2023 Central Plains Field Research

Gothenburg Learning Center

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Gothenburg Learning Center
2023

Welcome

The 2023 Bayer Water Utilization Learning Center Team, from left to right: Hugo Nunes, Alex Hewitt, Trenton Houston, Matthew Nielsen, Shawn McDonald, Brandon Bihlmaier, Zach Harbur, Lisa Bihlmaier, Kenneth Harbur, Madison Woehrle, Nancy Slack, Mark Reiman, Khris Jinks, and Alex Rosa.

Welcome to the 2023 Central Plains Field Research Book! It's a showcase of field research conducted at the Bayer's Water Utilization Learning Center near Gothenburg, Nebraska. These trials give the opportunity to gain insights into how our products and practices will perform under local weather and agronomic conditions. The goal being to help you make decisions on your farm. To start We've included a brief overview of the growing conditions for the Central Plains so you can understand the background leading to the results.

Last year the Learning Center team hosted over 2,000 visitors to the Learning Center, and we look forward to hosting even more in 2024. Currently, the Central Plains technical teams are implementing research trials and demonstrations that will be valuable to your operation. Research includes looking at new uses of crop protection products, how to manage extremely compacted soils, adding manure into high yield systems and so many more. We are looking forward to your visit in 2024.

To schedule a visit for field tours or any ag related meeting at the Learning Center with a group of any size, please contact Khris Jinks (khris.jinks@bayer.com) or Lisa Bihlmaier (lisa.bihlmaier@bayer.com) at (308) 537-4500. We'd enjoy the opportunity to show you around the field and classrooms if you're in the area. If you have any questions, or research ideas for Learning Center team feel free to contact Mark Reiman (mark.reiman@bayer.com)

Thank You from the Learning Center Team and Central Plains Technology Development Team

Follow us on Facebook, Twitter, YouTube, and/or SnapChat for agronomic info and tour updates.

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Research Report / Cover Crop Management and Herbicide Program Selection Impact on Weed Suppression and Soybean Yields

Trial Objective

- To suppress troublesome weeds, farmers may need to consider all possible tools available to them. While herbicides have a long history of effective weed suppression, cover crops have the potential to add value by competing with weeds.
- The objective of this study was to evaluate the combination of cover crops with pre- and post-emergence herbicides in suppressing weed populations and the potential impact on soybean yield.

Experiment/Trial Design

Location	Soil Type	Previous Crop	Tillage Type	Year	Potential Yield (bu/acre)	Seeding Rate (seeds/acre)
Gothenburg, NE	Hord silt loam	Corn	No-till	2022 & 2023	70	160,000

- The trial design was a randomized complete block with four replications and three treatment factors (Table 1):

Table 1. List of experimental factors and herbicide application dates.

Experimental Factor		Date of herbicide application	
		2022	2023
Cover Crop Termination* Timing WBP = Weeks before planting soybean WAP = Weeks after planting soybean	5 WBP	April 22	April 22
	3 WBP	May 6	May 8
	1 WBP	May 21	May 22
	1 WAP	June 4	June 6
Pre-emergence (PRE) herbicide application	Yes	June 4	May 31
	No		
Post-emergence (POST) herbicide application	Yes	June 21	June 27
	No		

*Cover crops were terminated with an application of Roundup PowerMax® herbicide at 32 fl oz/acre and a spray volume of 15 gallons per acre.

- Field operations, seeding rates for cover crops and soybean, fertilizer nutrients and application rates, and the amount of irrigation water applied are listed in Table 2:

Table 2. List of field operations, precipitation, irrigation, seeding, and fertilizer rates by year.

Field Operation	Products/Rates		2022	2023
Cover crop planting	Winter Wheat (approximately 100 lb seed/acre)		November 12, 2021	November 17, 2022
Soybean planting*	MG 2.5 product with XtendFlex® Technology at 160,000 seeds/acre		May 31	N/A
	MG 2.7 product with XtendFlex® Technology at 160,000 seeds/acre		N/A	May 24
Precipitation	Growing season total (inches)		6.48	12.63
Irrigation	Irrigation water applied (inches)		9.0	6.0
Base fertilizer nutrient application	Nitrogen	29.3 lb/acre	Dribbled on soil surface April 12	Furrow applied at soybean planting May 24
	Phosphorus	60.0 lb/acre		
	Sulfur	25.0 lb/acre		
	Zinc	0.25 lb/acre		

*30 inch row spacing.

- The pre-emergence (PRE) and post-emergence (POST) herbicide programs used in this study are presented in Table 3:

Table 3. List of herbicide products, application timing and rates in 2022 and 2023.

Year	Application Timing	Products	Rate (fl oz/acre)
2022	Pre-emergence (PRE)	Roundup PowerMAX® herbicide	32.0
		Fierce® MTZ Herbicide	16.0
	Post-emergence (POST)	Roundup PowerMAX® herbicide	32.0
		Warrant® herbicide	48.0
		XtendiMax® Herbicide with VaporGrip® Technology	22.0
		Sentris™ Buffering Technology	8.0
2023	Pre-emergence (PRE)	Roundup PowerMAX® herbicide	32.0
		Zidua® SC herbicide	3.0
		XtendiMax® Herbicide with VaporGrip® Technology	22.0
		Sentris™ Buffering Technology	8.0
	Post-emergence (POST)	Roundup PowerMAX® herbicide	32.0
		Warrant® herbicide	48.0
		XtendiMax® Herbicide with VaporGrip® Technology	22.0
		Sentris™ Buffering Technology	8.0

All herbicide tank mixes were applied at a spray volume of 15 gallons per acre. OnTarget® adjuvant at 0.5% v/v was included in the POST applications in both years, and in the PRE application in 2023.

Cover Crop Management and Herbicide Program Selection Impact on Weed Suppression and Soybean Yields

- Weed suppression for the pre-emergence (PRE) herbicide treatments (Figure 2) was evaluated at 17 days after treatment (DAT) on 6/21/2022 and at 25 DAT on 6/25/2023.
- The post-emergence (POST) herbicide treatments were evaluated for weed suppression on 7/8/2022 (17 DAT) and at 21 DAT on 7/18/2023 (Figure 3).
- After weed suppression evaluations, weeds were removed by hand to facilitate soybean harvest.
- The study was machine harvested with a plot combine. The moisture content, test weight, and total weight of the grain was collected using the combine.
- Statistical analysis for Fisher's Least Significant Difference (LSD) was performed.

Understanding the Results

- The most prevalent weeds during the growing season were Palmer amaranth (*Amaranthus palmeri*) and kochia (*Bassia scoparia*). Volunteer corn pressure was high.
- Pre-emergence (PRE) herbicides provided good control of volunteer corn. However, control of volunteer corn due to the cover crop was minimal (data not presented).
- Cover crops terminated at 5 WBP had minimal plant growth and were essentially equal to not having a cover crop present at all.

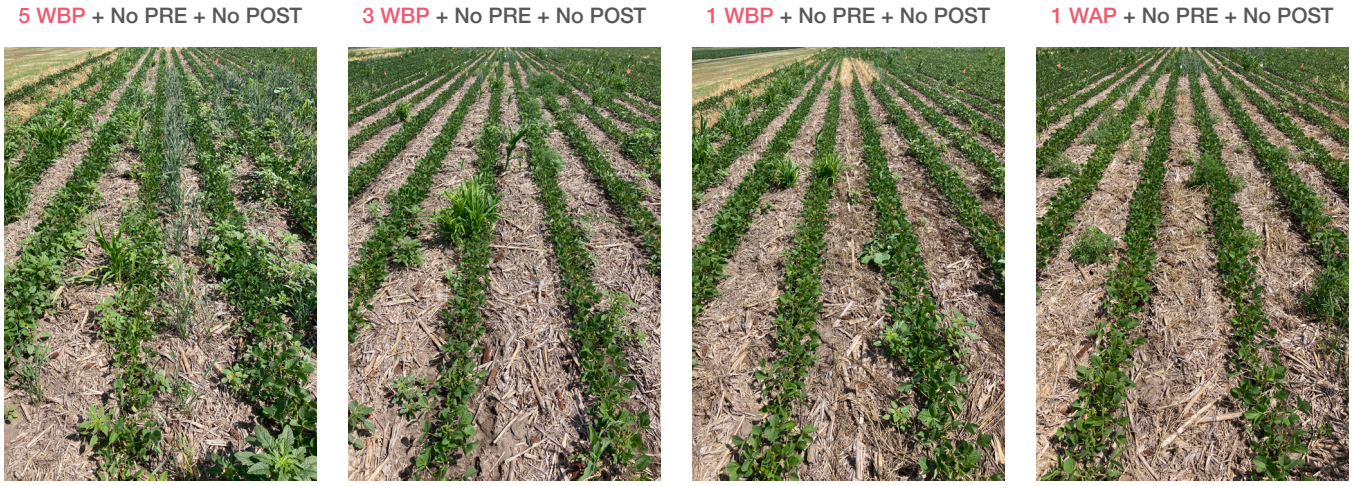


Figure 1. Effect of cover crop termination timing without PRE and POST herbicides on weed suppression. Pictures were taken on 6/26/2023 at the Bayer Water Utilization Learning Center, Gothenburg, NE by Alex Rosa.

Table 4. Effect of pre-emergence herbicide (PRE) application and cover crop termination timings on percent weed suppression in 2023.

Cover Crop Termination Timing	Pre-emergence (PRE) Herbicide		Average of Cover Crop Termination*
	Yes PRE	No PRE	
	Weed Suppression (%)		
5 WBP	92 bc	50 f	71
3 WBP	89 cd	62 e	76
1 WBP	94 ab	86 d	90
1 WAP	96 a	93 ab	95
Average of pre-emergence (PRE) herbicide*	93	73	-

*No statistical comparison. Abbreviations: WBP, weeks before planting; WAP, weeks after planting. Weed suppression ratings taken on 6/25/2023. Numbers followed by letters indicate statistical difference at α = 0.1.

- Cover crops terminated one week after planting soybean (1 WAP) resulted in 95% weed suppression compared to 90%, 76%, and 71% for the 1 WBP, 3 WBP, and 5 WBP treatments, respectively (Table 4 and Figure 1).
- Averaged across cover crop termination timings, pre-emergence herbicide application (Yes PRE) provided 93% weed suppression compared to 73% without a pre-emergence herbicide (No PRE) treatment (Table 4 and Figure 2).
- Cover crop termination at 1 WAP combined with pre-emergence herbicide (Yes PRE) application had slightly improved weed suppression (96%) compared to the 1 WAP + No PRE (93%) and 1 WBP + Yes PRE (94%) treatments. Weed suppression resulting from the combination of 1 WAP + with PRE herbicide was statistically higher than all other treatment combinations (Table 4). Cover crops terminated at 5 WBP without pre-emergence (No PRE) herbicide resulted in the least amount of weed suppression (Table 4).

5 WBP + No PRE + No POST

5 WBP + Yes PRE + No POST

Figure 2. Effect of PRE emergence herbicides on weed suppression. Pictures were taken on 6/26/2023 at the Bayer Water Utilization Learning Center, Gothenburg, NE by Alex Rosa.

Table 5. Effect of post-emergence herbicide (POST) application and cover crop termination timings on percent weed suppression in 2023.

Cover Crop Termination Timing	Post-emergence Herbicide (POST)		Average of Cover Crop Termination*
	Yes POST	No POST	
	Weed Suppression (%)		
5 WBP	90 b	45 e	68
3 WBP	89 b	57 d	73
1 WBP	92 b	77 c	85
1 WAP	95 a	81 c	88
Average of POST emergence herbicide*	92	65	-

*No statistical comparison. Abbreviations: WBP, weeks before planting; WAP, weeks after planting. Weed suppression ratings taken 7/18/2023. Numbers followed by letters indicate statistical difference at α = 0.1.

Cover Crop Management and Herbicide Program Selection Impact on Weed Suppression and Soybean Yields

- Averaged across cover crop termination timings, the post-emergence herbicide application (Yes POST) provided 92% weed suppression compared to 65% without a POST treatment applied (No POST, Table 5 and Figure 3).
- Terminating the cover crop one week after planting soybeans (1 WAP) resulted in 88% weed suppression compared to 85%, 73%, and 68% for the 1 WBP, 3 WBP, and 5 WBP treatments, respectively (Table 5).
- Cover crop termination at 1 WAP combined with post-emergence herbicide (Yes POST) application resulted in the highest weed suppression (95%) among all treatments. Cover crops terminated 5 WBP without post-emergence herbicide (No POST) had 45% weed suppression, the lowest among all treatments (Table 5).

5 WBP + No PRE + No POST

5 WBP + No PRE + Yes POST

Figure 3. Effect of POST herbicides in weed suppression. Pictures were taken on 7/18/2023 at the Bayer Water Utilization Learning Center, Gothenburg, NE by Alex Rosa.

Table 6. The effect of a pre-emergence herbicide (PRE) application with or without a post-emergence herbicide (POST) application on percent weed suppression. Results are combined from 2022 and 2023 data.

Pre-emergence Herbicide (PRE)	Post-emergence Herbicide (POST)		Average of PRE herbicide*
	Yes POST	No POST	
	Weed Suppression (%)		
Yes PRE	94 a	83 c	89
No PRE	89 b	45 d	67
Average of POST herbicide*	92	64	-

*No statistical comparison. Abbreviations: WBP, weeks before planting; WAP, weeks after planting. Weed suppression ratings were taken on 7/8/2022 and 7/18/2023. Numbers followed by letters indicate statistical difference at α = 0.1.

Cover Crop Management and Herbicide Program Selection Impact on Weed Suppression and Soybean Yields

- The post-emergence herbicide application treatment (Yes POST) resulted in 89% weed suppression; however, it was significantly increased to 94% when the Yes POST treatment was combined with the pre-emergence (Yes PRE) herbicide treatment (Table 6).
- The POST and PRE herbicide treatments alone are not a fair comparison because of the timing of the weed suppression ratings between the two years of the study. Weed suppression was evaluated at 32 and 48 days after PRE herbicide application in 2022 and 2023, respectively. Weed suppression ratings for the POST herbicide treatments were taken at 17 and 21 days after POST application in 2022 and 2023, respectively (Table 6).

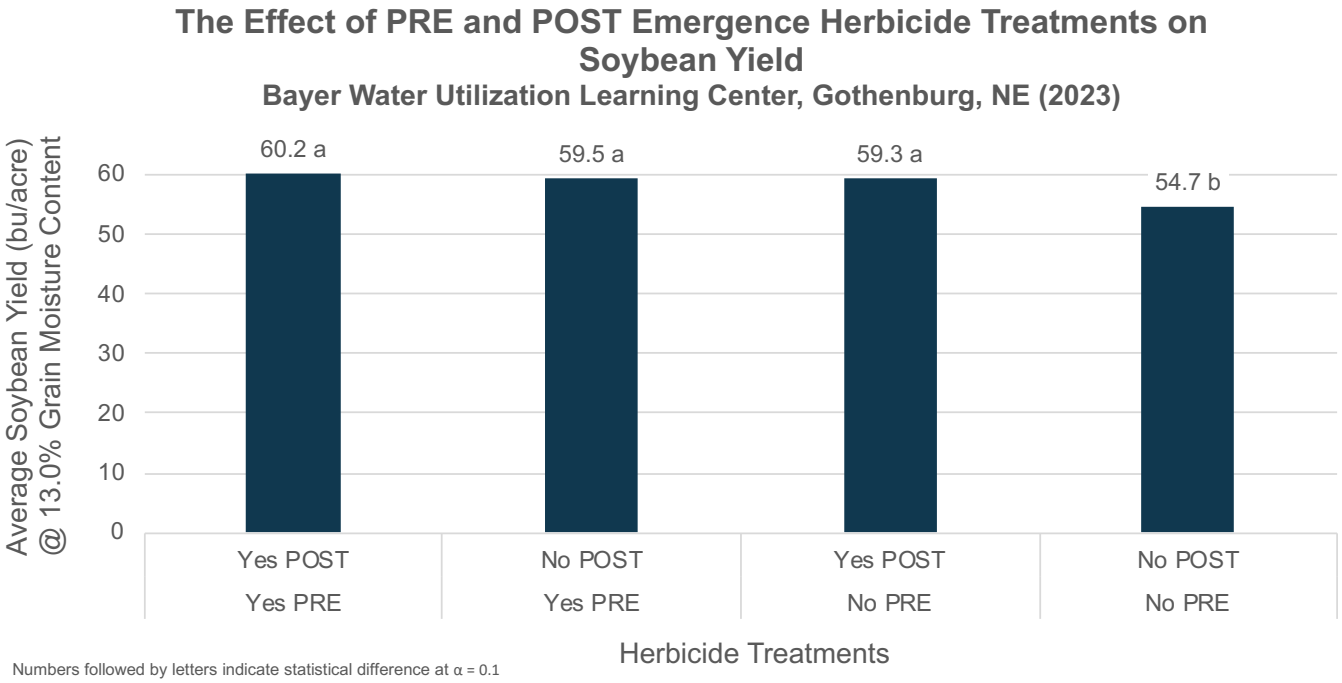


Figure 4. Soybean seed yield according to PRE and POST emergence herbicide treatments.

- The PRE and POST emergence herbicide alone, and in combination, had significantly (α = 0.1) higher yields compared to no herbicide application (Figure 4).

Cover Crop Management and Herbicide Program Selection Impact on Weed Suppression and Soybean Yields

Key Learnings

- Cover crops did not influence soybean yields (data not presented); however, they had key participation in suppressing weeds in this study.
- Post-emergence herbicides were successful in suppressing weeds and achieving higher soybean yields, especially when combined with pre-emergence herbicides.
- The treatment combining pre-emergence and post-emergence herbicides enhanced weed suppression compared to the use of either treatment alone.
- Cover crop termination within 1 week before or after soybean planting increased percent weed suppression compared to termination taking place at 3 or 5 weeks before planting.
- Cover crops function as a weed management tool and are a valuable resource when suppressing herbicide-resistant weeds.

Legal Statements

Research Report / Dryland Soybean Yield Responses to Agronomic Management Practices

Trial Objective

- Identifying good management practices is very important for maximizing yield potential in low-rainfall environments, particularly in unirrigated fields.
- The objective of this study was to determine the impact of tillage types (conventional, strip-till, no-till, and no-till plus cover crop), seeding rate, and maturity group on yield in Bayer products in a dryland soybean system.
- This soybean study was completed in conjunction with similarly designed corn study.

Experiment/Trial Design

Location	Soil Type	Previous Crop	Tillage Type	Planting Date	Harvest Date	Potential Yield (bu/acre)	Seeding Rate (seeds/acre)
Gothenburg, NE	Hord Silt Loam	Corn	No-till, Strip-till, Conventional	05/05/2023	09/24/2023	70	80,000 & 160,000

- The trial was arranged as a strip-split plot with two replicates, four tillage systems, four soybean products, and two planting populations.
- Rye was planted as a cover crop in early spring 2023, but there was a poor stand establishment.
- Tillage treatments were performed on 05/02/2023 with 29 lb nitrogen/acre, 60 lb phosphorus/acre, and 25 lb sulfur/acre. Fertilizer applications were either incorporated with strip-tillage or surface applied for no-till and conventionally tilled treatments.
- Soybeans were planted on 05/05/2023 into 67.5 x 10 ft plots.
- On 06/14/2023, a post-emerge herbicide mix was applied with 22 fl oz/acre XtendiMax® Herbicide with VaporGrip® Technology (a restricted use pesticide) , 48 fl oz/acre Warrant® Herbicide, and 30 fl oz/acre Roundup PowerMAX® herbicide.
- The total rainfall accumulated during the 2023 growing season was 13.5 inches.
- Total weight, test weight, and moisture content were collected with a plot combined on 09/24/2023, and average yield per acre was calculated later.

XtendiMax® herbicide with VaporGrip® Technology has been classified as a restricted use pesticide and must be used with VaporGrip® Xtra Agent (or an equivalent volatility reduction adjuvant). For approved tank-mix products (including VRAs and DRAs), nozzles and other important label information visit XtendiMaxApplicationRequirements.com. Applicators must check XtendiMaxApplicationRequirements.com no more than 7 days before application of this product for additional labeling, including state restrictions. Where applicable, users must comply with additional requirements found on this website.

Dryland Soybean Yield Responses to Agronomic Management Practices

Figure 1. Trial overview in Gothenburg, NE on August 30, 2023. Differences between soybean maturity group are evident, with the earlier maturity-group soybeans beginning to yellow.

Understanding the Results

- The 2023 weather conditions provided the plants with adequate moisture after planting and through most of the growing season, until the weather turned very hot and dry in late August through September.
- Heat and moisture stress during the late reproductive stages severely reduced yield potential from the originally predicted 70 to 80 bushels per acre.
- There were no statistically significant differences in average yield between maturity groups (MG) (data not shown).
- There were no significant differences in average yields between tillage treatments, despite the dry conditions at the end of the season (Figure 2).
- The 80,000 seed/acre seeding rate resulted in an average yield of 47 bu/acre, and the 160,000 seed/acre seeding rate resulted in an average yield of 52.4 bu/acre (Figure 3).
- A higher seeding rate provided a significant yield increase in the 2.0 and 2.5 relative maturity groups. At the lower seeding rate, the maturity group 2.0 product had the lowest yields in the trial (Figure 4).

Dryland Soybean Yield Responses to Agronomic Management Practices

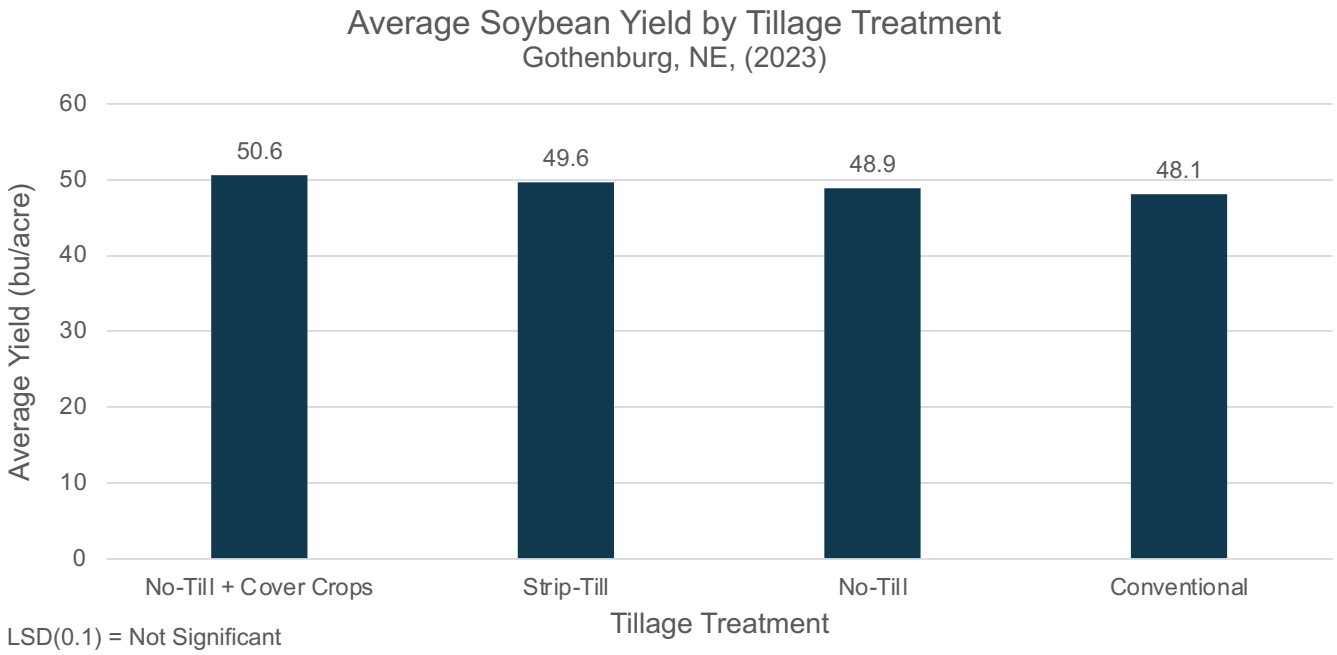


Figure 2. Soybean yield averaged across maturity groups for 4 tillage treatments tested in Gothenburg, NE in 2023.

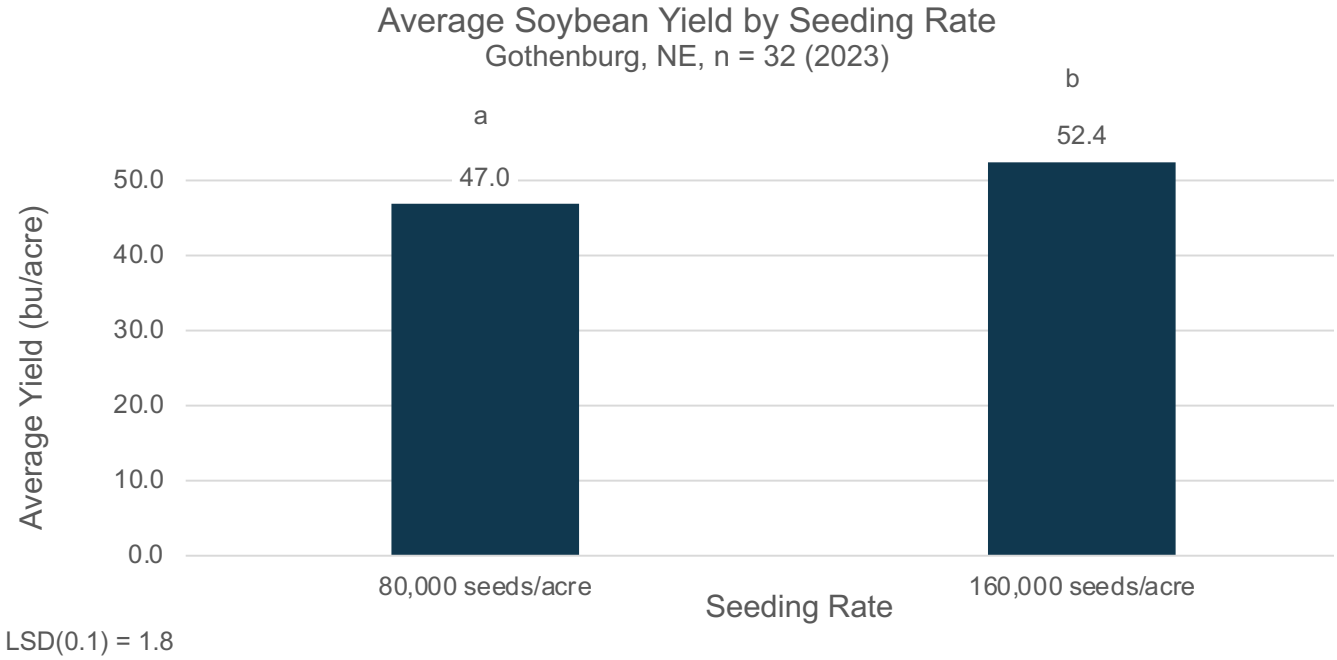


Figure 3. Soybean yield averaged across maturity groups and tillage treatments for 2 seeding rates tested in Gothenburg, NE in 2023.

Dryland Soybean Yield Responses to Agronomic Management Practices

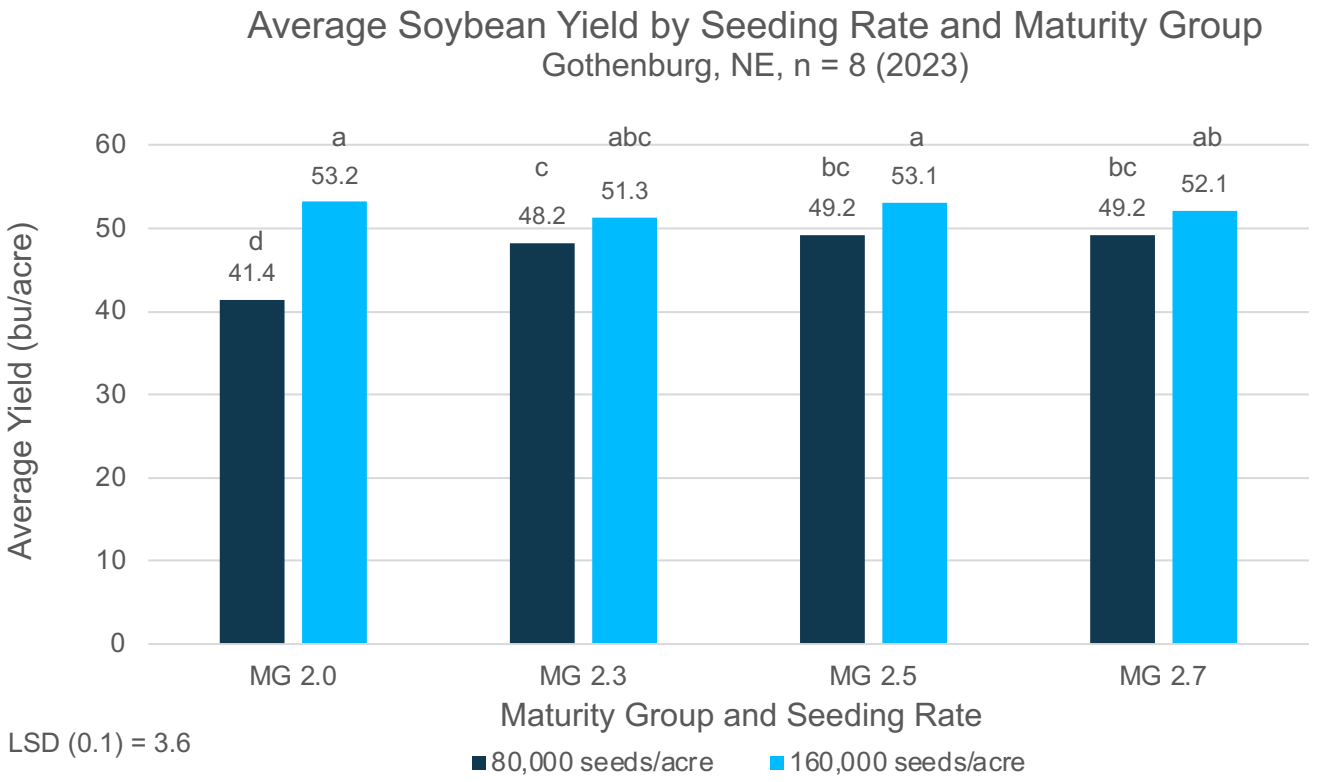


Figure 4. Average soybean yield for 4 relative maturity groups (MG) and 2 seeding rates tested in Gothenburg, NE in 2023.

