied at planting (AP) with no additional N
  - 120 AP + 100 V7: 120 lbs/acre N applied at planting plus 100 lbs/acre N side dressed at the V7 growth stage
- Four planting densities were used: 28K, 36K, 44K, and 52K (K = 1,000) seeds/acre.
- Soil tests indicated 45 lbs/acre residual N in the top 2 ft. of soil, low phosphorus and sulfur levels, and adequate levels of potassium and micronutrients.
- Nutrients applied besides the N rates specified above were: 60 lbs/acre P_2O_5, 0.5 lbs/acre zinc, and 25 lbs/acre sulfur with strip tillage.
- A total of 6.6 inches of irrigation was applied during the growing season to meet crop needs.
- No fungicides or insecticides were applied to the trial and weeds were uniformly controlled across the study.
- Grain yield, stalk lodging, and plants that died prematurely were measured.

Corn Product Response to Nitrogen and High Densities

UNDERSTANDING THE RESULTS

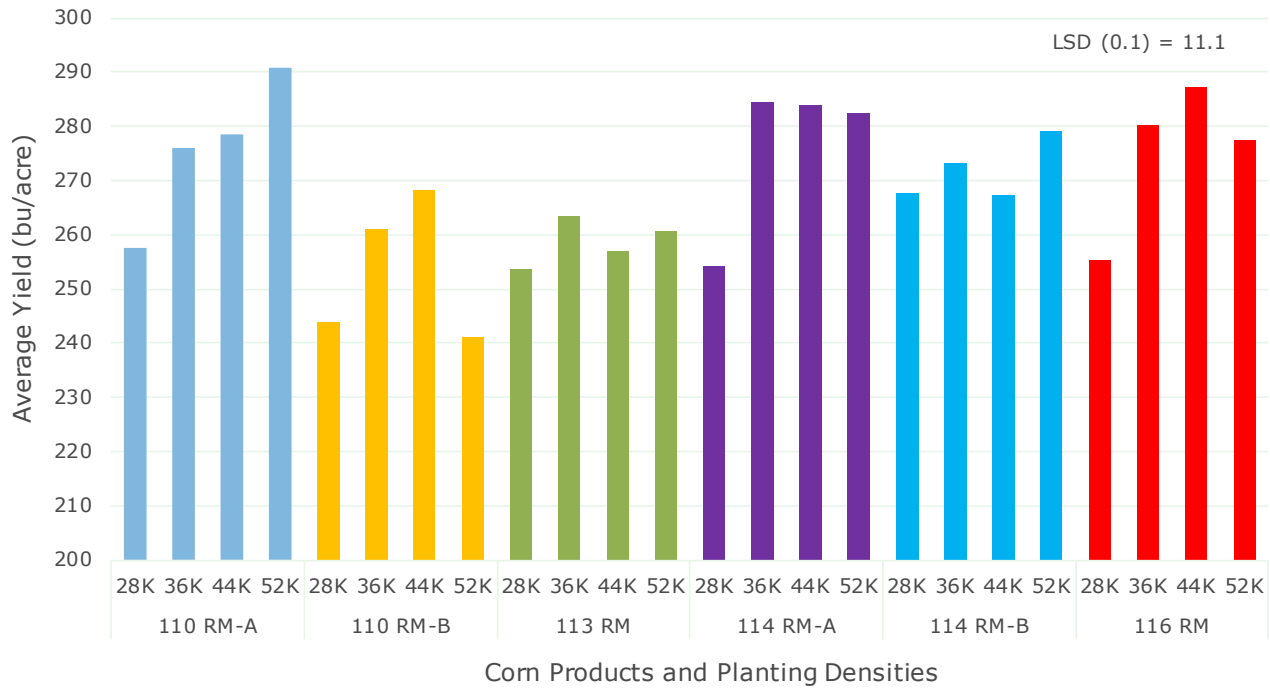


Figure 1. Yields by product and planting density

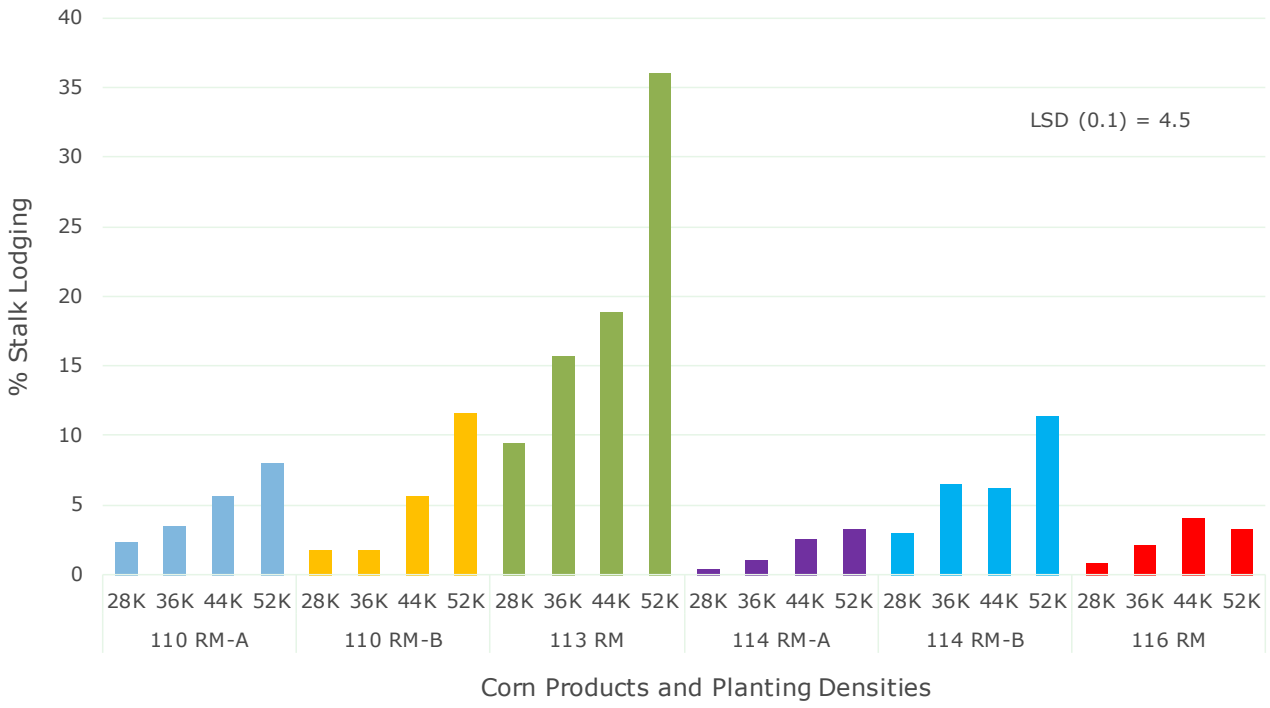


Figure 2. Late-season stalk lodging by product and planting density

Corn Product Response to Nitrogen and High Densities

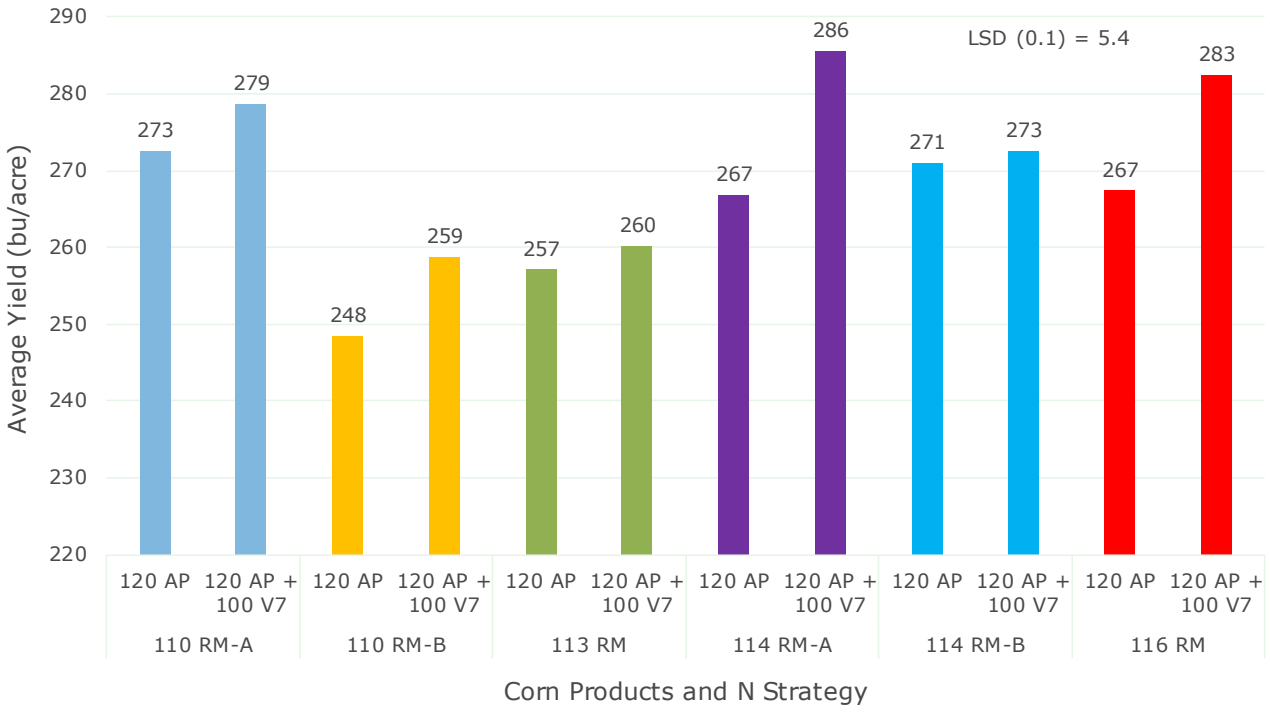


Figure 3. Corn product yield by nitrogen strategy

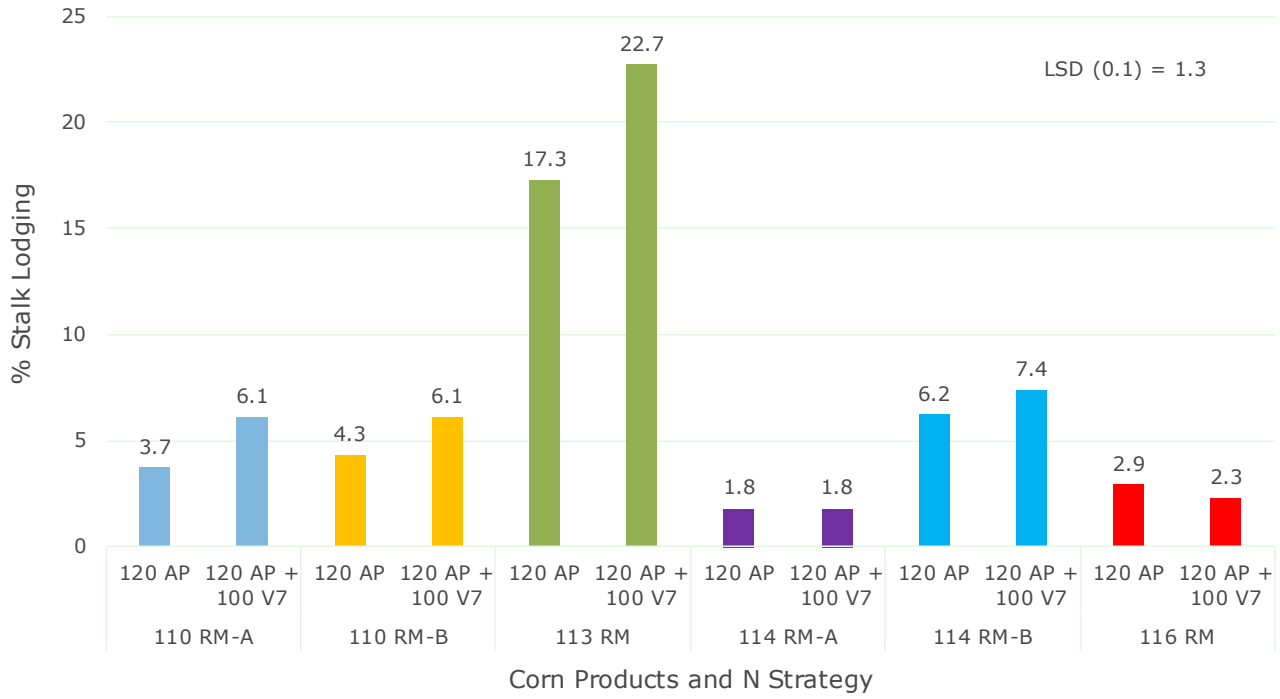


Figure 4. Late-season stalk lodging by nitrogen strategy and corn product

Corn Product Response to Nitrogen and High Densities

YIELDS BY PLANTING DENSITY

- The corn products differed in their responses to planting density with respect to yield. The 110 RM-A product responded with increased yields up to the highest density, while yields of most other products trended downward at the highest density (Figure 1).

STALK LODGING BY PLANTING DENSITY

- Higher planting densities resulted in higher rates of stalk lodging for nearly all products. Some corn products had higher lodging rates overall, particularly the 113 RM product. Conversely, stalk lodging in two products, 114 RM-A and 116 RM, remained below 5% in all treatments (Figure 2).

N APPLICATION STRATEGY AND YIELDS

- Changing the N application strategy from the 120 AP treatment to the 120 AP + 100 V7 treatment significantly improved yields in four of the six corn products, indicating that the extra sidedressed N helped alleviate some of the N stress in most products (Figure 3).

N APPLICATION STRATEGY AND STALK LODGING

- The N application strategy also impacted stalk lodging. The 110 RM-A, 110 RM-B, and 113 RM products had significantly increased stalk lodging in the 120 AP + 100 V7 treatment (Figure 4). The reason for this wasn't clear, but even with the increased lodging, higher yields were usually achieved.

PREMATURE PLANT DEATH

- There was a significant difference among corn products for premature plant death, while the planting density and the N strategy had no impact on this measurement.

WHAT DOES THIS MEAN FOR YOUR FARM?

- The corn products had varying responses to the growing environments, which could be applied to field situations.
- Yield and standability can become issues in stressful growing environments. Further research is critical for understanding corn product performance in varying environmental conditions.
- Branded information to identify these corn products can be acquired from your local Monsanto seed sales team.

Response of Corn Products to Planting Population and Nitrogen Fertility

TRIAL OVERVIEW >

- This trial was conducted to measure responses of corn products to both population and nitrogen (N) applications.
- As corn products enter the marketplace, knowledge of these responses is critical for proper management of the products.
- With lower grain prices, some growers are trying to save on input costs by reducing N fertility.
- We evaluated a range of N fertility rates and planting populations across 4 corn products.

RESEARCH OBJECTIVE >

- The primary goal was to investigate the response of corn products to planting population and rates of N fertility.

LOCATION	SOIL TYPE	PREVIOUS CROP	TILLAGE TYPE	PLANTING DATE	HARVEST DATE	POTENTIAL YIELD	PLANTING RATE
Scott, MS	Clay Loam	Cotton	Conventional	03/21/17	08/03/17	300 bu/acre	Various

SITE NOTES >

- 4 corn products were planted: Product A, Product B, Product C, and Product D
- 2 Fertility regimes: Full nitrogen fertility (240 lbs/acre actual N applied as 28-0-0-5); 60% of the full N rate (144 lbs/acre actual N applied as 28-0-0-5)
- 4 planting populations: 23,000 kernels/acre, 28,000 kernels/acre, 33,000 kernels/acre, 38,000 kernels/acre
- 2 replications; All agronomic inputs were applied per local standards.
- Plots were 8 rows by 160 feet or 0.10 acres/plot. Plots were intended to be irrigated but no irrigation was applied due to adequate rainfall.

UNDERSTANDING THE RESULTS >

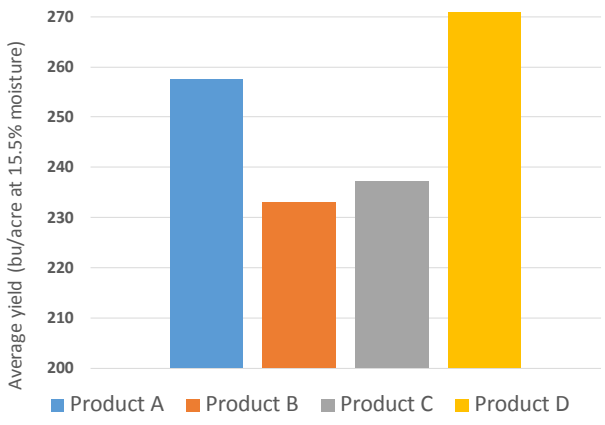


Figure 1. Average yield response of corn products to planting population and fertility.

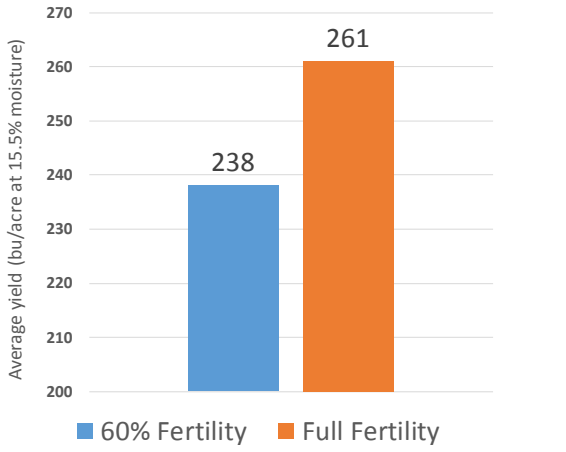


Figure 2. Average response of corn products to nitrogen fertility.

Response of Corn Products to Planting Population and Nitrogen Fertility

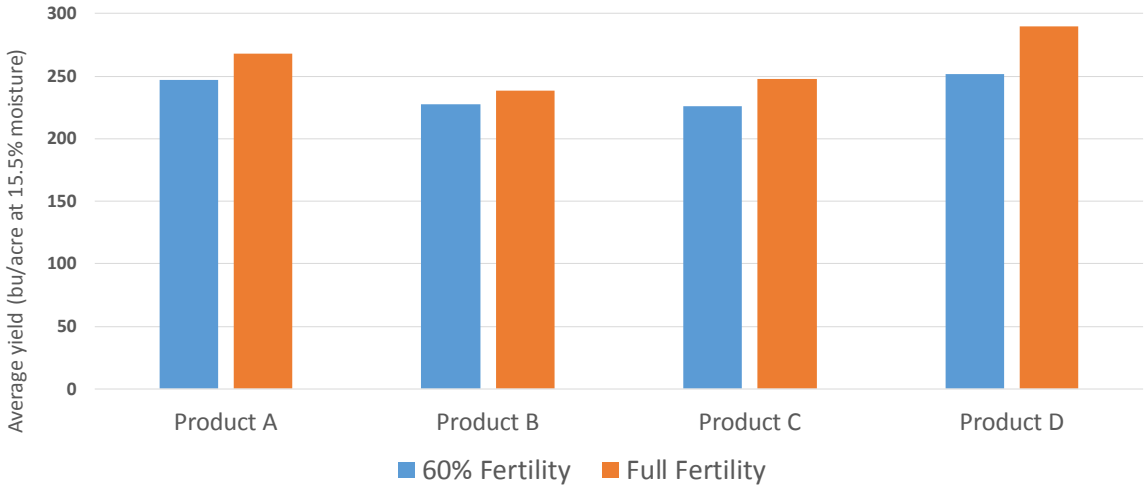


Figure 3. Average yield response of corn products to nitrogen fertility across populations.

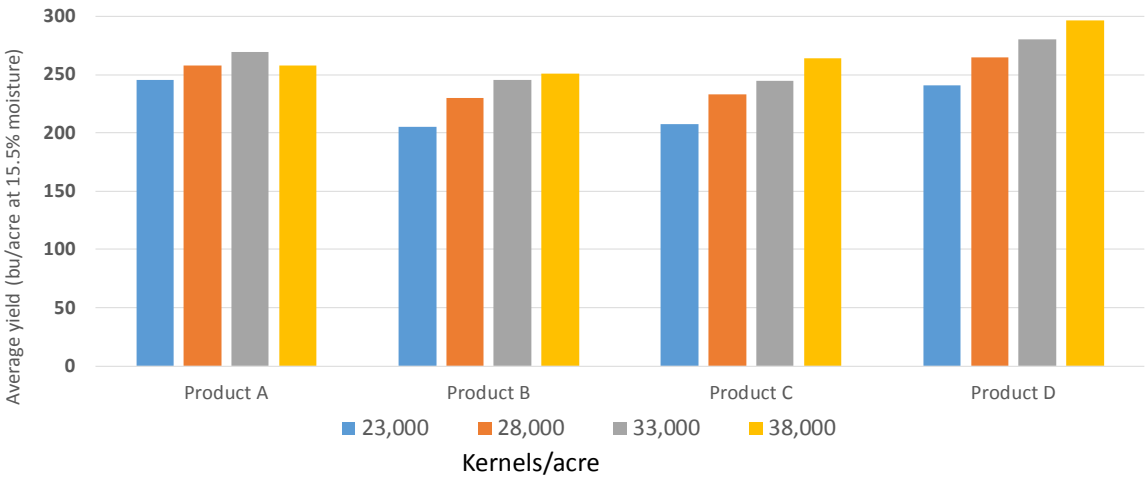


Figure 4. Average yield response of corn products to planting population across fertility.

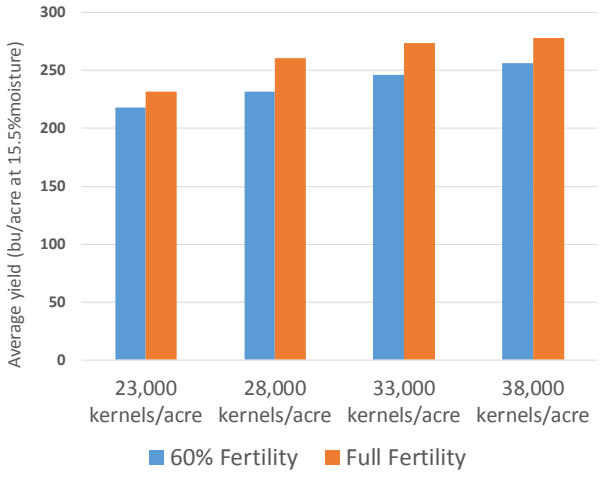


Figure 5. Average yield response of corn products to planting population and fertility.

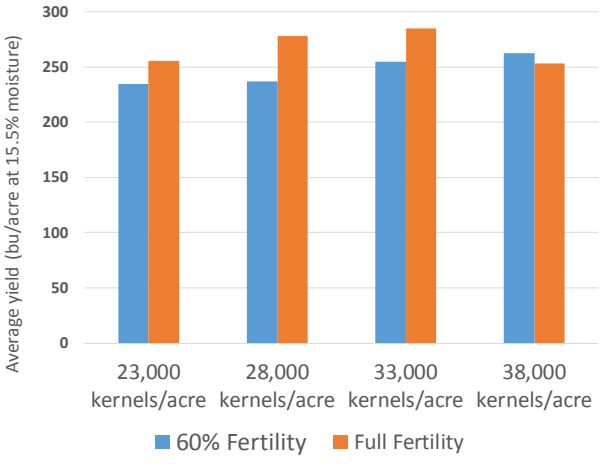


Figure 6. Average yield response of Product A to planting population and fertility.

Response of Corn Products to Planting Population and Nitrogen Fertility

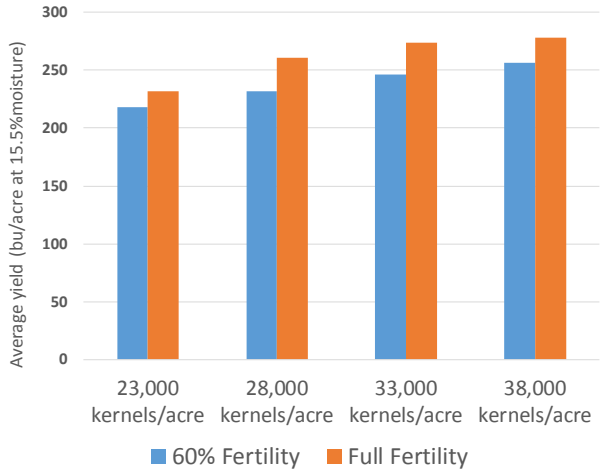


Figure 7. Average yield response of Product B to planting population and fertility.

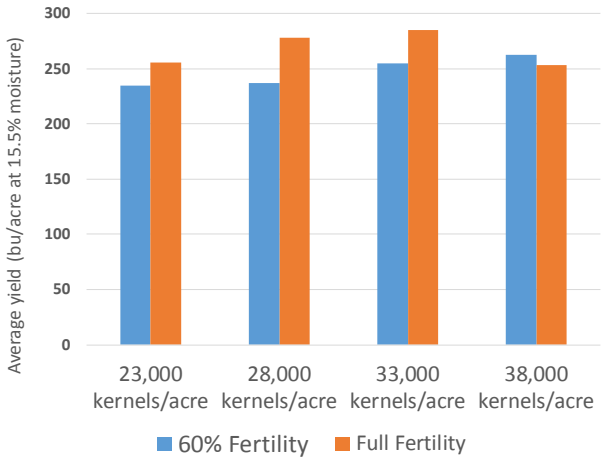


Figure 8. Average yield response of Product C to planting population and fertility.

WHAT DOES THIS MEAN FOR YOUR FARM?

- Exceptionally high yield potential was seen in this trial due to the moderate weather conditions at Scott, MS during 2017 pollination and grain fill. Product A and Product D produced particularly high yields.
- Within the commercially acceptable range of populations, all populations and corn products responded positively to the full fertility regime. Only Product A at 38,000 kernels/acre and Product B at 23,000 kernels/acre were neutral and these populations are outside of the typical recommendation or general agronomic practice for this region and environment.
- Population can have a significant influence on the yield potential of a corn product.
- Population/yield responses were similar to previous demonstrations at the Monsanto Learning Center at Scott, MS.
- Growers should be very cautious when considering cutting fertility inputs.
- The tested corn products have exceptionally high yield potential.

Nitrogen Management Using Climate FieldView™

SUSTAINABILITY SPOTLIGHT

The evolution and introduction of digital tools represents an important advancement in farming and our collective ability to meet the food and nutrition needs of present and future generations. In addition, it's important to recognize that modern agriculture can contribute not just to our dinner plates, but also to the preservation of our land and resources.

TRIAL OVERVIEW

- From fall application to spring application, to side dressing, to different nitrogen (N) sources and rates, to different growing conditions year-after-year, the nitrogen practice that best optimizes corn productivity needs to be understood for sustainable operations.
- The Climate FieldView™ nitrogen management tool provides insight into the N status of a field throughout the growing season to help growers efficiently manage this vital resource.

RESEARCH OBJECTIVE

- To evaluate how Climate FieldView nitrogen management tool may assist growers in managing their N applications and usage in the most profitable way when compared to local standards.

LOCATION	SOIL	PREVIOUS CROP	TILLAGE TYPE	PLANTING DATE	HARVEST DATE	POTENTIAL YIELD/ACRE	PLANTING RATE/ACRE
Huxley, IA	Clay Loam	Soybean	Conventional	4/24/2017	10/17/2017	225 bu/acre	34,000 seeds/ acre

SITE NOTES >

- A 110 RM SmartStax® RIB Complete® corn blend product was used for this trial.
- The trial was carried out in 30-inch row spacing, 6 rows/treatment, with 2 replications.
- The N treatments were based on a grower standard rate of 160 lbs N/acre for the research site. The treatments tested are shown below (Table 1).

TABLE 1. *PRE INDICATES THAT NITROGEN WAS APPLIED PRE-PLANT (BEFORE PLANTING).

TREATMENTS	DESCRIPTION
80 PRE*	50% Grower Standard PRE*
160 PRE*	100% Grower Standard PRE*
175 NMT PRE*	100% Climate FieldView™ nitrogen management tool (NMT) PRE*
105 PRE* + 55	65% Grower Standard PRE* followed by 35% side dress at V5
105 PRE* + 60 NMT	65% Grower Standard PRE* followed by NMT side dress at V5

UNDERSTANDING THE RESULTS

- The different treatments significantly affected the N availability throughout the growing season (Fig. 1). The 80 PRE treatment showed a severe N deficit, whereas the 160 PRE treatment was on the verge of deficiency. In contrast, the 175 NMT PRE (Fig. 1) and the other split application treatments (not shown here) showed surplus levels of N at black layer.

Nitrogen Management Using Climate FieldView™

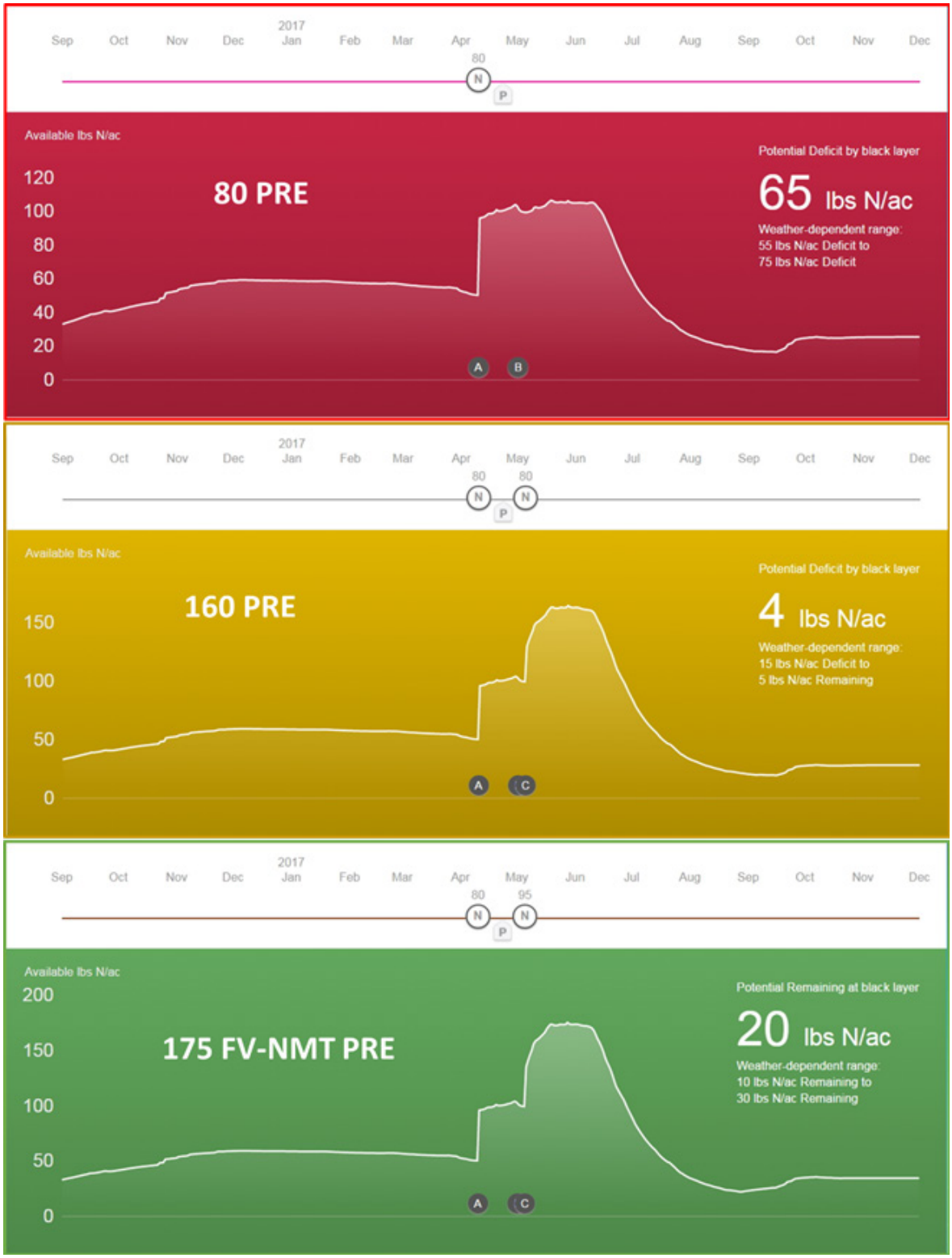


Figure 1. Screenshots of the N status of the three pre-plant (PRE) N treatments as modelled by the Climate FieldView nitrogen management tool. The model was for a target of 10 lbs N/acre at black layer. Red (top) indicates severe deficit, yellow (middle) indicates potential deficit, and green (bottom) indicates some surplus at black layer.

Nitrogen Management Using Climate FieldView™

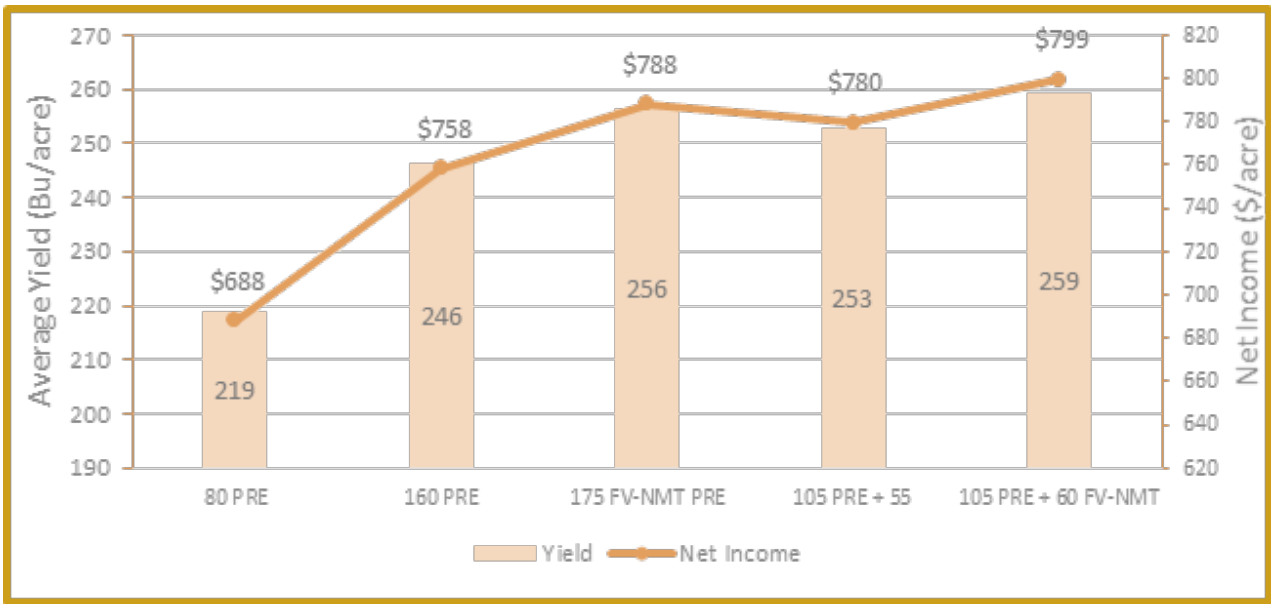


Figure 2. Effects of N management on the average yield and profitability of corn.

- The Climate FieldView nitrogen management tool (NMT) gave application rate recommendations slightly higher than the grower standards in both the 100% PRE and the split application treatments.
- Split applications out-yielded the 100% PRE applications in both the NMT and the grower standard practice (Fig. 2).
- The NMT recommendation resulted in higher yields than the grower standard practices.
- Using the NMT resulted in higher economic returns over the grower standard practice with up to $30 higher net income at the 100% PRE rate, and up to $19 at the split application rate.
- The treatment with the lowest N rate (80 PRE) had the lowest yields and the lowest income.

WHAT DOES THIS MEAN FOR YOUR FARM?

- N management in corn production continues to be a subject of much research. This, in part, is due to the complexity of the nitrogen cycle with regards to its availability to plants.
- Every growing season is different and has a significant impact on the performance of farm inputs. During the 2017 growing season, the research site experienced drought and high temperature conditions interspersed with a few 2-3" rainfalls, a scenario that significantly affects N dynamics in the soil.
- Climate FieldView™ nitrogen management tool continues to adjust the N status model throughout the growing season as environmental conditions change. This provides real time insights to help growers make informed decisions.
- Growers are encouraged to invest in tools like this to help with operation decisions, especially those that depend on unpredictable variables, like weather conditions during the growing season.

Climate FieldView™ Nitrogen Management Recommendations

SUSTAINABILITY SPOTLIGHT

Just like you and I might check the weather on our smartphones, farmers can use web-based technology and apps to help make decisions like when to plant, how much fertilizer to apply, and which seeds to use on different parts of a field to get the best level of production. This access to data helps farmers get the most out of every acre, driving better outcomes on the farm and our planet.

TRIAL OVERVIEW

- Nitrogen (N) is the number one fertilizer that farmers must manage in a corn crop.
- Previous crop, growing conditions, product genetics, commodity price, and N cost are factors to consider when determining the highest return for N investment.
- Weather plays an important role in how farmers manage N.

RESEARCH OBJECTIVE

- To help determine how FieldView™ nitrogen management recommendations can help farmers manage N.

LOCATION	SOIL	PREVIOUS CROP	TILLAGE TYPE	PLANTING DATE	HARVEST DATE	POTENTIAL YIELD/ACRE	PLANTING RATE/ACRE
Monmouth, Illinois	Silt loam	Corn	Conventional	05/19/2017	10/05/2017	240 bu/acre	36,000 seeds/acre

SITE NOTES >

- Five 32% UAN N Treatments Consisting of Three Replications
  - Treatment 1: 200 lbs/acre 32% UAN applied Pre-Plant on 5/9/17 = Standard Rate (SR)
  - Treatment 2: SR-15% or 170 lbs/acre followed by (fb) 30 lbs/acre applied 2 weeks pre-tassel on 7/5/17
  - Treatment 3: SR-15% fb a FieldView nitrogen management recommendation of 35 lbs/acre applied 2 weeks pre-tassel to tassel on 7/5/17 (Figure 1, Left)
  - Treatment 4: Half SR fb 100 lbs/acre applied by sidedress on 6/19/17
  - Treatment 5: Half SR fb a FieldView nitrogen management recommendation sidedress rate of 75 lbs/acre on 6/9/17 (Figure 1, Right).

Climate FieldView™ Nitrogen Management Recommendations

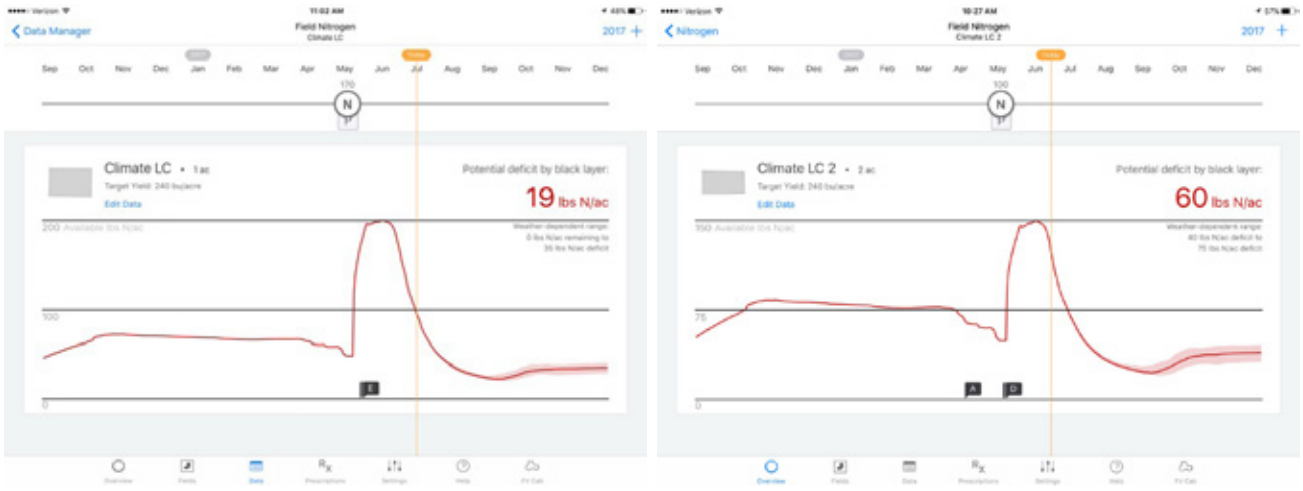


Figure 1. Screen shots of FieldView™ nitrogen management recommendations: Left - 7/5/17 when 35 lbs/acre of 32% UAN was sidedress applied to Treatment 3; Right - 6/9/17 when 75 lbs/acre of 32% UAN was sidedress applied to Treatment 5. The high end of the deficit was used for both applications.

UNDERSTANDING THE RESULTS

Figure 2. Average yield and net income/acre after nitrogen cost for five different nitrogen application treatments at Monmouth, IL in 2017 (3 Replications)

Climate FieldView™ Nitrogen Management Recommendations

- Yields were good across the five treatments (Figure 2); however, FieldView nitrogen management recommendations provided a higher gross profit/acre and the highest yielding treatment (Figure 2).
- The Monsanto Learning Center at Monmouth, IL will continue to examine ways FieldView nitrogen management recommendations can provide farmers with information to help manage N and in-season N application decisions.

WHAT DOES THIS MEAN FOR YOUR FARM?

- When used by farmers, FieldView™ nitrogen management recommendations can provide valuable information that can potentially increase yields and net income.
- Yields were good across the five treatments; however, FieldView nitrogen management recommendations provided a higher gross net income/acre and the highest yielding treatment.
- Because of the advantage that FieldView nitrogen management recommendations provide over other online N management calculators, farmers can react quickly to changing weather patterns.

Effect of Starter Fertilizer on Corn Growth, Development and Yield

TRIAL OVERVIEW

- There are several reasons for applying starter fertilizer; it is important to study the outcome of an application of starter fertilizer in fields.
- These data did not support a clear yield benefit for starter fertilizer in corn; although, height and vigor seemed to improve with the use of starter fertilizer.

RESEARCH OBJECTIVE >

- The objective was to evaluate the effect of starter fertilizer on corn growth and yield.

LOCATION	SOIL	PREVIOUS CROP	TILLAGE TYPE	PLANTING DATE	HARVEST DATE	POTENTIAL YIELD/ACRE	PLANTING RATE/ACRE
Monmouth, IL	Silt loam	Soybeans	Conventional	05/10/2017	10/02/2017	N/A	36,000 seeds/ acre

SITE NOTES >

- There were 10 replicates.
- Half of the plots received 3.5 gal/acre of 10-34-0 fertilizer plus 1 qt of a chelated 0.7% zinc (Zn) product in-furrow at planting time. The other half received no starter fertilizer. All other conditions were the same between the two sets of plots.
- A 114-day relative maturity SmartStax® RIB Complete® corn blend product was used in all plots.

