BRANDT®

Professional Agriculture®

2024

BRANDT Research and Development Results

Welcome

As we recap the 2024 season, many things stand out but the most significant is how the BRANDT Research Farm has evolved into a destination for farmers, agronomists, partners and BRANDT customers from central Illinois and around the world to learn the latest in crop production practices and products. Now, with the Evelyn Brandt Thomas Ag Innovation Center located at the research farm, we have improved that experience even further. In 2024, we also added a second Ph.D. Agronomist, Marcos Loman. The duo of Eric Winans, Ph.D. and Marcos Loman, Ph.D., along with support staff, has raised the bar of research, education and product development that takes place at the research farm.

The 2024 crop season at the research farm was similar to what our central Illinois farmers experienced. We had a good early planting window in early to mid-April, which was followed by rain events that pushed that second planting window into mid-May. Late May, and most of June, the research farm was very dry but then gained some timely and significant rain events late June and through July. Overall, growing conditions were conducive for very high yields across the farm.

Please enjoy our research results from the 2024 growing season. Over the last few years we have expanded our research to include central Illinois on-farm trials and independent/third party cooperators to gain better understanding of how our products and practices perform under different conditions.

As always, we invite you to ask questions, visit our research facilities and engage with our experts to help your operation. Please reach out to your BRANDT contact and we'd be happy to assist you and your operation.

Thank you and best wishes on a safe and successful 2025 season.

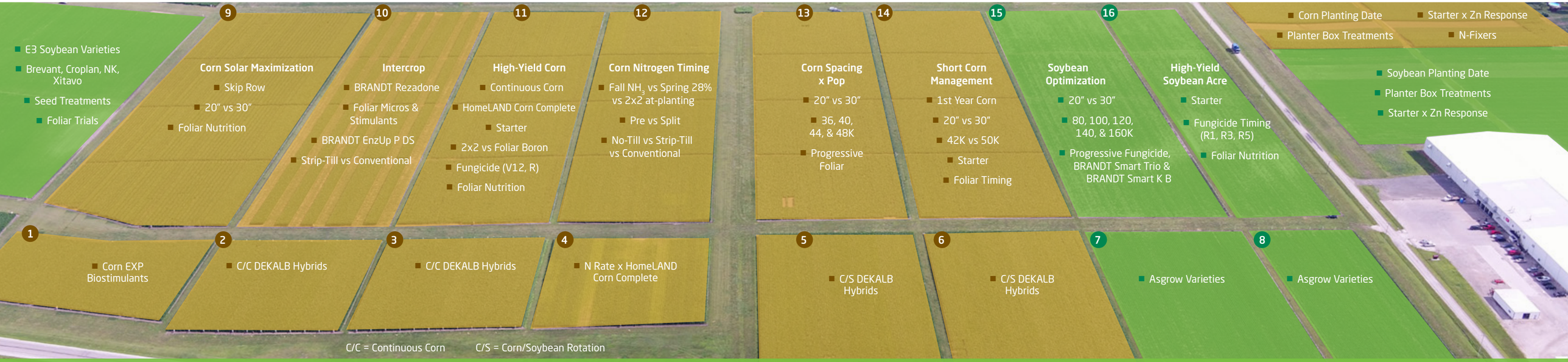
BRANDT Agronomy Staff

Evelyn Brandt Thomas Ag Innovation Center

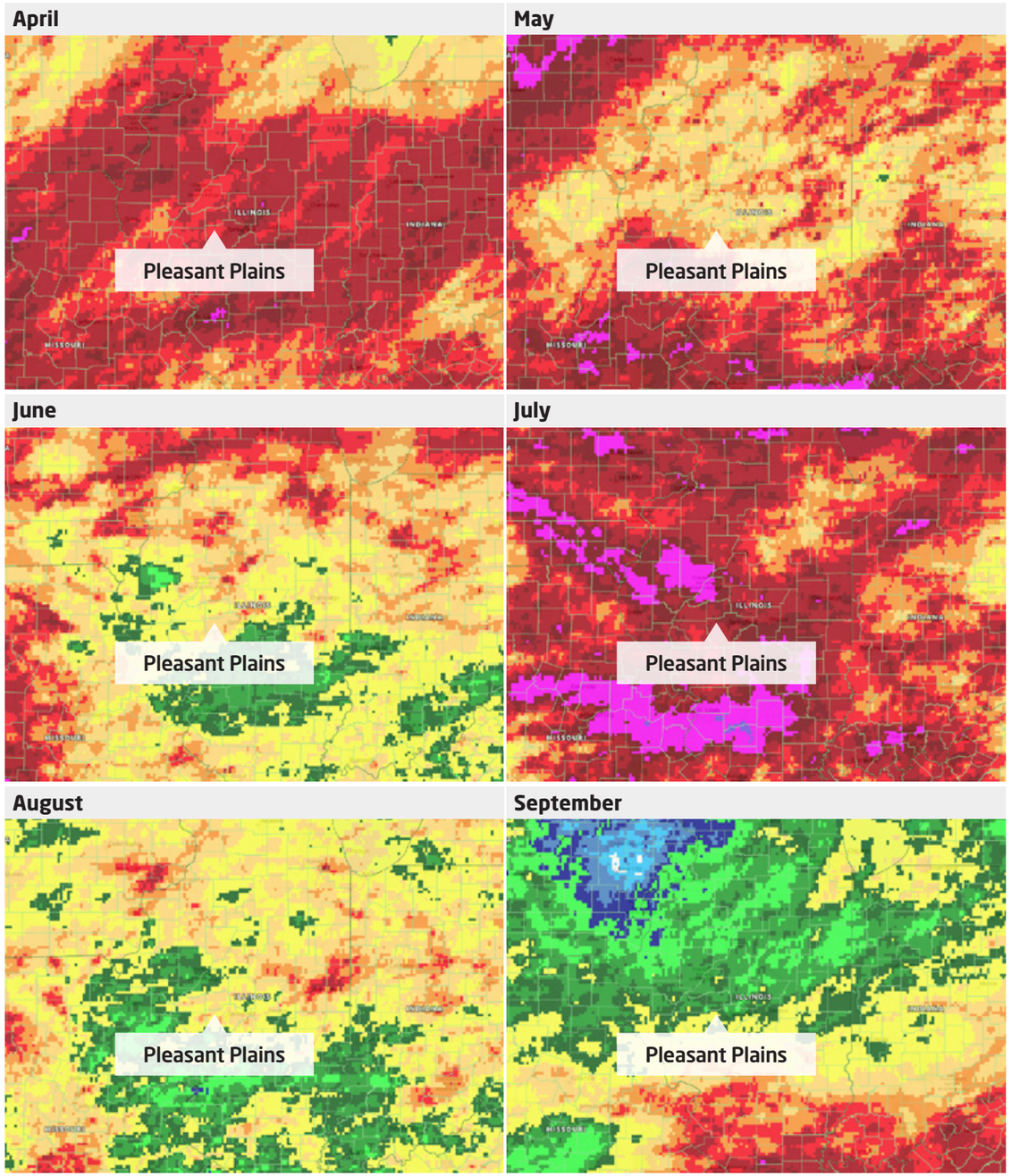
The Evelyn Brandt Thomas Ag Innovation Center was dedicated, and officially opened, with the celebration of Evelyn's 101st birthday on August 24. The new 17,500 square foot facility is dedicated to Evelyn for her unwavering passion for agriculture and her local community. The center will enable BRANDT to continue to advance and share our state-of-the-art agriculture products, processes and practices.

The building will serve as BRANDT's hub for research, development and collaboration, while advancing the company's mission to provide solutions for farmers worldwide. It includes meeting spaces, presentation areas and equipment storage to facilitate education while functioning as a full service farm.

Research Farm Plots



2024 Climate Data - BRANDT Research Farm



BRANDT Discovery and Innovation Team

Brian Haschemeyer - VP BRANDT Discovery & Innovation

Eric Winans, Ph.D. - Research Farm Manager, Technical Agronomist

Marcos Loman, Ph.D. - Technical Agronomist

Tom Kimes - Operations Manager, Research Farm

Ed Corrigan - Technical Agronomist, Midwest

Brad Walker - Technical Agronomist, Great Plains

Brad Bergefurd - Technical Agronomist, Eastern Corn Belt

Greg Jackson - Technical Agronomist, East Coast and Delta

John Weber - Crop Protectant Manager, Technical Agronomist, PNW

Raquel Gomez - Technical Agronomist, West Coast

Natalie Starich - Technical Data Specialist

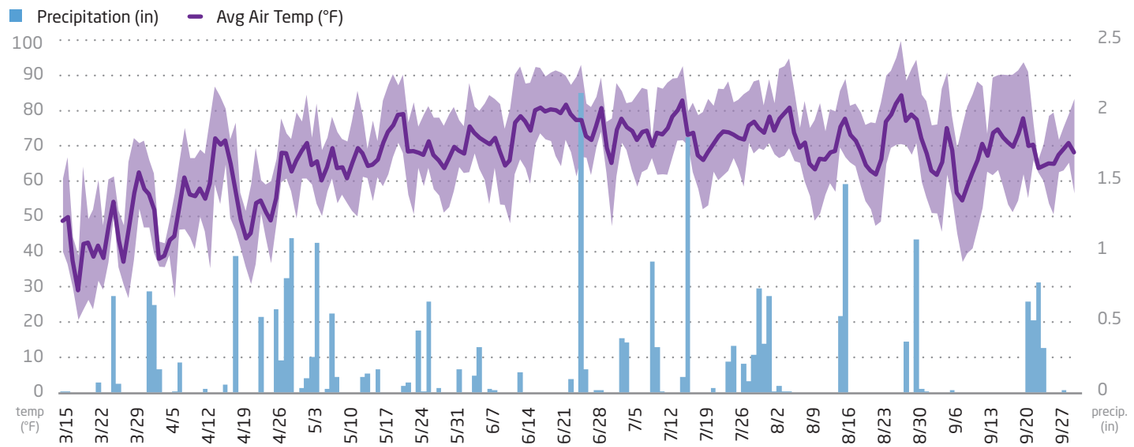
BRANDT Agronomic Services Team

Kyle McClelland - Seed and Technical Agronomy Manager

Brian Dintelmann - Technical Agronomist

Steve Clement - Technical Systems Advisor

2024 Weather in Pleasant Plains



Weather maps can be found at: https://water.noaa.gov

BRANDT Agronomic Services Community and On-Farm Trials

The BRANDT Agronomic Services team collaborates with local farms to generate local data for our retail customers. This includes the BRANDT Community Trials, which represent over 50 locations around central Illinois with a replicated set of corn hybrids and soybean varieties. Additionally, we focus on larger scale on-farm trials where we look at different management practices, new crop protection products, proprietary nutrient formulations and creating high yield environments. This data provides valuable insights to help our customers make the best decisions for their operation.

Third Party Trial Locations

Contract Researchers Used in the Trials

Company	City	State
Purdue University	West Lafayette	IN
	Butlerville	IN
	Columbia City	IN
	Wanatah	IN
University of Illinois	Champaign	IL
	Nashville	IL
	Yorkville	IL
ABG Ag Service	Sheridan	IN
Alliance Research	Island	KY
Buckeye Ag Testing	Troy	OH
TSM Services	Catlin	IL
SGS Field Research	Aurora	SD
Performance Crop Research	Great Bend	KS
Irrigation Research Foundation	Yuma	CO
Impact Agronomics	Pantego	NC
Elite Research	Aurora	NE
Alpha Ag Research	Sanborn	IA
Southern Ag Services	Starkville	MS
PRS	Holden	MO
North Central Research Station	St. Johns	MI
Diamond Ag Research	Larned	KS
AGVISE Research	Northwood	ND
SynTech Research	Verona	WI

Contents

Corn and Soybean Planting Date

BRANDT Research Farm - Pleasant Plains, IL - 2024

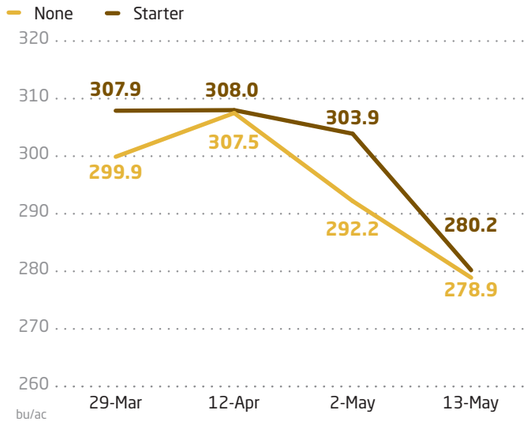
2024 Planting Date Study:

- Corn and Soybean were planted on March 29, April 12, May 2 and May 13 with or without starter fertilizer
- Starter Fertilizer:
  - 2x2: ATS (10 gal/ac), BRANDT EnzUp P DS (2.5 lbs/ac), 9% EDTA Zn (1 qt/ac)
  - In-furrow: BRANDT EnzUp Zn (1 pt/ac)

2024 Corn Planting Date:

- Maximum corn yield, with or without starter fertilizer, was achieved when planted on April 12.
- For the first planting date, applying starter fertilizer was necessary to maximize yield. It provided an 8 bu/ac advantage over no-starter application, likely due to the lack of mineralization in cooler soils.
- The use of starter fertilizer reduced corn yield variability across planting dates, highlighting its role as a consistent nutrient source, regardless of the soil's environmental and biological conditions.
- For both starter and no-starter treatments, yields dropped significantly when planting in mid-May.

2024 Corn Planting Date Trials

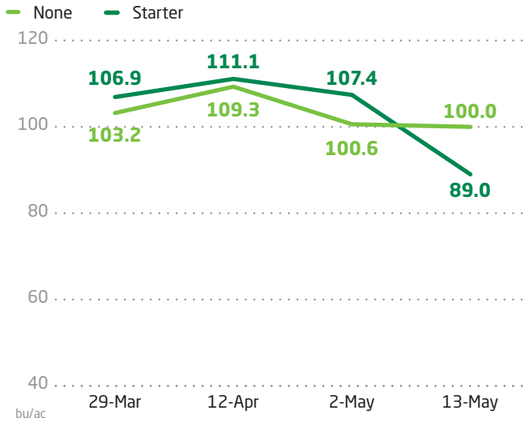


Notes: Previous crop: soybean; Hybrid: DKC66-06RIB; Planting rate: 38,000 plants/ac; Fall Fertility: 25-75-100 suspension; Nitrogen: 180 lbs/ac as fall NH_3; V5 foliar: BRANDT Smart Trio with herbicide; V12 foliar: Veltyma, Warrior, BRANDT Smart K B, BRANDT Smart Trio; R2 foliar: Veltyma, BRANDT Smart Trio, BRANDT Smart K B

2024 Soybean Planting Date:

- Maximum soybean yield, with or without starter fertilizer, was achieved when planted on April 12.
- The application of starter fertilizer increased soybean yield at all planting dates except the last one, with the greatest increase observed at the third planting date (6.8 bu/ac).
- The yield drop caused by starter fertilizer at the last planting date may be due to higher soil temperatures, which accelerate organic matter mineralization. This, combined with the starter fertilizer, may have led to excessively high nutrient concentrations in the rhizosphere, resulting in a phenomenon known as *futile nutrient cycling*, which can be detrimental to crop yields.
- The lowest yields for both starter and no-starter treatments were recorded on the last planting date.

2024 Soybean Planting Date Trials

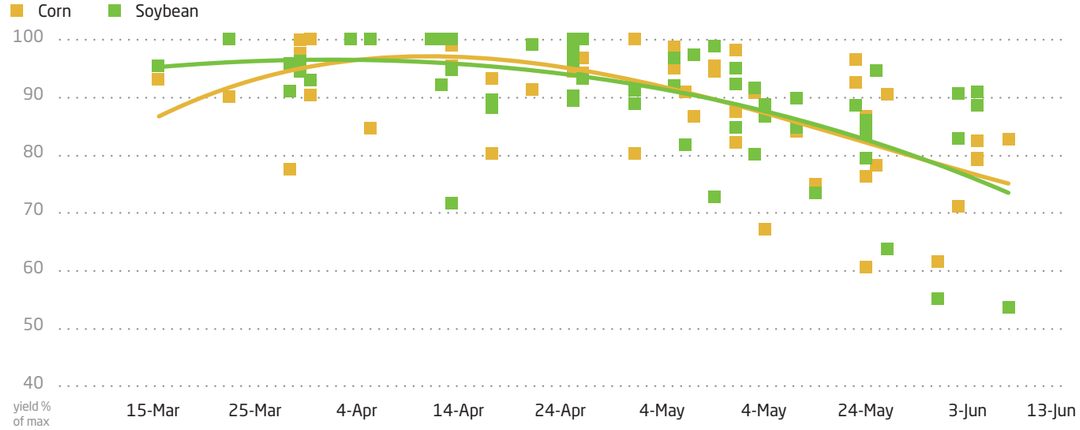


Notes: Previous crop: corn; Variety: AG38XF3; Planting rate: 120,000 plants/ac; Fall Fertility: 25-75-100 suspension; V3 foliar: BRANDT Smart Trio with herbicide; R3 foliar: Miravis Top, Warrior, BRANDT Smart K B, BRANDT Smart Trio

Pleasant Plains Research Farm Historical Planting Data:

- Historical planting date data from the research farm shows that corn and soybean both follow a similar yield decline as planting date is delayed.
- Soybean benefited from planting during the last two weeks of March and the first week of April, while corn yields declined within the same period. Due to its plasticity, soybean is more resilient than corn in cooler planting conditions and does not require a perfect stand to maximize yield.
- On average for both corn and soybean, 95% of maximum yield was achieved if planted by April 23, 90% of maximum yield was achieved if planted by May 8, and 80% of maximum yield was achieved if planted by May 28. However, yield potential variability increased significantly with delayed planting dates.

Pleasant Plains Research Farm Historical Planting Data - 2016-2024



Corn Results

Top 5 Corn Insights

1. Highest corn yields continue to be achieved with early planting dates. Response to ATS and starter fertilizer is greatest when planting early into cooler soils.

2. Excellent soil mineralization, driven by warmer soil temperatures, adequate moisture, high organic matter, and strong soil fertility, resulted in high yields and less opportunity for significant impact from certain biologicals.

3. Nitrogen was best managed when banded beneath the future crop row in the fall and protected with a nitrification inhibitor.

4. Balancing high phosphorus levels with a zinc application through the planter box, in-furrow, or early foliar had positive impacts on yield.

5. Season-long foliar management of fungicide and nutrition protected photosynthetic capacity through grain fill and helped meet nutrient requirements during periods of peak demand.

Introduction to Corn Yield Development

To understand how corn grain yield is built, we can start with the fundamental corn yield algorithm, which defines yield as follows:

Corn yield = ears per acre × kernels per ear × average weight of the kernels

In simple terms, increasing yield requires enhancing one or more of these components. However, each element is interrelated meaning that a change in one often influences the others—sometimes positively, but often negatively. This phenomenon, known as yield component compensation, adds a layer of complexity to yield improvement. A common observation in the field is a reduction in the number of kernels when corn is planted at higher densities without additional management. When population increases but resource availability (such as nutrients) remains constant, each plant has fewer resources to sustain kernel development. As a result, the number of kernels per plant decreases. However, with proper management, this effect can be mitigated. By optimizing each yield component at the appropriate stages of the corn growth cycle, it is possible to achieve higher yields.

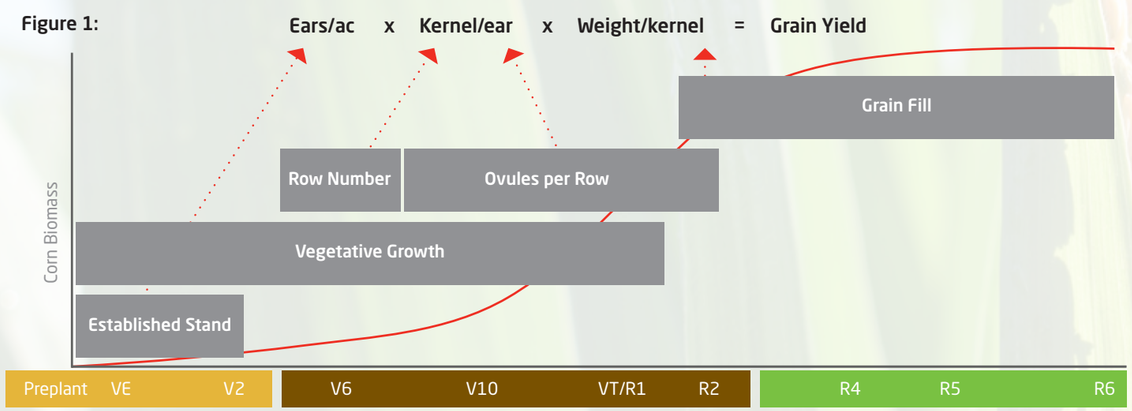
Throughout the season, each component of the yield equation is influenced by different growth stages, beginning with planting and ending at physiological maturity, as depicted in Figure 1:

- **Ears per acre** depend on the number of seedlings that successfully emerge and establish.
- **Kernels per ear** are primarily influenced from the V4 stage through the R2 growth stage.
- **Kernel weight** is developed during the grain-filling period.

By understanding these growth stages and their impact on yield components, farmers can adopt targeted management practices to optimize yield potential at each step of the growing season.

To further explore how to positively influence these components, we can divide the corn growing season into three key phases: Foundation of Resource Capture, Establishment of Productive Potential and Yield Determination and Realization.

