Nutrien
Ag Solutions®

INNOVATION FARM RESULTS

2023

Our Innovation Farm Network at Nutrien Ag Solutions represents a strategic investment in local agronomy and new technology to support our growers and crop consultants. Support from Loveland Products, Dyna-Gro and our Research & Development partners enables us to bring hands on training, innovation testing and technology demonstration at scale.

2023 was a major year across our network with the appointment of Thaddeus Bates as the Senior Manager for the Innovation Farms and under his leadership the network has grown significant capabilities, reach and connections creating more value at local and national level. Major achievements alongside the trials and technology testing include:

1. Accessing state-of-the-art precision agronomy equipment across the network through a unique new partnership with John Deere and local dealers.
2. Expanding the collaboration with our Retail training team and the Regional Agronomy Managers to extend the successful new training program, Agronomy Essentials.
3. Investing in new building facilities at our farms to allow more face-to-face interactions, connections, and events.
4. Integrating the farm network into our Agronomy & Environmental Sciences pipeline with Soil Health, Weather and Agronomic Innovation Trials to help steer development and accelerate new technology delivery to the field.

These deliverables were designed with one purpose in mind, how to bring more value to our grower customers by leveraging all our assets at Nutrien Ag Solutions.

I hope you enjoy reviewing the new agronomic insights on corn, soybeans, wheat, and cotton which were generated on our Owensboro, Hopkinsville, Champaign, and Winterville farms this year. As we look forward to 2024, we aim to extend our science based, data backed recommendations for Crop Nutrition and Stress management with new datasets from the emerging field of soil biology genomics and advanced environmental modeling.

Special thanks to the Innovation Farm team alongside collaboration across AES and our marketing team for bring you this fantastic resource to help find local solutions to maximize farm productivity,

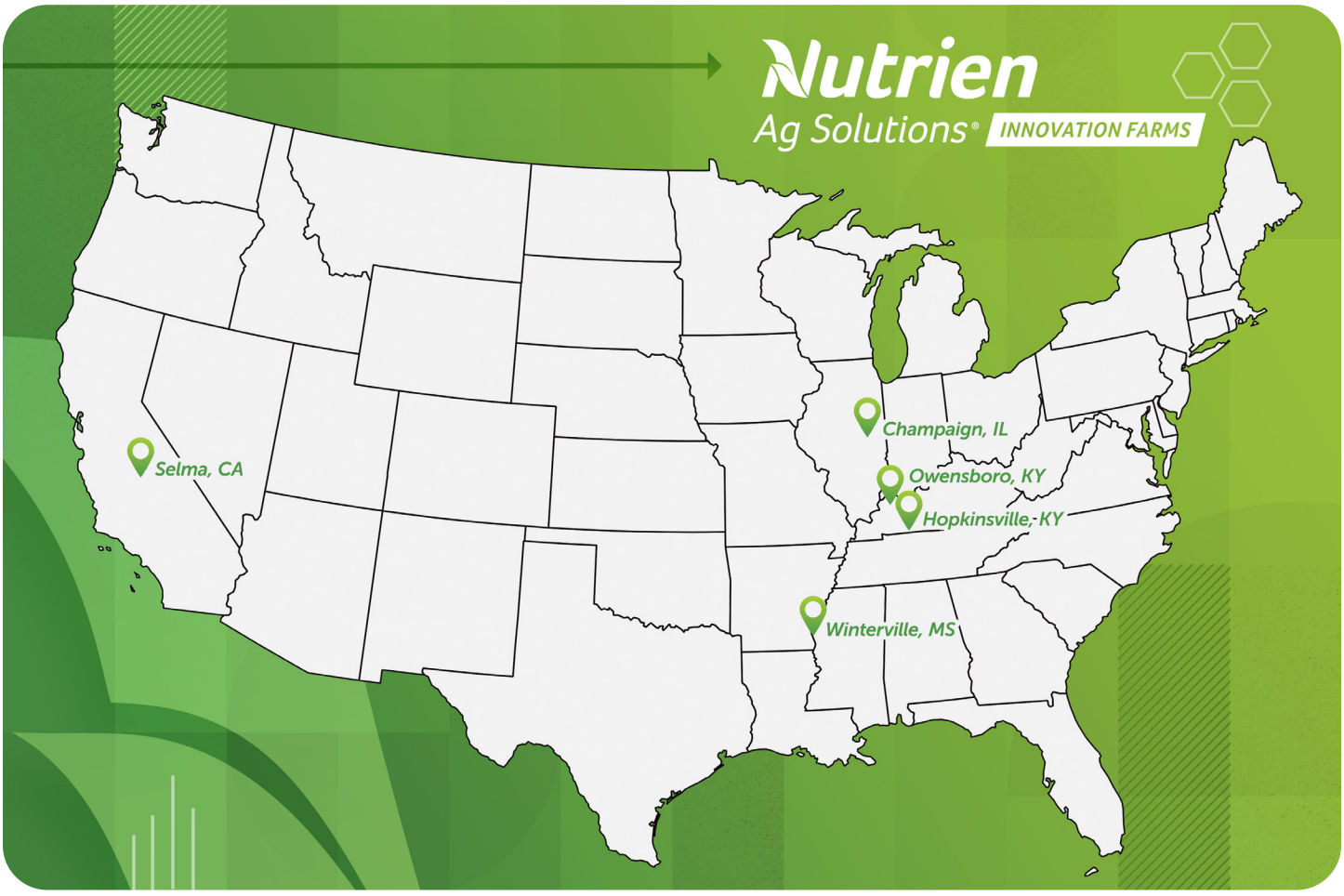
Paul Bonnett
Sr. Director, Agronomy & environmental Science

NUTRIEN AG SOLUTIONS INNOVATION FARM NETWORK

The Nutrien Ag Solutions Innovation Farm Network is designed to provide locally relevant whole-acre solutions on a commercial scale that will increase our growers' return on investment and help them sustainably grow more per acre.

The network consists of five innovation farms and smaller-scale trial locations which act as regional hubs to collaborate across Nutrien Ag Solutions to quantify the value of new equipment, technology, products and practices at a farm scale.

Each farm provides a unique training experience for crop consultants, growers, and future talent to help solve the agronomic and environmental challenges facing growers today. Together we can push the boundaries of Agronomy and Environmental Science while empowering individuals to their full potential. With partnerships and shared commitments, the Innovation Farm Network strives to advance agriculture through Research at the Speed of Farming.



DESIGN PRINCIPLES FOR THE INNOVATION FARM NETWORK

COLLABORATE & LISTEN

- Showcasing - Testing - Trial - Demonstration of tomorrow's standard practice

BEST FARM PRACTICES

- Differentiate by accelerating solutions that growers can use today
- Community and regional engagement

GROWERS AND CROP CONSULTANTS

GUIDING PRINCIPLES

- Adopt service mindset to our retail business
- Scale and leverage our entire organization and partners

DEMONSTRATE & EXCITE LOCALLY

- Demonstrate the power of trusted agronomic and technology in the real world and market conditions

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HOPKINSVILLE, KY

OWENSBORO, KY

HYBRID VARIETY TRIALS

CHAMPAIGN, IL

WINTERVILLE, MS

We would thank to acknowledge, and thank our product partners for their support during our innovation trials:

ATMOSPHERIC SCIENCES TEAM

The Atmospheric Sciences Team strives to be the most trusted provider of agronomically relevant weather information. Based in Champaign, IL, the team of six empower growers by providing decision support as they manage weather-related risks throughout the year. This team produces daily written and video weather reports that focus on agronomically relevant weather across the world. They aim to provide the most trustworthy analysis and forecasts to minimize the impact adverse weather can have on a producer while maximizing their efficiency in planning around weather events. Their daily Weather Intelligence Reports are read by over 10,000 subscribers each day and the forecast videos have nearly 30,000 views each week.