UNDERSTANDING THE RESULTS >

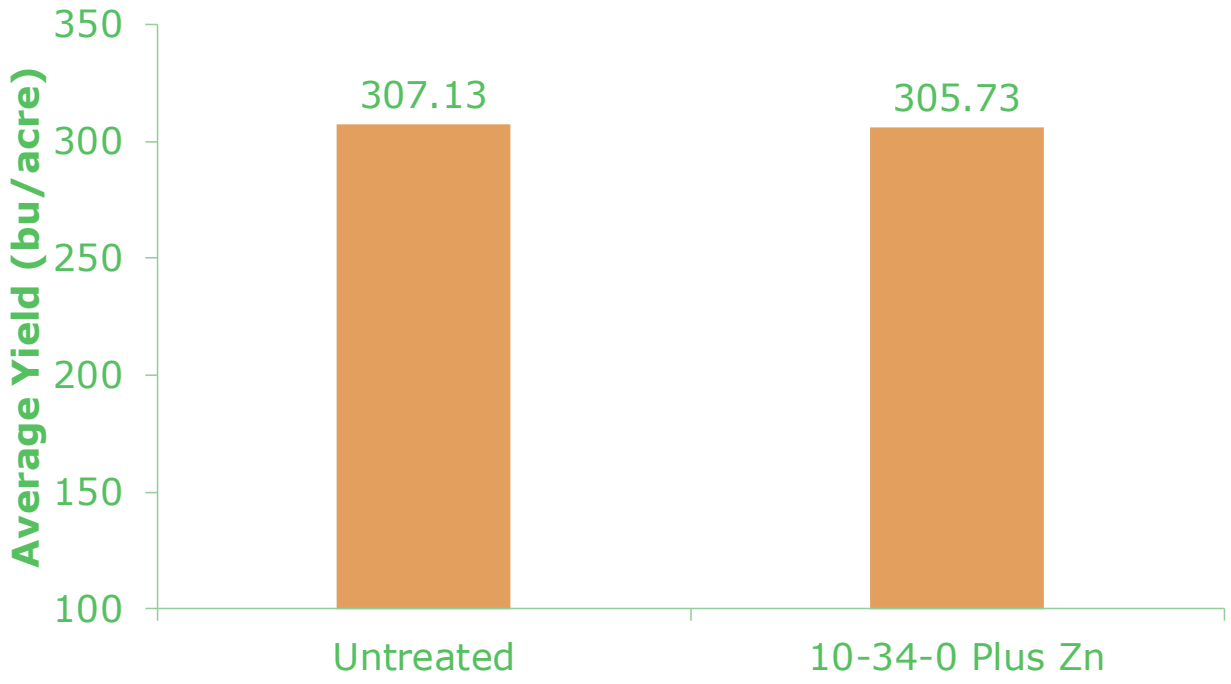


Figure 1. Effect of starter fertilizer on corn yield when comparing the untreated check (UTC).

Effect of Starter Fertilizer on Corn Growth, Development and Yield

- During the early season, plots with starter fertilizer were taller and exhibited more vigor. This was visually apparent through the majority of the growing season.
- However, this difference in seedling height and vigor did not translate into a yield difference.
- These results are similar to university trials, which generally indicate starter fertilizer may benefit yield in fields with an underlying fertility issue, reduced tillage systems, and cool soils.[1]

WHAT DOES THIS MEAN FOR YOUR FARM?

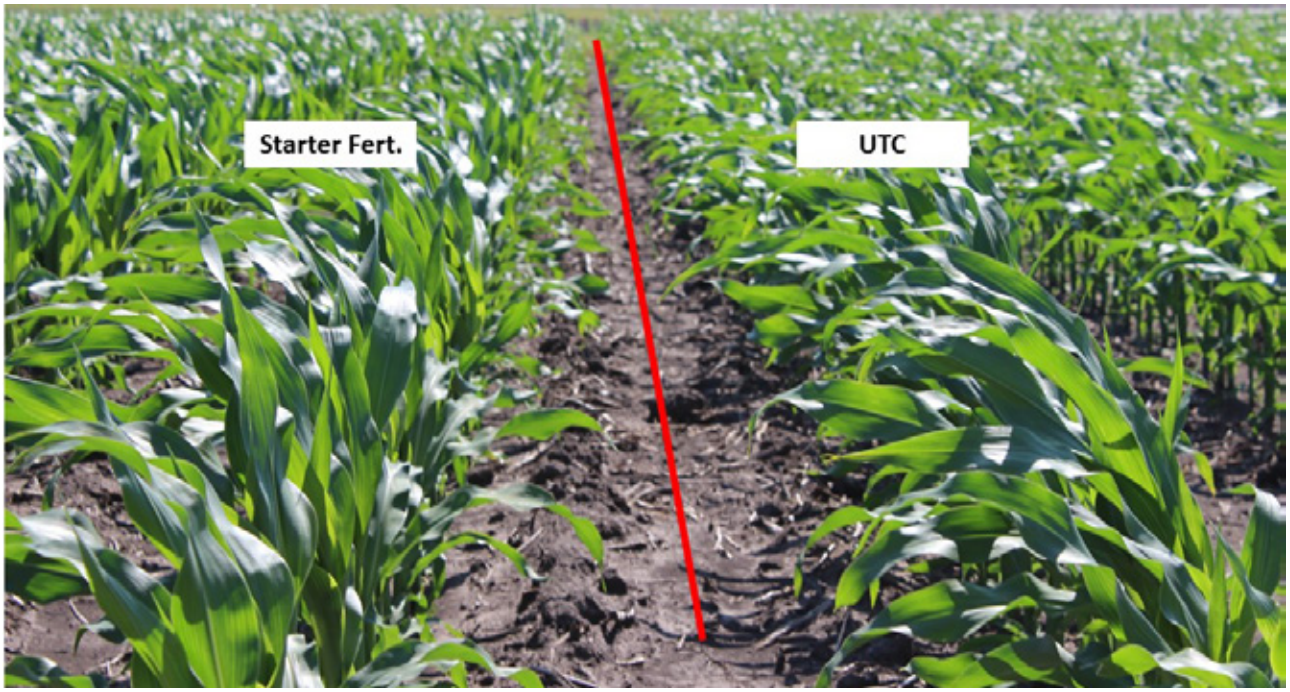


Figure 2. Corn receiving starter fertilizer may have a visual difference (left) compared to untreated check (UNT).

- Starter fertilizer can increase seedling height and vigor, but this does not necessarily translate into a yield benefit.
- Starter fertilizer may increase yield in soils with an underlying fertility issue. In these cases, it is important to try to identify and treat the underlying issue.

SOURCE >

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

Placement of Nitrogen During Sidedressing

TRIAL OVERVIEW

- Nitrogen (N) placement and its effect on N uptake and potential yield is a management concern of farmers.
- Nitrogen is a major investment in corn production. Knowing where to place sidedressed N can help farmers decide which method of application is best for their operation.

RESEARCH OBJECTIVE

- The objective of this study was to determine if an advantage exists for placing N at the base of the plants vs. down the center of the row at the V6 growth stage (six leaf collars).

LOCATION	SOIL	PREVIOUS CROP	TILLAGE TYPE	PLANTING DATE	HARVEST DATE	POTENTIAL YIELD/ACRE	PLANTING RATE/ACRE
Monmouth, IL	Silt Loam	Corn	Conventional	04/25/2017	09/28/2017	290 bu/acre	36,000 seeds/ acre

SITE NOTES >

- A 114 RM SmartStax® RIB Complete® corn blend product was planted.
- The N form used for all treatments was 32-0-0 UAN.
  - 80 lbs/acre was applied before planting and incorporated.
  - 100 lbs/acre was sidedressed with a urease inhibitor.
- Two sidedress application methods were used on 6/16/17 when plants were at the V6 growth stage.
  - A rolling coulter with a shallow knife in the center of the row (Figure 3 - top right).
  - 360 Y-Drop® (Figure 3 - bottom pictures).
- The trial consisted of 4 replications.
- The data from 2016 was added to show 2 years of data.

Placement of Nitrogen During Sidedressing

UNDERSTANDING THE RESULTS

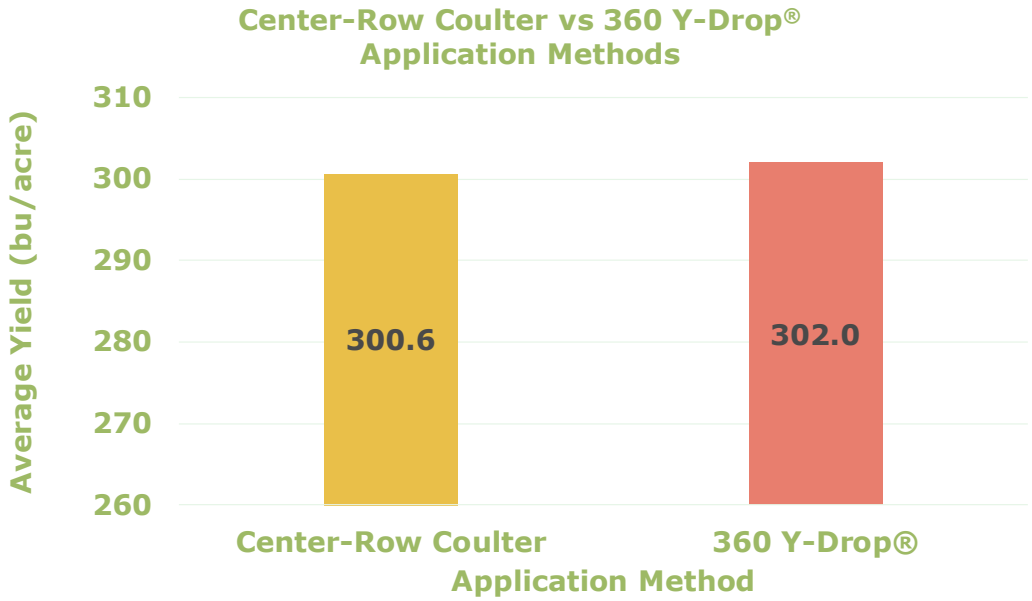


Figure 1. Average Yield in 2017 for Center-Row Coulter vs. 360 Y-Drop® Application Methods

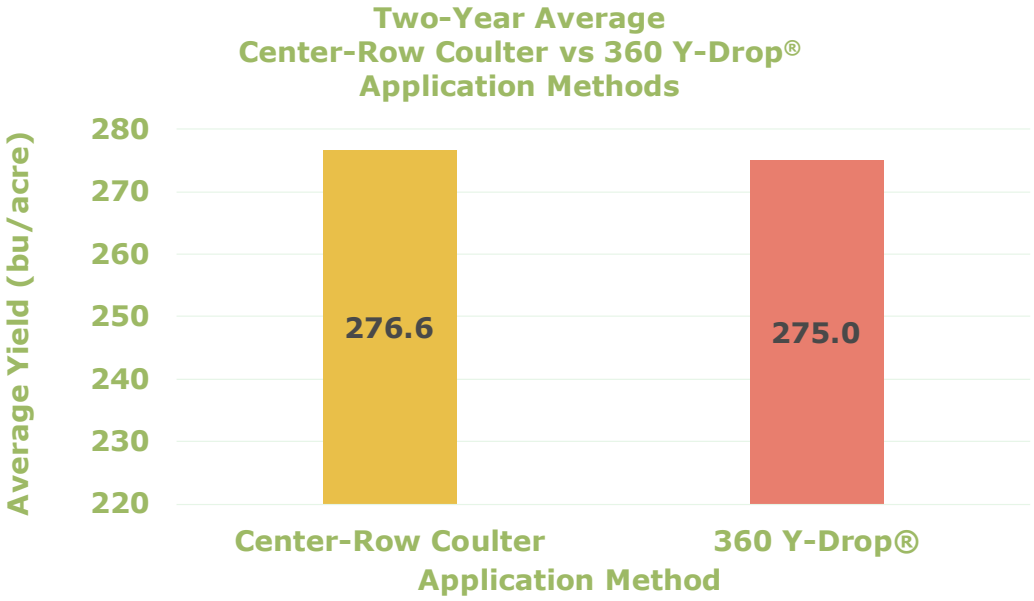


Figure 2. Two-year (2016 and 2017) Average Yield for Center-Row Coulter vs. 360 Y-Drop® Application Methods

- The average yields for both methods were similar in 2017 (Figure 1).
- The two-year average yields for both methods are similar (Figure 2).
- Application at the V6 growth stage by either method showed no clear advantage.
- Rolling coulter applications should be made before plant height exceeds toolbar height.
- Individual corn products may respond differently to application timing.

Placement of Nitrogen During Sidedressing

Figure 3. The 360 Y-Drop® unit applies nitrogen (N) to the base of the plants (top left), rolling coulter applicator applies the N behind the coulter as it cuts through the soil (top right), 360 Y-Drop® unit (bottom left), and 360 Y-Drop® applicator (bottom right).

WHAT DOES THIS MEAN FOR YOUR FARM?

- The use of a rolling coulter with a shallow knife is limited due to corn height.
- 360 Y-Drop® applicators allow a wider application window and are not limited to early-season sidedressing.
- The ideal placement of sidedressed N could change from year to year due to weather and environment.
- Individual products may respond differently to the timing of N application. Consult your local seed specialists for recommendations.
- Yield differences may not be economically feasible when all costs are considered. Local costs should be evaluated when making N management decisions.

Timing of Nitrogen Application

TRIAL OVERVIEW

- There is considerable interest in applying nitrogen (N) later in the growing season; therefore, farmers and agronomists want to know when is the best time to sidedress N in a later-season application.
- Because N is a major and required investment in corn production, knowing when corn plants are most responsive to an application of N can help farmers determine the application time for the best return on their investment.

RESEARCH OBJECTIVE

- To compare the effectiveness of different N application times during the growing season.

LOCATION	SOIL	PREVIOUS CROP	TILLAGE TYPE	PLANTING DATE	HARVEST DATE	POTENTIAL YIELD/ACRE	PLANTING RATE/ACRE
Monmouth, IL	Silt Loam	Corn	Conventional	04/25/2017	09/28/2017	290 bu/acre	36,000 seeds/ acre

SITE NOTES >

- A 114 RM SmartStax® RIB Complete® corn blend product was utilized in the trial.
- Nitrogen in the form of 32% UAN (32-0-0) was used as the N source.
- 80 lbs/acre of N was applied before planting and incorporated.
- Nitrogen was sidedressed with a high-clearance sprayer using 360 Y-DROP® at an application rate of 100 lbs/acre with a urease inhibitor at three growth stages:
  - V4 (4 leaf collars) on 6/09/17
  - V8 (8 leaf collars) on 6/19/17
  - V12 (12 leaf collars) on 7/05/17
- The trial consisted of 3 replications.
- Data from 2016 was added for supporting information.

UNDERSTANDING THE RESULTS

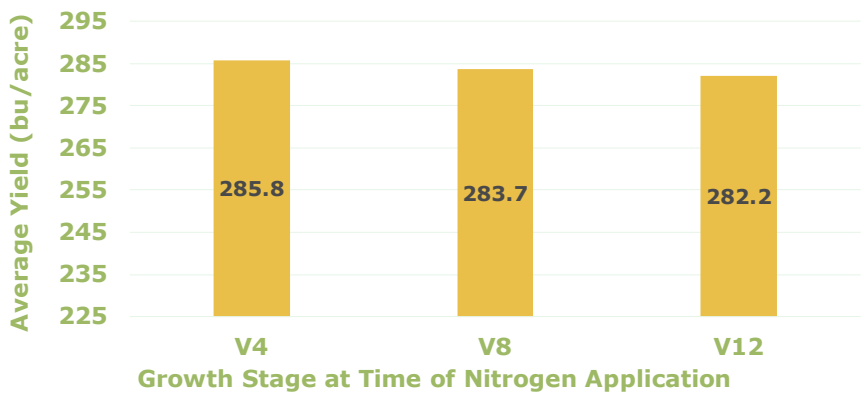


Figure 1. Average yield (bu/acre) response to nitrogen application timing in 2017 at Monmouth, IL (3 replications).

Timing of Nitrogen Application

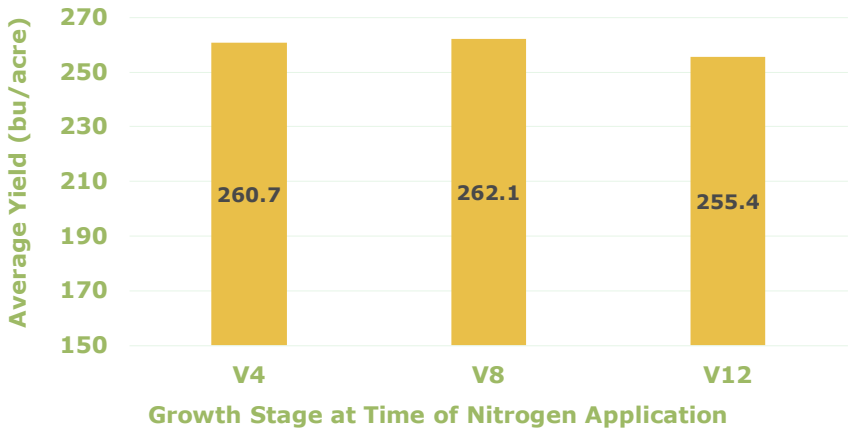


Figure 2. Two-year (2016 - 2017) average yield (bu/acre) response to nitrogen application timing at Monmouth, IL.

- Individual corn products may respond differently to the timing of an application of N.
- The cost to potentially obtain greater yields, based on the timing of an application of N, may not be economically feasible when all costs are considered.
- The ideal timing of a later-season application could change yearly because of weather and environmental challenges.
- In 2016, the V8 application demonstrated a larger response (2016 response: V4 = 235.7, V8 = 240.4, and V12 = 228.7).[2] However, the average differences for the combination of 2016 and 2017 were minimal (Figure 2).

WHAT DOES THIS MEAN FOR YOUR FARM?

- Nitrogen applications later in the growing season have the potential to improve yields and reduce the potential for N loss through leaching and nitrification.[1]
- Environmental conditions and the costs associated with N applications should be considered when making a N plan for each field.
- Use of 360 Y-DROP® for later growth season N applications can allow for greater flexibility in the timing of the application and use in taller corn.

SOURCES >

[1] Scharf, P.C. and Lory, J.A. 2006. Integrated Pest Management. Best management practices for nitrogen fertilizer in Missouri. IPM1027.

[2] Timing of nitrogen sidedress application in corn. 2016. Demonstration Report. Monsanto Learning Center at Monmouth, IL.

Effects of Nitrogen Management Practices on Corn Yield

TRIAL OVERVIEW

- Nitrogen (N) management in corn production continues to be a subject of much research. This, in part, is due to the complexity of the nitrogen cycle with regards to its availability to plants.
- From N application timing, to different sources and rates, to changing environmental conditions, the N practice that best optimizes corn productivity needs to be understood for sustainable operations.

RESEARCH OBJECTIVE

- To determine the response of two corn products to different N management practices.

LOCATION	SOIL	PREVIOUS CROP	TILLAGE TYPE	PLANTING DATE	HARVEST DATE	POTENTIAL YIELD/ACRE	PLANTING RATE/ACRE
Huxley, IA	Clay Loam	Soybean	Conventional	05/06/2017	10/17/2017	225 bu/acre	34,000 seeds/ acre

SITE NOTES >

- A 105 RM and a 113 RM SmartStax® RIB Complete® Corn Blend were used for this trial.
- The trial was carried out in 30-inch row spacing, 6 rows/treatment with 2 replications.
- Nitrogen Treatments:
  - 160 lbs/acre PRE
  - 80 lbs/acre PRE + 80 lbs/acre at V5 with coulter
  - 80 lbs/acre PRE + 80 lbs/acre at V5 with 360 Y-Drop®
  - 80 lbs/acre PRE + 80 lbs/acre at VT with 360 Y-Drop®

UNDERSTANDING THE RESULTS

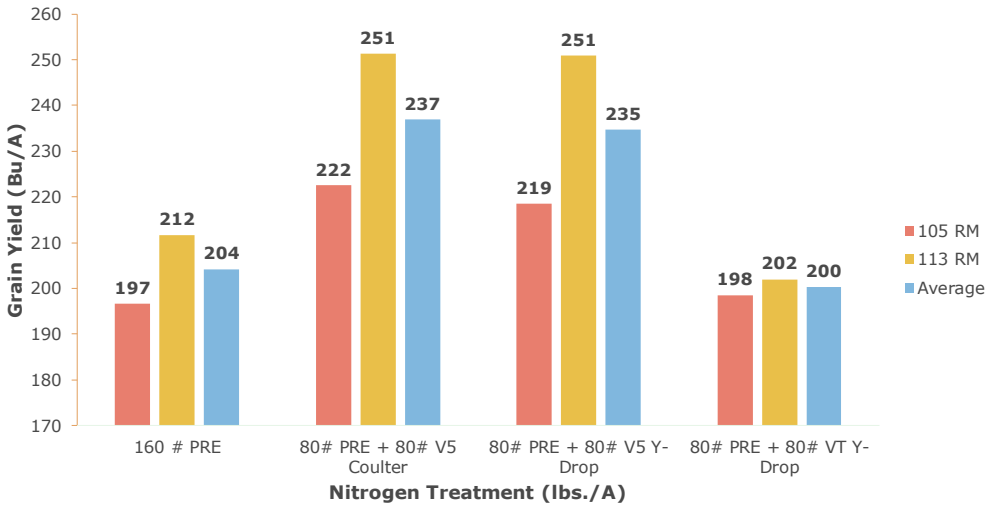


Figure 1. Effect of nitrogen management practice on 105 RM and 113 RM corn products.

Effects of Nitrogen Management Practices on Corn Yield

- The two corn products responded differently to the nitrogen treatments.
- In all nitrogen treatments, the 113 RM product out-yielded the 105 RM product.
- For both products, the two V5 sidedress applications substantially out-yielded the other treatments.
- With the V5 sidedress applications, there was no difference between coulter and 360 Y-Drop® technologies in the 113 RM product. Application with coulters slightly out-yielded 360 Y-Drop® in the 105 RM product.
- In both corn products, VT sidedressing yielded much less than the V5 application.
- In all the nitrogen treatments, grain moisture content was about 1% lower in the 105 RM product.

WHAT DOES THIS MEAN FOR YOUR FARM?

- Corn products respond differently to different N management systems.
- Every growing season is different which can have a significant impact on the performance of farm inputs. During the 2017 growing season, the research site at Huxley, IA experienced drought and high temperature conditions interspersed with a few 2 to 3 inch rainfalls, a scenario that significantly affects N dynamics in the soil.
- Growers are encouraged to perform small scale trials in their fields to understand how management practices impact economics and production.

Corn Response to Nitrogen Fertilizer Application Timing

TRIAL OVERVIEW >

Applying Nitrogen (N) fertilizer in single pre-plant or at-planting applications remain a common local practice in corn.

- Fertilizing with split applications can result in less risk of N loss before it is needed by the crop, but can be difficult to properly time with traditional side-dress fertilizer rigs.
- Recent adoption of drop-nozzle application equipment that places a stream of fertilizer on the soil surface, within the row, provides more opportunity for split applications at later growth stages.
- With the genetic diversity and high yield potential in modern corn products, response to N applied at different stages of growth may vary.

RESEARCH OBJECTIVE >

- Experiments were conducted at Monsanto Precision Product Placement Sites in Burleson County and Hill County, Texas in 2017 to determine the response of four corn products to different N fertility regimes. Fertility treatments were: 1) Untreated; 2) At Planting; 3) V6 Split; 4) V10 Split; and 5) V6 followed by (fb) V10 (Table 1).

LOCATION	SOIL	PREVIOUS CROP	TILLAGE TYPE	PLANTING DATE	HARVEST DATE	POTENTIAL YIELD/ACRE	PLANTING RATE/ACRE
Burleson County, TX	silty clay	corn	conventional	03/03/2017	07/25/2017	150	28,000
Hill County,TX	clay	corn	conventional	03/15/2017	08/10/2017	120	26,000

SITE NOTES >

- All treatments, including untreated, received 15-20 lbs N in a Fall application only.
- At Planting, V6 Split, and V10 Split treatments all received the same total lbs N per location, spread across 1-2 applications.
- The V6 fb V10 treatment was identical to the V6 Split treatment, but received a supplemental 25-30 lb N at the V10 timing.
- Target rates of total N were lower than normal recommendations for each location to elicit crop response that may have been masked by excessive residual N.
- UAN (32-0-0) was applied with standard knife injection equipment at the At Planting and V6 Split treatment timings.
- The V10 application was made through sprayer-mounted, drop-nozzle applicator hoses, directed at the soil surface alongside the base of the plants.
- Treatments were replicated twice at each location to account for field variability.

Corn Response to Nitrogen Fertilizer Application Timing

TABLE 1. NITROGEN (N) FERTILITY TREATMENTS WITH N RATE (LBS/ACRE) AND TIMING OF APPLICATION.

	BURLESON COUNTY					HILL COUNTY				
Treatment Name	Fall	At Planting	V6-V7	V10-V12	Total N	Fall	At Planting	V6-V7	V10-V12	Total N
Untreated	20				20	15				15
At Plant	20	100			120	15	65			80
V6 Split	20	70	30		120	15	35	30		80
V10 Split	20	70		30	120	15	35		30	80
V6 fb V10	20	70	30	25	145	15	35	30	30	110

UNDERSTANDING THE RESULTS >

- Corn grain yields, when averaged across products and locations, were similar for At Planting and V6 Split treatments (Figure 1). Interestingly, delaying the second application to the V10 timing resulted in a 5 bu/acre increase. It is plausible that the potential advantages to V6 Split treatments may have been negated by the application method and climatic conditions. At both locations, very little rainfall was received in the weeks following the V6 applications. Soil disturbance and possible root pruning could have resulted in reduced water and nutrient uptake in those treatments. The supplemental 25-30 lbs of N applied at the V10 timing averaged a 23 bu/acre increase, compared to the V6 Split treatment. Rainfall received following the V10 application, through grain fill, probably contributed to results obtained with this late supplemental treatment.
- Yield responses of each product, by location, are presented in Figures 2-5.

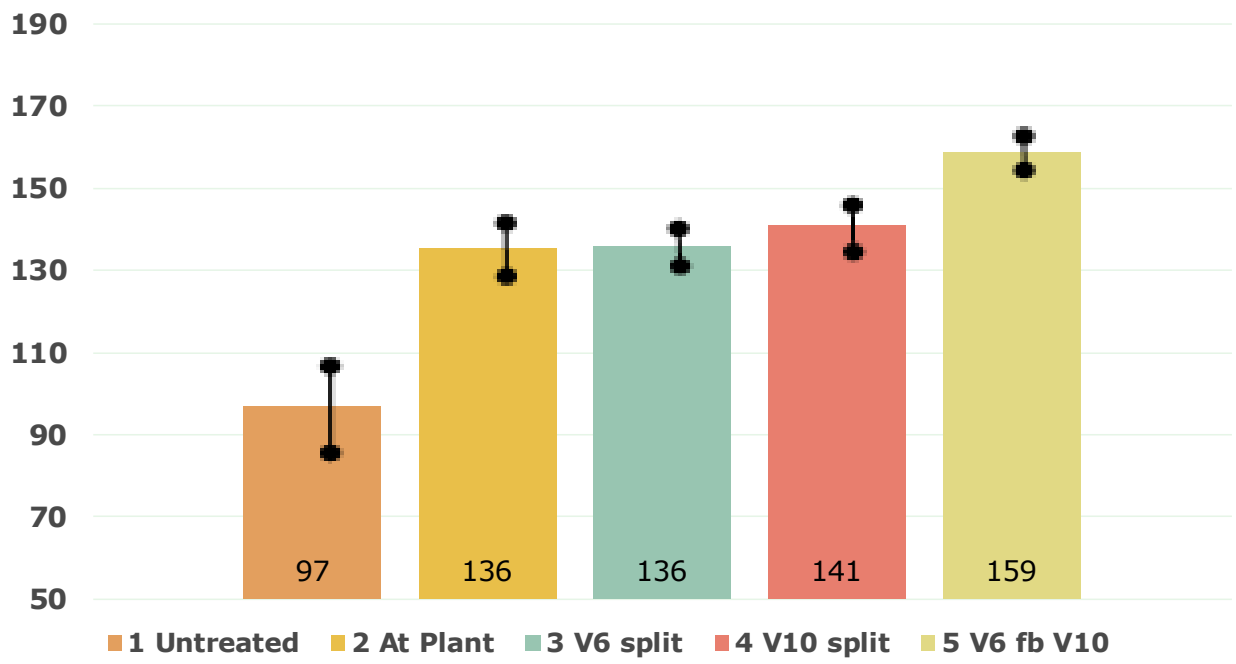


Figure 1. Corn grain yield by N treatment averaged across products and locations. Arrows represent standard deviations within treatment.

Corn Response to Nitrogen Fertilizer Application Timing

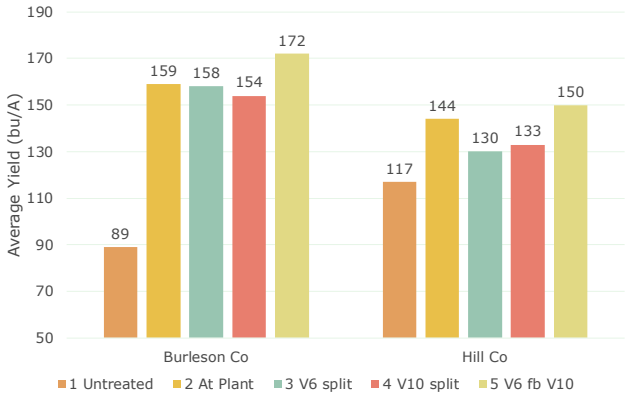


Figure 2. Product A corn grain yield by N treatment.

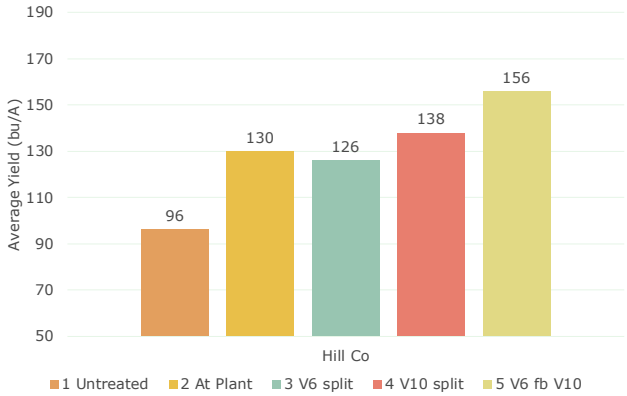


Figure 3. Product B corn grain yield by N treatment.

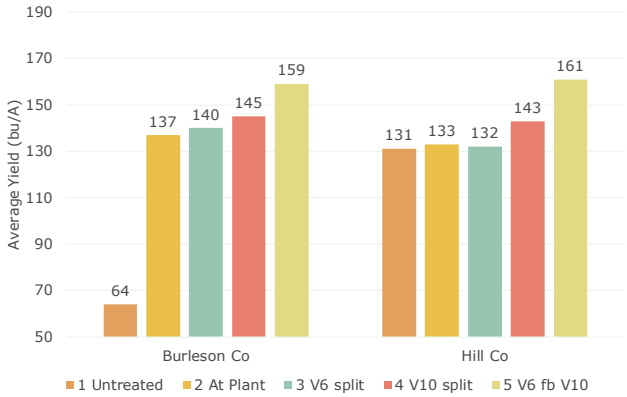


Figure 4. Product C corn grain yield by N treatment.

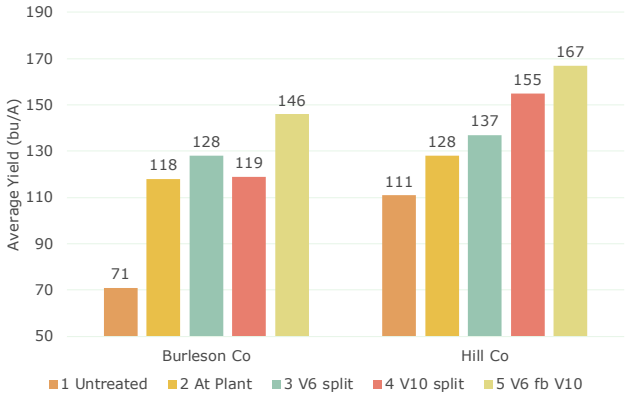


Figure 5. Product D corn grain yield by N treatment.

- Yield differences among each of the split application treatments, individually compared to At Planting, were calculated and used to summarize product response to split applications (Table 2). Similarly, the yield difference in V6 fb V10, compared to V6 Split, was used to describe product response to late applications of supplemental N.
- Overall yields of Product B (the VT Double PRO® corn brand) were excellent, especially in Burleson County, where it out-yielded any other product across each treatment. Surprisingly, split application treatments, at constant total N, did not provide a yield advantage for Product B. Neither the V6 Split, nor V10 Split treatments, out-yielded At Planting. Though additional research would be required to confirm, these results could indicate a higher early-season N requirement for this product. Supplemental late-season N increased Product B yield by an average 17 bu/A, which was numerically lower than that observed with any other product at each location.
- Both Product A (SmartStax® corn brand in Hill Co only) and Product C (SmartStax® corn brand) had moderately positive responses to split applications. Yield advantages with split applications were similar with Product C and Product D (VT Double PRO® corn) in Burleson County; however, Product D experienced an 18 bu/A numerical increase with split applications in Hill County, over 3x that of any other product. All three products had remarkably similar yield responses to supplemental V10 N application (18-19 bu/A in Burleson County; 30-31 bu/A in Hill County).

Corn Response to Nitrogen Fertilizer Application Timing

- The responsiveness of Product D corn to sequential and supplemental N application may be supported by the results of leaf N content analysis, taken just prior to grain fill (Figure 6). In Burleson County, leaf N with all split application treatments was higher with Product D than any other product. A similar pattern was observed in Hillsboro, with leaf N content in the "high" range for the At Planting, V6, and V6 fb V10 treatments. Nitrogen content of the ear leaf at pollination is an indicator of N status of the plant before it begins translocating nutrients to kernels. Thus, it can be concluded that Product D may accumulate a higher concentration of N in leaf tissue, compared to other products with the same rates and application timings of N fertilizer, and is particularly evident with side-dress applications.

TABLE 2. YIELD RESPONSE OF EACH CORN PRODUCT TO SPLIT APPLICATIONS AND V10 SUPPLEMENTAL N.

	CHANGE IN YIELD (BU/A) WITH SPLIT APPLICATION			CHANGE IN YIELD (BU/A) WITH V10 SUPPLEMENTAL N		
Product	Burleson Co	Hill Co	Avg	Burleson Co	Hill Co	Avg
Product A		2			30	
Product B	-3	-12.5	-7.8	14	20	17
Product C	5.5	4.5	5	19	31	24
Product D	5.5	18	11.8	18	30	24

Values shown on the left side of the table are averages of yield changes with V6 and V10 applications, individually compared to at planting. Values shown on the right side of the table are yield change with the V6 followed by V10 treatment, compared with V6 split treatment.

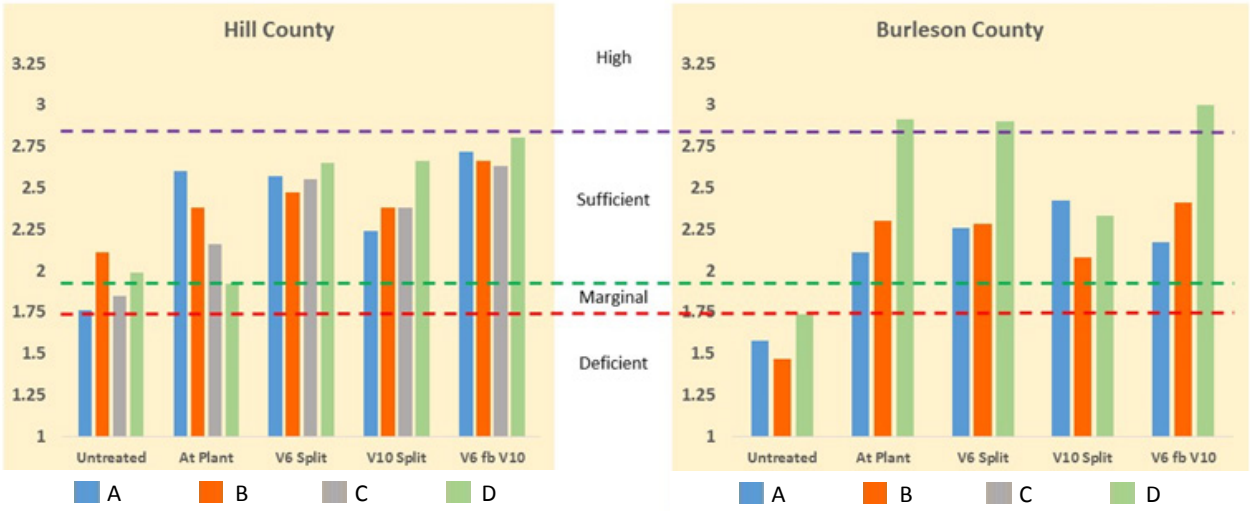


Figure 6. Nitrogen concentration in ear leaves (%N on a 100% biomass basis) collected at silking for corn products. Samples were a composite of 10 leaves per treatment, across replications, and at each location.

Corn Response to Nitrogen Fertilizer Application Timing

WHAT DOES THIS MEAN FOR YOUR FARM?

- Individual product yield response varied not just with N rate but with application method and timing.
- In these trials, Product B corn brand performed as well with 100% of N applied at planting, then with either split application of the same rate.
- Product A, Product C and Product D had mostly positive yield responses to split applications.
- The unique weather conditions encountered this year could have also impacted results from later applications, as adequate incorporating rainfall was received soon after V10 application at both locations (moreso at Hill County), and excellent growing conditions remained throughout grain fill and maturation.
- V10 applications of supplemental N was beneficial for all products, particularly on Product A, Product C, and Product D, which had yield increases 1.5X that of Product B.
- Delaying side-dress application to V10, with drop-nozzle applicators, seemed like an effective method and timing for N fertilization with these 3 products.

Corn Disease Systems

TRIAL OVERVIEW >

The objective of this trial was to test an ideal corn disease mitigation system by comparing the combination of new disease resistant genetics with tolerance to multiple diseases, seed treatment to control early season pests/pathogens, and mid-season chemical control versus management practices not focused on protecting from the risk of yield loss due to disease. Overall broad acre yield was evaluated in 3 different growing seasons as well as looking at results of yield advantages due to genetics, seed treatment, and fungicide use:

- Genetics – Strong disease resistance package for multiple pathogens
- Seed Treatment – Use of Acceleron® Seed Applied Solutions ELITE with Enhanced Disease Control (EDC) vs. Acceleron® Seed Applied Solutions BASIC
- Fungicide Use – Application of foliar fungicide at R1 growth stage

RESEARCH OBJECTIVE >

Scope

- 24 locations; 3 replications per location; results across spray blocks and seed treatments

Treatments

- **Disease Mitigation System:** Strong disease resistant corn product, Acceleron® Seed Applied Solutions ELITE with EDC, foliar fungicide applied at R1 growth stage
- **Old System:** Average disease corn product, Acceleron® Seed Applied Solutions BASIC, unsprayed

UNDERSTANDING THE RESULTS >

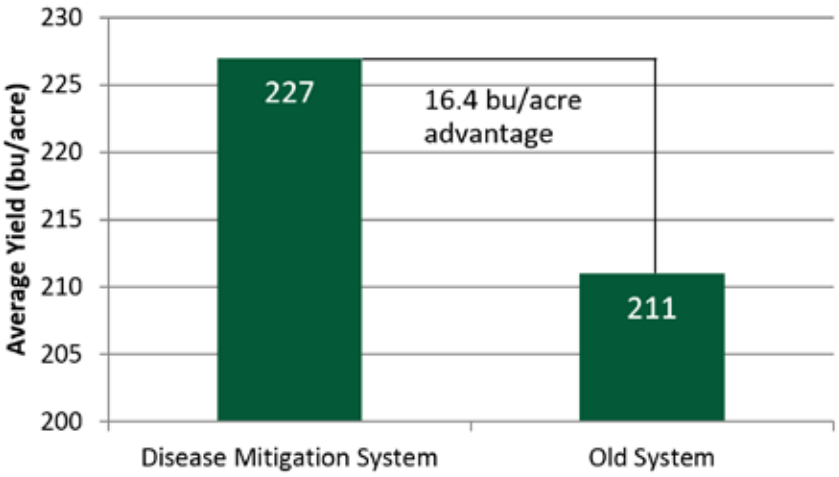


Figure 1. 2017 Yield Comparison of Disease Mitigation System to Old System across 24 locations.

Corn Disease Systems

- In 2017, foliar diseases were not as widespread with less yield impact than in 2015, resulting in less of an impact from fungicides in systems trials (similar to 2016). Resistant germplasm results were strong again for 2017, and EDC seed treatment advantage was comparable across years.
- Disease Mitigation System advantage in 2016: 16 bu/acre over 28 locations
- Disease Mitigation System advantage in 2015: 22 bu/acre over 31 locations; Ranged from 17.5 bu/acre with stalk rot pressure (11 locations) to 32.2 bu/acre with foliar disease pressure (10 locations)

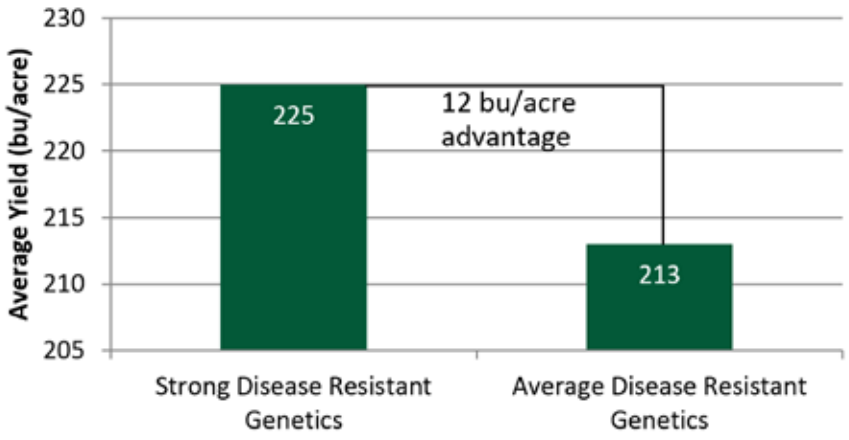


Figure 2. *2017 Yield advantage of disease resistant genetics across all seed treatments and spray blocks.*

- 2016 Genetics comparison: 13 bu/ac advantage
- 2015 Genetics comparison: 9.2 bu/ac advantage

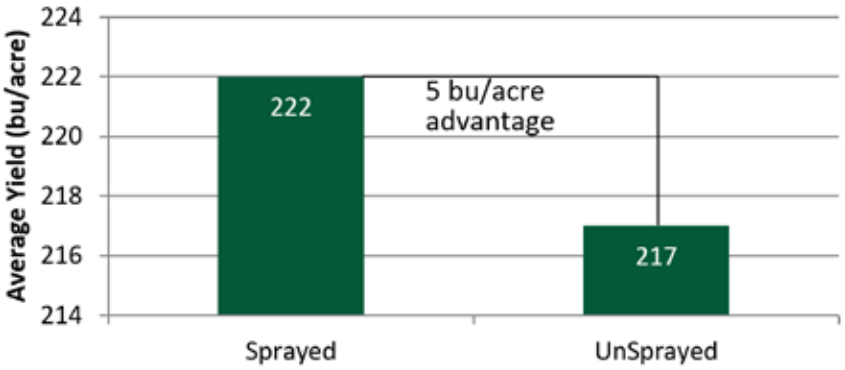


Figure 3. *2017 Yield advantage of fungicide application across all genetics and seed treatments.*

2017 results showed a 5 bu/acre advantage across all corn products and seed treatments

- 2016 Fungicide comparison: 4 bu/ac advantage

Corn Disease Systems

- 2015 Fungicide comparison: 11 bu/ac advantage (a year reported with anthracnose stalk rot pressure and high foliar fungal disease pressure: mostly Southern Rust and Gray Leaf Spot.)