Figure 1:



Preplant - V2

Foundation of Resource Capture

This phase of corn development involves establishing the optimal conditions for capturing sunlight, water and nutrients effectively. It begins before planting and continues until the crop stand emerges and reaches approximately the V2 growth stage. Key management aspects to consider include:

- Plant population
- Hybrid
- Row spacing
- Planting date
- Nitrogen program
- Crop rotation
- Tillage system
- Residue management + residual herbicide
- Seed treatment
- Starter fertilizer program (N, P, K and Zn)
- Planter box treatment
- Enzymes, biologicals
- Micronutrients

V3 - R2

Establishment of Yield Potential

The second phase, spanning early vegetative stages to the start of reproductive development, focuses on optimizing canopy and root formation and maximizing ovule numbers for kernel development. Kernel rows per ear are determined around the V6-V8 stage, while potential ear length is set between V12-V14. Maximizing potential ear size during these stages is crucial, as lost yield potential cannot be recovered later. At tasseling and early reproductive phases, the number of fertilized ovules that develop into kernels is finalized, defining the crop's yield potential. Additionally, peak nutrient uptake and biomass accumulation occur from approximately V8-V10 through R2, placing high demands on soil nutrients, water and photoassimilates. Transient nutrient deficiencies are common during these stages and can affect kernel count due to the plant's limited nutrient absorption capacity. Therefore, timely foliar applications of nutrients are vital to support maximum yield potential. Key management aspects to consider:

- In-season nitrogen
- Foliar nutrition
- Herbicide
- Fungicide/insecticide
- In-season biological products
- Plant stress management (~ROS)

R3 -R6

Yield Determination/Realization

The final phase, from early reproductive stages to physiological maturity, focuses on maximizing grain weight. During this time, plants direct resources to grain development, making them vulnerable to environmental stress and nutrient limitations that can affect yield. Maintaining crop health and active photosynthesis until the end of the cycle is crucial, as about half of the kernel's dry matter accumulates after the R5 (dent) stage. Key management aspects to consider:

- Fungicide/insecticide (stay green)
- Foliar nutrition

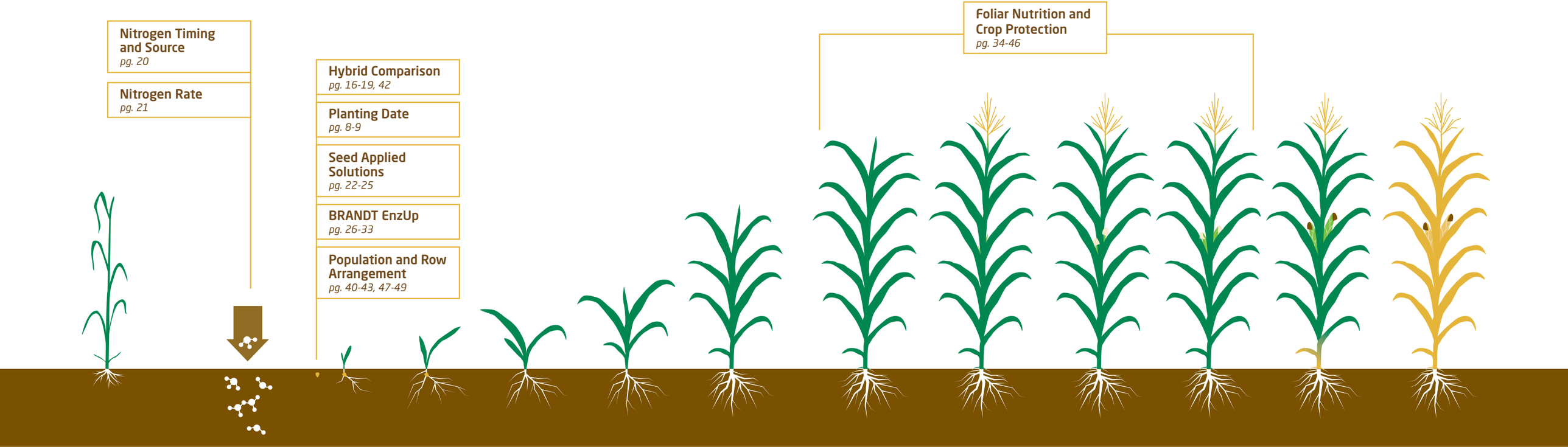
Corn

BRANDT Corn Production Base Management

The BRANDT Research Farm base applications reflect a high yield management recommendation that can be implemented in parts or as a whole to fit within a grower's current program. Applications for 2024 were:

- Conventional fall tillage
- 25-75-100 suspension in the fall with BRANDT® Rezadone®
- Fall NH_3 with N-Serve – 160 lbs N/ac
- Planter 2x2: 10 gal/ac Ammonium Thiosulfate (ATS, 12-0-0-26S), 2.5 lbs/ac BRANDT EnzUp P DS, 1 qt/ac BRANDT® Sequestar® 9% Zn
- Planter in-furrow: 1 pt/ac BRANDT EnzUp Zn
- HomeLAND Corn Complete planter box treatment
- 38,000-44,000 plants/ac
- Pre-emergent herbicide
- Post herbicide with 1 qt/ac BRANDT Smart Trio® and 1 pt/ac BRANDT Smart B-Mo
- Fungicide and insecticide with 1 qt/ac BRANDT Smart K B, and 1 qt/ac BRANDT Smart Trio V12 & R2

We have illustrated the production practices as they relate to application timing. Please note how many important decisions are made before and at planting.



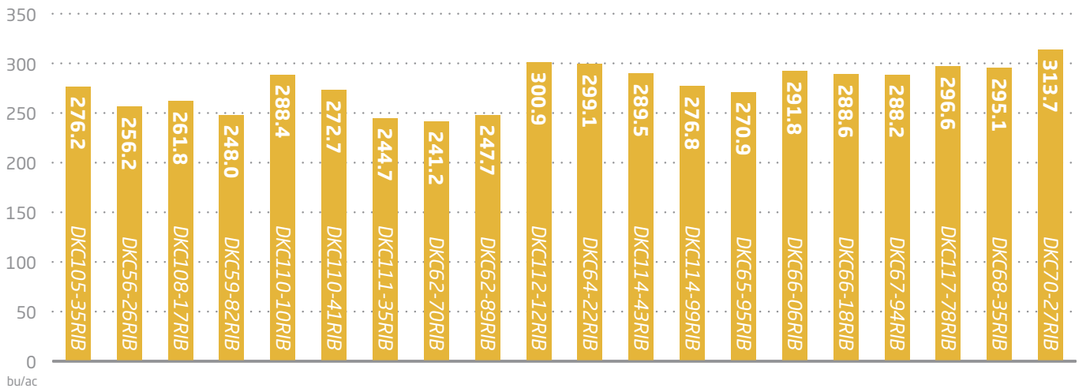
Corn Hybrid Comparison

BRANDT Research Farm - Pleasant Plains, IL - 2024

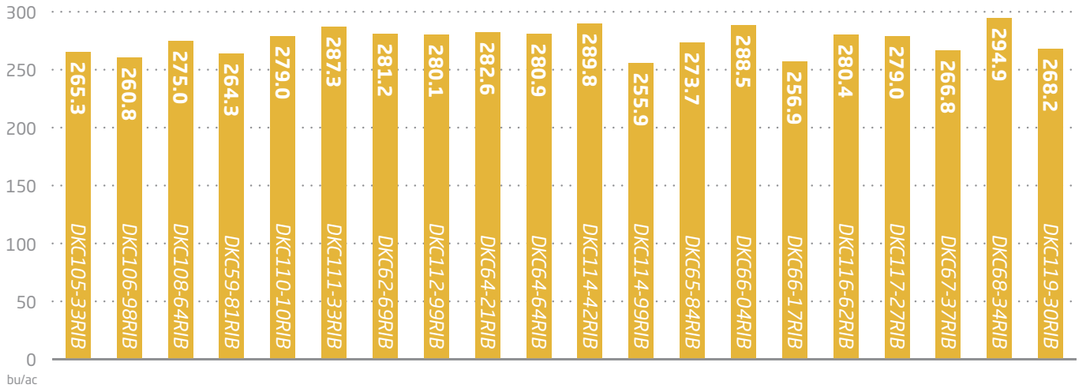
Summary:

- Hybrid selection is a crucial decision that requires careful consideration of trait packages, agronomic performance and pest resistance.
- Among the hybrids tested at the Pleasant Plains research farm in 2024, the yield difference between the top and lowest performing hybrids was 72.5 bu/ac in first-year corn and 38.9 bu/ac in continuous corn.
- Averaged across the common hybrids in both the first-year and continuous corn trials, the response to rotation was +15.1 bu/ac.
- The top performing hybrids at Pleasant Plains were DKC70-27RIB, DKC112-12RIB, DKC64-22RIB, DKC117-78RIB, and DKC68-35RIB, all yielding above 295 bu/ac on rotated ground.
- Fuller maturity hybrids tended to produce the highest yields in first-year corn fields, but this trend was not observed in continuous corn hybrids.

DEKALB Hybrids - 1st Year Corn

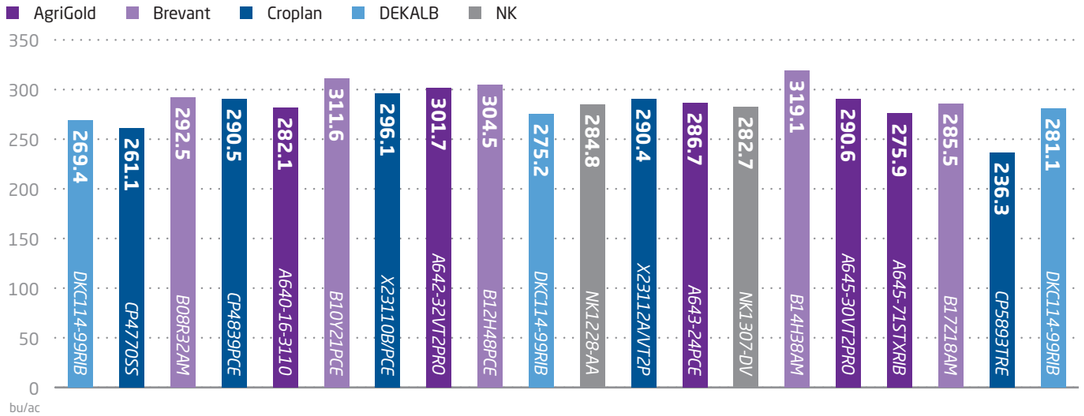


DEKALB Hybrids - Continuous Corn



Notes: Planting date: 5/12/2024; Planting rate: 38,000 plants/ac; Fall Fertility: 25-75-100 suspension; Nitrogen: 180 lbs N/ac as fall NH_3; 2x2: 10 gal/ac ATS, 2.5 lbs/ac BRANDT EnzUp P DS; In-furrow: 1 pt BRANDT EnzUp Zn; V5 foliar: BRANDT Smart Trio with herbicide; V12 foliar: Veltyma, Warrior, BRANDT Smart K B, BRANDT Smart Trio

Corn Hybrid Brand Comparison - 1st Year Corn



Notes: Planting date: 5/2/2024; Planting rate: 38,000 plants/ac; Fall Fertility: 25-75-100 suspension; Nitrogen: 180 lbs N/ac as fall NH_3; 2x2: 10 gal/ac ATS, 2.5 lbs/ac BRANDT EnzUp P DS; In-furrow: 1 pt BRANDT EnzUp Zn; V5 foliar: BRANDT Smart Trio with herbicide; V12 foliar: Veltyma, Warrior, BRANDT Smart K B, BRANDT Smart Trio

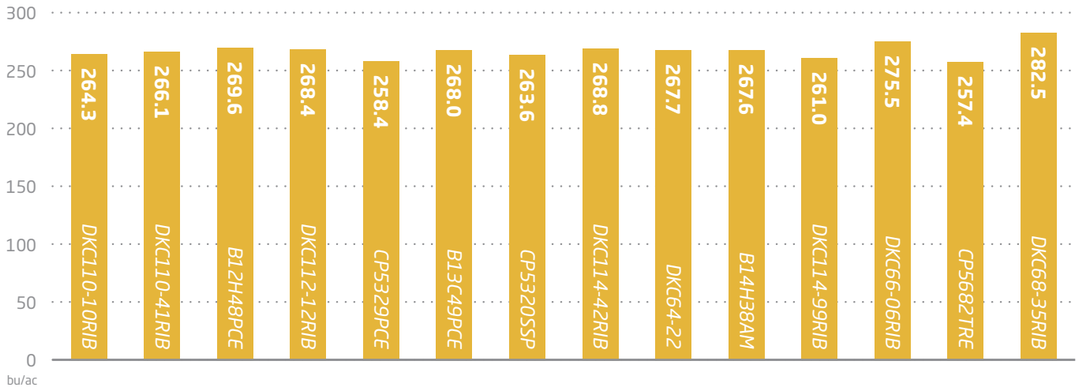
BRANDT Community Trial Hybrid Comparison

13 Central IL Plot Locations - 2024

Summary:

- Community trails were located in Franklin (2), Ashland, New Berlin, Greenview, Auburn, Mt. Auburn (3), Raymond, Oakford (2) and Williamsville.
- There are many high yielding hybrid offerings that come in a range of Bt trait platforms and maturity lengths that can fit operational needs.
- The yield difference between the top and bottom preforming hybrids across all locations was 25.1 bu/ac.

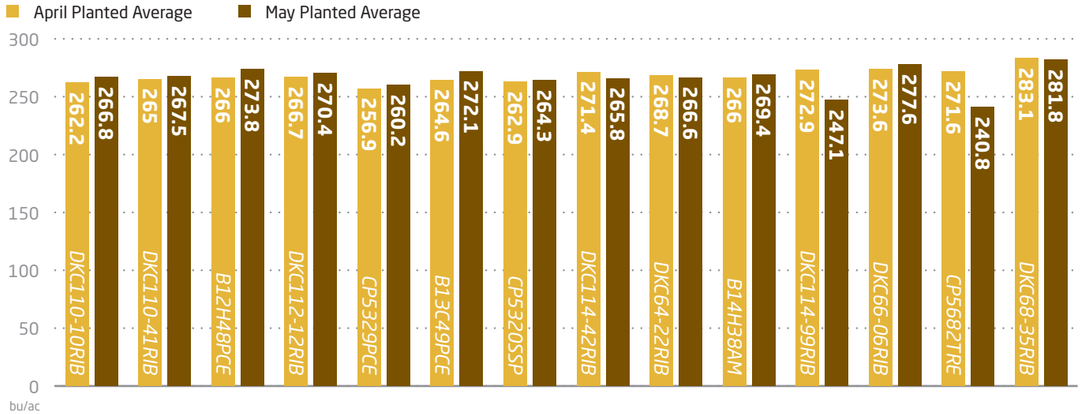
2024 Community Trial Results - Average of 13 Locations



Notes: Previous crop: soybean; Planting dates: 4/13/2024-5/18/24; Harvest dates: 9/12/24-10/30/24; Planting rate: 37,000 seeds/ac; Each hybrid planted 8 rows wide by 600' long; Non-irrigated silt loam soils.

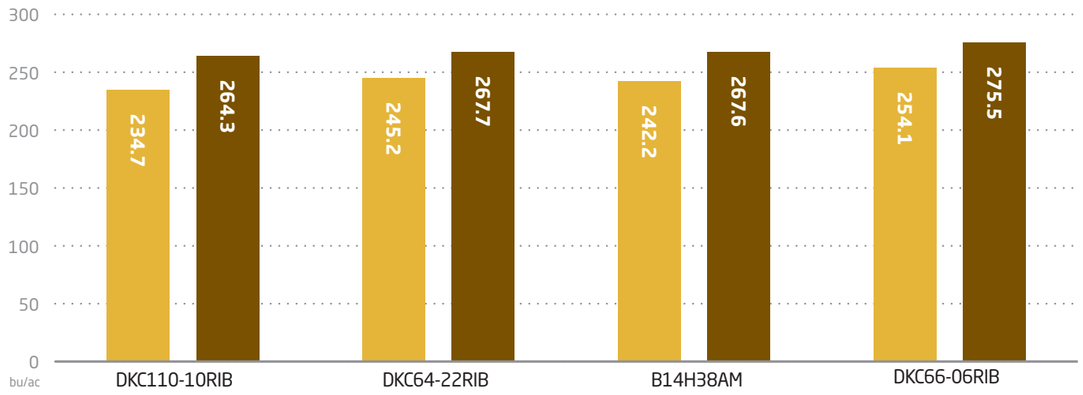
- DKC68-35RIB was the top yielding hybrid averaging 285.52 bu/ac across plots, which was 7 bu/ac higher than the second-place hybrid, DKC66-06RIB.
- B12H48PCERIB, DKC114-42RIB, DKC112-12RIB, DKC64-22RIB and B14H38AMRIB round out the top half of the hybrids in the community trial set.

Community Trial Results - April vs May Planted



- DKC114-99RIB and CP5682TRE suffered significant aphid damage from the plots planted in May. For example, DKC 114-99RIB and CP5682TRE had a 26 bu/ac and 31 bu/ac yield decrease from April to May planted plots, respectively (other hybrids only had a -3 to 7 bu/ac swing).
  - Aphids are rarely an issue and should be scouted for and potentially treated in DKC114-99RIB and CP5682TRE in the future to maximize yield.
  - DKC114-99RIB and CP5682TRE were in the top 5 yielding hybrids from April planted plots. These are high yielding hybrids and should not be overlooked due to aphid damage in 2024.

Community Trial Results - 2 Year Hybrids



- Four hybrids were tested in 2023 and 2024. Hybrid yield increased 25 bu/ac year over year. DKC66-06RIB and DKC64-22RIB were the top yielding hybrids across the 2023 and 2024 seasons.

Nitrogen Timing and Source

BRANDT Research Farm - Pleasant Plains, IL - 2024

Summary:

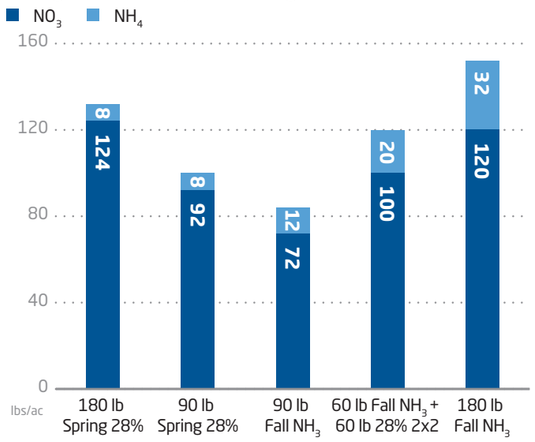
- To maximize yield potential, the corn crop requires a significant amount of N available in the soil, near the row, once the nodal root system begins to develop.
- Nitrogen stabilizers or split applications of N can be used to better time the availability of applied N with crop demand in-season.
- This season, banding all 180 lbs of N in the fall beneath the future crop row maximized yield compared to broadcasting N in the spring or delaying some N for sidedress.
- Fall application of NH_3 with N-Serve maximized early season availability of N to the crop when yield potential is determined.

Treatments:

- All treatments were balanced for 180 lbs N/ac.
- Fall: NH_3 band injected directly below the future crop row with N-Serve (1 qt/ac).
- Spring: UAN-28 broadcast applied with incorporation prior to planting.
- At-Planting: UAN-28 banded 2" below and 2" away from the seed.
- Sidedress: UAN-28 applied with coulter directly between the rows with Anvol (0.75 qt/ton) at the V4 growth stage.

Treatment	Yield (bu/ac)
180 lbs N Fall	289.7
90 lbs N Fall + 90 lbs N Sidedress	282.2
60 lbs N Fall + 60 lbs N At-Planting + 60 lbs N Sidedress	278.4
180 lbs N Spring	261.3
90 lbs N Spring + 90 lbs N Sidedress	275.5
*Data is the average of 2 replications	

Nitrogen Availability at Planting



*Soil samples pulled from the 0-12" depth.

Notes: Previous crop: Corn; Planting date: 4/22/2024; Hybrid: DKC114-99RIB; Planting rate: 38,000 plants/ac; Fall Fertility: 25-75-100 suspension; V5 foliar: BRANDT Smart Trio with herbicide; V12 foliar: Veltyma, Warrior, BRANDT Smart K B and BRANDT Smart Trio.

Nitrogen Rate - 1st Year Corn

BRANDT Research Farm - Pleasant Plains, IL - 2024

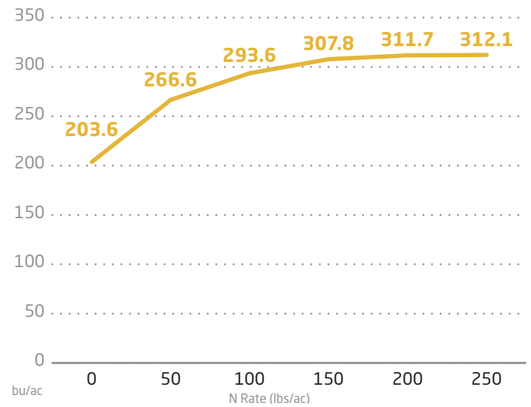
1st Year Corn N Rate:

- The high yield of 203.6 bu/ac with 0 lbs of N demonstrates the high capacity of our soils to supply N, especially on rotated ground.
- The economic optimal N rate (EONR) is the point at which the yield response to the last pound of applied N is paid for by the extra yield produced in response to that pound of N. The EONR, calculated assuming prices of $0.40/lb N and $4.10/bu corn, was 176 lbs N in 1st year corn and 212 lbs N in continuous corn.

Treatments:

- 1st year corn following soybean.
- Fall applied NH_3 with N-Serve for 0-250 lbs of total N.

1st Year Corn N Rate



Notes: Previous crop: soybean; Planting date: 4/13/2024; Hybrid: DKC64-22RIB; Planting rate: 38,000 plants/ac; Fall Fertility: 25-75-100 suspension; V5 foliar: BRANDT Smart Trio with herbicide; V12 foliar: Veltyma, Warrior, BRANDT Smart K B and BRANDT Smart Trio.

Nitrogen Rate - HomeLAND Corn Complete

BRANDT Research Farm - Pleasant Plains, IL - 2024

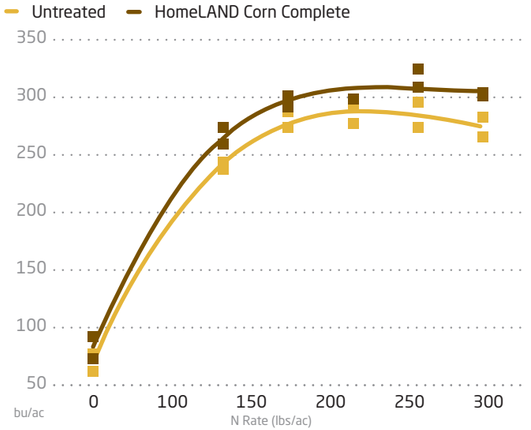
Continuous Corn N Rate x HomeLAND Corn Complete

- HomeLAND Corn Complete is a dry planter box seed inoculant that combines patented enzymes, micronutrients, microbial inoculants, and seed fluency agents to enhance seed flow, improve root development, and boost nutrient uptake for better plant health.
- HomeLAND Corn Complete increased yield over the control at all tested N rates, averaging a yield increase of 22 bu/ac.
- The greatest yield increase with HomeLAND Corn Complete was 32 bu/ac at the 250 lbs N rate.
- There was little economic advantage to applying N in rates greater than 200 lbs/ac.

Treatments:

- 18th consecutive year of continuous corn.
- Fall applied NH_3 with N-Serve for 0-300 lbs of total N.
- Within each N rate, corn was assessed for its yield response to HomeLAND Corn Complete.