They are experts in high impact weather and work tirelessly to provide timely safety information on severe and hazardous weather. They work with their safety partners to manage the release and dissemination of division level weather safety bulletins, striving to deliver timely safety information to protect life and property across Nutrien, so that every employee is home safe every day.

The team specializes in long range prediction as well as global weather analysis in agronomically productive regions. They have developed a suite of web and mobile applications that provide historically accurate weather data to help growers track the progress of a crop and prepare for weather-related stresses throughout a growing season. They partner with NOAA, ECMWF, Bureau of Meteorology (Australia), NASA, and numerous universities to study and predict impactful weather and climate events.

The atmospheric sciences team are focused on outreach and communication. They travel across North America presenting at over 150 conferences and meetings each year providing the latest weather analysis and showcasing their tools and forecasts. Their outreach allows us to learn more about the specific meteorological challenges to producers in each region across North America. Using these connections, they are able to build the most useful tools for growers, using in-house 30-year historical & forecast weather database. From frost and heat alerts in the West, to customizable growing degree day tools across the corn belt, to accurate precipitation forecasts across the South, the team focuses on requirements and recommendations to create the most reliable and easy to use applications that can be easily accessed at the touch of a button.

ERIC SNODGRASS
Senior Scientist Fellow,
Atmospheric Scientist for the Corn Belt

EMILY HOGAN
Manager of Computational Sciences,
Atmospheric Scientist for the South

ANDREW PRITCHARD
Senior Scientist, Severe Weather Safety Expert,
Atmospheric Scientist for Canada & the East

MATT REARDON
Senior Computational Scientist,
Atmospheric Scientist for the West

BILL TURNER
Principal Computational Scientist,
Atmospheric Scientist for the East

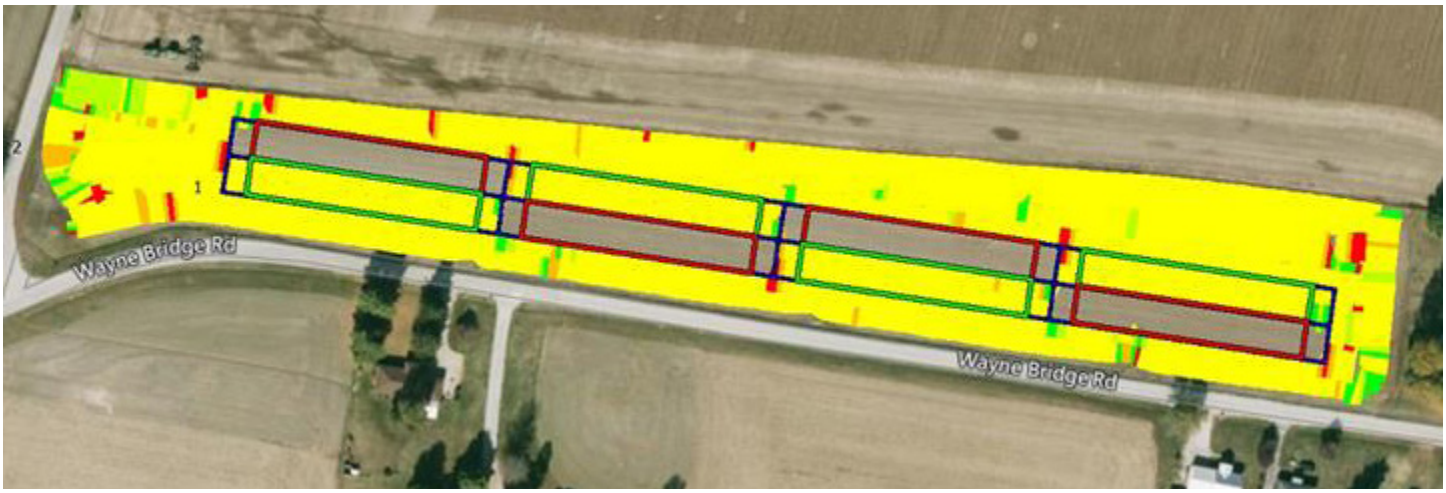
SCOTT JAMES
Computational Scientist,
Atmospheric Scientist for the Corn Belt

Nutrien Ag Solutions®

AGRONOMIC INNOVATION TRIALS

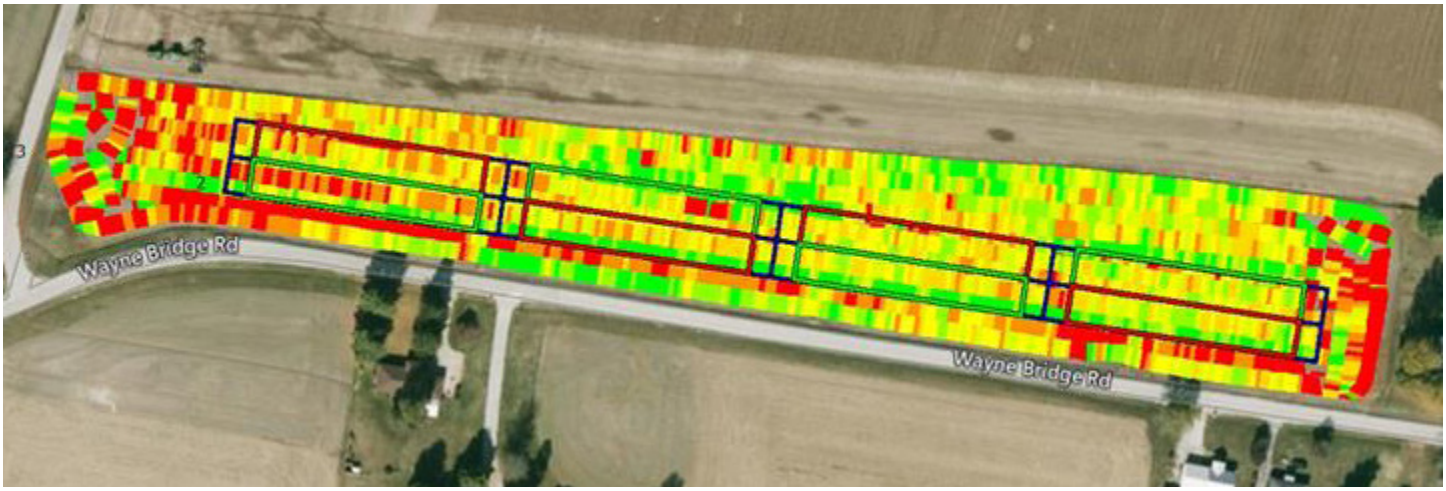
The Agronomic Innovation Trial platform is Nutrien's answer to streamlining the process involved with on-farm research.

This technology-based process allows for fully randomized, replicated field trials without the hassle of flagging off an area for applications and spending extra time during harvest measuring lengths and calculating yields with weigh wagons.



Your local Nutrien precision ag specialist determines a grid layout based on your field to allow for multiple replications. Randomizing treatments within a field overcomes the productivity variability across that field to ensure that we have multiple data points in different zones. This increases statistical significance and ensures data credibility.

RESEARCH AT THE SPEED OF FARMING



Applications are prescription based, so there is a decreased chance of an applicator making an error like forgetting to shut the boom off, changing rates, or applying the product outside the desired area. These prescriptions can be exported in many file types suited for different machines, so the application can be made by the grower or local Nutrien location.