Figure 5. MG 2.7 soybean strip-till planted at 80,000 seeds/acre; this plot yielded 46.4 bushels/acre. Soybean planted at this density were branchier and had more leaves attached at harvest.

Figure 6. MG 2.7 soybeans strip-till planted at 160,000 seeds per acre; this plot yielded 53.6 bushels/acre. Soybean planted at this density had more complete leaf drop at harvest and were less branchy.

Dryland Soybean Yield Responses to Agronomic Management Practices

Key Learnings

- Tillage systems did not impact yield as it had in previous trials. Adequate soil moisture early in the season prior to canopy closure may have mitigated solar evaporation from the tilled soils.
- When averaged across the other management practices tested, soybean maturity group alone did not produce a significant difference in average yield (data not shown).
- However, soybean seeding rate did have an impact on yield on the MG 2.0 and MG 2.5 treatments in dry conditions. A seeding rate of 160,000 seeds/acre increased the average yield in each maturity group by about 7.9 bu/acre compared to a seeding rate of 80,000 seeds/acre.
- We will continue to evaluate this trial in future years to determine which, if any, of these factors consistently influence yields over time.

Legal Statements

Research Report / Tillage and Fertilization in Soybean: Are They Always Necessary to Increase Grain Yield?

Trial Objective

- Reduced tillage might benefit soybean production by helping with soil preparation and water management. Furthermore, adequate and balanced plant nutrition is a key factor in maximizing plant growth and grain yield. However, it is unclear if either tillage or fertilization is always needed to achieve higher soybean yields.
- This study aimed to evaluate the effect of tillage and fertilization on soybean grain yield.

Experiment/Trial Design

Location	Soil Type	Tillage Type	Previous Crop	Planting Date	Harvest Date	Potential Yield (bu/acre)	Seeding Rate (seeds/acre)	Row Spacing (inches)
Gothenburg, NE	Hord Silt Loam	Strip-till, No-till	Corn	5/22/23	9/29/23	90	120,000	30

- The trial design was a randomized complete block with four replications and three treatment factors:
  - » Tillage:
    - – Strip-till
    - – No-till
  - » Fertilization:
    - – Not fertilized
    - – Fertilized with nitrogen (N), phosphorus (P), sulfur (S), and zinc (Zn)
    - – Seed treated with cobalt and molybdenum (CoMo) + inoculant (I)
  - » Maturity Group:
    - – Each block had a different XtendFlex® soybean product with a maturity group rating of either 2.8 or 3.2.
- Soybean plants were fully irrigated throughout the growing season.
- One 0- to 8-inch depth composite soil sample per block was taken prior to fertilization on 5/4/2023 (Table 1).
- The trial was strip-tilled on 5/4/2023 according to treatments.
- Fertilized plots received 29 lb/acre N, 60 lb/acre P_2O_5, 25 lb/acre S, and 0.25 lb/acre Zn on 5/4/2023. Fertilizer was deep banded (9-inch depth) with a strip-till machine for strip-till plots and surface banded for no-till plots.
- Weeds were controlled uniformly across the study area.
- Plots were combine harvested and grain moisture content, test weight, and total weight data were collected. A Fisher's Least Significant Difference statistical analysis was performed.

Tillage and Fertilization in Soybean: Are They Always Necessary to Increase Grain Yield?

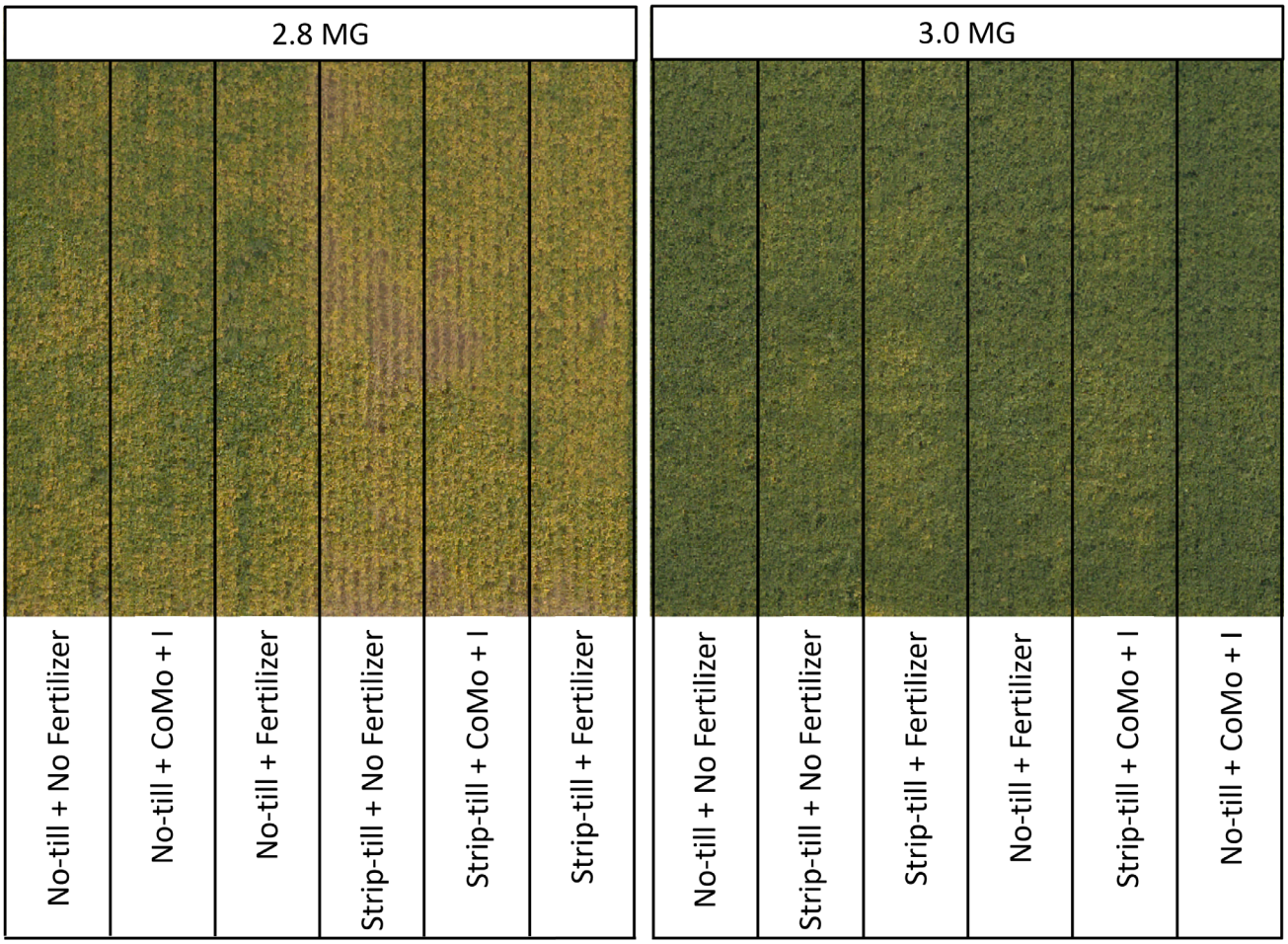


Figure 1. Aerial image from the soybean tillage and fertilizer trial in Gothenburg, NE. Picture taken on 09/15/2023.

Table 1. Soil sample results (0 to 8 inches).

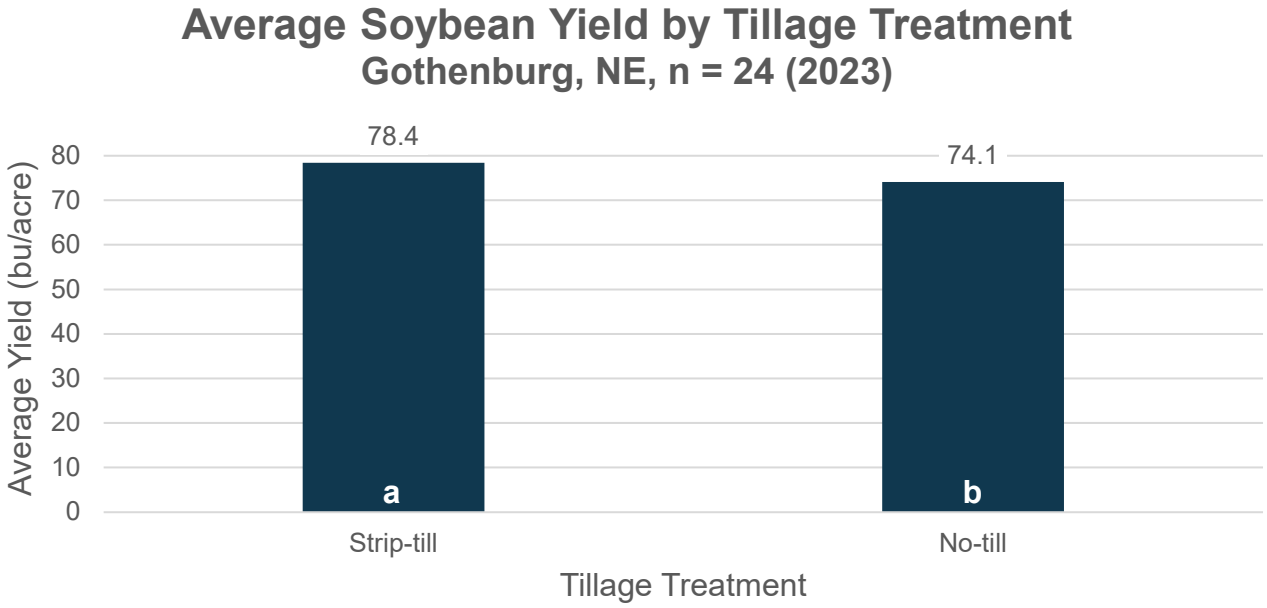
Soil Sample	Organic Matter LOI (%)	Nitrate-Nitrogen (ppm)	Phosphorus Mehlich-III (ppm)	Sulfate-Sulphur (ppm)	Zinc (ppm)
Rep 1	3.7	12.7	58	9.4	1.15
Rep 2	3.1	19.8	45	15.1	1.5
Rep 3	3.2	30	36	22.5	1.31
Rep 4	3.3	12.4	39	14.9	1.34

Tillage and Fertilization in Soybean: Are They Always Necessary to Increase Grain Yield?

Understanding the Results

Tillage – Figure 2

- The average soybean yield was 4.3 bu/acre higher under strip-till compared to no-till, regardless of fertilization.
- Soil compaction might be responsible for lower yields in no-till plots. Previous soybean experiments at this location have shown no tillage effect, or even higher yields under no-till when soil structure is not an issue.



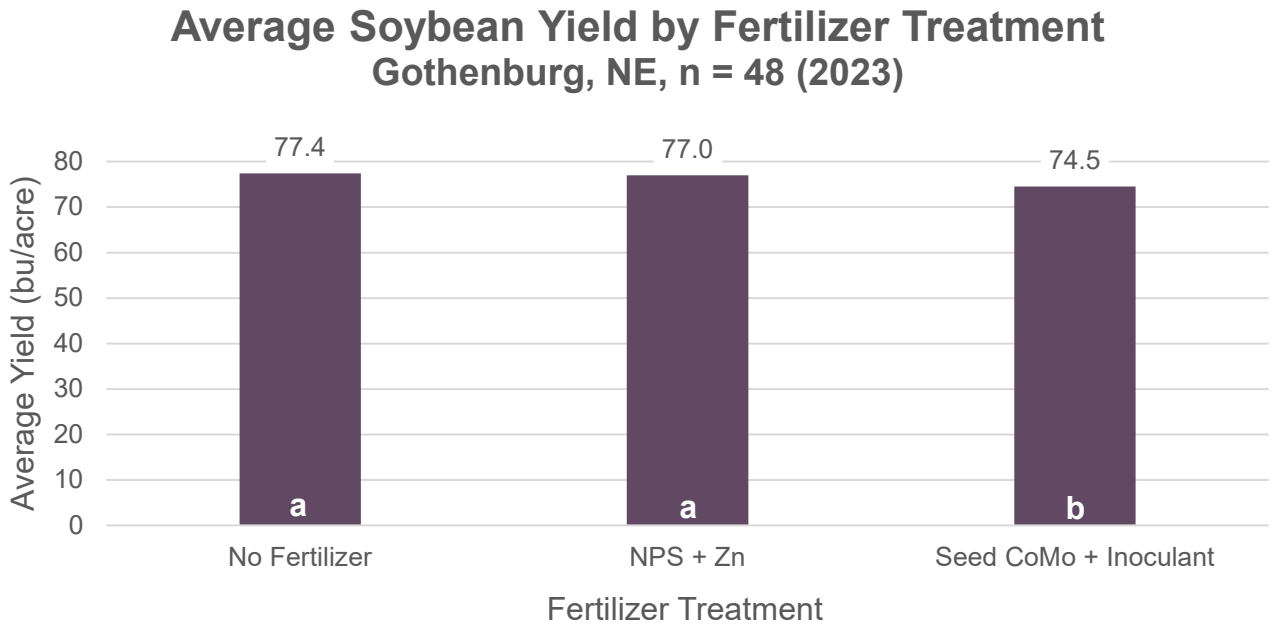
LSD (0.1) = 1.8

Figure 2. Average soybean yields as impacted by tillage at the Bayer Water Utilization Learning Center, Gothenburg, NE (2023).

Tillage and Fertilization in Soybean: Are They Always Necessary to Increase Grain Yield?

Fertilization – Figure 3

- Fertilization with NPS + Zn did not result in any significant difference in soybean yield. Based on state fertilization guidelines, nutrient concentrations for all reps (Table 1) were well above critical levels for soybean. No yield response is expected when additional fertilization is provided at these starting nutrient levels, and this outcome was seen in this trial.
- Soybean seed treated with CoMo + inoculant resulted in lower yields on average. Although the yield difference was relatively small compared to unfertilized plots (2.9 bu/acre), it was significant. Molybdenum toxicity might be responsible for the yield drop, but further research is needed.



LSD (0.1) = 2.2

Figure 3. Average soybean yields as impacted by fertilization at the Bayer Water Utilization Learning Center, Gothenburg, NE (2023).

Tillage and Fertilization in Soybean: Are They Always Necessary to Increase Grain Yield?

Key Learnings

- Reduced tillage, like strip-till, could be helpful in situations where soil structure is an issue. However, it is still important to consider the difference in costs when choosing strip-till over no-till.
- Soybean yields did not respond to combined nitrogen, phosphorus, sulfur, and zinc fertilization in this trial, regardless of tillage. The lack of yield difference was likely due to soil nutrient levels being well above critical levels for soybean production.
- Fertilization with cobalt and molybdenum + inoculant resulted in slightly lower soybean yields. Previous studies suggest this could be the result of molybdenum toxicity, but further investigation is needed.[1]

Sources

[1]Campo, R.J., Araujo, R.S., and Hungria, M. 2009. Molybdenum-enriched soybean seeds enhance N accumulation, seed yield, and seed protein content in Brazil. Field Crops Research. 110(3): 219–224. https://doi.org/10.1016/j.fcr.2008.09.001

Legal Statements

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

No dicamba may be used in-crop with seed with Roundup Ready® Xtend Technology, unless and until approved or specifically permitted, and no dicamba formulations are currently registered for such use in the 2024 season. Please follow https://www.roundupreadyxtend.com/pages/xtendimax-updates.aspx for status updates.

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

ALWAYS READ AND FOLLOW PESTICIDE LABEL DIRECTIONS.

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

Performance may vary, from location to location and from year to year, as local growing, soil and environmental conditions may vary. Growers should evaluate data from multiple locations and years whenever possible and should consider the impacts of these conditions on their growing environment.

The recommendations in this material are based upon trial observations and feedback received from a limited number of growers and growing environments. These recommendations should be considered as one reference point and should not be substituted for the professional opinion of agronomists, entomologists or other relevant experts evaluating specific conditions.

Products with XtendFlex® Technology contains genes that confer tolerance to glyphosate, glufosinate and dicamba. Plants that are not tolerant to glyphosate, dicamba, and/or glufosinate may be damaged or killed if exposed to those herbicides. Contact your seed brand dealer or refer to the Bayer Technology Use Guide for recommended weed control programs.

Research Report / Asgrow® Soybean Product Comparisons Following Cover Crop Mix

Trial Objective

- Testing various soybean products is crucial for better understanding how to position them under the right field and management conditions to meet the farmer's needs.
- The objective of this trial was to test a broad spectrum of Asgrow® brand soybean products that are currently recommended for the western Central Plains in a high-residue environment.

Experiment/Trial Design

Location	Soil Type	Previous Crop	Tillage Type	Planting Date	Harvest Date	Potential Yield (bu/acre)	Seeding Rate (seeds/acre)
Gothenburg, NE	Hord Silt Loam	Corn	No-till	5/24/2023	10/7/2023	80	160,000

- The trial was arranged using a randomized complete block design with four replications. The only treatment factor was the soybean product.

Table 1. List of field operations, products, and rates in 2023.

Field Operation	Products/rates		Comments
Cover crop planting	Cover crop mix at 85 lb seed/acre		Planted on 11/17/2022
Preplant burndown herbicides applied	Roundup PowerMAX® 3 herbicide	32.0 fl oz/acre	Applied at 15 gallons per acre (GPA) on 05/20/2023
	Ammonium sulfate (AMS)	17 lb/100 gallons	
Soybean planting	160,000 seeds/acre		Planted on 05/24/2023 in 17.5 feet x 10 feet plots
Liquid fertilizer applied	Nitrogen (N)	18.0 lb/acre	Applied as a side-dress application on 06/13/2023
	Phosphorus (P_2O_5)	38.0 lb/acre	
	Sulfur (S)	16.0 lb/acre	
	Zinc (Zn)	0.16 lb/acre	
Post-emergence herbicides applied	Roundup PowerMAX® 3 herbicide	30.0 fl oz/acre	Applied 06/20/2023
	XtendiMax® Herbicide with VaporGrip® Technology, which has been classified as a restricted use pesticide.	22.0 fl oz/acre	
	Warrant® herbicide	48.0 fl oz/acre	
	Volt-Edge™, a VaporGrip® Xtra Agent	20.0 fl oz/acre	
	OnTarget™ Adjuvant	0.5 gallon/100 gallons	
Post-emergence herbicide application to control volunteer corn	Section® Three herbicide	10.0 fl oz/acre	Applied 07/12/2023
	Superb® HC adjuvant	0.5 gallon/100 gallons	
Harvest	Grain weight, test weight, and grain moisture content collected with a plot combine		Harvested on 10/07/2023. Yield per acre was calculated later

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Asgrow® Soybean Product Comparisons Following Cover Crop Mix

- The total rainfall accumulated during the 2023 soybean growing season was 12.6 inches. This trial was implemented under an overhead pivot irrigation system and the total irrigation water applied was 6.0 inches.

Understanding the Results

- The highest average yield was obtained with Asgrow® AG26XF3 brand at 64.1 bu/acre. The lowest yield was obtained with AG26XF4 brand at 41.1 bu/acre, 35.9% less than AG26XF3 brand (Table 2).
- Plant lodging was significantly different between Asgrow® products. AG23XF2 brand had the lowest average rating (1.0) while AG27XF4 brand had the highest (2.5) (Table 2).
- Green leaf/stem was also significantly different between Asgrow® products. The lowest scoring products were AG26XF3 and AG28XF3, with an average score of 1.0. AG27XF3 had the highest score with an average of 3.3 (Table 2 and Figure 1).

Table 2. Yield, lodging rating, and green leaf/stem rating by Asgrow® brand soybean products planted into overwinter-mix cover-crop residue were taken. All soybean products in this trial contain XtendFlex® Technology (XF).

Product	Yield (bu/acre)	Yield Difference (%)	Lodging (1-10)	Green Leaf/Stem (1-10)
AG26XF3 brand	64.1 a	—	1.8 bcd	1.0 e
AG27XF3 brand	63.5 a	–0.9	2.3 ab	3.3 a
AG28XF3 brand	61.3 ab	–4.4	1.5 cde	1.0 e
AG29XF4 brand	57.1 bc	–10.9	2.0 abc	3.0 a
AG24XF3 brand	55.1 cd	–14.0	1.3 de	2.8 ab
AG23XF2 brand	55.0 cd	–14.2	1.0 e	1.5 de
AG27XF4 brand	53.6 cd	–16.4	2.5 a	2.3 bc
AG24XF4 brand	51.6 d	–19.5	2.3 ab	1.8 cd
AG30XF2 brand	51.3 d	–20.0	1.8 bcd	2.3 bc
AG26XF4 brand	41.1 e	–35.9	1.5 cde	1.8 cd

LSD (0.1) Yield = 4.41; LSD (0.1) Lodging = 0.6; LSD (0.1) Green leaf/stem = 0.7; n = 4 replicates. Means in a column followed by the same letter not significantly different.
Lodging score of 1 equals no lodging, 10 is severe lodging. Green leaf/stem rating of 1 is equal to no green leaf/stem, 10 is equal to all plants have green leaf/stem.

Asgrow® Soybean Product Comparisons Following Cover Crop Mix

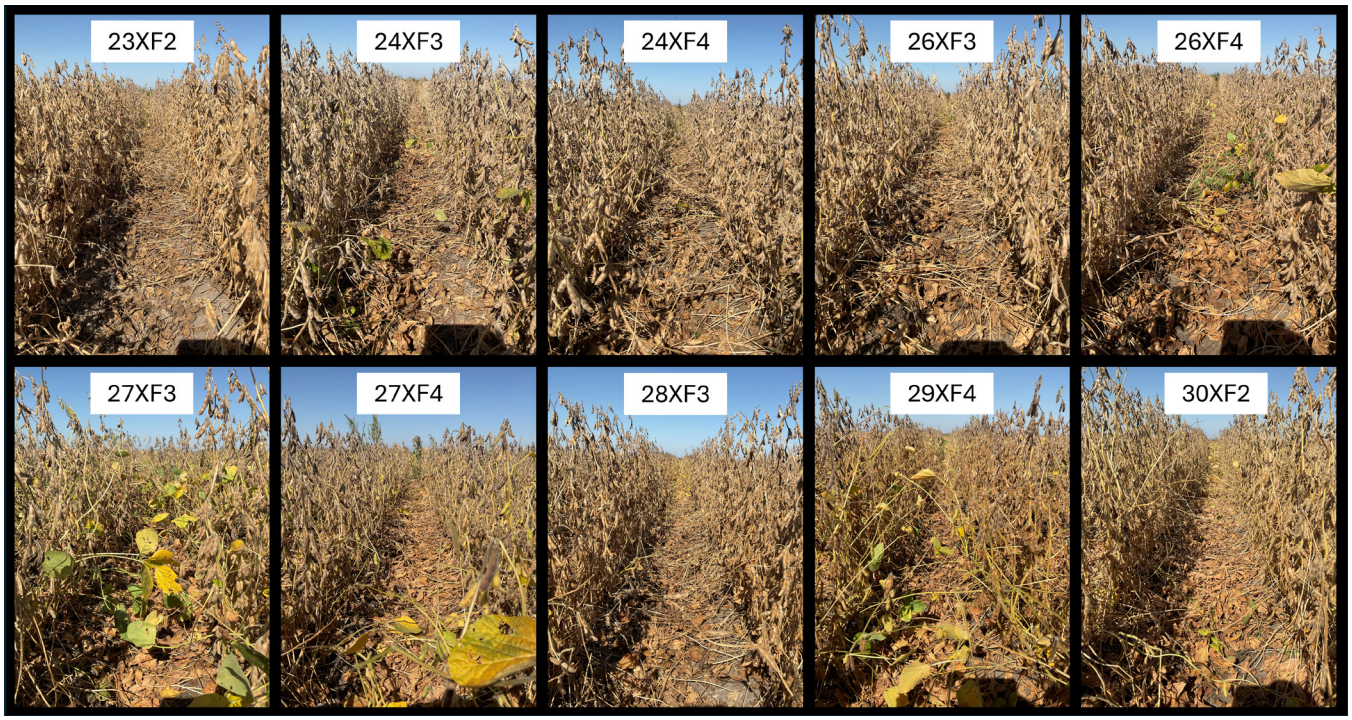

Figure 1. Side-by-side comparison of all Asgrow® brand products tested under no-till and cover crops at the Gothenburg Learning Center in 2023. Pictures taken on October 1, 2023.

Asgrow® Soybean Product Comparisons Following Cover Crop Mix

Legal statements:

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No dicamba may be used in-crop with seed with Roundup Ready® Xtend Technology, unless and until approved or specifically permitted. No dicamba formulations have been registered for such in-crop use at the time this material was published. Please follow https://www.roundupreadyxtend.com/pages/xtendimax-updates.aspx for status updates.

Based on Court ruling and EPA Existing Stocks Order* on XtendiMax® Herbicide registration, Bayer has stopped its sale and distribution of XtendiMax® Herbicide. Visit our XtendiMax herbicide updates page to learn the latest www.roundupreadyxtend.com/xtendimaxupdates. *Low-volatility dicamba products subject to the ruling include XtendiMax® herbicide with VaporGrip® Technology, Engenia® herbicide and Tavium® Plus VaporGrip® Technology herbicide.

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

XtendiMax® herbicide with VaporGrip® Technology has been classified as a restricted use pesticide and must be used with VaporGrip® Xtra Agent (or an equivalent volatility reduction adjuvant). For approved tank-mix products (including VRAs and DRAs), nozzles and other important label information visit XtendiMaxApplicationRequirements.com. Applicators must check XtendiMaxApplicationRequirements.com no more than 7 days before application of this product for additional labeling, including state restrictions. Where applicable, users must comply with additional requirements found on this website.

ALWAYS READ AND FOLLOW PESTICIDE LABEL DIRECTIONS.

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

For more information regarding the intellectual property protection for the seed products identified in this publication, please see www.asgrowanddekalb.com. **Performance may vary,** from location to location and from year to year, as local growing, soil and environmental conditions may vary. Growers should evaluate data from multiple locations and years whenever possible and should consider the impacts of these conditions on their growing environment.

The recommendations in this material are based upon trial observations and feedback received from a limited number of growers and growing environments. These recommendations should be considered as one reference point and should not be substituted for the professional opinion of agronomists, entomologists or other relevant experts evaluating specific conditions.

Products with XtendFlex® Technology contains genes that confer tolerance to glyphosate, glufosinate and dicamba. Plants that are not tolerant to glyphosate, dicamba, and/or glufosinate may be damaged or killed if exposed to those herbicides. Contact your seed brand dealer or refer to the Bayer Technology Use Guide for recommended weed control programs.

XtendiMax® has been classified as a restricted use pesticide. Not all products are registered for use in all states and may be subject to use restrictions. The distribution, sale, or use of an unregistered pesticide is a violation of federal and/or state law and is strictly prohibited. Check with your local dealer or representative for the product registration status in your state. Asgrow®, Bayer, Bayer Cross, DiFlexx®, Roundup PowerMAX®, Roundup Ready 2 Xtend®, Roundup Ready 2 Yield®, Roundup Ready®, VaporGrip®, Warrant®, XtendFlex® and XtendiMax® are registered trademarks of Bayer Group. LibertyLink logo® and LibertyLink® are trademarks of BASF Corporation. All other trademarks are the property of their respective owners. For additional product information call toll-free 1-866-99-BAYER (1-866-992-2937) or visit our website at www.BayerCropScience.us. Bayer CropScience LP, 800 North Lindbergh Boulevard, St. Louis, MO 63167. ©2024 Bayer Group. All rights reserved.1310_394450.