Continuous Corn N Rate x HomeLAND Corn Complete



Previous crop: corn; Planting date: 4/22/2024; Hybrid: DKC114-99RIB; Planting rate: 38,000 plants/ac.

Corn Planter Box Trials

BRANDT Research Farm - Pleasant Plains, IL - 2024

- BRANDT offers a range of planter box treatment options that not only improve seed fluency but also provide added benefits. Select formulations include micronutrients, enzymes and microorganisms to enhance seed performance and plant health.
- Early-season nutrient availability is critical for maximizing crop yield potential. Seed treatment with micronutrients is an efficient method to evenly distribute the required small amounts across the acre, ensuring adequate nutrient levels without risking toxicity. Zinc is essential for C4 crops like corn and is especially important in environments with high soluble phosphate availability as found in many U.S. farmlands where it can interact negatively with phosphorus, often leading to deficiencies.
- Enzymes are non-living molecules that act as biological catalysts. Many soil processes, like mineralization, are driven by enzymes produced by microbes rather than the microbes themselves. BRANDT's patented enzymes enhance soil activity as it emerges from the cold winter, releasing carbon as an energy source to stimulate microbial activity and converting nutrients from their organic form into plant-available forms.
- The microbes in certain BRANDT planter box products associate with corn plants by colonizing root surfaces. *Azospirillum* species promotes plant growth by enhancing root development, nutrient uptake, and resilience through phytohormone production and stress adaptation mechanisms (**Figure 1**). *Pseudomonas* species release organic acids that lower soil pH, solubilizing precipitated nutrients, converting otherwise unavailable nutrients into forms accessible to plants (**Figure 2**).

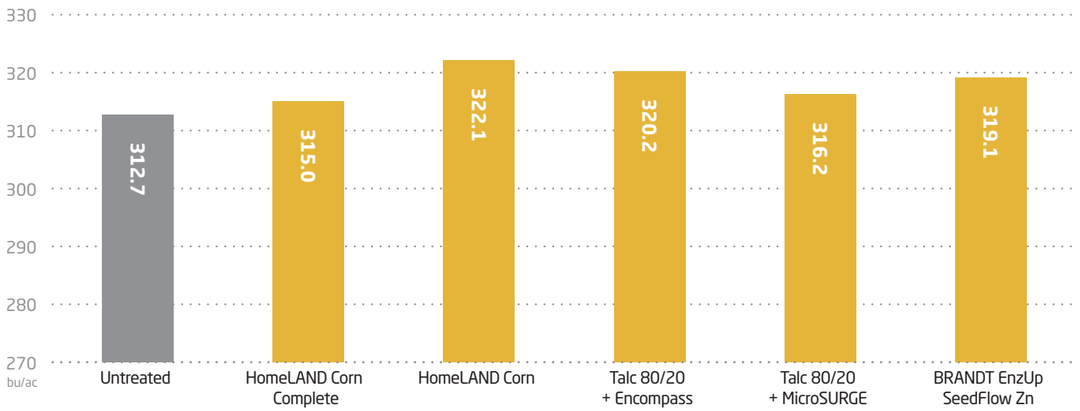
Summary:

- All treatments resulted in higher yields compared to the check treatment, with HomeLAND Corn producing the highest yield in the study.
- The addition of Zn and enzymes through BRANDT EnzUp SeedFlow Zn increased yield by 6.4 bu/ac compared to the check, highlighting the importance of supplemental Zn when using a starter P fertilizer.

Treatments:

- BRANDT EnzUp SeedFlow Zn, Talc 80/20 + MicroSURGE, Talc 80/20 + Encompass, HomeLAND Corn or HomeLAND Corn Complete applied at ¼ cup/unit of seed compared to an untreated control.
- All treatments, including the control, received ATS (10 gal/ac) 2x2 and BRANDT EnzUp P DS (2.5 lbs/ac) in-furrow.

Corn Planter Box Trials



Notes: Previous crop: soybean; Planting date: 4/13/2024; Hybrid: DKC66-06RIB; Planting rate: 38,000 plants/ac; Fall Fertility: 25-75-100 suspension; Nitrogen: 180 lbs/ac as fall NH_3; V5 foliar: BRANDT Smart Trio with herbicide; V12 foliar: Veltyma, Warrior, BRANDT Smart K B and BRANDT Smart Trio.

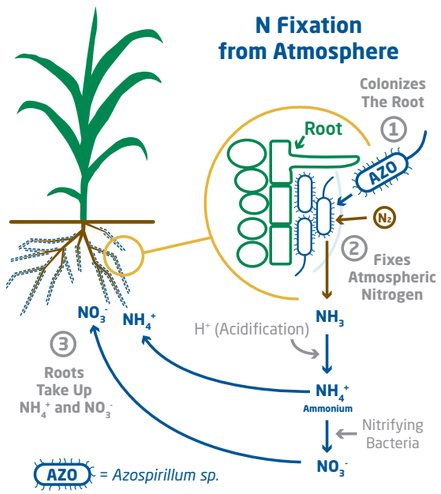


Figure 1

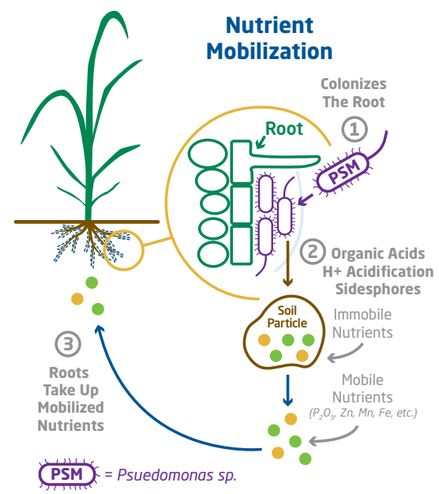


Figure 2

BRANDT Planter Box Offerings

2024 Planter Box Offerings	Components of the Various Planter Box Treatments													
	Seed Lubricants			Nutritional						Enzyme Technology		Inoculants/Biologicals		
	Talc	Graphite	SeedFlow Technology	Zn	Mo	Mn	Fe	B	Cu	Mannanase	Lipase	2 *Azospirillum* (N-fixing)	3 *Pseudomonas* (P-mobilizing)	*Bradyrhizobium japonicum* (Soy N-fixing)
Talc	✓					✓ 0.9%	✓ 0.7%							
Talc 80/20	✓	✓				✓ 0.9%	✓ 0.7%							
80/20 + MicroSURGE	✓	✓				✓ 0.9%	✓ 0.7%					✓		
80/20 + Encompass	✓	✓				✓ 0.9%	✓ 0.7%					✓	✓	
BRANDT SeedFlow Micro	✓	✓	✓	✓ 3.0%	✓ 0.5%	✓ 1.5%	✓ 1.5%	✓ .25%	✓ .25%					
BRANDT SeedFlow Nutra	✓	✓	✓		✓ 3.0%	✓ 3.0%	✓ 2.0%	✓ .25%	✓ .25%					
BRANDT EnzUp SeedFlow Zn	✓	✓	✓	✓ 4.0%		✓ 0.9%	✓ 0.7%			✓	✓			
HomeLAND Corn	✓	✓	✓	✓ 3.0%	✓ 2.0%	✓ 1.0%	✓ 1.1%		✓ 0.26%			✓		
HomeLAND Corn Complete	✓	✓	✓	✓ 3.0%	✓ 2.0%	✓ 1.0%	✓ 1.1%		✓ 0.26%	✓	✓	✓	✓	
HomeLAND Soybean	✓	✓	✓	✓ 1.2%	✓ 10.0%	✓ 2.0%	✓ 2.0%		✓ 0.26%					✓

Corn Planter Box Product Comparison

3rd Party Multi-State Trials - 2024

Location: Trial data encompasses 13 environments across 10 U.S. states, with each environment including six replications.

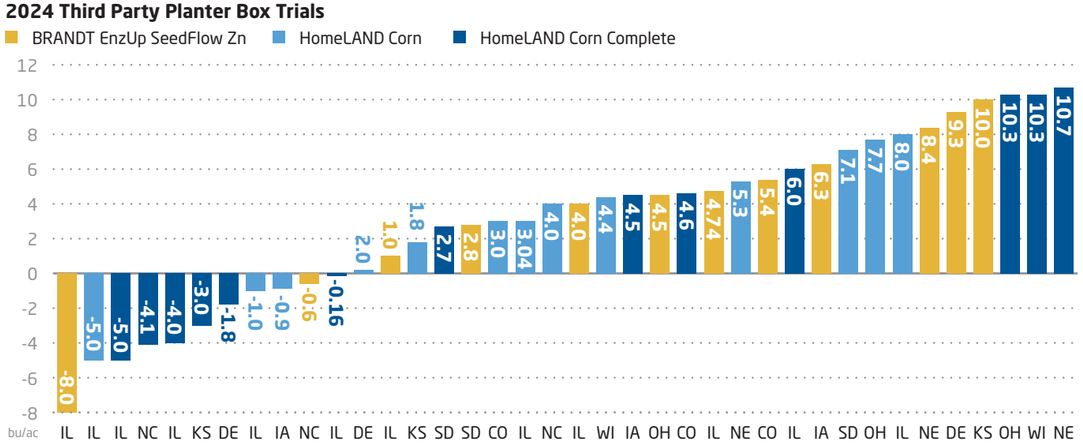
Treatments:

- BRANDT EnzUp SeedFlow Zn, HomeLAND Corn or HomeLAND Corn Complete applied at ¼ cup/unit of seed compared to an untreated control.

Summary of the Results:

- Corn planter box seed treatments with biologicals and micronutrients resulted in an overall success rate of 72%.
- BRANDT EnzUp SeedFlow Zn increased yields at 83% of the locations, with an average yield increase of 4.0 bu/ac.
- HomeLAND Corn increased yields at 75% of the locations, with an average yield increase of 2.9 bu/ac.
- HomeLAND Corn Complete increased yields at 58% of the locations, with an average yield increase of 2.4 bu/ac.

2024 Third Party Planter Box Trials



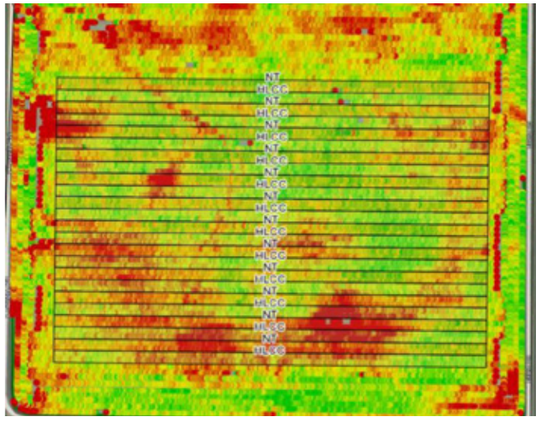
Corn Response to HomeLAND Corn Complete

Central IL On Farm Trial - 2024

Location: Auburn, Greenview, Franklin, Gridley and Waverly (18 on-farm trials)

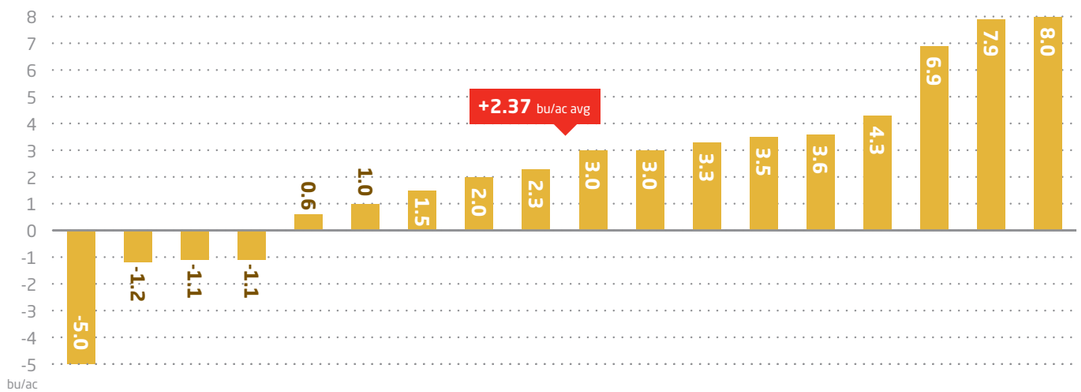
Treatments:

- HomeLAND Corn Complete was treated on corn by customers at ¼ cup/unit of seed, compared to untreated or farmer standard seed fluency agent.
- Trials were performed in a split-planter format.
- Evaluations were made across the entire field or in large treatment areas to make equal comparisons.
- Software used to verify results included AgVance, John Deere Operations Center and Climate FieldView.



Yield map overlaid with treatment boxes that represent non-treated (NT) and HomeLAND Corn Complete (HLCC). Yield analyzed in each box individually and summarized across the field.

HomeLAND Corn Complete Yield Response - 18 Locations



Summary:

- Across the 18 on-farm trials in 2024, HomeLAND Corn Complete resulted in an average yield of 241.23 bu/ac, which was 2.37 bu/ac greater than the non-treated/grower standard.

BRANDT® EnzUp® Technology Highlight

BRANDT's patented EnzUp enzyme technology helps transform your soil's health and fertility. By enhancing soil and plant health, EnzUp not only improves the quality and yield of your crops but also contributes to a better return on investment, making it a smart choice for efficient and profitable farming.

Unlike microbial products, EnzUp's enzymes are non-living, offering immediate and consistent performance across all soil types.

Currently the BRANDT EnzUp product line contains three patented enzymes:

- Mannanase
- Lipase
- Phosphatase

Phosphatase enzyme

BRANDT EnzUp P DS
BRANDT EnzUp K DS
Dry Soluble and Liquid <pH 5
Mannanase and **Phosphatase**

Mannanase enzyme

Lipase enzyme

BRANDT EnzUp Zn
BRANDT EnzUp Mn
BRANDT EnzUp Grain ST
BRANDT EnzUp SeedFlow Zn
Mannanase and **Lipase**

Mannanase Enzyme

Released Sugars:

The Mannanase enzyme specifically targets and breaks down polysaccharides, cellulose and hemi-cellulose found in the soil, plant cell walls and certain microbial structures as well as the complex carbohydrates exuded from the roots. When mannanase acts on mannan-based carbohydrates, it releases simple sugars.

Seed Germination:

During germination, the plant embryo produces mannanase, which helps degrade the endosperm cell walls, allowing the radicle (primary root) to emerge. The highest concentration of mannanase activity is typically found in the micropylar region of the endosperm, where the radicle emerges. When the radicle emerges, mannanase enzymes is present along the emerging root interface.

Plant Benefit:

Mannanase also breaks down starches in the exudate around the root tips, which releases sugars and draws water and nutrients to the root zone. Roots can directly absorb the released mannose as a readily available sugar source, promoting root growth and development.

Microbial Benefit:

The released sugars, particularly the oligosaccharides, serve as a food source for beneficial soil microbes, stimulating their growth and activity.

Lipase

Function of Lipase:

Lipase is an enzyme that specifically breaks down lipids, which are often greater than 20% of the total organic matter in soil.

Nutrient Release:

By breaking down these lipids, lipase releases nutrients like phosphorus and nitrogen that were previously bound to the fat molecules, making them accessible to plant roots.

Microbial Activity:

Increased lipase activity in the soil often indicates a healthy microbial community, as microbes produce this enzyme to digest organic matter.

Root Uptake:

When lipids are broken down by lipase, the released nutrients can be more easily absorbed by plant roots, promoting better nutrient uptake and ultimately, increased plant growth.

Plant Development Stages:

While most prominent in seed germination, lipase may also be involved in other plant development stages, including root growth and response to stress, by regulating lipid metabolism. This mobilization of stored lipids is crucial for the early growth of a seedling, providing the necessary energy until it can start producing its own food through photosynthesis.

Phosphatase

Function:

Phosphatase enzymes play a crucial role in releasing organic phosphate from complex organic compounds in soil by breaking down the phosphate bonds, making the phosphorus available for plant uptake; essentially, phosphatase "mineralizes" organic phosphorus into inorganic phosphate that can be used by plants.

Importance in Phosphorus Cycling:

Since a significant portion of soil phosphorus exists in organic forms, phosphatase activity is vital for recycling phosphorus within the ecosystem.

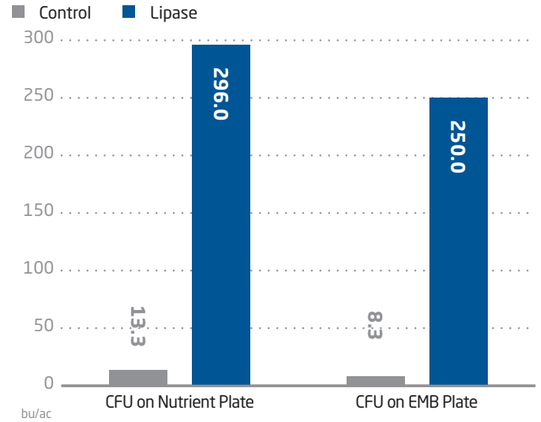
Rhizosphere Significance:

The area around plant roots (rhizosphere) often exhibits high phosphatase activity due to the release of root exudates that stimulate microbial phosphatase production.

Germination:

During seed germination, acid phosphatases are constantly expressed, and their activity increases to release nutrients for the growing embryo.

Lipase Increases Microbial Activity, CFUs



The presence of lipase enzymes in the soil can boost microbial populations by breaking down lipids releasing readily available food sources.

Phosphatase enzymes are naturally produced in limited quantities. The blue stains indicate where P is naturally available.

In this lab test, phosphatase was added to soil-less media. The yellow cloud is the converted P and large pool of available phosphorus after application.

BRANDT EnzUp Zn with Starter Fertilizer

BRANDT Research Farm - Pleasant Plains, IL - 2024

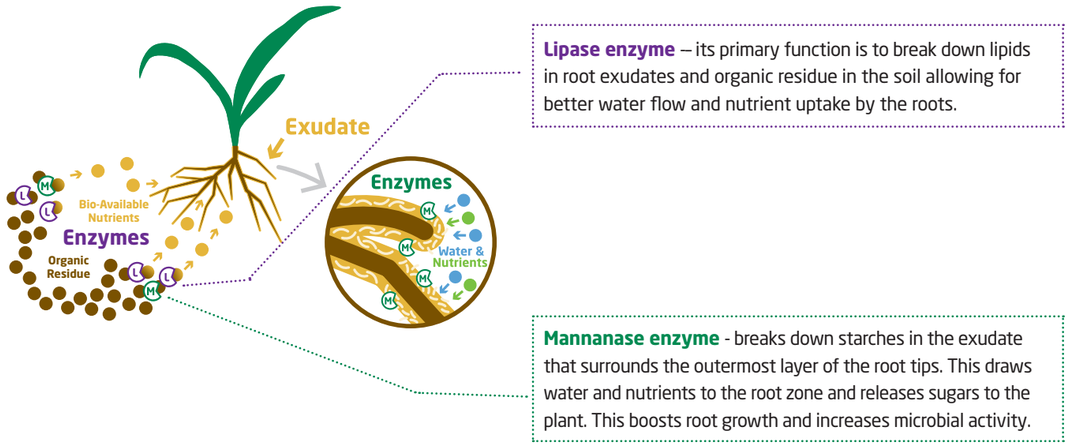
- Starter fertilizers can help meet early-season crop nutrient demand prior to adequate development of the plant's nodal root system.
- Zinc is the most common micronutrient deficiency in corn and is vital for nitrogen assimilation, protein metabolism and auxin synthesis. It is also essential to the enzyme carbonic anhydrase, which plays a key role in the C4 photosynthetic pathway by converting carbon dioxide (CO_2) into bicarbonate. Since this process is a rate-limiting step in photosynthesis, zinc deficiencies can significantly impair corn yield performance.
- Low soil temperatures limit zinc availability by reduced diffusion and slowing organic matter mineralization. This is why, even in soils with adequate zinc levels, early planting often benefits from row-applied zinc.
- Starter fertilizers often contain phosphorus, which can induce zinc deficiency by causing rhizosphere precipitation and inhibiting the growth of arbuscular mycorrhizal fungi (AMF), essential for zinc uptake in crops. Therefore, it is advisable to apply zinc whenever a phosphorus starter fertilizer is used.

Summary of the Results:

- Minimal response was observed from the application of ATS and BRANDT EnzUp P DS without Zn.
- Compared to BRANDT EnzUp P DS alone, BRANDT Sequestar 9% Zn, BRANDT EnzUp Zn and BRANDT EnzUp SeedFlow Zn increased yield by 4.6, 4.3 and 4.1 bu/ac, respectively.
- The yield responses observed could be explained by a Zn rate response, with 1 qt/ac of BRANDT Sequestar 9% EDTA Zn delivering the highest rate of Zn compared to the other Zn treatments.

Treatments:

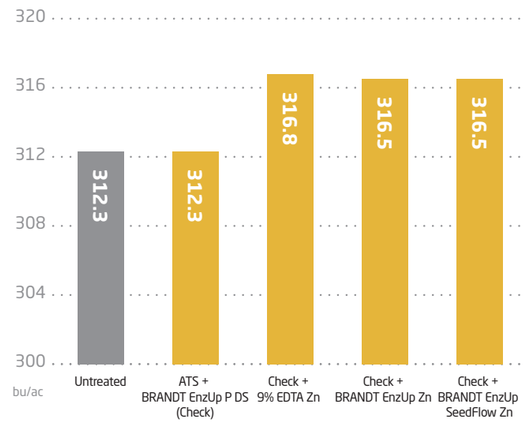
- 10 gal/ac of ATS was applied 2x0 with the planter.
- BRANDT Sequestar 9% Zn (1 qt/ac), BRANDT EnzUp Zn (1 qt/ac) and BRANDT EnzUp P DS (2.5 lbs/ac) were applied in-furrow at planting at 5 gal/ac.
- BRANDT EnzUp SeedFlow Zn was applied to the seed in the planter box at 2 oz/unit of seed.



Lipase enzyme – its primary function is to break down lipids in root exudates and organic residue in the soil allowing for better water flow and nutrient uptake by the roots.

Mannanase enzyme - breaks down starches in the exudate that surrounds the outermost layer of the root tips. This draws water and nutrients to the root zone and releases sugars to the plant. This boosts root growth and increases microbial activity.