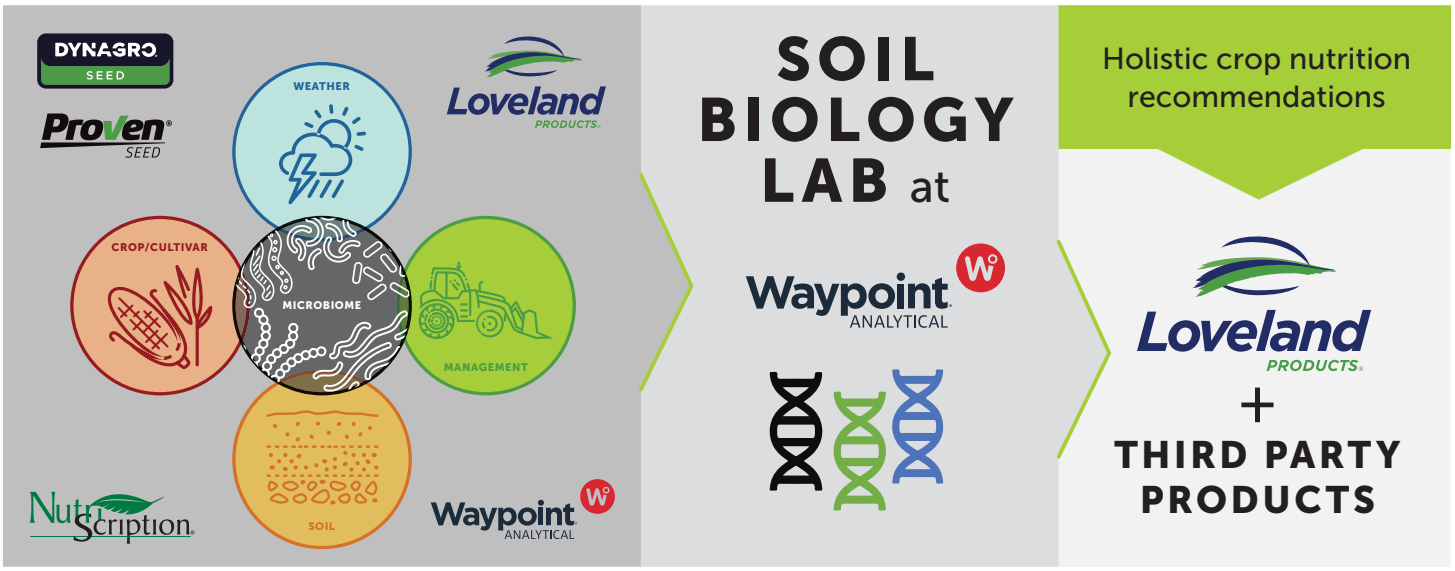
Harvest data is analyzed from the yield maps by a team of data specialists. The initial application map is used to determine the location of the trial, and the team is able to analyze the separate strips and summarize the data accordingly.

The Agronomic Innovation Trial design is suited for many trial types, from a simple comparison of treated and untreated strips to a multi-treatment trial. We can form whole-acre solutions through the use of these prescriptions at various times in the growing season. These capabilities extend to any piece of equipment with a rate controller.

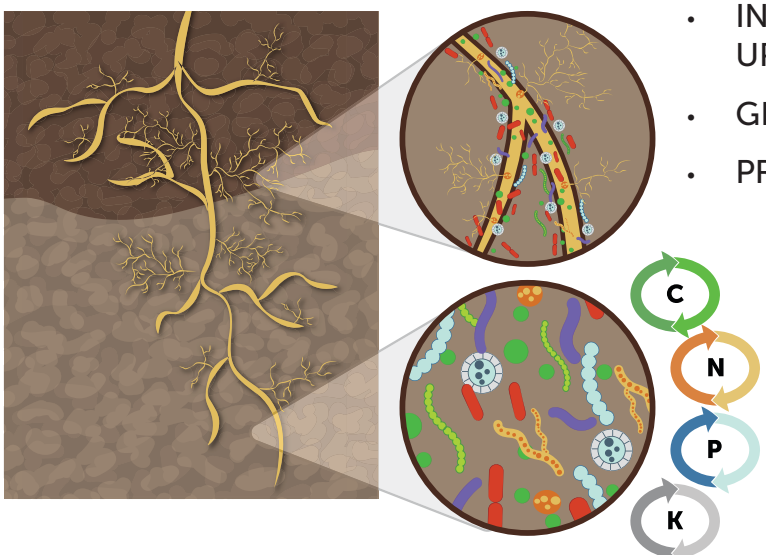
SOIL BIOLOGY
GET IN THE GAME!

Get in the game by starting now! Nutrien Ag Solutions is launching a new Soil Biology Test. We are asking you to participate by incorporating soil sample for biological analysis into your normal soil sampling activities.

Why should you? Creating a nutritional recommendation that has the greatest impact for your field starts with understanding the soil's biology. By measuring these important microorganisms we can start to tie all the pieces of the puzzle together to give a more holistic, total nutritional solution for your fields. Better understanding the soil biology will help your crop consultant with proper placement of biological products.



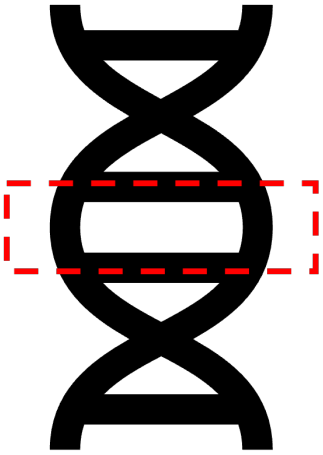
What is Soil Biology? It is the microorganisms living in the soil that are a critical part of plant growth, nutrient cycling and protection from stress.



- INCREASED NUTRIENT AVAILABILITY & UPTAKE
- GROWTH STIMULATION
- PROTECTION FROM STRESS

- INCREDIBLY DIVERSE, COMPLEX COMMUNITY
- ENGINE THAT DRIVES NUTRIENT CYCLING

How is Nutrien different? We are using a more targeted approach that is more cost-effective and fits into your normal soil sampling process. We will provide data on nitrogen, phosphorus, and potassium cycling microbes as well as overall soil biology with future plans for additional nutrient cycles, carbon, pest and pathogens.



LEVERAGE DNA ANALYSIS TO PROVIDE AGRONOMIC INSIGHTS

- TARGETED APPROACH
- SCALABLE
- LOW COST COMPARED TO COMPETITION
- FITS INTO CURRENT SOIL SAMPLING PROCESSES (I.E., ECHELON OR NUTRISCRIPTION)

All that is required is either sending your composite samples or a subset of your normal set of samples (Grid/Zone) from each participating field to be submitted for soil biology analysis through your local Nutrien Ag Solutions branch.

Contact your Nutrien Ag Solutions branch and/or Crop Consultant for more information and to sign up.

Soil Biology Report

Grower: Dustin Dossett | **Crop:** Corn | **Date Sampled:** 06/28/2023
Farm: Hopkinsville Innovation Farm | **Rep:** DDossett | **Date Tested:** 07/01/2023
Field: BLACKMAX22

Lab: Waypoint Analytical Illinois, Inc. | **BagID:** TEST-GH06_1

P	K	Ca	Mg	S	B	Cu	Fe	Mn	Zn	Na
27	78	1104	105	16	0.3	1	102	322	2.3	9

Soil Characteristics

Organic Matter — 2.9

pH — 5.8

CEC — 8.2

Chemistry results indicate biostimulant application may result in moderate improvements to plant health in this field.

Acidic environments inhibit microbial activity. Applying lime to raise pH should improve biofertility measures.

BioFertility

Soil Microbial Biomass — 82

Total Bacteria — 68

Total Fungi — 44

DNA analysis found good levels of biofertility measures.

No recommendations for these conditions.

Soil Characteristics ratings are determined by regional agronomists using data in the Nutriscription system. Nutrients are reported in parts per million (ppm) obtained using a Mehlich 3 extraction method. BioFertility metrics are based on both DNA and chemistry analyses quantified as percentiles from the distributions of values within Nutrien's nationwide database. Higher BioFertility values are always considered favorable. Consult your local Nutrien agronomist for more insight into the findings in this report.