Research Report / Channel® Brand Soybean Product Comparisons Following Cover Crop Mix

Trial Objective

- Testing various soybean products is crucial for better understanding how to position them in the right field and under the right management conditions to meet the farmer's needs.
- The objective of this trial was to test a broad spectrum of Channel® brand soybean products that are currently recommended for the western Central Plains in a high-residue environment.

Experiment/Trial Design

Location	Soil Type	Previous Crop	Tillage Type	Planting Date	Harvest Date	Potential Yield (bu/acre)	Seeding Rate (seeds/acre)
Gothenburg, NE	Hord silt loam	Corn	No-till	5/24/2023	10/7/2023	80	160,000

- The trial was arranged as a randomized complete block design with four replications. The only treatment factor was the soybean product.

Table 1. List of field operations, products, and rates in 2023.

Field Operation	Products/rates		Comments
Cover crop planting	Cover crop mix including clover, peas, cereal rye, barley, rapeseed, and hairy vetch at 85 lb seed/acre		Planted on 11/17/2022
Preplant burndown herbicides applied	Roundup PowerMAX® 3 herbicide	32.0 fl oz/acre	Applied at 15 gallons per acre (GPA) on 05/20/2023
	Ammonium sulfate (AMS) 17 lb/100 gallons		
Soybean planting	160,000 seeds/acre		Planted on 05/24/2023 in 17.5 feet x 10 feet plots
Liquid fertilizer applied	Nitrogen (N)	18.0 lb/acre	Applied as a side-dress application on 06/13/2023
	Phosphorus (P_2O_5)	38.0 lb/acre	
	Sulfur (S)	16.0 lb/acre	
	Zinc (Zn)	0.16 lb/acre	
Post-emergence herbicides applied	Roundup Power MAX® 3 herbicide	30.0 fl oz/acre	Applied 06/20/2023
	XtendiMax® Herbicide with VaporGrip® Technology (which has been classified as a restricted use pesticide)	22.0 fl oz/acre	
	Warrant® herbicide	48.0 fl oz/acre	
	Volt-Edge™, a VaporGrip® Xtra Agent	20.0 fl oz/acre	
	OnTarget™ Adjuvant	0.5 gallon/100 gallons	
Post-emergence herbicide application to control volunteer corn	Section® Three herbicide	10.0 fl oz/acre	Applied 07/12/2023
	Superb® HC adjuvant	0.5 gallon/100 gallons	
Harvest	Grain weight, test weight, and grain moisture content collected with a plot combine		Harvested on 10/07/2023. Yield per acre was calculated later

Channel® Brand Soybean Product Comparisons Following Cover Crop Mix

- Cover crop biomass was about 770 lbs/acre at the time of termination (4 days before soybean planting). Soybean was no-till planted over the standing residue of cover crops.
- The total rainfall accumulated during the 2023 soybean growing season was 12.6 inches. This trial was implemented under an overhead pivot irrigation system and the total irrigation water applied was 6.0 inches.

Understanding the Results

Table 2. Yield, lodging rating, and green leaf/stem rating for each Channel® brand soybean product. *All soybean products in this trial contain XtendFlex® Technology (RXF).*

Product	Yield (bu/acre)	Yield Difference (%)	Lodging (1–10)	Green Leaf/Stem (1–10)
2024RXF brand	63.5 a	—	2.8 f	1.0 a
3223RXF brand	62.6 ab	–1.4	1.5 abc	3.2 cd
2221RXF brand	60.9 ab	–4.1	1.1 a	1.2 a
2123RXF brand	60.3 abc	–5.1	1.3 ab	1.2 a
2524RXF brand	58.6 bcd	–7.7	2.5 ef	2.0 b
2721RXF brand	56.3 cde	–11.5	1.3 ab	1.2 a
2724RXF brand	56.1 cdef	–11.7	2.2 cdef	3.0 c
2922RXF brand	55.7 def	–12.4	1.5 abc	3.0 c
2823RXF brand	55.3 def	–13.1	1.3 ab	2.0 b
2824RXF brand	55.1 def	–13.2	1.8 abcde	3.8 de
2223RXF brand	54.3 def	–14.5	1.9 bcde	1.0 a
2321RXF brand	54.2 def	–14.6	1.7 abcd	1.0 a
2424RXF brand	52.4 efg	–17.4	3.8 g	1.2 a
3022RXF brand	52.4 efg	–17.4	1.7 abcd	1.9 b
2521RXF brand	52.3 efg	–17.7	1.3 ab	1.2 a
2622RXF brand	51.8 fg	–18.4	1.8 abcde	1.2 a
2924RXF brand	49.3 g	–22.4	2.4 def	4.2 e

LSD (0.1) Yield = 3.6 bu/acre; n = 4. For Channel® brand soybean, the first two numbers displayed in the product name represent the soybean maturity group (e.g., 2024RXF is a 2.0 maturity group). Letters after a number indicate a statistical difference within that column.

- The soybean product with the highest average yield was Channel® brand 2024RXF at 63.5 bu/acre (Table 2). The product with the lowest average yield was Channel® brand 2924RXF with 49.3 bu/acre, 22.4% less than 2024RXF.
- Plant lodging was significantly different between the Channel® brand products. 2221RXF had the least amount of lodging with an average rating of 1.1, while 2424RXF had the highest average rating of 3.8 (Table 2).
- Differences in green leaf/stem were also significant among the Channel® brand products. The lowest score obtained was with 2024RXF, 2321RXF, and 2223RXF with an average of 1.0. The highest average score was 4.2 with 2924RXF.

Channel® Brand Soybean Product Comparisons Following Cover Crop Mix

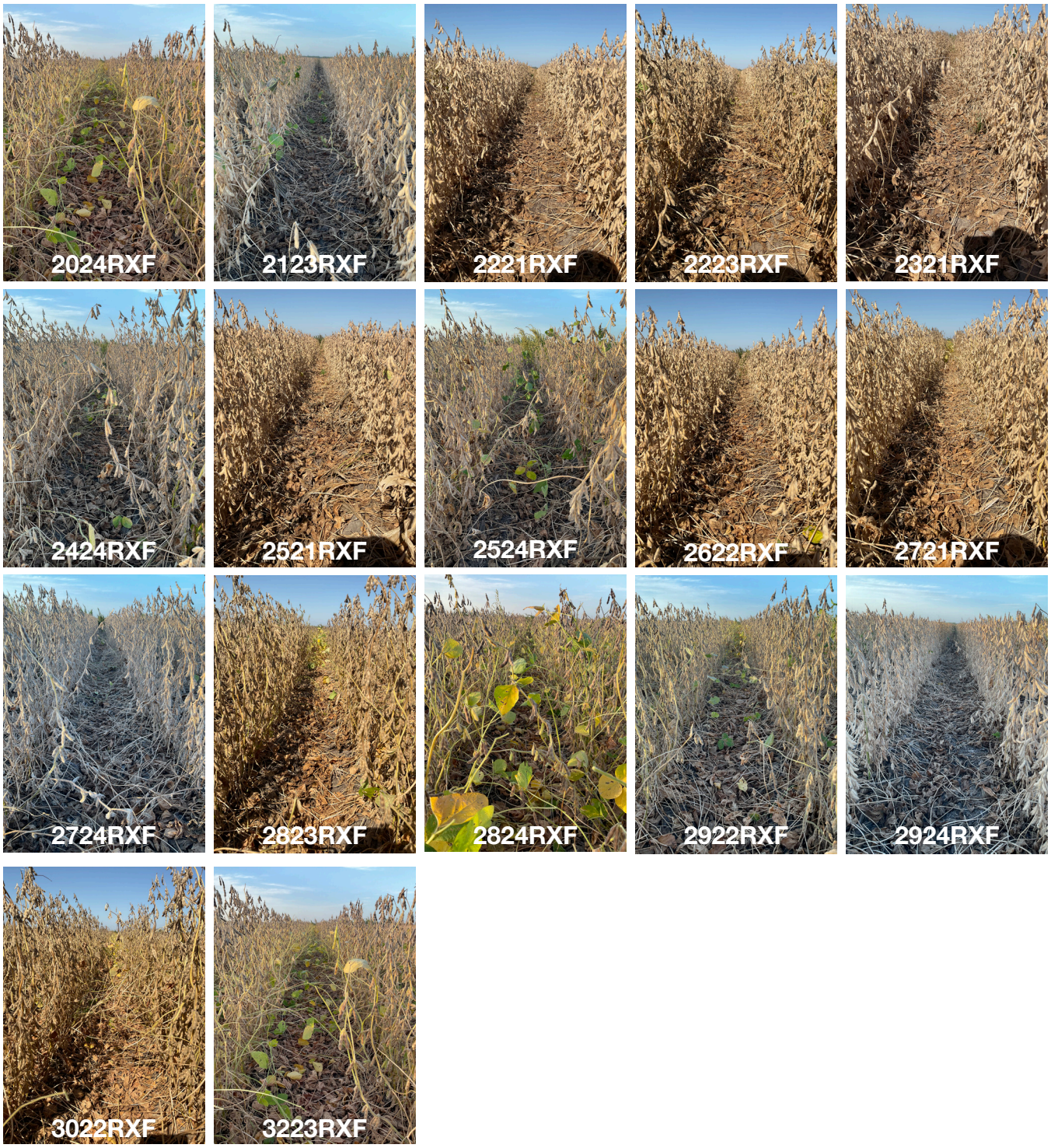

Figure 1. Side-by-side comparison of all Channel® brand products tested in no-till and cover crops at the Gothenburg Learning Center in 2023. Pictures taken on October 1, 2023.

Channel® Brand Soybean Product Comparisons Following Cover Crop Mix

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Research Report / Effect of Vertical Tillage on Corn and Soybean Grain Yield

Trial Objective

- Possible benefits of vertical tillage include improvements in seedbed, root growth, and water infiltration while preventing compaction layers in the soil profile.
- Vertical tillage can also help with residue management, especially in reduced tillage systems where the accumulation of biomass in the soil surface can impede the correct planter operation and keep soil temperatures lower, delaying emergence.
- The objective of these trials was to determine the effect of vertical tillage on corn and soybean yield compared to other tillage practices such as strip-till and no-till.

Experiment/Trial Design

Location	Soil Type	Crop	Tillage Type	Planting Date	Harvest Date	Potential Yield (bu/acre)	Seeding Rate (seeds/acre)	Previous Crop
Gothenburg, NE	Hord silt loam	Corn	Varied	05/30/2023	10/19/2023	240	32,000	Soybean
	Hord silt loam	Soybean	Varied	05/21/2023	09/27/2023	70	140,000	Corn

- The trial design was a randomized complete block with four replications and four tillage treatments:
  - » Vertical-till at 0 degrees gang angle
  - » Vertical-till at 6 degrees gang angle
  - » Strip-till
  - » No-till
- Both trials (corn and soybean) were planted next to each other using the same experimental design. The Bayer products used were a 111 relative maturity (RM) corn and a 2.5 maturity group (MG) soybean.
- Strip-till and vertical-till were conducted on 05/01/2023 and 05/03/2023, respectively, according to treatments.
- Zero to 3 inch and 3 to 6 inch composite soil samples were taken from each plot in the corn experiment on 05/22/2023 (Table 1).
- The trial received a 2 x 2 starter fertilizer application of 29 lb/acre nitrogen (N), 60 lb/acre P_2O_5, 25 lb/acre sulfur (S), and 0.25 lb/acre zinc (Zn) at planting across all treatments. Both crops were planted in 30 inch rows.
- Nitrogen was side-dressed across all corn plots using 360 Y-DROP® nozzles at a rate of 150 lb/acre on 06/21/2023.
- Two pictures per plot were taken at planting on the corn experiment for soil coverage classification. The software used was the Stover App from Kansas State University.
- Weeds were uniformly controlled with herbicides and no other pesticides were applied.
- Plots were combine-harvested with grain moisture content, test weight, and total weight collected. Statistical analysis for Fisher's Least Significant Difference was performed.

Effect of Vertical Tillage on Corn and Soybean Grain Yield

Understanding the Results

Corn trial

- Several soil test results were affected by tillage treatment, especially in the first 0 to 3 inches of soil. Soil samples were taken 19 to 21 days after the tillage operation (Table 1).
- With more soil disturbance (strip-till and vertical-till at 6 degrees) there was higher nitrogen mineralization. However, increases in phosphorus and potassium levels were only seen under strip-till.

Table 1. Soil sample results in the corn trial 19 to 21 days after tilled (0 to 3 inches and 3 to 6 inches).

Depth	Treatment	Organic Matter LOI (%)	Nitrate-Nitrogen (ppm)	Phosphorus Mehlich-III (ppm)	Potassium (ppm)	Sulfate-Sulphur (ppm)
0–3 in.	Vertical-till 0°	4.6	21.2	31.8	559	8.6
	Vertical-till 6°	4.6	34.8	35.5	551	10.2
	Strip-till	4.9	41.3	51.5	626	10.4
	No-till	4.6	18.1	33.8	512	9.2
	LSD (0.1)	NS*	10.1	9.7	52	NS*
3–6 in.	Vertical-till 0°	3.5	14.8	13.8	398	8.1
	Vertical-till 6°	3.6	20.6	12.3	388	8.3
	Strip-till	3.6	23.0	15.5	433	8.1
	No-till	3.6	15.1	12.3	397	7.1
	LSD (0.1)	NS*	NS*	2.2	NS*	NS*

*ANOVA not significant ($p > 0.10$)

- The average percentage of soil covered by residue was similar under no-till (66%) and vertical-till at 0 degrees (69%) (Figure 1). Tilling with no angle cut the residue but most of it was left on the surface.
- A statistically significant difference was observed when comparing residue coverage between vertical-till settings. Plots tilled at 6 degrees had less than half of the residue coverage compared to the same equipment but at 0 degrees (28% and 69%, respectively).
- Although no statistically significant effects were found on corn yield between tillage treatments (Figure 3), yield was numerically the highest on plots where vertical-till was done at a gang angle of 0 degrees (198.5 bu/acre). The lowest average yields were achieved using the same equipment but at 6 degrees (179.4 bu/acre). It is important to select the appropriate equipment settings depending on the specific objective.
- Corn yield was on average 8.7 bu/acre higher under no-till compared to strip-till.
- Soil nutrient differences observed between tillage treatments early in the season (Table 1) did not impact in yield. It is important to notice that those lower levels in plots with less soil disturbance were still sufficient to sustain early plant growth. Also, all plots received starter fertilizer at planting.
- No statistically significant results were obtained when looking at corn plant heights at the V5 to V6 growth stage (Figure 4). Corn plants tended to be taller in vertical tilled plots with a gang angle of 6 degrees (24.3 inches). Strip-till and no-till obtained similar plant heights (23.5 and 23.2 inches, respectively) but slightly lower than vertical-till at 6 degrees. The shortest plants were measured under vertical-till at 0 degrees (22.2 inches).

Effect of Vertical Tillage on Corn and Soybean Grain Yield

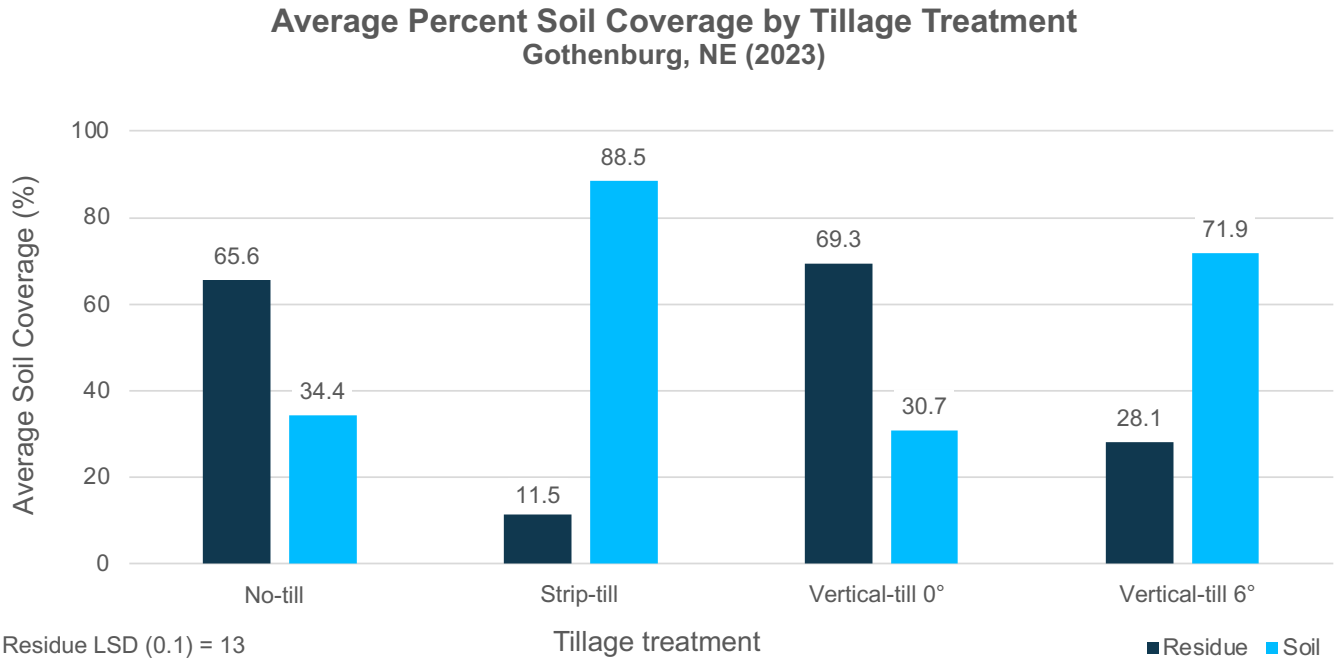

Figure 1. Average soil coverage as affected by tillage at planting at the Bayer Water Utilization Learning Center, Gothenburg, NE (2023).

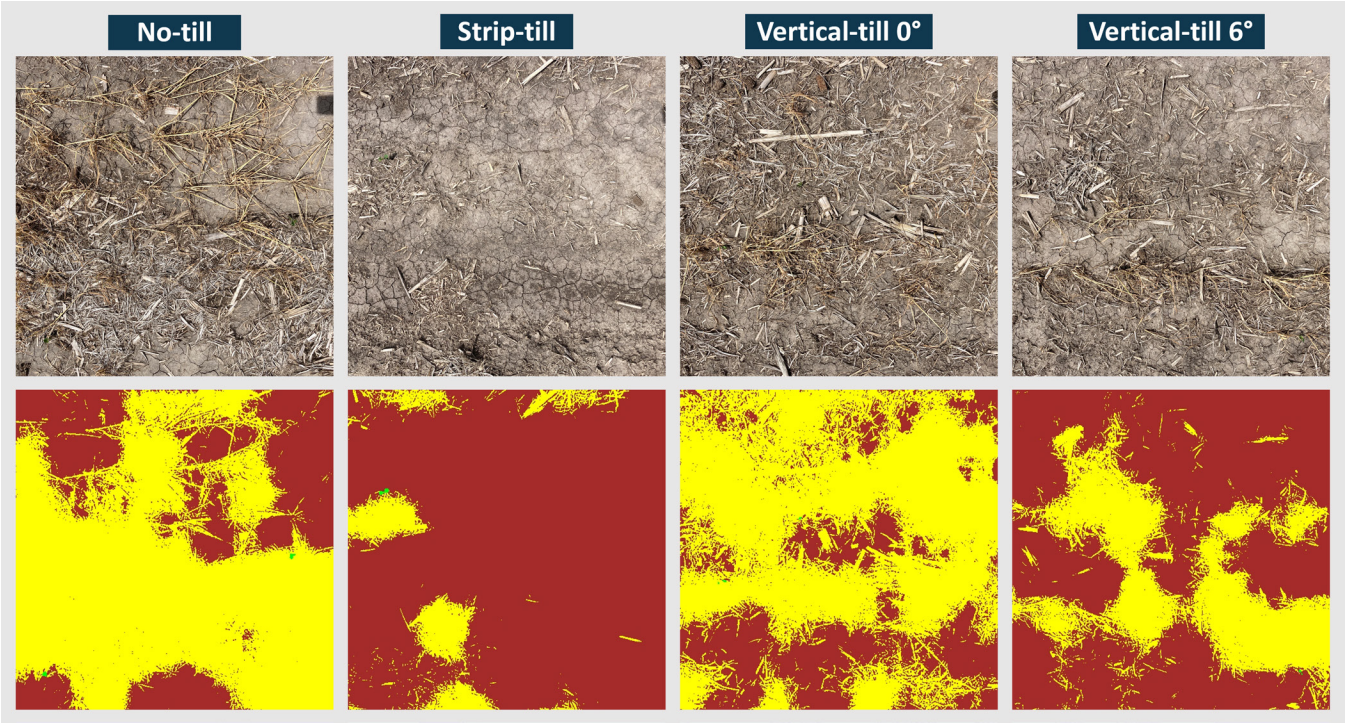

Figure 2. A sample of images taken at planting from the four tillage treatments classified using the Stover App. Yellow represents residue cover.

Effect of Vertical Tillage on Corn and Soybean Grain Yield

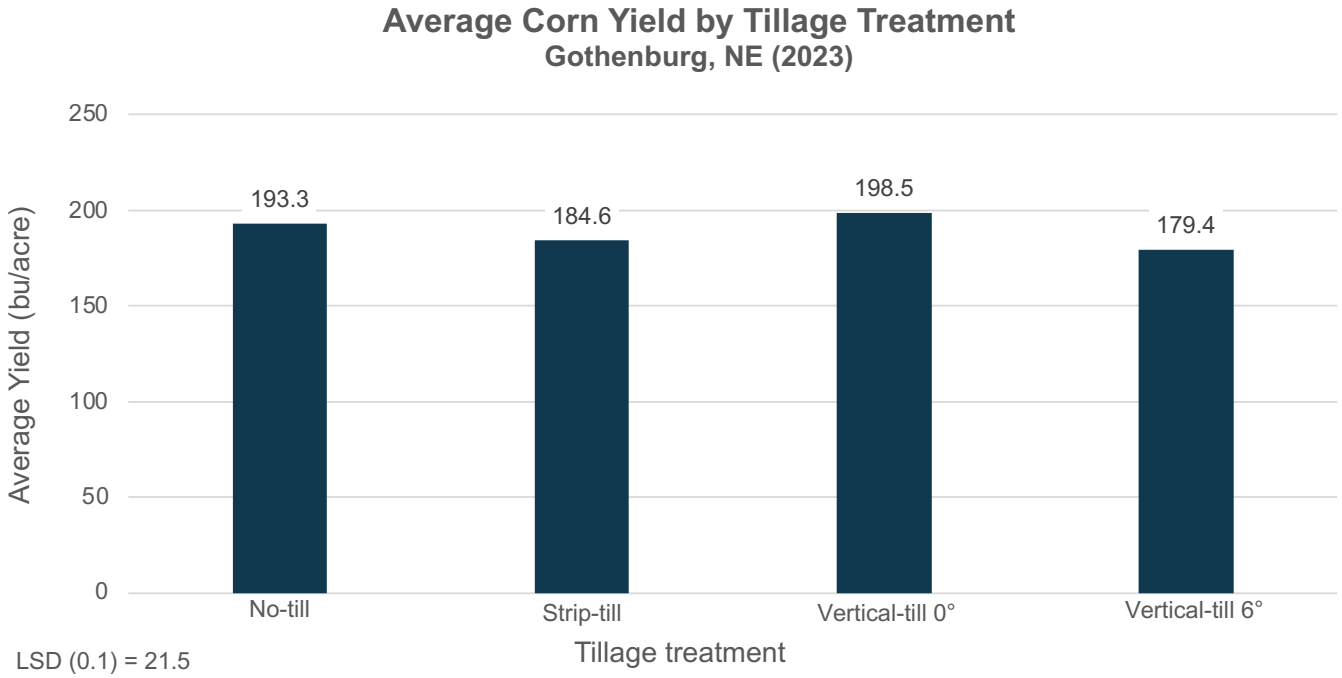

Figure 3. Average corn yields as impacted by tillage at the Bayer Water Utilization Learning Center, Gothenburg, NE (2023).

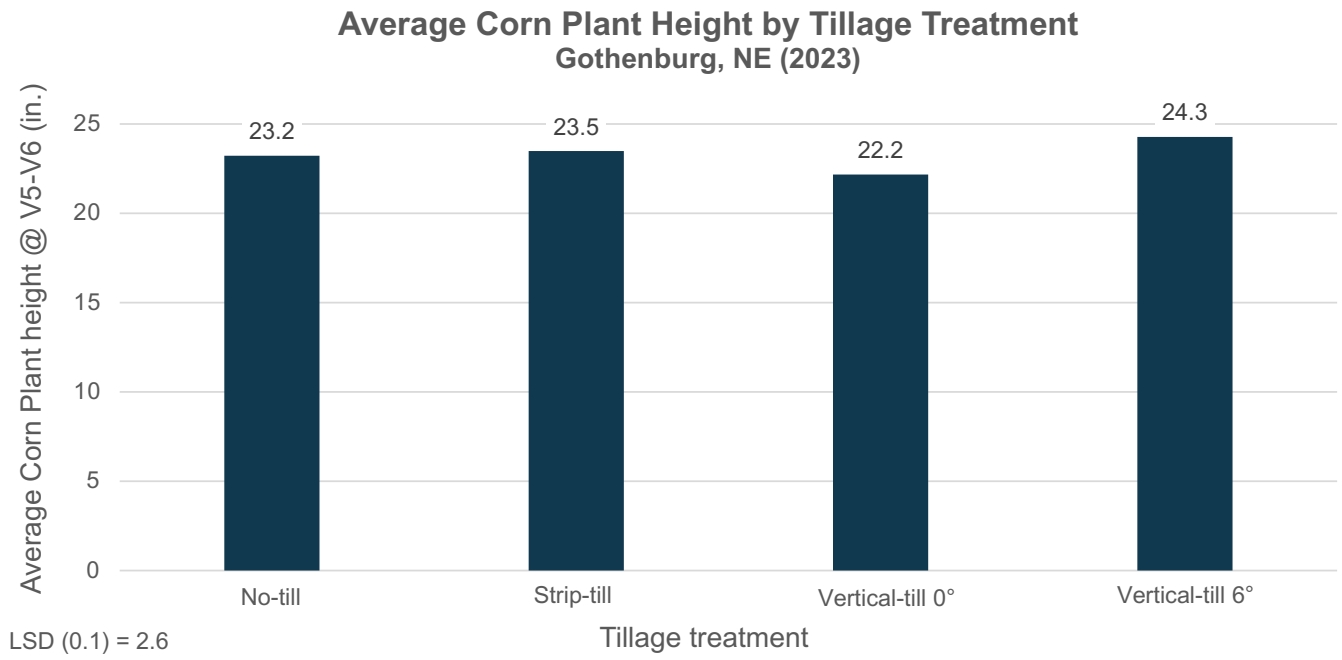

Figure 4. Average plant height at the V5 to V6 growth stage as impacted by tillage at the Bayer Water Utilization Learning Center, Gothenburg, NE (2023).

Effect of Vertical Tillage on Corn and Soybean Grain Yield

Soybean trial

- The effects on average soybean yield between tillage treatments were similar to the effects observed in the corn trial. Vertical-till plots at 0 degrees obtained the highest yield (48.3 bu/acre) but the difference was not statistically significant (Figure 5).
- Small differences in soybean yield were observed between no-till, strip-till, and vertical-till at 6 degrees.