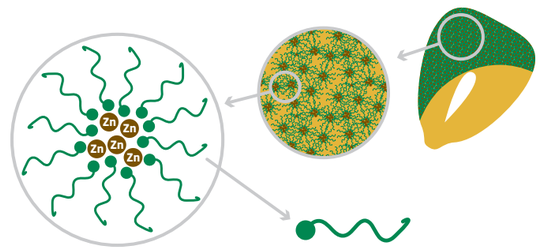
Corn Starter Fertilizer Trial



Notes: Previous crop: soybean; Planting date: 4/13/2024; Hybrid: DKC66-06RIB; Planting rate: 38,000 plants/ac; Fall Fertility: 25-75-100 suspension; Nitrogen: 180 lbs/ac as fall NH_3; V5 foliar: BRANDT Smart Trio with herbicide; V12 foliar: Veltyma, Warrior, BRANDT Smart K B and BRANDT Smart Trio.

BRANDT SeedFlow technology: dry powder micronutrient encapsulation for improved seed retention and fluency.

- Film forming dry powder.
- Improves retention of micronutrients to the seed.
- Improves overall seed fluency properties.
- Reduces dust-off and residual build-up in planters.
- Natural and biodegradable.



BRANDT EnzUp Zn vs BRANDT EnzUp SeedFlow Zn

3rd Party Multi-State Trials - 2023-2024

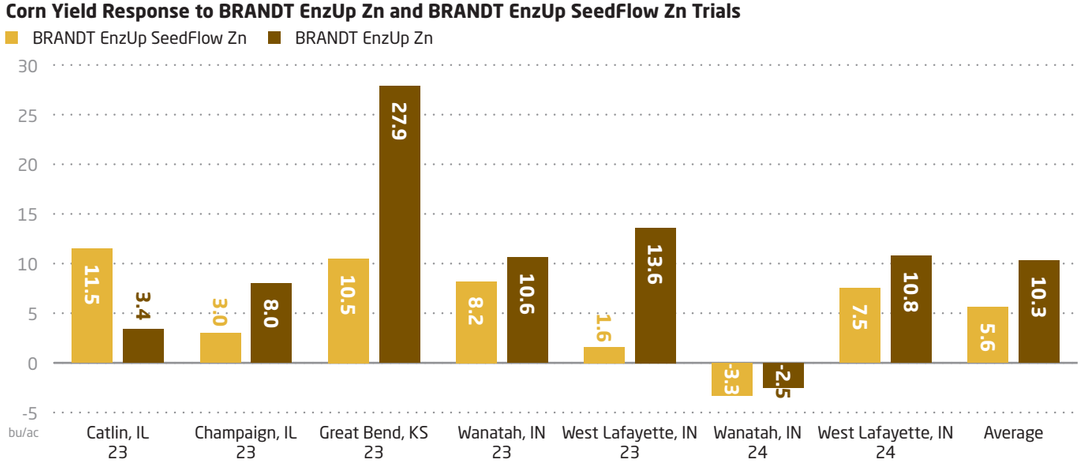
Summary

- Across 7 environments in 2023-2024, BRANDT EnzUp SeedFlow Zn (planter box treatment) increased yield by 5.6 bu/ac and BRANDT EnzUp Zn (In-furrow) increased yield by 10.3 bu/ac.
- At 4 of the 7 locations, minimal or slightly negative yield responses were observed in response to the application of 10-34-0 starter fertilizer without the application of Zn. High soluble phosphate levels near the crop row can reduce Zn uptake, inducing Zn deficiency. Starter fertilizers need to be well-balanced for maximum crop uptake and response.

Treatments

- BRANDT EnzUp Zn (1 qt/ac) and BRANDT SeedFlow Zn (2 oz/unit) applied in addition to 5 gal/ac 10-34-0 in-furrow.

Corn Yield Response to BRANDT EnzUp Zn and BRANDT EnzUp SeedFlow Zn Trials



Corn Response to BRANDT EnzUp K DS Across Different Applied Potash Rates

Purdue University Buttlerville, IN - 2024

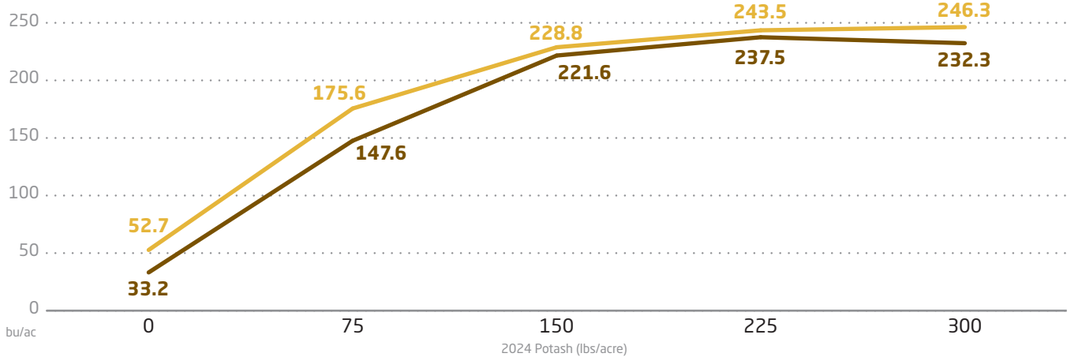
Summary:

- BRANDT EnzUp K DS was assessed by Purdue University under low spring soil test K values (28 ppm STK) with and without different spring broadcast rates of Potash (0-0-60).
- Yield increases from BRANDT EnzUp K DS application ranged from 6-28 bu/ac. The largest yield increases in response to BRANDT EnzUp P DS were observed under the 0 and 75 lb potash rates.

Treatments:

- BRANDT EnzUp K DS applied at 5 lbs/ac in-furrow at planting compared to untreated plots across spring applied potash rates of 0, 75, 150, 225, and 300 lbs/ac.

Corn Yield Response to BRANDT EnzUp K DS Across Different Soil K Levels



Corn Response to BRANDT EnzUp P DS

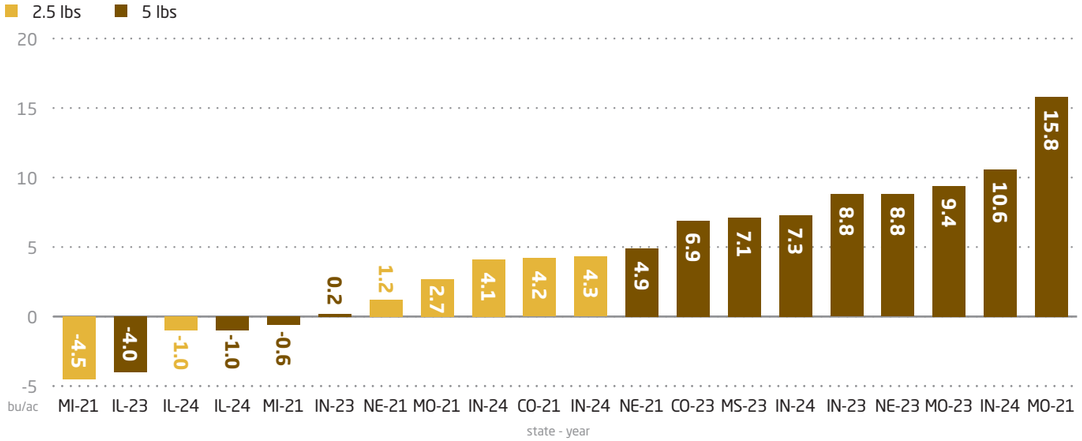
3rd Party Multi-State Trials - 2021-2024

- BRANDT EnzUp P DS (12-58-0) contains phosphatase enzymes whose primary function is to convert tied up organic phosphate into soluble, bio-available phosphate that is immediately available for plant use.
- Across 20 comparisons from 2021-2024 BRANDT EnzUp P DS increased corn grain yield by an average of 4.3 bu/ac. At the 5 lb/ac rate, BRANDT EnzUp P DS increased average yield by 5.7 bu/ac.

Corn Response to BRANDT EnzUp P DS - 2021-2024

- BRANDT EnzUp P DS applied in-furrow at planting at 2.5 or 5 lbs/ac.
- Data includes BRANDT EnzUp P DS compared to grower standard starter program, applied in addition to grower standard starter program, and compared to no starter fertilizer.

Corn Response to BRANDT EnzUp P DS



BRANDT EnzUp P DS compare to 10-34-0:

- 9 replicated field trials in 2023 and 2024.
- In-furrow treatments included 10-34-0 at 5 gal/ac, EnzUp P DS at 5 lbs/ac, and 10-34-0 at 3 gal/ac with EnzUp P DS at 2 lbs/ac compared to an untreated control with no starter fertilizer.

3rd Party Multi-State Trials - 2023-2024

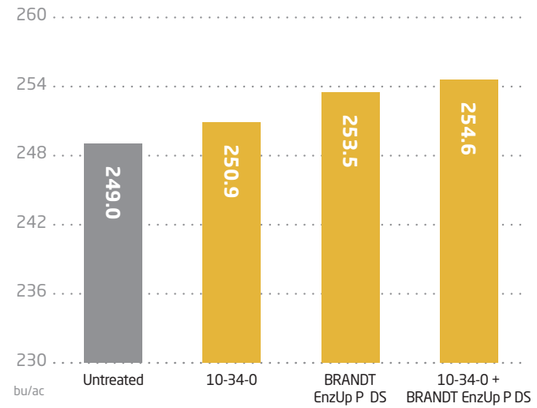
BRANDT EnzUp P DS compared to 10-34-0:

- 9 replicated field trials in 2023 and 2024.
- In-furrow treatments included 10-34-0 at 5 gal/ac, BRANDT EnzUp P DS at 5 lbs/ac, and 10-34-0 at 3 gal/ac with BRANDT EnzUp P DS at 2 lbs/ac compared to an untreated control with no starter fertilizer.

Effect of in-furrow treatments on corn grain yield across different states in the Midwest:

Location	Year	Treatment			
		Untreated	10-34-0 (5 gal)	BRANDT EnzUp P DS (5 lb)	10-34-0 (3 gal) + BRANDT EnzUp P DS (2 lb)
		Grain Yield (bu/ac)			
Champaign, IL	2023	265.0	262.0	261.0	264.0
West Lafayette, IN	2023	288.6	298.2	297.4	294.2
Wanatah, IN	2023	272.4	268.1	273.2	272.6
Holden, MO	2023	165.4	169.0	174.8	180.5
Holly Ridge, MS	2023	199.2	203.5	206.3	206.4
Holdrege, NE	2023	260.5	266.1	269.3	271.8
Champaign, IL	2024	285.0	287.0	284.0	290.0
West Lafayette, IN	2024	288.5	281.3	288.6	291.9
Wanatah, IN	2024	216.3	223.3	226.9	219.9
Average		**249.0**	**250.9**	**253.5**	**254.6**

Average Yield Response to 10-34-0 and BRANDT EnzUp P DS - 9 Locations



- Averaged across 9 trials in 2023-2024, application of BRANDT EnzUp P DS in-furrow at 5 lbs/ac increased yield by 4.5 bu/ac compared to no starter fertilizer and by 2.6 bu/ac compared to 5 gal/ac 10-34-0. BRANDT EnzUp P DS applied at 2.5 lbs/ac in combination with 2.5 gal/ac 10-34-0 increased yield by 5.6 bu/ac compared to no starter fertilizer and by 3.7 bu/ac compared to 5 gal/ac 10-34-0.

Corn Fungicide Timing

BRANDT Research Farm - Pleasant Plains, IL - 2024

- Fungicides can boost crop yield by protecting plants from fungal diseases that hinder photosynthesis and impair growth. The emergence of resistant strains of fungal phytopathogens makes plant fungal diseases become increasingly challenging to treat.
- Environmental factors such as humidity and temperature greatly influence disease development, making continuous monitoring and strategic fungicide applications essential for protecting yield.
- Optimal fungicide application timing is crucial; early applications can prevent disease spread but must be precisely timed to remain effective throughout the season. Poor timing or unnecessary use can lead to financial losses and add undue stress to crops.
- Overlapping fungicide activity can be beneficial in years with high disease pressure; however, due to the cost of chemicals and additional field passes, these decisions should be carefully considered.

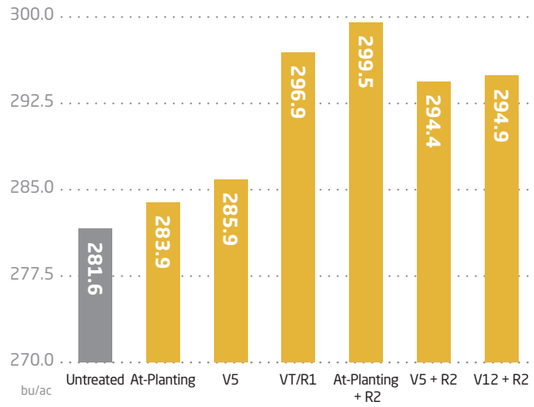
Summary of the results:

- The highest-yielding treatment in the study combined Xyway LFR applied 2x2 at planting with an R2 Veltyma spray application. However, the 2-bushel yield advantage over the second-highest treatment—a single Veltyma application at VT/R1—likely does not offset the additional chemical costs.
- Early-season fungicide protection alone was insufficient to maximize yield, likely due to the waning of chemical activity later in the season when disease pressure is typically higher.

Treatments:

- At plant fungicide consisted of Xyway LFR applied 2x2 at 15.2 fl oz/ac.
- In-season foliar fungicide sprays at V5, V12, R1, or R2 consisted of Veltyma at 7 fl oz/ac.

Fungicide Timing



Notes: Previous crop: soybean; Planting date: 4/12/2024; Hybrid: DKC67-94RIB; Planting rate: 38,000 plants/ac; Fall Fertility: 25-75-100 suspension; Nitrogen: 180 lbs N as fall NH_3; 2x2: 10 gal/ac ATS, 2.5 lbs/ac BRANDT EnzUp P DS; In-furrow: 1 pt BRANDT EnzUp Zn; V5 foliar: BRANDT Smart Trio with herbicide; R1 foliar: Warrior.

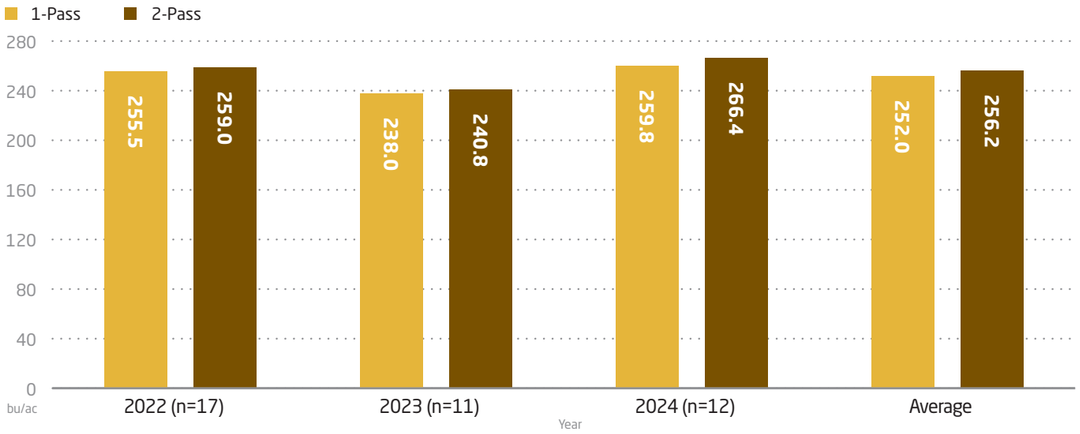
2-Pass Fungicide Trials

Central IL On-Farm Trials - 40 Locations - 2022-2024

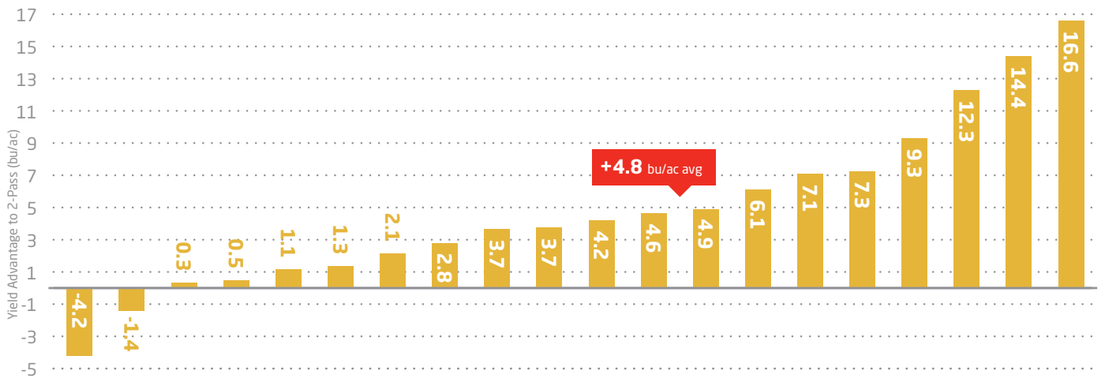
Treatments:

- Various treatments of 1 vs 2 pass fungicide from 2022-2024.
- Application timings:
  - Fungicide applied at V8-14 followed by (fb) R1-R2.
  - Fungicide applied in two passes during the reproductive stages.
  - 2-Pass fungicide was compared to 1-pass fungicide. There was no non-fungicide treatment included.
- We combined data across all application types and years to evaluate 2-pass fungicide across a wide range of environments, hybrids, etc.

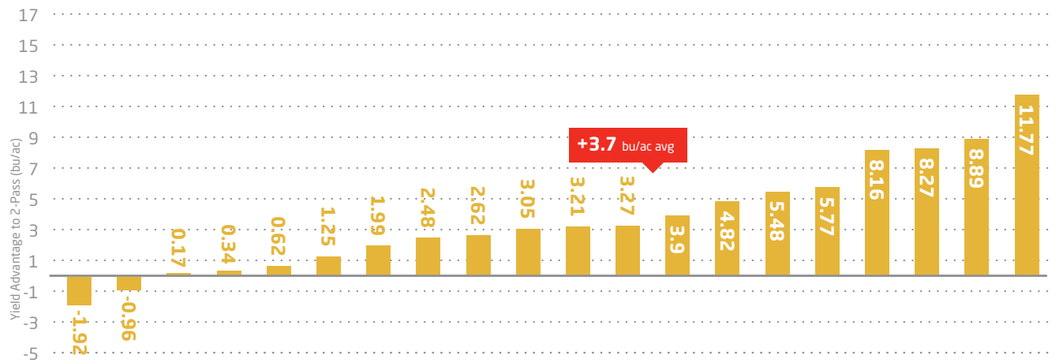
BRANDT Multi-Year 2-Pass Fungicide Trials - Central IL (2022-2024)



Yield Response to 2-Pass Fungicide at Vegetative Followed by Reproductive Stages vs. 1-Pass at Reproductive Stage - 20 Total Trials, Central IL (2022-2024)



Yield Response to 2-Pass Fungicide at Reproductive Stages vs. 1-Pass at Reproductive - 20 Total Trials, Central IL (2022-2024)

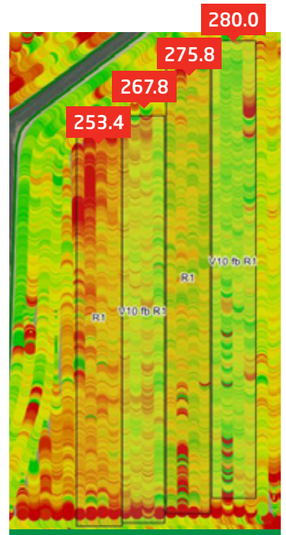


Summary

- 2-Pass fungicide provided a 90% win rate in terms of a positive yield increase from 2022-2024.
- Response to 2-pass fungicide varied over the years. In 2024, there was a 6.6 bu/ac response. This could be due to higher tar spot pressure. Other years had less disease/tar spot pressure.
- The 3-year average response to corn 2-pass fungicide vs 1-pass fungicide across application timings was 4.2 bu/ac.
- Fungicide applications at the vegetative growth stage, followed by the reproductive stage, resulted in a greater yield response (+4.8 bu/ac) compared to two passes during the reproductive stage (+3.7 bu/ac) from 2022-2024.

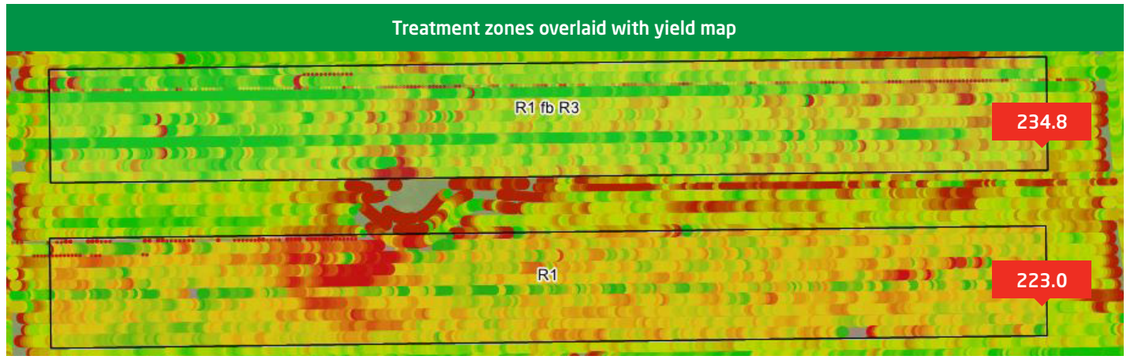
Conclusion:

- 2-Pass fungicide did not provide a positive ROI across the average of all studies from 2022-2024. However, there are certain situations where 2-pass fungicide works. Targeting hybrids and proper application timing are critical for a positive ROI.
- Greater disease pressure, particularly tar spot, results in greater yield response to fungicide. Carefully monitor tar spot pressure in your fields and the surrounding states. If tar spot comes in late, two passes during the reproductive stage may provide greater returns than what these studies show.



Treatment zones overlaid with yield map

Treatment zones overlaid with yield map



Tar Spot - A Growing Concern For Farmers

Tar spot was a concern for central Illinois and midwestern farmers during the 2024 growing season. Illinois' first tar spot confirmation during the 2024 growing season occurred on June 27 in Macoupin County, which was abnormally early. Early detection of tar spot and varied crop maturity within the region caused many growers to be concerned about this devastating disease as the summer progressed. Tar spot is still somewhat of a "new" foliar disease in central Illinois and the industry is continuing to gain more knowledge each year. Below are some of the need-to-know details behind tar spot and its management.