BioFertility Color Code	Poor	Below Average	Average	Above Average	Exceptional
NutriScription Color Code	Low	Questionable	Optimal	High	Excessive

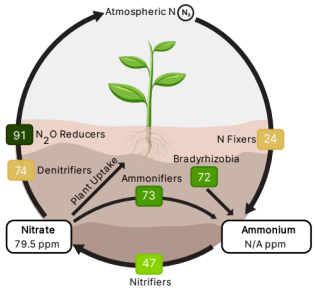
BioFertility: Nitrogen (N)

Nitrifier Balance — 79

N Conservation Potential — 38

High levels of denitrifiers can contribute to decreases in nitrogen use efficiency.
DNA analysis shows high levels of ammonifiers, which protect N from leaching.

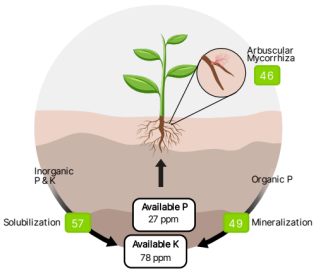
Controlled release N fertilizers
Nitrification inhibitors
Split N application
Nitrogen use efficiency products such as Blackmax 22 or AccomplishMax



BioFertility: Phosphorus (P) & Potassium (K)

DNA abundance of P mineralizing microbes correlates positively with P mineralization activity.

No recommendations for these conditions.



Soil Biology Report

Grower: Luke Wilson | **Crop:** Soybean | **Date Sampled:** 05/23/2023
Farm: Owensboro Innovation Farm | **Rep:** Luke Wilson | **Date Tested:** 05/25/2023
Field: Ensurgo + ReaX

Lab: Waypoint Analytical Illinois, Inc. | **BagID:** TEST-GH06_1

P	K	Ca	Mg	S	B	Cu	Fe	Mn	Zn	Na
51	74	610	48	11	0.2	2.2	133	101	2.3	8

Soil Characteristics

Organic Matter — 2

pH — 4.9

CEC — 6.6

Chemistry results indicate biostimulant application may result in strong improvements to plant health in this field.

Acidic environments inhibit microbial activity. Applying lime to raise pH should improve biofertility measures.

BioFertility

Soil Microbial Biomass — 32

Total Bacteria — 37

Total Fungi — 35

DNA analysis found low levels of microbial biomass, bacteria, and fungi.

No till/reduced tillage
Cover crops
Organic amendments
C2 Technology or biocatalyst product like Blackmax 22 or AccomplishMax

Soil Characteristics ratings are determined by regional agronomists using data in the Nutriscription system. Nutrients are reported in parts per million (ppm) obtained using a Mehlich 3 extraction method. BioFertility metrics are based on both DNA and chemistry analyses quantified as percentiles from the distributions of values within Nutrien's nationwide database. Higher BioFertility values are always considered favorable. Consult your local Nutrien agronomist for more insight into the findings in this report.

BioFertility Color Code	Poor	Below Average	Average	Above Average	Exceptional
NutriScription Color Code	Low	Questionable	Optimal	High	Excessive

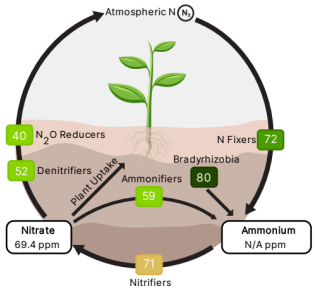
BioFertility: Nitrogen (N)

Nitrifier Balance — 40

N Conservation Potential — 57

High levels of nitrifiers can contribute to decreases in nitrogen use efficiency.

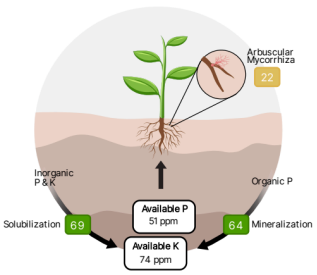
Controlled release N fertilizers
Nitrification inhibitors
Split N application
Nitrogen use efficiency products such as Blackmax 22 or AccomplishMax

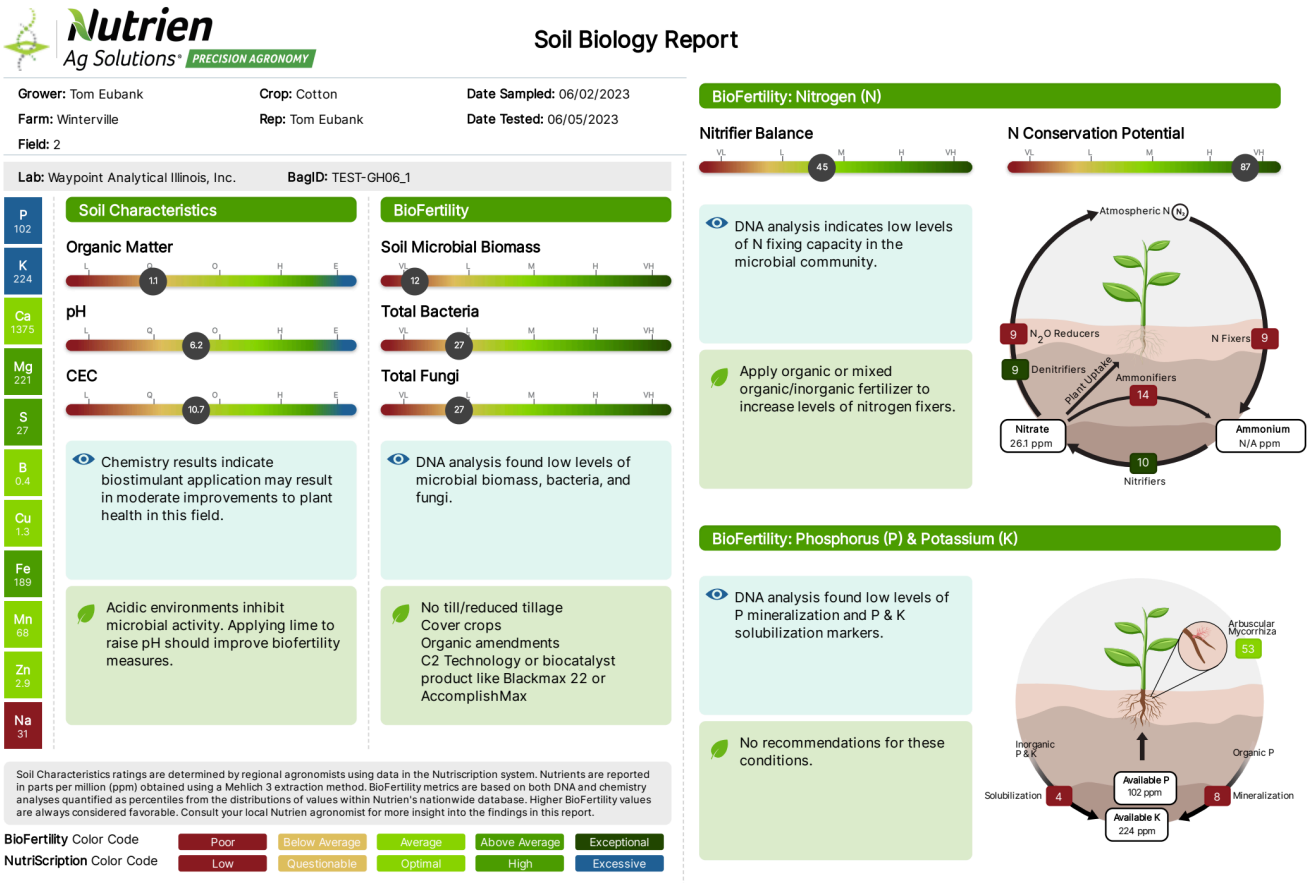


BioFertility: Phosphorus (P) & Potassium (K)

DNA analysis found low levels of arbuscular mycorrhizal fungi markers.