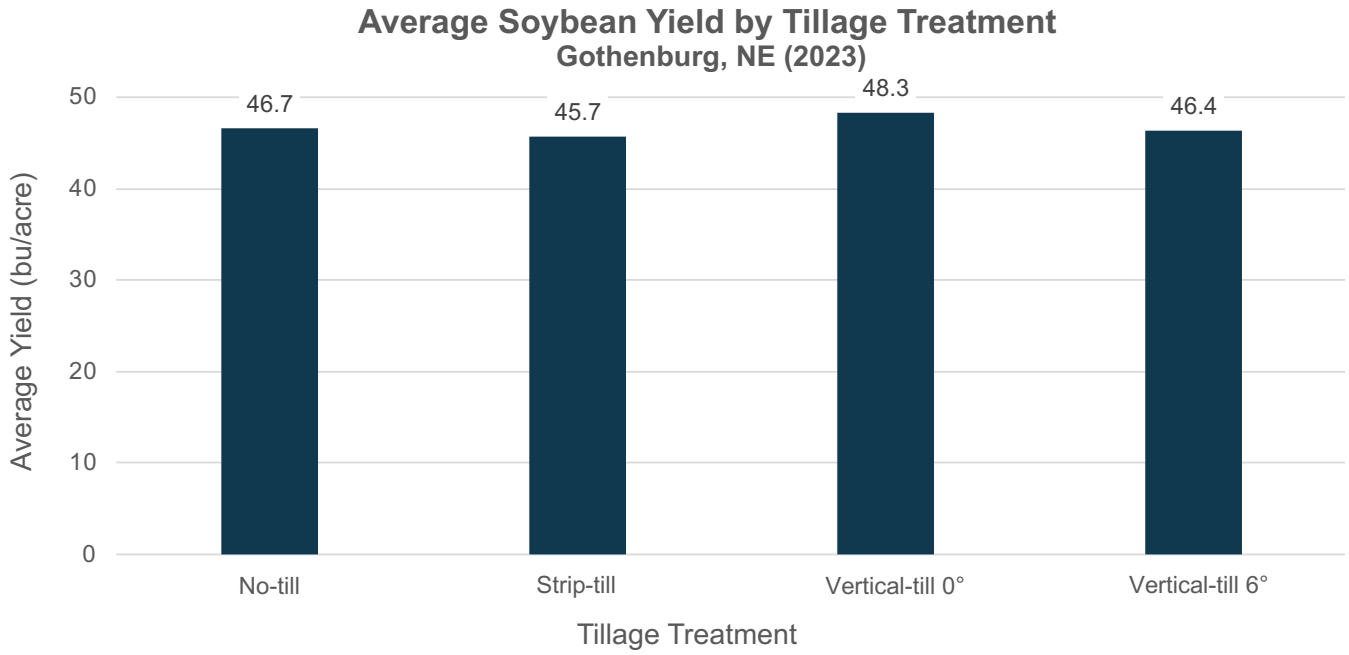

Figure 5. Average soybean yields as impacted by tillage at the Bayer Water Utilization Learning Center, Gothenburg, NE (2023).

Effect of Vertical Tillage on Corn and Soybean Grain Yield

Key Learnings

- Vertical tillage at a gang angle of 0 degrees tended to obtain the highest yields in both corn and soybean studies, though the result was not statistically significant. No numerical yield advantage was detected in plots where the equipment was set up at 6 degrees.
- Nutrients such as nitrogen were more available at planting in tilled plots. The effect was more noticeable under strip-till and vertical-till at 6 degrees. However, this availability did not impact the average yield in these experiments.
- The percentage of soil that was covered by residue at planting was similar in plots under vertical-till and no-till. Residue cover is important when preventing wind and water erosion.
- More research is needed to assess the long-term impacts of vertical tillage on soil test properties.

Legal Statements

Research Report / Dryland Corn Production Decisions Impact on Potential Yield and Profit

Trial Objective

- Testing dryland production systems is crucial to understanding how to manage corn under environmental conditions to meet the farmer's needs and achieve a successful outcome.
- The objective was to establish a long-term study of how management practices (i.e., cover crops, crop rotation, maturity selection, planting rate, and tillage practices) influence productivity in tough dryland environments.

Experiment/Trial Design

Location	Soil Type	Previous Crop	Tillage Type	Planting Date	Harvest Date	Potential Yield (bu/acre)	Seeding Rate (seeds/acre)
Gothenburg, NE	Hord silt loam	Corn	No-till, Strip-till, Conventional	05/04/2023	09/18/2023	180	16,000 & 24,000

- The trial was arranged as a split-split plot with tillage as the main plot and corn product as the sub-plot. The trial had two replications, four tillage systems, four corn products with relative maturities (days) of 95, 103, 109, and 115, and two planting rates (seeds/acre).
- A rye cover crop was planted in early spring of 2023. However, establishment of the cover crop prior to planting the corn was poor.
- Tillage treatments were completed on 05/02/2023 with 29 lb nitrogen/acre, 60 lb phosphorus/acre, and 25 lb sulfur/acre incorporated through strip-tillage, surface applied for no-till, or incorporated in conventionally tilled treatments.
- The corn products were planted on 05/04/2023 at 16,000 and 24,000 seeds/acre into 70 x 10 ft plots on a 30-inch wideow spacing.
- On 05/30/2023, pre-emerge herbicides were applied consisting of Roundup PowerMAX® 3 Herbicide (30 fl oz/acre), Atrazine 4L Herbicide (32 fl oz/acre), Harness® Herbicide (32 fl oz/acre), Balance® Flexx herbicide (5 fl oz/acre), and DiFlexx® herbicide (8 fl oz/acre).
- On 06/15/2023, a sidedress application of 32-0-0 was applied at a rate of 120 lb nitrogen/acre.
- On 06/15/2023, post emergence herbicides were applied consisting of Laudis® herbicide (3 fl oz/acre), Atrazine 4L Herbicide (32 fl oz/acre), Harness® Herbicide (24 fl oz/acre), and DiFlexx® herbicide (12 fl oz/acre).
- Final stand counts, intactness ratings, lodged plants, and ear height were measured at harvest time.
- The total rainfall accumulated during the 2023 corn-growing season was 13.5 inches.
- Study was harvested on 09/18/2023 for total plot weight, test weight, and moisture content.

Dryland Corn Production Decisions Impact on Potential Yield and Profit

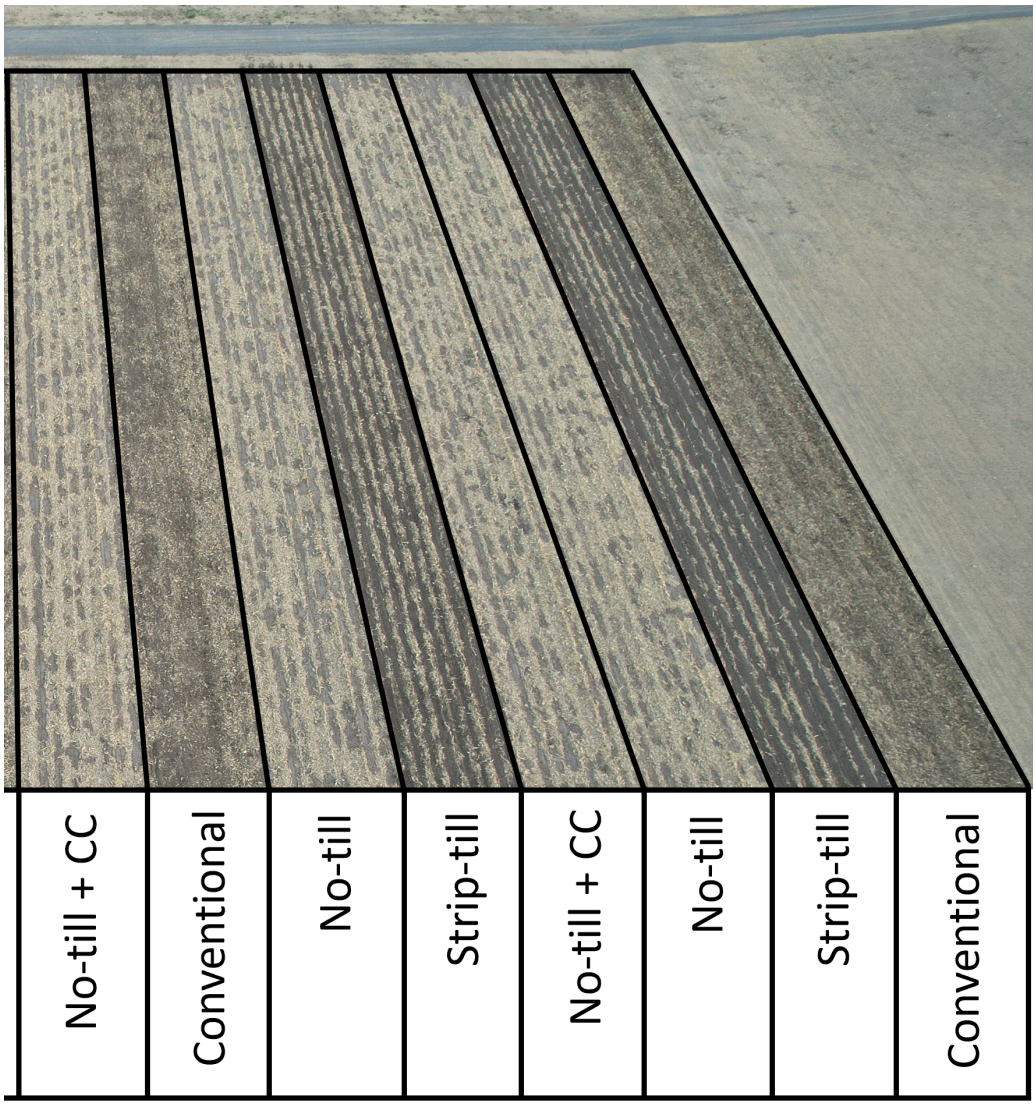

Figure 1. Tillage strips set up for planting. Note that the cover crop (CC) strips have limited growth because they were seeded in the spring rather than fall.

Table 1. Relative Maturity and Trait of the Four Corn Products Planted.	
Product Relative Maturity (days)	**Product Trait**
95	VT Double PRO® RIB Complete® corn blend
103	SmartStax® RIB Complete® corn blend
109	DroughtGard™ Hybrids with VT Double PRO® RIB Complete® corn blend
115	DroughtGard™ Hybrids with VT Double PRO® RIB Complete® corn blend

Dryland Corn Production Decisions Impact on Potential Yield and Profit

Understanding the Results

- At an average of 202.4 bu/acre, the 109 RM product had the highest yield of any corn product (Figure 2). Compared to the other products in this study the 109 RM product was 42.1, 26.3, and 29.9 bu/acre greater than the 95 RM, 103 RM, and 115 RM products, respectively.

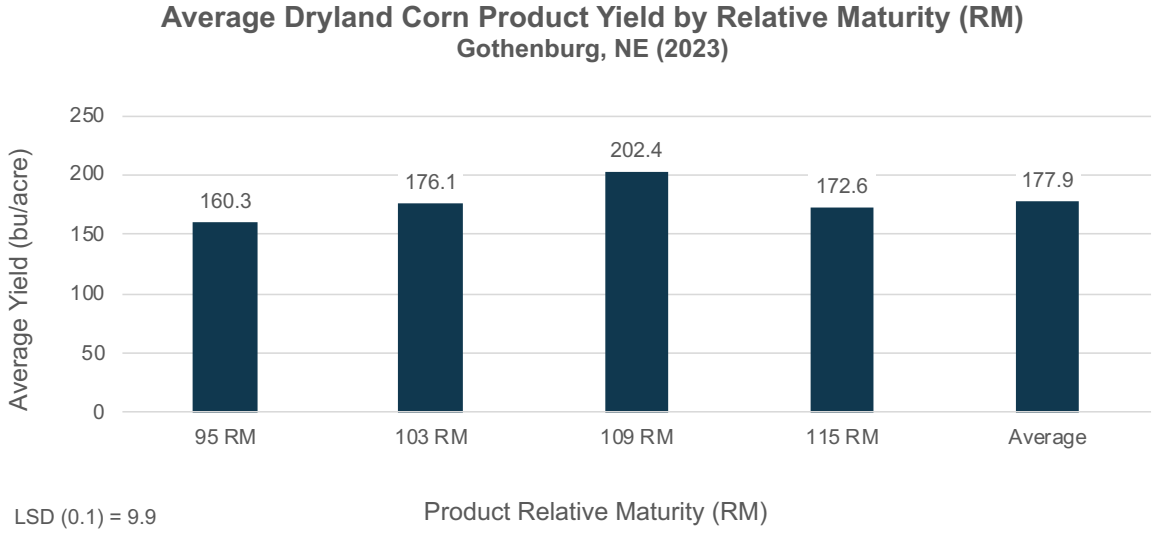

Figure 2. Average yield of corn products by relative maturity.

- The conventional tillage treatment averaged the highest overall yield at 180.9 bu/acre (Figure 3). This was not significantly different compared to the no-till treatment (178.91 bu/acre). Conventional tillage treatments did have a significant yield advantage over no-till + cover crop and strip-till treatments averaging greater than 5 bu/acre more.

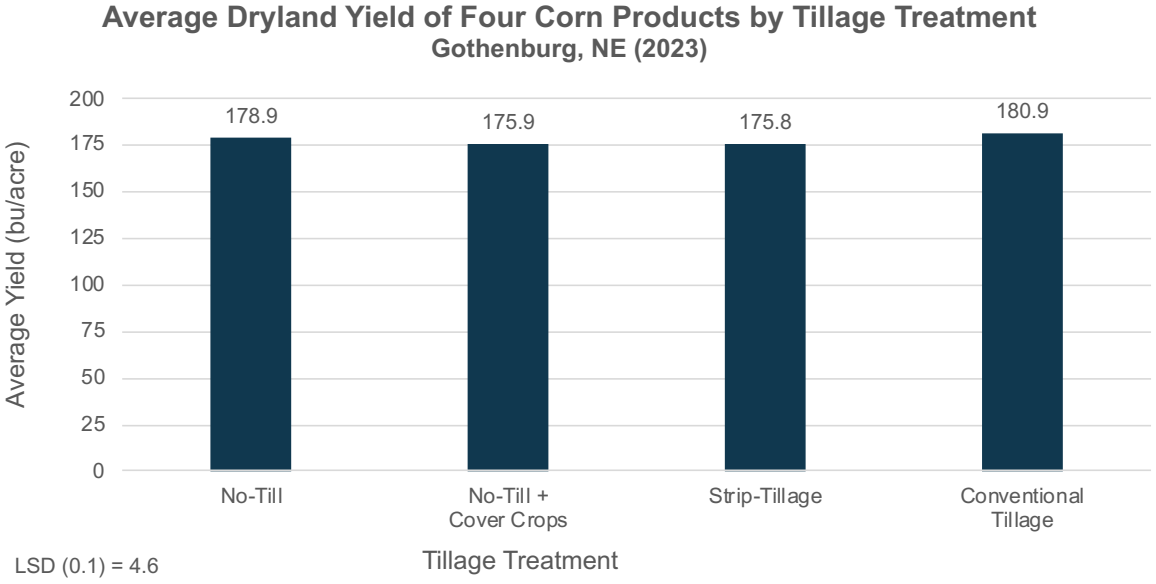

Figure 3. Average yield (bu/acre) of four corn products by tillage treatment.

Dryland Corn Production Decisions Impact on Potential Yield and Profit

- Increasing seeding rates from 16,000 to 24,000 seeds/acre provided a significant yield increase of 38.3 bu/acre averaged across the four products. (Figure 4)

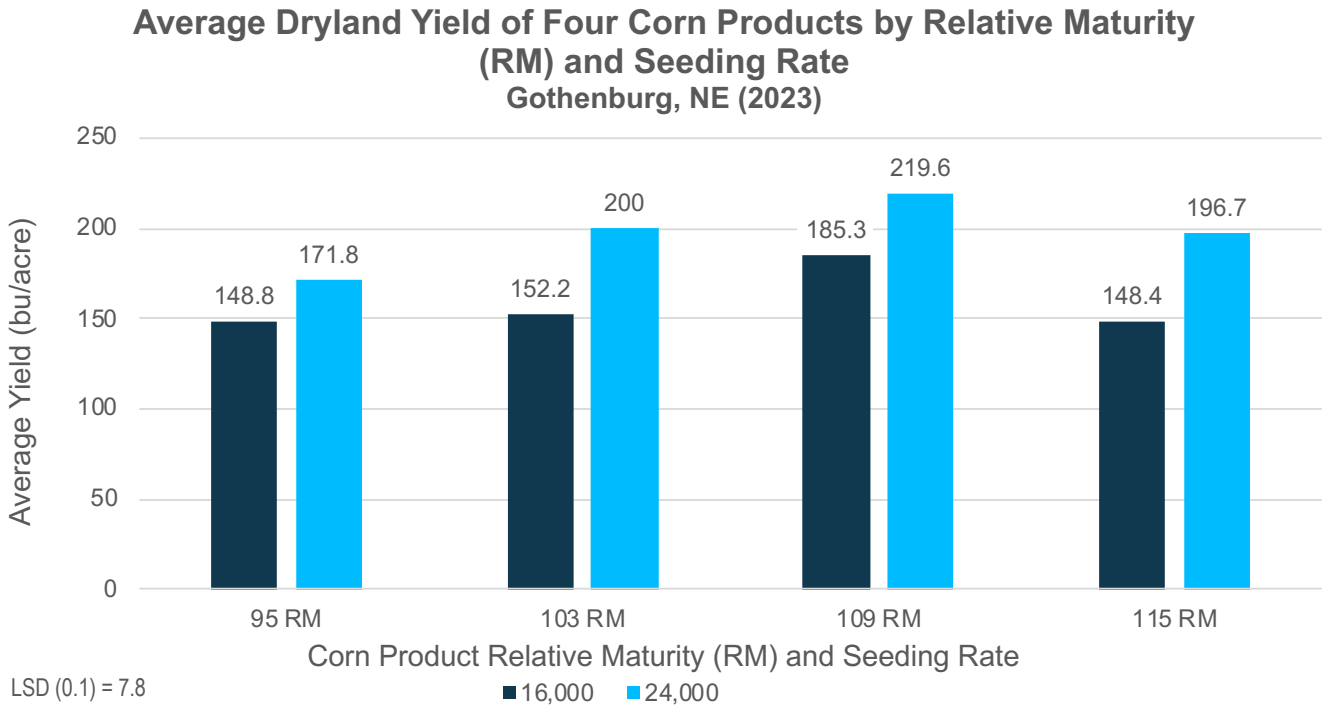

Figure 4. Average yield of four corn products by relative maturity and two seeding rates.

- Except for the 95 RM product, treatments seeded at 24,000 seeds/acre were one to two percent drier at harvest than the 16,000 seeds/acre treatments (Table 2).

Dryland Corn Production Decisions Impact on Potential Yield and Profit

Table 2. Harvest Data

Product Relative Maturity	Tillage	Seeding Rate (seeds/acre)	Harvest Population (plants/acre)	Moisture Content (%)	Average Yield (bu/acre)	Yield Delta (bu/acre)
95	No-Till	16,000	14,455	12.4	143.5	--
		24,000	21,619	13.4	176.3	+ 32.8
	No-Till + Cover Crop	16,000	14,197	12.5	145.9	--
		24,000	22,006	12.3	183.1	+37.2
	Strip-Till	16,000	14,778	12.3	146.9	--
		24,000	22,393	12.5	163.3	+ 16.4
	Conventional	16,000	14,261	12.9	159.0	--
		24,000	21,038	12.3	164.6	+ 5.6
103	No-Till	16,000	15,165	16.9	153.0	--
		24,000	22,458	14.6	197.6	+ 44.6
	No-Till + Cover Crop	16,000	14,972	17.5	156.7	--
		24,000	22,780	13.9	194.5	+ 37.8
	Strip-Till	16,000	15,488	16.8	149.3	--
		24,000	23,103	13.8	201.8	+52.5
	Conventional	16,000	15,811	15.6	149.9	--
		24,000	23,167	13.8	206.9	+ 57.0
109	No-Till	16,000	15,165	20.8	188.4	--
		24,000	22,070	18.8	229.6	+ 41.2
	No-Till + Cover Crop	16,000	15,359	20.4	190.1	--
		24,000	23,232	18.0	223.0	+32.9
	Strip-Till	16,000	14,972	18.8	175.2	--
		24,000	22,070	16.7	205.7	+ 30.5
	Conventional	16,000	15,746	18.5	187.5	--
		24,000	23,555	16.6	220.1	+ 32.6
115	No-Till	16,000	14,197	21.4	147.9	--
		24,000	20,844	21.5	195.9	+ 48.0
	No-Till + Cover Crop	16,000	13,939	22.1	144.3	--
		24,000	21,038	21.5	169.3	+ 25.0
	Strip-Till	16,000	15,488	21.9	152.1	--
		24,000	23,038	20.8	212.0	+ 59.9
	Conventional	16,000	14,907	21.5	149.4	--
		24,000	23,103	19.8	209.8	+ 60.4
Products Combined	No-Till	16,000	14,746	17.9	158.2	--
		24,000	21,748	17.1	199.9	+ 41.7
	No-Till + Cover Crop	16,000	14,617	18.1	159.3	--
		24,000	22,264	16.4	192.5	+ 32.2
	Strip-Till	16,000	15,181	17.5	155.9	--
		24,000	22,651	16.0	195.7	+ 39.8
	Conventional	16,000	15181	17.1	161.45	--
		24,000	22,716	15.6	200.35	+38.9

Dryland Corn Production Decisions Impact on Potential Yield and Profit

- Based on an average seed cost of $325/unit of seed (1 unit = 80,000 seeds), the cost of the seeding rate, and a $4.00/bu cash price, the increase in profitability was $120.90/acre for seeding at 24,000 seeds/acre instead of 16,000 seeds/acre when averaging the treatments (Table 3).

Table 3. Seeding Rate Profitability of 16,000 seeds/acre vs 24,000 seeds/acre. Gothenburg, NE.

	$3.077/bu[1]	$4.00/bu	$4.696/bu[1]	$5.00/bu	$6.00/bu	$8.135/bu[1]
	August 3, 2020	Cash Price	December 29, 2023	Cash Price	Cash Price	April 25, 2022
Net Profit 16,000 seeds/acre ($/acre)	$ 488.37	$ 634.76	$ 745.30	$ 793.45	$ 952.14	$ 1,290.94
Net Profit 24,000 seeds/acre ($/acre)	$ 606.39	$ 788.16	$ 925.42	$ 985.20	$ 1,182.24	$ 1,602.92
Gross Profit 16,000seeds/acre ($/acre)[2]	$ 423.37	$ 569.76	$ 680.30	$ 728.45	$ 887.14	$ 1,225.94
Gross Profit 24,000 seeds/acre ($/acre)[2]	$ 508.89	$ 690.66	$ 827.92	$ 887.70	$ 1,084.74	$ 1,505.42
Gross Profit Delta ($/acre)	$ 85.52	$ 120.90	$ 147.61	$ 159.60	$ 197.60	$ 279.48

[1]Corn prices taken from historical data from www.tradingeconomics.com/commodity/corn
[2]Gross Profit calculated as net profit minus seeding cost: seeding cost based on $325/unit (1 unit = 80,000 seeds), 16,000 seeds/acre Seed Cost = $65.00/acre, 24,000 seeds/acre Seed Cost = $97.50/acre

Key Learnings

- This study demonstrates a minor increase in seed cost can provide an exponential return on investment in tough acre situations.
- Tillage seemed to have little effect on the average corn yield in 2023.
- The 109 RM corn product was favored in 2023, but climate and weather conditions may change that outcome depending on the growing season.
- Product selection and placement for dryland environments is critical; therefore, please contact your local Bayer seed provider for local recommendations.
- This research will be continued in 2024 and will include continuous corn and rotated soybean-corn treatments.

Dryland Corn Production Decisions Impact on Potential Yield and Profit

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The recommendations in this material are based upon trial observations and feedback received from a limited number of growers and growing environments. These recommendations should be considered as one reference point and should not be substituted for the professional opinion of agronomists, entomologists or other relevant experts evaluating specific conditions.

IMPORTANT IRM INFORMATION: Certain products are sold as RIB Complete® corn blend products, and do not require the planting of a structured refuge except in the Cotton-Growing Area where corn earworm is a significant pest. Products sold without refuge in the bag (non-RIB Complete) require the planting of a structured refuge. **See the IRM/Grower Guide for additional information. Always read and follow IRM requirements.**

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Research Report / Tall and Short Stature Corn Agronomic Response to Nitrogen Rates

Trial Objective

- The optimum nitrogen (N) rate for corn can be difficult to determine, as different products can require different amounts of N. Inadequate N can cause a noticeable reduction in yield, whereas excess N can cause weak stalks and water quality risks.
- Short stature corn (SSC) is a new corn breeding innovation that will be part of the Preceon™ Smart Corn System set to launch in the United States within the next few years. SSC is intended to provide high-yielding corn with a shortened internode (the area between leaves), resulting in shortened corn height. Short stature corn will typically have a maximum height of seven feet and corn ear placement of at least two feet above the soil level.
- The reduced height of SSC is expected to decrease green snap and stalk lodging issues.
- The objective of this trial was to evaluate the effects of N rate on three commercially available corn products and three short stature corn (SSC) products.

Experiment/Trial Design

Location	Soil Type	Previous Crop	Tillage Type	Planting Date	Harvest Date	Potential Yield (bu/acre)	Seeding Rate (seeds/acre)
Gothenburg, NE	Hord Silt Loam	Corn	Strip-till	05/3/2023	10/19/2023	250	36,000

- The trial design was a split-plot with N fertilizer as the whole plot and corn product as the subplot, with four replications.
- A total of six N rates and six corn products were selected for this trial.
  - » N rates: 0, 60, 120, 180, 240, and 300 lb/acre
- Three tall corn products of 113 relative maturity (Tall-A, Tall-B, and Tall-C), and three short stature corn products of 110 to 113 relative maturity (SSC-A, SSC-B, and SSC-C) were evaluated.
- The nitrogen fertilizer used was 32-0-0 and was applied using the 360 Y-DROP® fertilizer tube attachments on 06/14/2023.
- Weeds were uniformly controlled with herbicides and no other pesticides were applied.
- Plant heights were measured at the R4 to R5 growth stage.
- Ear height, plant lodging, nitrogen stress, intactness, drought, and stay green ratings were collected close to harvest time.
- Plots were combine-harvested and total plot weight, test weight, and moisture measurements were collected.
- The grain yield was corrected to a standard moisture content of 15%.

Tall and Short Stature Corn Agronomic Response to Nitrogen Rates

Understanding the Results

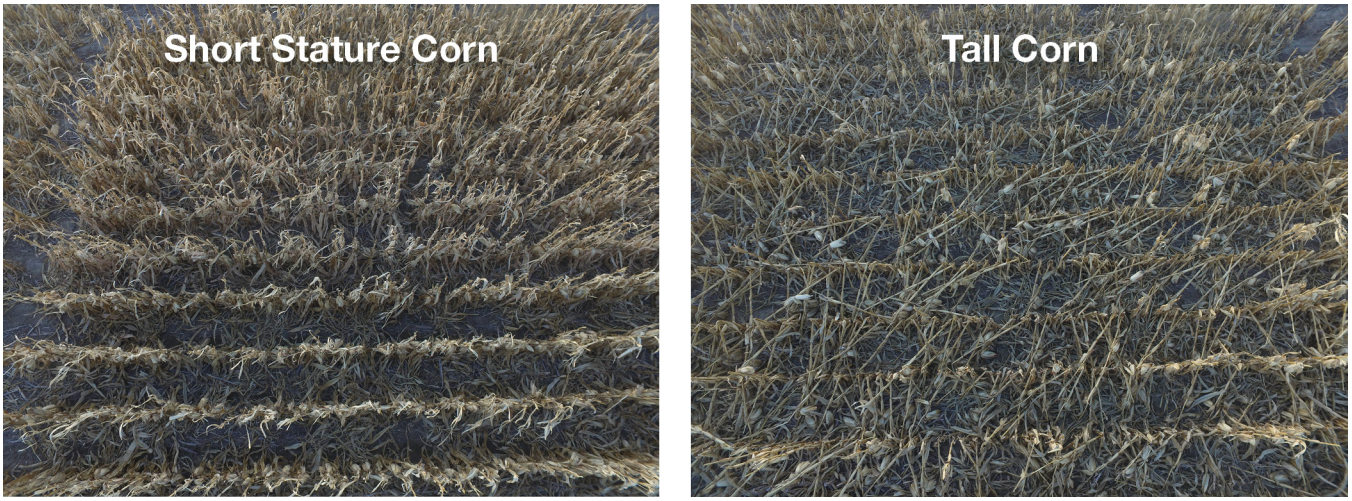

Figure 1. Plant lodging on short and tall stature corn. Pictures were taken on 11/15/2021 at the Water Utilization Learning Center in Gothenburg, Nebraska.