Return on investment considerations:

- Cost of fungicide and application ~$30/acre
- Breakeven – 8.5 bu/acre at $3.50/bu

WHAT DOES THIS MEAN FOR YOUR FARM?

- Good disease mitigation systems consisting of high yielding, disease tolerant genetics combined with new seed treatments to protect from yield loss due to early season diseases, and the timely use of chemical application of fungicide together provide a yield advantage and could provide a possible return on investment under conditions conducive to foliar fungal disease development.
- In academic data from the Corn Disease Working Group across multiple growing seasons, R1 applications of fungicide on corn are economical approximately half the time at locations with a chance of disease, assuming fungicide trials are done under conditions with some likelihood of disease occurrence.[1]
- Yield responses to fungicides depends on product genetics, fungicide timing, and if environmental conditions are conducive to disease development.
- Knowing if your field has a history of corn diseases can help you to better select corn products with improved tolerance to diseases and to better understand how to manage those products during the growing season.

Source: [1]Corn Disease Working Group (CDWG) fungicide yield response data from 1999-2017.

Corn Seed Product Yield Response to Fungicide Application

TRIAL OVERVIEW >

- The impact of a fungicide application on corn yield can be influenced by several factors including seed product disease tolerance and existing disease pressure.
- This study was established to determine the yield response of fungicide application on six corn seed products.

RESEARCH OBJECTIVE >

- Evaluate corn seed products yield response to fungicide applied at R1 (silking) growth stage.

LOCATION	SOIL	PREVIOUS CROP	TILLAGE TYPE	PLANTING DATE	HARVEST DATE	POTENTIAL YIELD/ACRE	PLANTING RATE/ ACRE
Camden Point, MO	Silt loam	Corn	Minimum tillage	04/17/2017	09/27/2017	200 bu/acre	34,000 seeds/acre

SITE NOTES >

- Each seed product had two treatments: 1) No fungicide; 2) Stratego® YLD Fungicide applied at 5 fl oz/acre on July 17, 2017 at R1 (silking) growth stage.
- Disease incidence was as follows: gray leaf spot - moderate; southern corn rust - low; crown rot - observed to be present.

UNDERSTANDING THE RESULTS >

- The application of Stratego® YLD Fungicide increased yield in five of the six brand blend products.
- In previous Monsanto inoculated disease trials, under high disease pressure, all brand blend products in the trial were rated 4 or 5 on a scale of 1 to 9 (with 1 being resistant and 9 being susceptible) to gray leaf spot (GLS).
- In this trial, the yield increase observed on five seed products with the application of Stratego® YLD Fungicide ranged from 7.1 to 27.1 bu/acre and is likely the result of the inhibition of GLS and/or southern rust development.
- In comparison, Product E brand blend, saw no yield advantage from fungicide application. This seed product's host resistance presumably provided adequate protection for the severity of diseases observed in Camden Point, Missouri during 2017. Therefore, the application of Stratego® YLD Fungicide or application timing did not contribute to disease control or impact yield potential for this seed product.
- Seed products rated as moderate to GLS exhibited a more consistent yield response to Stratego® YLD Fungicide application compared to seed products rated as moderately resistant to GLS.
- No significant differences in grain moisture content were observed across treatments.

Corn Seed Product Yield Response to Fungicide Application

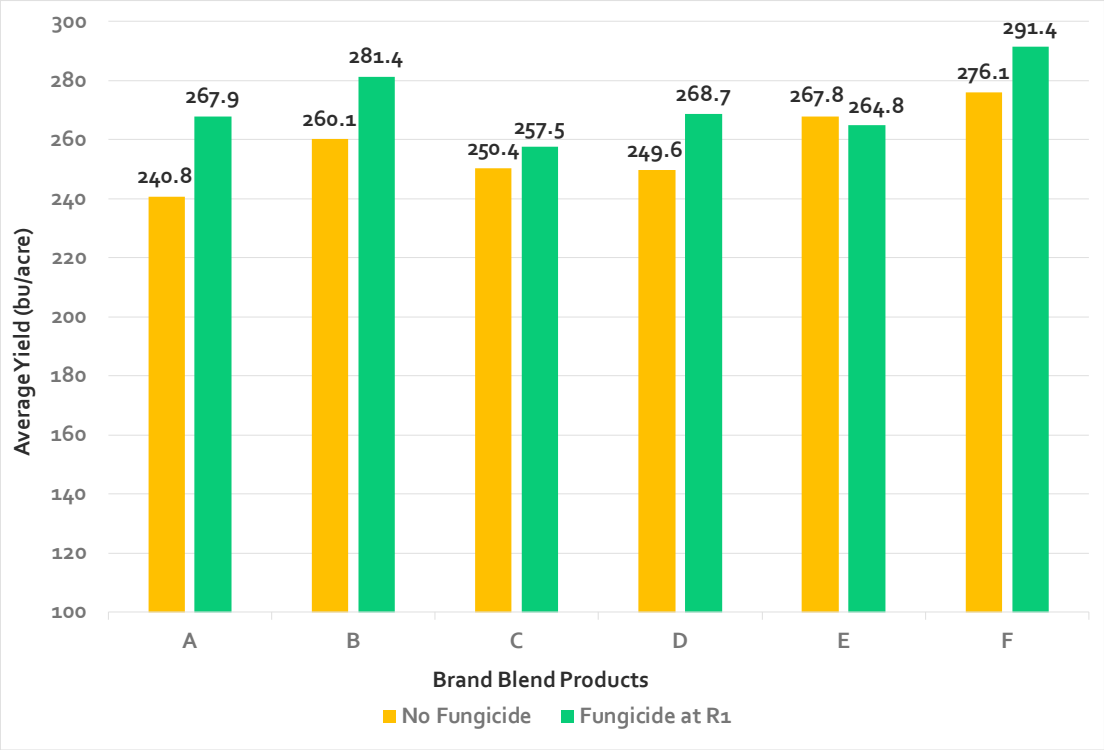


Figure 1. Corn seed product response to fungicide application at R1 (silking) growth stage.

WHAT DOES THIS MEAN FOR YOUR FARM?

- Fungicides can protect yield when applied correctly.
- The benefits of a fungicide treatment at the appropriate growth stage may have more impact when applied to moderate to susceptible (disease ratings) seed products under high disease pressure conditions.
- Scouting plans should be in place prior to tasseling for fields with susceptible genetics, that are continuously corn-on-corn, or have a history of disease.
- Yield potential, corn growth stage, disease risk, cost of fungicide, and corn commodity price should all be considered when deciding whether to spray a fungicide.
- Farmers can further minimize the risk of disease-induced yield loss by selecting a resistant to moderately-resistant seed product when planting in disease-prone regions.
- The data is a result of a single, non-replicated study conducted in Camden Point, Missouri and is intended to represent the seed products' response under 2017 conditions for this region. Results may vary depending on disease presence, environmental conditions, and other factors.

SOURCES >

1 Rees, J.M. and Jackson, T.A. 2008. Gray leaf spot of corn. NebGuide G1902. University of Nebraska-Lincoln Extension. http://extensionpublications.unl.edu/.

2 Nielsen, R.L. 2017. Stress during grain fill: A harbinger of stalk health problems. Purdue University. https://www.agry.purdue.edu/ext/corn/news/timeless/stalkhealth.html. Web sources verified 11/24/17. 171016105359

Corn Seed Products Yield Response to an Aerial Fungicide Application

TRIAL OVERVIEW

- Corn disease infestations can decrease leaf and stalk quality which may negatively affect yield potential. A broad-spectrum fungicide applied around VT (tasseling) to R1 (silking) growth stages may reduce the effect of diseases on yield potential.
- The effect of a fungicide application on corn yield can be influenced by several factors including seed product disease tolerance, existing disease pressure, timing of application, and environmental conditions.

RESEARCH OBJECTIVE

- The objective of this study was to evaluate brand blend seed products' yield response to an aerial fungicide application at VT growth stage.

LOCATION	SOIL	PREVIOUS CROP	TILLAGE TYPE	PLANTING DATE	HARVEST DATE	POTENTIAL YIELD/ACRE	PLANTING RATE/ACRE
Goodland, KS	Silt loam	Sunflowers	Strip-till	05/18/2017	11/07/2017	220bu/acre	26,000 seeds/ acre

SITE NOTES:

- Each seed product had two treatments: 1) No fungicide and 2) Quilt Xcel® Fungicide applied at 12 fl oz/acre on July 14, 2017 at VT growth stage.
- Eight brand blend seed products were tested in small plots with three replications at two (untreated and treated) locations at opposite ends of the same field.
- Disease incidence was as follows: southern rust (Puccinia polysora) that was initially observed at the V12 (12 leaf collars) growth stage – moderate infestation; Goss's wilt and bacterial leaf streak – observed to be present.

UNDERSTANDING THE RESULTS

- Economic benefit was determined assuming $2.95/bu corn commodity price and a fungicide product and aerial application cost of $30.00/acre.
- The application of Quilt Xcel® Fungicide increased yield in all products tested and the average yield increase was 36.6 bu/acre.
- All corn products exhibited a positive economic benefit from a Quilt Xcel® Fungicide application.
- Brand Blend products B and F had the highest positive yield response from Quilt Xcel® Fungicide application.
- Brand blend products E and G had the lowest positive yield response from Quilt Xcel® Fungicide application.

Corn Seed Products Yield Response to an Aerial Fungicide Application

WHAT DOES THIS MEAN FOR YOUR FARM?

- Fungicides can protect yield when applied correctly and timely.
- The benefits of a fungicide treatment at the appropriate growth stage may have a greater effect when applied to moderate to susceptible (disease ratings) seed products under high disease pressure conditions.
- Scouting plans should be in place prior to tasseling for fields with susceptible genetics, that are continuously corn-on-corn,or have a history of disease.
- Yield potential, corn growth stage, disease risk, cost of fungicide, and corn commodity price should all be considered when deciding whether to spray a fungicide.
- Farmers can further minimize the risk of disease-induced yield loss by selecting a resistant to moderately-resistant seed product when planting in disease-prone regions.
- The data is a result of a single site, replicated study conducted in Goodland, Kansas and is intended to represent the seed products' response under 2017 conditions for this region. Results may vary depending on disease presence, environmental conditions, and other factors.

Brand Blend Seed Product	Average Yield (bu/acre)	Yield Gain (bu/acre) (treated yield minus untreated yield) Economic Gain From Application ($2.95/bu yield gain minus $30.00/acre application cost)	Average Moisture Content (%)
Product A			
Quilt Xcel® Fungicide	240.3	38.6 bu/acre	14.2
Untreated	201.7	$83.87/acre	14.1
Product B			
Quilt Xcel® Fungicide	239.7	49.1 bu/acre	15.2
Untreated	190.6	$114.85/acre	14.3
Product C			
Quilt Xcel® Fungicide	227.0	30.0 bu/acre	14.1
Untreated	197.0	$58.50/acre	14.1
Product D			
Quilt Xcel® Fungicide	246.0	38.1 bu/acre	13.9
Untreated	207.9	$82.40/acre	14.4
Product E			
Quilt Xcel® Fungicide	245.4	18.4 bu/acre	15.1
Untreated	227.0	$24.28/acre	14.5
Product F			
Quilt Xcel® Fungicide	258.6	66.7 bu/acre	15.2
Untreated	191.9	$166.77/acre	13.8
Product G			
Quilt Xcel® Fungicide	227.7	17.0 bu/acre	14.7
Untreated	210.7	$20.15/acre	14.3
Product H			
Quilt Xcel® Fungicide	241.7	35.3 bu/acre	15.0
Untreated	206.4	$74.14/acre	14.6

Figure 1. Brand blend seed products' average yield (bu/acre) gain and economic gain (dollars/acre) with a Quilt Xcel® Fungicide application.

SOURCES

[1] Rees, J.M. and Jackson, T.A. 2008. Gray leaf spot of corn. NebGuide G1902. University of Nebraska-Lincoln Extension. http://extensionpublications.unl.edu/.

[2] Robertson, A. 2016. 2015 Evaluation of foliar fungicides on corn at four Iowa locations. Integrated Crop Management. Iowa State University. https://crops.extension.iastate.edu/cropnews/2016/06/2015-evaluation-foliar-fungicides-corn-four-iowa-locations. Web sources verified 12/14/17. 171206172133.

Corn Hail Damage

TRIAL OVERVIEW

- Every year, many acres of corn are hailed on. Depending on the growth stage and severity of the hail damage, minor to significant losses can be incurred. For example, a pea-sized hail event with light intensity at the R6 stage will likely bruise the corn ear but not cause significant yield loss, while a golf ball-sized hail event with moderate intensity at VT would cause significant yield loss.
- To help farmers understand their options to mitigate yield loss incurred after a hail event, a study was initiated to evaluate whether various amendments, such as fertilizer or a fungicide, could reduce yield loss from a simulated hail event on corn at the V14 growth stage.

RESEARCH OBJECTIVE

- This study was conducted to evaluate the impact of applying fertilizer and/or a fungicide following a hail event at the V14 corn growth stage.

LOCATION	SOIL	PREVIOUS CROP	TILLAGE TYPE	PLANTING DATE	HARVEST DATE	POTENTIAL YIELD/ACRE	PLANTING RATE/ACRE
Gothenburg, NE	Cozad silt loam	Corn	Strip tillage	04/27/2017	11/13/2017	230 bu/acre	34,000

SITE NOTES >

- Three levels of hail damage, measured by plant defoliation, were simulated on July 14, 2017 using a string trimmer to corn at the V14 growth stage; simulation levels were 0%, 30%, and 60% defoliation.
- Foliar treatments were applied on July 17, 2017, three days after the simulated damage. The foliar treatments included:
  - A: Ammonium thiosulfate 12-0-0-26S (ATS) at 5.19 gal/acre
  - B: Headline AMP® fungicide at 12 oz/acre
  - C: Headline AMP fungicide at 12 oz/acre with ATS at 5.19 gal/acre
  - D: KS2075 (20-0-7.5-5S) liquid fertilizer at 1 gal/acre
  - E: KS2075 liquid fertilizer at 1 gal/acre with Headline AMP at 12 oz/acre
  - UT: Untreated control
- ATS was diluted to a 100 gal/acre application rate to prevent crop phytotoxicity.
- The study was set up as a randomized complete block with three rWeplications.
- Yields and plants that died prematurely were recorded.

Corn Hail Damage

UNDERSTANDING THE RESULTS

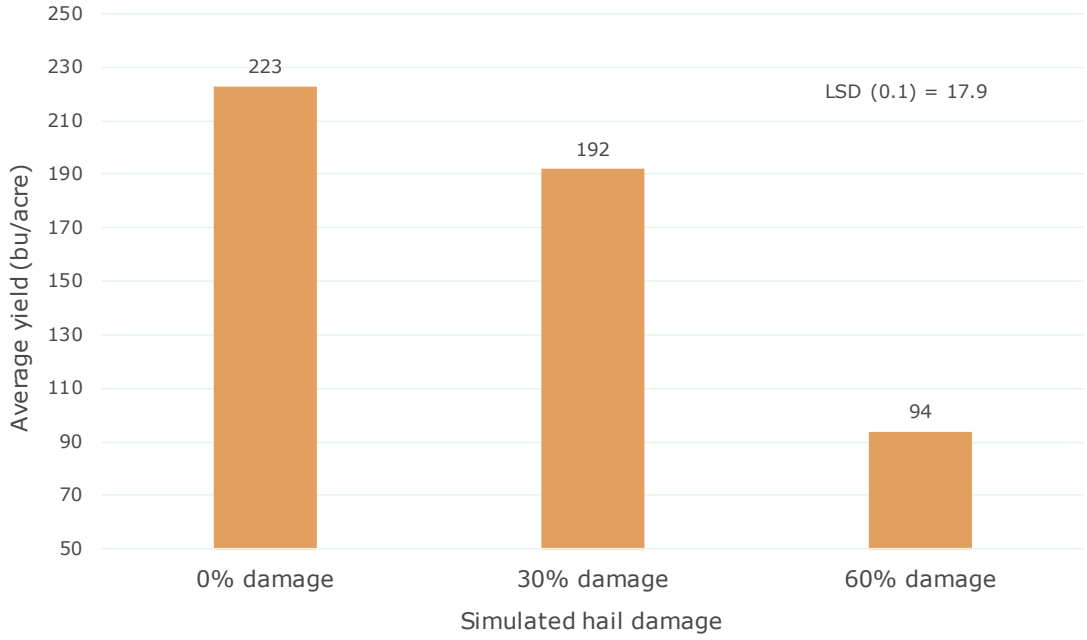


Figure 1. Average yield across all foliar treatments for each hail damage treatment.

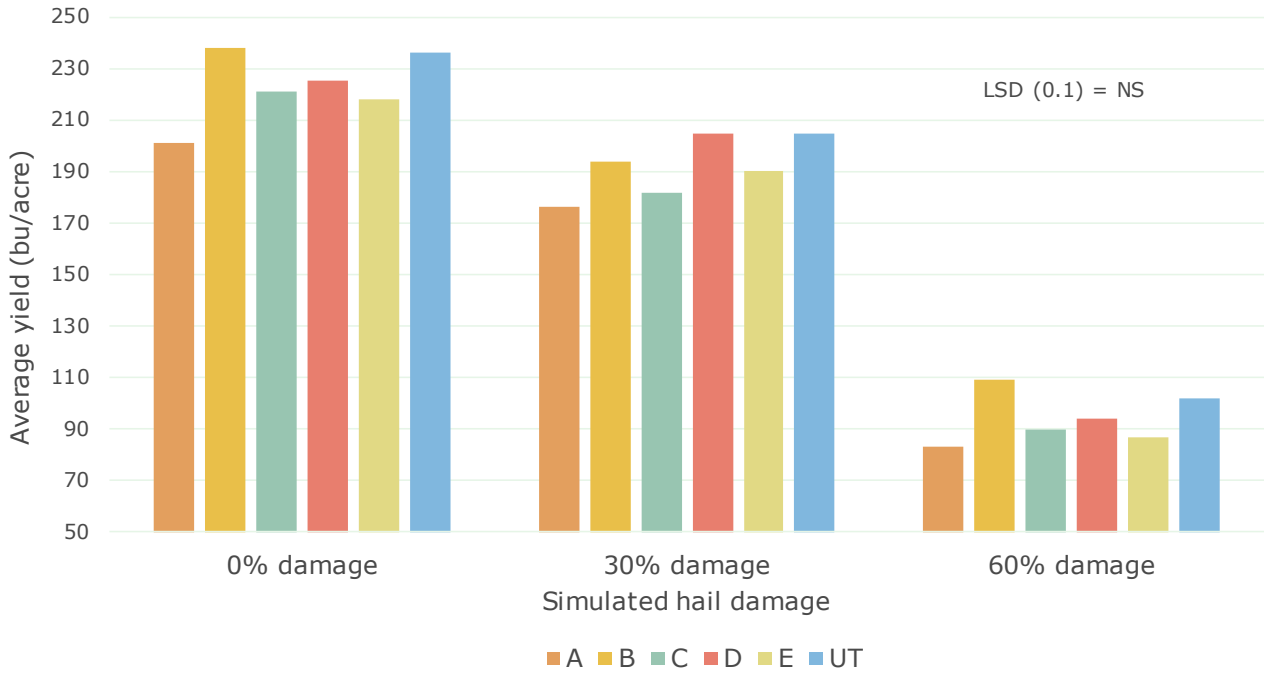


Figure 2. Average yield in each foliar treatment at each hail damage treatment. Treatment A: ATS only, B: fungicide only, C: ATS + fungicide, D: KS2075 only, E: KS2075 + fungicide, UT: untreated control.

Corn Hail Damage

Figure 3. A 60% simulated hail damage plot in the foreground. The 0% hail damage plot can be observed further down the row where the canopy is denser.

- Simulated hail damage impacted yield as expected, with significant yield loss at the 30% damage treatment compared with the 0% damage treatment and even higher losses at the 60% damage level (Figure 1).
- 18% more plants died prematurely in the 60% hail damage treatment compared to the 0% and 30% treatments.
- None of the foliar treatments reduced yield loss compared to the untreated control (Figure 2). These results were similar to research completed in 2015 and 2016 where no benefit was realized when applying a fungicide 7 days after a hail event at two different corn growth stages.

WHAT DOES THIS MEAN FOR YOUR FARM?

- Over the last three years of testing, no treatment has been found to reduce yield loss in corn from a simulated hail damage event.
- Small plot research like this allows for comparison of many corn products at different growth stages or levels of damage. However, small plot research cannot account for field-level environmental influences, such as humidity or application from an airplane, which could alter results.

Evaluating the Response to Fungicide in Different Tillage Systems

TRIAL OVERVIEW >

- Fungicide application to corn is a relatively common practice in Illinois.
- Low commodity prices are calling the return on investment (ROI) for a fungicide application into question.
- Different tillage systems may provide different environments that are more or less preferable to disease development.

RESEARCH OBJECTIVE >

- This trial was established to evaluate the yield response to fungicide in different tillage systems.

LOCATION	SOIL	PREVIOUS CROP	TILLAGE TYPE	PLANTING DATE	HARVEST DATE	POTENTIAL YIELD/ACRE	PLANTING RATE/ACRE
Monmouth, IL	Silt Loam	Corn	Various	04/24/2017	09/29/2017	240 bu/acre	36,000 seeds/ acre

SITE NOTES >

- A large land block was divided into three different tillage zones:
  - Vertical Tillage
  - Strip Tillage
  - Conventional Tillage
- Within each of the three tillage zones, two corn products were planted:
  - 108 Day RM SmartStax® RIB Complete® Corn Blend
  - 114 Day RM SmartStax® RIB Complete® Corn Blend
- Each product had treatments consisting of an untreated check and an application of a foliar fungicide that contained strobilurin and triazole active ingredients (A.I.). There were two replications of all treatments. The fungicide was applied at the R1 growth stage.

Evaluating the Response to Fungicide in Different Tillage Systems

UNDERSTANDING THE RESULTS >

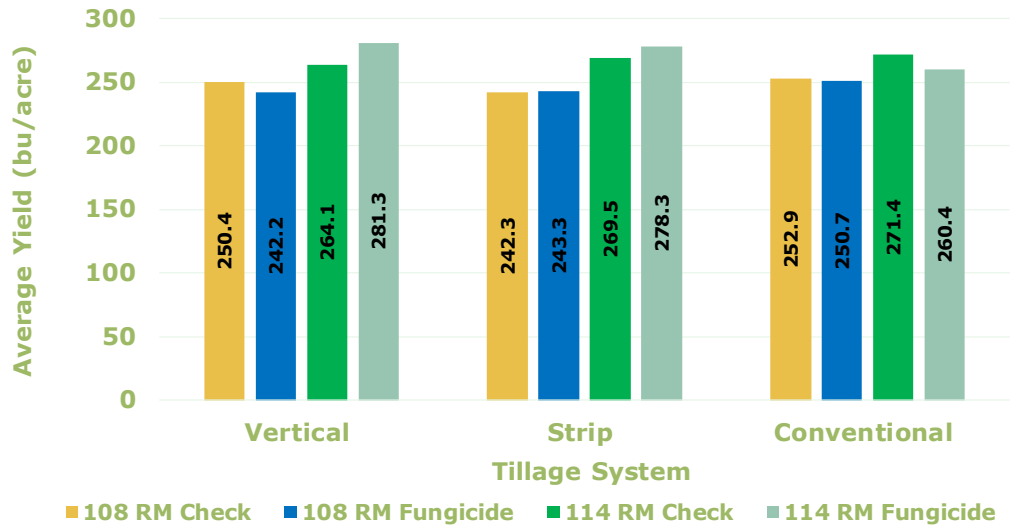


Figure 1. Average yield response (bu/acre) for fungicide application to three tillage systems at Monmouth, Illinois (2017, 2 Replications).

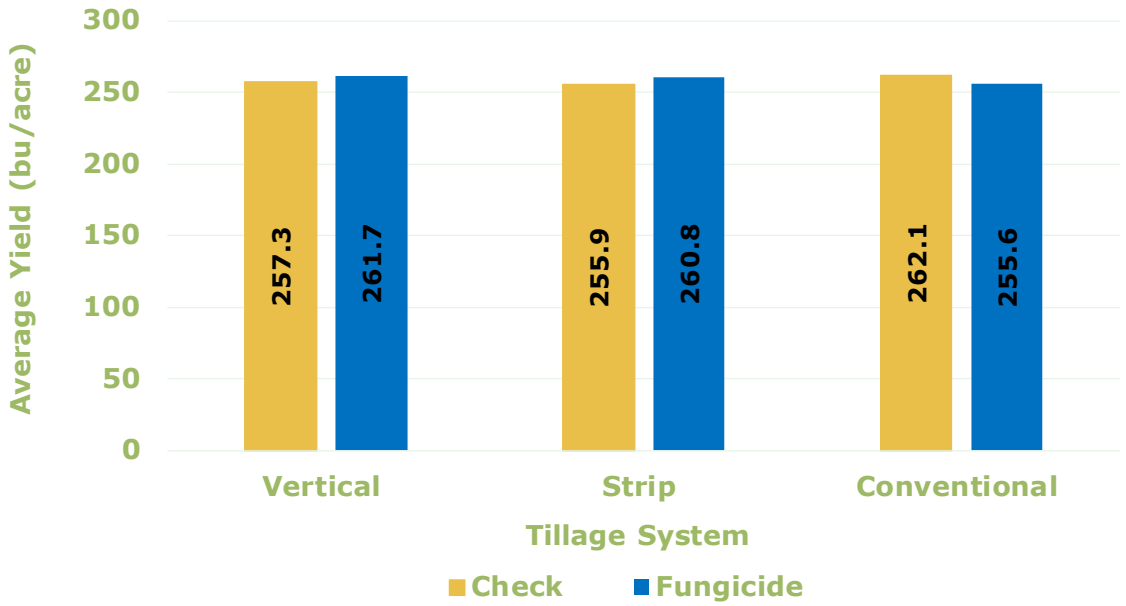


Figure 2. Average yield response (bu/acre) of a fungicide application on two corn products and three tillage systems at Monmouth, Illinois (2017, 2 Replications).

- Disease incidence was low; however, the disease symptoms that appeared were generally very late in the season and likely had little to no impact on yield.
- No differences in symptomology were seen between the treated and untreated plots.
- Because of these factors, no discernible differences or trends were observed in the final yield results (Figures 1 and 2).

Evaluating the Response to Fungicide in Different Tillage Systems

Figure 3. Gray leaf spot, Monmouth, Illinois - 2017.

- Three factors are required for disease development: a pathogen, a susceptible host, and favorable environmental conditions.
- In 2017, the cool, dry conditions in July and August likely held disease pressure to a minimum at the Monsanto Learning Center at Monmouth, IL. An example is the minimal number of gray leaf spot lesions found on corn leaves (Figure 3).

WHAT DOES THIS MEAN FOR YOUR FARM?

- Various methods for preventing disease development in corn include planting resistant genetics, crop rotation, and good residue management practices.
- A good scouting program is crucial to identify whether a disease is a problem in any given field.
- If all three factors for disease development are present, a fungicide application may help protect yield potential.

Effect of Plant Population on ASR Severity in Corn

TRIAL OVERVIEW

- As growers consider using higher seeding rates to help access the genetic potential for higher yield potential, it's important to consider how higher populations can also lead to more plant stress.
- Anthracnose Stalk Rot (ASR) can be one of the most damaging corn diseases in New York and Pennsylvania.
- An understanding of how higher plant populations affect the severity of ASR can help growers in corn product selection and aid in selecting the appropriate plant population.

Figure 1. Corn stalks at Verona, New York displaying late season disease symptoms of shiny black discoloration of outer stalk (left) and internal discoloration at the nodes common with Anthracnose stalk rot (right).

RESEARCH OBJECTIVE

- Determine the impact of three plant populations on incidence of ASR in corn products with varying degrees of ASR tolerance.

LOCATION	SOIL	PREVIOUS CROP	TILLAGE TYPE	PLANTING DATE	EVALUATION DATE	POTENTIAL YIELD/ACRE	PLANTING RATE/ACRE
Canandaigua, NY	Sandy Loam	Corn	Conventional	05/22/2017	10/24/2017	200 bu/acre	24,000 to 48,000 seeds/ acre
Verona, NY	Clay Loam	Soybean	Strip Till	05/21/2017	10/27/2017	200 bu/acre	24,000 to 48,000 seeds/ acre

SITE NOTES >

- 12 corn products (92-103 RM) with an ASR tolerance rating of 4 or 5 were selected for this trial.
- All corn products were planted at low, medium and high populations (24,000, 36,000 and 48,000 plants per acre).

Effect of Plant Population on ASR Severity in Corn

- Evaluations for incidence of ASR were conducted at two locations – Canandaigua (Ontario Co.) and Verona (Oneida Co.), NY. Evaluations were made by harvesting five consecutive, typical stalks.
- For each stalk, the number of nodes infected with ASR and nodes with greater than 75% necrosis were measured.

UNDERSTANDING THE RESULTS

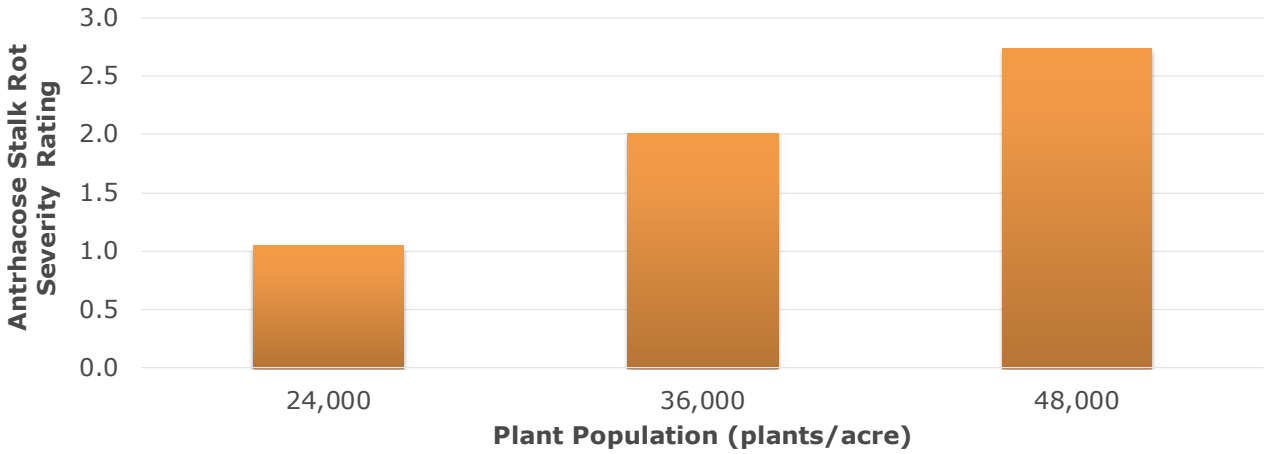


Figure 2. 2017 Anthracose stalk rot rating averaged over plant population for 2 locations in New York.

- Both incidence and severity of Anthracnose stalk rot (ASR) increased as plant populations went from 24,000 to 48,000 plants per acre.
- Previous crop did not affect results. Both locations had significant ASR levels.
- ASR was more severe in earlier RM (less than 97 RM) products compared to later RM. Average RM rating for early RM was 3.0 versus 1.5 for 98+ RM hybrids. It is not possible to determine if the difference in ASR between earlier and later RM products was due to maturity or due to the reactions of the specific products in those RM groups.

WHAT DOES THIS MEAN FOR YOUR FARM?

- Fertility, tillage, environmental conditions and crop rotation can all affect incidence and severity of ASR.
- In addition to the reduction in yield potential that ASR can cause, ASR can also cause standability problems and affect harvestability of the crop.
- Population recommendations for a corn product should be based on multiple factors including the ability of the product to maintain healthy stalks at high plant populations.
- As growers consider increasing seeding rates, the occurrence of stalks rots associated with stress, such as ASR, become more important.

Value Assessment of Corn Products with SmartStax® Technology

TRIAL OVERVIEW >

Corn products with SmartStax® technology used in combination with other management tactics have proven to be a viable strategy for limiting the economic impact of corn rootworm (CRW); however, the yield benefit may not always offset the additional cost of the seed.

RESEARCH OBJECTIVE >

The objective of this study was to determine the likelihood of a positive return on investment (ROI) when using corn products with SmartStax technology vs. nearly identical corn products lacking CRW protection traits.

SITE NOTES >

- Trials were conducted in 87 locations throughout the Corn Belt as side-by-side strip trials with SmartStax® RIB Complete® corn blend products (with activity against CRW) and VT Double PRO® RIB Complete® corn blend products (without CRW activity). Products had nearly identical genetics except for their biotech traits.
- Approximately 50 locations also included a strip treated with a soil-applied insecticide (SAI) alongside an untreated strip.
- Plots ranged from 6-12 rows wide and 300 to 2500 feet in length (Figure 1) with 1-3 replications.
- All locations were continuous corn fields managed according to practices typical for the region.
- The presence of CRW was determined through a combination of sticky traps for adult beetle collection and/or observations of root feeding/plant lodging.

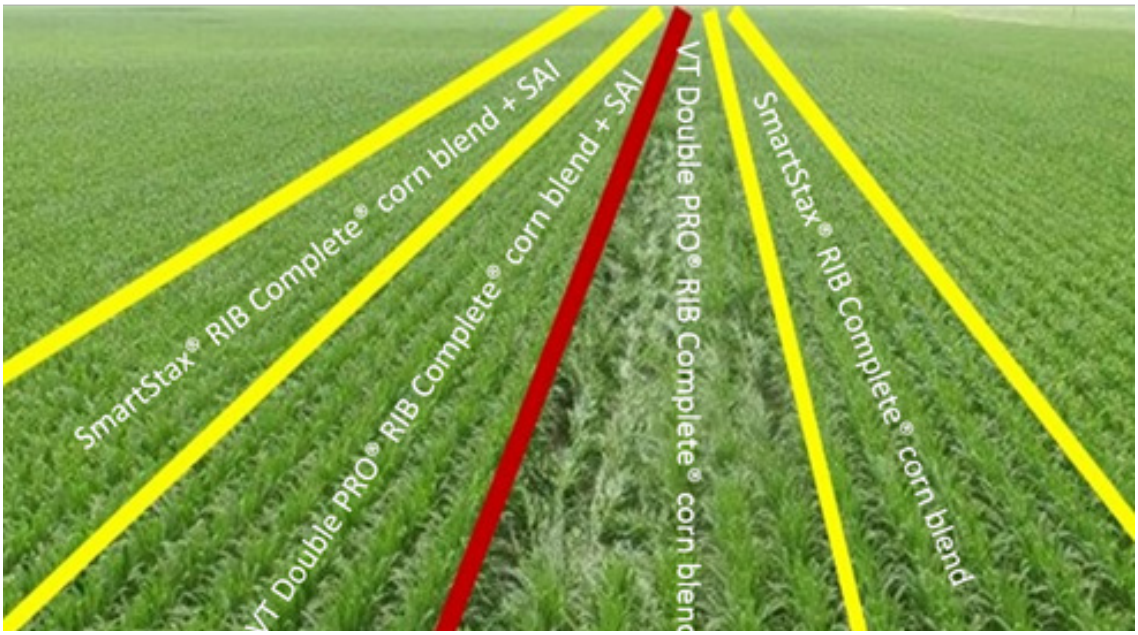


Figure 1. Typical layout of the side-by-side strip trials. Photo courtesy of Craig Lamoureux.

Value Assessment of Corn Products with SmartStax® Technology

UNDERSTANDING THE RESULTS

- Yield differences between the different products varied widely across the locations, reflecting a high degree of variability in the growing environments.
- The presence of CRW was confirmed at only one third of the test sites. For the locations where CRW presence was observed, products with SmartStax technology showed an average of a 13 bu/acre yield advantage over products with VT Double PRO technology. When the SAI was applied, products with SmartStax technology showed a 6 bu/acre yield advantage (Figure 2).
- In the locations where CRW were absent, the VT Double PRO RIB Complete corn blend products yielded similarly or slightly higher (approximately 2 bu/acre) than the products with SmartStax technology (Figure 2).
- Simulations based on differing pricing scenarios for products with SmartStax technology were run using a crop selling price of $3.50/bu and are presented in Figure 3.
- Across all locations, a positive ROI was realized at 47% of the locations at a $20/unit seed cost, 37% of the locations at $40/unit, and 31% of the locations at $60/unit. In the locations where CRW presence was confirmed, a positive ROI was achieved at 83%, 76%, and 69% of the locations for a $20/unit, $40/unit, and $60/unit seed cost, respectively.

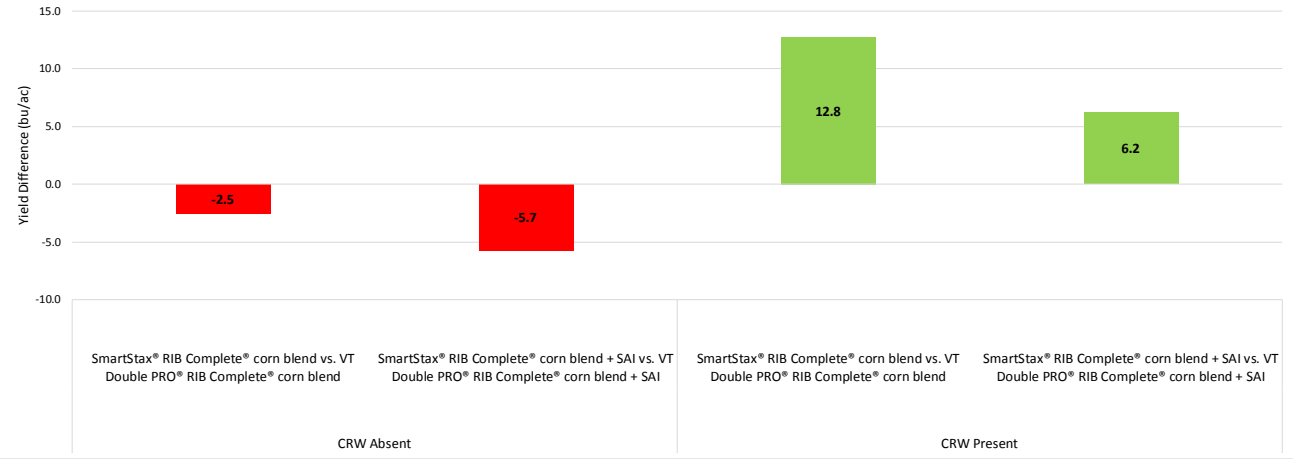


Figure 2. Yield advantage of SmartStax RIB Complete corn blend products over VT Double PRO RIB Complete corn blend products in the absence (left) and presence (right) of CRW.

Value Assessment of Corn Products with SmartStax® Technology

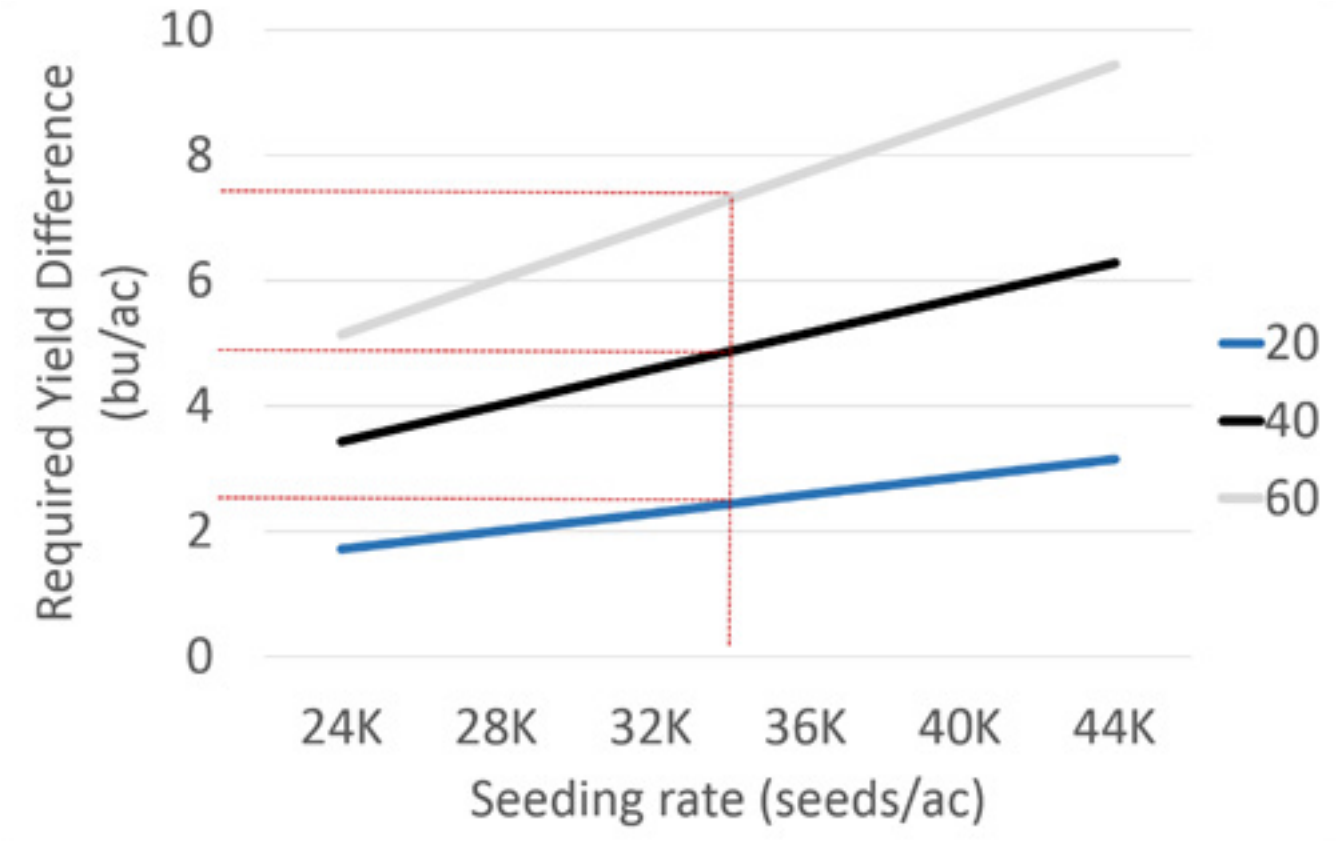


Figure 3. Additional yield required to offset increased seed cost at different planting populations assuming a corn selling price of $3.50/bu. For example, for a seeding rate of 34,000 seeds/acre, the additional yield required to recover the seed cost would be 2.2, 4.9, or 7.7 bu/acre at a seed cost of $20, $40, and $60, respectively.

WHAT DOES THIS MEAN FOR YOUR FARM?

- This study demonstrates that the use of corn products with SmartStax technology can be highly profitable, but the probability of a positive ROI is greatest where CRW risk is highest.
- The profitability of using corn products with SmartStax technology over corn products with VT Double PRO technology in similar genetics will be dictated by the expected yield advantage, the additional cost of seed, the crop selling price, and the seeding rate.

Trecepta® Technology Launch

TRIAL OVERVIEW >

Trecepta® technology was developed by combining VT Double PRO® (MON 89034) and Agrisure Viptera® (MIR162) technology to provide:

- Greater efficacy
- Broader spectrum control
- Trait durability

RESEARCH OBJECTIVE >

Trials were conducted to evaluate Trecepta® technology for efficacy against above-ground corn insect pests.