No till/reduced tillage
Reduced P fertilization (include Titan XC to maximize efficiency)





WHAT WE LEARNED

HOPKINSVILLE

- In a side by side trial, treatment with BLACKMAX 22 or BLACKMAX + Extract especially improved the abundance of ammonifiers—microbes that keep nitrogen in forms less vulnerable to leaching
- All treatments generally reduced the abundance of nitrifiers and denitrifiers, both of which can contribute to nitrogen loss
- BLACKMAX 22 alone broadly improved the abundance of phosphorus- and potassium-cycling microbes

OWENSBORO

- Treated plants exhibited vigorous early season growth
- Treatments broadly improved nitrogen efficiency metrics
- Treated soils were also associated with reduced nitrate and nitrifiers, potentially indicating that treatments improved plant nitrate uptake

WINTERVILLE

- BioFertility markers were usually lowest in cotton fields
- Fungal and bacterial biomass and N efficiency metrics were generally above average, but markers like Bradyrhizobia and P mineralization were low

NOTES:

HOPKINSVILLE, KY

CORN SOYBEAN WHEAT

HOPKINSVILLE, KY

The Innovation Farm in Hopkinsville, KY, is where the agronomic knowledge presented in the following pages was gathered. This year across our 87-acre farm, we conducted hundreds of research trials and tested dozens of products and agronomic applications on wheat, corn, and soybeans. We tested these products and those of our vendors on local soils to find products that work well and work well together. Each of these trials is specifically designed to provide information and data to the grower, focusing on increasing their overall farm profitability and ensuring long-term success.

The primary focus of every trial we conduct on the Hopkinsville Innovation Farm is to increase the on-farm profitability of our customers. Many of the products we have chosen to release have consistently demonstrated a two-to-one or greater return on investment.

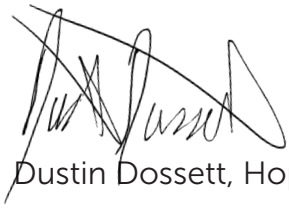
Our 2023 season began with a good planting window for most of our full season beans and part of our corn crop in early April, before turning cold and wet. We finished planting in late April through early May. Although the rains made planting difficult, after the second week of May, the weather turned mostly hot and dry through June with relief coming in the third week with much needed rain. The lack of rain in June significantly affected the corn, resulting in a discoloration of the leaves until rain restored the natural, vibrant colors. Pollination occurred during another hot, dry spell in early July, resulting in kernel length loss and likely yield reduction. However, with consistent rains beginning in mid-July along with some temperature relief, kernel depth was added, and some yield regained. Full season soybeans also experienced these hot, dry conditions, but consistent August rains added to seed size and increased yield.

This year we not only gathered yield data, but also additional data for Grain Sample Tests and a new Titan Study focusing on soil fertility, as you will see in the following pages. These studies provide growers with additional data to assist them in making sound operational decisions.

This summer we were able to host multiple agronomy field days at the farm, providing our local crop consultants and salesmen with new innovations, product performances, and best practices. We are already looking forward to our 2024 Research Field Days and the knowledge we will gain to share with more growers.

In the meantime, we hope that this information provided will help salesmen and growers alike in gaining predictable and profitable results.

At the Innovation farm there is a great amount of work that goes into the Farm and I would like to thank everyone who supported and helped at the farm this year and was able to come out. Also, Thank you Emily Jenkins for all of your help this year as our Summer Intern.



Dustin Dossett, Hopkinsville Innovation Farm Manager

HOPKINSVILLE WEATHER

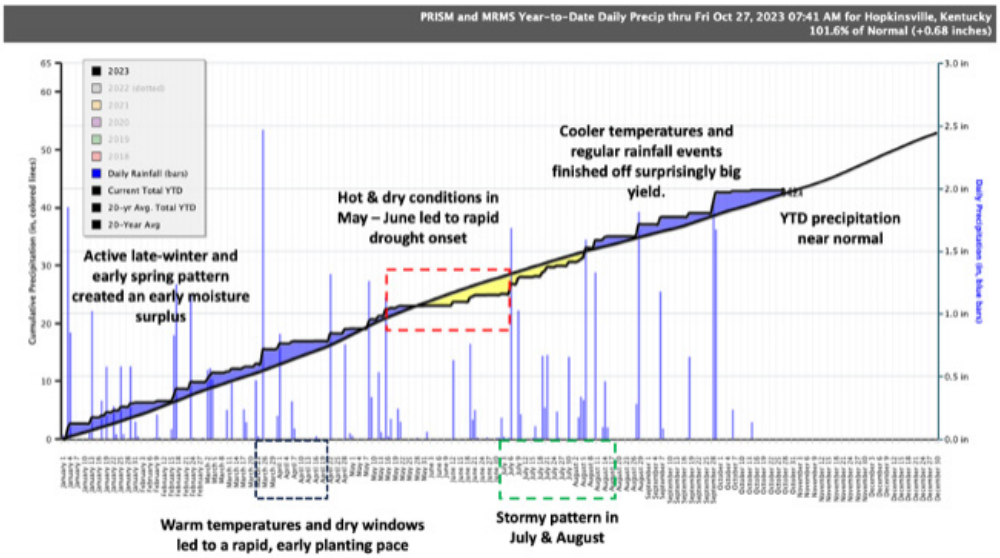
The Hopkinsville farm was plagued by the same blocked jet stream pattern that delivered dry conditions to much of the Ohio Valley and Mid-South during the months of May and June. Higher atmospheric pressure led to prolonged periods of northwesterly jet stream flow overhead, with sunny and dry weather conditions resulting.

This extended dry period led to concerns about crop health which were ultimately proven unwarranted as high yields resulted. There are a couple reasons for this better-than-expected crop condition in the face of a two-month drought.

First, abundant early spring rains provided deep soil moisture that crops were able to tap into and use as a reserve until rain returned in the last week of June. Additionally, with northwest flow delivering shots of mild, dry air, the absence of prolonged excessive heat likely prevented further crop stress during this extended stretch of dry weather. Still, moderate drought had developed across the region by mid-June.

A run of hot weather did develop in late June and July as a ridge of high pressure began to develop and expand across the region. Luckily, instead of centering itself over the region deep into the summer, the ridge was mobile and willing to bend, allowing periods of stronger jet stream flow to interrupt heat with rounds of ridge-riding thunderstorms. This weekly pattern of on-again, off-again hot weather and ridge-riding thunderstorms resulted in a rather typical summertime weather pattern overall.

The tide began to turn in favor of a cooler, more active pattern in late July and August. Year-to-date precipitation trended positive in the first week of August and remained there through the end of the growing season as regular rains and numerous 1"+ precipitation events impacted the farm in August and September.