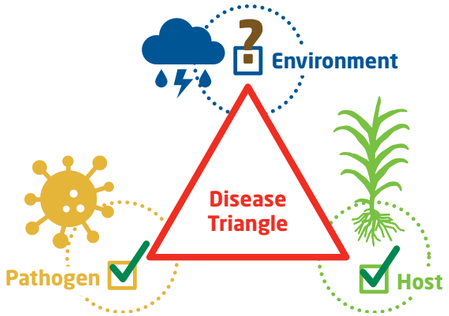
- First found in the U.S. in 2015.
- Experts estimated tar spot was the number one yield limiting disease in the U.S. in 2021.
- Symptoms: small, slightly raised black specks/streaks (stromata). Stromata can NOT be scratched off leaves and are present on upper and lower leaf surfaces.
- Once tar spot infects a plant, visual symptoms will not appear for 15-20 days.
- Tar spot overwinters on residue and survives multiple years. Tar spot has long distance dispersal.

Conditions Favoring Development:

- Temperature: mild temps of 64-73°F.
- High moisture/leaf wetness/relative humidity (RH) favors spore germination and initial infection.
- Fluctuating RH coupled with mild temperatures are best known environmental factors that favor tar spot development. Wet-dry-wet periods align with disease severity over the years.

Management Tactics:

- Hybrid selection is critical. Ask your seed representative for hybrid ratings. Hybrid ratings can determine downstream management.
- Due to tar spot's ability to survive multiple years on residue and have long distance spore spread, deep tillage or crop rotation will likely NOT overcome tar spot alone.
- Multiple mode of action fungicides can be applied to suppress tar spot. Applications at VT/R1 are the most effective but can be applied as late as R4 under heavy pressure and on susceptible hybrids with positive ROI.
- Fungicides applied to soil or at early vegetative stages will not provide control.
- Scout fields in season to develop management plans for future. Check fields prior to harvest to determine if stalk quality has been compromised, which can result in additional yield losses.



Corn Response to R3 Fungicide

Menard County, IL On Farm Trial - 2024

Treatments:

- Fungicide application at R3 (tar spot detection).
- 13.7 fl oz Miravis Neo.
- Applied with helicopter at 2 gal/ac.

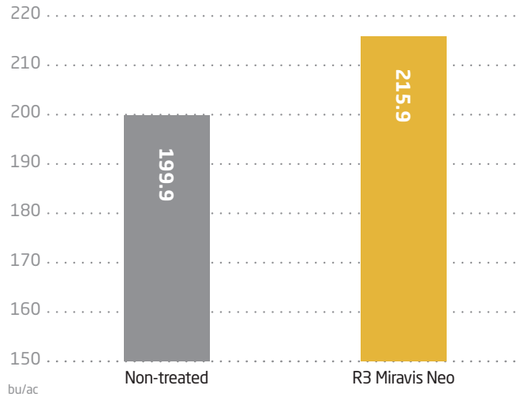
Summary:

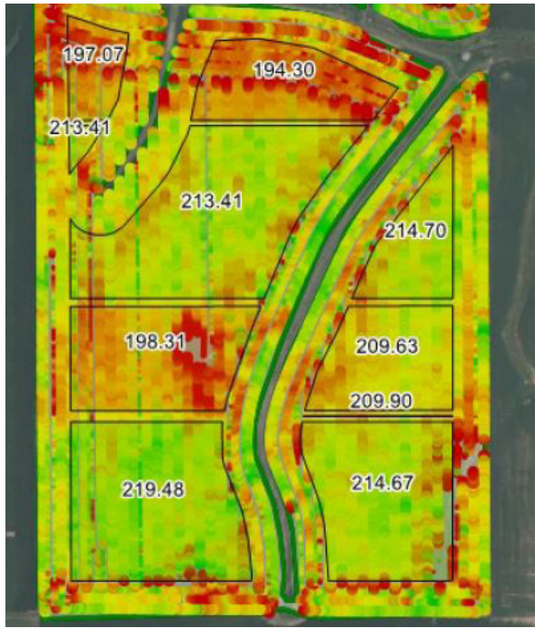
- Tar spot pressure was high in 2024. Lots of conversation was had during the 2024 growing season if a late treatment was necessary or would result in a positive ROI.
- Application of fungicide at R3 under heavy tar spot pressure (and on a very susceptible hybrid) resulted in a 16 bu/ac yield increase across the whole field.
- Corn moisture was increased in the fungicide treatment.

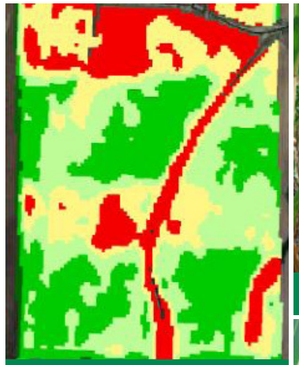
Conclusion:

- The yield increase from the R3 fungicide application provided a positive ROI.
- Increased grain moisture indicates increased standability, which can also be a contributing factor to providing a positive ROI.
- Tar spot suppression and increased plant health were observed 3 weeks after application.

Corn Yield Response to R3 Fungicide







Climate FieldView Field Health Image - Aug 10, 2024 (3 weeks after application)

Non-treated Aug 8, 2024

R3 Fungicide Aug 8, 2024 (3 weeks after application)

Progressive Foliar x Plant Population x Row Spacing

BRANDT Research Farm - Pleasant Plains, IL - 2024

Summary:

- Historical grain yield increases in corn have been matched with higher planting populations. Higher stands of corn require hybrids with greater density stress tolerance and precision placement of nutrition.
- Narrower row spacing has been proven to be a better arrangement of higher plant populations, as observed at the research farm in 2024. Significant responses to 20-inch rows were seen at planting densities ranging from 40,000-52,000 plants/ac, which are well above typical seeding rates in the Corn Belt. When averaged across foliar treatments, yield increases in response to higher planting densities were observed in 20-inch rows up to 44,000 plants/ac. In 30-inch rows, no positive yield response were observed from increasing planting population beyond 36,000 plants/ac.
- Averaged across plant populations and row spacing, the application of fungicide with BRANDT Smart System products increased yield by 10.1 bu/ac when applied at V5, an additional 5.9 bu/ac with a second application at V12, and an additional 5.9 bu/ac when a third application was made at R2.
- Tolerance of higher densities in 30 and 20-inch rows was greater when foliar applications were made in season.

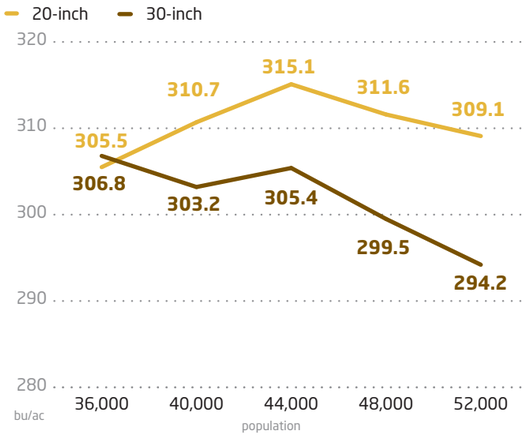
Treatments:

- 20- vs 30-inch row spacing.
- 36,000, 40,000, 44,000, 48,000 and 52,000 plants/ac.

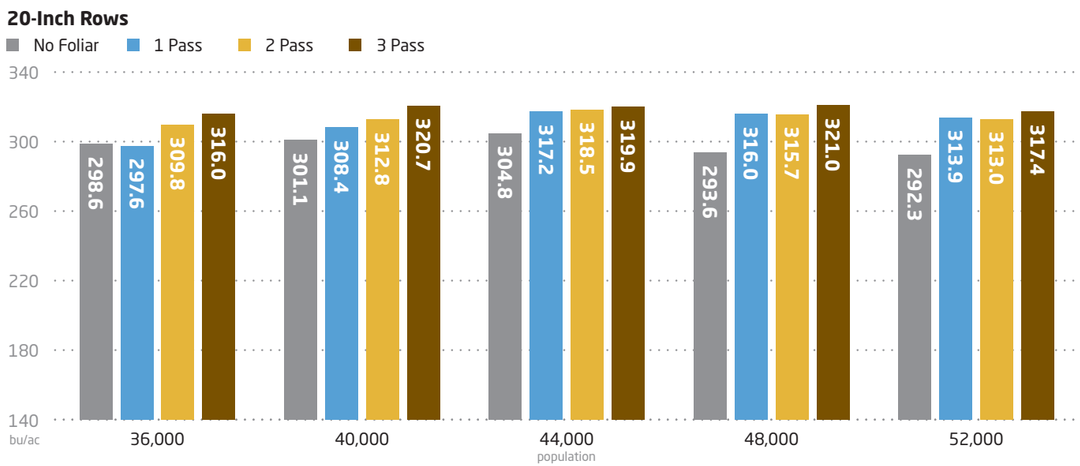
Foliar Treatments and average yield across plant populations and row arrangements.

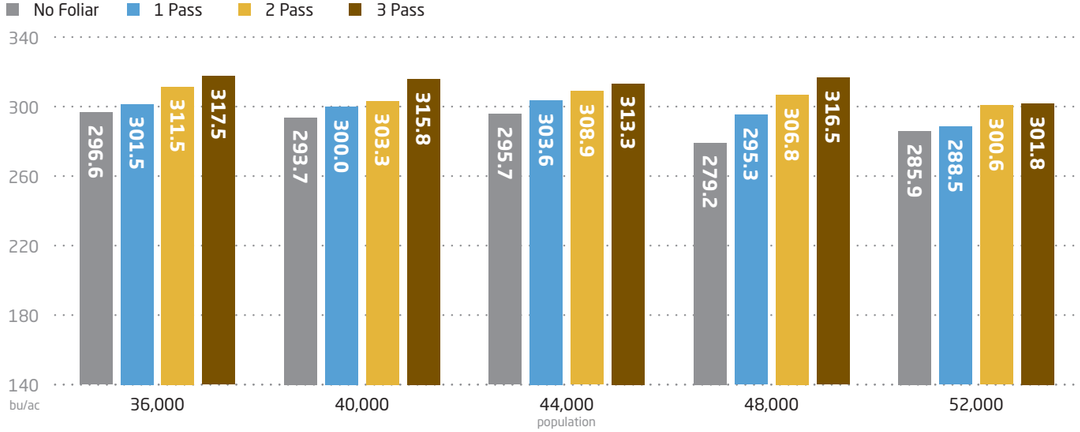
Treatment	Timing	Product	Yield (bu/ac)
No Foliar	-	-	294.1
1 Pass	V5	Fungicide + BRANDT Smart Trio (1 qt/ac) + BRANDT Smart K B (1 qt/ac)	304.2
2 Pass	V5 + V12	Fungicide + BRANDT Smart Trio (1 qt/ac) + BRANDT Smart K B (1 qt/ac)	310.1
3 Pass	V5 + V12 + R2	Fungicide + BRANDT Smart Trio (1 qt/ac) + BRANDT Smart K B (1 qt/ac)	316.0

Average Yield at Each Population and Row Spacing Across Foliar Treatments



Left: 2 pass foliar application at V5 & V12; **Right:** No foliar application.





Notes: Previous crop: soybean; Planting date: 4/16/2024; Hybrid: DKC66-06RIB; Planting rate: variable; Fall Fertility: 25-75-100 suspension; Nitrogen: 180 lbs/ac as fall NH_3; 2x2: 10 gal/ac ATS, 2.5 lbs/ac BRANDT EnzUp P DS; In-furrow: 1 pt BRANDT EnzUp Zn.

Short Stature Corn Management

BRANDT Research Farm - Pleasant Plains, IL - 2024

Summary:

- Short stature corn has the potential to provide many physiological and practical advantages including improved plant standability, increased density tolerance, extended in-season crop access with ground equipment, and more efficient use of limiting resources.
- Compared to currently available commercial corn hybrids, short stature corn has a reduction in stalk biomass while maintaining the size and number of leaves and reproductive tissues, allowing for a more efficient portioning of nutrients and energy.
- At the BRANDT Research Farm in 2024, pre-commercial short stature corn hybrid PR116-20SSRIB from Bayer was compared to DKC66-06RIB in response to agronomic management.
- Averaged across plant population, row spacing, and foliar treatments, PR116-20SSRIB yielded 278.8 bu/ac compared to 306.1 bu/ac from DKC66-06RIB. However, PR116-20SSRIB demonstrated greater yield increases in response to foliar applications, higher plant densities, and narrower row spacing than DKC66-06RIB.
- Higher yields were achieved in 20-inch rows compared to 30-inch rows for all plant populations, with the response to narrower row spacing increasing as plant density increased. When averaged across foliar treatments, yield increases in response to higher planting densities were observed in 20-inch rows up to 52,000 plants/ac and in 30-inch rows up to 44,000 plants/ac.
- Averaged across plant populations and row spacing, application of fungicide with BRANDT Smart System products increased yield by 11.5 bu/ac when applied at V5, an additional 10.9 bu/ac when a second application was made at V12, and an additional 9.7 bu/ac when a third application was made at R2.

Treatments:

- Preceon short stature corn hybrid PR116-20SSRIB.
- 20- vs 30-inch row spacing.
- 36,000, 40,000, 44,000, 48,000, and 52,000 plants/ac.

Population and Row Spacing Across Foliar Treatments

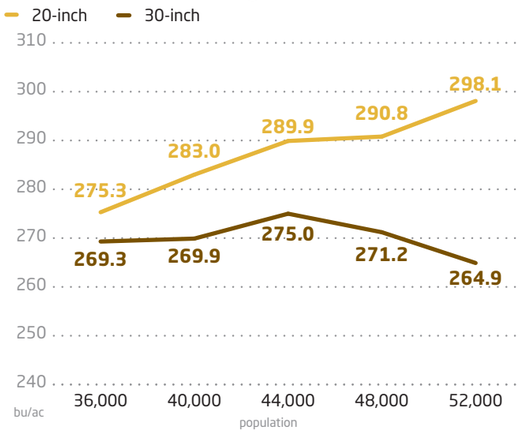
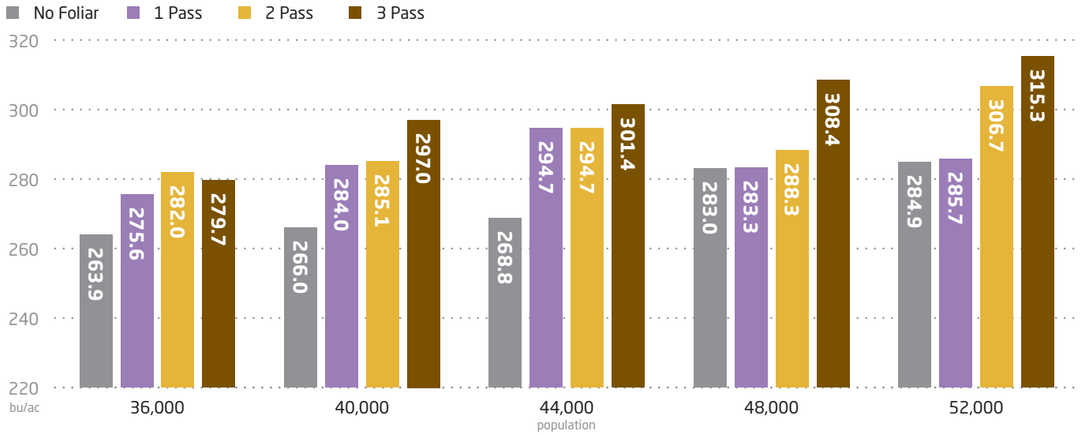


Figure 1. Comparison between short stature and conventional corn hybrids

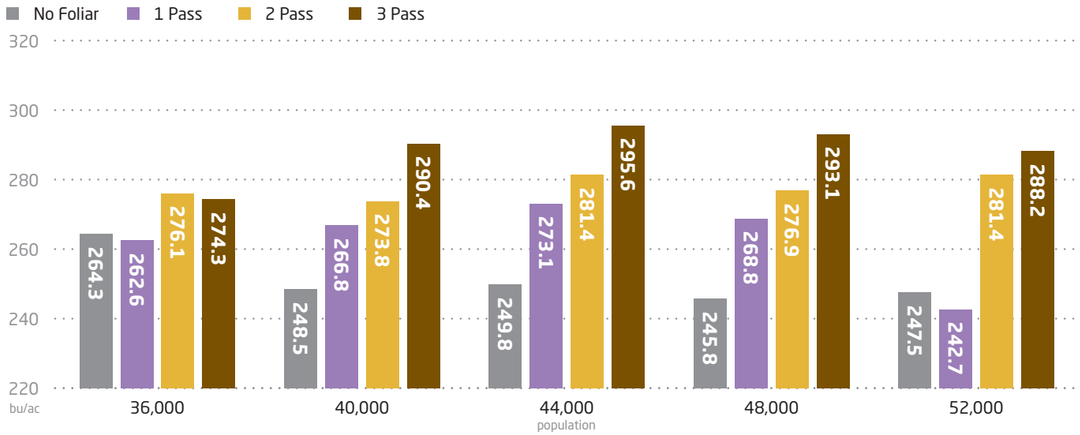
Foliar Treatments and average yield across plant populations and row arrangements.

Treatment	Timing	Product	Yield (bu/ac)
No Foliar	-	-	262.2
1 Pass	V5	Fungicide + BRANDT Smart Trio (1 qt/ac) + BRANDT Smart K B (1 qt/ac)	273.7
2 Pass	V5 + V12	Fungicide + BRANDT Smart Trio (1 qt/ac) + BRANDT Smart K B (1 qt/ac)	284.6
3 Pass	V5 + V12 + R2	Fungicide + BRANDT Smart Trio (1 qt/ac) + BRANDT Smart K B (1 qt/ac)	294.3

20-Inch Rows



30-Inch Rows



Notes: Previous crop: soybean; Planting date: 4/16/2024; Hybrid: PR116-20SSRIB; Planting rate: variable; Fall Fertility: 25-75-100 suspension; Nitrogen: 180 lbs/ac as fall NH_3; 2x2: 10 gal/ac ATS, 2.5 lbs/ac BRANDT EnzUp P DS; In-furrow: 1 pt BRANDT EnzUp Zn.

Boron in High-Yield Corn Production

Boron's role in corn growth:

- **Critical growth stages:** Boron (B) is crucial in high-yielding scenarios, especially between the V10-V14 growth stages. Severe deficiencies (below 6 ppm, as per tissue tests) can lead to poor pollination due to delayed tassel development and reduced pollen viability.
- **Peak accumulation period:** A substantial 65% of a corn crop's total B uptake occurs within just 1/5th of its growing season directly ahead of pollination, emphasizing the high demand for B ahead of reproductive growth **(Figure 1)**.
- **Kernel development:** Insufficient B in the plant (below 9 ppm) from the blister (R2) to dough (R4) stages can hinder kernel development. Boron is essential for proper cell wall structure and facilitates carbohydrate metabolism and sugar transport through membranes **(Figure 2)**.
- **Availability in the soil:** Boron deficiency correlates with soil type, organic matter, rainfall, and pH. It's highly soluble and easily leached in well-drained or excessively irrigated soils. Its availability decreases in alkaline-calcareous soils and under drought conditions.

Boron Synergism with Potassium and Fungicides:

- Why consider potassium application with boron: Potassium (K), like B, is in peak demand directly ahead of tassel and is vital for sugar transport in the plant. Nearly 75% of a corn crop's total K requirement is accumulated prior to tassel **(Figure 1)**, and, even with adequate soil test levels, K uptake through the roots may not be sufficient during periods of peak demand. Potassium is a vital cation that regulates water use in crops, facilitates the movement of sugars and nitrogen within the plant, enhances nitrogen utilization, and helps maintain cell hydration.
- **Synergistic response with fungicide:** Boron and potassium applications typically perform well in combination with fungicides. A net increase in photosynthesis and carbohydrate production from the fungicide, combined with improved sugar movement and partitioning from the B and K, can effectively improve yields.

Effective Application Strategies:

- **Optimal timing:** The best results for boron application are seen between V10 and flowering (VT/R1), aligning with its peak demand and often coinciding with fungicide and insecticide treatments.
- **Product selection:** Choose boron products that ensure effective mobility within the plant. BRANDT Smart K B, with Smart System delivery technology, prevents B from binding to cell walls, enhancing translocation to developing kernels and growing points.

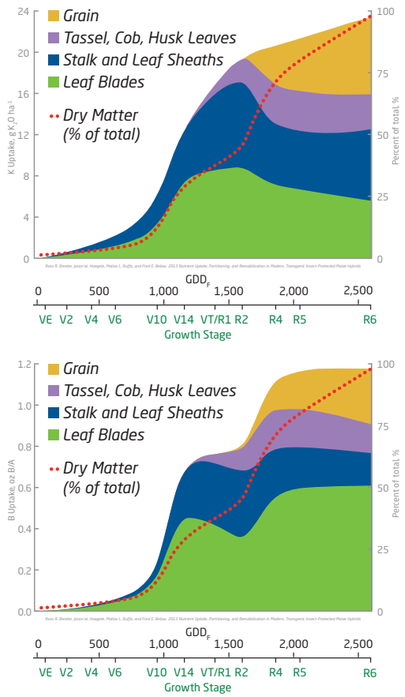


Figure 1. The seasonal accumulation and partitioning of K and B in corn. (Bender et al., 2013)

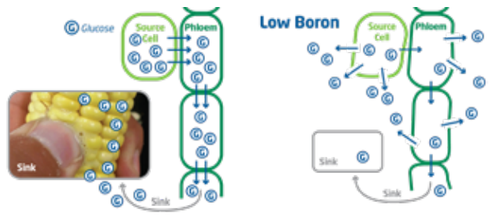


Figure 2. Movement of glucose molecules through the phloem from leaf tissues to the developing kernels under adequate and low B conditions.

Corn Yield Response to Boron at VT/R1

BRANDT Research Farm - Pleasant Plains, IL - 2024

Summary:

- The application of BRANDT Smart K B at the VT/R1 growth stage increased yield by 14.6 bu/ac compared to the untreated control.
- The complexation of boron in BRANDT's Smart System enhances plant uptake and utilization of B compared to other market-available sources.
- Applying 10% boron at a high-rate reduced yield compared to lower rates. Although higher application rates are often recommended due to the low uptake efficiency of 10% boron, oversaturating leaves with boric acid can cause phytotoxicity.
- A progressive yield increase was observed with the addition of nutrients to the boron application, such as molybdenum in BRANDT Smart B-Mo and both molybdenum and potassium in BRANDT Smart K B.

Effect of boron foliar treatments on corn grain yield:

Product	Rate	Yield (bu/ac)	Yield Advantage (bu/ac)
Untreated	-	305.5	
10% B	8 oz	308.6	+3.1
10% B	0.5 gal	308.8	+3.3
10% B	1 gal	306.7	+1.2
BRANDT Smart B	1 pt	314.0	+8.5
BRANDT Smart B-Mo	1 pt	316.7	+11.2
BRANDT Smart K B	1 qt	320.1	+14.6

All treatments were applied at VT/R1.