- Small-plot testing locations across the southern United States from 2015 through 2017 (internal trials as well as external cooperators).
- Pre-launch grower trials in 2017: 30 strip trial sites across southern United States (24-26 with data)

SITE NOTES:

Treatments were evaluated by counting the average number of kernels per ear that were damaged from corn earworm feeding.

UNDERSTANDING THE RESULTS >

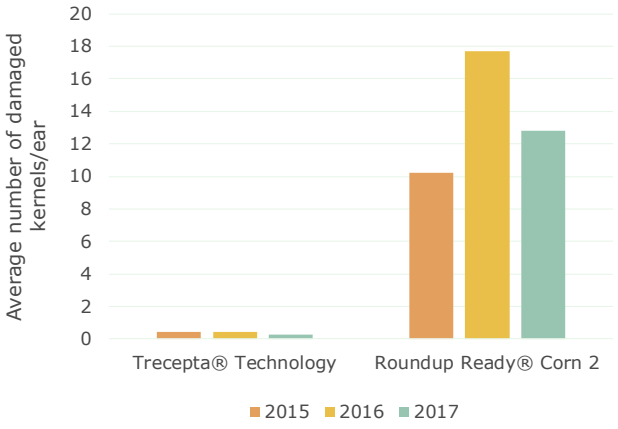


Figure 1. Comparison of average number of damaged kernels/ear across small plot testing locations from 2015-2017.

> Data from 2017 trials conducted in TX, MS, LA, GA, NC, SC, TN, and AR.

> Data from 2015 and 2016 trials conducted in TX, MS, GA, NC, TN, and AR.

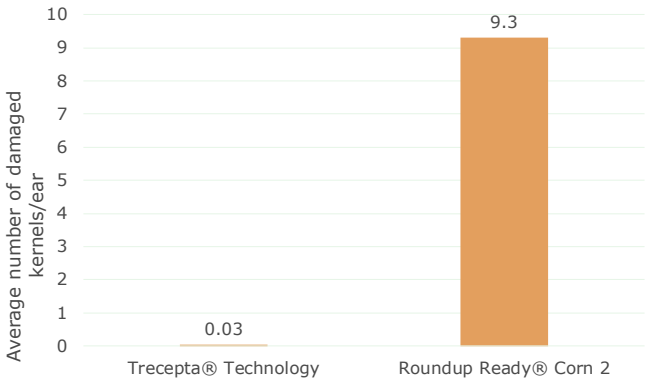


Figure 2. Comparison of average number of damaged kernels/ear across 26 pre-launch grower trials in 2017.

Trecepta® Technology Launch

Figure 3. Corn ears showing Trecepta® technology (L) and Roundup Ready® Corn 2 (R). Photos taken in Jerseyville, Illinois on August 17, 2016.

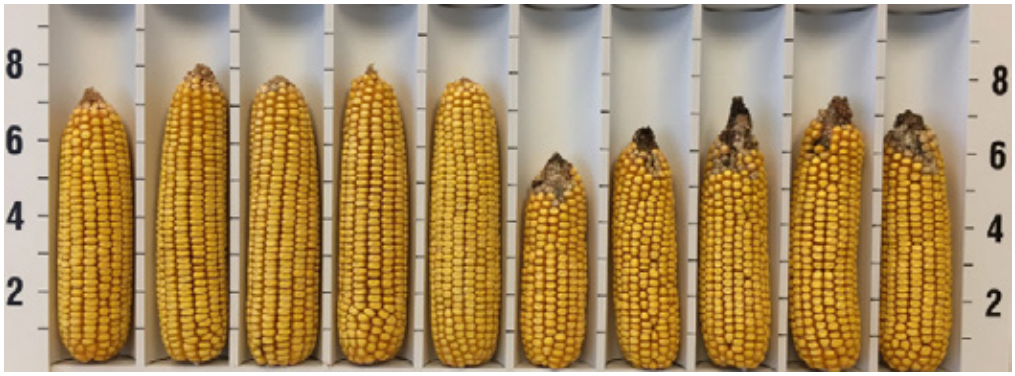


Figure 4. Corn ears showing Trecepta® technology (L) and Roundup Ready® Corn 2 (R). Harvested from Gadsden, Tennessee on August 24, 2017.

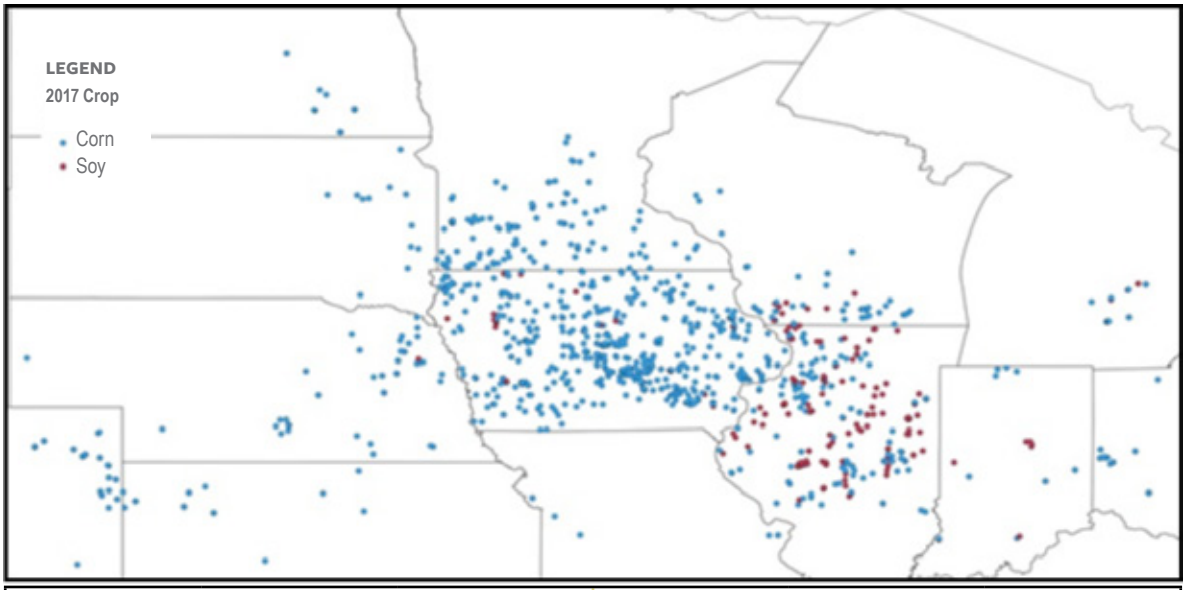
WHAT DOES THIS MEAN FOR YOUR FARM?

- Built on the proven performance of VT Double PRO® technology with the addition of Agrisure Viptera® technology.
- Promotes healthy stalks and cleaner ears through broader spectrum control of above ground pests, including corn borer, fall armyworm, corn earworm, western bean cutworm, and black cutworm.
- 100% of pre-launch grower trial participants surveyed would adopt Trecepta® technology and recommend it to other growers.

Using 2017 Corn Rootworm Beetle Counts to Help Evaluate the Risk of an Infestation for 2018

TRIAL OVERVIEW >

- The 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 infestation reaching economic damage levels in corn fields during the next growing season.
- Use of this information may help guide decisions regarding management strategies including corn product selection.



			AVERAGE PEAK NUMBER OF BEETLES/TRAP/DAY		
2017 Crop	Previous Crop	Number of Sampled Fields	Northern Corn Rootworm	Western Corn Rootworm	Total
Corn	Corn	381	0.27	3.85	4.11
Corn	Rotated	386	0.28	0.46	0.74
Corn	Not Specified	520	0.05	1.26	1.30
Total Corn	All Rotations	1287	0.18	1.78	1.97
Soybean	Corn	208	0.02	0.40	0.42
Corn and Soybean	All Rotations	1495	0.16	1.59	1.75

Figure 1. *Location of 2017 corn rootworm beetle (CRW) monitoring fields by crop (top) and characterization of 2017 sampled fields by present crop and previous crop with average maximum daily captures for western (WCR) and northern (NCR) CRW beetles (bottom).*

RESEARCH OBJECTIVE >

- The objective of this project was to measure adult corn rootworm population levels in corn and soybean fields in 2017 to assist in risk evaluation for 2018.

LOCATION	SOIL	PREVIOUS CROP	TILLAGE TYPE	PLANTING DATE	HARVEST DATE	POTENTIAL YIELD/ACRE	PLANTING RATE/ACRE
1495 Fields	Drained or Well Drained	See Figure 1	Conventional			110-250 bu/acre	28 - 36,000 seeds/acre

Using 2017 Corn Rootworm Beetle Counts to Help Evaluate the Risk of an Infestation for 2018

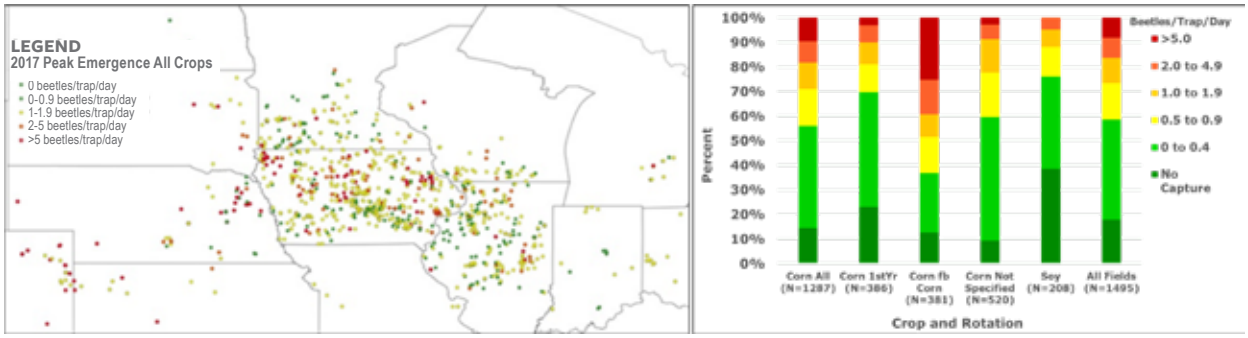


Figure 2. (Top Left) Corn rootworm (CRW) beetle monitoring locations for 2017 categorized by peak beetle counts observed during sampling and (Right) peak beetle emergence frequency categories (beetles/trap/day) observed in 2017 CRW monitoring fields by crop and rotation.

SITE NOTES >

- One to four Pherocon® AM non-baited trapping sites were established at 1495 field locations across the corn growing areas of IA, IL, IN, OH, MI, WI, MN, ND, SD, NE, KS, MO, and CO (Figure 1, Top).
- The trapping sites were installed in the interiors of corn and soybean fields that encompassed a variety of crop and management histories (Figure 1, Bottom).
- The Pherocon® AM traps were refreshed at 5-10 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 (NCRW) and western (WCRW) 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 maximum 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 Universities of Illinois and Iowa State and provide economic damage (ED) potential for the following season.[1,2]
  - Less than 2 beetles indicate a low risk of ED.
  - Greater than 1 beetle suggests a low risk for ED but could indicate populations are increasing.
  - Greater than 2 beetles indicate ED probability is likely if control measures are not used.

    Control measures include CRW Bacillus thuringiensis (B.t.) protected corn products or soil-applied insecticides.
  - Greater than 5 beetles indicate ED is very likely and populations are expected to be very high.

Using 2017 Corn Rootworm Beetle Counts to Help Evaluate the Risk of an Infestation for 2018

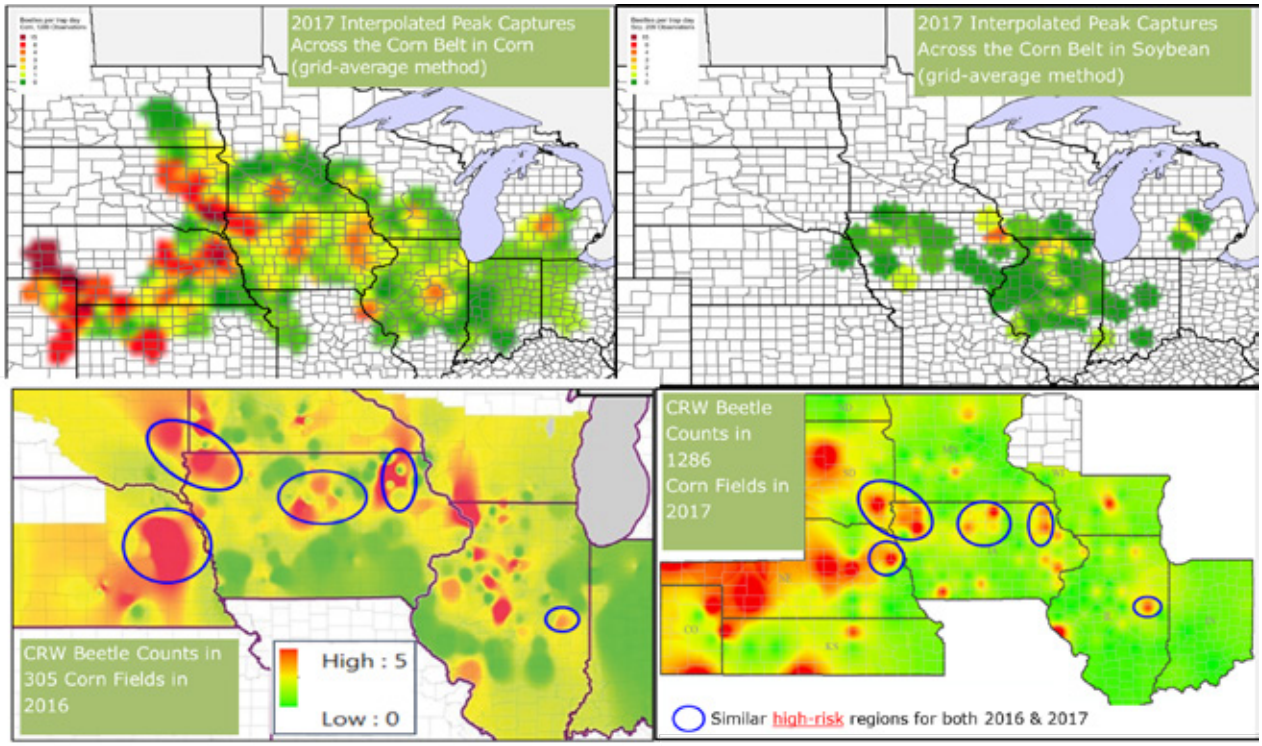


Figure 3. *2017 Interpolated peak beetle captures across the Corn Belt in corn (Top Left) and in soybean (Top Right). Comparison of 2016 (Bottom Left) and 2017 (Bottom Right) CRW beetle captures in corn. (Circled areas represent similar areas of higher CRW populations in 2016 and 2017).*

- 2017 CRW Beetle Survey Data (Figure 2, Left and Right).
  - Populations were variable across the corn area (Figure 2, Left).
  - Suggests that environment and management are factors in determining CRW pressure levels.
  - 19% of corn fields had counts exceeding the threshold of 2 beetles/trap/day.
  - 11% of the corn fields were approaching threshold levels (Figure 2, Right).
  - Corn fb corn had higher avg. max. daily counts than 1st-year corn (4.7 vs. 0.74 beetles/trap/day (Figure 1, Table).
  - 39% of continuous corn fields exceeded the threshold (Figure 2, Right).
  - Counts from soybean fields in IL and E IA were low (0.42 beetles/trap/day) (Figure 1, Table).
  - The threshold was exceeded in 5% of all soybean fields sampled (Figure 2, Right).
  - Counts of 0 were recorded in 14% and 38% of corn and soybean fields, respectively (Figure 2, Right).
- 2017 Data Interpolation (Figure 3, Top Right and Left).

Using 2017 Corn Rootworm Beetle Counts to Help Evaluate the Risk of an Infestation for 2018

  - 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 systematic grid applied to the estimation area.
  - On a broad scale, CRW populations, and consequently, risk potential is elevated in corn fields across E and SW NE, NE CO, W KS, SE SD, as well as NW, C, and EC IA.
  - Corn rootworm populations continue to be relatively low in many parts of ND, MO, IL, and S WI; however, localized hot spots can be found every year.
  - Notable CRW beetle presence in soybean fields was isolated to small areas in NC IL and NE IA.
- Comparison of 2016 vs. 2017 CRW Beetle Data (Figure 3, Bottom).
  - Absolute comparisons between 2016 and 2017 populations should be made with low confidence due to large differences in sampling intensity and distribution. However, trends may still be reliably identified.
  - Areas with large populations (i.e. "hot spots") are consistent from year to year. Populations appear to have grown in some areas (e.g. IA) while dissipating in others (e.g. portions of IL and S WI).

WHAT DOES THIS MEAN FOR YOUR FARM?

- Corn rootworms pose a significant threat to yield and profit, 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 up to 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. Use this information to help prepare for the 2018 season by selecting B.t. protected corn products to protect your risk of CRW larvae damaging roots the following year.

SOURCES >

[1] Western corn rootworm. Diabrotica virgiferavirgifera 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-using-sticky-traps-assess-corn-rootworm-activity.

[3] Evaluating corn rootworm risk and economic impact. 2017. Agronomic Spotlight. Monsanto Company. Websites verified 11/9/17. 171106192900

Advantages of Products with SmartStax® Technology for Corn Rootworm Protection

SUSTAINABILITY SPOTLIGHT

GM crops, paired with advanced breeding techniques, can help increase productivity without expanding the footprint of a farm. In 2015, had GM crops not been available, more than 48 million additional acres would have been needed to meet the demand for corn, soy, cotton, and canola. In total, this land mass would roughly be the size of New York state. By helping reduce the need to expand farmland, GM crops can help preserve native habitat.

TRIAL OVERVIEW >

- Corn rootworm (CRW) (*Diabrotica virgifera*) is dubbed the billion-dollar pest due to the significant annual yield losses and control costs associated with its infestation.1
- Crop rotation to a non-host crop, scouting, insecticide applications (soil- and/or foliar-applied), and corn product selection are major management strategies.
- Use of dual mode of action corn products for CRW protection can prove to be more efficient than using a soil-applied insecticide on a corn product without *Bacillus thuringiensis* (*B.t.*) CRW protection.

RESEARCH OBJECTIVE >

- To demonstrate the advantages of a dual-mode *B.t.* CRW protected corn product, such as products with SmartStax® technology.

LOCATION	SOIL	PREVIOUS CROP	TILLAGE TYPE	PLANTING DATE	HARVEST DATE	POTENTIAL YIELD/ACRE	PLANTING RATE/ACRE
Monmouth, IL	Silt Loam	Corn	Conventional	04/24/2017	09/28/2017	240 bu/acre	36,000 seeds/acre

SITE NOTES >

- Two treatments with 4 replications were established using two 108 RM corn products with the same genetic background.
  - A product with SmartStax® technology.
  - A product with VT Double PRO® technology + Force® 3G soil-applied insecticide.

Advantages of Products with SmartStax® Technology for Corn Rootworm Protection

UNDERSTANDING THE RESULTS >

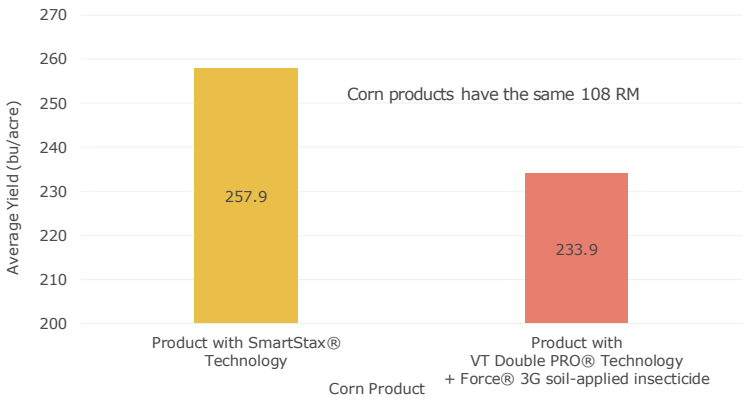


Figure 1. *Average yield comparison of a product with SmartStax® technology compared to a product with VT Double PRO® technology + Force® 3G soilapplied insecticide at the Monsanto Learning Center at Monmouth, IL in 2017 (4 replications).*

- Low levels of CRW pressure were observed at the Monsanto Learning Center at Monmouth, IL in 2017.
- Regardless of the low incidence of CRW, the product with SmartStax® technology demonstrated a yield advantage in this situation compared to the product with VT Double PRO® technology + Force® 3G soil-applied insecticide in a corn-on-corn situation (Figure 1).
- Yield advantages for *B.t.* protected CRW products with the same base genetics as products without *B.t.* CRW trait protection, especially when CRW pressure is low, are not always attributable to the *B.t.* trait.

WHAT DOES THIS MEAN FOR YOUR FARM?

- In a corn-on-corn situation, the use of a product with SmartStax® technology can provide more protection against CRW than the use of a soil-applied insecticide alone.
- Products with SmartStax® technology continue to provide assurance against CRW when planting into a corn-on-corn environment.
- Corn products for an operation should be selected based on needed agronomic characteristics for the fields for which the products will be grown. Characteristics include disease resistance, root and stalk strength, drought tolerance, adaptability for final use, and the use of *B.t.* insect protection when appropriate.

SOURCES >

[1]Gassmann, A. 2015. Management of western corn rootworm and other insect pests of corn. Iowa State University and USDA. http://portal.nifa.usda.gov/web/crisprojectpages/1007123-management-of-western-corn-rootworm-and-other-insect-pests-of-corn.html. 171016095229

Advantages of Using SmartStax® Technology and Insecticide for Corn Rootworm Protection

TRIAL OVERVIEW >

Corn rootworm (CRW) (*Diabrotica virgifera*) causes significant annual yield losses. Management strategies include: crop rotation to a non-host crop, scouting, insecticide applications, and corn product selection. The use of dual mode of action corn products for CRW protection can be more effective than using a soil-applied insecticide (SAI) on a corn product without *Bacillus thuringiensis* (*B.t.*) CRW protection.

RESEARCH OBJECTIVE >

- To evaluate the advantages of using a dual-mode *B.t.* CRW protected corn product, such as products with SmartStax® Technology.
- To evaluate the influence of SAI for CRW protection.

LOCATION	SOIL	PREVIOUS CROP	TILLAGE TYPE	PLANTING DATE	HARVEST DATE	PLANTING RATE/ACRE
Benson, MN	Silty Clay Loam	Corn	Conventional	05/06/2017	10/26/17	32,000
Luverne, MN	Silty Clay Loam	Soybean	Conventional	05/08/17	10/24/17	36,000
Luverne, MN	Silty Clay Loam	Soybean	Conventional	05/08/17	10/24/17	36,000
Rushmore, MN	Silty Clay Loam	Soybean	Conventional	05/09/17	10/20/17	36,000
Rushmore, MN	Silty Clay Loam	Soybean	Conventional	05/09/17	10/20/17	36,000
Svea, MN	Silty Clay Loam	Corn	Conventional	04/27/17	10/27/17	36,000
Benson, MN	Silty Clay Loam	Soybean	Conventional	05/02/17	10/27/17	36,000
Cosmos, MN	Silty Clay Loam	Soybean	Conventional	05/12/17	11/06/17	36,000
Mapleton, MN	Silty Clay Loam	Soybean	Conventional	05/08/17	10/24/17	35,000

SITE NOTES >

Trials were conducted in a strip plot design with one replication conducted at 9 locations or environments. Each location was considered a replication or environment in the analysis of the data.

Advantages of Using SmartStax® Technology and Insecticide for Corn Rootworm Protection

UNDERSTANDING THE RESULTS >

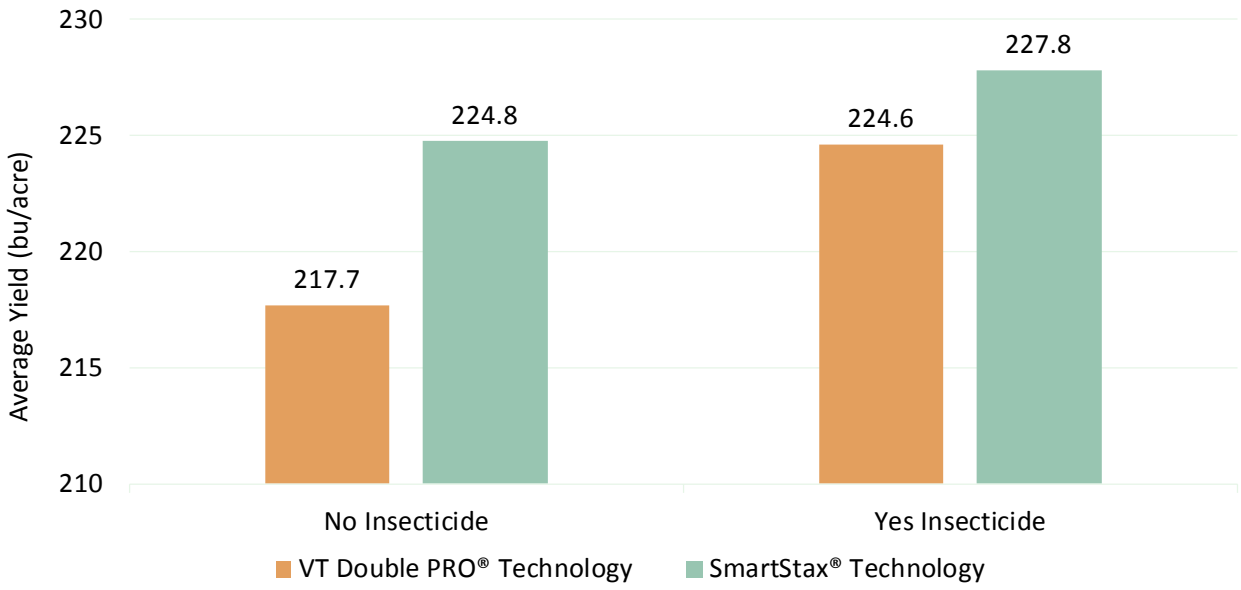


Figure 1. Average Yield of VT Double PRO® and SmartStax® products with and without insecticide for all locations.

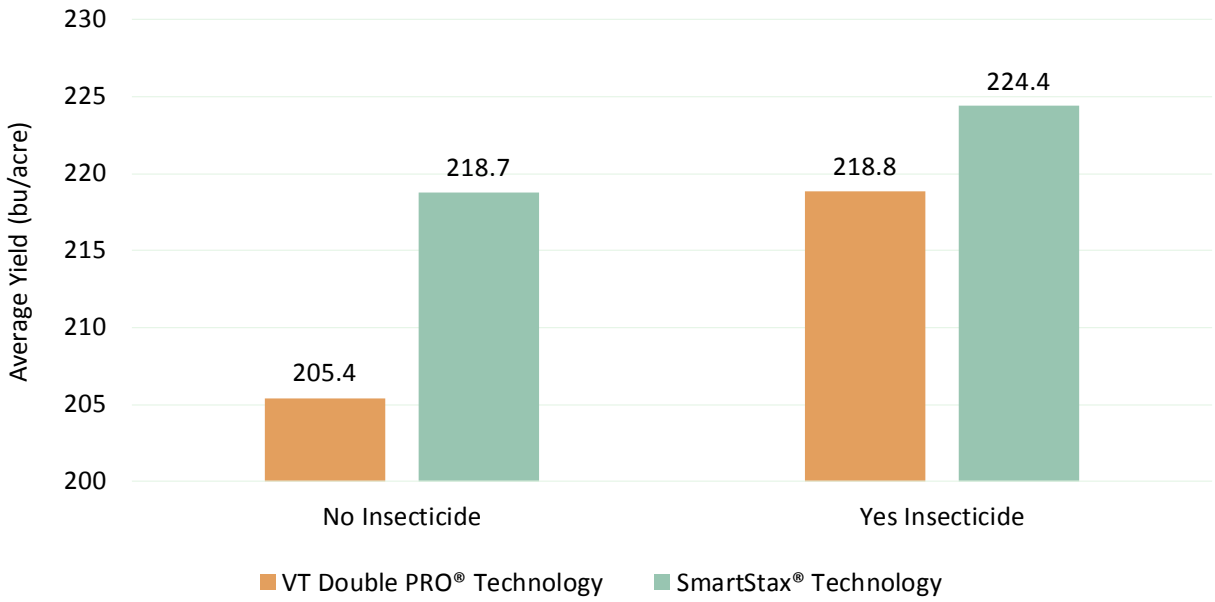


Figure 2. Average Yield of VT Double PRO® and SmartStax® products with and without insecticide for locations with high CRW infestation.

Advantages of Using SmartStax® Technology and Insecticide for Corn Rootworm Protection

TABLE 1. SUMMARY OF TRIAL FINDINGS OVER 9 MINNESOTA LOCATIONS.*
SmartStax® Technology vs. VT Double PRO® Technology – 80% win • 7.0 bu/acre average advantage considering all locations or $21.00/acre • 13.3 bu/acre average advantage considering locations with high infestation of CRW or $39.90/acre
VT Double PRO® Technology + SAI vs. VT Double PRO® Technology – 90% win • 6.9 bu/acre average advantage considering all locations or $20.70/acre • 12.7 bu/acre average advantage considering locations with high infestation of CRW or $38.10/acre
SmartStax® Technology vs. VT Double PRO® Technology + SAI – 55% win • Win ratio slightly favored SmartStax®, but actual yield difference was small • Price difference per acre could be approximately $20 between SmartStax® and VT Double PRO® before there would be an advantage to use VT Double PRO® with Insecticide vs. SmartStax® without insecticide
SmartStax® Technology + SAI vs. SmartStax® Technology – 78% win • 3.1 bu/acre average advantage considering all locations or $9.30/acre • 5.6 bu/acre average advantage considering locations with high infestation of CRW or $16.80/acre • Insecticide will cost $16-25, so addition of insecticide would not prove to be beneficial within the parameters of this data set
** Revenue per acre advantages calculated based upon a corn price of $3.00 per bushel.*

WHAT DOES THIS MEAN FOR YOUR FARM?

- The summary data shows that the average advantage of SmartStax® Technology is about 7.0 bu/acre over all locations and 13.3 bu/acre on sites with high CRW pressure. The average economic advantage considering all locations and locations with high CRW pressure, with a corn price of $3.00/bu equals $21.00/acre and $39.90/acre, respectively. In the case where a seeding rate of 35,000 seeds/acre was used, a unit of seed (80,000 kernels) would cover approximately 2.25 acres.
- The increased value of SmartStax® Technology equates to approximately $50-90+ per unit of seed compared to VT Double PRO® Technology. Considering the average differential in cost between SmartStax® Technology and VT Double PRO® Technology (using Zone 2 pricing) is approximately $50-55, the advantage of using SmartStax® Technology vs. VT Double PRO® Technology exceeds the investment by an average of $25/acre.

Corn Seed Products Injury Response to Selected Herbicides Under High pH Soils

TRIAL OVERVIEW >

- High pH soils are common in Western Kansas and Eastern Colorado.
- Corn seed products have varying tolerance to high pH soils and these products may have differential injury response to selected growth regulator and HPPD inhibitor herbicides when applied on high pH soil conditions.

RESEARCH OBJECTIVE >

- The trial was designed to determine corn seed product injury response to selected herbicides applied early postemergence, when planted in high pH soils.

LOCATION	SOIL	PREVIOUS CROP	TILLAGE TYPE	PLANTING DATE	HARVEST DATE	POTENTIAL YIELD/ACRE	PLANTING RATE/ACRE
Bethune, CO	Silt loam	Corn	Strip-till	05/08/2017	10/10/2017	240 bu/acre	34,000 seeds/ acre

SITE NOTES >

- The trial was planted in two blocks. One block was placed on high pH soils (pH = 8.3) and a check plot was planted on more neutral pH soils (pH = 7.7).
- The trial was sprayed with each herbicide product, early postemergence, at the maximum labeled rate across the rows at the V2 (two visible leaf collars) growth stage.
- Plots were evaluated for herbicide injury one week after spray application and rated using the following scale.
  - Warning = plots exhibiting greater than 50% herbicide injury.
  - Caution = plots exhibiting 10 to 49% herbicide injury.
  - Good = plots exhibiting less than 9% herbicide injury.

TABLE 1. CORN SEED PRODUCT INJURY RESPONSE TO VARIOUS HERBICIDE ACTIVE INGREDIENTS IN HIGH PH (8.3) SOIL CONDITIONS.

		Herbicide Active Ingredient (site of action)			
Relative Maturity (RM)	Corn seed product tolerance rating to high pH soil	tembotrione (HPPD inhibitor) - Laudis® applied at 3 fl oz/acre	isoxaflutole (HPPD inhibitor) - Balance® Flexx applied at 5 fl oz/acre	mesotrione (HPPD inhibitor), metolachlor (long-chain fatty acid inhibitor), glyphosate (EPSP synthase inhibitor) - Halex® GT applied at 4 pt/acre	dicamba (growth regulator) - Clarity® applied at 16 fl oz/acre
100 RM	Good				
101 RM	Average				
103 RM	Good				
104 RM	Good				
105 RM A	Caution				
105 RM B	Caution				
107 RM	Good				
109 RM	Good				
110 RM	Good				
112 RM A	Good				
112 RM B	Caution				
113 RM	Good				
	Herbicide Injury Response Ratings	Good	Caution	Warning	

Corn Seed Products Injury Response to Selected Herbicides Under High pH Soils

UNDERSTANDING THE RESULTS >

- No herbicide injury response was observed in near neutral pH (7.7 pH) soil conditions (data not shown).
- Only one of the corn seed products rated as having "good" tolerance to high pH soils (109 RM) exhibited herbicide injury response to tembotrione ("warning").
- Corn seed products not recommended for high pH soils, 105 RM A, 105 RM B, 112 RM B ("caution" tolerance to high pH soils), exhibited increased herbicide injury response for nearly all herbicide active ingredients.

WHAT DOES THIS MEAN FOR YOUR FARM?

- Corn seed products rated as "caution" for planting in high pH soils generally have a greater risk of exhibiting herbicide injury response from certain HPPD inhibitor and growth regulator herbicides.
- If high pH soils are a concern, consult your local seed dealer about selecting the appropriate corn seed products that have high pH tolerance and fit your agronomic needs.
- Use care when selecting herbicide programs for weed control if planting corn seed products with "average" or "caution" pH tolerance ratings to high pH soil.

Cotton Research

Response of Four Deltapine® Cotton Varieties to Plant Growth Regulators

TRIAL OVERVIEW

- Cotton varieties all respond differently to plant growth regulator (PGR) treatments. It is important to understand the response of new cotton varieties to PGR application rates.

RESEARCH OBJECTIVE

The objective of this experiment was to evaluate the response of four Deltapine® cotton varieties to PGR application over two years for plant height and yield response.

SITE NOTES:

- Six locations were used:
  - 2016: Suffolk, VA; Jackson, NC; Plymouth, NC; Pantego, NC; Belvidere, NC and Hartsville, SC
  - 2017: Jackson, NC; Plymouth, NC; Pantego, NC; Belvidere, NC; Maxton, NC and Blackville, SC
- Pantego, NC and Jackson, NC locations were small plot designs with four replications. All other locations were single strip trials.
- Treatments included two approaches to PGR management:
  - Passive – standard PGR application schedule and rate for local conditions.
  - Aggressive – 1.5 to 2x rate of Passive treatment.
- PGR selected by grower.

UNDERSTANDING THE RESULTS

- Treatment means are two year averages (2016-2017) across all locations.

TREATMENT	DELTAPINE COTTON VARIETY	PLANT HEIGHT (INCHES)	PLANT HEIGHT CHANGE (%)	AVERAGE LINT YIELD (LBS/ACRE)	AVERAGE LINT YIELD CHANGE (%)
PASSIVE	DP 1725 B2XF	42.5		1143	
AGGRESSIVE	DP 1725 B2XF	40.5	-4.7	1135	-0.01
PASSIVE	DP 1646 B2XF	45.5		1218	
AGGRESSIVE	DP 1646 B2XF	41.5	-8.8	1271	4.3
PASSIVE	DP 1639 B2XF	43.0		1182	
AGGRESSIVE	DP 1639 B2XF	39.0	-9.3	1128	-4.6
PASSIVE	DP 1614 B2XF	38.5		1152	
AGGRESSIVE	DP 1614 B2XF	35.5	-7.8	1126	-2.3

Response of Four Deltapine® Cotton Varieties to Plant Growth Regulators

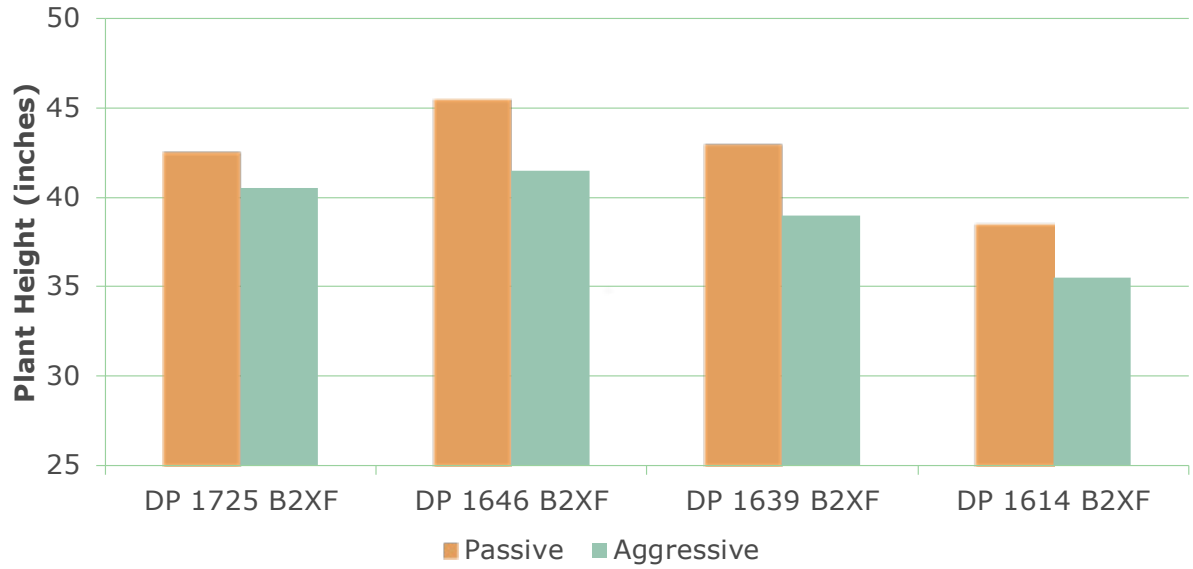


Figure 1. Average plant height (inches) for each cotton variety and treatment.

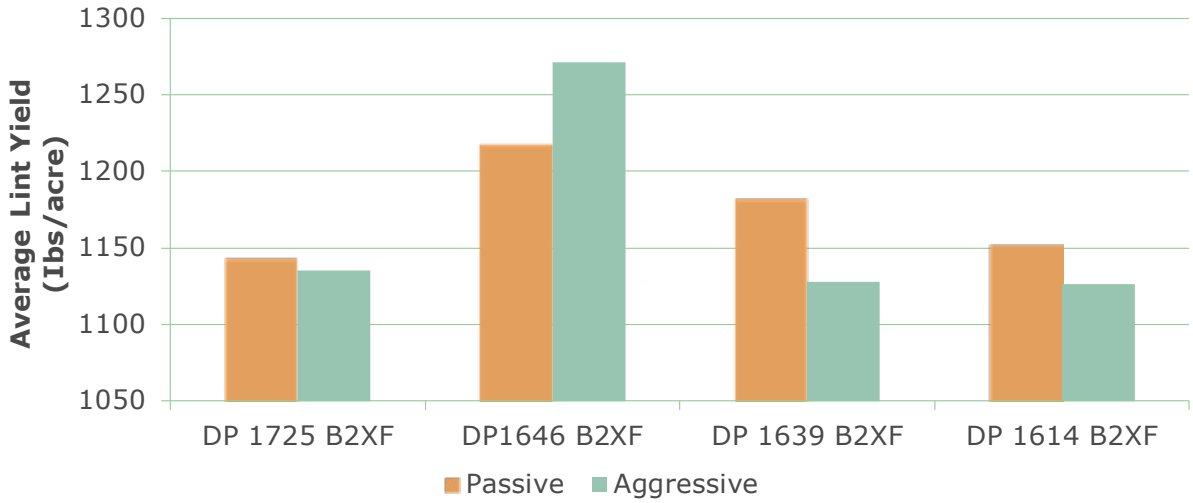


Figure 2. Average lint yield (lbs/acre) for each variety and treatment.

WHAT DOES THIS MEAN FOR YOUR FARM?

- DP 1725 B2XF was least responsive for plant height and lint yield when applying an aggressive PGR treatment followed by DP 1614 B2XF and DP 1639 B2XF.
- DP 1646 B2XF had a greater plant height for both PGR treatments compared to the other cotton varieties tested, with DP 1614 B2XF having the shortest plant type for both PGR treatments.
- DP 1646 B2XF was the only cotton variety that had a positive yield response from the aggressive PGR treatment.

Soybean Research

Irrigation Strategies for Soybean Production in Nebraska

TRIAL OVERVIEW >

- There are many different irrigation environments across the Great Plains. In some areas, water applications are restricted by pumping capacity or by allocation, but there are still many fully-irrigated fields.
- Farmers need information on how soybean products perform in various irrigation environments to help them choose the best products for their fields.

RESEARCH OBJECTIVE >

- To determine the effects of different irrigation strategies on the final yield and profitability of soybean in various irrigation environments.

LOCATION	SOIL	PREVIOUS CROP	TILLAGE TYPE	PLANTING DATE	HARVEST DATE	POTENTIAL YIELD/ACRE	PLANTING RATE/ACRE
Battle Creek, NE	Loamy sand	Corn	Conventional	5/23/2017	10/12/2017	90 bu/acre	140,000
Gothenburg, NE	Silt loam	Winter wheat	Strip tillage	5/15/2017	10/17/2017	80 bu/acre	160,000
Bruning, NE	Silt loam	Corn	Conventional	05/16/2017	09/30/2017	80 bu/acre	160,000

SITE NOTES:

- Rainfall totals and irrigation amounts by location were as follows:
  - Battle Creek, NE: rainfall = 12.3 in., full irrigation = 7.0 in.
  - Gothenburg, NE: rainfall = 10.83 in., full irrigation = 6.25 in.
  - Bruning, NE: rainfall = 12.3 in., full irrigation = 8.4 in.
- Two Roundup Ready 2 Xtend® soybean products were planted in four irrigation blocks at each location with 1 repetition per location, so the site was used as a repetition when analyzed.
- Irrigation treatments included:
  - Full irrigation (FI) to meet the evapotranspiration needs of the crop
  - Irrigation only from the R1 growth stage through physiological maturity (R1-PM)
  - Irrigation only from the R3 to R6 growth stages (R3-R6)
  - Dryland
- Each trial location was irrigated with an overhead irrigation system equipped with variable rate technology.