HIGH MANAGEMENT WHEAT PROGRAM

FOUNDATION

Apply Pre-plant Fertilizer Based on Soil Test

- Identify limiting fertility issues to be addressed in season applications

Plant quality seed with a fungicide and Aphid Rate Insecticide Seed Treatment

- Increase normal seeding rate to 2 to 2.5 million seed per acre
- Base seeding rate based on variety and environment
- Main stem seed head production is the goal to increasing yield
- Increased stand will lead to more nutritional needs and using a Plant Growth Regulator in-season

MAINTAINING

Application of First Shot UAN

- 40-70 units, rate dependent on existing stand and final season N rate recommendation
- Apply additional nutrition as identified in soil test

PROTECTING

- At green up timing, tissue sample two weeks prior to foliar applications
- Apply a fungicide, herbicide and bio stimulant (to promote early growth)
- Apply Palisade at 10-12 ounces at Feekes 5-7
- Apply foliar nutrition based on tissue sample results

MAXIMIZING

- Apply second shot nitrogen to reach maximum N recommendation (125 to 155 units to total Nitrogen)
- Add Nitrogen efficiency products to increase N uptake
- Add Nitrogen stabilizer above and below ground
- Add AccesS Sulfur at 1-3 gallons rate
- Add any additional foliar nutrition based on tissue sample

FINISHING

Head Scab Fungicide Protection

- Add foliar nutrition to maximize head fill

GROWER STANDARD PRACTICE

Dyna-Gro 9151, 1.4 million seeds/acre

100 lbs Dap, 100 lbs Mes10, 150 lbs Potash

1 gal AccesS + 60 units 28% (Feb. 7th) 1st Shot N

1 gal AccesS + 70 units 32% (March 28th) 2nd Shot N

.75 oz Quelex + 5oz Magistrate + 1.28 oz Warrior ll (March 29th) Feekes 6 Herbicide

13.7 oz Miravis Ace + 1 pt/100 Liberate + 1.28 oz Warrior ll (May 10th) Heading

NUTRIEN KNOWLEDGE MANAGEMENT SYSTEM

Dyna-Gro,9151 1.4 million seeds/acre and 2.3 million seeds/acre

100 lbs Dap, 100 lbs Mes10, 150 lbs Potash

1gal AccesS + 60 units 28% (Feb. 14th) 1st Shot N

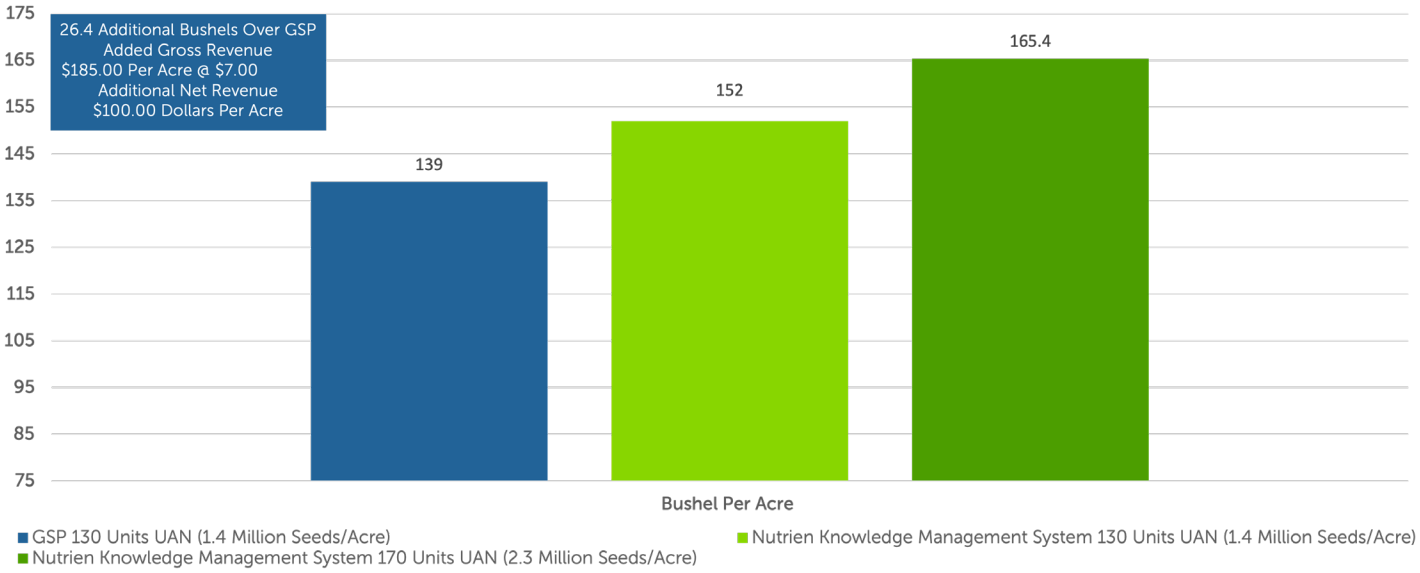
2 gal AccesS + 2 qts Blackmax 22 + 1 qt Borosol 10 + 110 units 32% (March 28th) 2nd Shot N

.75 oz Quelex + 5 oz Magistrate + ***12 oz Palisade*** + ***1 qt NutriSync Copper*** + ***2 oz Radiate*** + ***1 qt NutriSync Complete 3D*** (March 29th) Feekes 6 Herbicide

13.7 oz Miravis Ace + 1 pt/100 Liberate + 1.28 oz Warrior ll + ***.5 gal. Maximum N-Pact K*** + ***2 oz Radiate Next***+ ***1 pt NutriSync Boron*** (May 10th) Heading

ROI'S CALCULATED AT $7.00 BUSHEL

Nutrien Knowledge Management System 2023

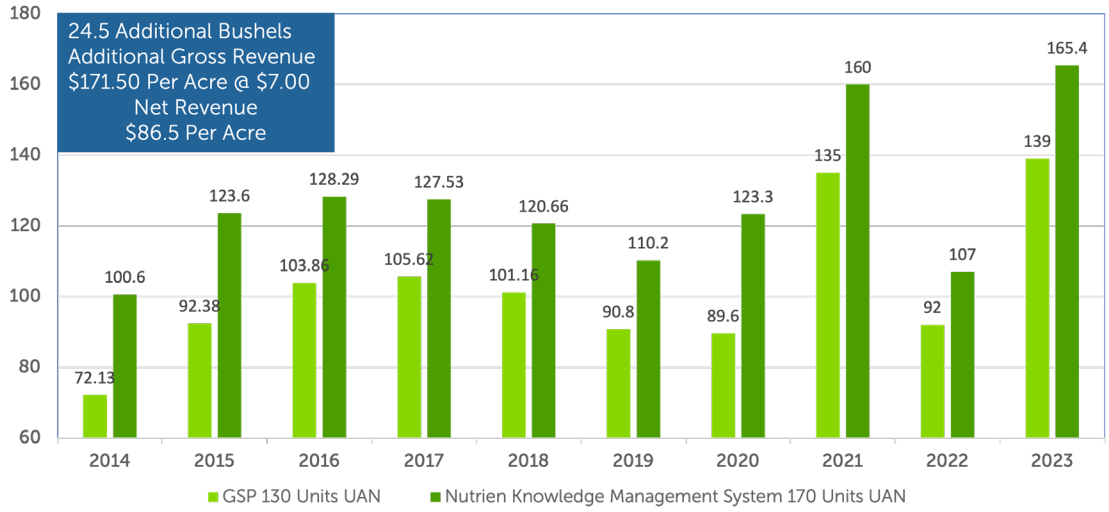


What We Learned:

- The Nutrien Knowledge Management System references the recommendations on page 23.
- The extra agronomic products in the Nutrien Management System gained an additional 26.4 bushels adding a net revenue of $100 per acre.
- Applying the Nutrien Knowledge Management practices gains 13 bushels that leads to an additional net revenue of $31 per acre, without increasing seed population or UAN applied.
- The Grower Standard does provide an economic win, however additional agronomic practices and products would increase revenue for the grower.

Timing: Fall and Spring Applied

Average Bushel Increase 10 Years (2014-2023)



What We Learned:

- Since 2014, the Nutrien Management System has increased revenue by using agronomic products to address yield limiting factors.
- Over the last 10 years the bushels gained, minus the cost of inputs, lead to an average increase in net revenue by $86.50 per acre.
- Since 2014, this study has consistently demonstrated an increased yield and positive ROI, leading to multiple growers across the Mid-South adopting the Nutrien Management System.