Notes: Previous crop: soybean; Planting date: 4/12/2024; Hybrid: DKC67-94RIB; Planting rate: 38,000 plants/ac; Fall Fertility: 25-75-100 suspension; Nitrogen: 180 lbs N as fall NH_3; 2x2: 10 gal/ac ATS, 2.5 lbs/ac BRANDT EnzUp P DS; In-furrow: 1 pt BRANDT EnzUp Zn; V5 foliar: BRANDT Smart Trio with herbicide; R1 foliar: Veltyma, Warrior.

Purdue University Smart K B Trials

Purdue University - 5 Indiana Locations - 2023-2024

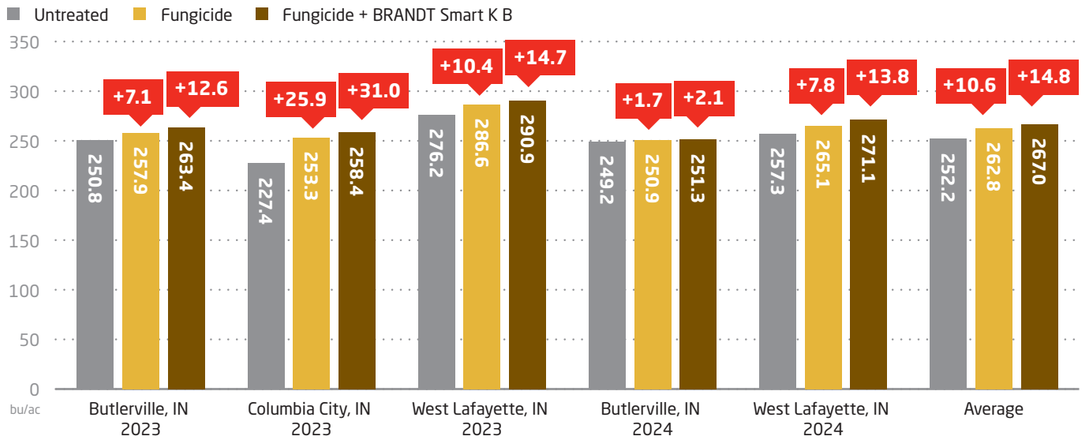
Summary:

- Across 5 Indiana locations, application of BRANDT Smart K B with fungicide at R1 growth stage increased yield by 14.8 bu/ac compared to the untreated control.
- Fungicide alone increased yield by 1.7-25.9 bu/ac between the 5 locations.
- At the West Lafayette location in 2024, grain fill duration and maximum kernel weight were measured. Compared to plots receiving only fungicide, the addition of BRANDT Smart K B lengthened kernel fill duration by 2.8 days and increased final individual kernel weight by 4.2%.

Treatments:

- Research was conducted by Dr. Dan Quinn, extension corn specialist at Purdue University, as part of an on-farm Intensive corn management study.
- Large-plot field research trials arranged in a randomized complete block design with 4-5 replications at each location.
- Hybrid P1108Q planted at a target population of 32,000 plants/ac.
- BRANDT Smart K B (1 qt/ac) applied in addition to Delaro Complete fungicide (8 oz/ac) at the R1 growth stage compared to plots receiving fungicide alone or no fungicide.

30-Inch Rows



Skip-Row Solar Corridor

BRANDT Research Farm- Pleasant Plains, IL - 2024

- The concept of skip-row solar corridor planting configurations is to drive more sunlight to the lower canopy, which is the source of energy for the lower stalk and roots.
- In this study, different patterns of skip-row planting, row spacing, and varying plant populations were tested to determine their influence on grain yield.

Summary of Results:

- Skipping every third row at a 30-inch row spacing resulted in yield decreases of 7.7 and 29.7 bu/ac at populations of 38,000 and 42,000 plants/ac, respectively. The more pronounced yield reduction at higher in-row populations suggests that the skip-row solar corridor may require a lower total population than standard 30-inch row spacing to achieve maximum yield.
- At a total plant population of 44,000 plants/ac in a 20-inch row spacing arrangement, skipping every third row resulted in a yield decrease of 12.5 bu/ac.
- Previous research farm data has shown that narrowing row spacing (e.g., switching from 30" to 20" rows) can increase corn grain yield due to decreased plant-to-plant spacing within the row. In contrast, switching to a skip-row configuration increases plant-to-plant competition within the row, which may account for the negative impacts on yield observed.

Treatments: Row spacing x Skip-row x Population

- 20" rows, 20" skip-row, 30" rows, 30" skip-row.
- Total populations of 38,000 and 44,000 plants/ac in each row configuration.

Skip Row =

Effect of skip-row treatments on corn total population, in-row population, and grain yield:

Treatment	Total population	In-row population	Yield
	---------- plants/ac ----------		bu/ac
30" rows	38,000	38,000	262.9
30" rows	44,000	44,000	268.6
30" skip-row	38,000	57,000	255.2
30" skip-row	44,000	66,000	238.9
20" rows	44,000	44,000	289.3
20" skip-row	38,000	57,000	254.6
20" skip-row	44,000	66,000	276.8

Notes: Previous crop: corn; Planting date: 4/22/2024; Hybrid: DKC68-34RIB; Fall Fertility: 25-75-100 suspension; Nitrogen: 180 lbs/ac as fall NH_3; 2x2: 10 gal/ac ATS, 2.5 lbs/ac BRANDT EnzUp P DS; In-furrow: 1 pt BRANDT EnzUp Zn; V5 foliar: BRANDT Smart Trio with herbicide; V12 foliar: Veltyma, Warrior, BRANDT Smart K B, BRANDT Smart Trio; R2 foliar: Veltyma, BRANDT Smart Trio, BRANDT Smart K B.

Corn & Soybean Intercropping

BRANDT Research Farm - Pleasant Plains, IL - 2024

- Several aspects of intercropping can benefit corn and soybean crops, particularly in rows where the different crops grow adjacently:
  1. Increased sunlight penetration into the lower canopy, enhancing energy availability to lower stalks and roots.
  2. Improved nutrient use efficiency by leveraging the staggered timing of nutrient demands between crops, boosting nutrient acquisition. Additionally, crops with varied root structures can access different soil layers, optimizing nutrient acquisition and reducing competition for the same nutrients.
  3. Optimized light distribution and air flow through intercropping arrangements, creating favorable microclimates that may reduce the prevalence of certain diseases.
  4. Diverse root systems that stimulate microbial activity and nutrient cycling, contributing to soil health and better nutrient availability.

Summary of Results:

- Intercropping increased corn yield over monoculture corn by 30.2 bu/ac in the static population treatment and 38.2 bu/ac in the variable population treatment.
- Redistributing the 42,000 plants/ac where proportionally more plants are in the outside rows adjacent to soybean passes increase yield by 8.0 bu/ac compared to a static seeding rate of 42,000 plants/ac across all rows.
- Financial return analysis - When accounting for crop-specific costs, the net income from intercropping with static and variable populations increased by 18% and 20%, respectively, compared to standard corn.

Treatments: Intercrop x In-Row Plant Population

- **1-Standard Corn:** monocrop corn planted at 42,000 plants/ac.
- **2-Intercrop Corn, static population:** alternating 8-row passes of corn and soybean. The corn passes were planted at a density of 42,000 plants/ac, maintaining an even distribution of plants across each row.
- **3-Intercrop Corn, variable population:** alternating 8-row passes of corn and soybean. An average population of 42,000 plants/ac was distributed across the rows ranging from 36,000 to 48,000 plants/ac with the lowest seeding rate in the middle of the pass and highest seeding rate in outside rows adjacent to soybean passes. **(Figure 1).**

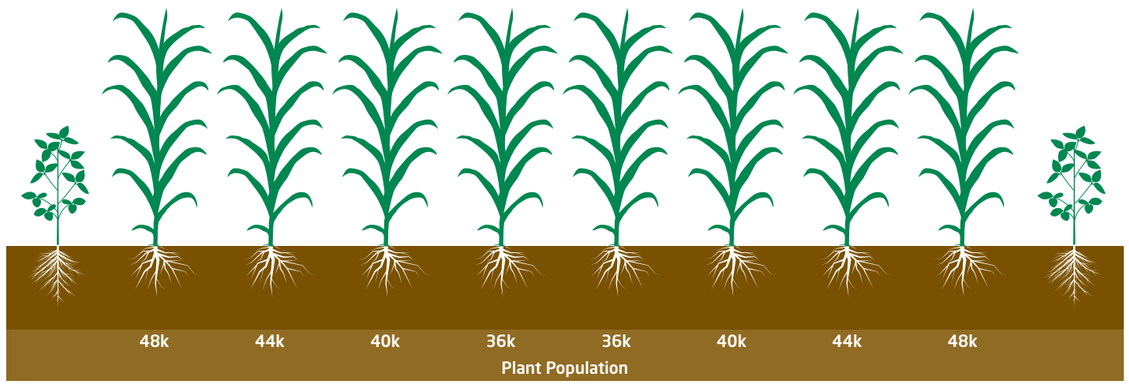


Figure 1. Illustration of the plant arrangement in Treatment 3: intercrop corn with variable population.

Effect of intercropping treatments on corn and soybean grain yield, grain harvest moisture, and gross income:

Treatment	Yield	Moisture	Gross Income
	bu/ac	%	$/ac
Standard Corn	257.2	19.7	1,000
Intercrop Corn, Static Population	287.3	18.7	1,132
Intercrop Corn, Variable Pop	295.3	19.0	1,159
Intercrop Soybean	84.2	12.0	863

Effect of intercropping treatments on relative net income:

System	Gross income	Relative Net Income*
	$/ac	%
Standard Corn	1,000	100
Intercrop Corn & Soy, Static Population	998	118
Intercrop Corn & Soy, Variable Pop	1011	120

*All management practices and inputs were consistent for both crops, except for differences in nitrogen fertilizer application and seed costs. The relative net income reflects these crop-specific expenses and is presented relative to the net income of standard corn.

Notes: Previous crop: corn; Planting date: 4/17/2024; Hybrid: DKC68-34RIB; Variety: AG38XF3; Soybean population: 120,000 plants/ac; Fall Fertility: 25-75-100 suspension; Nitrogen: 180 lbs/ac as fall NH_3 (corn only); 2x2: 10 gal/ac ATS, 2.5 lbs/ac BRANDT EnzUp P DS; In-furrow: 1 pt BRANDT EnzUp Zn; V5 foliar: BRANDT Smart Trio with herbicide; V12 foliar: Veltyma, Warrior, BRANDT Smart K B, BRANDT Smart Trio; R2 foliar: Veltyma, BRANDT Smart Trio, BRANDT Smart K B.

Soybean

Soybean Results

Top 5 Soybean Insights

1. With the use of a good seed treatment, soybean can be resilient in early planting conditions. Historical research farm data continues to show that maximum soybean yield is achieved when planted in early April.

2. The combination of planting early, optimizing plant population and planting a fuller maturity variety drives node number on the main stem and branches, resulting in increased pod number and yield.

3. The combination of starter fertilizer and planter box treatment including molybdenum impacted nodule production and nitrogen manufacturing and utilization.

4. Foliar BRANDT Smart System nutritional products, fungicide and insecticide applications during flowering and beginning pod development continues to provide the largest impact on yield by reducing flower and pod abortion and protecting the trifoliates near the middle of the plant.

5. Foliar BRANDT Smart System nutritional products, fungicide and insecticide applications near R4-R5 aided in protecting against pod-feeding insects, extending photosynthetic capacity, and assisting carbohydrate partitioning to the pods.

Introduction to Soybean Yield Development

Soybean yield formation is inherently more complex than that of corn due to a larger number of interrelated factors. Unlike corn, soybeans exhibit significant plasticity, adjusting their growth and structure in response to environmental conditions. An example of this adaptability is the increase in branching observed when soybeans are planted at lower densities. This plasticity results in considerable variability among plants within the same field, leading to differences in the number of nodes, branches, and pods per plant.

Unlike corn, where yield components are primarily assessed based on the number of plants per acre (as each plant typically produces one ear), soybean yield components must be evaluated on an area basis. The fundamental yield equation for soybeans is as follows:

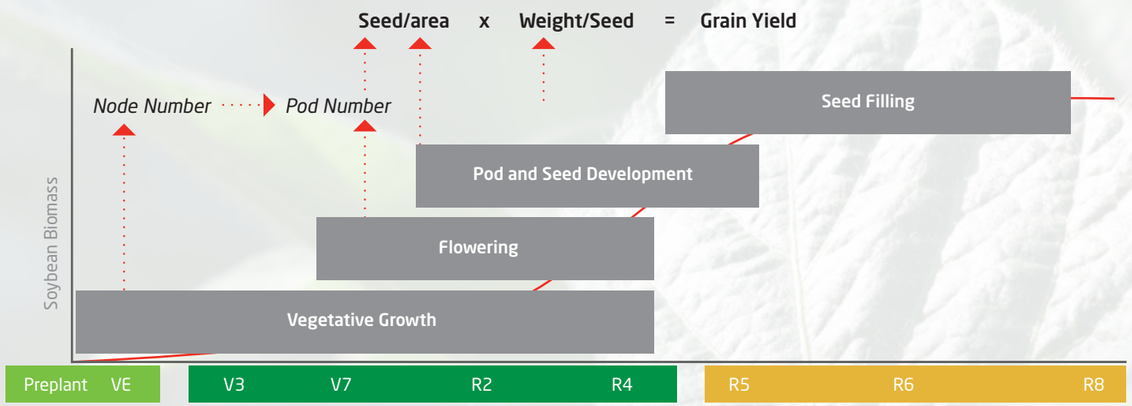
Soybean yield = number of seeds per acre × average seed weight

While seed number and seed weight are the final determinants of yield, they are built upon a hierarchy of interconnected factors. These include:

- **Node Number**: The foundational growth unit from which pods develop.
- **Pod Number:** The result of node development and flowering success.
- **Seeds per Pod:** Mostly influenced by successful pollination and genetics.

Enhancing soybean yield ultimately means improving these yield components. However, just like in corn, soybean yield is influenced by a phenomenon known as yield component compensation. Effective management throughout the growing season is crucial to addressing these interactions and achieving maximum yield potential.

Each yield component is defined during specific growth stages, as illustrated in the figure below. By understanding the timing and factors influencing these stages, growers can implement targeted management practices to optimize yield.



Preplant - V2

Foundation of Resource Capture

During this phase, soybean development focuses on building a strong, proliferative root system that supports a healthy seedling. Seed treatments with micronutrients and biological products promote early root growth, creating favorable conditions for *Bradyrhizobium* nodulation. This early nodule formation is essential for efficient nitrogen fixation, which ultimately maximizes the crop's yield potential. Key management practices to consider:

- Planting date (early planting is usually better)
- *Bradyrhizobium* inoculation
- Seed treatment with micronutrients (Mo)
- Starter fertilizer (P and Zn)
- Enzymes
- Plant population
- Variety
- Row spacing
- Tillage system
- Residue management
- Residual herbicide

V3 - R4

Establishment of Yield Potential

During this phase, the soybean plant focuses on building a strong vegetative structure. The primary objective is to maximize the number of nodes and branches, which serve as critical attachment points for pods, directly influencing the plant's reproductive potential. Since soybeans grow both vegetatively and reproductively simultaneously, the plant begins producing flowers even as it continues to stack nodes. Research shows that 50-75% of soybean flowers typically abort, presenting a significant opportunity for management interventions to retain more flowers that can eventually develop into pods. Supporting flower retention through timely nutrient applications (B) and effective stress management can enhance pod set and increase yield potential. By the R3 stage, soybeans reach peak biomass and nutrient accumulation, making nutrient availability and ongoing stress management essential to prevent transient deficiencies that could limit growth during this critical period. Key management practices to consider:

- Herbicide
- Fungicide/insecticide
- In-season biological products
- Plant stress management
- Foliar nutrition

R5 -R8

Yield Determination/Realization

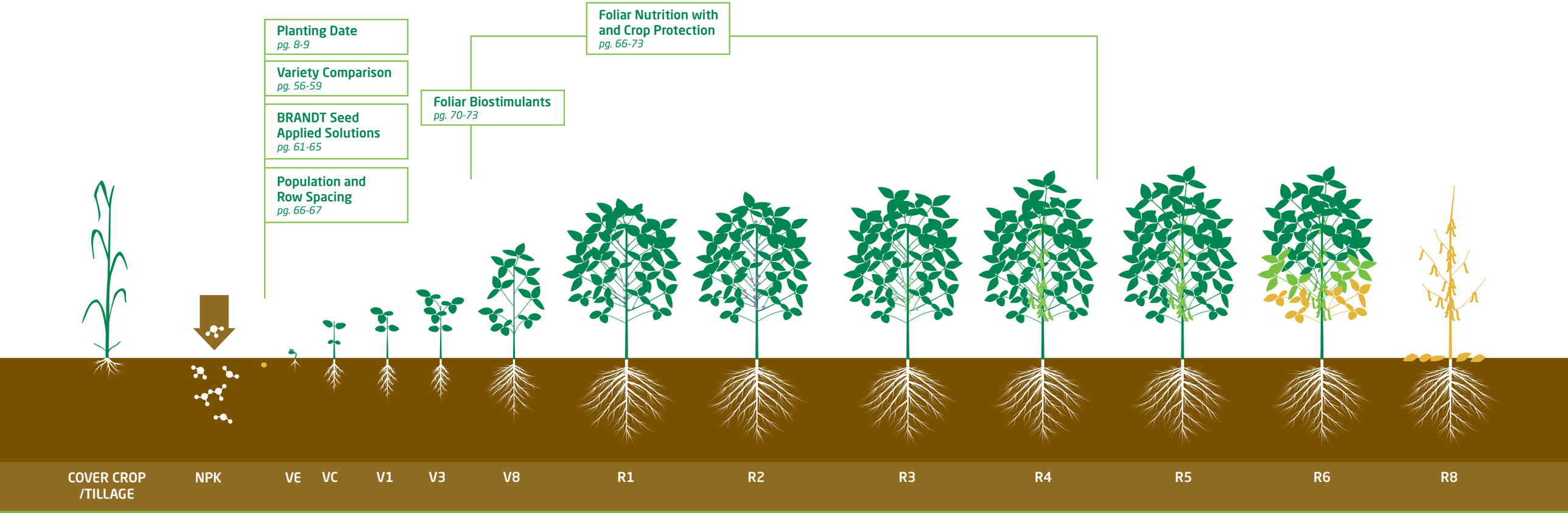
In the final phase of soybean development, the focus is on maximizing grain weight by maintaining crop health and sustaining active photosynthesis through the end of the growth cycle. Due to the high protein concentration in soybeans, there is an increased nitrogen requirement during this stage. Preventing early nodule senescence through proper nutrient management and stress reduction is essential to avoid premature leaf nitrogen remobilization. Key management practices to consider include:

- Fungicide/insecticide
- Foliar nutrition

BRANDT Research Farm Soybean Base Management

The BRANDT Research Farm base applications reflect a high yield management recommendation that can be implemented in parts or as a whole to fit within a grower's current program. Applications for 2024 were:

- Conventional fall tillage
- 25-75-100 suspension in fall with BRANDT Rezadone
- Planter 2x2: 10 gal/ac Ammonium Thiosulfate (ATS, 12-0-0-26S), 2.5 lbs/ac BRANDT EnzUp P DS, 1 qt/ac BRANDT Sequestar 9% Zn
- Planter In-Furrow: 1 pt/ac BRANDT EnzUp Zn
- BRANDT Battleground seed treatment
- HomeLAND Soybean planter box treatment
- 120,000 plants/ac seeding rate
- Pre-emergent herbicide
- Post herbicide with 1 qt/ac BRANDT Smart Trio and 1 pt/ac BRANDT Smart B-Mo
- Fungicide, insecticide, 1 qt/ac BRANDT Smart Trio, and 1 qt/ac BRANDT Smart K B at R3



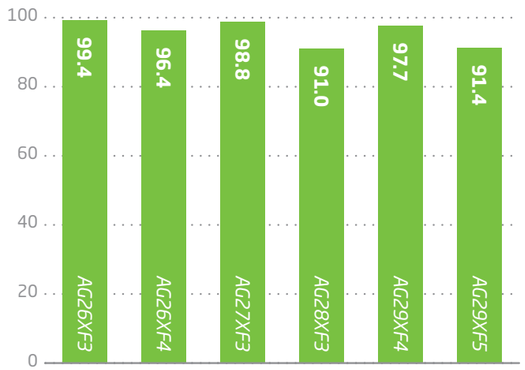
Soybean Variety Trials

BRANDT Research Farm - Pleasant Plains, IL - 2024

Summary:

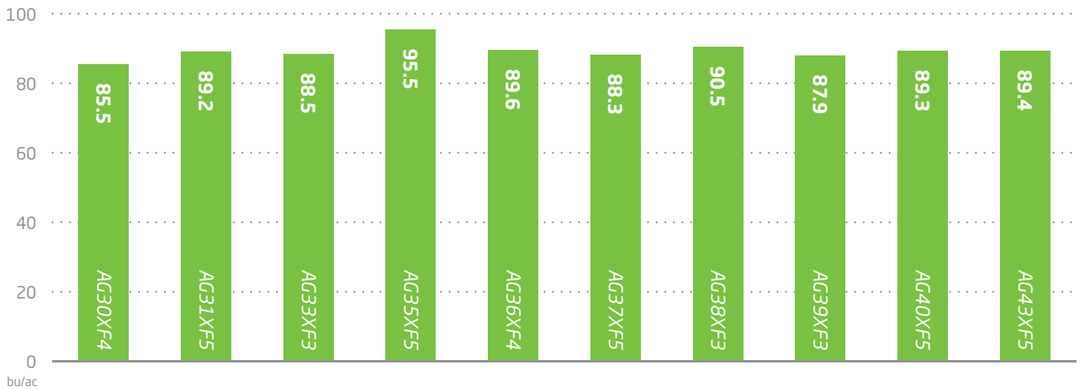
- At the Pleasant Plains research farm in 2024, the yield difference between the top and lowest performing variety was 13.9 bu/ac among Asgrow XtendFlex varieties and 29.4 bu/ac among the varieties in our E3 variety & brand comparison trial.
- Among the Asgrow brand, the shorter maturity set of varieties were harvested at an earlier date and more favorable moisture for high yields.
- Highest yields were achieved with maturity groups ranging from 3.3-3.8 in the May planted E3 plot at the research farm in 2024.