Irrigation Strategies for Soybean Production in Nebraska

UNDERSTANDING THE RESULTS >

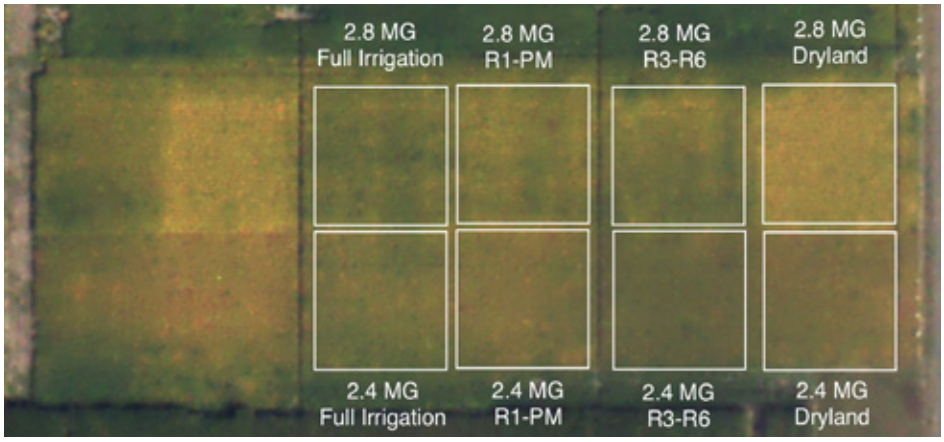


Figure 1. Aerial image of the trial at Gothenburg, NE. This image was taken on September 13th, 2017 and displays how the plots were laid out and the earlier senescence (yellowing) in the dryland treatment blocks.

TABLE 1. SOYBEAN YIELDS ACROSS LOCATIONS, TREATMENTS, AND PRODUCTS (*TREATMENT X SOYBEAN PRODUCT AVERAGE ACROSS LOCATIONS)

Soybean product	Trt	Bruning	Gothenburg	Battle Creek	Trt x P*	Trt avg
		----------	Average yield (bu/acre)		----------	
2.4 MG	FI	75.3	78.2	85.6	**79.7**	**77.5 a**
2.8 MG	FI	75.2	73.6	77.3	**75.4**	
2.4 MG	R1-PM	68.6	73.4	81.5	**74.5**	**72.4 ab**
2.8 MG	R1-PM	69.1	70.7	71.2	**70.3**	
2.4 MG	R3-R6	67.9	69.0	76.0	**71.0**	**68.9 bc**
2.8 MG	R3-R6	63.0	66.6	71.0	**66.9**	
2.4 MG	Dryland	47.4	67.3	78.1	**64.3**	**64.5 c**
2.8 MG	Dryland	58.8	60.8	74.4	**64.7**	
Location avg		**65.7**	**70.0**	**76.9**		**70.8** (LSD = 6.4)

TABLE 2. ECONOMIC ANALYSIS – NET RETURN BY TREATMENT AFTER PUMPING COSTS, AVERAGED ACROSS ALL LOCATIONS (*TREATMENT X SOYBEAN PRODUCT AVERAGE YIELD ACROSS LOCATIONS).

Soybean product	Trt	Trt x P* (bu/acre)	Gross return at $9.00/bu	Irrigation (inches)	Energy cost/inch of irrigation	Net return after energy costs	Net return by treatment
2.4 MG	FI	**79.7**	$717.30	7.2	$7.28	$664.88	**$645.38**
2.8 MG	FI	**75.4**	$678.30	7.2	$7.28	$625.88	
2.4 MG	R1-PM	**74.5**	$670.50	5.8	$7.28	$628.28	**$609.53**
2.8 MG	R1-PM	**70.3**	$633.00	5.8	$7.28	$590.78	
2.4 MG	R3-R6	**71.0**	$638.70	4.25	$7.28	$607.76	**$589.31**
2.8 MG	R3-R6	**66.9**	$601.80	4.25	$7.28	$570.86	
2.4 MG	Dryland	**64.3**	$578.40	0	$0	$578.40	**$580.20**
2.8 MG	Dryland	**64.7**	$582.00	0	$0	$582.00	

Irrigation Strategies for Soybean Production in Nebraska

UNDERSTANDING THE RESULTS >

- No significant difference was found in yields between the FI treatment or when delaying the first irrigation until the R1 growth stage (R1-PM).
- Yields in the dryland treatment did not differ significantly from yields in the R3-R6 treatment.
- No statistically significant yield difference was found between delaying initial irrigation until the R1 growth stage compared to the R3 stage.
- Starting irrigation in the vegetative stages (FI) resulted in increased plant height and lodging in both products at the Bruning, NE location (data not shown).

WHAT DOES THIS MEAN FOR YOUR FARM?

- Growers may want to consider delaying the initial irrigation of soybean at least until the R1 stage of growth (beginning flowering).
- Irrigating soybean during the vegetative stages can lead to increased plant height and potential lodging.
- Growers should consider the price per bushel of soybean when developing a strategy for irrigating their crop.
- Monsanto intends to repeat these trials to evaluate the yield response to irrigation strategies for the 2018 season. Readers should keep in mind that these results are from only one year, and that additional data collected in future trials may provide additional insight into this research topic.

Interaction of Soybean Planting Date and Seeding Rate

TRIAL OVERVIEW

- Soybean yield and the potential for lodging can be highly variable depending on a number of factors including environment, soybean product, nutrient management, irrigation, and planting rate and date. With this in mind, a study was designed to evaluate the interaction of soybean planting date and seeding rate.

RESEARCH OBJECTIVE

- To assess the effects of planting date and seeding rate on soybean yield.

LOCATION	SOIL	PREVIOUS CROP	TILLAGE TYPE	PLANTING DATE	HARVEST DATE	POTENTIAL YIELD/ACRE	PLANTING RATE/ACRE
Gothenburg, NE	Hord silt loam	Corn	Strip tillage		10/13/2017	90 bu/acre	Varied

SITE NOTES:

- This study was a randomized split-plot trial with date as the whole plot and seeding rate as the subplot. The study had 4 replications.
- A 2.8 MG soybean product was planted into strip-tilled, irrigated ground that was previously planted to corn with an application of 29.3 lbs/acre nitrogen, 60 lbs/acre phosphorus, 25 lbs/acre sulfur, and 0.25 lbs/acre zinc that was applied during the strip-till operation.
- Planting occurred at six dates (4/11/17, 4/21/17, 5/5/17, 5/24/17, 6/7/17, and 6/19/17) with six seeding rates (80K, 120K, 160K, 200K, 240K, and 280K seeds/acre).
- Weeds were controlled uniformly throughout the season and no insecticides or fungicides were needed.
- The April 11 and April 21 planting dates were exposed to freezing temperatures and six inches of snowfall at the end of April.
- Yield and the incidence of lodging and stem borer were measured.

UNDERSTANDING THE RESULTS >

YIELD

- The seeding rate impacted yield differently across planting dates (Figure 1).
  - For the April 11 and 21 planting dates, the impact of seeding rate was highly variable with high yields observed at both high and low seeding rates. The variability in these results could partially be attributed to the freezing temperatures and snowfall that occurred at the end of April.
  - For the May 5 and 24 planting dates, higher yields were observed with either the 160K or 200K seeds/acre rate, with lower yields observed at the lower and higher seeding rates. For the June 7 and 19 planting dates, the higher seeding rates had higher yields.

Interaction of Soybean Planting Date and Seeding Rate

LODGING

- The seeding rate and date impacted the extent of soybean lodging differently (Figure 3).
  - For the April 11, April 21, May 24, and June 19 planting dates, higher lodging was observed with higher seeding rates.
  - For the May 5 and June 7 planting dates, higher lodging was observed at the higher and lower seeding rates.

STEM BORER

- Infestation of soybean stem borer was impacted by planting date but not seeding rate, with the May 5 planting date having high levels of stem borers and the other planting dates having little to no stem borers.

WHAT DOES THIS MEAN FOR YOUR FARM?

- Typically, a soybean crop is planted after corn; this can be three to four weeks after the optimal soybean planting date for the area, which can significantly reduce yield potential by 10 to 15 bu/acre. Soybean planted too early can be affected by freezing temperatures, which can reduce yield potential. Farmers should work with their local seed sales team to determine the optimum planting date for their area.
- The early spring freeze and snowfall probably caused some variability in the results for seeding rate. To that end, farmers should expect a more typical response to seeding rate as what was observed with the May 5 and May 24 planting dates, with high yields observed at the 160K to 200K seeds/acre rates.
- For late-planted soybean, higher seeding rates (200K to 280K seeds/acre) should give the best opportunity for high yields.
- Earlier-planted soybean crops have a greater risk of infestation with stem borer.

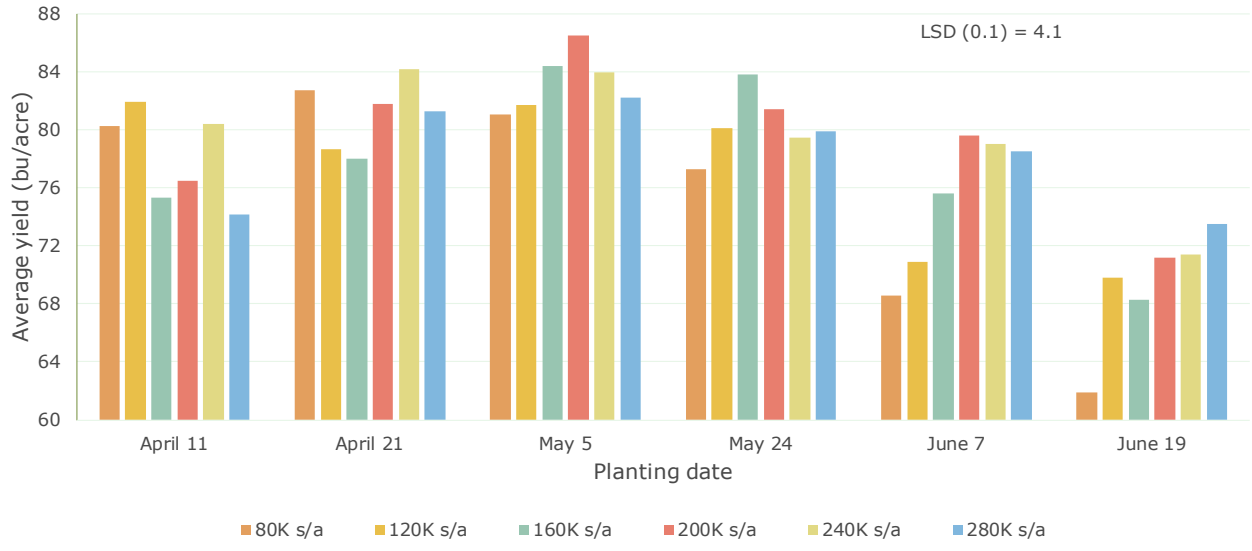


Figure 1. Soybean yields by planting date and seeding rate

Interaction of Soybean Planting Date and Seeding Rate

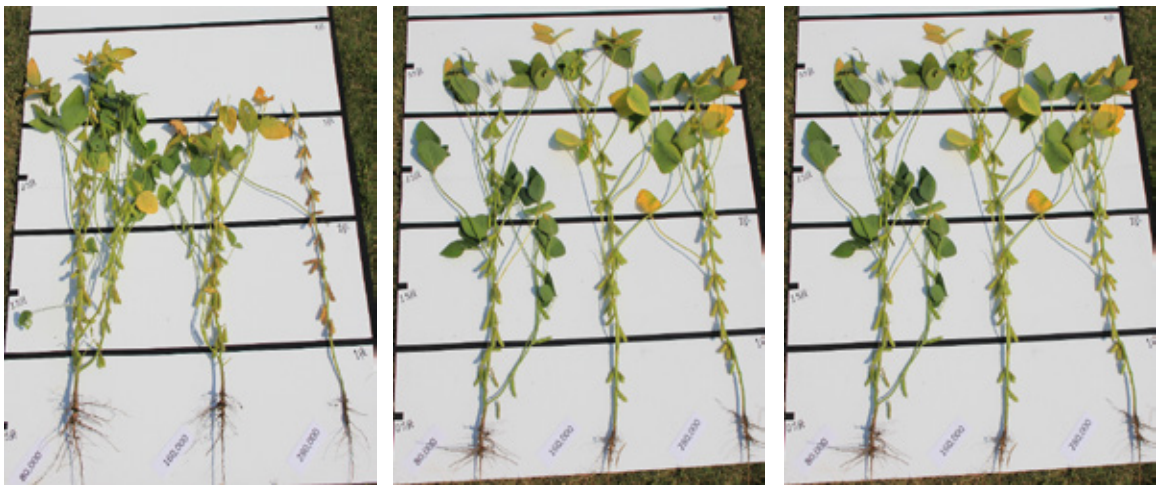


Figure 2. Soybean plants from three planting dates and three seeding rates. Each image shows a plant from the 80K seeds/acre (left), 160K seeds/acre (middle), and 280K seeds/acre (right) seeding rate.

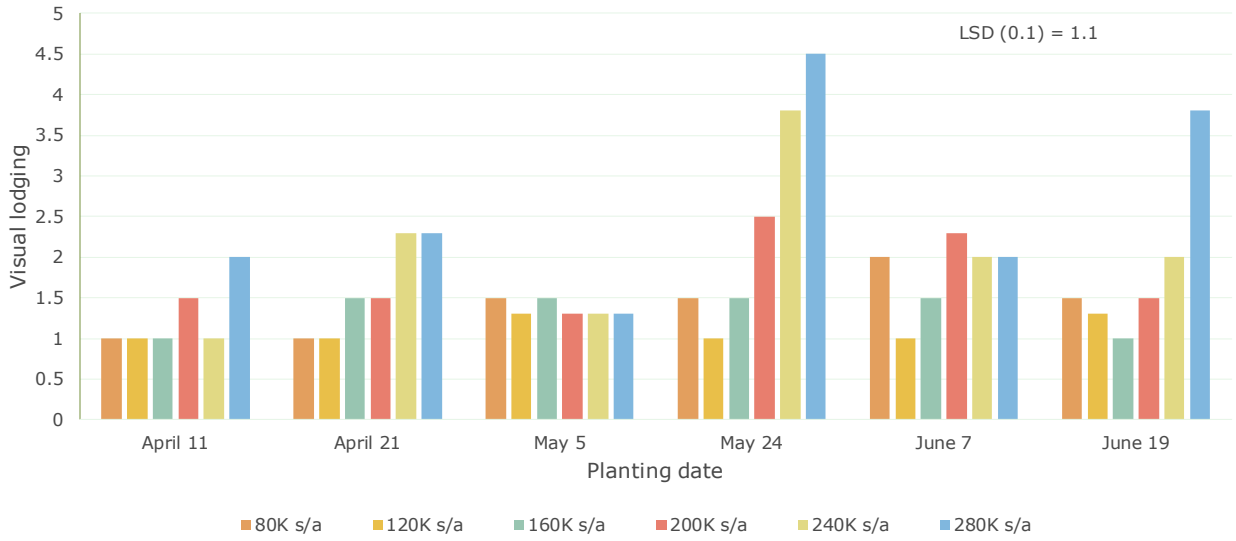


Figure 3. Soybean lodging by planting date and seeding rate. Soybean lodging was rated on a scale of 1 to 9 with 1 = no lodging and 9 = extreme lodging.

Yield Impacts of Dryland Soybean Management Decisions

TRIAL OVERVIEW

- Managing dryland soybeans is a challenge on the High Plains because highly variable moisture conditions make it difficult to determine whether an input or practice will be profitable.
- This trial evaluated several practices to determine how effective they are in improving dryland soybean yield.

RESEARCH OBJECTIVE

- To evaluate the yield effects of manageable inputs on a dryland soybean crop.

LOCATION	SOIL	PREVIOUS CROP	TILLAGE TYPE	PLANTING DATE	HARVEST DATE	POTENTIAL YIELD/ACRE	PLANTING RATE/ACRE
Gothenburg, NE	Cozad silt loam	Corn	Conventional tillage or No-till	06/01/2017	10/19/2017	65 bu/acre	130K and 220K

SITE NOTES:

- A 3.1 RM soybean product was planted on a dryland field with nine different treatments including tillage type, planting rate, row spacing, and fungicide and herbicide applications (Table 1). *Note that treatment 9 was intended to evaluate an earlier planting date (5/15/17), but poor weather prohibited the pre-emergence herbicide application, which was a key treatment element. Therefore, we evaluated poor weed control instead.
- The study was designed as a randomized complete block with five replications.
- Fertilizer was broadcast applied prior to planting and amounted to 24 lbs/acre nitrogen, 40 lbs/acre phosphorus, and 26 lbs/acre sulfur.
- Rainfall: May 2.53 in., June 0.75 in., July 1.52 in., August 3.63 in., and September 2.4 in.

UNDERSTANDING THE RESULTS

- Due to the dry conditions during the vegetative and early reproductive stages, uncontrolled weeds competed with the plants for moisture.
- Weed control was the factor that influenced yield the most with all residual weed control programs having significantly higher yields than treatment 1 (low management) or treatment 9 (missed weed control) (Figure 1).
- A reduction in the planting rate (treatment 6) significantly reduced yields relative to the highest yielding treatment planted at 220K seeds/acre (treatment 4), but the combination of using twin rows and fungicide (treatment 8) helped yields rebound.

Yield Impacts of Dryland Soybean Management Decisions

TABLE 1. TREATMENT LIST. APPLICATION RATES WERE ON A PER-ACRE BASIS. HIGHLIGHTED TEXT INDICATES DIFFERENCE FROM THE PREVIOUS TREATMENT.

Treatment	Tillage	Density	Row Spacing	Fungicide	Pre- Herbicides	Post Herbicides	Planting Date
1. Low Management	Disc	220,000	30 Inch	None	32 oz. Roundup	32 oz. Roundup	06/01/17
2. Residual Weed Control with XtendiMAX	Disc	220,000	30 Inch	None	32 oz. Roundup 14 oz. Authority MTZ 22 oz. XtendiMAX	32 oz. Roundup	06/01/17
3. No-Till	No-Till	220,000	30 Inch	None	32 oz. Roundup 14 oz. Authority MTZ 22 oz. XtendiMAX	32 oz. Roundup	06/01/17
4. Residual Weed Control + XtendiMAX POST	No-Till	220,000	30 Inch	None	32 oz. Roundup 14 oz. Authority MTZ 22 oz. XtendiMAX	32 oz. Roundup 22 oz. XtendiMAX	06/01/17
5. Post Residual Weed Control with Warrant POST	No-Till	220,000	30 Inch	None	32 oz. Roundup 14 oz. Authority MTZ 22 oz. XtendiMAX	32 oz. Roundup 22 oz. XtendiMAX 48 oz. Warrant	06/01/17
6. Lower Planting Rate	No-Till	130,000	30 Inch	None	32 oz. Roundup 14 oz. Authority MTZ 22 oz. XtendiMAX	32 oz. Roundup 22 oz. XtendiMAX 48 oz. Warrant	06/01/17
7. 30 Inch Twin Row	No-Till	130,000	Twin Row 30”	None	32 oz. Roundup 14 oz. Authority MTZ 22 oz. XtendiMAX	32 oz. Roundup 22 oz. XtendiMAX 48 oz. Warrant	06/01/17
8. Disease Control with Fungicide	No-Till	130,000	Twin Row 30”	6 oz./acre Headline	32 oz. Roundup 14 oz. Authority MTZ 22 oz. XtendiMAX	32 oz. Roundup 22 oz. XtendiMAX 48 oz. Warrant	06/01/17
9. Missed Weed Control*	No-Till	130,000	Twin Row 30”	6 oz./acre Headline	32 oz. Roundup		05/15/17

TABLE 2. COST ANALYSIS OF THE DIFFERENT MANAGEMENT TREATMENTS.

Treatment	Seed	Weed Control	Application	Fungicide	Tillage	Cost	Yield
1. Low Management	$102.14	$12.50	$20.00	$0.00	$15.00	$149.64	56.6
2. Residual Weed Control	$102.14	$49.03	$20.00	$0.00	$15.00	$186.17	62
3. No-Till	$102.14	$49.03	$20.00	$0.00	$0.00	$171.17	61.4
4. Residual Weed Control + XtendiMAX	$102.14	$61.06	$20.00	$0.00	$0.00	$183.21	62.9
5. Post Residual Weed Control with Warrant	$102.14	$76.44	$20.00	$0.00	$0.00	$198.58	61.1
6. Lower Planting Rate	$60.36	$76.44	$20.00	$0.00	$0.00	$156.79	58.4
7. 30 Inch Twin Row	$60.36	$76.44	$20.00	$0.00	$0.00	$156.79	59.6
8. Disease Control with Fungicide	$60.36	$76.44	$30.00	$28.13	$0.00	$194.92	62.8
9. Missed Weed Control*	$60.36	$6.25	$10.00	$28.13	$0.00	$104.73	32.7

Yield Impacts of Dryland Soybean Management Decisions

WHAT DOES THIS MEAN FOR YOUR FARM?

- On irrigated acres, weeds are still damaging, but irrigation can replace some of the moisture taken up by the weeds. In dryland production, soil moisture management is paramount to achieving high yield potential.
- To achieve maximum profitability in dryland soybean production, focus on excellent weed control programs that include strong pre- and post-emergence weed control components.

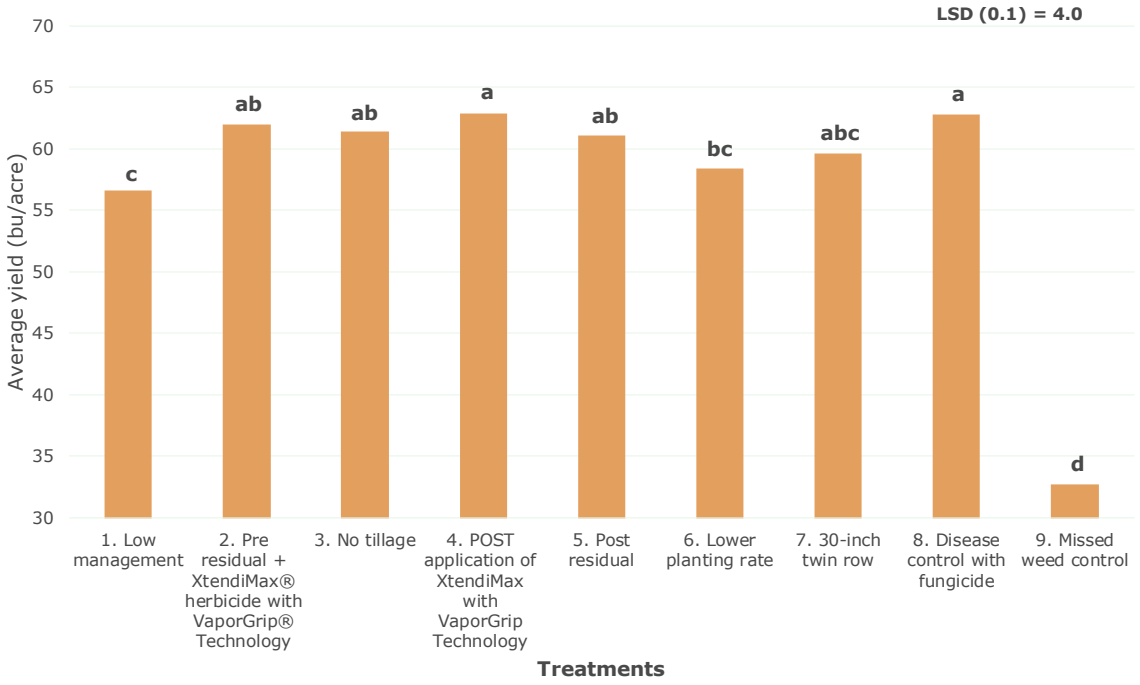


Figure 1. Dryland soybean yields in the different management treatments.

Response of Four Soybean Varieties to Population and Row Configuration

TRIAL OVERVIEW >

- This trial was conducted primarily to investigate the response of four soybean products to different population and row configurations. Soybean production systems in the mid-south are very diverse and many growers have questions relating to optimal plant populations and row configurations.

RESEARCH OBJECTIVE >

- This trial evaluated the yield potential of four soybean products in three row configurations at two different populations.

LOCATION	SOIL	PREVIOUS CROP	TILLAGE TYPE	PLANTING DATE	HARVEST DATE	POTENTIAL YIELD/ACRE	PLANTING RATE/ACRE
Scott, MS	Clay Loam	Corn	Conventional	04/20/2017	10/10/2017	75 bu/acre	Various

SITE NOTES >

- Row configurations:
  - 30-inch single row
  - 38-inch single row
  - 7.5 x 38-inch twin rows
- Soybean products:
  - Product A
  - Product B
  - Product C
  - Product D
- Populations planted:
  - 100K seeds/acre
  - 160K seeds/acre
- 80% emergence.

UNDERSTANDING THE RESULTS

- The 30-inch row plots were planted before a rain event on April 20, 2017. The 39-inch wide row plots were planted about three weeks later on May 11, 2017.
- Differences in the 30-inch and 38-inch wide row plots need to be clearly acknowledged as primarily due to planting date.
- The 38-inch row configurations (single and 38-inch twin) can be directly compared and show a typical slight yield advantage for the 38-inch twin row configuration. This has been observed across many Monsanto Learning Center demonstrations conducted at Scott, MS.
- No consistent interaction between soybean product and row spacing was observed.
- In both 38-inch row treatments, the higher population was numerically higher yielding. It is probable that the ideal population is between 100 seed/acre and 160 seeds/acre as observed in other studies.

WHAT DOES THIS MEAN FOR YOUR FARM?

- Growers can use the data from this demonstration with confidence when making decisions on row spacing and plant population on their farm.

Response of Four Soybean Varieties to Population and Row Configuration

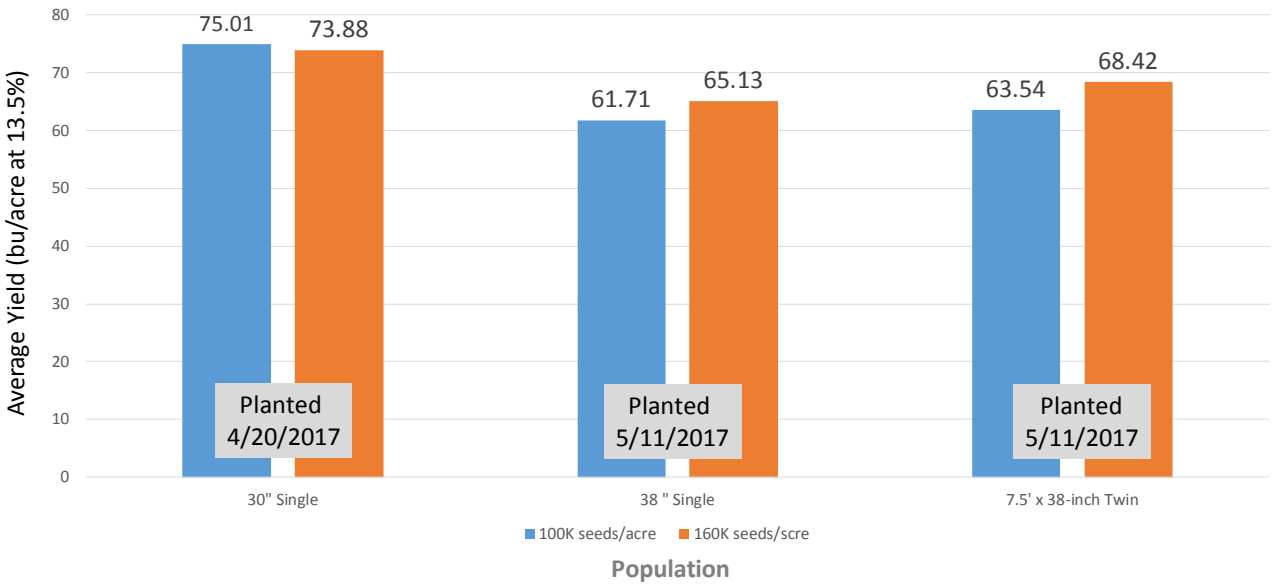


Figure 1. Response of four soybean products to different planting population and row configuration at different planting dates when averaged across soybean populations

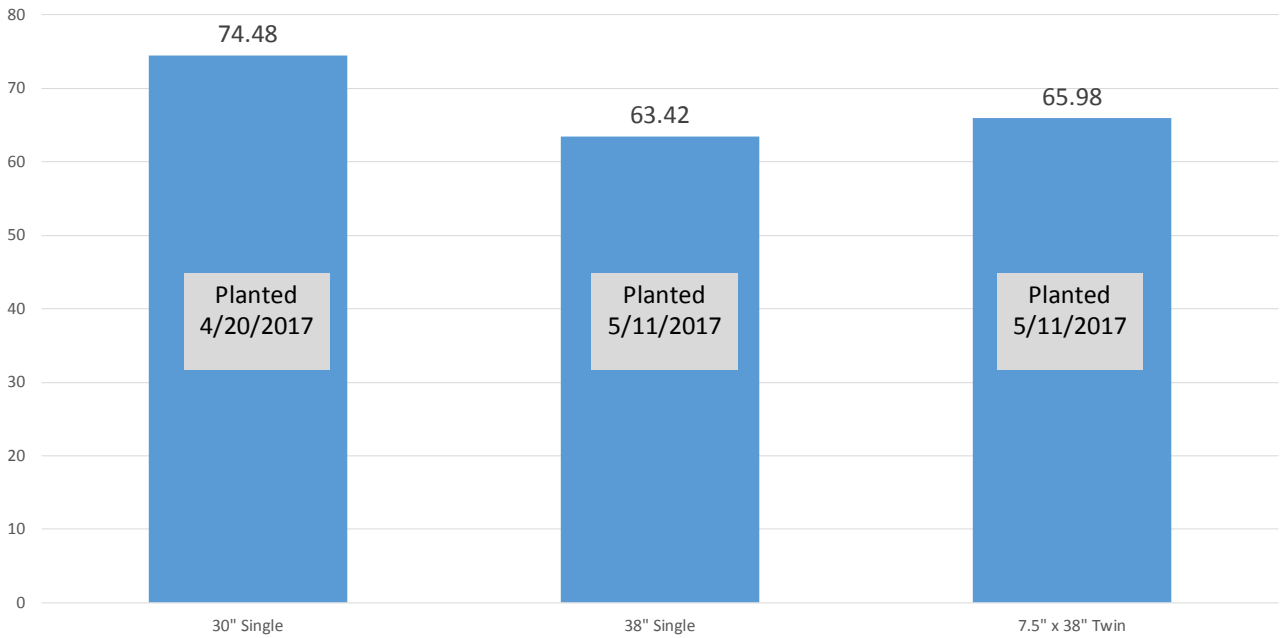


Figure 2. Response of four soybean products to row configuration and planting date when averaged across plant populations and soybean products.

Response of Four Soybean Varieties to Population and Row Configuration

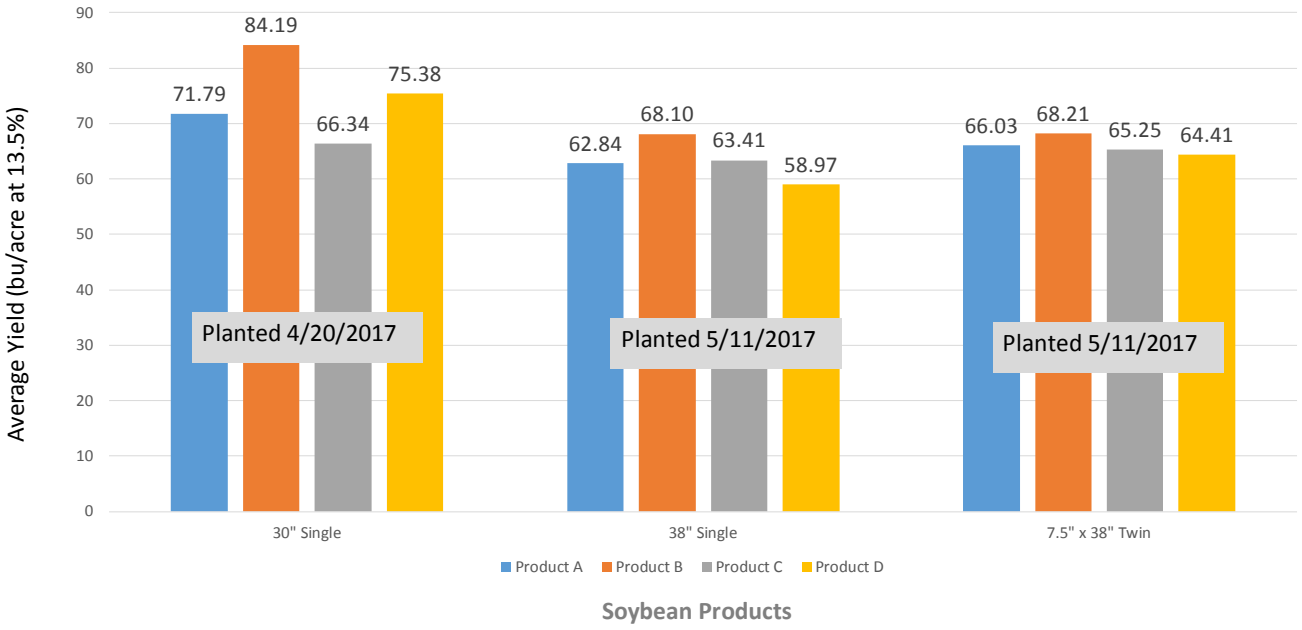


Figure 3. Response of four soybean products to row configuration and plant date when averaged across planting population.

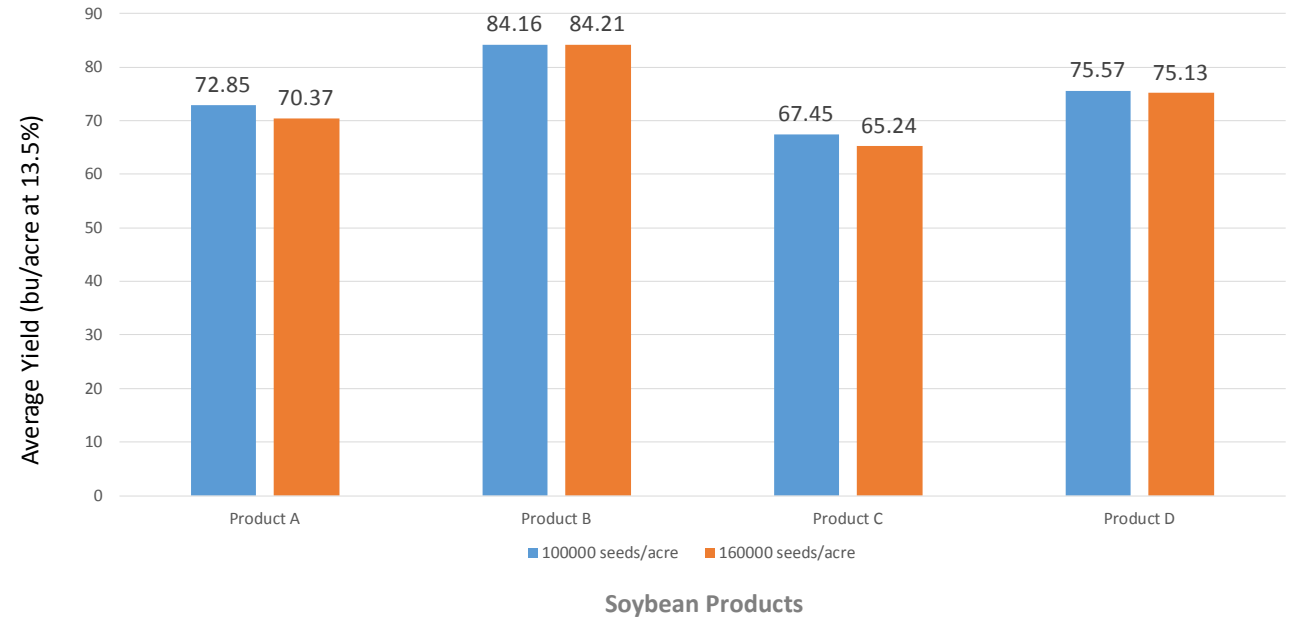


Figure 4. Response of four soybean products to population for 30-inch single row configuration. Planted on 4/20/2017

Response of Four Soybean Varieties to Population and Row Configuration

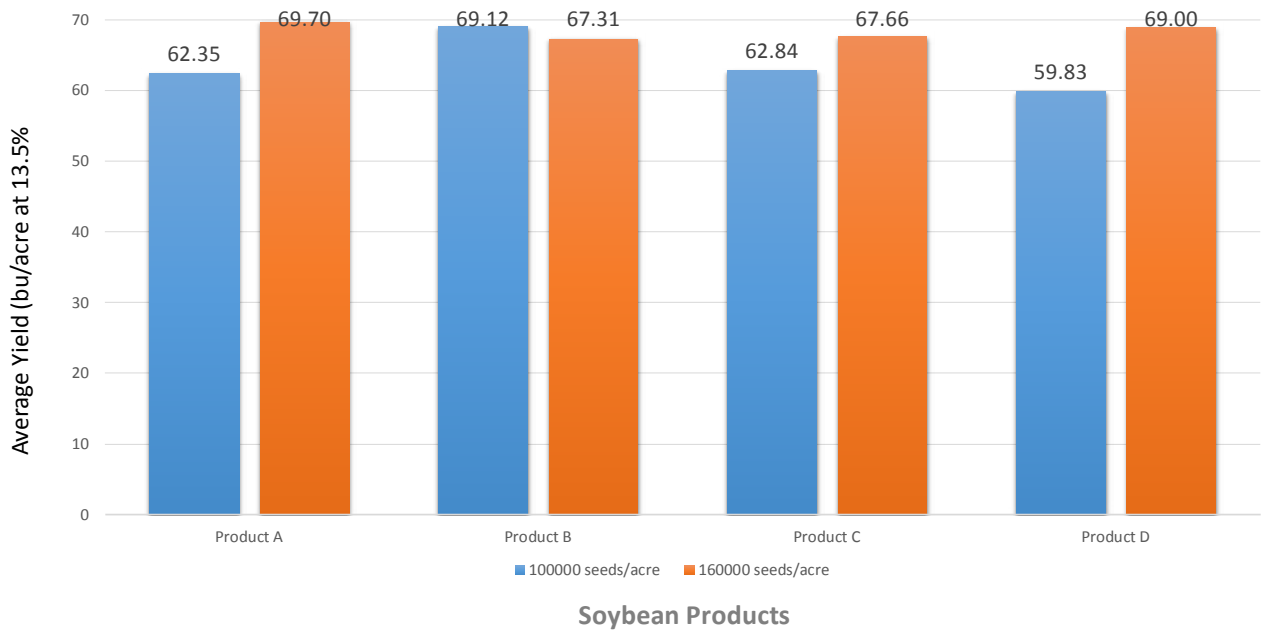


Figure 5. Response of four soybean products to population for 38-inch twin row configuration. Planted on 5/11/2017

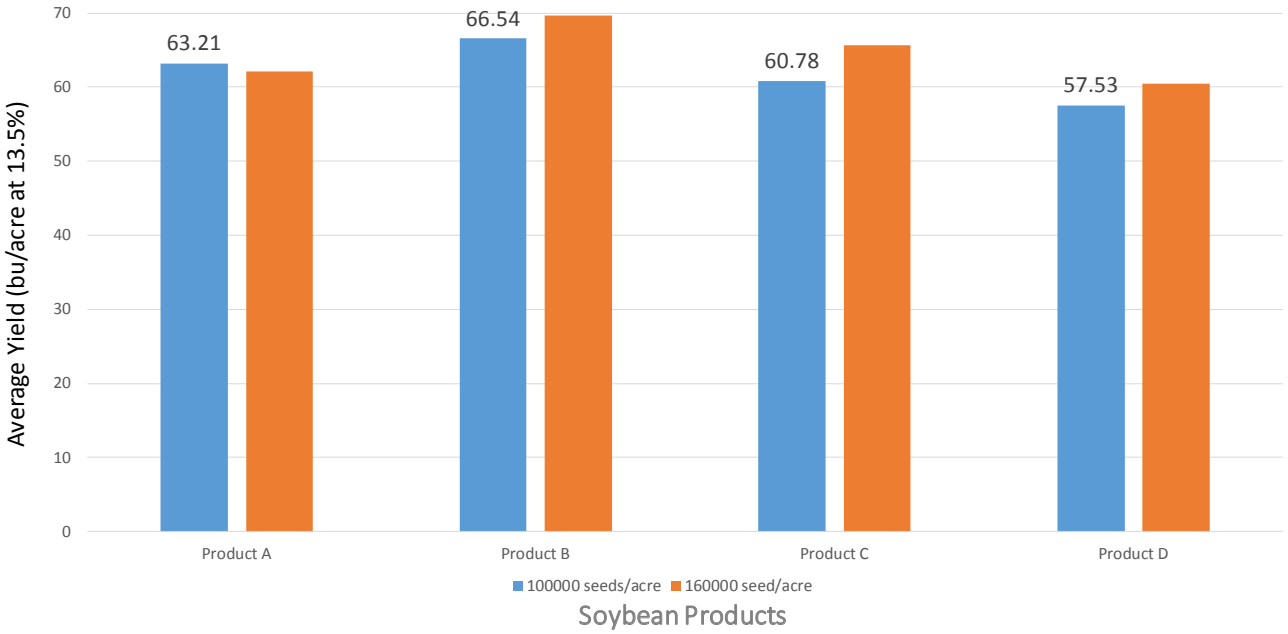


Figure 6. Response of four soybean products to population and 38-inch single row configuration. Planted on 5/11/2017

Soybean Variety Response to Planting Configuration and Population

TRIAL OVERVIEW >

- Midsouthern growers have many questions about row configuration and planting population in soybeans. This demonstration was conducted in cooperation with Mississippi State University to provide information for use in making decisions both when considering equipment choices and at planting.

RESEARCH OBJECTIVE >

- Evaluate the yield potential of soybeans planted in 3 different row spacings and at multiple populations.
- Evaluate the response of a soybean product to planting population.

LOCATION	SOIL	PREVIOUS CROP	TILLAGE TYPE	PLANTING DATE	HARVEST DATE	POTENTIAL YIELD/ACRE	PLANTING RATE/ACRE
Scott, MS	Clay Loam	Corn	Conventional	05/11/2017	10/12/2017	75 bu/acre	Various

SITE NOTES >

- Row Configurations planted:
  - 38-inch single row plantings
  - 38-inch x 7.5-inch twin row plantings
  - 30-inch single row plantings
- Plot sizes:
  - Four 38-inch rows, 125 feet long (about .05 acre/plot)
  - Eight 30-inch rows, 125 feet long (about .05 acre/plot)
- Populations planted:
  - 100,000 seeds planted/acre
  - 120,000 seeds planted/acre
  - 140,000 seeds planted/acre
  - 160,000 seeds planted/acre
  - 180,000 seeds planted/acre
  - 200,000 seeds planted/acre
- Emergence was about 80%; All agronomic inputs were per local standards.