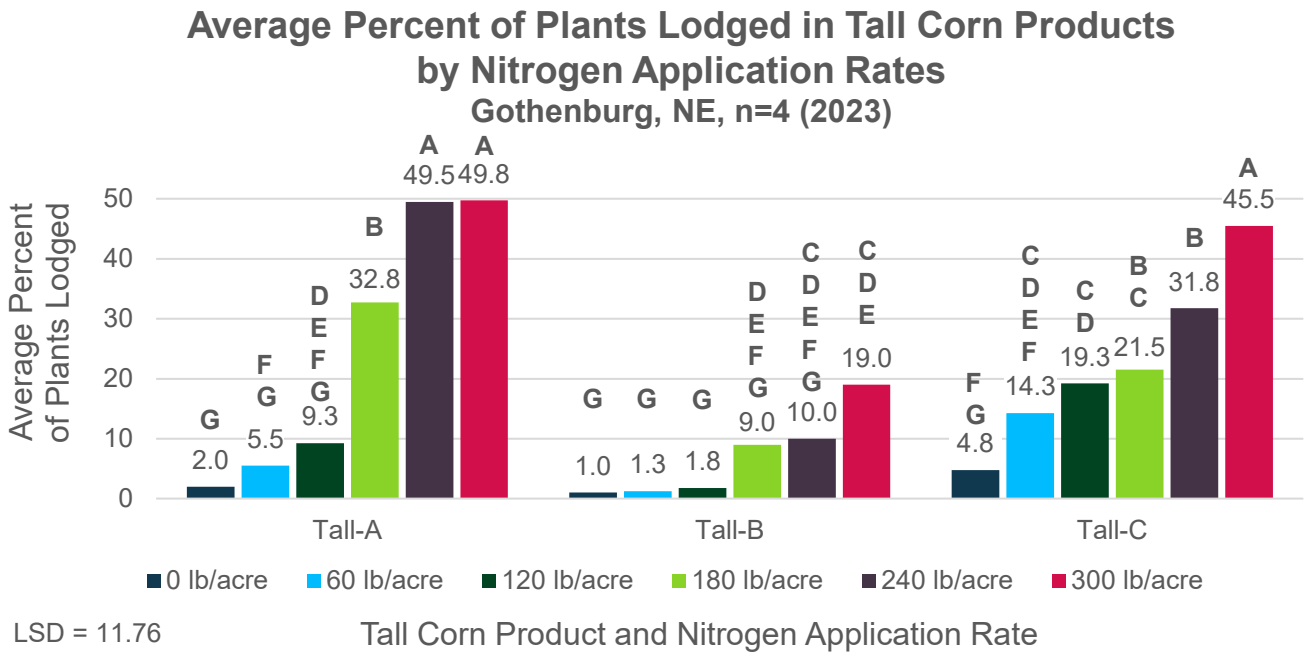

Figure 2A. Average rate of lodging by nitrogen treatment and corn product for tall products tested in Gothenburg, NE in 2023. Letters indicating statistical significance apply to Figures 2A and 2B.

Tall and Short Stature Corn Agronomic Response to Nitrogen Rates

- Lower nitrogen rates (0 to 120 lb/acre) resulted in reduced lodging for products Tall-A and Tall-B (Figure 2A).
- Lodging increased with higher nitrogen rates (180 to 300 lb N/acre), though the 180 lb/acre N treatment was not statistically different from 60 or 120 lb/acre in product Tall-C (Figure 2A).
- Nitrogen treatments had less of an effect on lodging in product Tall-B than they did on the other tall products, though the 300 lb/acre nitrogen rate still produced a significantly higher percentage of lodged plants in Tall-B (19%) than the 0 lb/acre nitrogen rate (1%) (Figure 2A).

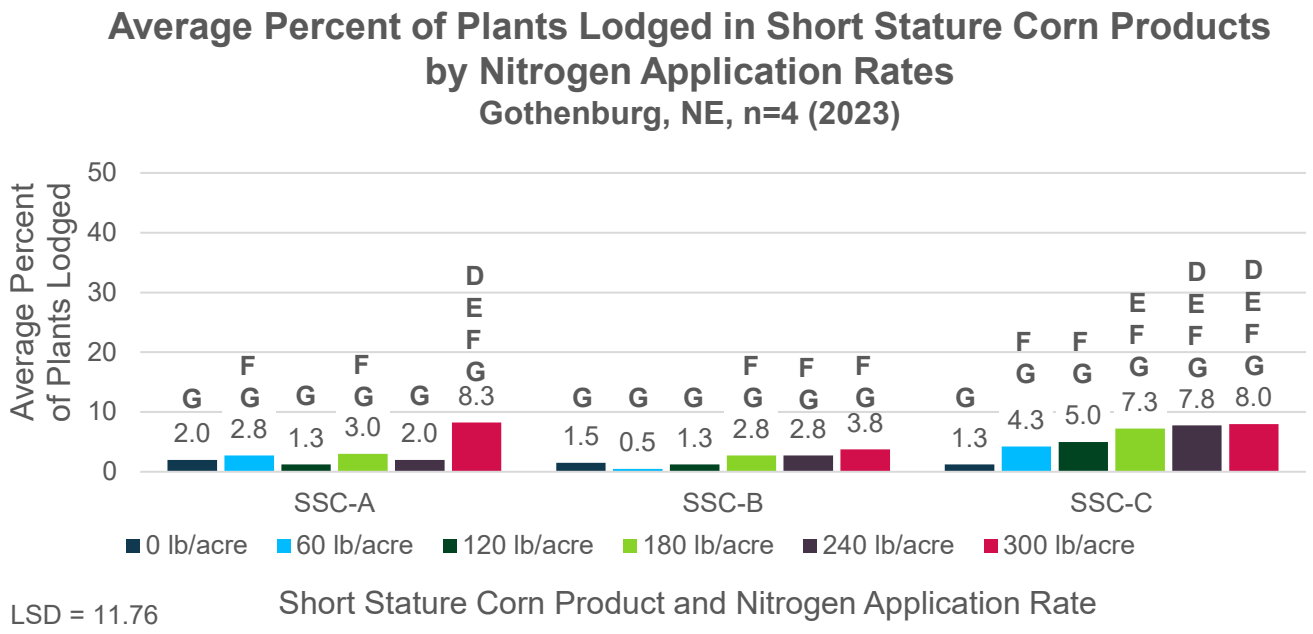

Figure 2B. Average rate of lodging by nitrogen treatment and corn product for short products tested in Gothenburg, NE in 2023. Letters indicating statistical significance apply to Figures 2A and 2B.

- In SSC products, no statistical difference was found between treatments regardless of nitrogen rate or product (Figure 2B).
- Lodging in all short corn products (Figure 2B) across all nitrogen rates (0 to 300 lb/acre) was not statistically different from all tall products (Figure 2A) within the 0 to 120 lb N/acre range.
- The 300 lb/acre nitrogen treatment did not produce significant differences in lodging between the Tall-B product (Figure 2A), the SSC-A product, and SSC-C product (Figure 2B).

Tall and Short Stature Corn Agronomic Response to Nitrogen Rates

Table 1. Corn parameters of nitrogen stress, intactness, drought, and stay green ratings organized by corn product.

Corn Product	Nitrogen Stress (1–9)	Intactness (1–9)	Drought (1–9)	Stay Green (1–9)	Plant Height (in.)	Ear Height (in.)
Tall-A	6.0 a	5.2 b	4.0 bc	5.9 a	—	—
Tall-B	6.2 a	4.1 d	4.1 b	5.8 a	—	—
Tall-C	5.7 a	6.0 a	4.7 a	5.9 a	—	—
SSC-A	4.0 c	5.0 b	3.2 d	3.3 c	82 a	37.9 a
SSC-B	4.6 b	4.5 c	3.5 cd	3.5 c	62 c	23.9 c
SSC-C	5.0 b	5.3 b	3.6 bcd	4.3 b	74 b	31.2 b

The characteristic rating scale runs from 1-9; 1 to 2 is excellent, 3 to 4 is good, 5 to 6 is average, 7 to 8 is fair, and 9 is poor.
Numbers followed by letters indicate statistical difference at α = 0.1.

- Tall products showed greater nitrogen stress compared to short stature products (Table 1).
- In general, tall products showed greater drought stress compared to short stature products, except SSC-C which showed similar drought stress to Tall-A and Tall-B (Table 1).
- Short stature products had greater stay green than tall products (Table 1).
- There was a strong correlation between plant height and ear height (R2 = 0.99) for short stature corn products. SSC-A produced the largest average ear height (37.9 inches), followed by SSC-C (31.2 inches), and SSC-B produced the smallest average ear height (23.9 inches) (Table 1).

Table 2. Corn parameters of nitrogen stress, intactness, drought, and stay green ratings organized by nitrogen application rates.

Nitrogen Rates (lb/acre)	Nitrogen Stress (1–9)	Intactness (1–9)	Drought (1–9)	Stay Green (1–9)
0	4.2 d	4.2 d	3.4 de	3.8 c
60	4.8 bc	4.3 d	3.0 e	4.1 c
120	4.7 cd	4.8 c	3.6 cd	4.2 c
180	5.3 b	5.3 b	4.0 bc	5.0 b
240	6.0 a	5.7 a	4.5 ab	5.6 a
300	6.4 a	5.8 a	4.6 a	5.9 a

The characteristic rating scale runs from 1 to 9; 1 to 2 is excellent, 3 to 4 is good, 5 to 6 is average, 7 to 8 is fair, and 9 is poor.
Numbers followed by letters indicate statistical difference at α = 0.1.

- Higher nitrogen rates (180 to 300 lb/acre) produced poorer intactness and stay green. In addition, high nitrogen rates (240 to 300 lb/acre) increased drought stress (Table 2).
- The findings on the effects of nitrogen application rates on nitrogen stress, drought, and stay green can be justified by the hot and dry conditions found especially from August 10 to September 3 in Gothenburg, NE in 2023. Less nitrogen likely produced smaller plants, which required less water than larger plants to stay green and so experienced less drought stress.

Tall and Short Stature Corn Agronomic Response to Nitrogen Rates

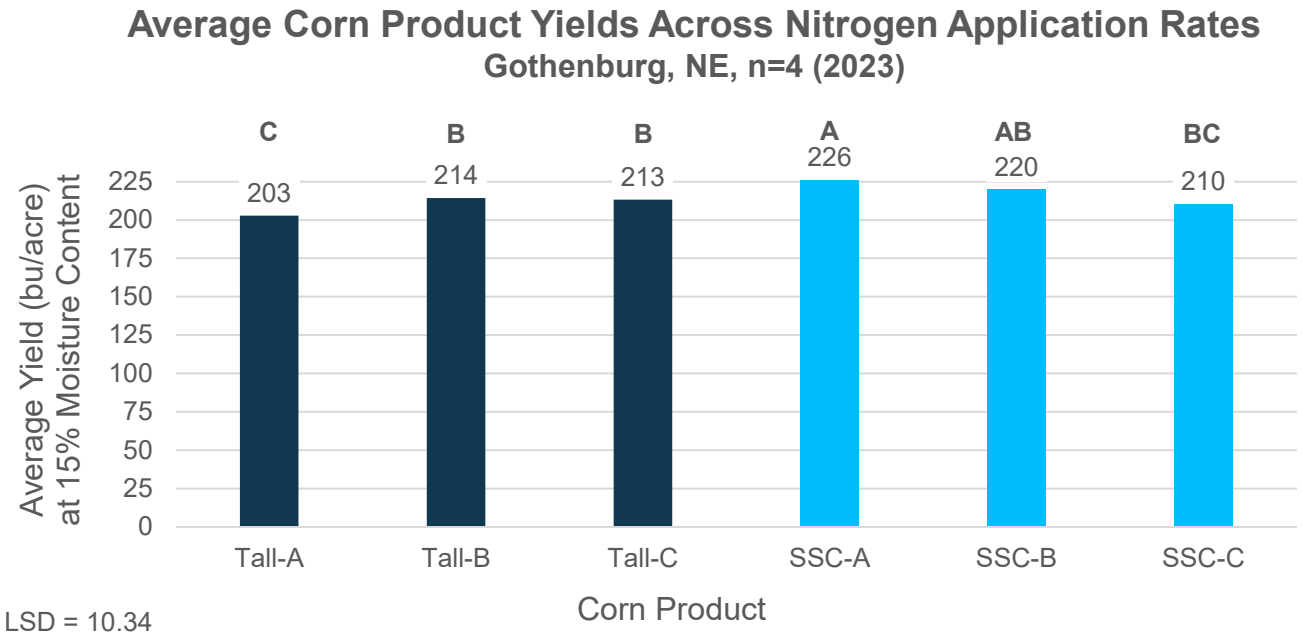

Figure 3. Yield produced by all corn products averaged across all nitrogen application rates tested in Gothenburg, NE in 2023.

- The average yield produced by short stature corn products (218.6 bu/acre) was numerically higher than that produced by tall corn products (210.1 bu/acre), but no statistical difference was found in this comparison (Figure 3).
- Short stature product SSC-A had the highest yield, though it was not statistically different from SSC-B (Figure 3).
- Two tall (Tall-B and Tall-C) and 2 short (SSC-B and SSC-C) products produced statistically similar average yields (Figure 3).
- The Tall-A product had the lowest overall average yield, though it was not statistically different from SSC-C (Figure 3).

Tall and Short Stature Corn Agronomic Response to Nitrogen Rates

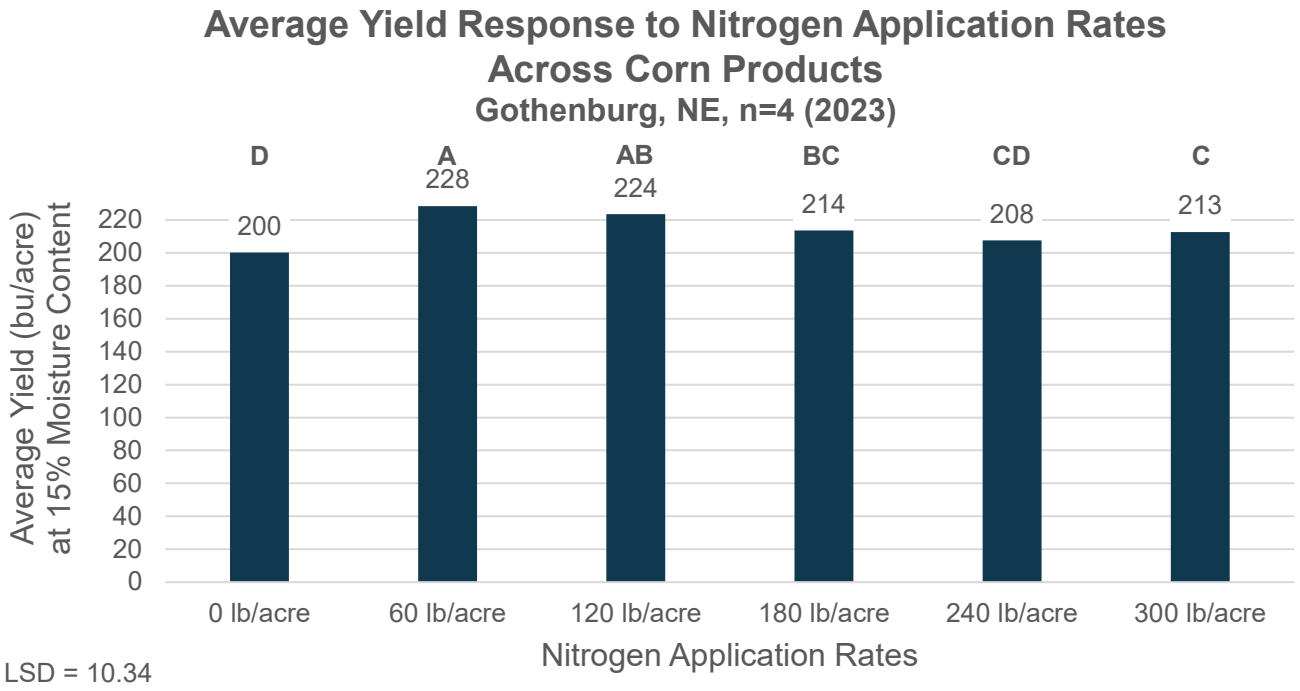

Figure 4. Yield produced by all nitrogen rates averaged across all corn products tested in Gothenburg, NE in 2023.

- The 60 lb N/acre rate had the numerically highest yield but it was not statistically different from the 120 lb N/acre rate (Figure 4).
- Higher N rates (180, 240, and 300 lb/acre) had an intermediate effect on yield and were not statistically different from one another (Figure 4).
- The 0 lb N/acre rate had the lowest yield. It produced an average of 28.4 bu/acre less than the highest-yielding nitrogen rate (60 lb/acre) and 7.7 bu/acre less than the second lowest-yielding nitrogen rate 240 lb/acre), but it was not statistically different from the 240 lb N/acre rate (Figure 4).

Key Learnings

- Short stature corn was less prone to lodging when compared to tall corn regardless of the nitrogen rate used. In addition, short stature corn showed less N stress, had greater stay-green scores, and had the potential to show less drought stress than some tall corn products.
- Short stature corn could be a great alternative for farmers located in regions with a high risk of plant lodging and environments that may respond to increments in N application.
- Higher nitrogen rates do not always show a corresponding yield increase and certain parameters such as corn product characteristics, population, precipitation, soil type, crop rotation, and management practices should be considered when applying fertilizer.
- Carefully matching nitrogen rate with corn product, yield potential, soil moisture conditions, and residual soil nitrogen is key to maximizing the potential benefit of N fertilizer while minimizing potential drawbacks.

Tall and Short Stature Corn Agronomic Response to Nitrogen Rates

Legal Statements

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

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The Preceon™ Smart Corn System, including short stature corn developed through traditional breeding, is expected to be available, subject to final commercialization decisions, for planting in the 2024 growing season. Short stature corn developed through biotechnology is not currently available for commercial sale or commercial planting. Commercialization is dependent on multiple factors, including successful conclusion of the regulatory process. The information presented herein is provided for educational purposes only, and is not and shall not be construed as an offer to sell.

Performance may vary, from location to location and from year to year, as local growing, soil and environmental conditions may vary. Growers should evaluate data from multiple locations and years whenever possible and should consider the impacts of these conditions on their growing environment.

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Research Report / Understanding the Role of Biological Products in Corn Nitrogen Fertilization

Trial Objective

- Biological products may offer environmentally friendly and sustainable solutions to enhance crop productivity, improve soil health, and manage pests and diseases. These products include beneficial bacteria, plant extracts, beneficial viruses, and other compounds.
- The objective of this trial was to test emerging biological products that enhance nitrogen uptake by corn plants, thereby decreasing the plants' synthetic nitrogen fertilizer needs.

Experiment/Trial Design

Location	Soil Type	Previous Crop	Tillage Type	Planting Date	Harvest Date	Potential Yield (bu/acre)	Seeding Rate (seeds/acre)
Gothenburg, NE	Hord Silt Loam	Corn	Conventional	05/21/2023	10/09/2023	220	32,000

- The trial was arranged as a randomized complete block design with three replications and two treatment factors (Figure 1):
  - » Nitrogen Rates:
    - – 0 lb/acre
    - – 100 lb/acre
    - – 200 lb/acre
  - » Biological Nitrogen Products:
    - – no product
    - – Pivot Bio biological product PROVEN® 40 On-Seed (biological fertilizer seed treatment)
    - – Sound Agriculture biological product SOURCE® (soil activator)

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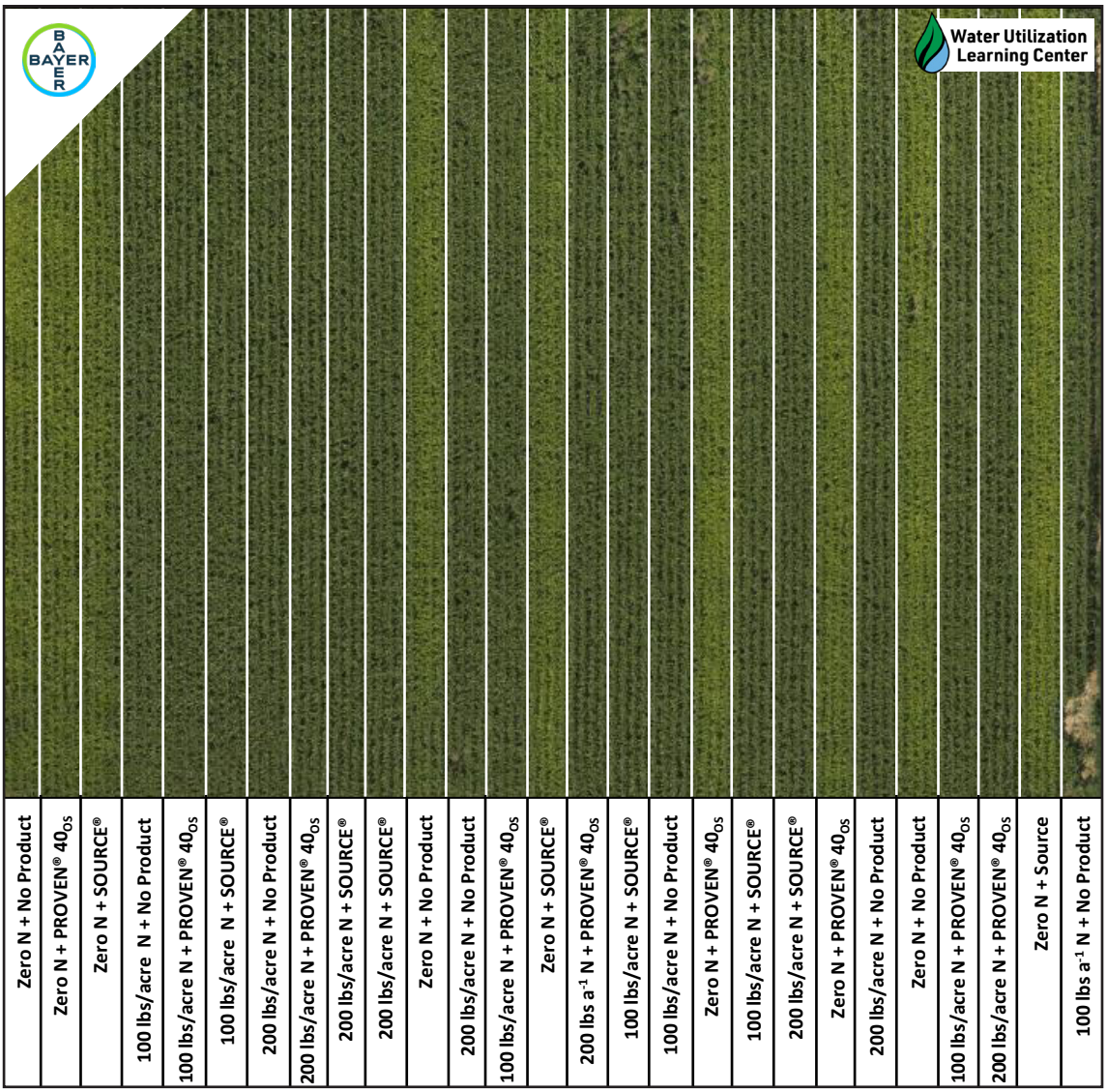

Figure 1. Aerial image of corn, nitrogen rates, and biological products trial in Gothenburg, NE. Note the light green strips where no nitrogen (N) was applied. Picture taken on August 11, 2023.

- Soil was conventionally tilled with no base fertilizer application.
- On May 20, 2023, corn PRE herbicides were sprayed consisting of Roundup PowerMAX® 3 Herbicide (30 fl oz/acre), atrazine 4L (1 lb/acre), Harness® herbicide (32 fl oz/acre), Diflexx® herbicide (8 fl oz/acre), and Corvus® herbicide (5 fl oz/acre).
- 211-11SSPRIB brand corn (111 relative maturity) was planted on May 21, 2023, at a rate of 32,000 plants/acre into 190 ft by 10 ft strips.
- PROVEN® 40 On-Seed seed treatment was applied to seed according to the manufacturer's recommendation.

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- On June 7, 2023, corn POST herbicides were applied consisting of Roundup PowerMAX® herbicide (32 fl oz/acre), atrazine 4L herbicide (1 lb/acre), Harness® herbicide (24 fl oz/acre), Laudis® herbicide (3 fl oz/acre), Diflexx® herbicide (16 fl oz/acre) with high surfactant oil concentrate (HSOC) (0.5%), Volt-Edge™ a VaporGrip Xtra Agent volatility reduction agent (VRA) (0.5%), and a drift reduction agent (DRA) (0.5%).
- Nitrogen fertilization was applied with Y-drop equipment at the previously described treatment rates on June 13, 2023, at approximately the V4 corn growth stage.
- SOURCE® soil activator was sprayed at 0.7 fl oz per acre in a 10 gal water mix when the crop reached the V10 corn growth stage.
- The total rainfall accumulated during the 2023 corn growing season was 12.63 inches. This trial was implemented in a linear irrigation system, and the total irrigation applied was 4 inches.
- Normalized Difference Vegetation Index (NDVI) was collected when corn reached V4 and V6 corn growth stages using a handheld sensor over the corn canopy.
- Corn stand counts and phytotoxicity ratings were collected on July 6, 2023.
- Drought and stay green ratings were collected close to harvest time.
- Total weight, test weight, and moisture content were collected with a plot combine on October 9, 2023, and yield per acre was calculated later. Corn yield components were collected from six random ears from each plot in one replication.

Understanding The Results

Normalized Difference Vegetation Index (NDVI):

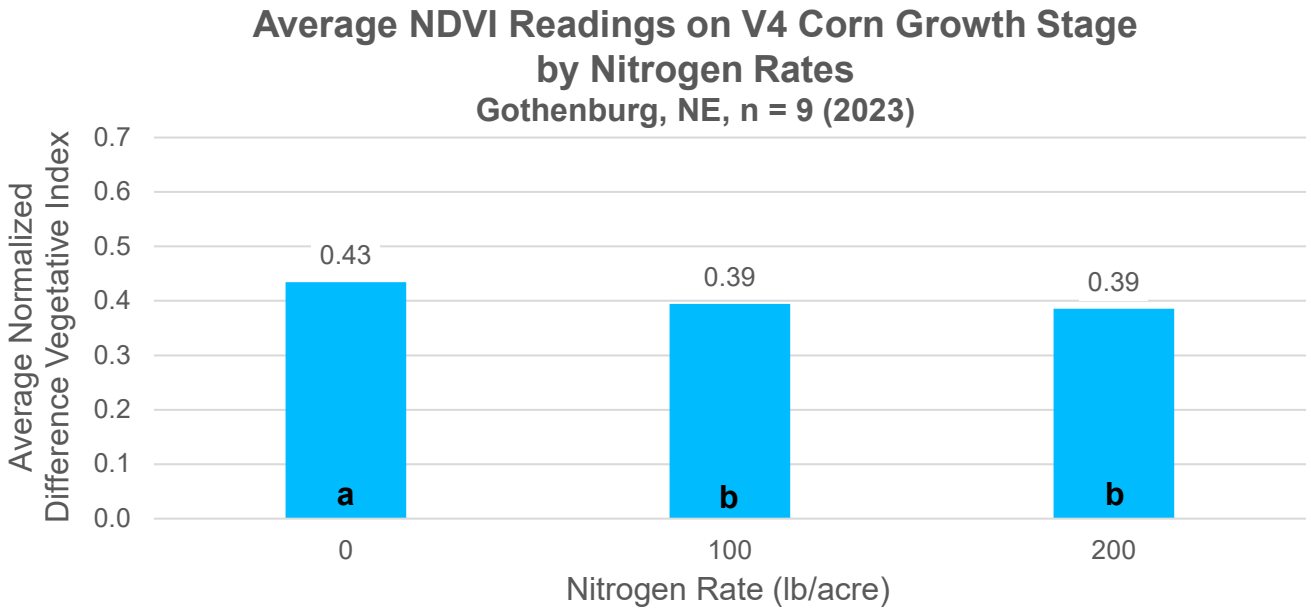

Figure 2. Normalized Difference Vegetation Index (NDVI) by nitrogen fertilizer rates averaged across all biological product applications. Letters indicate statistical difference at α = 0.1, n = 9, Gothenburg, NE, 2023.

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- The 0 lb/acre nitrogen application had a greater NDVI than the 100 and 200 lb/acre nitrogen (Figure 2).
- Average NDVI at the V4 corn growth stage was collected seven days after nitrogen fertilization, so corn biomass and plant health were likely unaffected by the added nitrogen at that time.

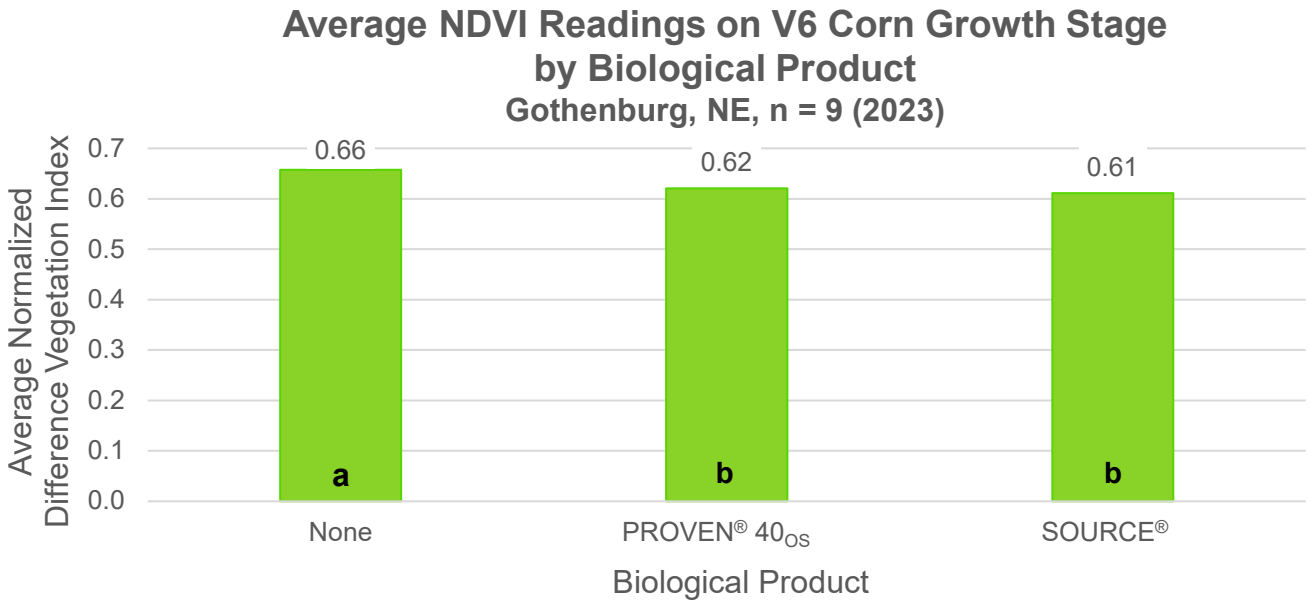

Figure 3. Normalized Difference Vegetation Index (NDVI) by biological products averaged across all nitrogen fertilization rates. Letters indicate statistical difference at α = 0.1, n = 9, Gothenburg, NE, 2023.