Asgrow Short RM



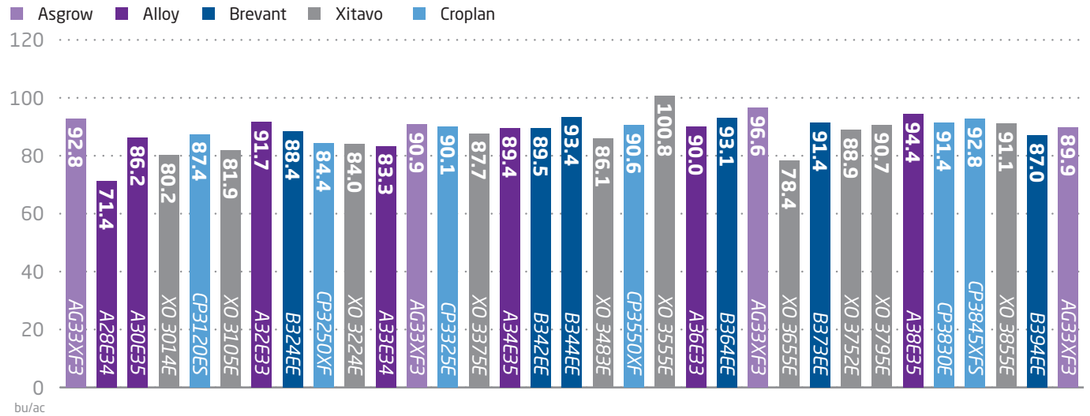
Notes: Previous crop: corn; Planting date: 4/17/2024; Harvest date: 9/20/24; Planting rate: 120,000 plants/ac; Fall Fertility: 25-75-100 suspension; 2x2: 10 gal/ac ATS, 2.5 lbs/ac BRANDT EnzUp P DS; In-furrow: 1 pt BRANDT EnzUp Zn; V3 foliar: BRANDT Smart Trio with herbicide; R3 foliar: Fungicide, Insecticide, BRANDT Smart K B, BRANDT Smart Trio.

Asgrow Long RM



Notes: Previous crop: corn; Planting date: 4/17/2024; Harvest date: 10/2/24; Planting rate: 120,000 plants/ac; Fall Fertility: 25-75-100 suspension; 2x2: 10 gal/ac ATS, 2.5 lbs/ac BRANDT EnzUp P DS; In-furrow: 1 pt BRANDT EnzUp Zn; V3 foliar: BRANDT Smart Trio with herbicide; R3 foliar: Fungicide, Insecticide, BRANDT Smart K B, BRANDT Smart Trio.

E3 Soybean Variety & Brand Comparison



Notes: Previous crop: corn; Planting date: 5/13/2024; Harvest date: 10/2/24; Planting rate: 120,000 plants/ac; Fall Fertility: 25-75-100 suspension; 2x2: 10 gal/ac ATS, 2.5 lbs/ac BRANDT EnzUp P DS; In-furrow: 1 pt BRANDT EnzUp Zn; V3 foliar: BRANDT Smart Trio with herbicide; R3 foliar: Fungicide, Insecticide, BRANDT Smart K B, BRANDT Smart Trio.

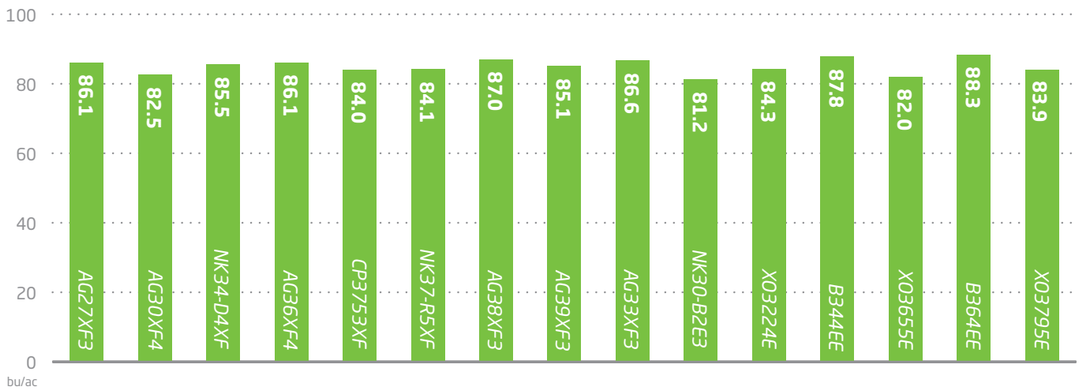
BRANDT Community Trial Variety Comparison

13 Total Central IL Plot Locations - 2024

Summary:

- Community trails included both XtendFlex (XF) and Enlist (E3) herbicide platforms and were located in Franklin, Auburn (2), Ashland (2), Williamsville (2), New Berlin, Greenview, Mt. Auburn (3) and Lincoln.
- There are many high yielding variety offerings that come in both E3 and XF trait platforms. It appears there are more consistent yielding varieties available in the XF trait platform.
- The gap between XF and E3 trait platform yield is much narrower than advertised over the years. This allows customers to plant a top yielding soybean in whichever herbicide trait platform they prefer.
- Choosing only the top yielding variety is risky. Diverse variety selection and placement on appropriate acres needs to be considered to maximize yield and spread risk.
- The yield difference between the top and bottom performing hybrids across locations was 7.1 bu/ac.

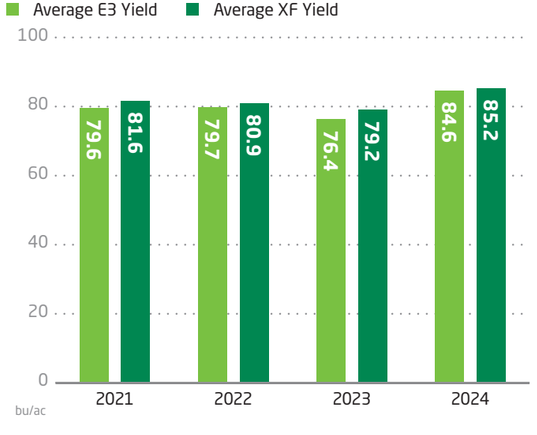
2024 Community Trial Results - 13 locations, Central IL



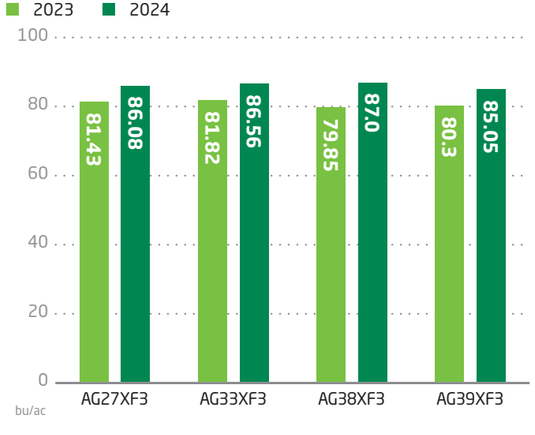
Notes: Previous crop: corn; Planting dates: 4/13/2024-5/18/24; Harvest dates: 9/18/24-10/16/24; Planting rate: 130,000 plants/ac; Each variety planted 8 rows wide (30" rows) by 800' long; Non-irrigated silt loam soils. AG = Asgrow, NK = NK, CP = Croplan, XO = Xitavo, B = Brevant

- B364EE was the top yielding variety summarized across plots in 2024 at 88.27 bu/ac, which was only 0.5 bu/ac higher than the second-place variety, B344EE.
- AG38XF3, AG33XF3, AG36XF4, AG27XF3 and NK34-D4XF round out the top half of the varieties in the community trial set.
- Yield swing in the E3 varieties was 7.1 bu/ac while the XF varieties varied by 4.5 bu/ac. While the overall yield gap between trait platforms is narrow, yield stability of herbicide trait platforms is different.

Community Trial Results - E3 vs XF Yield 2021-2024



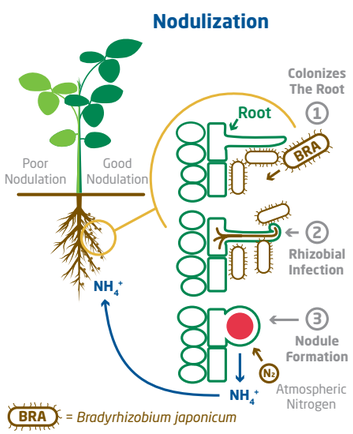
Community Trial Results - 2 Year Varieties



- Since 2021, the XF trait platform has had a 1-3 bu/ac yield advantage over the E3 platform. However, in 2024, there was only a 0.5 bu/ac difference between the trait platforms.
- Four varieties were tested in 2023 and 2024. Overall, varieties increased from 2023 by 5 bu/ac. Over the two years, AG33XF3 and AG27XF3 were the top yielding varieties at 84.2 and 83.8 bu/ac, respectively. AG38XF3 resulted in the largest yield gain from 2023 to 2024 at 7.1 bu/ac. This suggests that AG38XF3 thrives under high yield environments.

Biological Nitrogen Fixation (BNF) on Soybean

- **Soybean has a high nitrogen (N) demand:** Soybean requires over 4 lbs of N/bu produced, while corn requires just over 1 lb of N/bu. Soybean's high N requirement is primarily due to its high protein concentration (~36%) in the grain. Proteins are formed from amino acids, all of which contain N in their structure. Corn, on the other hand, produces kernels with less than 10% protein concentration, consisting primarily of starches.
- **Symbiotic nitrogen acquisition:** Although the N requirement per bushel for soybean is greater than that for corn, farmers typically do not apply N fertilizer to soybean. This is possible due to the symbiotic relationship between the soybean plant and *Bradyrhizobium* bacteria, which colonize the soybean roots. In this mutually beneficial relationship, the plant receives N from BNF, while the bacteria gain carbohydrates from the plant.
- **High energy cost of BNF:** Atmospheric nitrogen (N_2) has a triple bond between the N atoms, requiring significant energy to break down into ammonia. This energy is supplied through plant photosynthesis, meaning that while farmers do not directly pay for N, it still incurs an energy cost to the plant.
- **Soil and BNF are both nitrogen sources:** Research indicates that approximately 50% of soybean's N requirement is derived from atmospheric N and 50% from soil N. This ratio can shift depending on soil N availability: nitrogen fixation decreases when soil N is abundant and increases when it is scarce. In regions where soil N levels are typically low, nitrogen fixation may fulfill up to 75% of the plant's total N requirement.
- **Yield limitation due to nitrogen shortage:** Due to soybean's high N requirements, research shows that N is often yield limiting, particularly late in the season after the R5 growth stage during grain fill. This period coincides with nodule senescence, just as N demand for grain development peaks. Applying N fertilizer has shown limited effectiveness and rarely offsets fertilizer costs due to the inhibitory effect of fertilizer-derived N on nodulation. On the other hand, enhancing nodulation from the start of the season may help mitigate late-season N shortages by promoting greater biomass production and N accumulation. This biomass nitrogen then serves as a N source for the grain. Additionally, foliar nutrition that enhances photosynthesis and supplies key elements related to biological nitrogen fixation (BNF) can increase the influx of photoassimilates to the roots, delay root ethylene production, and potentially postpone nodule senescence.
- **Key nutrients for nitrogenase activity:** The breakdown of N_2 in BFN is facilitated by the enzyme nitrogenase, which relies on key nutrients—magnesium, sulfur, molybdenum, and iron—to function effectively. This process converts N_3 into ammonia, which is subsequently converted into ureides for transport within the plant.



Comparison of soybean at the R3 growth stage: untreated (left) versus HomeLAND Soybean treatment (right).

Source: Iowa State University Publication PM1945

Soybean Planter Box

BRANDT Research Farm - Pleasant Plains, IL - 2024

- Treating soybean seeds with *Bradyrhizobium* did not increase nodule weight, size, or soybean grain yield. In most Illinois fields with a history of soybean cultivation, the natural population of *Bradyrhizobium* is generally high due to the availability of substrates for microbial growth, such as carbon and nutrients, which limits the effectiveness of additional microbial inoculants. However, supplying these microbes with the nutrients necessary for their growth and function appears to be highly effective, as demonstrated by the other treatments in the trial, which all improved nodule parameters and soybean grain yield.
- Treating soybeans with a combination of nutrients and *Bradyrhizobium* proved highly effective in increasing nodule size, mass, and plant biomass at the R3 growth stage.
- The BRANDT EnzUp SeedFlow Zn treatment resulted in the highest yield in the study, underscoring the importance of Zn applications when using P starter fertilizer to enhance soybean productivity.

Treatments:

- Talc 80/20 + MicroSURGE or Mo Trioxide, HomeLAND Soybean, and BRANDT EnzUp SeedFlow Zn were applied to the planter box at 1/4 cup/unit of seed.
- All treatments, including the untreated plot, received 2.5 lbs BRANDT EnzUp P DS in-furrow and 10 gal ATS applied 2x2 with the planter.

Evaluations:

- At the R3 growth stage, all nodules from ten plants were collected, weighed, and classified into two size categories: greater than or smaller than four millimeters.
- Grain yield at physiological maturity.

Figure 1. Soybean Grain Yield Results

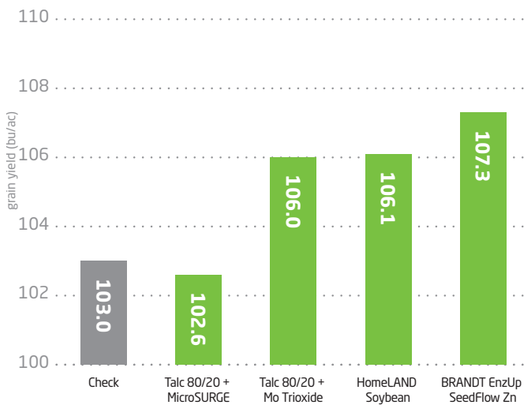
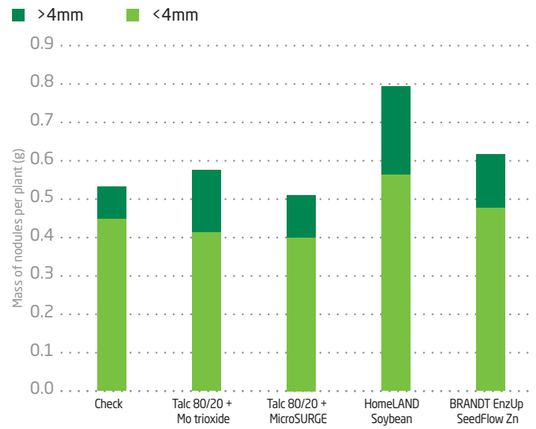


Figure 2. Evaluation of nodule size and weight at the R3 growth stage.



Notes: Previous crop: corn; Planting date: 4/13/24; Variety: AG38XF3; Planting rate: 120,000 plants/ac; Fall fertility: 25-75-100 suspension; 2x2: 10 gal/ac ATS; In-furrow: 2.5 lbs/ac BRANDT EnzUp P DS; V3 foliar: BRANDT Smart Trio with herbicide; R3 foliar: Fungicide, Insecticide, BRANDT Smart K B, BRANDT Smart Trio.

Soybean Planter Box Product Comparison

3rd Party Multi-State Trials - 2024

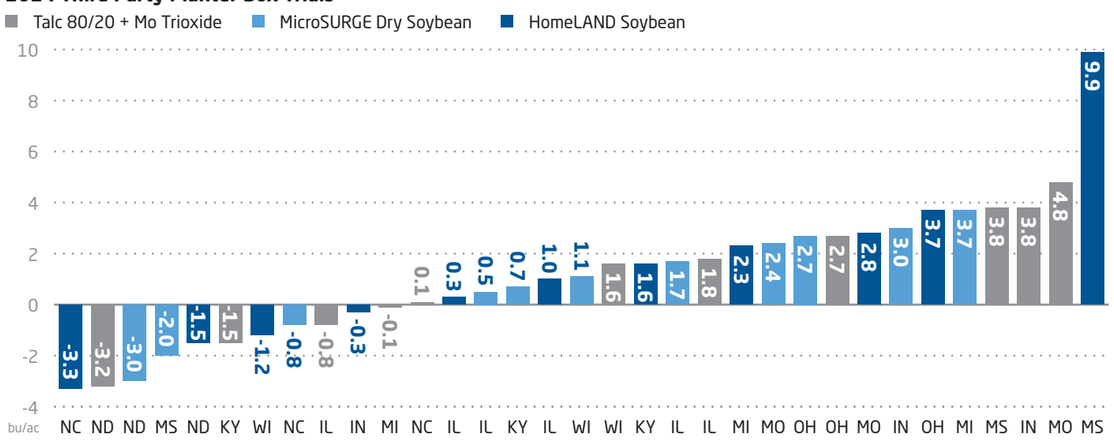
Treatments:

- Each environment includes six replications
- Talc 80/20 + Mo Trioxide, MicroSURGE or HomeLAND Soybean were applied to the planter box as a seed treatment at ¼ cup/unit of seed.

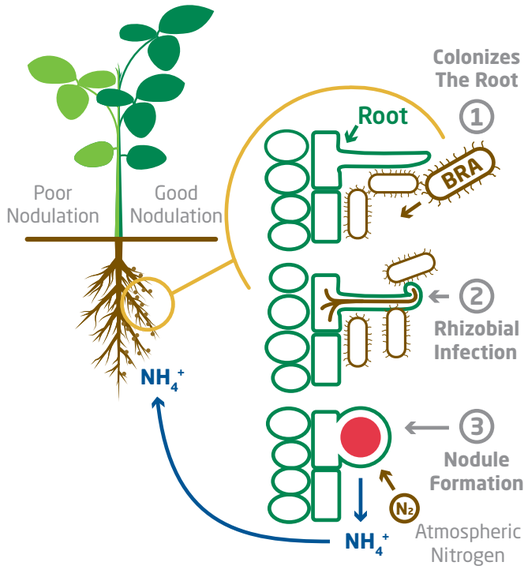
Summary of the results:

- Soybean planter box seed treatments with microbial inoculants and/or micronutrients resulted in an overall success rate of 67%.
- HomeLAND Soybean increased yields at 64% of the locations, with an average yield increase of 1.4 bu/ac.
- MicroSURGE Dry Soybean increased yields at 73% of the locations, with an average yield increase of 0.9 bu/ac.
- Talc 80/20 + Mo Trioxide increased yields at 64% of the locations, with an average yield increase of 1.2 bu/ac.

2024 Third Party Planter Box Trials



Comparison of soybean root nodules at the R3 growth stage: untreated (left) versus HomeLAND soybean treatment (right).



BRA Nodulation
Bradyrhizobium japonicum

Response to HomeLAND® Soybean

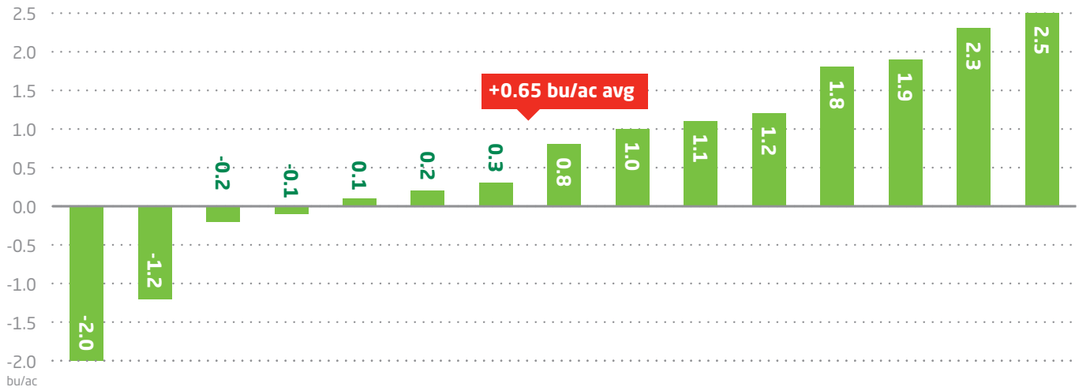
Central IL On Farm Trials - 2024

Location: Williamsville, Franklin, Gridley, Oakford and Auburn

Treatments:

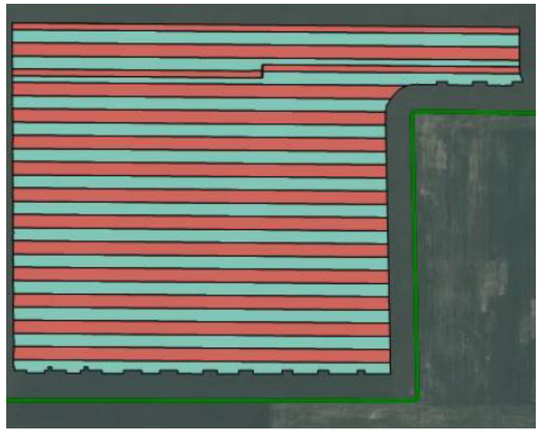
- HomeLAND Soybean was treated on soybean by customers at 1 pail/40 units of seed, compared to untreated/farmer standard seed fluency agent.
- Trials were performed in a split-planter format.
- Evaluations were made across the entire field, or in large (2+ ac) treatment boxes to make fair comparisons.
- A total of 15 on-farm trials were combined and included in the analysis.
- Software used to verify results included AgVance, John Deere Operations Center and Climate FieldView.

HomeLAND Soybean Yield Response - 15 Locations

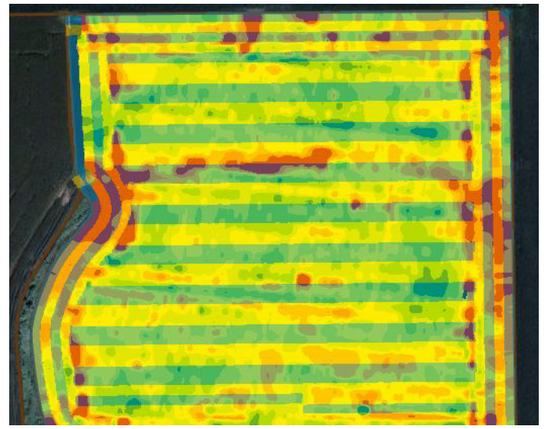


Summary:

- Across the 15 on-farm trials ran in 2024, HomeLAND Soybean resulted in an average yield of 79.89 bu/ac, which was 0.65 bu/ac greater than the non-treated or grower standard.



Split Planter Tool Analysis of HomeLAND Soybean - blue = non-treated, red = treated (-0.2 bu/ac).



Planting map overlaid with contoured yield map. Blue boxes represent HomeLAND soybean.