UNDERSTANDING THE RESULTS

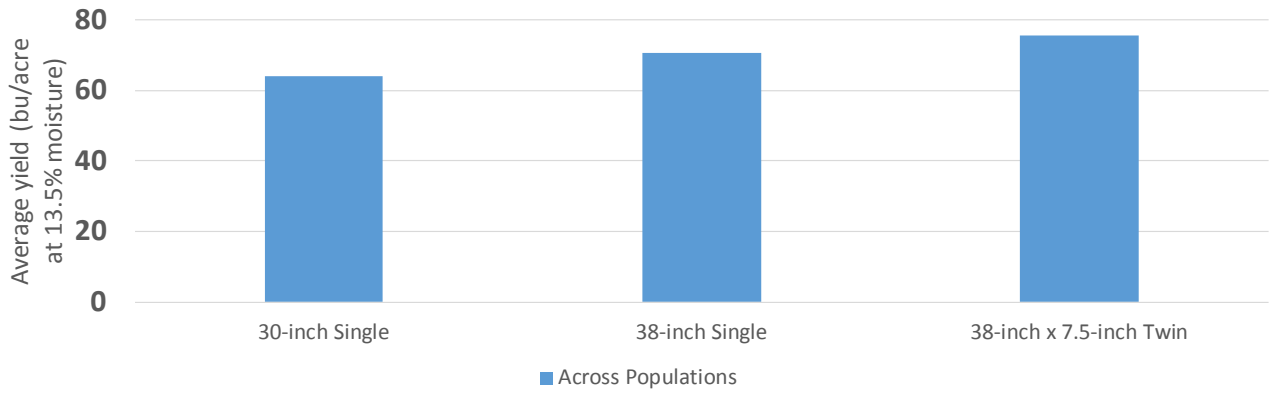


Figure 1. Average yield of soybean product by planting configuration across populations when planted on 5/11/2017.

Soybean Variety Response to Planting Configuration and Population

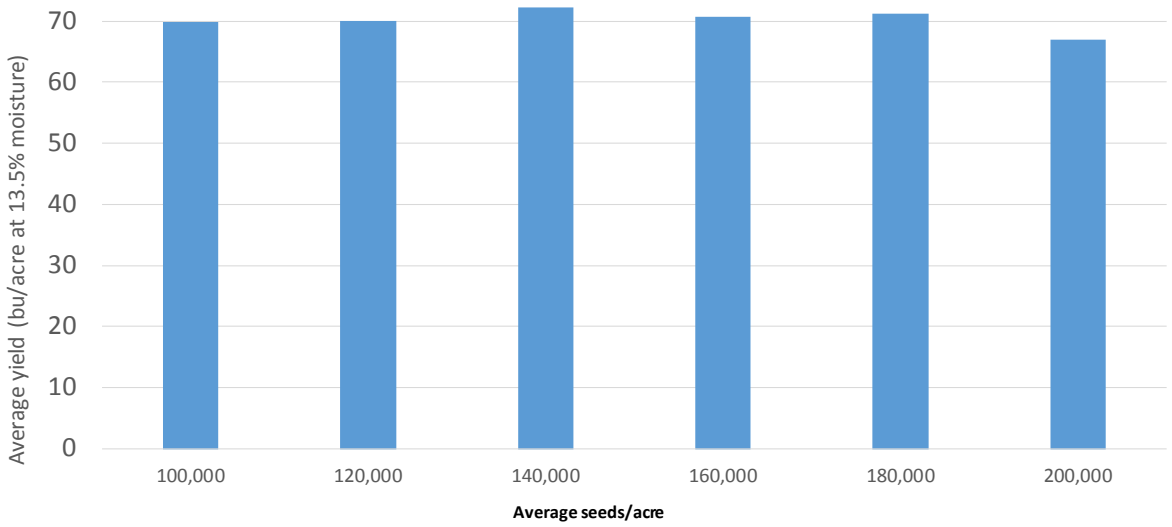


Figure 2. Average yield response of soybean product to planting populations across row configurations.

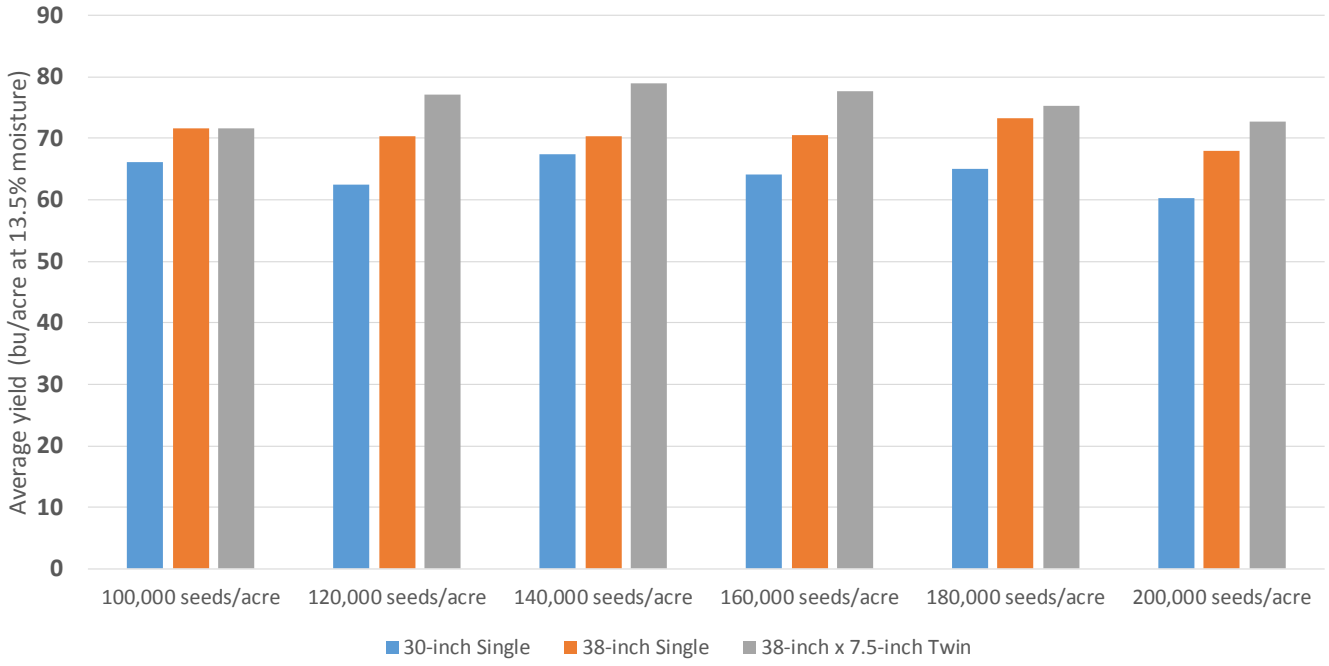


Figure 3. Average yield response of soybean product to row configuration by population.

Soybean Variety Response to Planting Configuration and Population

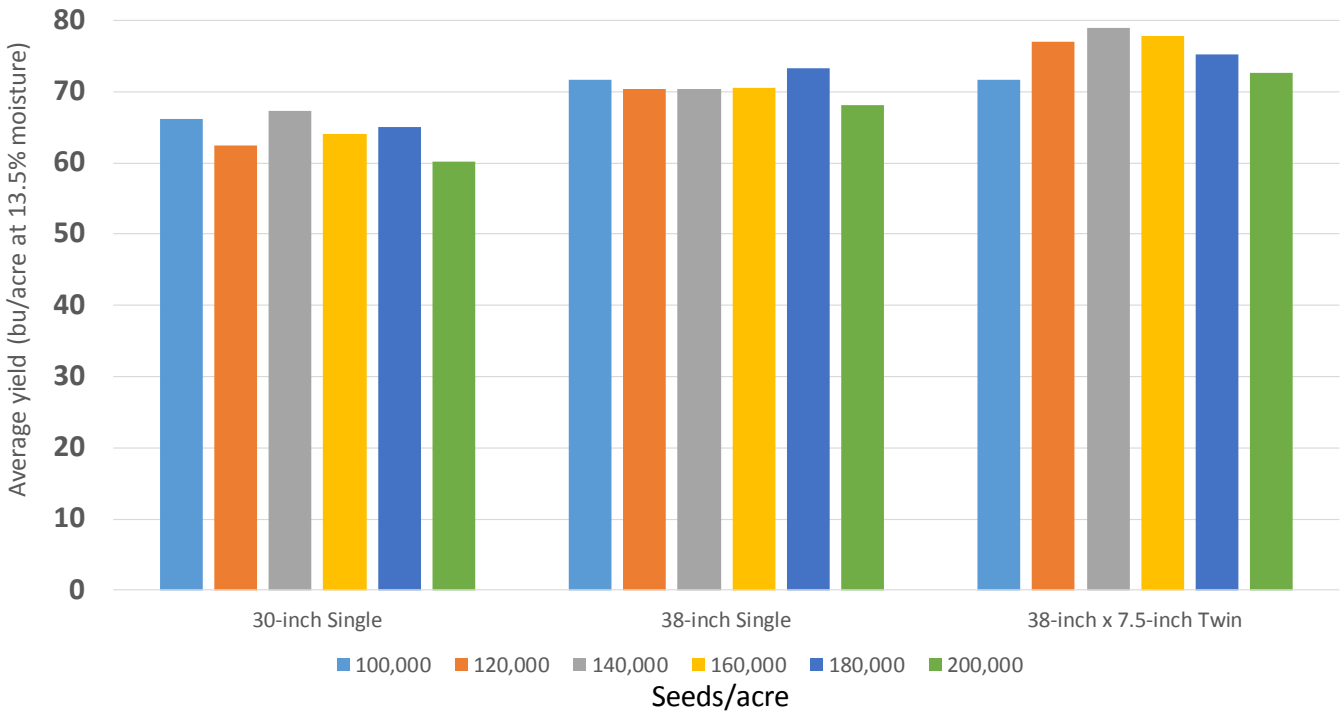


Figure 4. Average yield response of soybean product to row configuration by population.

WHAT DOES THIS MEAN FOR YOUR FARM?

- These results agree with previous demonstrations at the Monsanto Learning Center at Scott, MS, in that:
  - Twin-row plantings generally exhibit higher yield potential than other row configurations.
  - Soybeans planted in twin-rows produced the highest yields when planted at populations of 120,000 to 140,000 seeds/acre.
- Responses to row configurations also agree with previous demonstrations, including the following commentary:
  - 30-inch single rows appeared to pay some penalty in yield. This is likely due to issues with drainage, which is an issue in most of the coastal US.
  - 38-inch single rows were intermediate in yield to the other row configurations. This is best explained by increased drainage but a decreased ability to optimally intercept light i.e. shade the middle.
  - 7.5-inch x 38-inch twin rows demonstrated the highest yield potential in the trial. This is explained by the optimal tradeoff in drainage and light interception in the wide twin rows.
- These results are similar to previous demonstrations at the Monsanto Learning Center at Scott, MS.

Soybean Variety Response to Skippy Stands in Twin-Row and Single-Row Plantings

TRIAL OVERVIEW

- Previous learning center demonstrations have indicated that soybeans have the ability to compensate yields in response to a wide variety of issues that occur in the field.
- Twin-row plantings have increased in the midsouthern planting system, resulting in questions about the effects of skippy stands that sometimes occur in fields.
- This demonstration was designed as a follow-up to previous work done with twin-row plantings with additional data and incorporating into the data a set of treatments planted in single rows.

RESEARCH OBJECTIVE

- Evaluate the yield compensation ability of soybeans planted in single- and twin-row systems, at a variety of populations, and with several skippy stand configurations.

LOCATION	SOIL	PREVIOUS CROP	TILLAGE TYPE	PLANTING DATE	HARVEST DATE	POTENTIAL YIELD/ACRE	PLANTING RATE/ACRE
Scott, MS	Clay Loam	Soybeans	Conventional	05/10/2017	10/20/2017	60-70 bu/acre	Various

SITE NOTES>

- This demonstration included treatments with planting rates ranging from 60,000 to 150, 000 seeds planted/acre.
- Single rows were on a 38-inch row spacing and were planted using conventional single-row planters.
- Twin rows were planted on beds using Monosem planters on 38-inch rows with 7.5 inches between twin rows.
- Plots were 6 rows x 175 feet long or approximately .1 acre/plot.
- Skips were introduced into the planted plots by blocking holes in planter plates prior to planting. This was done using the "Skipulator" spreadsheet which is an original Monsanto Learning Center at Scott, MS idea.
- Treatment List:
  - 60,000 seeds with 12-inch skip
  - 60,000 seeds with 24-inch skip
  - 60,000 seeds with 36-inch skip
  - 60,000 seeds, solid
  - 90,000 seeds with 12-inch skip
  - 90,000 seeds with 24-inch skip
  - 90,000 seeds, solid
  - 120,000 seeds with 12-inch skip
  - 120,000 seeds, solid
  - 150,000 seeds with 1-inch skip
  - 150,000 seeds, solid

Soybean Variety Response to Skippy Stands in Twin-Row and Single-Row Plantings

UNDERSTANDING THE RESULTS

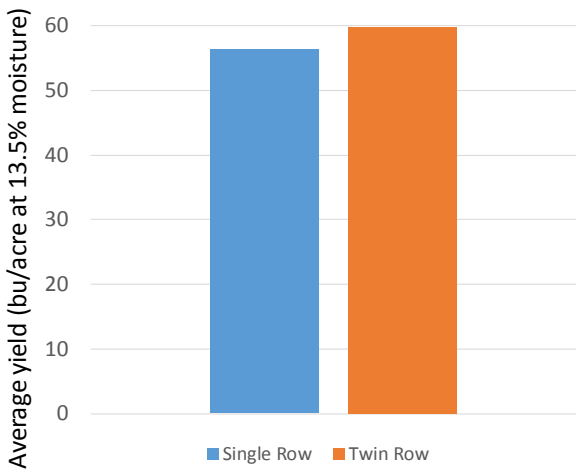


Figure 1. Response of 4.6 RM soybean product to skippy stands at Scott, MS.

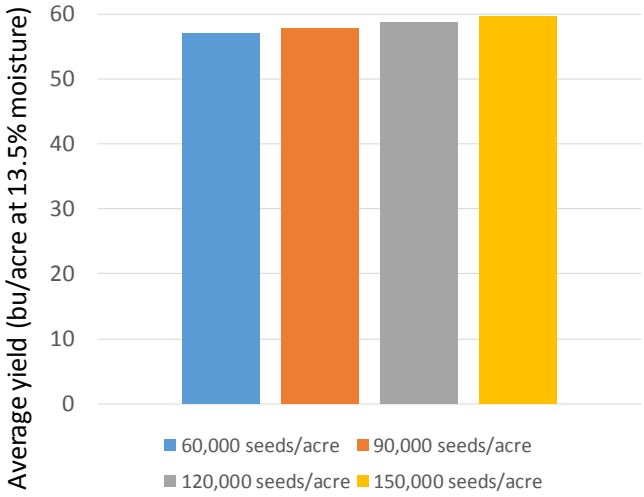


Figure 2. Response of 4.6 RM soybean product to skippy stands at Scott, MS.

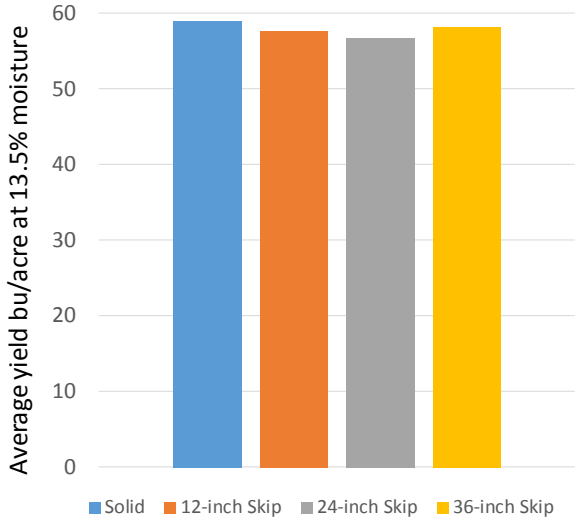


Figure 3. Response of 4.6 RM soybean product to skippy stands at Scott, MS.

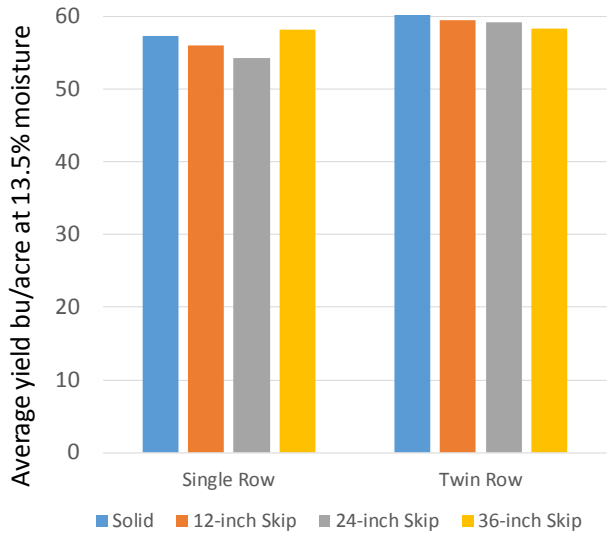


Figure 4. Response of 4.6 RM soybean product to skippy stands at Scott, MS.

- As previous results have indicated, the twin-row system showed a 3 bu/acre advantage vs. the single row.
- Little yield response was observed from planting population.
- No response was observed to any skip treatment in the field.
- Results seemed to be similar in both single- and twin-row plantings.

Soybean Variety Response to Skippy Stands in Twin-Row and Single-Row Plantings

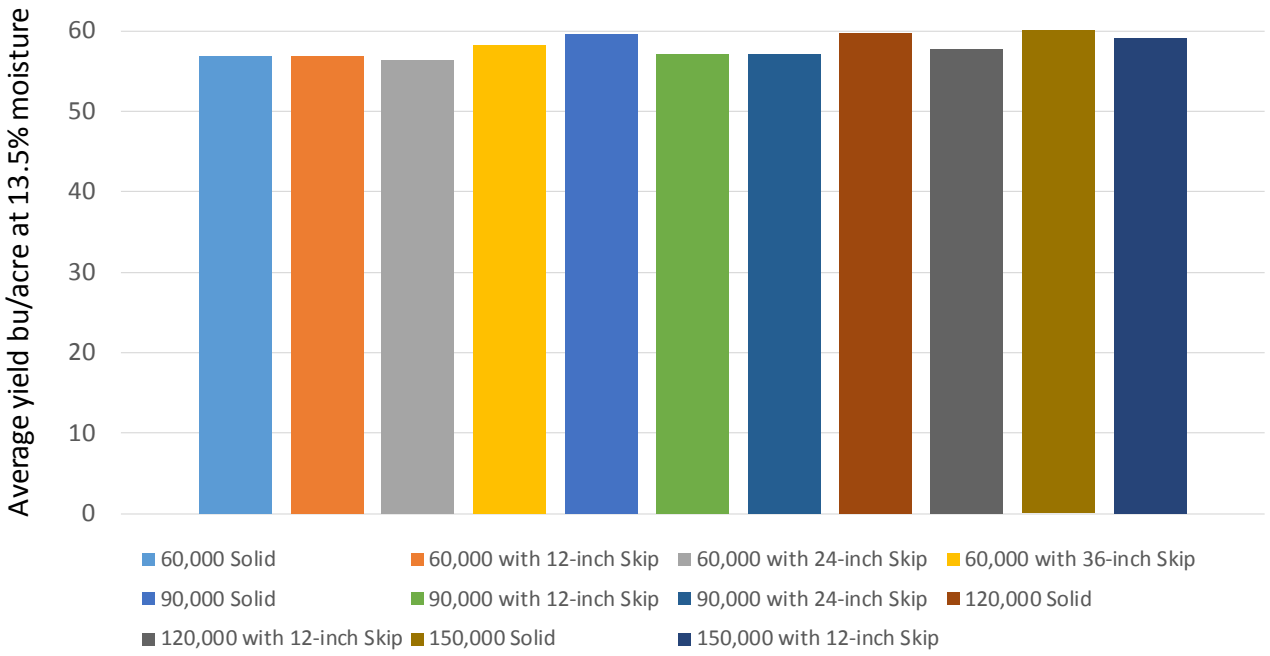


Figure 5. Response of 4.6 RM soybean product to skippy stands at Scott, MS.

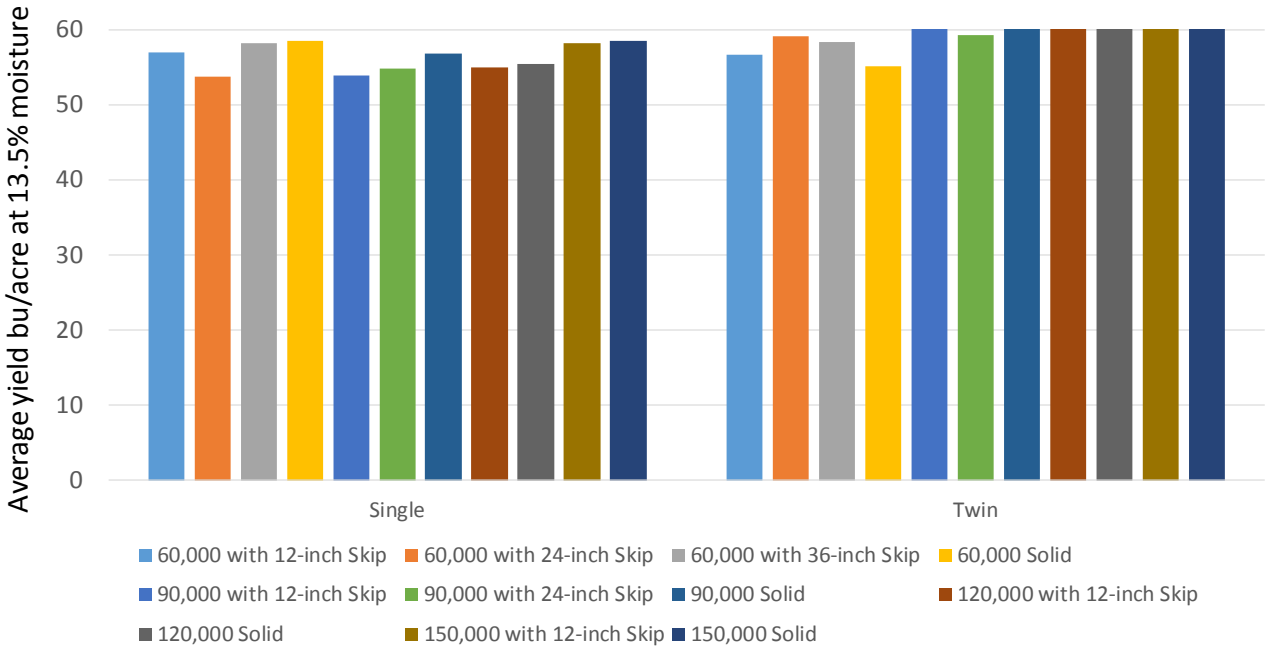


Figure 6. Response of 4.6 RM soybean product to skippy stands at Scott, MS.

Soybean Variety Response to Skippy Stands in Twin-Row and Single-Row Plantings

Figure 7. Examples of random skips in two plant populations in 38-inch twin rows.

Figure 8. Using predetermined data from a 'skipulator', planters were programmed to randomly insert skips into each planting population.

WHAT DOES THIS MEAN FOR YOUR FARM?

- These results DO NOT recommend planting at low populations. If populations are reduced and somewhat uniformly distributed, soybeans have the ability to compensate and maintain acceptable yield potential.
- This agrees with previous data showing tremendous compensation ability in soybean crops.
- Evaluate each field and situation individually.
- In many cases replanting is not necessary. Less-than-perfect soybean stands can be kept with reasonable expectation of yield potential.

Soybean Row Spacing by Plant Population

TRIAL OVERVIEW >

- Row spacing and plant population have the potential to influence soybean yield.

Figure 1. 20-inch rows (left); 30-inch rows (center); and twin rows on 30-inch center (right).

RESEARCH OBJECTIVE >

- Evaluate different soybean row spacings and plant populations to determine their effect on yield potential.

LOCATION	SOIL	PREVIOUS CROP	TILLAGE TYPE	PLANTING DATE	HARVEST DATE	POTENTIAL YIELD/ACRE	PLANTING RATE/ACRE
Monmouth, IL	Siilt loam	Corn	Conventional	05/30/2017	10/19/2017	75 bu/acre	120,000 and 170,000 seeds/acre

SITE NOTES >

- The trial consisted of two replications.
  - 2.7 RM and 3.6 RM Roundup Ready 2 Xtend® Soybeans were planted.
  - Seeding rates were 120,000 and 170,000 seeds/acre.
- Row width configurations were 20-inch, 30-inch, and twin rows on a 30-inch center (FIgure 1).

UNDERSTANDING THE RESULTS >

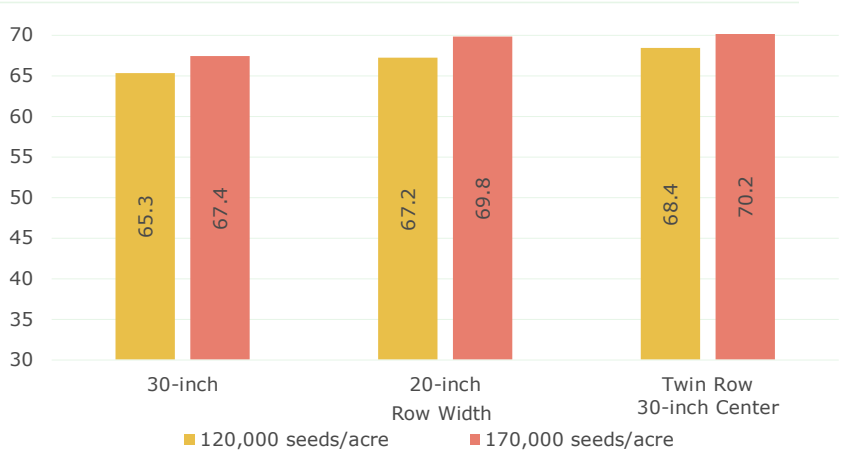


Figure 2. Average Yield Response of Two Soybean Products Using Three Row Widths and Two Seeding Rates, Monsanto Learning Center at Monmouth, IL (2017).

Soybean Row Spacing by Plant Population

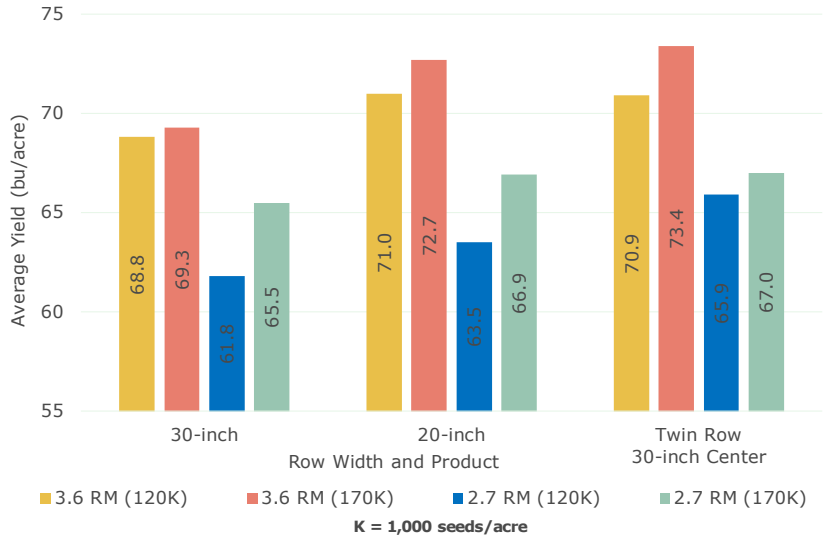


Figure 3. Soybean Yield Response to Row Width and Seeding Rate at the Monsanto Learning Center at Monmouth, IL (2017).

- Narrow rows (20-inch and twin) produced higher yields than wider, 30-inch rows (Figure 2). This is consistent with results from multiple row spacing trials over the past several years at the Monsanto Learning Center at Monmouth, IL.[2]
- The yield advantage in narrow rows and twin rows may be attributed to better weed control because of earlier canopy closure and increased sunlight interception.
- The 3.6 RM product @ 170,000 seeds/acre was the highest yielding regardless of row spacing (Figure 3).
- Although 170,000 seeds/acre was the optimum rate in this trial (Figure 3), previous work at the Monsanto Learning Center at Monmouth, IL has shown soybean response to planting population to be inconsistent year over year.
  - Soybean Populations by Stress Mitigation. 2013 Demonstration Report.[1]
  - Soybean Row Spacing by Population. 2014 Demonstration Report.[2]

WHAT DOES THIS MEAN FOR YOUR FARM?

- Multiple years of data from the Monsanto Learning Center at Monmouth, IL have shown high soybean yields at a range of seeding rates.
- The Monsanto Learning Center plans to continue conducting trials to help determine the optimum combination of soybean seeding rates and row spacing.
- Multiple years of data from the Monsanto Learning Center have supported an advantage of 20-inch and Twin 30-inch center rows over 30-inch rows.[2]

SOURCES >

1 Soybean Populations by Stress Mitigation. 2013 Demonstration Report. https://monsanto.com/app uploads/2017/05/mlc-lc-soybean-population-by-stress-mitigation.pdf.

2 Soybean Row Spacing by Population. 2014 Demonstration Report. https://monsanto.com/app/uploads/2017/05/mlc-lc-soybean-row-spacing-by-population.pdf. Sources verified 11/6/17. 171102110840

Effects of Planting Date on Soybean Yield

TRIAL OVERVIEW >

- Previous work at the Monsanto Learning Center at Monmouth, IL has shown that planting date is an important factor affecting soybean yield.[1]
- • An earlier planting date could potentially be a low-risk/high-return soybean management practice.

RESEARCH OBJECTIVE >

- The objective of this trial was to evaluate the impact of planting date on soybean yield.

LOCATION	SOIL	PREVIOUS CROP	TILLAGE TYPE	PLANTING DATE	HARVEST DATE	POTENTIAL YIELD/ACRE	PLANTING RATE/ACRE
Monmouth, IL	Siilt loam	Corn	Conventional	04/25/2017	10/18/2017	70 bu/acre	130,000 seeds/acre
Monmouth, IL	Siilt loam	Corn	Conventional	05/30/2017	10/18/2017	70 bu/acre	130,000 seeds/acre

SITE NOTES >

- A 3.6 RM Roundup Ready 2 Xtend® soybean product was planted.
- The trial included 5 replications and planting dates of April 25 and May 30, 2017.
- Data from 2015 and 2016 were included in the summaries to show a three-year average.
- Planting dates for the three-year average are recorded as early and late.

UNDERSTANDING THE RESULTS >

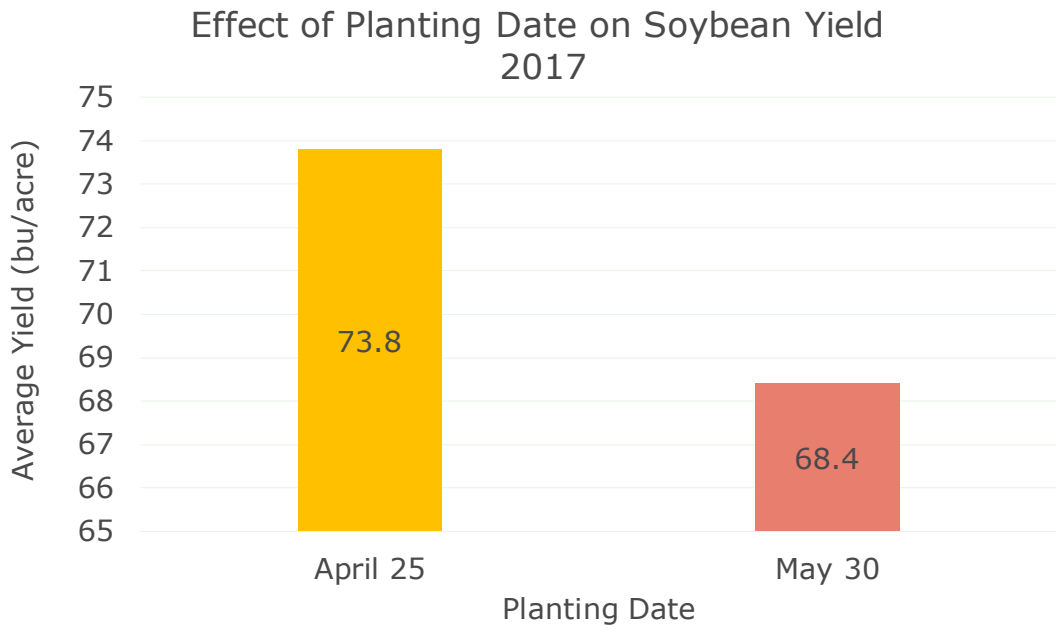


Figure 1. Soybean yield response to two planting dates at the Monsanto Learning Center at Monmouth, IL in 2017.

Effects of Planting Date on Soybean Yield

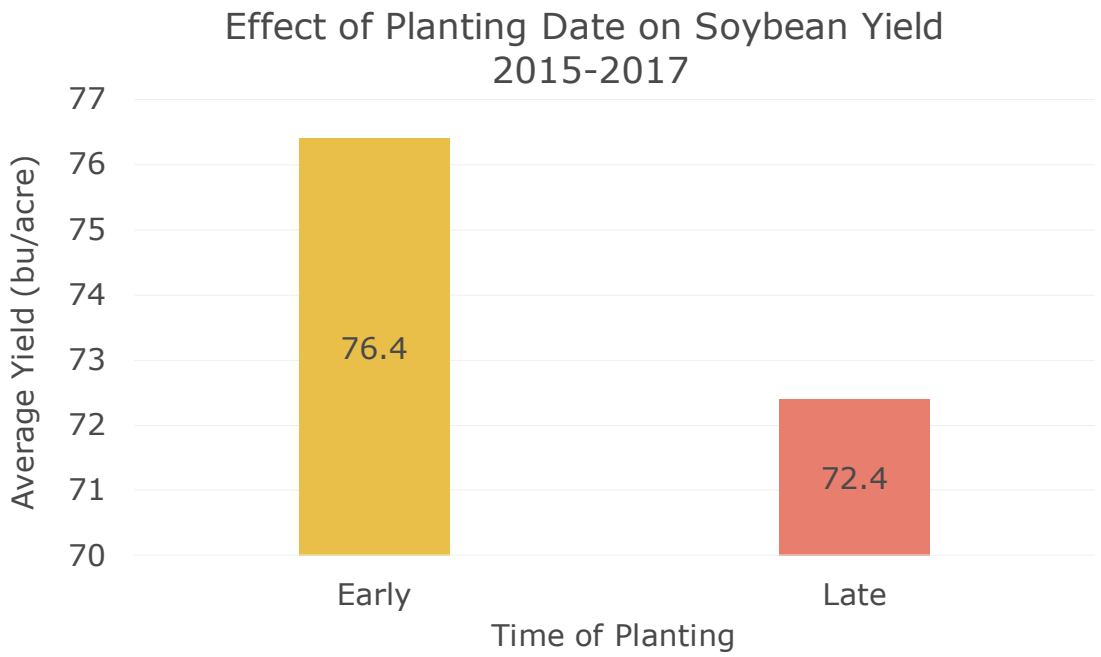


Figure 2. Soybean yield response to early and later planting dates at the Monsanto Learning Center at Monmouth, IL for the years 2015-2017.

- The April 25 planting date in 2017 showed a 5.4 bu/acre advantage (Figure 1).
- Early planting has resulted in consistently higher yields for the past three years (2015-2017) with an average yield advantage of 4 bu/acre (Figure 2).
- Although growing conditions change annually, the results at the Monsanto Learning Center at Monmouth, IL, generally agree with university planting date information.2

WHAT DOES THIS MEAN FOR YOUR FARM?

- Early-planted soybean crops tend to out-perform later-planted soybean crops fairly consistently.
- Early planting assumes that the soil and weather conditions are suitable for seedbed preparation and seed germination.

SOURCES >

1 Fungicide response and planting date in soybean. 2016. Demonstration Report. Monsanto Learning Center at Monmouth, IL. https://monsanto.com/app/uploads/2017/05/fungicide-response-planting-date-soybean.pdf.

2 Nafziger, E. 2017. Planting date for corn and soybeans in Illinois. The Bulletin. University of Illinois. http://bulletin.ipm.illinois.edu/?p=3848. Websites verified 11/9/17. 171103103817

Soybean Productivity Response to Different Management Practices

TRIAL OVERVIEW >

- Modern agriculture is equipped with advanced seed germplasm for optimum productivity.
- Farm operations make every effort to harness as much of the inherent yield potential as possible using some form of agronomic practices.
- The performance of such germplasm as influenced by these agronomic practices needs to be evaluated to understand how they complement these elite seed genetic products.

RESEARCH OBJECTIVE >

To evaluate the impact of in-season agronomic practices on the yield and profitability of soybean.

LOCATION	SOIL	PREVIOUS CROP	TILLAGE TYPE	PLANTING DATE	HARVEST DATE	POTENTIAL YIELD/ACRE	PLANTING RATE/ACRE
Huxley, IA	Clay Loam	Corn	Conventional	06/01/2017	10/20/2017	60 bu/acre	140,000 seeds/acre

SITE NOTES >

- A 2.7 maturity group soybean product was planted in 200 ft. long strips.
- The trial was carried out in 30-inch row spacing, 6 rows/treatment, with 2 replications.
- Acceleron® Seed Applied Solutions was the base seed treatment. In-season agronomic practices consisting of potassium (K), nitrogen (N), and fungicide with insecticide (FI) were compared in incremental stair-step treatments (Table 1).
- 32% UAN was applied to deliver 40 lbs/acre of N.
- Ele-Max® K-Leaf 0-0-30, the K brand used, was applied at 1 quart/acre.
- Headline AMP® fungicide and Mustang® Maxx insecticide were used for the foliar fungicide and insecticide treatment.

UNDERSTANDING THE RESULTS >

TABLE 1. TREATMENTS USED IN TRIAL.

Treatments	Input	Cost ($/A)
A	Acceleron® seed applied solutions (A)	$ 0.00
A+K	Foliar Potassium at R3 (K)	$ 6.59
A+N	Side dress 32% UAN at R3 (N)	$ 9.20
A+FI	Fungicide with Insecticide at R3 (FI)	$ 32.00
AFI+K	Fungicide with Insecticide + Potassium (FI+ K) at R3	$ 38.59
AFI+N	Fungicide with Insecticide + Side dress 32% UAN (FI+N) at R3	$ 41.20

Soybean Productivity Response to Different Management Practices

- Yields increased as inputs were added such that the base treatment (A) yielded the lowest and the 3-way stacked treatment (AFI+K) yielded the highest.
- Treatment with potassium (A+K), treatment with fungicide/insecticide (A+FI) and treatment with nitrogen (A+N), had the same yield response of 5 bu/acre over the base treatment of only Accerleron® Seed Applied Solutions (A).
- Yield gained by the other treatments over the base treatment was enough to provide higher economic returns than the base treatment; with return on investment (ROI) ranging from $13-38.
- The addition of K to the base treatment (A+K) provided the highest ROI of $464/acre.

WHAT DOES THIS MEAN FOR YOUR FARM?

- Every growing season is different, which has a significant impact on the performance of farm inputs. During the 2017 growing season, the research site experienced drought and high temperatures, which negatively impacted product performance. The yields reported in this trial are generally lower than the site average.
- Soybean products also respond differently to farm inputs. As such, it is important that growers have a good discussion with their trusted Agronomists on how well a product of interest performs under different growing conditions and management practices.
- Growers should also make a habit of performing small scale trials on their fields to understand how their management systems impact the economics of their operation.

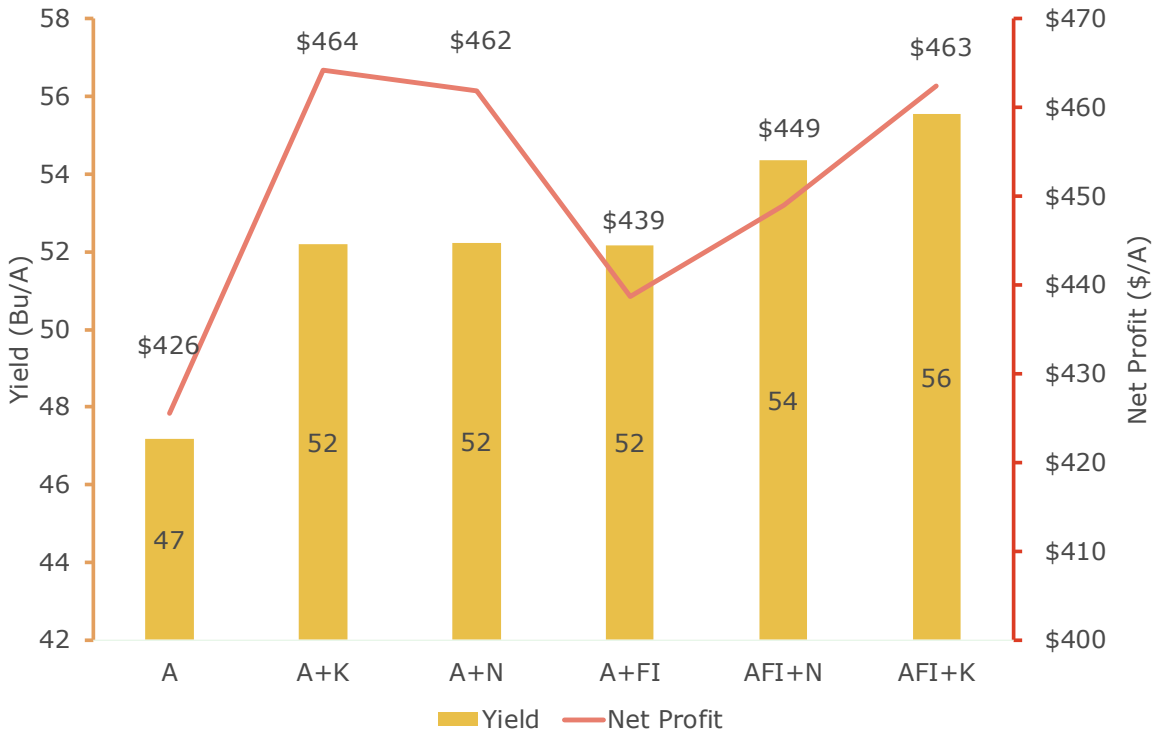


Figure 1. Yield and net profit of different treatments.

Soybean Response to Reproductive Stage-Applied Potassium

TRIAL OVERVIEW >

- Potassium levels are generally considered to be at sufficient levels to achieve good yields on the Great Plains.
- Soybean plants need approximately 205 lb of potassium/acre to produce yields of 60 bu/acre; however, as yield levels increase, more potassium is needed.[1]
- Soybean removes about 1.4 lb of potassium/bu with the grain compared to 0.26 lb/bu for corn.[2]

RESEARCH OBJECTIVE >

- This study evaluated the impact that different application rates of potassium have on soybean yield when applied at different growth stages to determine if additional potassium fertilizer will impact irrigated soybean yield.
- This study came about from farmers asking questions during the Learning Center tours in 2016.

LOCATION	SOIL	PREVIOUS CROP	TILLAGE TYPE	PLANTING DATE	HARVEST DATE	POTENTIAL YIELD/ACRE	PLANTING RATE/ACRE
Gothenburg, NE	Hord silt loam	Corn	Strip tillage	05/24/2017	10/13/2017	90 bu/acre	160K seeds/acre

SITE NOTES >

- Potassium was applied as 0-0-60 at 15, 30, and 45 lb K20/acre at the following growth stages: R1, R3, and R5.
- Potassium was applied by a 360 Y-Drop® applicator (R1) or dry spread (R3 and R5).
- A 2.4 and a 2.8 MG soybean product were evaluated.
- Potassium levels on site were 594 ppm, organic matter was 3.2%, and the pH was 6.8.
- The research was conducted as a randomized split-split plot with application growth stage as the whole plot, application rate as the subplot, and soybean product as the sub-subplot. There were 18 treatments and 4 replications.