- There was no significant difference in average NDVI between PROVEN® 40 On-Seed and SOURCE® treatments, though both products significantly reduced NDVI readings at the V6 corn growth stage compared to no product (Figure 3).
- Average NDVI at the V6 corn growth stage was collected 14 days after nitrogen application, when the application rate treatments started to show differences in the corn canopy (Figure 3).

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Corn Stands, Phytotoxicity, Drought, and Stay Green Ratings:

Table 1. Corn stands, phytotoxicity, drought, and stay green readings by nitrogen fertilizer rate and biological product application.

Nitrogen Rate (lb/acre)	Biological Product	Corn Population (plants/acre)	Product Phytotoxicity (1 to 10)	Drought Rating (1 to 10)	Stay Green Rating (1 to 10)
0	No Product	30,492	1	5.0	6.0 a
0	PROVEN® 40 On-Seed	31,654	1	3.7	3.3 c
0	SOURCE®	30,782	1	4.7	4.7 b
100	No Product	31,073	1	4.3	3.3 c
100	PROVEN® 40 On-Seed	32,815	1	4.3	4.0 bc
100	SOURCE®	32,525	1	4.0	3.3 c
200	No Product	31,654	1	5.0	3.3 c
200	PROVEN® 40 On-Seed	32,815	1	4.3	4.0 bc
200	SOURCE®	31,654	1	3.7	4.7 b

Abbreviations: Rating scales indicate 1 as very good and 9 as poor. Stay green numbers followed by letters indicate statistical difference at $\alpha = 0.1$, and $n = 3$ replications. Other values had no statistically significant differences.

- No significant differences were found in average corn population, phytotoxicity, or drought ratings when comparing the nitrogen rates and the biological product applications (Table 1).
- When no nitrogen was aplied (0 lb/acre), corn treated with PROVEN® 40 On-Seed treatment had the best stay green rating, followed by corn treated with SOURCE® soil activator, and corn with no biological product applied had the worst stay green score.
- When 100 lb N/acre was applied, there was no significant difference in stay green score between the biological product applications.
- When 200 lb N/acre was applied, corn with no biological product had a significantly better stay green score than corn with SOURCE® soil activator.

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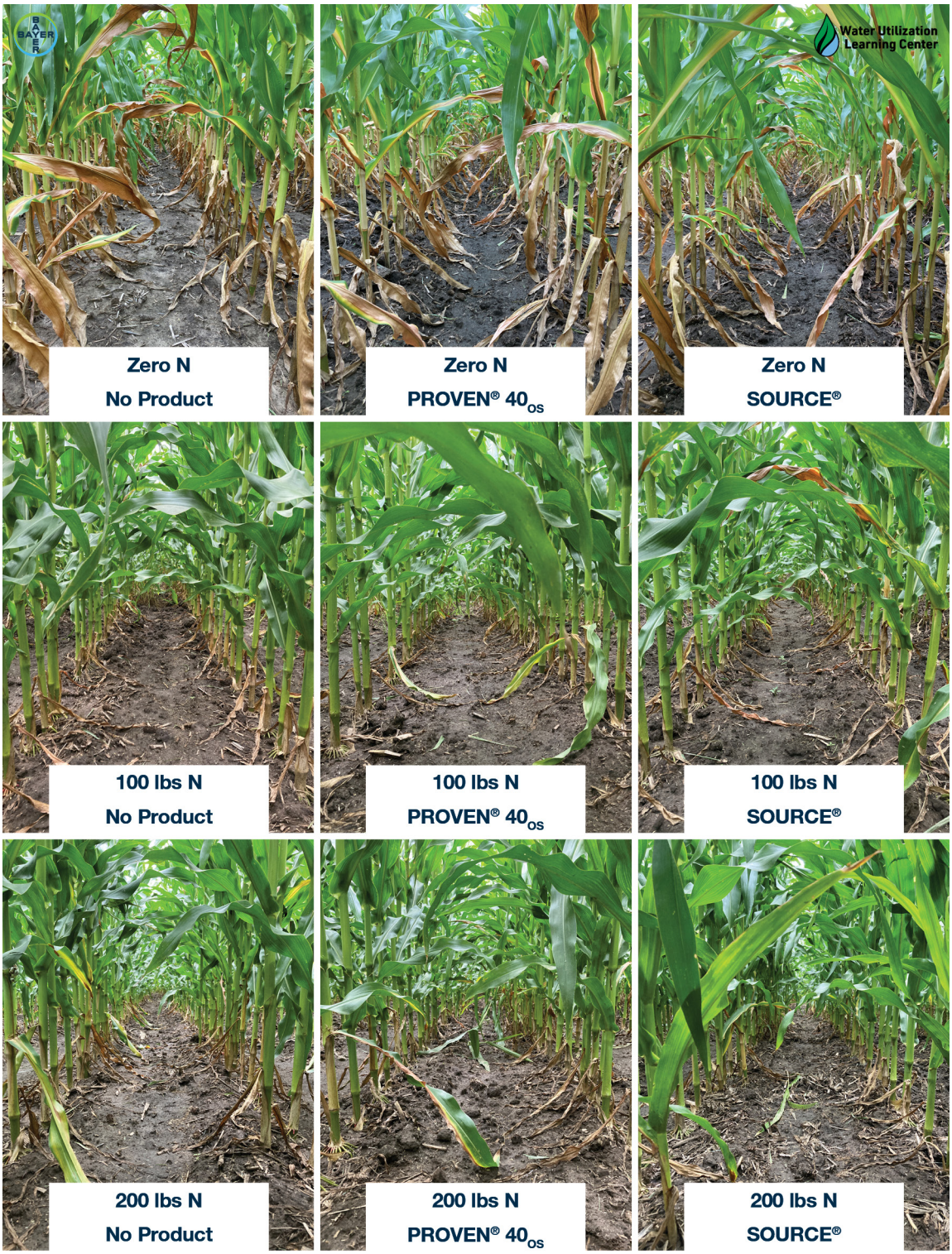

Figure 4. Corn canopy according to nitrogen fertilization rates and biological products used.

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Corn Grain Yield Components:

Table 2. Corn grain yield components according to nitrogen fertilizer rates and biological product.

Nitrogen Rate (lb/acre)	Biological Product	Number of Kernel Rows/Ear	Number of Kernels/Row
0	No Product	14.5	33.8
0	PROVEN® 40 On-Seed	14.3	36.3
0	SOURCE®	13.7	32.8
100	No Product	14.0	34.0
100	PROVEN® 40 On-Seed	13.3	36.8
100	SOURCE®	14	35.2
200	No Product	14.3	34.2
200	PROVEN® 40 On-Seed	13.7	37.5
200	SOURCE®	13.7	32.8

Corn Grain Yield:

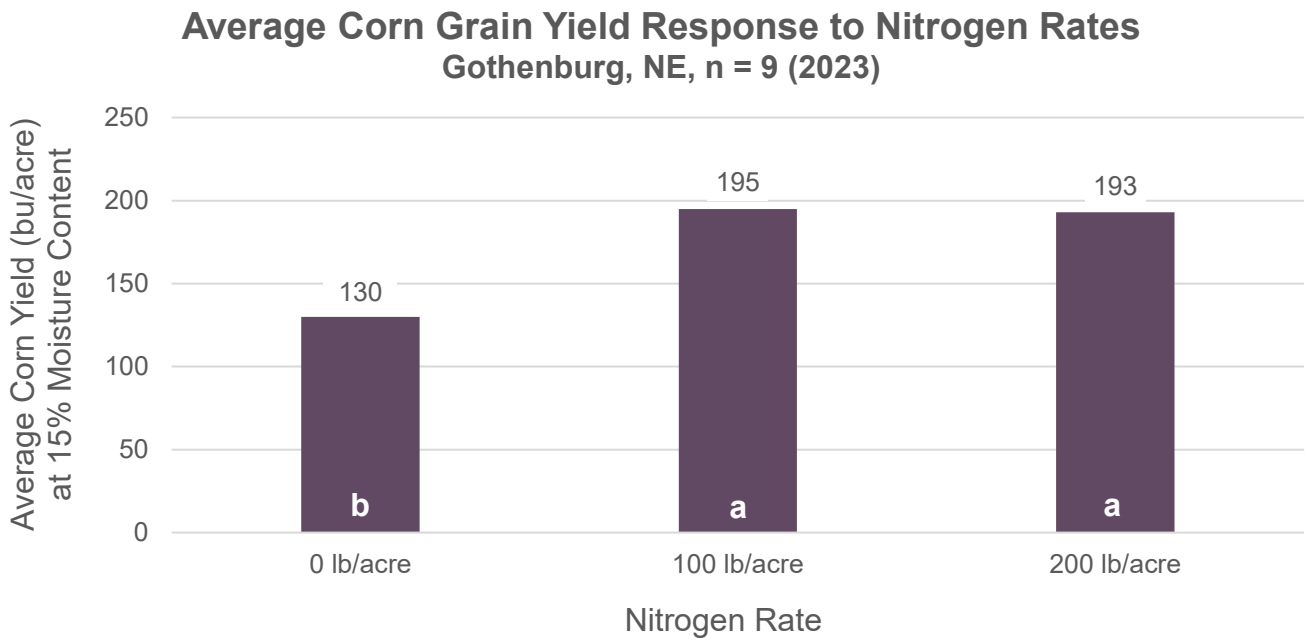

Figure 5. Corn grain yield and moisture by nitrogen fertilization rates averaged across all biological products used. Numbers followed by letters indicate statistical difference at α = 0.1, n = 9, Gothenburg, NE, 2023.

- Despite the lack of response in NDVI ratings, there was a positive corn grain yield response when nitrogen fertilization was applied at rates of both 100 and 200 lb/acre compared to the 0 lb/acre nitrogen treatment.

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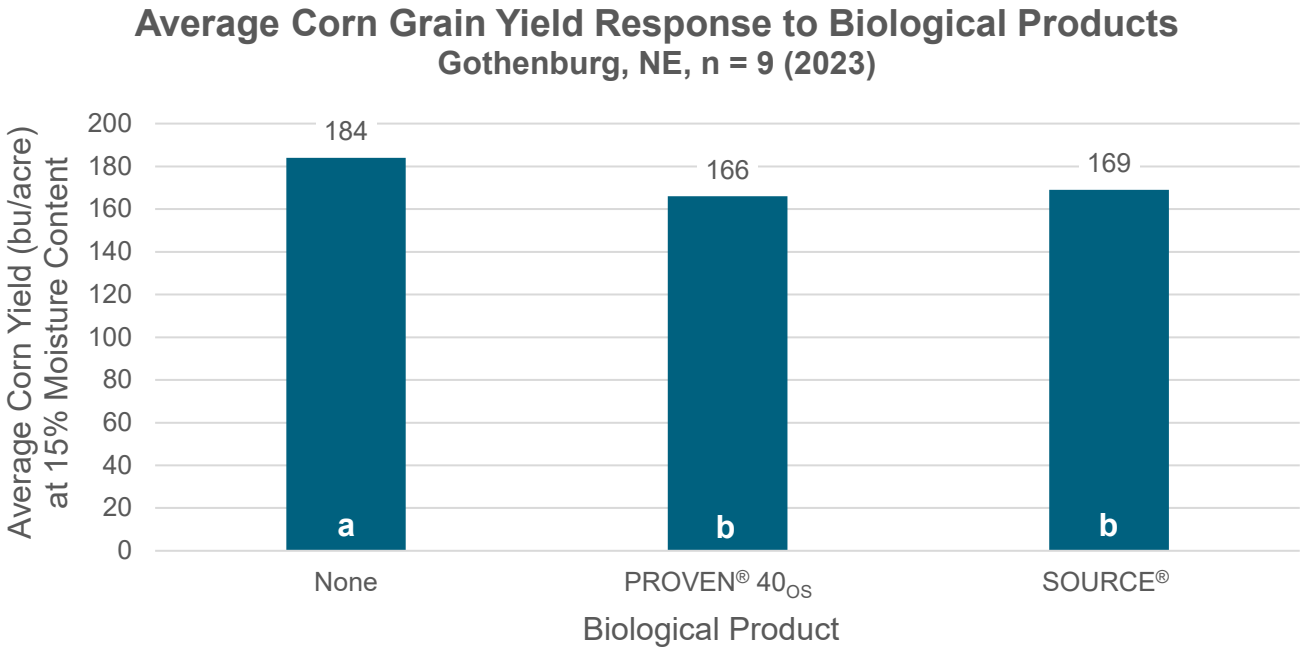

Figure 6. Corn grain yield and moisture according by biological product averaged across all nitrogen application rates. Numbers followed by letters indicate statistical difference at α = 0.1, n = 9, Gothenburg, NE, 2023.

- Corn with PROVEN® 40 On-Seed seed treatment and SOURCE® soil activator had lower corn grain yields compared to corn with no biological product applied.

Understanding the Role of Biological Products in Corn Nitrogen Fertilization

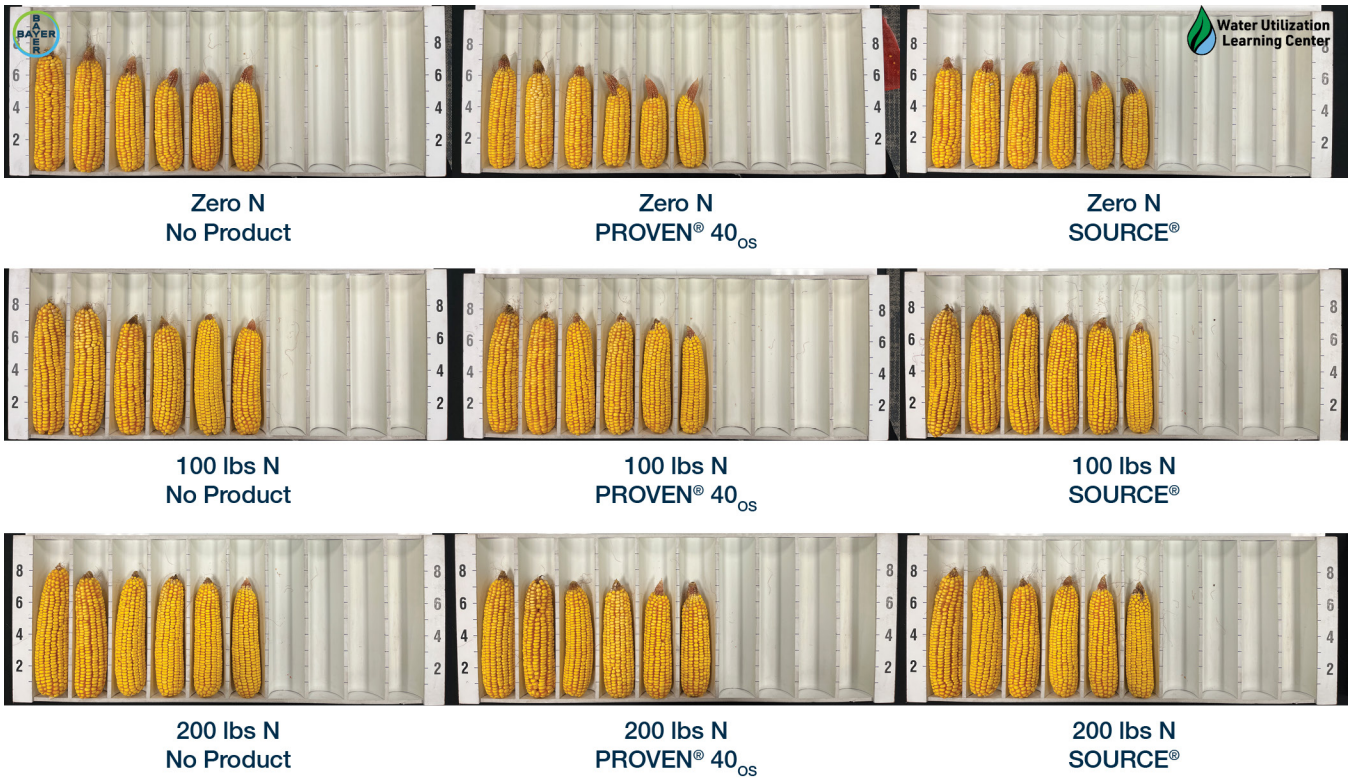

Figure 7. Corn ears according to nitrogen fertilization rates and biological products used, Gothenburg, NE, 2023.

Key Findings

- Both PROVEN® 40 On-Seed seed treatment and SOURCE® soil activator were not effective in increasing plant health, biomass, or corn grain yield.
- Applying nitrogen did increase yield. In this study corn yields decreased when either biological product was applied.
- Since they are live products, biologicals such as PROVEN® 40 On-Seed treatment and SOURCE® soil activator may respond to specific weather, management, and environmental conditions.

Understanding the Role of Biological Products in Corn Nitrogen Fertilization

Legal Statements

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

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Performance may vary, from location to location and from year to year, as local growing, soil and environmental conditions may vary. Growers should evaluate data from multiple locations and years whenever possible and should consider the impacts of these conditions on their growing environment.

The recommendations in this material are based upon trial observations and feedback received from a limited number of growers and growing environments. These recommendations should be considered as one reference point and should not be substituted for the professional opinion of agronomists, entomologists or other relevant experts evaluating specific conditions.

IMPORTANT IRM INFORMATION: Certain products are sold as RIB Complete® corn blend products, and do not require the planting of a structured refuge except in the Cotton-Growing Area where corn earworm is a significant pest. Products sold without refuge in the bag (non-RIB Complete) require the planting of a structured refuge. **See the IRM/Grower Guide for additional information. Always read and follow IRM requirements.**

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Insect Resistance Management
Planting Refuges, Preserving Technology

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

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Research Report / 2023 DEKALB® Brand Corn Product Comparisons Following Cover Crop Mix

Trial Objective

- Testing various corn products is crucial to better understanding how to position products in the right field and under the right management conditions to meet the farmer's needs.
- The objective of this trial was to test a broad spectrum of DEKALB® brand corn products that are currently recommended for the western Central Plains in a high-residue environment.

Experiment/Trial Design

Location	Soil Type	Previous Crop	Tillage Type	Planting Date	Harvest Date	Potential Yield (bu/acre)	Seeding Rate (seeds/acre)
Gothenburg, NE	Hord Silt Loam	Soybean	No-till	05/24/2023	10/24/2023	250	36,000

- The trial was arranged in a randomized complete block design with four replications. The only treatment factor was the corn product.

Table 1. List of field operations, products, and rates in 2023.

Field Operation	Products/rates		Comments
Cover crop planting	Mix of balansa clover, winter peas, cereal rye, winter barley, rapeseed, and hairy vetch at 60 lb seed/acre		Planted on 10/26/2022
Cover crop fertilizer applied	Nitrogen	29.0 lb/acre	Applied on 11/08/2022 with streamer bars
	Phosphorus	60.0 lb/acre	
	Sulfur	25.0 lb/acre	
Cover crop termination	Roundup PowerMAX® 3 herbicide at 32.0 fl oz/acre		Cover crop biomass averaged 1,062 lb/acre
Corn planting	36,000 seeds/acre		Planted on 05/24/23 in 27.5 feet by 10 feet plot size
Pre-emergence herbicides applied	Roundup Power MAX® 3 herbicide	30.0 fl oz/acre	Applied 05/30/2023
	Atrazine 4L	1.0 lb/acre	
	Harness® herbicide	32.0 fl oz/acre	
	Balance® Flexx herbicide	5.0 fl oz/acre	
	Diflexx® herbicide	8.0 fl oz/acre	
Corn fertilizer applied	Nitrogen	19.0 lb/acre	Applied 06/12/2023 with streamer bars
	Phosphorus	40.0 lb/acre	
	Sulfur	16.5 lb/acre	
Post-emergence herbicide applied	Roundup Power MAX® 3 herbicide	30.0 fl oz/acre	Applied 06/16/2023
	Diflexx® herbicide	16.0 fl oz/acre	
	Warrant® herbicide	48.0 fl oz/acre	
	Laudis® herbicide	3.0 fl oz/acre	
	Superb® HC adjuvant	0.5%	
Fertilizer applied	Nitrogen	150 lb/acre	Applied with Y-drop equipment at approximately the V5 growth stage
Harvest	Grain weight, test weight, and grain moisture content collected with a plot combine		Harvested on 10/24/2023. Yield per acre was calculated later

2023 DEKALB® Brand Corn Product Comparisons Following Cover Crop Mix

- Early stand counts and Normalized Difference Vegetation Index (NDVI) were measured on 6/26/2023 when the corn was about the V7 growth stage.
- Final stand counts, intactness ratings, lodged plants, and ear height were measured at harvest time.
- The total rainfall accumulated during the 2023 corn growing season was 13.5 inches. This trial was irrigated with a linear overhead irrigation system and the total irrigation applied was 2 inches. The trial had a wind storm a few days prior to harvest that impacted intactness ratings and stalk lodging percentages.

Table 2. DEKALB® brand corn products in this trial.

DEKALB® Brand Product	Relative Maturity	Trait Package
DKC61-41RIB brand blend	111	VT Double PRO® RIB Complete® corn blend
DKC105-33RIB brand blend	105	SmartStax® PRO RIB Complete® corn blend
DKC111-33RIB brand blend	111	SmartStax® PRO RIB Complete® corn blend
DKC62-89RIB brand blend	112	Trecepta® RIB Complete® corn blend
DKC59-82RIB brand blend	109	VT Double PRO® RIB Complete® corn blend
DKC63-90RIB brand blend	113	SmartStax® RIB Complete® corn blend
DKC101-33RIB brand blend	101	SmartStax® PRO RIB Complete® corn blend
DKC107-33RIB brand blend	107	SmartStax® PRO RIB Complete® corn blend
DKC62-70RIB brand blend	112	VT Double PRO® RIB Complete® corn blend
DKC64-65RIB brand blend	114	VT Double PRO® RIB Complete® corn blend

2023 DEKALB® Brand Corn Product Comparisons Following Cover Crop Mix

Understanding the Results

- During the spring of 2023, the predominant species in the cover crop mix were cereal rye and winter barley. Cover crop biomass averaged 1,062 lb/acre at the time of termination on 05/20/2023.
- DEKALB® DKC61-41RIB brand blend had the highest recorded yield at 214.8 bu/acre, while DEKALB® DKC64-65RIB brand blend had the lowest recorded yield at 186.6 bu/acre, 13.1% less (Table 3). The yield differences across DEKALB® brand products were not statistically significant, which indicates that any differences in yield were likely due to chance and not true differences in yield potential between the products.
- Early stand counts for DEKALB® DKC111-33RIB brand blend were 33,977 plants/acre, 5.6% less than the seeding rate of 36,000 seeds/acre (Table 3). DEKALB® DKC105-33RIB brand blend had the lowest stand count at 32,314 plants/acre, or 10.2% less than the seeding rate. Despite the numerical differences, there was no statistical difference in early stand across the ten DEKALB® brand products.
- Normalized Difference Vegetation Index (NDVI) at the V6 growth stage was the highest (0.57) with DEKALB® DKC105-33RIB brand blend, while DEKALB® DKC62-89RIB brand blend was the lowest (0.47) (Table 3). Those differences could be justified by their distinct relative maturities and Growing Degree Units (GDUs), where a late-maturity product would be a growth stage behind and consequently have lower biomass, a key indicator of NDVI. However, those differences were not statistically significant.
- Late-season stand counts were the highest with DEKALB® DKC111-33RIB brand blend at 34,531 plants/acre, or 4.1% less than the seeding rate of 36,000 seeds/acre. DEKALB® DKC101-33RIB brand blend had the lowest stand count of 31,046 plants/acre or 13.8% less than the seeding rate (Table 3). Despite the numerical differences, there was no statistical difference in late stand across the ten DEKALB® brand products.
- Stalk lodging was significantly different between the DEKALB® brand products with DEKALB® DKC62-89RIB brand blend having the highest lodging percentage (32.3% of total final stand) while DEKALB® DKC101-33RIB brand blend had the lowest lodging percentage at 1.6% of total final stand (Table 3). The trial had a wind storm a few days prior to harvest that impacted intactness ratings and stalk lodging percentages.
- DEKALB® DKC105-33 brand blend had the best intactness rating (3.5) among the ten DEKALB® brand products tested (Table 3).
- There was a significant difference in ear height among the DEKALB® brand products in this trial (Table 3). DEKALB® DKC62-89RIB brand blend had the highest average ear height at 51.6 inches while DEKALB® DKC101-33RIB brand blend had an average ear height of 41.5 inches (20% lower than DEKALB® DKC62-89RIB brand blend). There was a trend of lower ear heights with low relative maturity products.

2023 DEKALB® Brand Corn Product Comparisons Following Cover Crop Mix

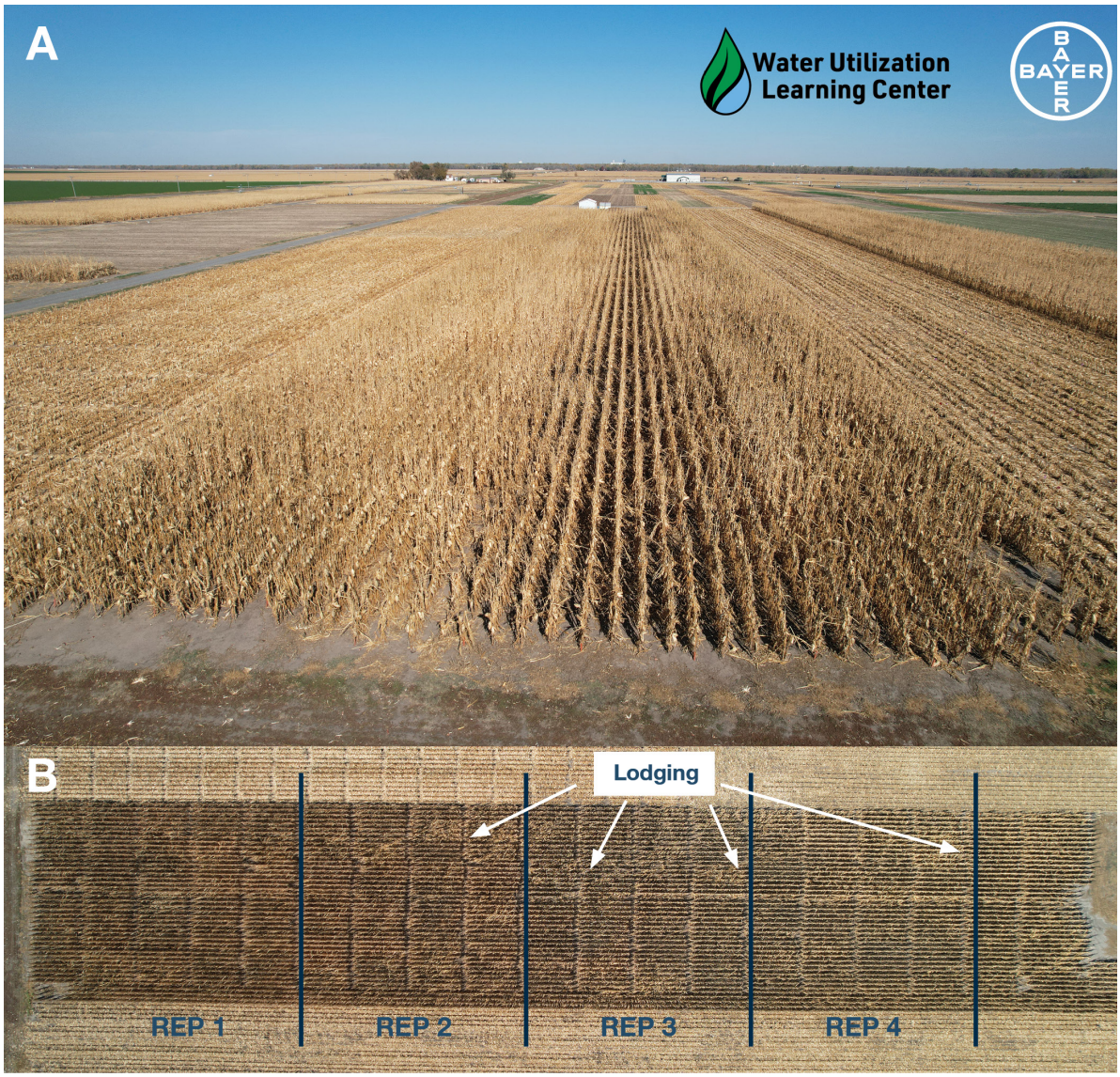

Figure 1. Aerial overview of the DEKALB® brand product testing at the Gothenburg Learning Center (A), and replications and lodged plants in the trial (B). Pictures were taken on October 23, 2023.