Timing: Fall and Spring Applied

COMPARISON OF TISSUE TEST

Grower Standard

		Very Low	Low	Optimum	High	Excessive
Total N	3.85					
Total P	0.33					
Total K	1.29					
Macronutrients		***Very Low***	***Low***	***Optimum***	***High***	***Excessive***
Ca	0.97					
Mg	0.22					
Na	0.01					
S	0.28					
Micronutrients		***Very Low***	***Low***	***Optimum***	***High***	***Excessive***
Zn-ppm	16.00					
Mn-ppm	179.00					
Fe-ppm	102.00					
Cu-ppm	5.00					
B-ppm	4.00					
Petioles		***Very Low***	***Low***	***Optimum***	***High***	***Excessive***

Very Low or Problem
Low
Optimum

Comments:
App Note: GSP 11.1

Nutrien Knowledge Management

		Very Low	Low	Optimum	High	Excessive
Total N	4.08					
Total P	0.33					
Total K	1.29					
Macronutrients		***Very Low***	***Low***	***Optimum***	***High***	***Excessive***
Ca	0.93					
Mg	0.21					
Na	0.01					
S	0.31					
Micronutrients		***Very Low***	***Low***	***Optimum***	***High***	***Excessive***
Zn-ppm	16.00					
Mn-ppm	210.00					
Fe-ppm	110.00					
Cu-ppm	6.00					
B-ppm	7.00					
Petioles		***Very Low***	***Low***	***Optimum***	***High***	***Excessive***

Very Low or Problem
Low
Optimum

Comments:
App Note: HY 170 11..1

Above shows a comparison of tissue tests taken from the Grower Standard and the Nutrien Knowledge Management plots at the milk stage.

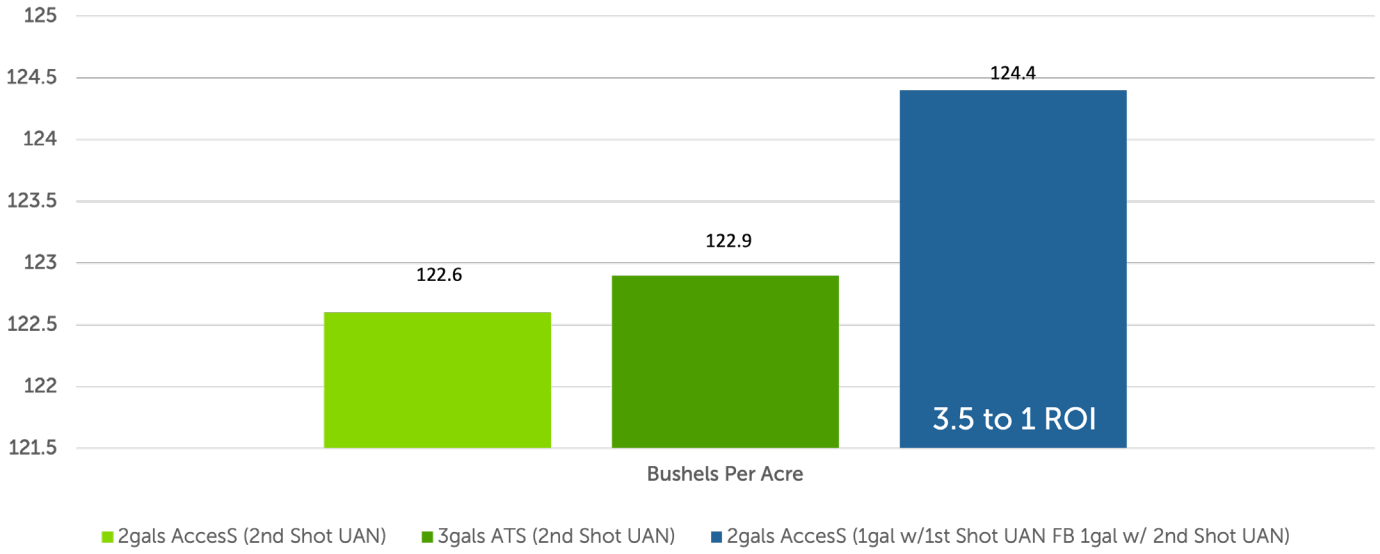
The test results from the grower standard plot show optimum results in N and P, as well as several macro- and micronutrients. However, it shows deficiencies in K, sulfur, and boron.

The purpose of the Nutrien Knowledge Management program is not to poke holes in grower standard practices, but instead to unlock the greatest yield potential and profitability that we can consistently achieve with the strategic application of more inputs and greater population.

Using Nutrien Knowledge Management we have pushed more nitrogen, sulfur, and boron into our practices which can be seen in our tissue samples. Although K and Zinc deficiencies still existed, the High Management practices still produced as additional 26.4 bushels per acre for an additional $100 of net revenue per acre. We are not just planting and planting a higher population, we are supporting the nutrition of the additional population and making sure our wheat crop reaches its maximum potential.

2023 Sulfur Trial On Wheat (2 Yr. Average)

(Average of 6 Reps.)



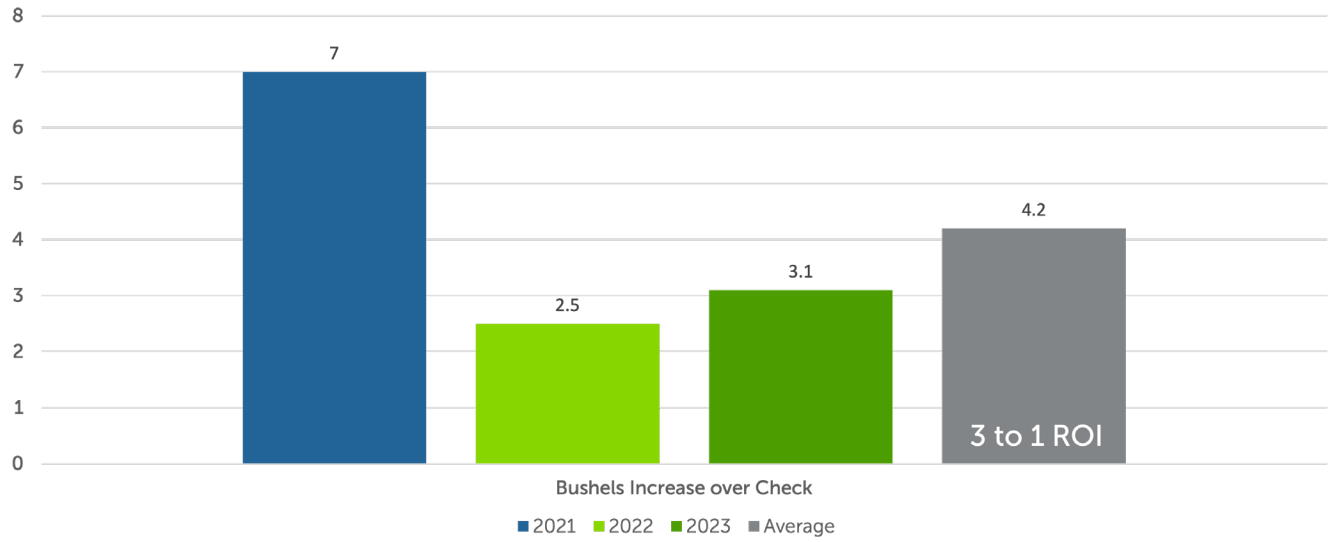
What We Learned:

- This study focused on how and when to most effectively apply Sulfur, either by ATS or AccesS, when receiving the same 130 units of Nitrogen.
- Each gallon of ATS contains 2.87 lbs of Sulfur, with half being in sulfate form ready for plant uptake and the other half in elemental form that must be broken down for plant availability.
- AccesS contains 1.87 lbs of plant ready Sulfur and trace amounts of micronutrients per gallon.
- A two year average shows a split AccesS application with each round of Nitrogen provided the best yield response, adding 1.5 bushels over the ATS treatment with a 3.5 to 1 ROI

Timing: Stage 2 - 6

2 Qts. Blackmax 22 Applied in 2nd N Application

(Min. 2 Reps.)