UNDERSTANDING THE RESULTS >

- The April 25 planting date in 2017 showed a 5.4 bu/acre advantage (Figure 1).
- The application rate had no effect on the soybean yield response to potassium.
- There was no difference in how the soybean products responded to the potassium applications.
- The timing of the application did impact yield (Figure 1). The difference in yield was 2.2 bu/acre between the R1 application and the R3 application. This difference was consistent across both products and application rates, which was somewhat surprising.

Soybean Response to Reproductive Stage-Applied Potassium

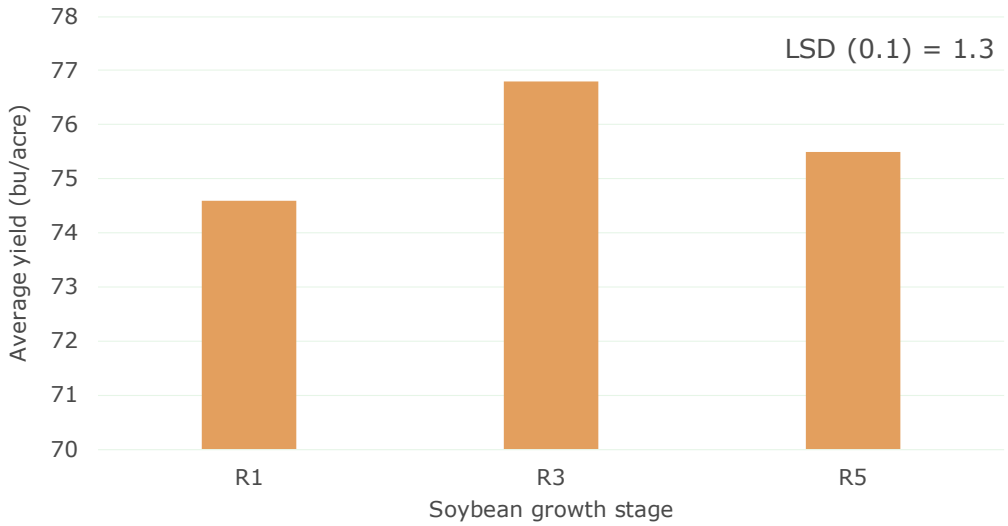


Figure 1. Soybean yield in response to potassium application at different growth stages

WHAT DOES THIS MEAN FOR YOUR FARM?

- There may be a marginal, yet consistent benefit in applying 15 lb/acre of potassium to soybean at the R3 growth stage.
- The information gathered from this study is only from one site in one year but the results are compelling and warrant further investigation.
- In 2018, research will be initiated to compare an application of potassium to an untreated check on six to eight soybean products.

SOURCES >

[1] Potassium in plants. Mosaic Crop Nutrition. www.cropnutrition.com/efu-potassium.

[2] Potassium Management. Kansas State University. www.agronomy.k-state.edu.

Effects of Fungicide and Planting Date on Soybean Yield

TRIAL OVERVIEW

- In many cases, a foliar fungicide application can protect soybean plant health and help maintain the yield potential of the product.

RESEARCH OBJECTIVE

- The objective of this trial is to help determine the effect of a foliar fungicide application on soybean yield potential with respect to planting date.

LOCATION	SOIL	PREVIOUS CROP	TILLAGE TYPE	PLANTING DATE	HARVEST DATE	POTENTIAL YIELD/ACRE	PLANTING RATE/ACRE
Monmouth, IL	Silt loam	Corn	Conventional	04/25/2017	10/18/2018	70 bu/acre	130K seeds/acre
Monmouth, IL	Silt loam	Corn	Conventional	05/30/2017	10/18/2018	70 bu/acre	130K seeds/acre

SITE NOTES >

- The trial used a 3.6 RM soybean product with Roundup Ready 2 Xtend® technology.
- The trial was replicated twice.
- Two planting dates:
  - April 25, 2017
  - May 30, 2017
- Foliar fungicide application dates depended on the plants reaching the R3 growth stage:
  - April 25 planting date was sprayed on July 20, 2017
  - May 30 planting date was sprayed on August 7, 2017

UNDERSTANDING THE RESULTS >

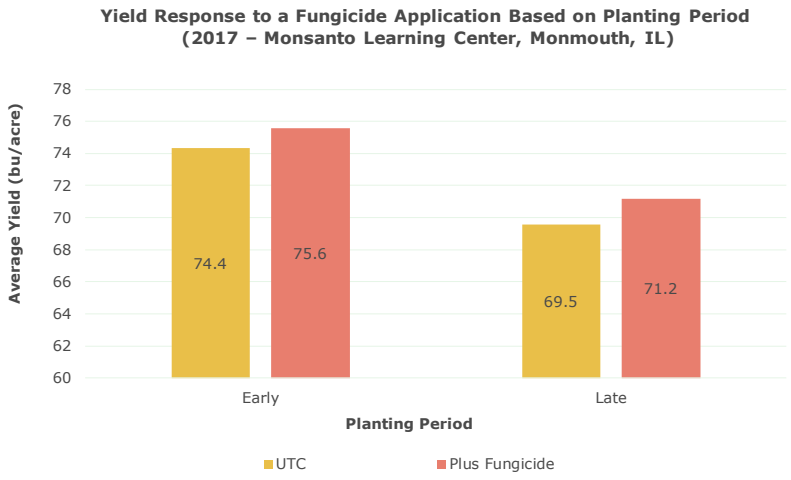


Figure 1. Yield response to a fungicide application based on planting period (2017 - Monsanto Learning Center, Monmouth, IL)

Effects of Fungicide and Planting Date on Soybean Yield

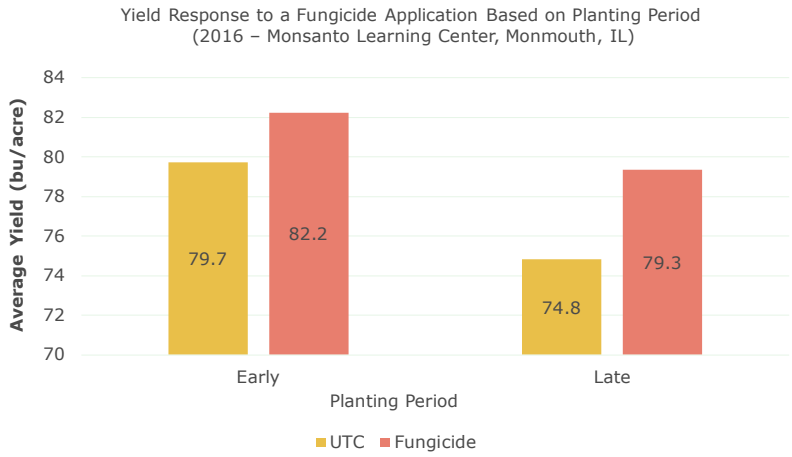


Figure 2. Yield response to a fungicide application based on planting period (2016 - Monsanto Learning Center, Monmouth, IL).

- A fungicide application showed little effect on soybean yield in 2017 (Figure 1).
- The early planting led to a substantial advantage over the late planting in 2017 (Figure 1).
- A very low disease incidence occurred in 2017 because of cooler and drier than normal conditions.
- In years such as 2016, when disease incidence was higher, a fungicide application can do more to protect yield potential (Figure 2).

WHAT DOES THIS MEAN FOR YOUR FARM?

- The benefit of fungicide applications will vary from year to year.
- Scouting regularly is the recommended way to determine if a fungicide application can be beneficial.
- Over the majority of years, early-planted soybean crops tend to out-perform later-planted crops fairly consistently.
- Early planting assumes that the soil and weather conditions are suitable for seedbed preparation and seed germination. Individual fungicide application results may vary based on disease presence. Consult your local seed provider for recommendations.

SOURCES

1 Fungicide response and planting date in soybean. 2016. Demonstration Report. Monsanto Learning Center at Monmouth, IL.

https://monsanto.com/app/uploads/2017/05/fungicide-response-planting-date-soybean.pdf.

2 Fungicide application yield response by soybean planting dates. 2015. Demonstration Report. Monsanto Learning Center at Monmouth, IL

https://monsanto.com/app/uploads/2017/05/fungicide-application-yield-response-by-soybean-planting-dates-mlc.pdf. Websites verified 11/9/17. 171107153903

Soybean Seed Product Yield Response to Fungicide Application

TRIAL OVERVIEW >

- The impact of a fungicide application on soybean yield can be influenced by several factors including the seed product's level of tolerance to disease and existing disease pressure.
- This study was established to determine the yield response of a fungicide application on six soybean seed products.

RESEARCH OBJECTIVE >

Evaluate soybean seed products' yield response to a fungicide applied at R2 (full bloom) to R3 (beginning pod) growth stages.

LOCATION	SOIL	PREVIOUS CROP	TILLAGE TYPE	PLANTING DATE	HARVEST DATE	POTENTIAL YIELD/ACRE	PLANTING RATE/ACRE
Camden Point, MO	Silt loam	Corn	Minimum tillage	05/08/2017	10/18/2017	70 bu/acre	145,000 seeds/acre

SITE NOTES >

- Each seed product had two treatments: 1) No fungicide; 2) Fungicide applied on July 17, 2017 at R2 (full bloom) to R3 (beginning pod) growth stages.
- Disease incidence was as follows: bacterial leaf blight - low; sclerotinia stem rot - low; frogeye leaf spot - some observed to be present.
- Individual treatment areas were six 30-inch rows wide and 200 feet long.

UNDERSTANDING THE RESULTS >

- A fungicide application increased the average yield on five of the six seed products compared to no fungicide.
- Yield response to fungicide application was variable, as ranging from a positive 11 bu/acre to a negative 3 bu/acre.
- No significant difference in grain moisture contents were observed across treatments.

WHAT DOES THIS MEAN FOR YOUR FARM?

- The impact of a fungicide application on yield can depend on disease pressure and the level of the seed product's disease tolerance.
- To determine if a fungicide application is warranted, consider yield potential, soybean growth stage, potential for additional development of disease symptoms, fungicide application cost, and the commodity price of soybean grain.
- Depending on yearly growing conditions and disease pressure, a fungicide application can be beneficial.

Soybean Seed Product Yield Response to Fungicide Application

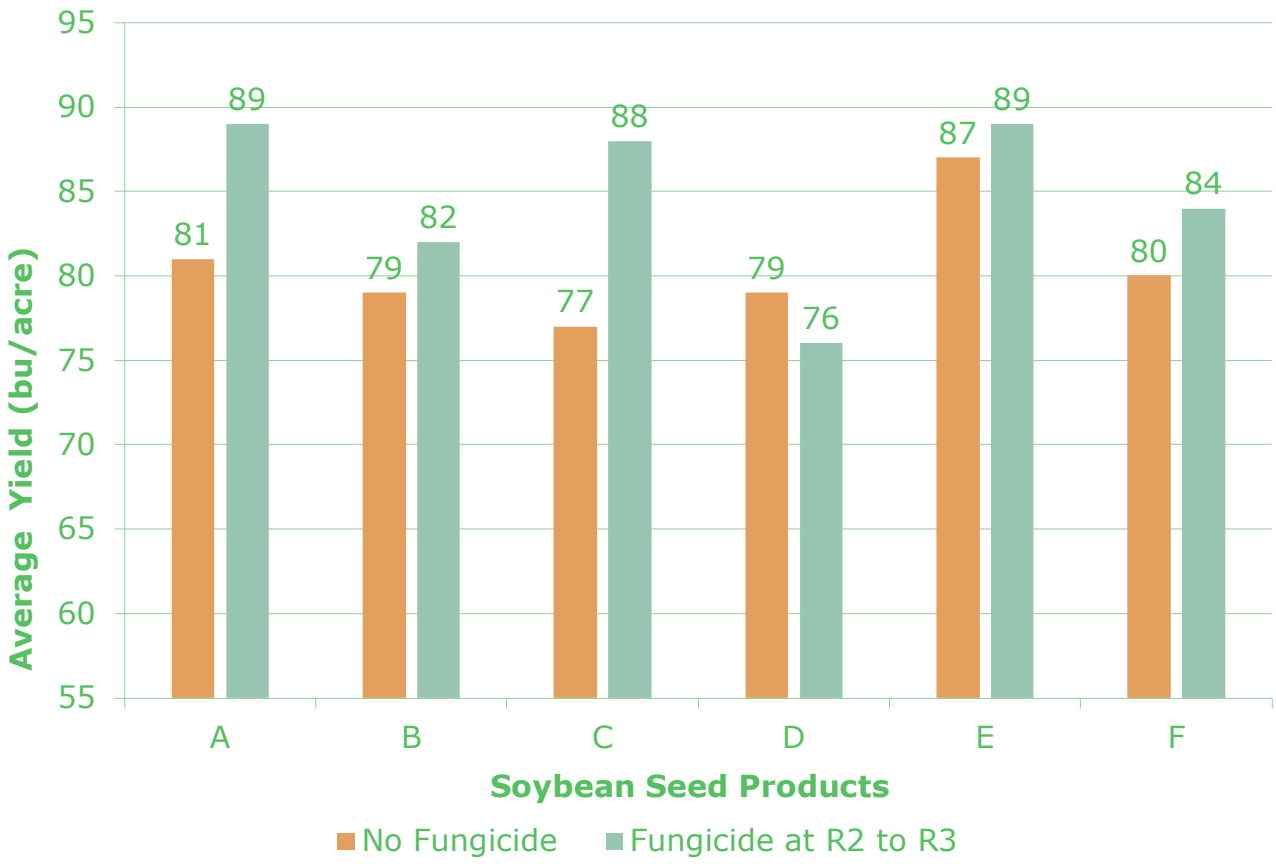


Figure 1. Soybean seed product yield response to fungicide application at R2 to R3 growth stages

Fungicide Efficacy on White Mold in Soybean

TRIAL OVERVIEW >

- White mold is a common soybean fungal disease in the upper Midwest where cool, wet conditions are favorable for infection. In these environments, cultural practices and selected genetic tolerance may not be enough to control the disease. Fungicides reduce the impact of white mold most when applied at the R1 growth stage (flowering).1

RESEARCH OBJECTIVE >

- To test the efficacy of new commercially available fungicide products to reduce the effects of white mold in soybean and to determine which product has the best return on investment (ROI).

LOCATION	SOIL	PREVIOUS CROP	TILLAGE TYPE	PLANTING DATE	HARVEST DATE	POTENTIAL YIELD/ACRE	PLANTING RATE/ACRE
Mason, MI	Loam	Continuous Soybean	Reduced Tillage	05/18/2017	11/10/2017	70 bu/acre	180,000

SITE NOTES >

Trial location was selected based on previous years of inoculum incorporated into the soil, continuous soybean rotation, high soil fertility, and high potential for disease pressure. A soybean product with 2.2 maturity and susceptibility to white mold was planted in 30-inch rows at a high population (180,000 seeds/acre) with five replications. Weeds were uniformly controlled using a residual/postemergence control program. Fungicides were applied at the R1 growth stage (Table 1).

TABLE 1. FUNGICIDE TREATMENTS.

TREATMENT	PRODUCT (RATE)	SITE OF ACTION (SOA)	COST/ACRE
1	Untreated Control		$0
2	Propulse® fungicide (6oz/acre)	SOA (3): Prothioconazole - Demethylation inhibitor (DMI) SOA (7): Fluopyram - Carboxamides	$27.65
3	Endura® fungicide (3 oz/acre)	SOA (7): Boscalid - Carboxamides	$31.50
4	Proline® fungicidea (3 oz/acre)	SOA (3): Prothioconazole - DMI	$14.31
5	Proline® fungicidea (5 oz/acre)	SOA (3): Prothioconazole - DMI	$23.85
6	Serenade® ASO fungicide (96 oz/acre) - Biological	SOA (44): QST 713 Strain - Bacillus subtilis syn. B amyloliquefaciens	$23.50
7	Serenade® ASO fungicide (128 oz/acre) - Biological	SOA (44): QST 713 Strain - Bacillus subtilis syn. B amyloliquefaciens	$31.30

[a] Labeled suppression only.

Fungicide Efficacy on White Mold in Soybean

UNDERSTANDING THE RESULTS >

- The ROI (Table 2) is based on 2017 prices of treatments, commodities, and applications costs.
- The ROI (Table 2) shows greater separation in revenue for each product even though yield may not be statistically different.
- The higher application rate of Proline® fungicide (5oz/acre) and Endura® fungicide treatments significantly improved yield over the untreated control. Yield increases from these treatments ranged from 5.8 to 7.7 bu/acre over the untreated control (Figure 1).

TABLE 2. RETURN ON INVESTMENT WHEN APPLYING EACH FUNGICIDE PRODUCT.

TREATMENT	FUNGICIDE	TREATMENT (OZ/ACRE)	GRAIN MOISTURE (%)	YIELD (BU/ACRE)	YIELD ACRE +/-	APPLICATION COST	TREATMENT COST	COMMODITY PRICE	REVENUE ACRE +/-
1	Untreated Control	0	16.8	49	0	$0	$0	$9.50	0
2	Propulse® fungicide	6	16.8	53.6	4.5	$7.65	$27.65	$9.50	$7.59
3	Endura® fungicide	6	16.8	55.4	6.3	$7.65	$31.50	$9.50	$20.94
4	Proline® fungicide	3	16.9	54.8	5.8	$7.65	$14.31	$9.50	$32.81
5	Proline® fungicide	5	16.8	56.8	7.7	$7.65	$23.85	$9.50	$41.99
6	Serenade® ASO fungicide	96	16.8	55.2	6.1	$7.65	$23.50	$9.50	$27.20
7	Serenade® ASO fungicide	S	16.7	49.1	0	$7.65	$31.30	$9.50	($38.78)

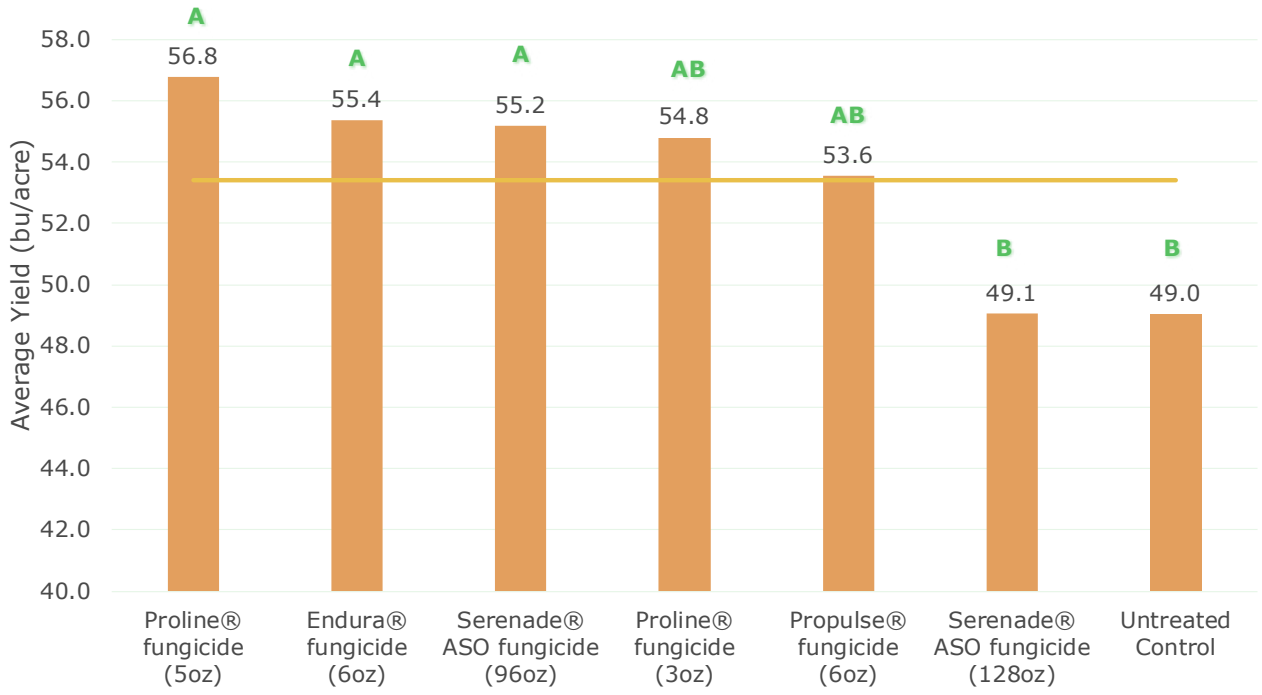


Figure 1. Effect of fungicide treatments on soybean yield at Mason, MI in 2017.

Fungicide Efficacy on White Mold in Soybean

- This data corresponds with previous research from 2015 that showed Endura® fungicide applications significantly improving yield over the untreated control. Yield increases from Endura application averaged 7.2 to 9.3 bu/acre over the untreated control.
- The lower rate of Proline® fungicide increased yields by 5.8 bu/acre compared with the untreated control (Figure 1) and had a ROI of $32.81 per acre (Table 2). The higher rate of Proline increased yields by 7.7 bu/acre when compared to the untreated control and had a ROI of $41.99 per acre.
- Propulse® fungicide, a dual mode of action fungicide, did increase yield 4.5 bu/acre compared with the untreated control (Figure 1); however, when factoring in the application cost and treatment cost, only a $7.59 ROI was projected (Table 2).
- Serenade® ASO fungicide, a biological, was used at 2 different rates, 96 oz and 128 oz per/acre. The 96 oz application rate showed a 6.1 bu/acre yield increase while the 128 oz application rate showed no increase on yield (Figure 1). This data suggests further testing of this product is required to determine its effectiveness.

WHAT DOES THIS MEAN FOR YOUR FARM?

- Overall, Endura® fungicide has shown to be consistent at reducing the impact of white mold and protecting yield potential year after year. However, in this one year study, Proline® fungicide showed equal to or better protection of yield potential and was a more cost effective program, allowing for maximum ROI of $32.81 to $41.99 an acre.

SOURCES >

1 Wise, K. 2017. Fungicide efficacy for control of soybean foliar diseases. BP-161-W. Purdue Extension. 171212152425

Time of Day Application Effect on Herbicide Efficacy

TRIAL OVERVIEW

Herbicide applications are made at all times of day. Depending on weather, early morning or evening applications may be the best to avoid misapplication. Time of day when applications are made may have an impact on the performance of systemic and contact herbicide treatments.

RESEARCH OBJECTIVE

- To evaluate how time of day during application may impact the efficacy of XtendiMax® herbicide with VaporGrip® Technology tank-mixtures in Roundup Ready 2 Xtend® soybeans.

HERBICIDE TREATMENT	RATE
Roundup PowerMAX® Herbicide + N-PAK® AMS liquid	1.13 lb ae/A + 2% v/v
XtendiMax® herbicide with VaporGrip® Technology + Roundup PowerMAX® Herbicide + INTACT™	0.5 lb ae/A + 1.13 lb ae/A + 0.5% v/v
XtendiMax® herbicide with VaporGrip® Technology + Roundup PowerMAX® Herbicide + Warrant® Ultra Herbicide + INTACT™	0.5 lb ae/A + 1.13 lb ae/A + 1.36 lb ai/A + 0.5% v/v
XtendiMax® herbicide with VaporGrip® Technology + Roundup PowerMAX® Herbicide + Cobra® Herbicide + INTACT™	0.5 lb ae/A + 1.13 lb ae/A + 0.156 lb ai/A + 0.5% v/v

SITE NOTES >

- A total of nine Roundup Ready 2 Xtend® Soybean locations were conducted in 2017 under protocol 2017-01-B7-16 in the states of IL, IN, KS, MO, NE, GA, and AR.
- Application timing was postemergence (POST) to weeds at sunrise (as the sun was coming up), solar noon (based on the time of solar noon for the location), and dark (applications made 1 hour after sunset).
- Treatments were applied to weeds at two heights: 4-inch and 8-inch tall weeds.
- POST treatments were applied using TTI nozzles calibrated to deliver approximately 12 gallons per acre.
- Weed control and crop safety evaluations were made at 7, 14, and 21 days after treatment.
- Broadleaf weeds across locations (number of locations containing the weed) were velvetleaf (2), Palmer amaranth (2), common waterhemp (3), glyphosate-resistant Palmer amaranth (2), glyphosate-resistant waterhemp (1), common ragweed (1), giant ragweed (2), ivyleaf morningglory (1), tall morningglory (1), kochia (1), prickly sida (2), and common cocklebur (1).
- Narrowleaf or grass weeds across locations were giant foxtail (3), yellow foxtail (1), green foxtail (1), broadleaf signalgrass (1), fall panicum (1), barnyardgrass (1), and large crabgrass (2).
- Treatments were applied to small plots (10 feet x 40 feet) with 3 replications in a randomized complete block design.
- Data was analyzed with means separated using Fisher's LSD ($P \leq 0.05$). Letters on bars of charts indicate significant differences.

Time of Day Application Effect on Herbicide Efficacy

UNDERSTANDING THE RESULTS

- Herbicide applications at solar noon showed marginally, but significantly, improved weed control over applications at sunrise.
- XtendiMax® herbicide with VaporGrip® Technology improved broadleaf weed control when tank-mixed with Roundup PowerMAX® Herbicide and Warrant® Ultra Herbicide or Cobra® Herbicide compared to Roundup PowerMAX® Herbicide alone (Figure 2). The time of day interaction with herbicide treatments was not significant.
- Excellent crop safety was observed with a tank-mix of Roundup PowerMAX® Herbicide + XtendiMax® herbicide with VaporGrip® Technology. Adding Warrant® Ultra Herbicide or Cobra® Herbicide to the tank-mix increased soybean injury, but it was reduced to only 6% injury at 21 DAT (Figure 3). Upper case letters are for comparisons at 14 DAT, and lower case are 21 DAT.

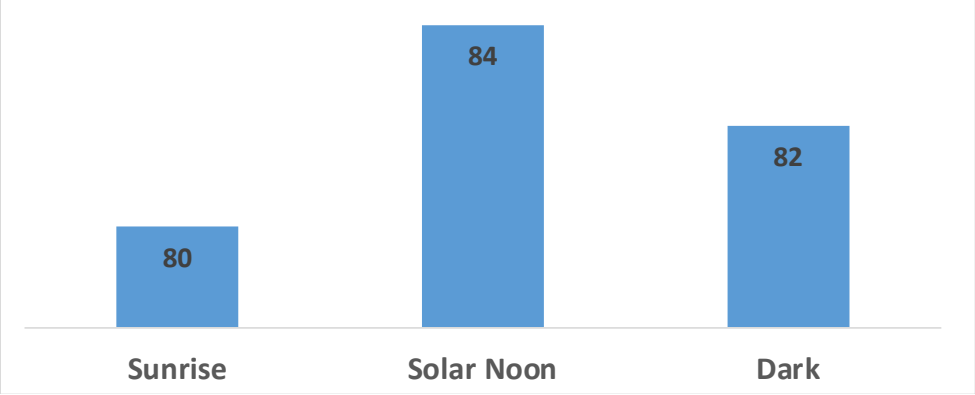


Figure 1. Overall weed control across locations, two weed heights, and three rating evaluations.

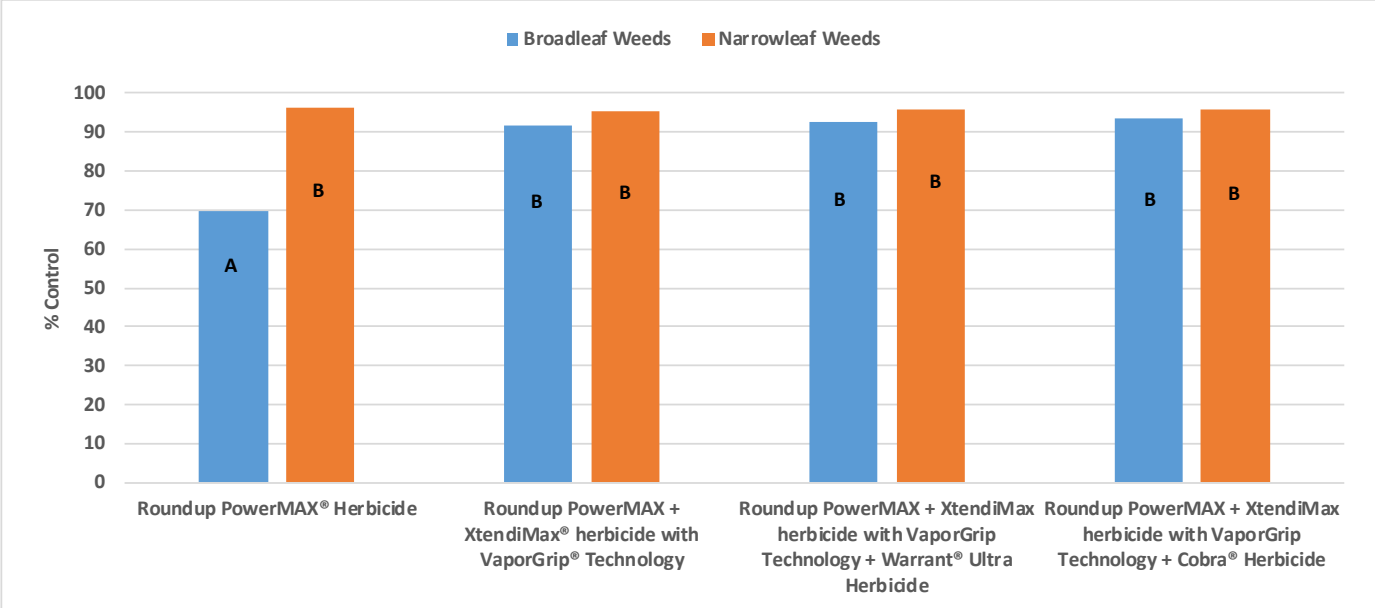


Figure 2. Overall weed control at 21 days after treatment (DAT)

Time of Day Application Effect on Herbicide Efficacy

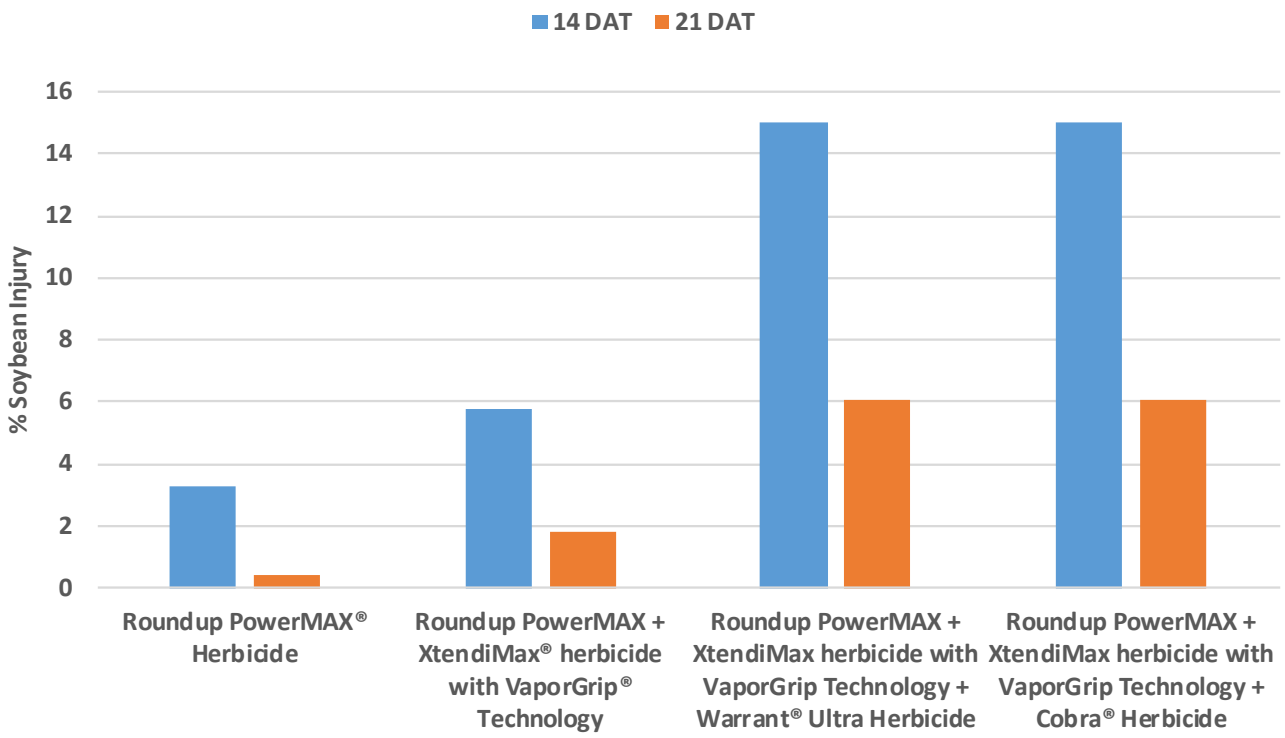


Figure 3. Crop safety observed with herbicide treatments.

WHAT DOES THIS MEAN FOR YOUR FARM?

- XtendiMax® herbicide with VaporGrip® Technology can be sprayed between sunrise and sunset, when wind speeds are 3-10 MPH and not blowing towards adjacent susceptible crops, and when there are no temperature inversions.
- XtendiMax herbicide with VaporGrip Technology improves the control of broadleaf weeds, including those that are resistant to glyphosate, with excellent crop safety in Roundup Ready 2 Xtend® soybeans.
- Improved weed control can be observed when herbicide applications are made at solar noon compared to sunrise, and XtendiMax® herbicide with VaporGrip® Technology applications should be made between sunrise and sunset when conditions meet the requirements on the product label.

IDC Response to Herbicide Treatments in Soybeans

TRIAL OVERVIEW >

Iron Deficiency Chlorosis (IDC) can be a problem for soybean production in Minnesota and other areas. IDC occurs when iron (Fe) uptake in the soluble form by the plant is limited causing chlorosis due to low chlorophyll formation. The distinctive symptom is yellowing of the leaves while the veins remain green (interveinal chlorosis). Although soil usually has large amounts of Fe, it may not be in the form needed by plants, especially when carbonates buildup in the soil. IDC is often associated with shallow depressions or low-lying areas in fields where water and solutes collect over time. Soybean products vary in their tolerance to IDC. Iron chelate products that carry the ortho-ortho-EDDHA Fe chelate form can be applied in-furrow at seeding to improve the plant's access to Fe in the soil. Stress from the use of herbicides can also cause problems with Fe uptake by plants, and this testing evaluates herbicide use in Roundup Ready 2 Xtend® soybeans.

RESEARCH OBJECTIVE >

Trials were conducted to evaluate the effect of Warrant® Herbicide and XtendiMax® Herbicide with VaporGrip® Technology applications on IDC response in Roundup Ready 2 Xtend® soybeans that are considered tolerant and susceptible to IDC.

- Four soybean field trials were conducted in Minnesota during 2017 at locations with a history of high IDC pressure.
- Early group 2 maturity soybean products with IDC susceptibility and IDC tolerance were used.
- A total of nine preemergence (PRE) and postemergence (POST) herbicide programs were applied at each location across IDC susceptible and tolerant soybean products.
- Soygreen® iron chelate product was applied at seeding in treatments where a tank-mixture of the herbicides was applied PRE and POST.
- Trials were small plot (10 x 30 feet) using a split plot design with four replications.
- Data was analyzed with means separated using Fisher's LSD (P≤0.05).

TREATMENT	RATES (FL OZ/A)	TIMING
Warrant Herbicide	48	PRE
XtendiMax Herbicide	22	PRE
Warrant Herbicide + XtendiMax Herbicide with VaporGrip Technology	48 + 22	PRE
Warrant Herbicide + XtendiMax Herbicide with VaporGrip Technology + Soygreen (3 lb/acre)	48 + 22	PRE
Warrant Herbicide	48	POST*
XtendiMax Herbicide with VaporGrip Technology	48	POST*
Warrant Herbicide + XtendiMax Herbicide with VaporGrip Technology	48 + 22	POST*
Soygreen (PRE at 3 lb/acre) fb Warrant Herbicide + XtendiMax Herbicide with VaporGrip Technology	48 + 22	POST*
Warrant Herbicide + XtendiMax Herbicide with VaporGrip Technology (PRE) followed by (fb) Warrant Herbicide + XtendiMax Herbicide with VaporGrip Technology (POST)	48 + 22 (PRE) fb 48 + 22 (POST)	PRE fb POST*

*POST treatments included Roundup PowerMAX® Herbicide (32 fl oz/A) + Class Act Ridion (1% v/v), and Intact (0.5% v/v) was included when XtendiMax® Herbicide with VaporGrip® Technology was in the tank mixture. POST treatments were applied at the V3 growth stage of soybeans.

IDC Response to Herbicide Treatments in Soybeans

UNDERSTANDING THE RESULTS >

Figure 1. IDC symptomology (chlorosis, necrosis, growth reduction).

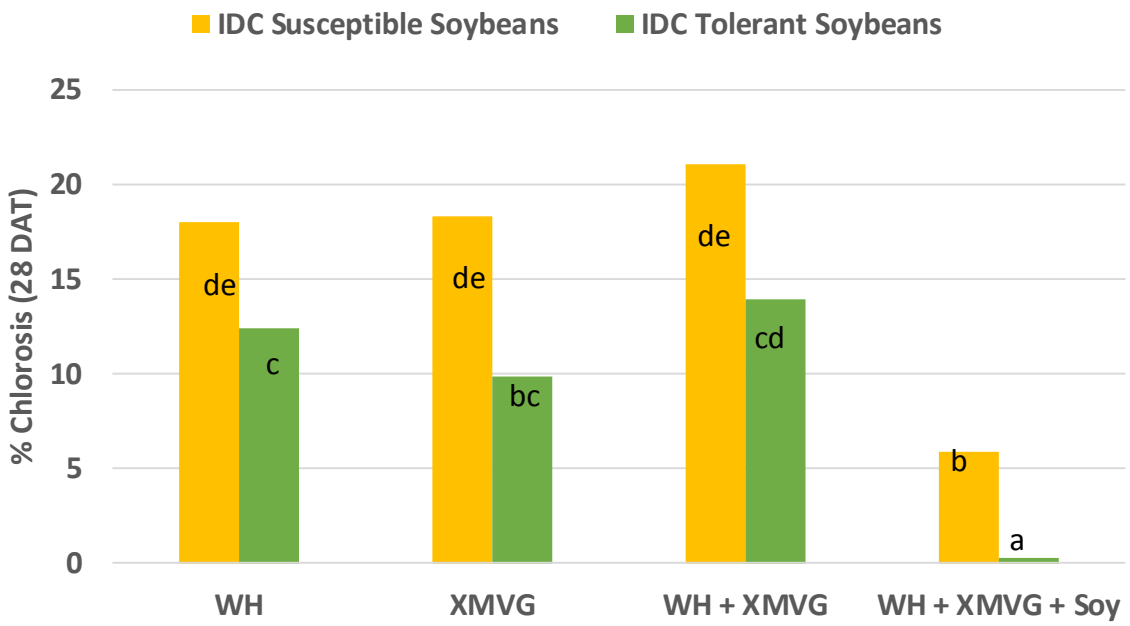


Figure 2. Soybean IDC as affected by preemergence herbicide treatments.

IDC Response to Herbicide Treatments in Soybeans

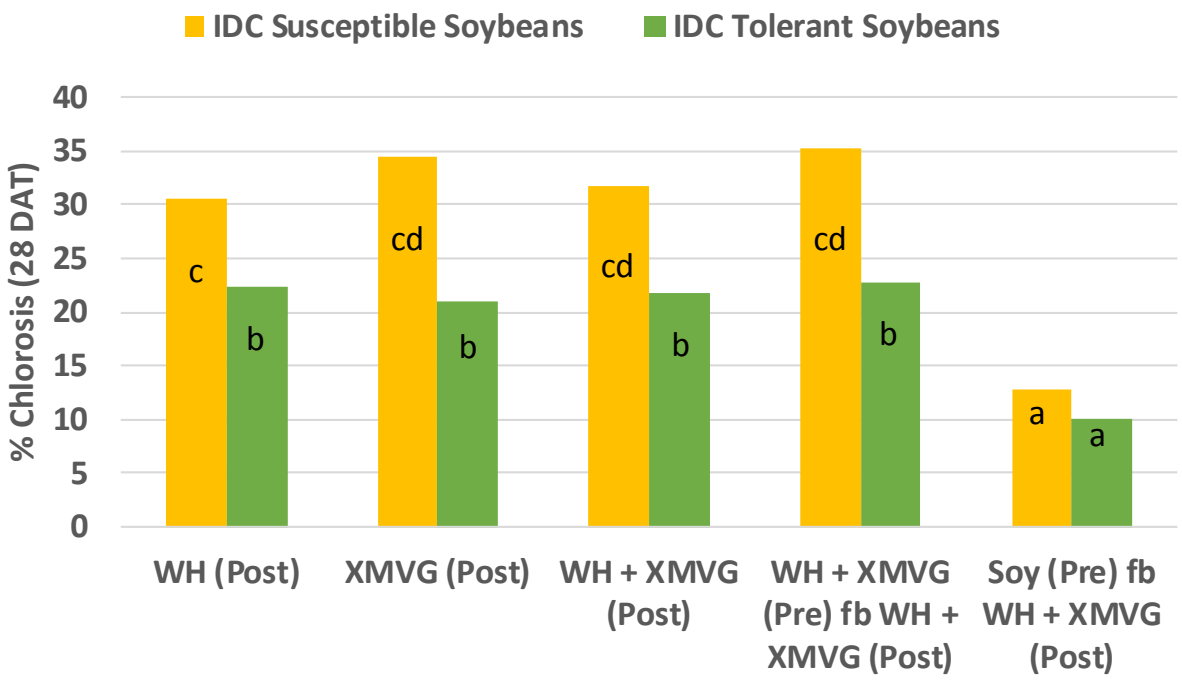


Figure 3. Soybean IDC as affected by preemergence and postemergence herbicide treatments.

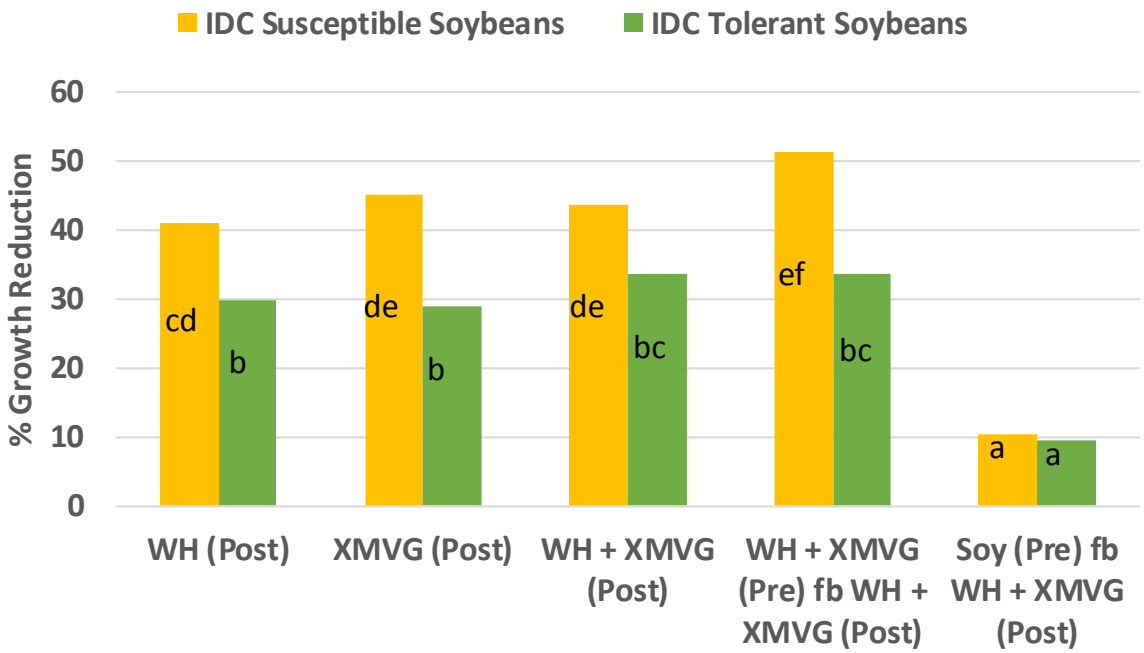


Figure 4. Soybean growth reduction as affected by preemergence and postemergence herbicide treatments (28 DAT).