2023 DEKALB® Brand Corn Product Comparisons Following Cover Crop Mix

Table 3. DEKALB® brand blend product yield, percent yield difference from the highest yield, early stand count, percent early stand vs seeding rate, normalized difference vegetation index (NDVI), final stand count, percent final stand vs seeding rate, percent stalk lodging, intactness, and ear height by corn product under no-till and cover crop mix residue.

DEKALB® brand blend Product	Yield (bu/acre)	Yield Difference (%)	Early Stand (plants/acre)	Early Stand vs Seeding Rate (%)	NDVI	Final Stand (plants/acre)	Final Stand vs Seeding Rate (%)	Stalk Lodging (%)	Intactness (1–10)	Ear Height (inches)
DKC61-41RIB	214.8 ns	0.0	33,422 ns	–7.2	0.53 ns	33,026 ns	–8.3	11.7 bc	7.0 ab	45.8 bc
DKC105-33RIB	214.5	–0.1	32,314	–10.2	0.57	31,601	–12.2	5.5 d	3.5 c	43.4 cd
DKC111-33RIB	213.9	–0.4	33,977	–5.6	0.56	34,531	–4.1	12.4 b	5.8 ab	50.3 a
DKC62-89RIB	211.3	–1.6	33,106	–8.0	0.47	31,601	–12.2	32.3 a	7.0 ab	51.6 a
DKC59-82RIB	211.2	–1.7	33,422	–7.2	0.52	32,736	–9.1	16.3 b	5.8 ab	48.6 ab
DKC63-90RIB	206.8	–3.7	32,868	–8.7	0.55	31,601	–12.2	17.3 b	5.5 b	51.4 a
DKC101-33RIB	206.0	–4.1	32,710	–9.1	0.50	31,046	–13.8	1.6 d	5.8 ab	41.5 d
DKC107-33RIB	197.5	–8.1	33,818	–6.1	0.53	32,472	–9.8	4.0 cd	7.3 a	44.6 cd
DKC62-70RIB	190.2	–11.5	33,502	–6.9	0.56	33,792	–6.1	11.4 b	6.3 ab	50.1 a
DKC64-65RIB	186.6	–13.1	33,026	–8.3	0.55	32,314	–10.2	12.0 b	7.0 ab	46.5 bc

Abbreviations. ns: Not Significant, Ear Height LSD @ 0.1 = 3.57 inches; Numbers followed by letters indicate statistical difference at α = 0.1; n = 4 replicates

2023 DEKALB® Brand Corn Product Comparisons Following Cover Crop Mix

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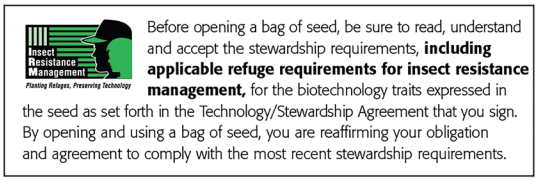

Research Report / 2023 Channel® Brand Corn Product Comparisons Following Cover Crop Mix

Trial Objective

- Testing various corn products is crucial for better understanding how to position products in the right field and under the right management conditions to meet the farmer's needs.
- The objective of this trial was to test a broad spectrum of Channel® brand corn products that are currently recommended for the western Central Plains in a high-residue environment.

Experiment/Trial Design

Location	Soil Type	Previous Crop	Tillage Type	Planting Date	Harvest Date	Potential Yield (bu/acre)	Seeding Rate (seeds/acre)
Gothenburg, NE	Hord Silt Loam	Soybean	No-till	05/24/2023	10/24/2023	250	36,000

- The trial was arranged in a randomized complete block design with four replications. The only treatment factor was the corn product.

Table 1. List of field operations, products, and rates in 2023.

Field Operation	Products/rates		Comments
Cover crop planting	Mix of balansa clover, winter peas, cereal rye, winter barley, rapeseed, and hairy vetch at 60 lb seed/acre		Planted on 10/26/2022
Cover crop fertilizer applied	Nitrogen	29.0 lb/acre	Applied on 11/08/2022 with streamer bars
	Phosphorus	60.0 lb/acre	
	Sulfur	25.0 lb/acre	
Cover crop termination	Roundup PowerMAX® 3 herbicide at 32.0 fl oz/acre		Cover crop biomass averaged 1,062 lb/acre
Corn planting	36,000 seeds/acre		Planted on 05/24/23 in 27.5 feet by 10 feet plot size
Pre-emergence herbicides applied	Roundup Power MAX® 3 herbicide	30.0 fl oz/acre	Applied 05/30/2023
	Atrazine 4L	1.0 lb/acre	
	Harness® herbicide	32.0 fl oz/acre	
	Balance® Flexx herbicide	5.0 fl oz/acre	
	Diflexx® herbicide	8.0 fl oz/acre	
Corn fertilizer applied	Nitrogen	19.0 lb/acre	Applied 06/12/2023 with streamer bars
	Phosphorus	40.0 lb/acre	
	Sulfur	16.5 lb/acre	
Post-emergence herbicide applied	Roundup Power MAX® 3 herbicide	30.0 fl oz/acre	Applied 06/16/2023
	Diflexx® herbicide	16.0 fl oz/acre	
	Warrant® herbicide	48.0 fl oz/acre	
	Laudis® herbicide	3.0 fl oz/acre	
	Superb® HC adjuvant	0.5%	
Fertilizer applied	Nitrogen	150 lb/acre	Applied with Y-drop equipment at approximately the V5 growth stage
Harvest	Grain weight, test weight, and grain moisture content collected with a plot combine		Harvested on 10/24/2023. Yield per acre was calculated later

2023 Channel® Brand Corn Product Comparisons Following Cover Crop Mix

- Early stand counts and Normalized Difference Vegetation Index (NDVI) were measured on 6/26/2023.
- Final stand counts, intactness ratings, lodged plants, and ear height were measured at harvest time.
- The total rainfall accumulated during the 2023 corn growing season was 13.5 inches. This trial was irrigated with a linear overhead irrigation system and the total irrigation applied was 2 inches. The trial had a wind storm a few days prior to harvest that impacted intactness ratings and stalk lodging percentages.

Table 2. List of Channel® brand corn products included in this trial.

Channel® Brand Product	Relative Maturity	Trait Package
203-83SSPRIB brand blend	103	SmartStax® PRO RIB Complete® corn blend
205-63STXRIB brand blend	105	SmartStax® RIB Complete® corn blend
206-16SSPRIB brand blend	106	SmartStax® PRO RIB Complete® corn blend
207-42STXRIB brand blend	107	SmartStax® RIB Complete® corn blend
207-87VT2PRIB brand blend	107	VT Double PRO® RIB Complete® corn blend
209-25SSPRIB brand blend	109	SmartStax® PRO RIB Complete® corn blend
209-89STXRIB brand blend	109	SmartStax® RIB Complete® corn blend
211-11VT2PRIB brand blend	111	VT Double PRO® RIB Complete® corn blend
211-57STXRIB brand blend	111	SmartStax® RIB Complete® corn blend
211-70TRERIB brand blend	111	Trecepta® RIB Complete® corn blend
212-70TRERIB brand blend	112	Trecepta® RIB Complete® corn blend
213-13SSPRIB brand blend	113	SmartStax® PRO RIB Complete® corn blend
213-19VT2PRIB	113	VT Double PRO® RIB Complete® corn blend
213-70TRERIB	113	Trecepta® RIB Complete® corn blend
213-81DGVT2PRIB	113	DroughtGard® Hybrids with VT Double PRO® RIB Complete® corn blend
214-22STXRIB	114	SmartStax® RIB Complete® corn blend
214-70TRERIB	114	Trecepta® RIB Complete® corn blend
214-78DGVT2PRIB	114	DroughtGard® Hybrids with VT Double PRO® RIB Complete® corn blend
215-42TRERIB	115	Trecepta® RIB Complete® corn blend
217-01VT2PRIB	117	VT Double PRO® RIB Complete® corn blend

2023 Channel® Brand Corn Product Comparisons Following Cover Crop Mix

Understanding the Results

- During the spring of 2023, the predominant species in the cover crop mix were cereal rye and winter barley. Cover crop biomass averaged 1,062 lb/acre at the time of termination on 05/20/2023.
- Due to late-season water stress, the grain yields reached were not as high as expected. As a reference, from August 8th to September 9th the trial received no rain or irrigation and temperatures were higher than normal.
- The highest yield was produced by 214-22STXRIB at 245.7 bu/acre while the lowest yield was produced by 211-57STXRIB at 189.1 bu/acre, 23% less than 214-22STXRIB (Table 3).
- Early stand counts for 214-78DGVT2PRIB were 33,977 plants/acre, which was 5.6% lower than the seeding rate of 36,000 seeds/acre (Table 3). 212-70TRERIB and 213-70TRERIB had the lowest early stand counts at 32,314 plants/acre, or 10.2% less than the seeding rate. Despite the numerical differences, there was no statistical difference in early stand counts across Channel® brand products.
- Normalized Difference Vegetation Index (NDVI) at corn V6 growth stage was higher in 212-70TRERIB with 0.61, whereas 214-22STXRIB had 0.44 (Table 3). Those differences could be justified by their distinct relative maturities, Growing Degree Units (GDUs), vigor, and plant architecture. A late-maturity product would be a growth stage behind and consequently have lower biomass, a key indicator of NDVI.
- Late season stand counts were the highest for 214-78DGVT2PRIB with 34,690 plants/acre, or 3.6% below the seeding rate of 36,000 seeds/acre. 211-11VT2PRIB produced the lowest stand count at 30,202 plants/acre, or 16.1% less than the seeding rate (Table 3).
- Stalk lodging was significantly different between Channel® brand products (Table 3), with the highest lodging rate occurring in 211-11VT2PRIB (36.6% of total final stand) and the lowest in 213-13SSPRIB (4.9% of total final stand).
- 209-25SSPRIB had the best intactness rating (3.8) among all Channel® brand products tested (Table 3).
- There was a significant difference in ear height between the Channel® brand products in this trial (Table 3). 214-78DGVT2PRIB had the highest measured ear height at 60.5 inches. Corn products 203-83SSPRIB and 207-42STXRIB had ear height measurements of 41.5 inches (31.4% lower compared to 214-78DGVT2PRIB).

2023 Channel® Brand Corn Product Comparisons Following Cover Crop Mix

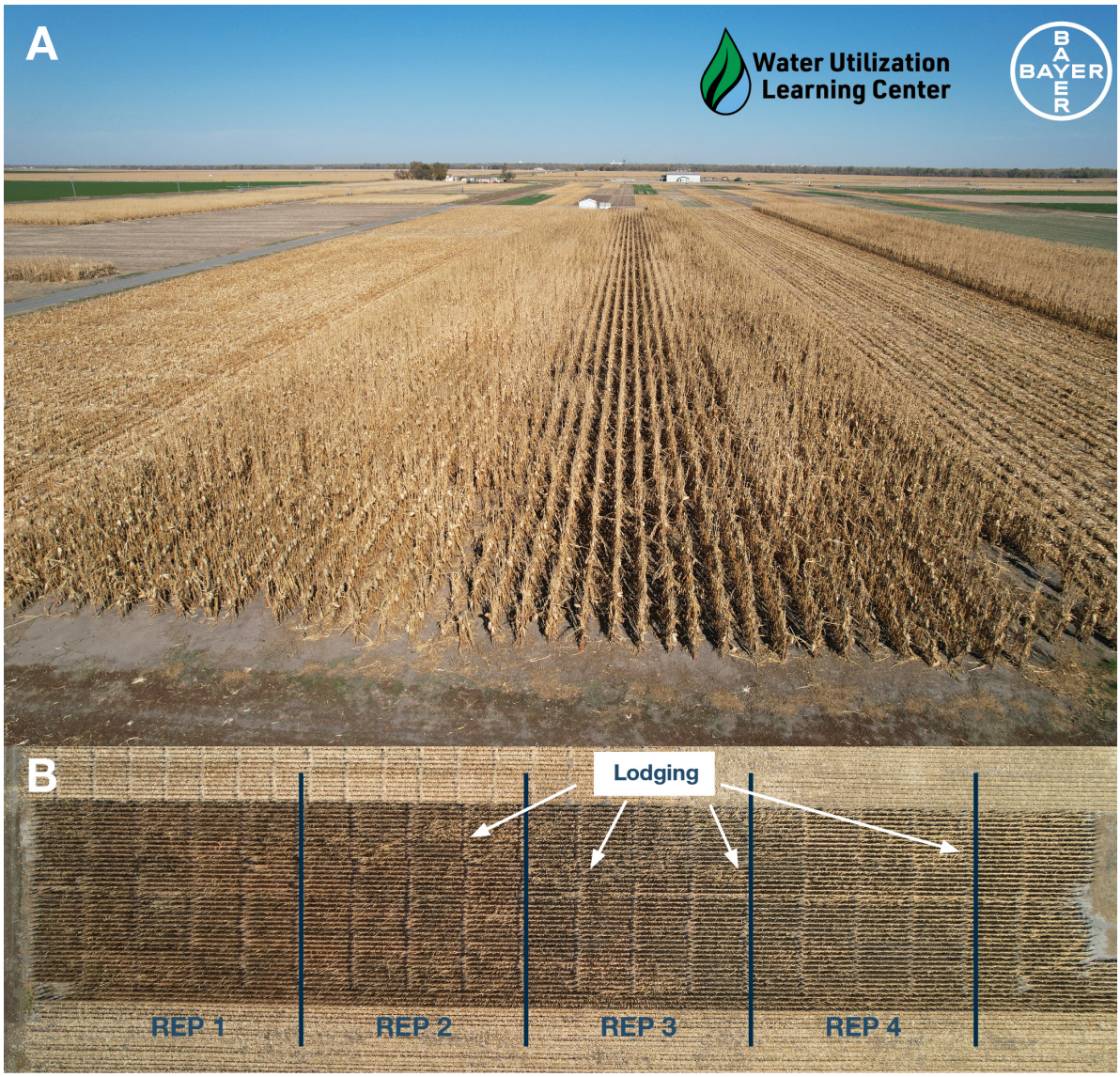

Figure 1. Aerial overview of the Channel® brand product testing at the Gothenburg Learning Center in 2023 (A), and replications and lodged plants in the trial (B). Pictures were taken October 23, 2023.

2023 Channel® Brand Corn Product Comparisons Following Cover Crop Mix

Table 3. Channel® brand product yield, yield difference from the top product, early stand count, early stand vs seeding rate, normalized difference vegetation index (NDVI), final stand count, final stand vs seeding rate, stalk lodging, intactness, and ear height by corn product under no-till and cover crop mix residue.

Product	Yield (bu/acre)	Yield Difference (%)	Early Stand (plants/acre)	Early Stand vs Seeding Rate (%)	NDVI	Final Stand (plants/acre)	Final Stand vs Seeding Rate (%)	Stalk Lodging (%)	Intactness (1–10)	Ear Height (inches)
214-22STXRIB	245.7 a	0.0	33422 ns	–7.2	0.44 f	32314 cde	–10.2	22.4 abcd	4.0 e	55.3 bcd
217-01VT2PRIB	235.2 ab	–4.3	32630	–9.4	0.53 cde	34214 ab	–5.0	8.4 fg	5.0 cde	52.2 defg
213-13SSPRIB	228.6 abc	–7.0	33264	–7.6	0.51 cdef	33343 abcd	–7.4	4.9 g	4.3 e	53.2 cdef
203-83SSPRIB	218.6 bcd	–11.0	32710	–9.1	0.59 abc	32314 cde	–10.2	9.7 efg	5.0 cde	44.5 k
209-89STXRIB	217.0 bcde	–11.7	33581	–6.7	0.59 abc	33660 abc	–6.5	15.2 bcdef	6.3 abcd	50.9 fgh
214-70TRERIB	214.4 bcde	–12.8	33686	–6.4	0.59 abc	32419 cde	–9.9	30.8 ab	5.0 cde	51.3 efgh
206-16SSPRIB	210.4 cdef	–14.4	32630	–9.4	0.55 abcde	31680 def	–12.0	12.5 cdef	6.0 abcd	47.0 ijk
209-25SSPRIB	209.8 cdef	–14.6	32710	–9.1	0.53 bcde	31363 ef	–12.9	11.8 cdef	3.8 e	52.1 efg
211-70TRERIB	209.7 cdef	–14.6	33502	–6.9	0.58 abcd	33739 abc	–6.3	27.7 abcd	7.0 a	50.8 fgh
214-78DGVT2PRIB	209.0 cdef	–14.9	33977	–5.6	0.57 abcd	34690 a	–3.6	5.0 fg	4.0 e	60.5 a
212-70TRERIB	204.0 def	–17.0	32314	–10.2	0.61 a	31469 ef	–12.6	20.5 abcd	5.5 abcde	54.2 bcde
205-63STXRIB	203.7 def	–17.1	32947	–8.5	0.51 def	31891 def	–11.4	14.8 bcdef	7.0 ab	46.7 jk
211-11VT2PRIB	202.2 def	–17.7	33106	–8.0	0.60 ab	30202 f	–16.1	36.6 a	6.5 abc	52.7 cdefg
213-81DGVT2PRIB	202.0 def	–17.8	33106	–8.0	0.56 abcd	32551 bcde	–9.6	22.1 abcd	6.5 abcd	53.6 cdef
207-42STXRIB	199.9 def	–18.7	33106	–8.0	0.51 cdef	32234 cde	–10.5	16.9 bcde	7.0 ab	44.5 k
213-70TRERIB	198.0 def	–19.4	32314	–10.2	0.58 abcd	30413 f	–15.5	26.2 abc	4.8 de	56.8 b
207-87VT2PRIB	197.0 def	–19.8	32630	–9.4	0.47 ef	31442 ef	–12.7	19.2 bcd	6.8 abc	51.3 efgh
215-42TRERIB	195.2 def	–20.6	33026	–8.3	0.57 abcd	31918 def	–11.3	28.5 abcd	5.3 bcde	55.8 bc
213-19VT2PRIB	194.3 ef	–20.9	33475	–7.0	0.56 abcd	32393 cde	–10.0	11.0 cdefg	6.3 abc	50.0 ghi
211-57STXRIB	189.1 f	–23.0	32868	–8.7	0.53 cde	32314 cde	–10.2	13.7 defg	6.3 abcd	48.8 hij

Abbreviations. ns: not significant, pl.: Plants; LSD @ 0.1 Final Stand = 1726; LSD @ 0.1 Ear Height = 3.14; LSD @ 0.1 Yield = 23.8; Numbers followed by letters indicate statistical difference within a column at α = 0.1; n = 4 replicates

2023 Channel® Brand Corn Product Comparisons Following Cover Crop Mix

Legal Statements

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Research Report / Effect of Planting Date and System on Short-Statured Corn Products

Trial Objective

- Short-statured corn is a new corn breeding innovation that is part of the Bayer Preceon™ Smart Corn System which is planned to be commercially available for planting in the 2025 growing season via the Ground Breakers® program.
- The product concept for short-statured corn is to provide high-yielding corn with shortened internode distances (area between leaves) that can result in shortened plant height. Short-stature corn will typically have a maximum height of seven feet and corn ear placement of at least two feet above the soil.
- Short-statured corn may perform differently according to planting dates, tillage method, and cover crop use. One of the main characteristics of interest is the ear height, and if that would affect grain yield.
- The objective of these studies was to determine how planting date and tillage method affect early corn stands, plant and ear height, and grain yield of short-statured corn products.

Experiment/Trial Design

Location	Soil Type	Crop	Harvest Date	Potential Yield (bu/acre)	Seeding Rate (seeds/acre)	Row Spacing (inches)	Previous Crop
Gothenburg, NE	Hord Silt Loam	Corn	10/24/2023	270	42,000	30	Soybean

Figure 1. Study overview. Picture taken on June 13, 2023, at the Bayer Water Utilization Learning Center in Gothenburg, NE.

Effect of Planting Date and System on Short-Statured Corn Products

- The study was arranged in a split-plot design with three replications and three treatment factors according to Table 1.

Table 1. List of experimental factors and levels. Three replications were used per experimental condition.

Experimental Factor	Levels	
Tillage and Cover Crop Trial	A, no-till with cereal rye cover crop B, strip-till without cover crop	
Short-Statured Corn Planting Date (whole plot)	Planting Date	Cover Crop* Termination Date
	April 10 April 24 May 17 May 22 June 6	April 12 April 12 April 22 May 8 May 22
Short-Statured Corn Products (split-plot)	RW5419KTFZ (106 RM) RV5575TVXZ (108 RM) RV5965TVXZ (113 RM) RV6203TVXZ (111 RM) RV6205TVXZ (112 RM) RV6210TVXZ (114 RM)	

*Only used in trial A. Cereal rye cover crop was terminated with an application of Roundup PowerMax® 3 herbicide at 30 fluid ounces per acre and a spray volume of 15 gallons per acre.

Effect of Planting Date and System on Short-Statured Corn Products

- Field operations, seeding rates for the cover crop and corn, fertilizer nutrients and rates applied, and the amount of irrigation water applied are listed in Table 2:

Table 2. List of field operations, precipitation, irrigation, and seeding and fertilizer rates for both trials.

Field Operation	Products/Rates		Comments
Cover crop planting	Cereal rye at 80 lb seed/acre		Seeded on October 10, 2022 (Trial A)
Base fertilizer nutrient application	Nitrogen	29.3 lb/acre	Applied with strip-till operation on trial B. For trial A it was dribbled on the soil surface. In both studies, the fertilizer mix was applied on April 10, 2023.
	Phosphorus	60.0 lb/acre	
	Sulfur	25.0 lb/acre	
	Zinc	0.25 lb/acre	
Pre-emergence herbicides applied	Roundup Power MAX® 3 herbicide	30.0 fl oz/acre	On trial A (no-till with cover crop), pre-emergence herbicides were sprayed on May 4 (for planting dates April 10 and April 24), May 24 (for planting dates May 17 and May 22), and June 7 (for planting date June 6). On trial B (strip-till without cover crop), pre-emergence herbicides were sprayed on May 3, 2023.
	Diflexx® herbicide	8.0 fl oz/acre	
	Harness® herbicide	32.0 fl oz/acre	
	Atrazine 4L herbicide	32.0 fl oz/acre	
	Corvus® herbicide	5.0 fl oz/acre	
Post-emergence herbicides applied	Laudis® herbicide	3.0 fl oz/acre	Applied on June 16, 2023.
	Diflexx® herbicide	16.0 fl oz/acre	
	Warrant® herbicide	48.0 fl oz/acre	
	Atrazine 4L herbicide	32.0 fl oz/acre	
Nitrogen application	32% N at 120 lb/acre		Applied on June 19, 2023.
	32% N at 70 lb/acre		Applied on July 31, 2023.
Irrigation	4 inches total		This led to some stress in the later in the season, particularly for trial B.
Precipitation	Growing season total of 13.5 inches		-

- Cereal rye cover crop biomass was collected at the time of termination, and total soil residue coverage was measured using the SRPNet web app from Kansas State University.
- Early stand counts, plant heights, and ear heights were measured during the growing season.
- Plots were combine-harvested and grain moisture content, test weight, and total weight were collected. A Fisher's Least Significant Difference statistical test was performed to determine if significant differences occurred.

Understanding the Results

- The cereal rye cover crop was terminated at the time of short-statured corn planting for the April 10 planting date because the cover crop biomass was low (148 lb/acre).
- For all the other planting dates, the cover crop was terminated at least 2 weeks prior to short-statured corn planting to minimize any detrimental effects to nitrogen immobilization, water use, and grain yield.
- The corn in Trial B (strip-till without cover crop) suffered from more moisture stress season-long (Table 2), which may have contributed to the lower yields in that trial.

Effect of Planting Date and System on Short-Statured Corn Products

- An overview of the cover crop biomass by May 25, 2023, is available in Figure 2.

Figure 2. Trial A cover crop biomass in the field according to the short-statured corn planting dates. Pictures taken on May 25, 2023, at the Bayer Water Utilization Learning Center, Gothenburg, NE.

- Cereal rye cover crop growth was accelerated in late May, creating higher biomass accumulations by the short-statured corn planting dates of May 22, and June 6 (Table 3).
- A similar increase was found for soil residue coverage. However, it is noticeable that soil residue coverage was reduced from May 11 to May 25 as the decomposition process accelerated with warmer temperatures and precipitation (Table 3). Only the May 17, May 22, and June 6 planting dates had a soil coverage percentage above 50% after May 25 (Table 3).

Table 3. Trial A cover crop biomass and soil residue coverage according to short-statured corn planting date.

Short-Statured Corn Planting Date	Cover Crop Biomass (lb/acre)	Soil Residue Coverage on May 11 (%)	Soil Residue Coverage on May 25 (%)
April 10th	148 c	58.5 c	28.3 d
April 24th	278 c	54.4 c	35.2 d
May 17th	457 c	82.1 ab	66.9 c
May 22nd	1663 b	73.2 b	98.2 a
June 6th	4010 a	86.3 a	84.5 b
Numbers followed by letters indicate statistical difference within a column at $\alpha = 0.1$, $n = 18$ replications.			

- In both trials A (no-till with cover crop) and B (strip-till without cover crop) the short-statured corn early stands were not affected by planting date or product (Tables 4 and 6).
- There was a significant interaction of short-statured corn planting date and corn product on plant heights in trial A (Table 4).

Effect of Planting Date and System on Short-Statured Corn Products

Table 4. Trial A (no-till with cover crop) values averaged by corn products and planting dates in 2023.

Planting Date	Product	Early Stand (% to 42,000 seeding rate)	Plant Height (inches)	Ear Height (inches)
April 10	RT6203TVXZ	76.6	66.2 ghij	28.2 cd
April 10	RV5575TVXZ	84.2	62.7 hij	24.3 d
April 10	RV5965TVXZ	85.7	70.3 defghi	28.3 cd
April 10	RV6205TVXZ	72.7	68.5 efghij	32.6 abcd
April 10	RV6210TVXZ	83.4	59.5 j	25.8 cd
April 10	RW5419KTFZ	81.0	65.8 ghij	32.1 abcd
Average for Planting Date April 10		**80.6**	**65.5**	**28.5**
April 24	RT6203TVXZ	89.3	69.8 defghij	31.9 abcd
April 24	RV5575TVXZ	85.3	65.3 ghij	27.7 cd
April 24	RV5965TVXZ	95.2	71.0 cdefghi	31.7 abcd
April 24	RV6205TVXZ	92.1	59.5 j	39.4 ab
April 24	RV6210TVXZ	85.7	62.0 ij	31.1 abcd
April 24	RW5419KTFZ	91.7	61.8 ij	32.8 abcd
Average for Planting Date April 24		**89.9**	**64.9**	**32.4**
May 17	RT6203TVXZ	91.7	79.0 abcde	24.0 d
May 17	RV5575TVXZ	89.3	73.3 bcdefg	30.3 abcd
May 17	RV5965TVXZ	85.7	77.5 abcdef	28.9 cd
May 17	RV6205TVXZ	82.2	85.5 a	28.8 cd
May 17	RV6210TVXZ	85.3	81.8 ab	32.0 abcd
May 17	RW5419KTFZ	89.3	74.3 bcdefg	30.3 abcd
Average for Planting Date May 17		**87.3**	**78.5**	**29.1**
May 22	RT6203TVXZ	86.1	81.0 abc	30.0 bcd
May 22	RV5575TVXZ	86.9	73.0 bcdefgh	28.7 cd
May 22	RV5965TVXZ	83.0	69.5 efghij	26.3 cd
May 22	RV6205TVXZ	76.6	78.8 abcde	25.3 d
May 22	RV6210TVXZ	84.6	78.8 abcde	25.8 cd
May 22	RW5419KTFZ	81.4	73.7 bcdefg	30.7 abcd
Average for Planting Date May 22		**83.1**	**75.8**	**27.8**
June 6	RT6203TVXZ	95.6	80.2 abcd	36.0 abc
June 6	RV5575TVXZ	93.6	66.3 ghij	37.2 abc
June 6	RV5965TVXZ	98.4	73.0 bcdefgh	40.6 a
June 6	RV6205TVXZ	97.6	66.3 ghij	30.8 abcd
June 6	RV6210TVXZ	93.6	68.2 fghij	30.8 abcd
June 6	RW5419KTFZ	91.9	65.4 ghij	36.2 abc
Average for Planting Date June 6		**95.1**	**69.9**	**35.2**

Numbers followed by letters indicate statistical difference within a column at $\alpha = 0.1$, $n = 3$ replications.