Soybean Progressive Foliar x Plant Population x Row Spacing

BRANDT Research Farm - Pleasant Plains, IL - 2024

Summary:

- Averaged across plant populations and row spacing, application of fungicide and insecticide with BRANDT Smart System products increased yield by 2.4 bu/ac when applied at R1, an additional 8.4 bu/ac when a second application was made at R3 and an additional 3.9 bu/ac when a third application was made at R5.
- Averaged across populations and foliar treatments, there was no significant difference between row spacings.
- In 30-inch rows, highest yields were achieved in plant densities ranging from 80,000-120,000 plants/ac, with yields decreasing as populations were raised above 120,000 plants/ac.
- The development and yield of certain varieties are optimized under lower plant populations. Increased plant-to-plant spacing within the row can induce branching and an increase internode number/ac.
- Narrower rows in soybean can be beneficial by allowing the canopy to close earlier in the season, which suppresses weed development and increases the amount of sunlight capture.

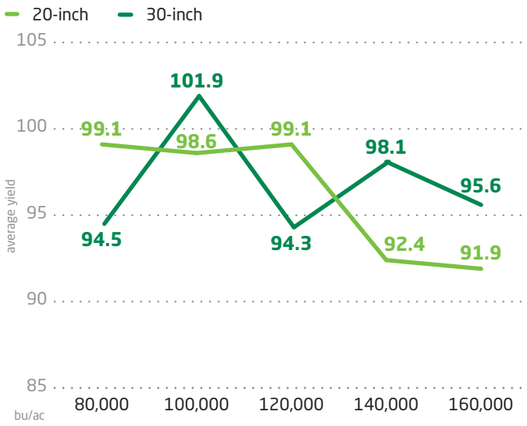
Treatments:

- 20-inch vs 30-inch row spacing.
- 80,000, 100,000, 120,000, 140,000, and 160,000 plants/ac.

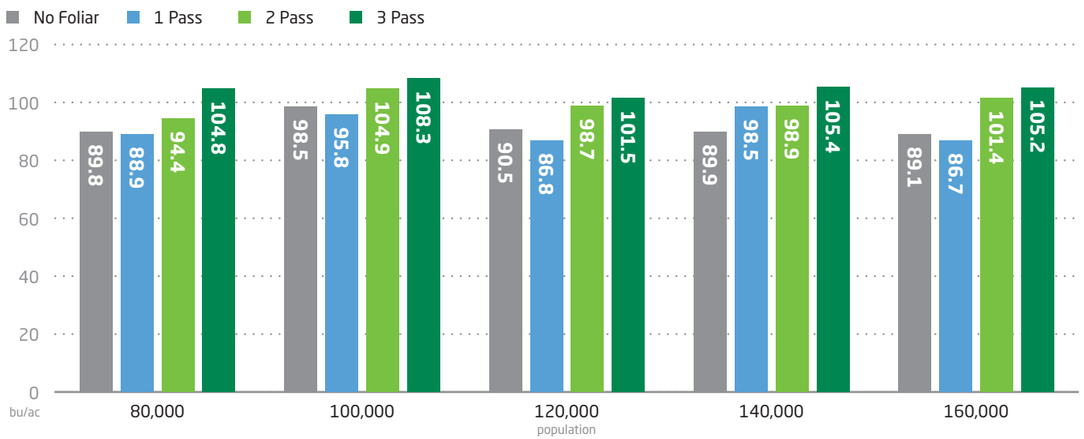
Foliar Treatments and average yield across plant populations and row arrangements:

Treatment	Timing	Product	Yield (bu/ac)
No Foliar	-	-	89.6
1 Pass	R1	Fungicide + Insecticide + Smart Trio (1 qt/ac) + Smart K B (1 qt/ac)	92.0
2 Pass	R1 + R3	Fungicide + Insecticide + Smart Trio (1 qt/ac) + Smart K B (1 qt/ac)	100.4
3 Pass	R1 + R3 + R5	Fungicide + Insecticide + Smart Trio (1 qt/ac) + Smart K B (1 qt/ac)	104.3

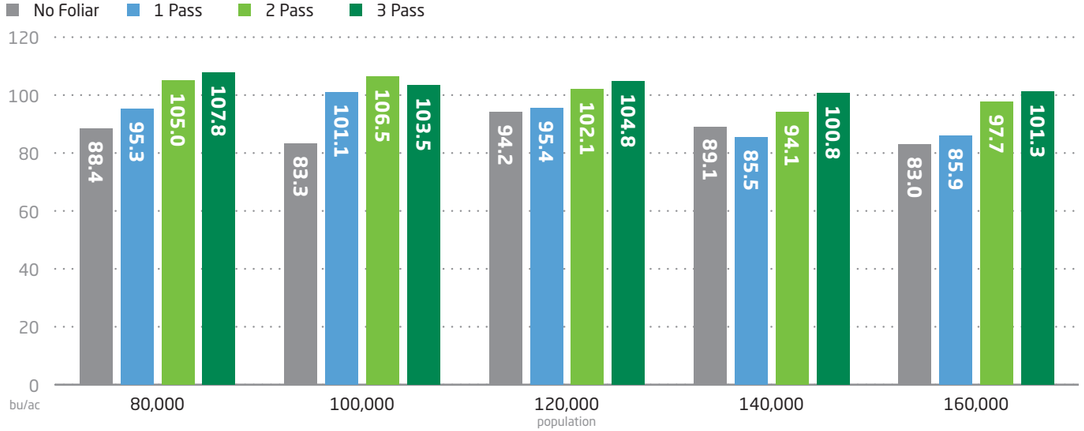
Population and Row Spacing Across Foliar Treatments



20-Inch Rows



30-Inch Rows



Notes: Previous crop: corn; Planting date: 5/13/2024; Harvest date: 10/2/24; Planting rate: 120,000 plants/ac; Fall Fertility: 25-75-100 suspension; 2x2: 10 gal/ac ATS, 2.5 lbs/ac BRANDT EnzUp P DS; In-furrow: 1 pt BRANDT EnzUp Zn; Planter box: HomeLAND Soybean; V3 foliar: BRANDT Smart Trio with herbicide; R3 foliar: Fungicide, Insecticide, BRANDT Smart K B and BRANDT Smart Trio.

Soybean Yield Response to BRANDT Smart System

3rd Party Multi-State Trials - 2024

Summary:

- BRANDT Smart System products are designed for superior compatibility with crop protection products and maximum foliar uptake.
- Foliar boron application during bloom and pod development in soybean can reduce abortion of blooms and young pods.
- A limitation of high-yielding soybean is insufficient N fixation and uptake of nutrition from the soil to maximize seed weight during pod fill. Phosphorus and nitrogen are two elements that have the largest impact on soybean seed weight.
- Application of Zn, Mn, B, and Mo during early vegetative stages can assist with nodule formation, nitrogen utilization, herbicide metabolism, and photosynthesis.
- Averaged across locations, application of BRANDT® Bio-Master® during vegetative growth increased yield by 3.7 bu/ac.
- At R3, the application of BRANDT Smart B-Mo and BRANDT Smart Trio increased yield by 4.0 bu/ac compared to the untreated control.
- Late season application of BRANDT PowerPhos increased yield by 2.5-2.8 bu/ac when applied alone and 5.1 bu/ac when following soybean treated with BRANDT Smart Trio and BRANDT Smart B-Mo at R3.

Effect of BRANDT foliar nutrition treatments on soybean grain yield across different states in the Midwest:

Trt	Product	Rate (qt/ac)	Timing	Location			Average
				KS	KY	OH	
				Grain yield change from untreated control (bu/ac)			
1	BRANDT Southeast Crop Mix			4.6	0.3	0.0	1.6
2	BRANDT Bio-Master			9.5	2.3	-0.6	3.7
3	BRANDT Smart Trio BRANDT Smart B-Mo	1.0 0.5	R3	11.4	0.7	-0.2	4.0
4	BRANDT Smart Trio BRANDT Smart B-Mo BRANDT PowerPhos	1.0 0.5 2.0	R3 R5	9.8	4.2	1.4	5.1
5	BRANDT PowerPhos	2.0	R3	4.5	4.2	-0.3	2.8
6	BRANDT PowerPhos	2.0	R5	5.4	0.3	-1.0	2.5

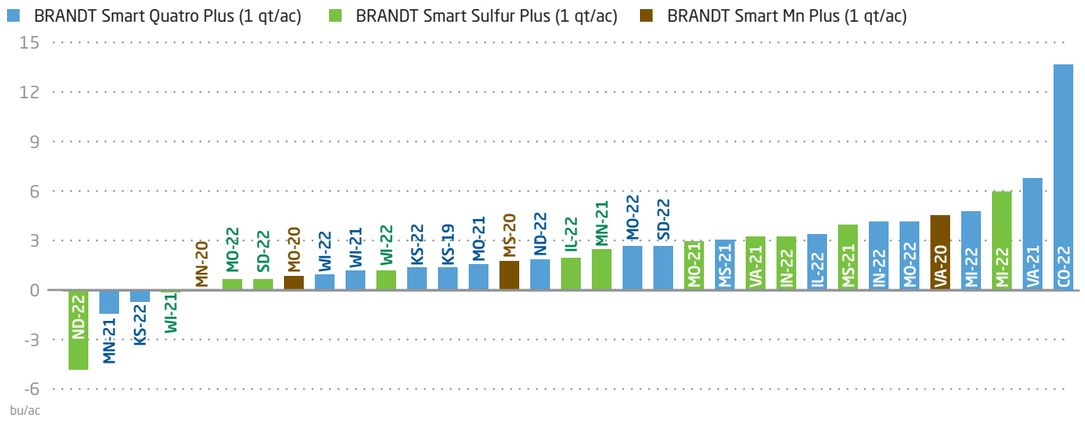
3rd Party Multi-State Trials - 2019-2024

Summary:

BRANDT Smart System applications during vegetative stages (V3 to V5) improved overall yields as follows:

- 3.1 bu/ac average yield increase over 17 environments for BRANDT Smart Quatro Plus.
- 1.8 bu/ac average yield increase over 12 environments for BRANDT Smart Sulfur Plus.
- 1.8 bu/ac average yield increase over 4 environments for BRANDT Smart Mn Plus.

V4 BRANDT Smart System Application Yield Advantage

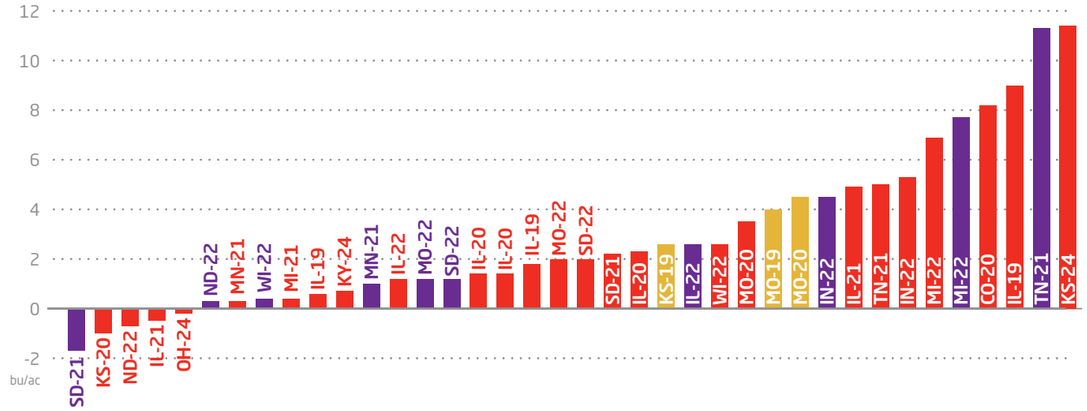


Summary:

BRANDT Smart System applications during reproductive stage (R3) improved overall yields as follows:

- 3.7 bu/ac average yield increase over 3 environments for BRANDT Smart K B.
- 3.0 bu/ac average yield increase over 10 environments for BRANDT Smart K B + BRANDT Smart Trio.
- 2.8 bu/ac average yield increase over 25 environments for BRANDT Smart B-Mo + BRANDT Smart Trio.

R3 BRANDT Smart System Application Yield Advantage

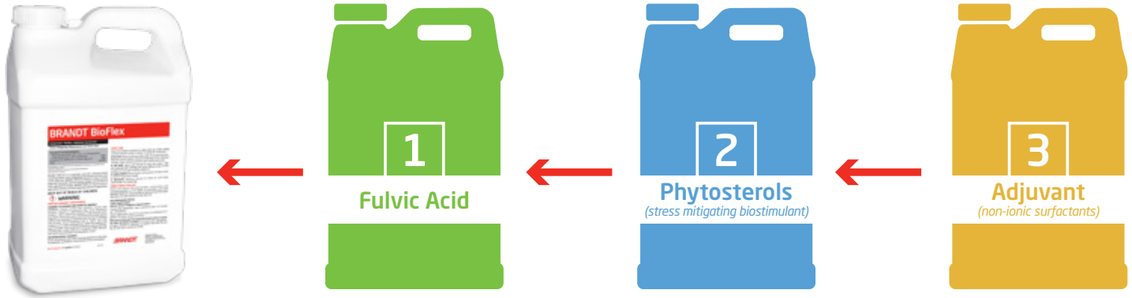


Stress Mitigating Biostimulants

BRANDT BioFlex

BRANDT now offers a new biostimulant-surfactant combo product designed to enhance plant antioxidant activity both reactively and proactively, allowing crops to remain active and photosynthesizing during periods of abiotic stress (heat, drought and salinity). By mitigating the effects of environmental challenges, these products help reduce yield losses and support sustained plant productivity. BRANDT BioFlex is also an effective non-ionic surfactant that improves performance of foliar applied crop protectants, PGRs and nutrients making it an excellent tank mix partner for many applications.

Biostimulant + Nonionic Surfactant



Heat Stress

- Protects the cell from dehydration and heat - induced damage
- Induces ROS scavenger production
- Increases water-use efficiency
- Enhances photosynthetic efficiency
- Improves N uptake

Drought Stress

- Increases water retention
- Stimulates root growth for better water and nutrient uptake
- Induces ROS scavenger production
- Increases water-use efficiency
- Enhances photosynthetic efficiency
- Improves N uptake

Salinity Stress

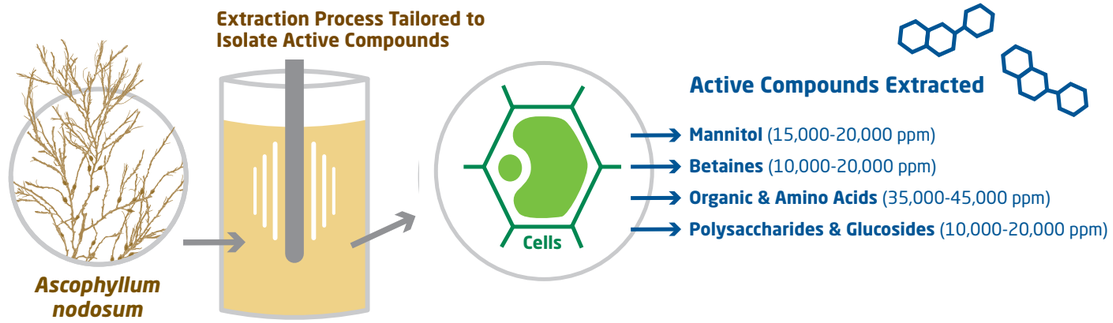
- Regulates ion homeostasis
- Alleviates osmotic stress
- Induces ROS scavenger production
- Improves N uptake

Nitrogen Assimilation

- Enhances nitrogen absorption and assimilation under stress conditions
- Enhances enzymes involved in nitrogen assimilation like nitrate reductase

BRANDT Seaweed Max

BRANDT Seaweed Max is a premium biostimulant product derived from *Ascophyllum nodosum*, a seaweed extract known for its ability to enhance plant growth by mitigating abiotic and biotic stresses and strengthening plant defenses. The active compounds isolated from *A. nodosum* extracts regulate key molecular, physiological, and biochemical processes, contributing to improved plant health and resilience.



Due to the extraction method, BRANDT Seaweed Max has higher concentrations of these active ingredients than most competitive products in market space. These actives include: mannitol, betaines, organic and amino acids, and polysaccharides and glucoside derivatives, offering a range of targeted benefits:

Mannitol

- Acts as an osmo-protectant during drought stress.
- Exhibits antioxidant properties, reducing cellular damage caused by oxidative stress.
- Reduced cellular damage during salt stress.

Betaines

- Improved growth and vigor during heat and drought stress through improved regulation of water in and out of cells.
- Improved tolerance to cold stress.

Organic and Amino Acids

- Enhance nutrient uptake and improved chlorophyll synthesis.

Polysaccharides and Glucosides Derivatives

- Improves nitrogen and sulfur assimilation by help plants control carbon and nitrogen transport balance in plants.

Biostimulant Trials

BRANDT Research Farm - Pleasant Plains, IL - 2024

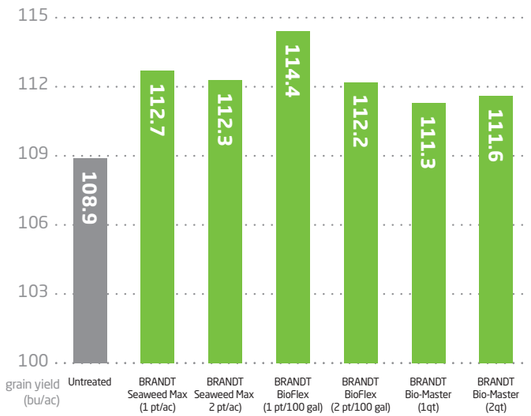
Summary:

- Although the untreated control resulted in a high yield, all treatments still achieved yield increases over the control. This indicates that stress-mitigating products provide benefits even under favorable growing conditions, likely by enhancing metabolic detoxification processes required to manage the elevated metabolic rates associated with high-yielding soybean.
- Among the approaches evaluated to mitigate plant stress, BRANDT BioFlex, applied at 1 pt/100 gal, resulted in the highest yield increase in the study, with an increase of +5.4 bu/ac over the untreated control.
- BRANDT Bio-Master, a combination of micronutrients, humic acid, and seaweed extract, increased yield by an average of 2.6 bu/ac.
- The application of seaweed alone, as BRANDT Seaweed Max, increased yield by 3.8 bu/ac at the 1 pt/ac rate and 3.4 bu/ac at the 2 pt/ac rate.

Treatments:

- In-season foliar treatments were applied at the V4 growth stage, consisting of BRANDT Seaweed Max at 1 or 2 pt/ac, BRANDT BioFlex at 1 or 2 pt/100 gal (equivalent to 3.2 or 6.4 fl oz/ac), and Bio-Master at 1 or 2 qt/ac.

In-Season Biostimulants Trials



Notes: Previous crop: corn; Planting date: 4/22/2024; Variety: AG33XF3; Planting rate: 120,000 plants/acre; Fall Fertility: 25-75-100 suspension.

3rd Party Multi-State Trials - 2024

Summary:

- Averaged across locations, all treatments increased yield over the control.
- Only one treatment at a single location resulted in a yield decrease compared to the control.
- While there was little difference in average yield response between rates across all locations, the rate applied had a more significant influence on yield within individual locations.

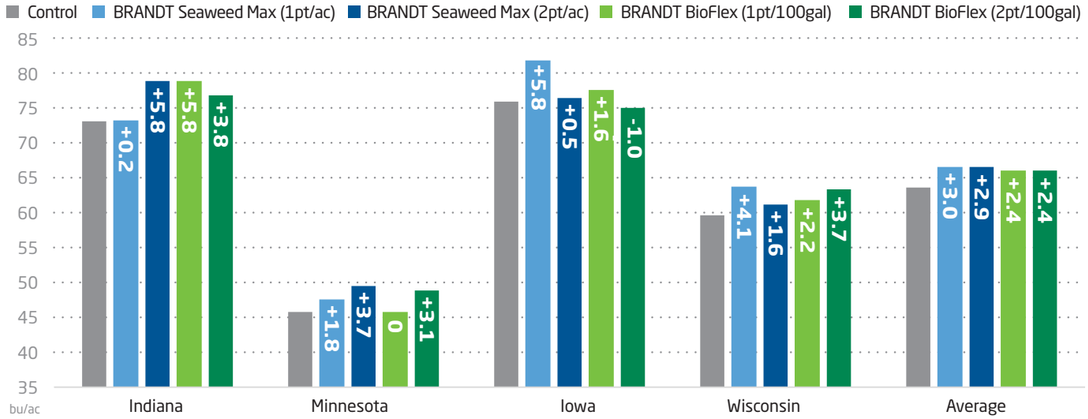
Treatments:

- In-season foliar treatments were applied at the V3-V4 growth stage, consisting of BRANDT Seaweed Max at 1 or 2 pt/ac, and BRANDT BioFlex at 1 or 2 pt/100 gal (equivalent to 3.2 or 6.4 fl oz/ac).

Effect of BRANDT in-season biostimulant treatments on soybean grain yield across different states in the Midwest:

Treatment	Rate	Yield Change from Check (bu/ac)				
		IN	MN	IA	WI	Average
Control	-	73.1	45.8	76	59.6	63.6
Seaweed Max	1pt/ac	+0.2	+1.8	+5.8	+4.1	3.0
Seaweed Max	2pt/ac	+5.8	+3.7	+0.5	+1.6	2.9
BioFlex	1pt/100 gal (3.2 fl oz/ac)	+5.8	0	+1.6	+2.2	2.4
BioFlex	2pt/100 gal (6.4 fl oz/ac)	+3.8	+3.1	-1	+3.7	2.4

2024 Third Party Trials



Thank You!

We make a significant investment in research and development to bring our customers local information and practices they can implement on their farm to be more profitable and more efficient in today's competitive environment. We appreciate the business relationship we have with each of you and for that we say - Thank You.

Please join us for our annual summer agronomy day - Thursday, July 17, 2025 at the at the Evelyn Brandt Thomas Ag Innovation Center. More details to follow at a later date.

BRANDT RETAIL LOCATIONS

Ashland	217 476 3438
Auburn	217 438 6158
Cooksville	309 725 3710
Cropsey	309 377 3121
Fairbury	815 692 2612
Franklin	217 675 2302
Grand Mound, IA	563 847 3931
Greenview	217 968 5589
Gridley	309 747 2233
Lexington	309 365 7201
Lincoln	217 735 2571
Mt. Auburn	217 676 3231
New Berlin	217 488 3125
Niantic	217 668 2228
Oakford	217 635 5765
Raymond	217 229 3442
Waverly	217 391 9705
Williamsville	217 566 2113

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