Chart Descriptions:

IDC = Iron Deficiency Chlorosis; DAT = days after treatment; Pre = preemergence; Post = postemergence; fb = followed by WH = Warrant® Herbicide XMVG = XtendiMax® Herbicide with VaporGrip® Technology Soy = Soygreen® Fe Chelate Product Means followed by the same letter are not significantly different.

IDC Response to Herbicide Treatments in Soybeans

- Within IDC susceptible or tolerant soybean products evaluated, there were no significant differences in the amount of chlorosis, necrosis, or growth reduction observed at 28 DAT with the herbicide products applied in a tank-mixture compared to products applied alone preemergence (Pre) or postemergence (Post). In addition, the tank-mixture applied Pre following with another application Post provided a similar IDC response compared to a Post only treatment of the tank-mixture.
- In general, the amount of chlorosis, necrosis, and growth reduction was greater on IDC susceptible soybeans compared to IDC tolerant soybeans. Soybean IDC response was also greater when herbicides were applied Post compared to Pre. Although necrosis data at 28 DAT is not shown, IDC susceptible soybeans showed 15-20% necrosis compared to 5-10% on IDC tolerant soybeans across Post herbicide treatments. Adding Soygreen iron chelate product to the program reduced necrosis to less than 5%.
- The addition of Soygreen iron chelate product to the program significantly helped to manage IDC, regardless of the soybean product being IDC susceptible or tolerant.

WHAT DOES THIS MEAN FOR YOUR FARM?

- It is important to reduce stress on the plant as much as possible to reduce the effect of IDC on soybean growth. Effective weed control is important in soybean production, and the use of glyphosate with other herbicides in Roundup Ready 2 Xtend® soybeans can be less stressful compared to weed management programs before herbicide-tolerant soybeans were available.
- This testing shows no difference in IDC response when a tank-mixture of Warrant® Herbicide plus XtendiMax® Herbicide with VaporGrip® Technology was applied compared to the products applied alone. Using a herbicide program that provides the most effective weed management is the best approach whether or not a field is susceptible to IDC.
- In fields susceptible to IDC, using a seed placement of an iron chelate product, such as Soygreen®, and choosing a soybean product that is IDC tolerant, can be an effective management approach.

SOURCE >

Kaiser, D.E., Lamb, J.A., and Bloom, P.R. 2011. Managing iron deficiency chlorosis in Soybean. University of Minnesota Extension. http://www.extension.umn.edu.

Roundup Ready® Xtend Crop System vs. LibertyLink® System

TRIAL OVERVIEW >

To demonstrate competitive advantages of the Roundup Ready® Xtend Crop System over the LibertyLink® System.

RESEARCH OBJECTIVE >

- How do low, medium, and high herbicide input levels compare in weed control at canopy and harvest, in yield, and in economics within each trait and across traits?
- How does the overall system compare across traits?

Table 1. Treatment comparisons: Roundup Ready® Xtend Crop System versus LibertyLink® System

	LOW	MEDIUM	HIGH
Roundup Ready® Xtend Crop System	**PRE:** residual herbicide **Fb POST:** XtendiMax® herbicide with VaporGrip® Technology 22oz + Roundup PowerMAX® herbicide 32oz	**PRE:** residual herbicide + XtendiMax® herbicide with VaporGrip® Technology 22oz **Fb POST:** XtendiMax® herbicide with VaporGrip® Technology 22oz + Roundup PowerMAX® herbicide 32oz	**PRE:** residual herbicide + XtendiMax® herbicide with VaporGrip® Technology 22oz **Fb POST:** XtendiMax® herbicide with VaporGrip® Technology 22oz + Roundup PowerMAX® herbicide 32oz + residual herbicide
LibertyLink® System	**PRE:** residual herbicide **Fb POST:** Liberty® herbicide 29oz	**PRE:** stronger residual herbicide **Fb POST:** Liberty® herbicide 29oz	**PRE:** stronger residual herbicide **Fb POST:** Liberty® herbicide 29oz + residual herbicide

*Roundup PowerMAX® was used in all PRE emergent treatments in the trial conducted under no-till conditions.

UNDERSTANDING THE RESULTS >

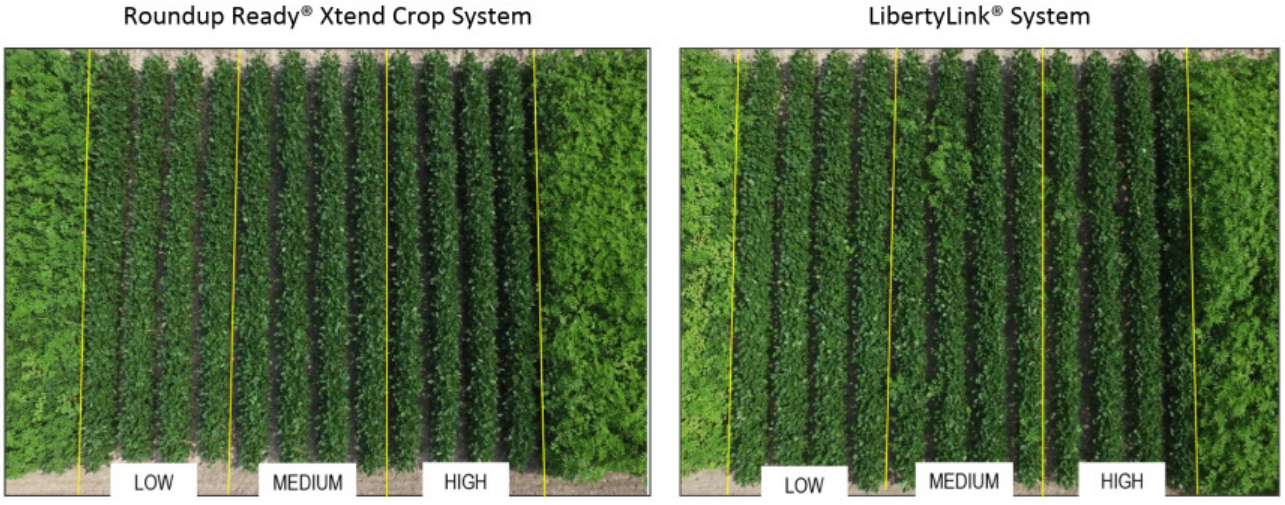


Figure 1. Systems comparisons: Pre-canopy. SIU Research Farm - Belleville, IL. Photos taken 7/13/2017.

Roundup Ready® Xtend Crop System vs. LibertyLink® System

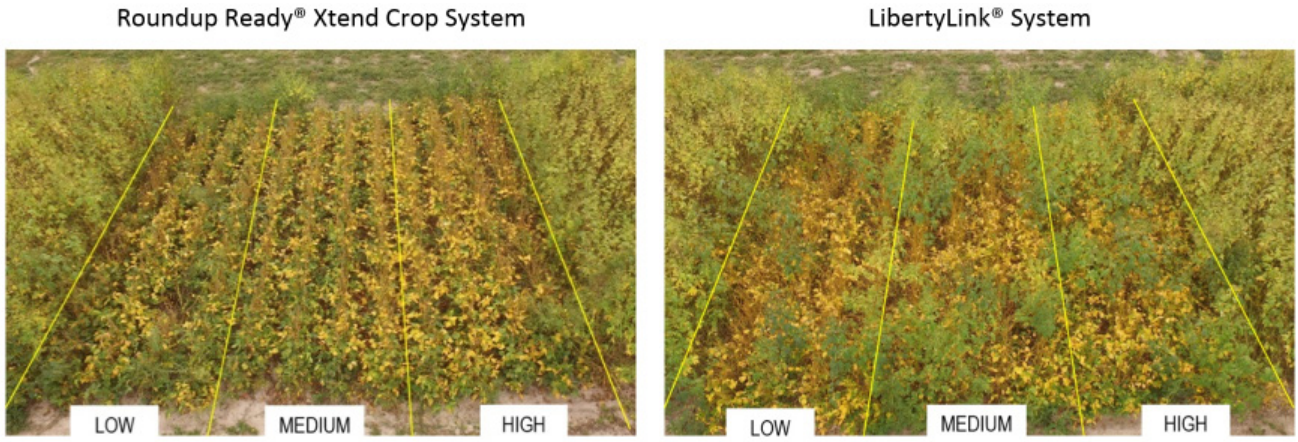


Figure 2. Systems comparisons: Pre-harvest. SIU Research Farm - Belleville, IL. Photos taken 9/21/2017.

WEED CONTROL RESULTS

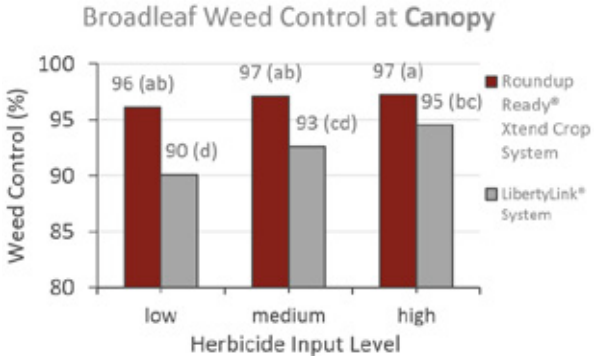


*Figure 3. Broadleaf weed control by treatment at **canopy**.*

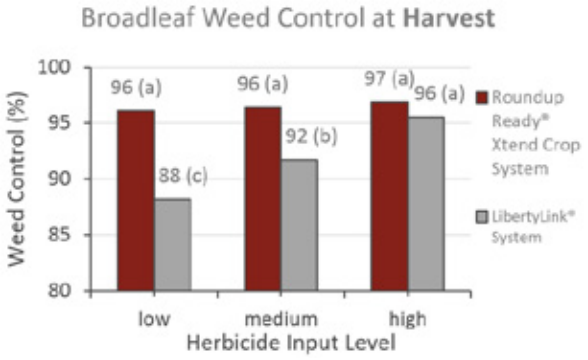


*Figure 4. Broadleaf weed control by treatment at **harvest**.*

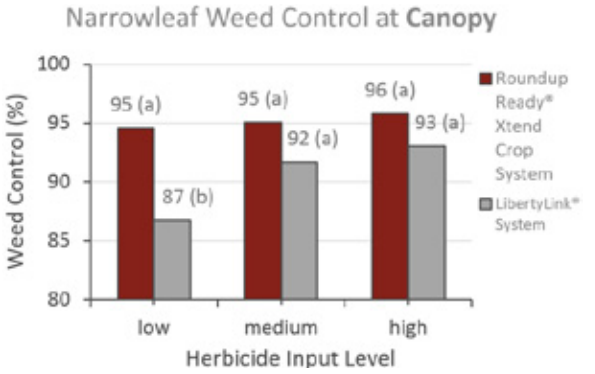


*Figure 5. Narrowleaf weed control by treatment at **canopy**.*

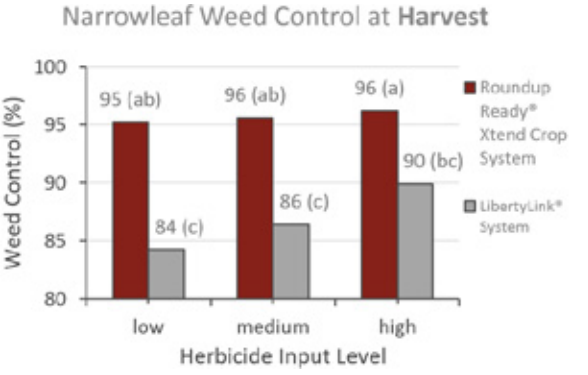


*Figure 6. Narroweaf weed control by treatment at **harvest**.*

Roundup Ready® Xtend Crop System vs. LibertyLink® System

YIELD PERFORMANCE RESULTS

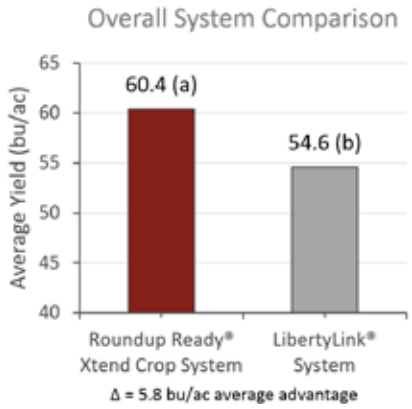


Figure 7. Comparison of Roundup Ready® Xtend Crop System versus LibertyLink® System across treatments.

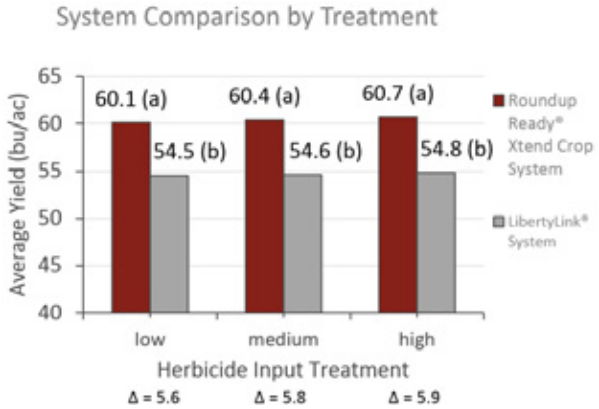


Figure 8. Comparison of Roundup Ready® Xtend Crop System versus LibertyLink® System by treatment.

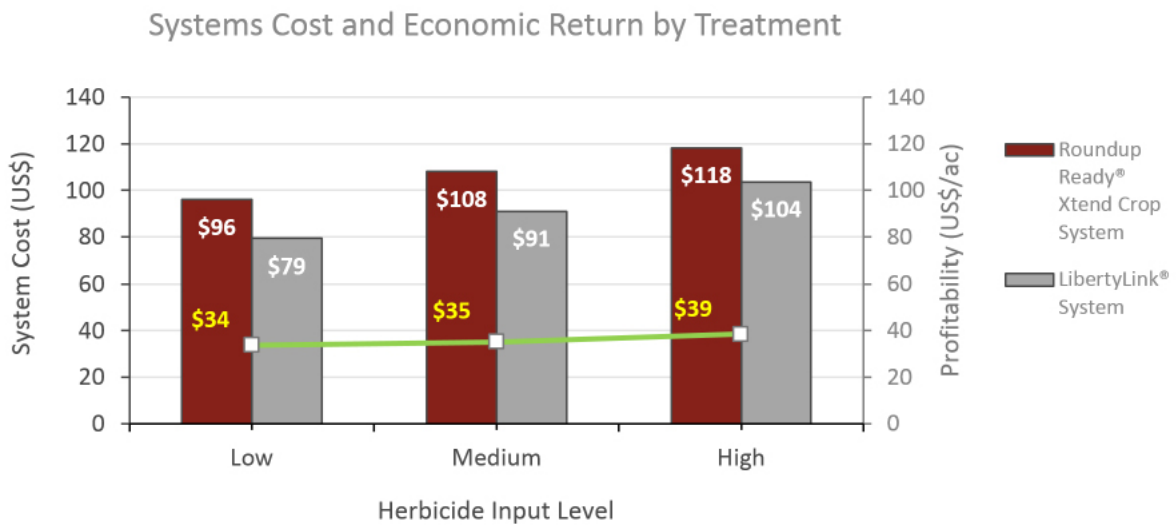


Figure 9. Systems cost and economic return on Roundup Ready® Xtend Crop System over LibertyLink® System by treatment. Bars represent systems costs (left axis) and the line is the profitability (right axis) of choosing Roundup Ready® Xtend Crop System over LibertyLink® System.

**Pricing assumptions used: Roundup Ready 2 Xtend® soybean seed cost $67/unit, LibertyLink® soybean seed cost $58/unit, and $9/bu soybean. Economic return was calculated based on: Yield/acre x commodity price – system cost (herbicide cost + seed cost).*

Roundup Ready® Xtend Crop System vs. LibertyLink® System

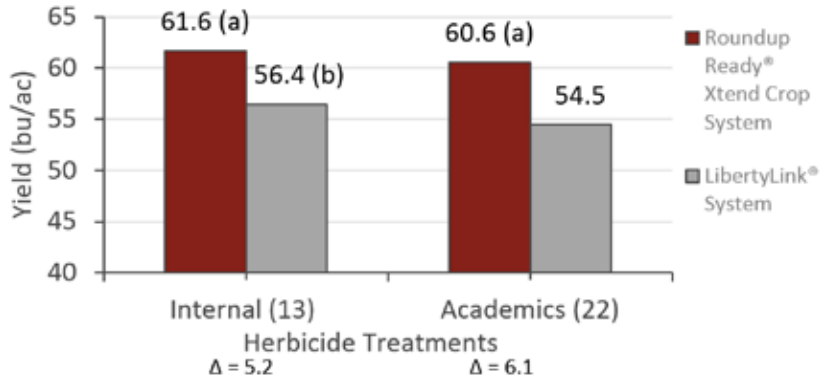


Figure 10. *Monsanto internal and academic sites.*

**Number displayed next to the network type represents the number of sites.*

WHAT DOES THIS MEAN FOR YOUR FARM?

- 97% of soybean growers surveyed in 2017 who applied XtendiMax® herbicide with VaporGrip® Technology were satisfied or very satisfied with weed control.[1]
- The Roundup Ready® Xtend Crop System demonstrated superior weed control over the LibertyLink® System for both broadleaf and narrowleaf weeds at both canopy and harvest across treatments as well as by each treatment level.
- When comparing the Roundup Ready® Xtend Crop System versus LibertyLink® System across treatments, there was a 5.8 bu/acre average yield advantage.

Source: [1]XtendiMax® with VaporGrip® Technology Grower Survey – August 2017- All growers surveyed were required to have 50+ acres of Roundup Ready 2 Xtend® soybeans or cotton with XtendFlex® Technology and treat at least some acres with XtendiMax® with VaporGrip® Technology to qualify.

Roundup Ready 2 Xtend® Soybean Versus LibertyLink® Soybean

SUSTAINABILITY SPOTLIGHT

As herbicide-resistant corn and soybeans were introduced in the U.S.—conservation tillage practices became more widely adopted. GM or genetically modified crops with herbicide-resistant traits can allow farmers to manage weeds without relying on the traditional method of tilling fields. Generally, less tillage results in fewer tractor-related emissions. In 2015 alone, this led to the equivalent of removing twelve million cars from the road.

TRIAL OVERVIEW >

- Growers faced with challenging weed control problems due to herbicide tolerance are looking for improved weed control methods. The recent launch of the Roundup Ready® Xtend Crop System provides growers one of the most effective broadleaf weed control programs. A multi-state project was developed to compare Roundup Ready 2 Xtend® soybean and LibertyLink® trait platforms in a conventional herbicide system to focus solely on germplasm performance.

RESEARCH OBJECTIVE >

- The objective of this study is to compare soybean yields from Roundup Ready 2 Xtend soybean and LibertyLink soybean products. Field trials were conducted in a weed-free environment, thus eliminating weed control as a confounding factor.

LOCATION	SOIL	TILLAGE TYPE	PLANTING DATE	HARVEST DATE	PLANTING RATE/ ACRE
Angola, IN	Silt Loam	Conventional	6/2/2017	11/1/2017	140,000
West Lafayette, IN	Silty Clay Loam	Conventional	5/17/2017	10/17/2017	140,000
New Richmond, IN	Silty Clay Loam	Conventional	6/2/2017	10/30/2017	140,000
Elwood, IN	Silt Loam	Conventional	5/31/2017	10/21/2017	140,000
Salem, IN	Silt Clay	No-Till	5/17/2017	10/6/2017	145,000
Owensboro, KY	Silt Clay	No-Till	5/11/2017	9/28/2017	145,000
Edwardsport, IN	Silt Loam	Conventional	5/19/2017	10/20/2017	140,000
Evansville, IN	Silt Loam	Conventional	5/16/2017	10/17/2017	140,000
Orrville, OH	Loam	No-Till	6/1/2017	10/19/2017	140,000
Martin, OH	Silt Loam	No-Till	6/1/2017	10/27/2017	140,000
Capac, MI	Silt Loam	Conventional	5/17/2017	10/5/2017	150,000
Mason, MI	Sandy Loam	Conventional	5/13/2017	11/10/2017	150,000
Westphalia, MI	Loam	Conventional	5/13/2017	10/1/2017	150,000
Cassopolis, MI	Loam	Conventional	5/15/2017	10/20/2017	150,000

SITE NOTES >

- 14 testing locations in 2017: IN (7), MI (4), OH (2), KY (1).
- Weed-free research trials were achieved using locally recommended herbicide programs. All plots at each location received the same herbicide treatments.
- Trials were small plots with two or four replications.
- Results were analyzed as a randomized complete block (RCB) design (alpha = 0.10).

Roundup Ready 2 Xtend® Soybean Versus LibertyLink® Soybean

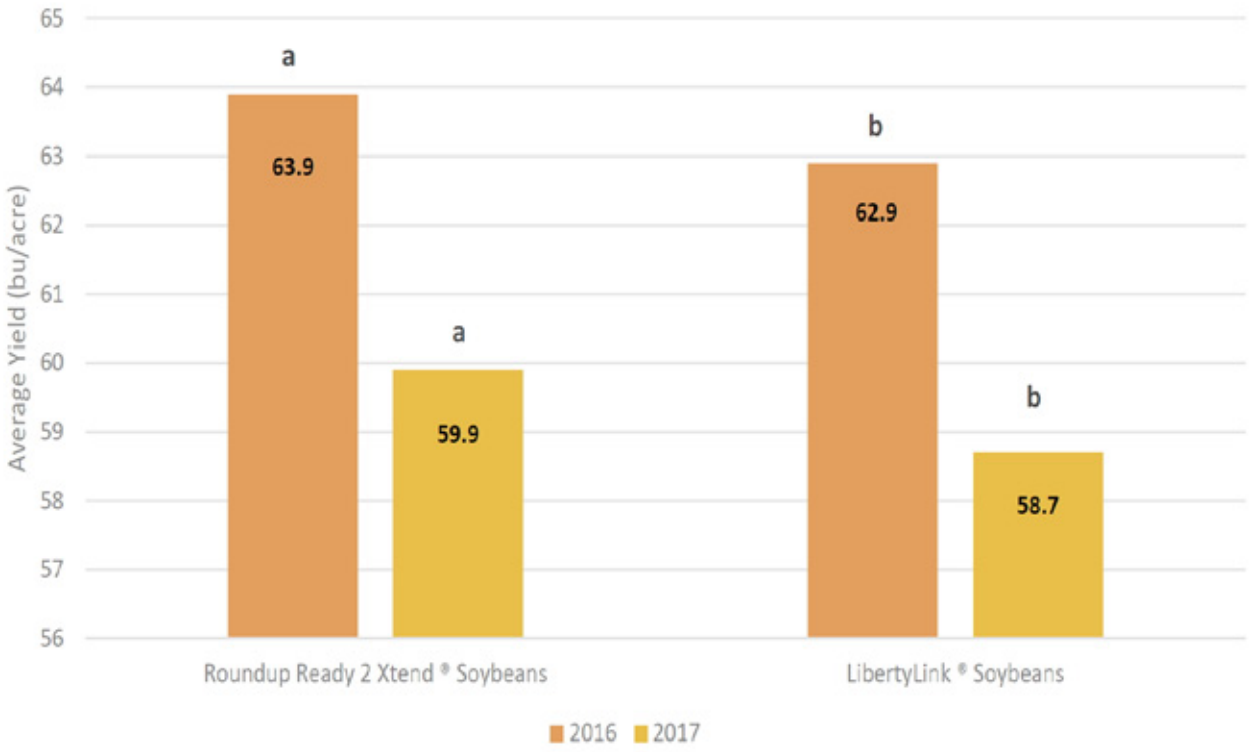


Figure 1. Multi-year average yield of Roundup Ready 2 Xtend® soybeans versus LibertyLink® soybeans. Data from 2016 includes 16 locations and 2017 data includes 14 locations across Michigan, Indiana, Kentucky, and Ohio. Yield means with the same letter are not significant at P = 0.10 (comparison made within testing year).

UNDERSTANDING THE RESULTS >

- Results illustrate higher yield potential of Roundup Ready 2 Xtend® soybean products when compared to older technologies such as LibertyLink® soybean products (Figure 1).
- Superior yield results of Roundup Ready 2 Xtend® soybean products in this study do not include potential benefits of weed control from the Roundup Ready® Xtend Crop System.
- Results in 2017 are consistent with findings of the study conducted in 2016 (Figure 1).
- These results are consistent with other research studies comparing herbicide tolerant traits.

WHAT DOES THIS MEAN FOR YOUR FARM?

- Roundup Ready Xtend soybean products had higher yield potential than LibertyLink soybean products.
- By planting Roundup Ready Xtend soybean products and incorporating Roundup Ready PLUS® Crop Management Solutions, farmers can both maximize soybean yield potential and weed control.

Soybean Weed Control System Comparison

TRIAL OVERVIEW

- Multiple herbicide-tolerant trait systems are available for weed management in soybean.
- Optimizing the use of effective residual and post-emergence herbicides within a weed management system contributes to season-long weed control.

TABLE 1. TREATMENT LIST.

Treatment	Soybean Trait	Herbicide Treatment
1	Roundup Ready 2 Xtend® soybeans	Non-treated
2	Roundup Ready 2 Xtend soybeans	2 oz. Rowel® Herbicide PRE* 22 oz. XtendiMax® herbicide with VaporGrip® Technology POST** 32 oz. Roundup PowerMAX® herbicide POST
3	Roundup Ready 2 Xtend soybeans	2 oz. Rowel Herbicide PRE 22 oz. XtendiMax with VaporGrip Technology **PRE and POST** 32 oz. Roundup PowerMAX herbicide POST
4	Roundup Ready 2 Xtend soybeans	2 oz. Rowel Herbicide PRE 22 oz. XtendiMax with VaporGrip Technology PRE and POST 32 oz. Roundup PowerMAX herbicide POST 48 oz. Warrant® Herbicide POST
5	LibertyLink® soybeans	Non-treated
6	LibertyLink soybeans	2 oz. Valor® SX herbicide PRE 29 oz. Liberty® herbicide*** POST
7	LibertyLink soybeans	6.4 oz. Authority® Maxx herbicide PRE 29 oz. Liberty herbicide*** POST
8	LibertyLink soybeans	6.4 oz. Authority Maxx herbicide PRE 29 oz. Liberty herbicide*** POST 2 oz. Zidua® herbicide POST

*PRE = Pre-emergence; **POST = Post-emergence; ***AMS was added. Application rates were on a per-acre basis. XtendiMax® herbicide with VaporGrip® Technology is a restricted use pesticide for retail sale to and use only by Certified Applicators or persons under their direct supervision.

RESEARCH OBJECTIVE

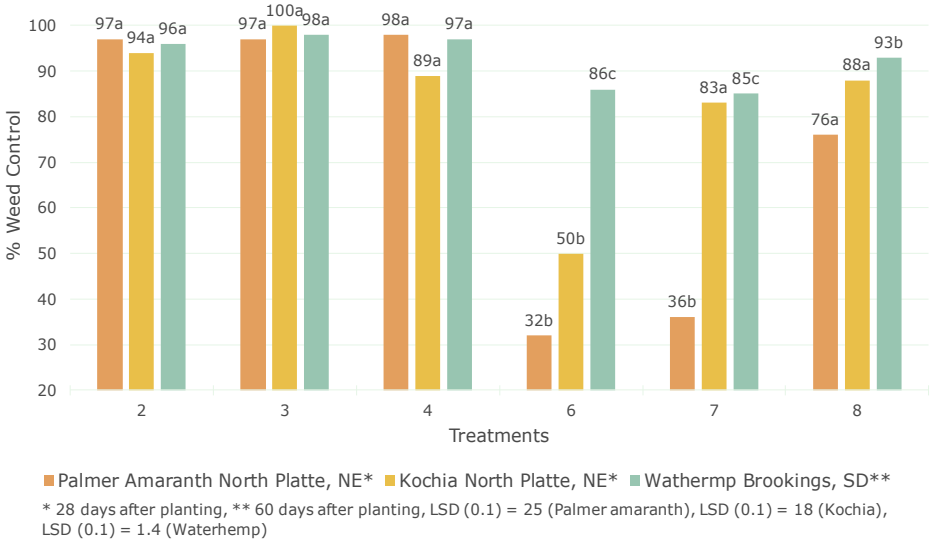
- Evaluate weed control and soybean yield under different herbicide treatments in the Roundup Ready Xtend® Crop System and the LibertyLink® system.

LOCATION	SOIL	PREVIOUS CROP	TILLAGE TYPE	PLANTING DATE	HARVEST DATE	PLANTING RATE/ACRE
Gothenburg, NE	Silty Loam	Wheat	Strip tillage	5/26/2017	10/15/2017	130,000
North Platte, NE	Silty Loam	Soybean	No tillage	5/15/2017	10/26/2017	140,000
Brookings, SD	Silty Clay Loam	Corn	Conventional	5/26/2017	10/11/2017	140,000
Fargo, ND	Silty Clay Loam	Soybean	Conventional	5/10/2017	10/5/2017	150,000

Soybean Weed Control System Comparison

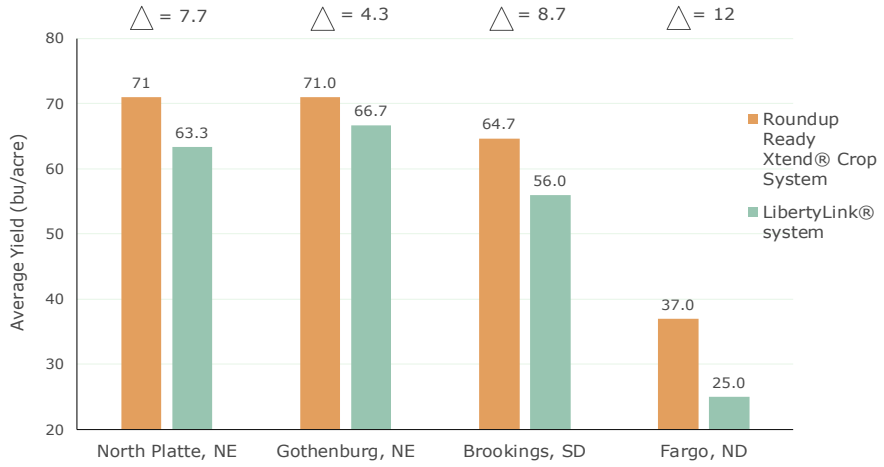
SITE NOTES >

- The study was arranged as a split plot design with two factors, herbicide-tolerance trait and herbicide program, with each treatment replicated 4 times.
- The Roundup Ready 2 Xtend® soybeans used in the trial had RMs of 3.1 at Gothenburg, 2.8 at North Platte, and 0.9 at Brookings and Fargo. The LibertyLink® soybeans used in the trial had RMs of 3.2 at Gothenburg and North Platte, 1.8 at Brookings, and 0.8 at Fargo.
- PRE-herbicide treatments were applied within 1 day of planting and POST-herbicide treatments were applied at the V3 stage.
- All plots were irrigated with sprinkler systems. Row spacing was 30 inches in Gothenburg, North Platte, and Fargo, and 22 inches in Brookings. All other agronomic practices were the same for the region.



* 28 days after planting, ** 60 days after planting, LSD (0.1) = 25 (Palmer amaranth), LSD (0.1) = 18 (Kochia), LSD (0.1) = 1.4 (Waterhemp)

Figure 1. Palmer amaranth, kochia, and waterhemp control



Yield deltas show the yield advantage of the Roundup Ready Xtend® Crop System over the LibertyLink® system

Figure 2. Yields in the Roundup Ready Xtend® Crop System over the LibertyLink® system across treatments by location. Yield deltas show the yield advantage of the Roundup Ready Xtend® Crop System over the LibertyLink® system

Soybean Weed Control System Comparison

TABLE 2. AVERAGE SOYBEAN YIELD IN THE DIFFERENT TREATMENTS AND LOCATIONS

	Treatment	Average yield (bu/acre)			
		Gothenburg, NE	North Platte, NE	Brookings, SD	Fargo, ND
		Roundup Ready Xtend® Crop System			
1	Roundup Ready 2 Xtend® soybeans non-treated	67 ab	14 b	-	-
2	Rowel® Herbicide PRE + XtendiMax® herbicide with VaporGrip® Technology POST + Roundup PowerMAX® herbicide POST	71 ab	74 a	65 a	36 a
3	Rowel Herbicide PRE + XtendiMax with VaporGrip Technology PRE and POST + Roundup PowerMAX herbicide POST	72 a	72 a	64 a	37 a
4	Rowel Herbicide PRE + XtendiMax with VaporGrip Technology PRE and POST + Roundup PowerMAX herbicide POST + Warrant® Herbicide POST	70 ab	67 a	65 a	38 a
		LibertyLink® system			
5	LibertyLink® soybeans non-treated	63 b	7 b	-	-
6	Valor® SX herbicide PRE + Liberty® herbicide POST	65 ab	73 a	51 c	17 c
7	Authority® Maxx herbicide PRE + Liberty herbicide POST	67 ab	58 a	57 b	28 b
8	Authority Maxx herbicide PRE + Liberty herbicide POST + Zidua® herbicide POST	68 ab	59 a	60 ab	30 b
	LSD (0.05)	5	16	5	4

Means followed by a different letter are significantly different (P = 0.05). XtendiMax® herbicide with VaporGrip® Technology is a restricted use pesticide for retail sale to and use only by Certified Applicators or persons under their direct supervision.

Figure 3. Weed control at Gothenburg, NE. The untreated Roundup Ready 2 Xtend® soybeans plot (left). LibertyLink® system with Valor® SX herbicide followed by Liberty® herbicide 30 days after application (middle). Roundup Ready Xtend® Crop System with Rowel® Herbicide followed by XtendiMax® herbicide with VaporGrip® Technology + Roundup PowerMAX® herbicide 30 days after application (right).

- Consistent control of palmer amaranth, waterhemp, and kochia was obtained using XtendiMax® herbicide with VaporGrip® Technology, whereas weed control with Liberty® herbicide was variable.
- Combining effective residual and POST herbicides provided the greatest weed control late into the season.
- Yields did not necessarily correspond to the intensity of the herbicide program, but yields in the Roundup Ready Xtend® Crop System were significantly greater across treatments compared to the LibertyLink® system at each location (Figure 2).

WHAT DOES THIS MEAN FOR YOUR FARM?

- Season-long weed control and minimization of the weed seedbank are important components for maximizing yield and improving long-term weed management.

Using XtendiMax® Herbicide with VaporGrip® Technology PRE for Additional Soil Activity

TRIAL OVERVIEW >

- With the launch of Roundup Ready 2 Xtend® soybeans, dicamba can be applied preemergence (PRE) in soybeans without a plant-back restriction.
- The lack of this restriction will be advantageous for burndown purposes, but dicamba also provides some weed control from soil activity.

RESEARCH OBJECTIVE >

- Evaluate weed control from PRE herbicides in soybeans at two locations in Minnesota, with and without the addition of XtendiMax® herbicide with VaporGrip® Technology, now a restricted use pesticide.

LOCATION	SOIL	PREVIOUS CROP	TILLAGE TYPE	PLANTING DATE	PLANTING RATE/ACRE
Morgan, MN	Silty loam	Corn	Conventional	05/26/2017	140,000
Gibbon, MN	Silty loam	Corn	Conventional	05/11/2017	140,000

SITE NOTES >

- Weed pressure at the Morgan, MN location was primarily waterhemp. Weed pressure at the Gibbon, MN location was primarily giant ragweed. The susceptibility of this giant ragweed population to Group 2 (ALS inhibitor) herbicides has not been formally characterized. Plot size was 10 feet x 30 feet with 4 replications. The PRE herbicide application was made the same day as planting. Treatment lists at the 2 locations were different and therefore the same comparisons cannot be made at each site. Adequate rainfall was received for proper soil applied herbicide activation. The rate for each herbicide discussed is as follows:
  - XtendiMax® with VaporGrip® Technology: 22 fl oz/acre
  - Warrant® Herbicide: 48 fl oz/acre
  - *Rowel® Herbicide: 2 oz/acre (**Rowel® Herbicide is no longer commercially available, but other flumioxazin products are still on the market.*)
  - Authority® First DF: 6.4 oz/acre

UNDERSTANDING THE RESULTS >

- The addition of XtendiMax® with VaporGrip® Technology to Warrant® Herbicide increased waterhemp control compared to Warrant® Herbicide alone.
- When applied PRE, XtendiMax® with VaporGrip® Technology alone provided less waterhemp control than Warrant® Herbicide alone.
- The addition of XtendiMax® with VaporGrip® Technology to Rowel® Herbicide increased giant ragweed control compared to Rowel® Herbicide alone.

Using XtendiMax® Herbicide with VaporGrip® Technology PRE for Additional Soil Activity

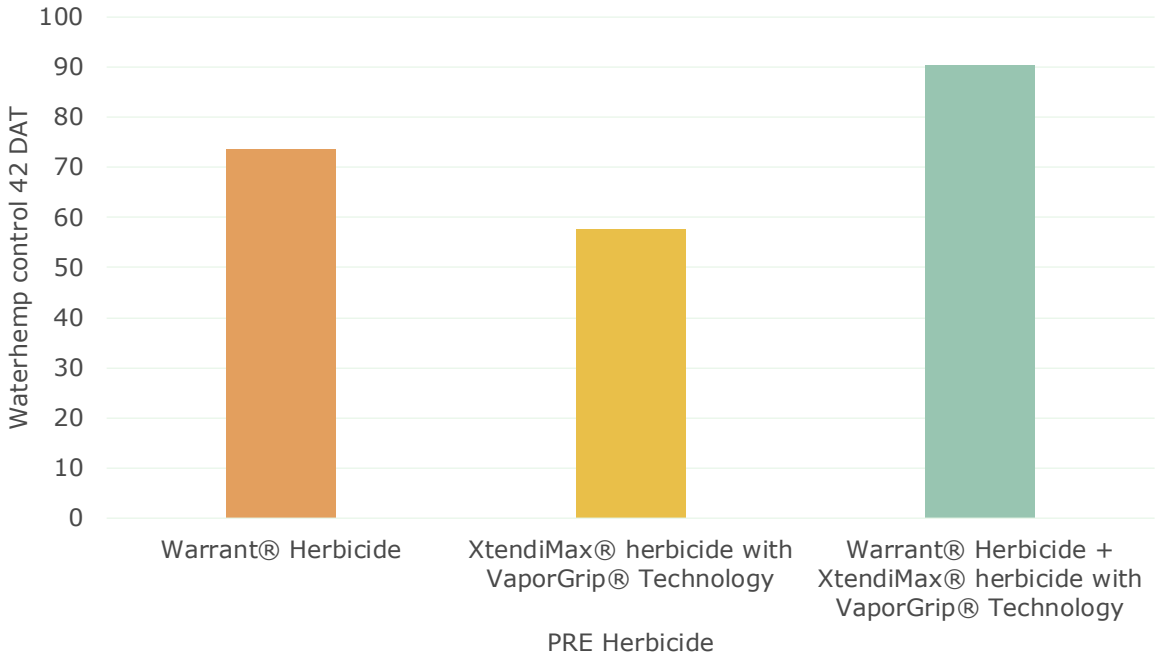


Figure 1. Percent waterhemp control 42 days after PRE application in Morgan, MN in 2017.

Figure 2. Percent giant ragweed control 28 days after PRE application in Gibbon, MN in 2017.

Using XtendiMax® Herbicide with VaporGrip® Technology PRE for Additional Soil Activity

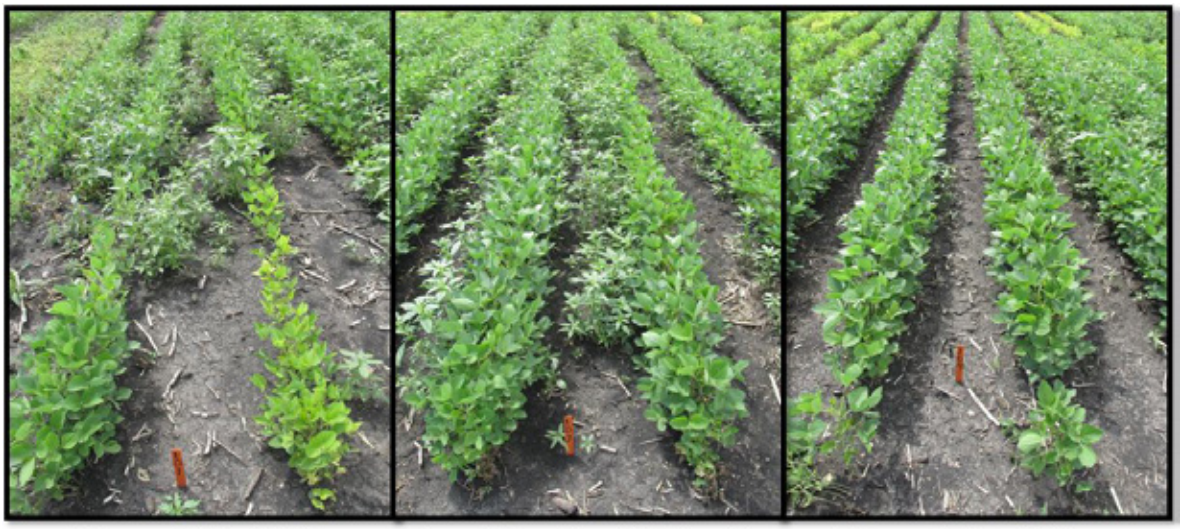


Figure 3. Varying waterhemp control depending on PRE herbicide in Morgan, MN in 2017.

Figure 4. Varying giant ragweed control depending on PRE herbicide in Gibbon, MN in 2017.

WHAT DOES THIS MEAN FOR YOUR FARM?

- Dicamba can be utilized PRE with other residual herbicides to provide additional soil activity for waterhemp and giant ragweed control.
- Dicamba should not be relied upon as the only herbicide used PRE in soybeans.
- Visit www.roundupreadyplus.com to learn more about potential incentives when utilizing Warrant® Herbicide or XtendiMax® herbicide with VaporGrip® Technology in a crop management solution.

Legal Statements

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Roundup Technology® includes glyphosate-based herbicide technologies.

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 PESTICIDE LABEL DIRECTIONS. Roundup Ready technology contains genes that confer tolerance to glyphosate, an active ingredient in Roundup® brand agricultural herbicides. Agricultural herbicides containing glyphosate will kill crops that are not tolerant to glyphosate.

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