Effect of Planting Date and System on Short-Statured Corn Products

- Short-statured plant heights varied from 85.5 (RV6205TVXZ planted on May 17) to 59.5 inches (RV6205TVXZ planted on April 24) in trial A.
- Corn products RT6203TVXZ and RV5965TVXZ produced significantly taller average plant heights than corn products RV6205TVXZ, RV6210TVXZ, RW5419KTFZ, and RV5575TVXZ . Corn products RV5575TVXZ, RV6210TVXZ, and RW5419KTFZ produced the shortest average plant height (Table 5).

Table 5. Trial A (no-till with cover crop) values averaged by corn product.

Product	Early Stand (% to 42,000 seeding rate)	Plant Height (inches)	Ear Height (inches)
RT6203TVXZ	87.9	75.2 a	30.0
RV5575TVXZ	87.9	68.1 c	29.6
RV5965TVXZ	89.6	72.3 ab	31.2
RV6205TVXZ	84.2	71.7 b	31.4
RV6210TVXZ	86.5	70.1 bc	29.1
RW5419KTFZ	87.0	68.2 c	32.4

NS, not significant. Numbers followed by letters indicate statistical difference within a column at $\alpha = 0.1$, n = 15 replications.

- There were no significant effects of planting date or corn product on plant heights in trial B (Table 6).
- The short-statured corn products in this trial had higher average plant heights (74.5 inches) in trial B (strip-till without cover crop) compared to trial A (70.9 inches, no-till with cover crop) when averaged across all planting dates and products (Tables 4 and 6).
- There was a significant interaction of corn planting date and product on ear heights in trial A (Table 4).
- Short-statured ear heights varied from 40.6 (RV5965TVXZ planted on June 6) to 24 inches (RV6203TVXZ planted on May 17) in trial A. In trial A, The highest average ear height occurred in corn products planted on June 6, whereas lowest average ear heights occurred in corn products planted on May 22 (Table 4). There was no effect of short-statured corn product on ear height (Table 5).
- There were no significant effects of planting date or corn product on ear heights in trial B (Table 6).
- When averaged by corn product and planting date, the planting date that produced the largest ear height varied between trials A and B. In trial A (no-till with cover crop), the largest average ear height occurred in corn products planted on June 6 (35.2 inches). While in trial B (strip-till without cover crop), the largest average ear height occurred in corn products planted on May 22 (35.4 inches). This difference in the effect of planting date on ear height may have been due to the cover crop biomass accumulation, which increased shading and thus promoted plant etiolation during the early growth stages.

Effect of Planting Date and System on Short-Statured Corn Products

Table 6. Trial B (strip-till without cover crop) values averaged by corn product and planting date in 2023.				
Planting Date	**Product**	**Early Stand (% to 42,000 seeding rate)**	**Plant Height (inches)**	**Ear Height (inches)**
April 10	RT6203TVXZ	88.1 NS	75.3 NS	28.1 NS
April 10	RV5575TVXZ	85.7	79.3	32.8
April 10	RV5965TVXZ	84.2	83.2	35.8
April 10	RV6205TVXZ	81.0	78.3	30.4
April 10	RV6210TVXZ	81.0	84.3	34.7
April 10	RW5419KTFZ	75.1	79.0	32.8
Average for Planting Date April 10		**82.5 NS**	**79.9 NS**	**32.4 NS**
April 24	RT6203TVXZ	89.3	79.8	34.6
April 24	RV5575TVXZ	87.3	70.5	25.1
April 24	RV5965TVXZ	85.7	80.0	33.7
April 24	RV6205TVXZ	84.7	73.8	31.8
April 24	RV6210TVXZ	83.9	72.5	29.7
April 24	RW5419KTFZ	70.3	75.5	30.0
Average for Planting Date April 24		**83.5**	**75.3**	**30.8**
May 8	RT6203TVXZ	85.7	71.3	30.3
May 8	RV5575TVXZ	84.2	71.2	29.3
May 8	RV5965TVXZ	79.8	70.0	33.3
May 8	RV6205TVXZ	79.8	71.2	34.8
May 8	RV6210TVXZ	77.0	72.2	34.4
May 8	RW5419KTFZ	73.9	73.8	34.3
Average for Planting Date May 8		**80.1**	**71.6**	**32.8**
May 22	RT6203TVXZ	91.3	78.1	34.3
May 22	RV5575TVXZ	91.3	76.7	33.4
May 22	RV5965TVXZ	88.9	78.3	33.3
May 22	RV6205TVXZ	88.3	81.0	37.6
May 22	RV6210TVXZ	85.7	77.0	39.2
May 22	RW5419KTFZ	79.4	77.8	34.4
Average for Planting Date May 22		**87.5**	**78.2**	**35.4**
June 6	RT6203TVXZ	86.1	67.8	30.2
June 6	RV5575TVXZ	83.0	66.2	26.9
June 6	RV5965TVXZ	77.8	71.0	30.7
June 6	RV6205TVXZ	77.0	66.3	25.7
June 6	RV6210TVXZ	76.6	64.8	29.3
June 6	RW5419KTFZ	76.3	69.8	30.9
Average for Planting Date June 6		**79.5**	**67.7**	**28.9**
NS, not statistically significantat α = 0.1, n = 3 replications.				

Effect of Planting Date and System on Short-Statured Corn Products

Table 7. Trial B (strip-till without cover crop) values averaged by corn product.			
Product	**Early Stand (% to 42,000 seeding rate)**	**Plant Height (inches)**	**Ear Height (inches)**
RT6203TVXZ	84.1 NS	74.5 NS	31.5 NS
RV5575TVXZ	84.3	72.8	29.5
RV5965TVXZ	83.5	76.5	33.4
RV6205TVXZ	84.2	74.1	32.0
RV6210TVXZ	77.4	74.2	33.5
RW5419KTFZ	82.1	75.2	32.5
NS, not statistically significant at α = 0.1, n = 15 replications.			

- There was a significant effect of planting date on short-statured corn grain yield in both trials. In both trials A and B , yields were greater on May 17 and May 22 compared to April 10 and June 6 (Figure 3).
- In trial A, the June 6 planting date produced significantly lower grain yields. This difference may have been due to the cover crop immobilizing nitrogen and using water. In both trials, average yield appeared to increase from April to May planting dates and then decrease from May to June planting dates (Figure 3).
- In general, short-statured corn grain yields were greater under no-till with cover crop compared to strip-till without cover crop. This was different than the 2022 trial where the no-till with cover crop treatments generally had lower yields than those of the short-statured corn planted with strip-till and no cover crop. In 2022, cover crops were terminated at the timing of corn planting, whereas in 2023 cover crops were terminated at least 2 weeks before corn planting (except for the April 10 planting date, Table 1).

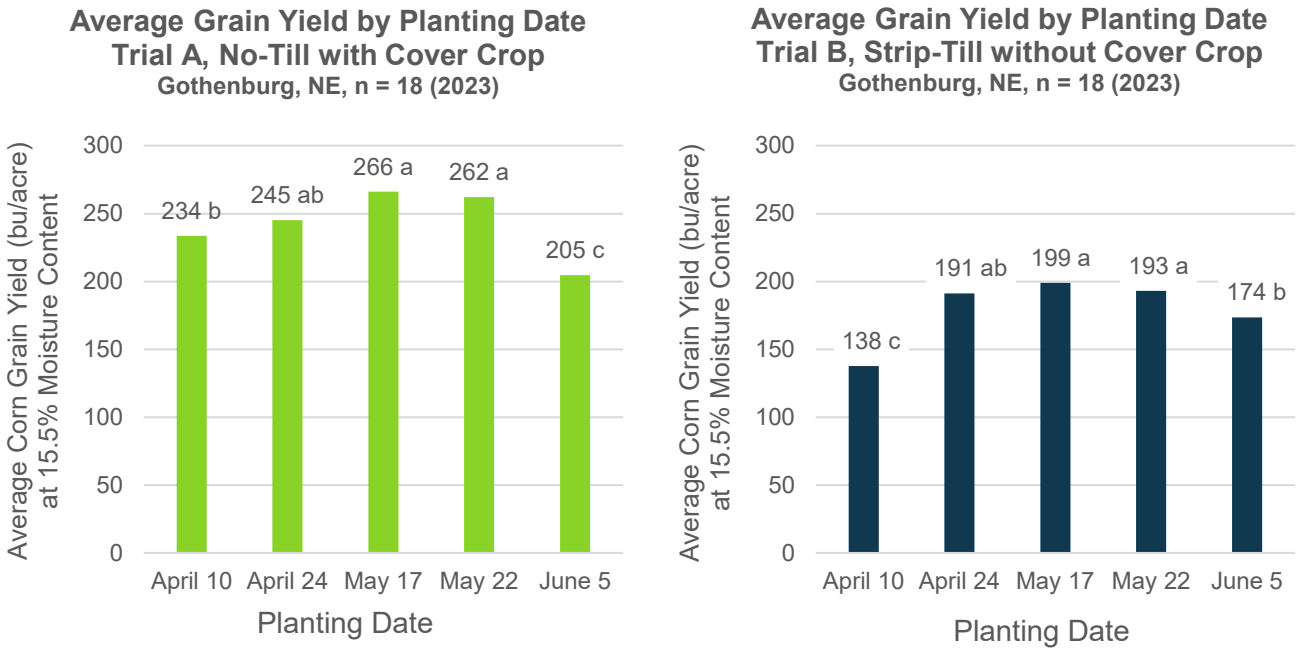

Figure 3. Short-statured corn grain yield according to planting date at the Bayer Water Utilization Learning Center, Gothenburg, NE (2023). Means followed by letters indicate statistical difference within a trial at α = 0.1, n = 18 replications.

Effect of Planting Date and System on Short-Statured Corn Products

Key Learnings

- When using grass cover crop species like cereal rye, the cover crop should be terminated at least two weeks prior to short-statured corn planting. Too much cover crop biomass accumulation such as that which occurred with the June 6 planting date (4010 lb/acre) may be harmful to corn, potentally due to nitrogen immobilization and soil water use.
- Short-statured corn plant height and ear height seem to respond differently to planting dates under no-till with cover crop, and under strip-till without cover crop. Further investigation is needed to better position products on those tillage systems.
- Cover crops, if well managed, could have a beneficial effect on yield potential in the novel short-statured corn system.
- As found in previous studies, short-statured corn grain yield seems to benefit from a mid- to late-May planting date at the Gothenburg Learning Center.

Legal Statements

Research Report / Long-Term Impact of Fertilizer Withdrawal on Corn Yield Potential and Soil Properties

Trial Objective

- The relationship between fertilizer application and crop yield is well-documented with fertilizers playing a crucial role in enhancing soil fertility and promoting plant growth.
- Nitrogen (N) is probably one of the most limiting nutrients for high yielding corn. Given the crop's substantial demand for this nutrient, farmers add fertilizer to supplement natural N levels in the soil.
- Evaluating the long-term impact of fertilizer withdrawal on corn grain yield potential and soil properties is the objective of this study.

Experiment/Trial Design

Location	Soil Type	Tillage Type	Previous Crop	Planting Date	Harvest Date	Potential Yield (bu/acre)	Seeding Rate (seeds/acre)	Row Spacing (inches)
Gothenburg, NE	Hord silt loam	Strip-till	Corn	Various	Various	90	34,000 36,000	30

- The study consisted of a 40 ft wide by 150 ft long strip that has been in continuous corn for 14 years. Soybean was the previous crop and last planted in 2009. No fertilizer has been applied since 2010. However, an estimated average of 11 lb/acre of N per year was added through irrigation based on water nitrate levels. This average increased or decreased depending on irrigation application each season.
- Cover crops were not utilized in the area to limit sources of N and organic matter (O.M.) entering the system.
- Corn was fully irrigated throughout the growing seasons.
- Zero to 8-inch and 8 to 24-inch composite soil samples were taken in the spring.
- The trial was strip-tilled every year a few weeks before planting, with no application of nutrients.
- Weeds were controlled uniformly across the study area.
- Plots were combine-harvested with grain moisture content, test weight, and total weight collected.

Long-Term Impact of Fertilizer Withdrawal on Corn Yield Potential and Soil Properties

Figure 1. Aerial image of the corn strip without fertilizer next to plots with recommended fertilization rates in Gothenburg, NE. Note the light green color where no fertilizer was applied. Picture taken on September 14, 2022.

Understanding the Results

- As expected, soil N levels were the most negatively impacted after withdrawing fertilization (Figure 2). However, this decline was not immediately observed.
- Nitrate levels at the 0 to 8-inch and 8 to 24-inch depths began to descend approximately 4 to 5 years after starting the study.
- The decline in N levels is clear if focused on the amount of Nitrate-N per acre in the 0 to 24-inch profile. From 2013 to 2016, the average was 32 lb/acre of Nitrate-N, while from 2017 to 2022 it was around 12 lb/acre.
- No clear trend was observed in test results for soil pH, O.M., and Sulfate-S throughout the years.
- Except for the 2020 soil test results, phosphorus (P) concentration at the 0 to 8-inch depth tended to decrease over time. After 12 years of continuous corn without fertilization, P levels were 50% lower compared to the beginning (13 vs 26 ppm).

Long-Term Impact of Fertilizer Withdrawal on Corn Yield Potential and Soil Properties

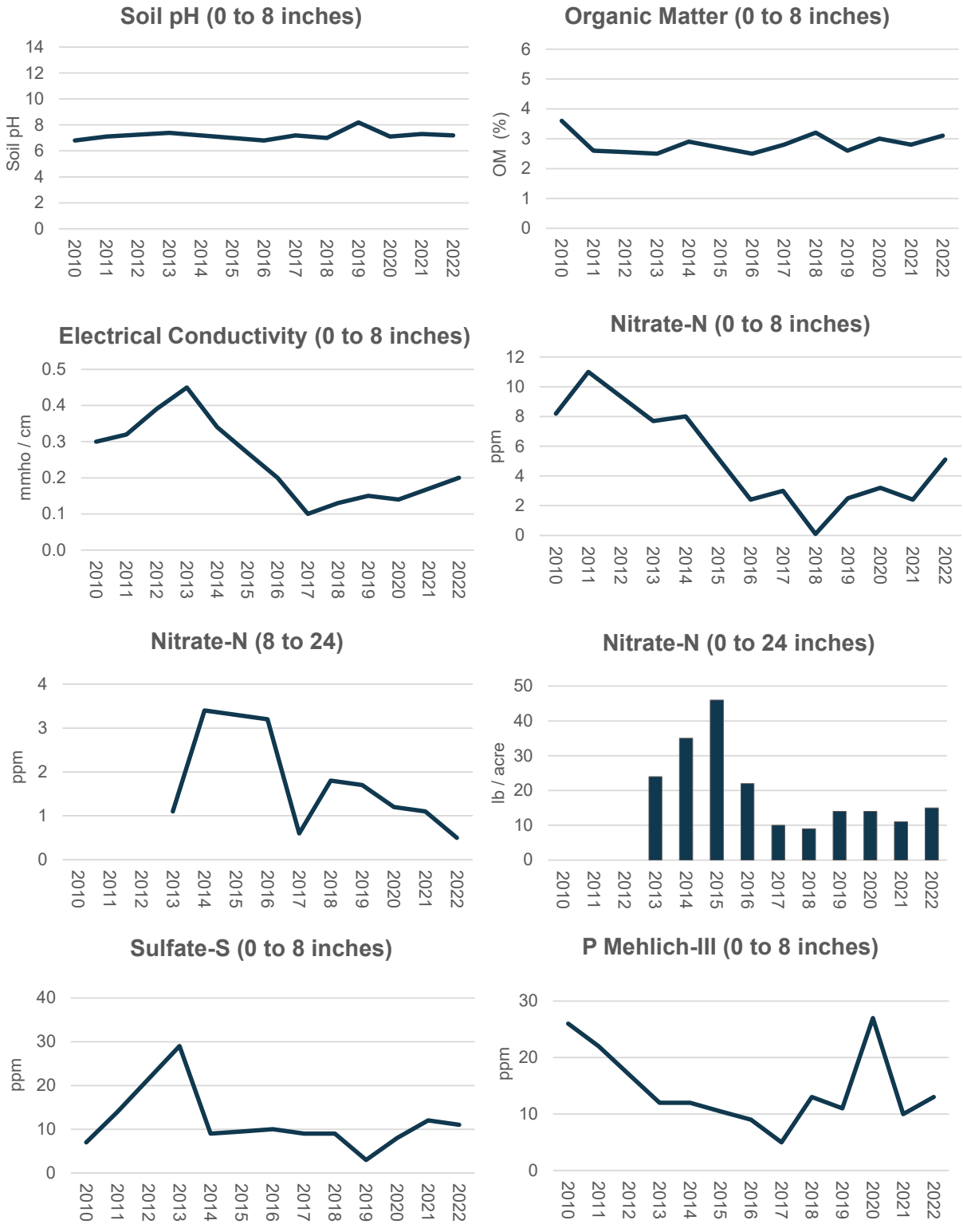

Figure 2. Soil pH, organic matter, salts, nitrate, sulfate, and phosphorus test results from 2010 to 2022 taken from the unfertilized corn strip in Gothenburg, NE.

Long-Term Impact of Fertilizer Withdrawal on Corn Yield Potential and Soil Properties

- Cation exchange capacity (CEC) decreased around 20% from 2010 to 2022 (Figure 3). This is a result of a decline in calcium (Ca), magnesium (Mg), and potassium (K) concentrations in the 0 to 8-inch soil depth. Corn production removes nutrients from the soil, and the exact removal rate can vary depending on factors such as soil fertility, yield, and weather conditions.
- Soil test results for micronutrients like zinc (Zn), boron (B), iron (Fe), manganese (Mn), and copper (Cu) fluctuated over time, but no consistent downward trend was observed.

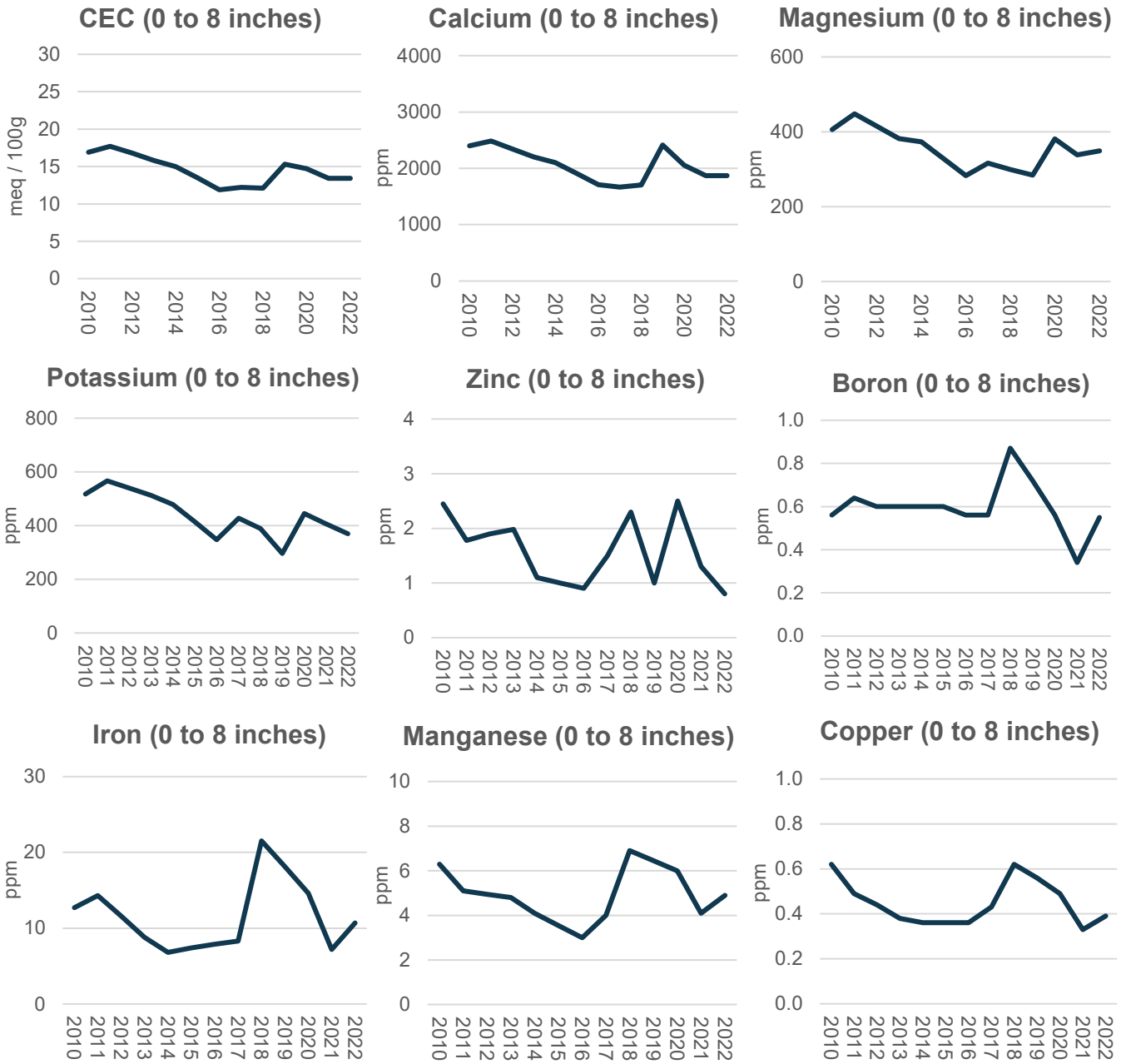

Figure 3. Soil cation exchange capacity and micronutrient test results from 2010 to 2022 from the unfertilized corn strip in Gothenburg, NE.

Long-Term Impact of Fertilizer Withdrawal on Corn Yield Potential and Soil Properties

- In 2022, soil that was fertilized regularly for crop production was sampled adjacent to the zero N trial to evaluate change between the two management systems (Table 1). The soil adjacent was typically managed in a corn and soybean rotation and fertilized with N, P, S, and Zn as required for production.
- Higher nitrate levels, higher P levels, and higher Zn levels were noted, along with lower levels of Zn in the adjacent sample otherwise the soil chemical properties did not seem affected. Even organic matter was consistent between the systems (Table 1).

Table 1. Fertility results in 2022 from soil strip that was fertilized regularly and the adjacent zero nitrogen trial.

Sample Location and Depth	Soil pH 1:1	Soluble Salts: 1:1 mmho/c	Organic Matter LOI-%	KCl Nitrate ppm N	Nitrate lb N/acre	M-3 Phos	Ammonium Acetate				M-3 Sulfate ppm-S
							K ppm	Ca ppm	Mg ppm	Na ppm	
Adjacent (0 to 8 inches)	7	0.17	3	9.1	22	32	323	1863	343	38	8.3
Adjacent (8 to 24 inches)				3.7	18						
Zero N (0 to 8 inches)	7	0.2	3.1	5.1	12	13	370	1869	349	46	11.2
Zero N (8 to 24 inches)				0.5	3						

Table 1. (continued)

Sample Location and Depth	DTPA				Hot Water Boron	Sum of Cations me/100	% Base Saturation				
	Zn	Fe	Mn	Cu			H	K	Ca	Mg	Na
Adjacent (0 to 8 inches)	1.6	11.4	5.6	0.33	0.33	13.2	0	6	71	22	1
Adjacent (8 to 24 inches)											
Zero N (0 to 8 inches)	0.8	10.7	4.9	0.39	0.55	13.4	0	7	69	22	2
Zero N (8 to 24 inches)											

Long-Term Impact of Fertilizer Withdrawal on Corn Yield Potential and Soil Properties

Corn grain yield (Figure 4)

- In 2010, after a soybean crop in 2009, corn grain yield without fertilization was 185 bu/acre. At this point, soil N levels could still sustain a decent crop and some breakdown of soybean residue provided some N to the corn throughout the season. Previous management could have resulted in higher levels of residual N.
- In 2011, a large decline in grain yield (113 bu/acre) was observed. This downward trend continued until 2014, but at a lower rate. After that, yield tended to stabilize around 70 bu/acre.
- The last two years of this series (2022 and 2023) registered 64 and 62 bu/acre, respectively.
- Yield data for 2018 missing because trial was accidentally harvested as bulk. Grain was collected without weight recorded and stover was not removed.

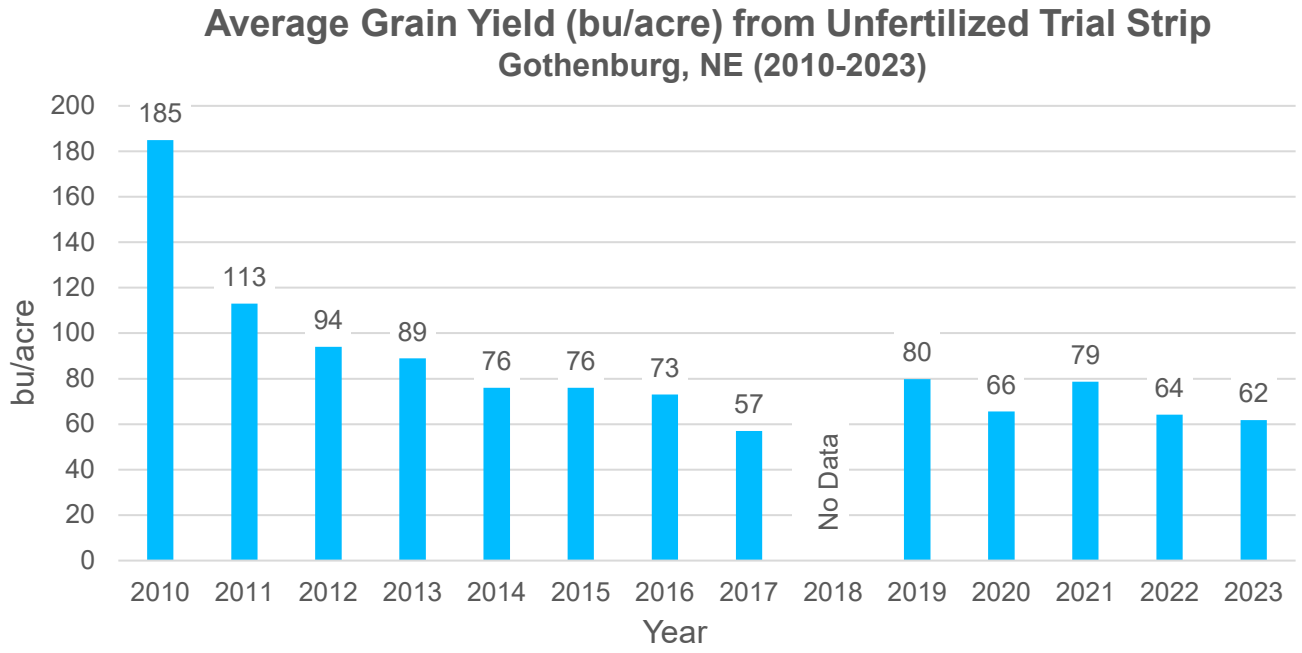

Figure 4. Average corn grain yield by year harvested from the unfertilized corn strip in Gothenburg, NE.

Key Learnings

- These findings highlight the importance of fertilization in crop production. After 5 years of continuous corn without supplemental fertilizer, grain yield dropped at least by a factor of 5 times compared to plots that were rotated and appropriately fertilized.
- Although several nutrients were below recommended critical levels, N has been the most limiting based on crop deficiency symptoms.
- The main reason for maintaining this site is to understand soil nutrient dynamics with no additional fertilization, continuous strip-till, and growing continuous corn. This trial provides an excellent way to evaluate the impact of N deficiency on corn yield potential. It is also valuable for discussing why farmers use fertilizer to groups that are not familiar with corn production.

Long-Term Impact of Fertilizer Withdrawal on Corn Yield Potential and Soil Properties

- Based on learnings from long-term trials such as the Morrow Plots at the University of Illinois, expectations were for declines in O.M. over time.[1] Yearly strip-tillage, reliance on mineralization for nutrients, and low residue production because of reduced yield are factors that would typically be assumed to cause O.M. reductions. Based on current data, that has not happened in this trial.
- Understanding nutrient removal is crucial for maintaining soil fertility and helping to maximize yield potential.

Source

[1]Odell, R.T., Walker, W.M., Boone, L.V., and Oldham, M.G. 1982. (revised 1984). The Morrow Plots. A century of learning. Bulletin 775. Agricultural Experiment Station. College of Agriculture. University of Illinois at Urbana-Champaign. https://archive.org/details/morrowplotscentu00univ/page/n7/mode/2up

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