What We Learned:

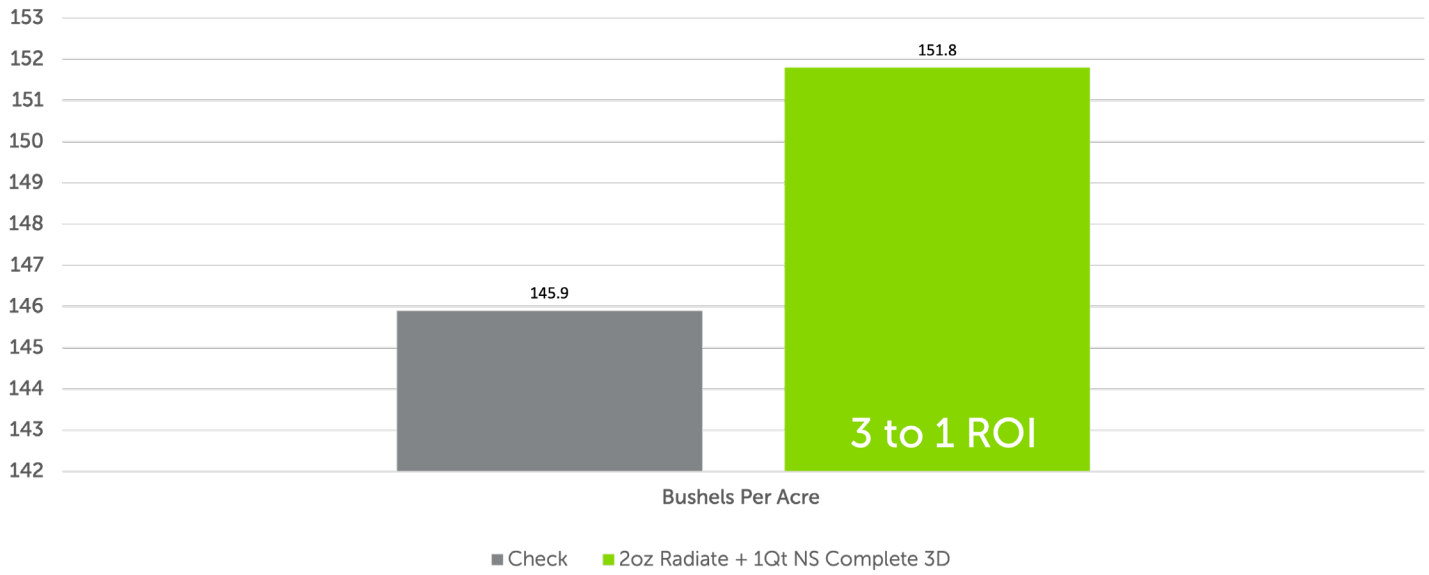
- Blackmax 22 is beneficial to soil microbe growth which can increase nutrient availability and support positive soil attributes when blended with your fertility program.
- A three year study showed that Blackmax 22 provided an average yield gain of 4.2 bushels with a 3 to 1 ROI

Timing: Stage 2 - 6

BLACKMAX® 22, built with C^2 Technology, is a proprietary combination of extracted carbon and carbohydrates that reacts with your fertility program to increase nutrient availability and support positive soil attributes. As part of your fertilizer program, this powerful combination of extracted carbon and carbohydrates fosters beneficial soil microbe growth to strengthen your crop fertility program.

Foliar Nutrition at Feekes 5

(Average of 2 Reps.)



What We Learned:

- When applied at Feekes 5, NutriSync Complete 3D helps to correct nutrient deficiencies and provide increased yields by filling nutritional demands in the plant.
- Applying Radiate aids the plants ability to access soil nutrients by promoting root and biomass development.
- Yield increased by 5.9 bushels when using Radiate and NutriSync Complete 3D leading to a 3 to 1 ROI

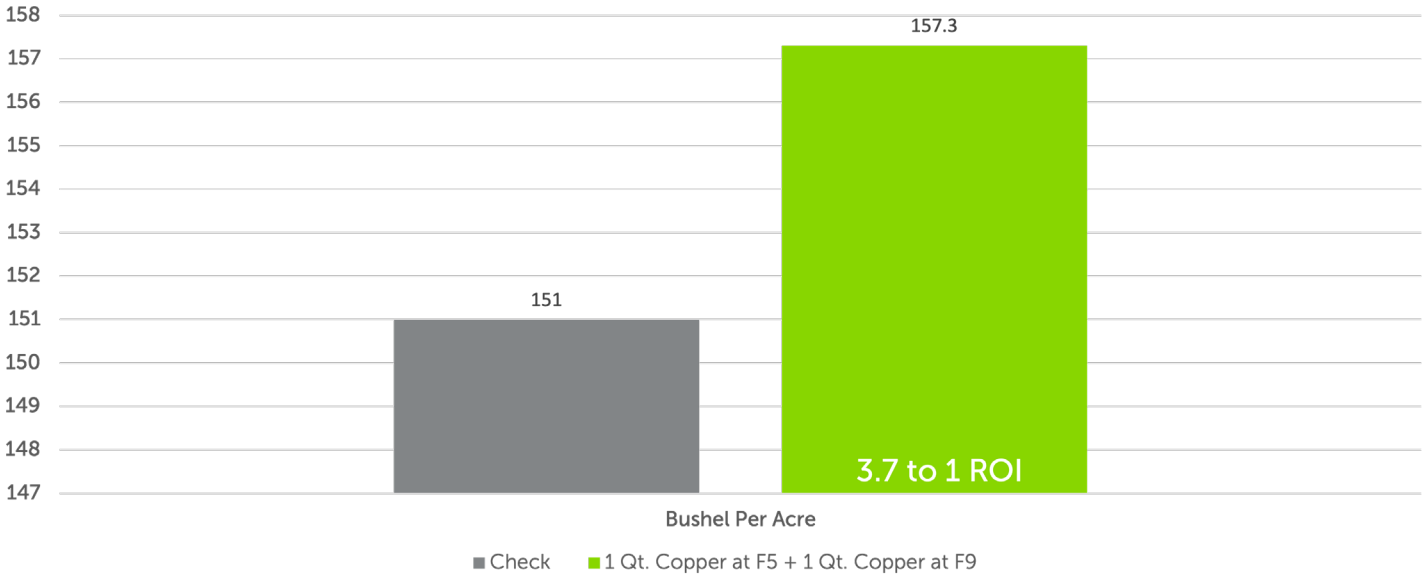
Timing: Feekes 5

NutriSync Complete 3D

NUTRISYNC® COMPLETE 3D (10-4-6 with Zn, Mn, Cu, Fe, B, Co & Mo) is a fully formulated foliar nutrition tool powered by NutriSync, Loveland's premium foliar transport technology, and contains key macro- and micronutrients. NutriSync technology helps growers Load, Haul and Deliver nutrients critical for growth and development to areas that are most needed – providing better utilization of nutrients to fulfill plant demands.

NutriSync Copper Cold Resilience Study

(Min. 2 Reps.)



What We Learned:

- The first application of NutriSync Copper was applied at Feekes 5 on March 13th, with nighttime lows averaging 19 degrees F for the following 8 days.
- An additional NutriSync Copper application was applied at Feekes 9 on April 21st, followed by another cool front of below freezing nighttime temperatures.
- NutriSync Copper helped the wheat recover from frost and freezing temperatures by preventing crystal formation and managing plant stress, leading to a 6.3 bushel increase and 3.7 to 1 ROI.

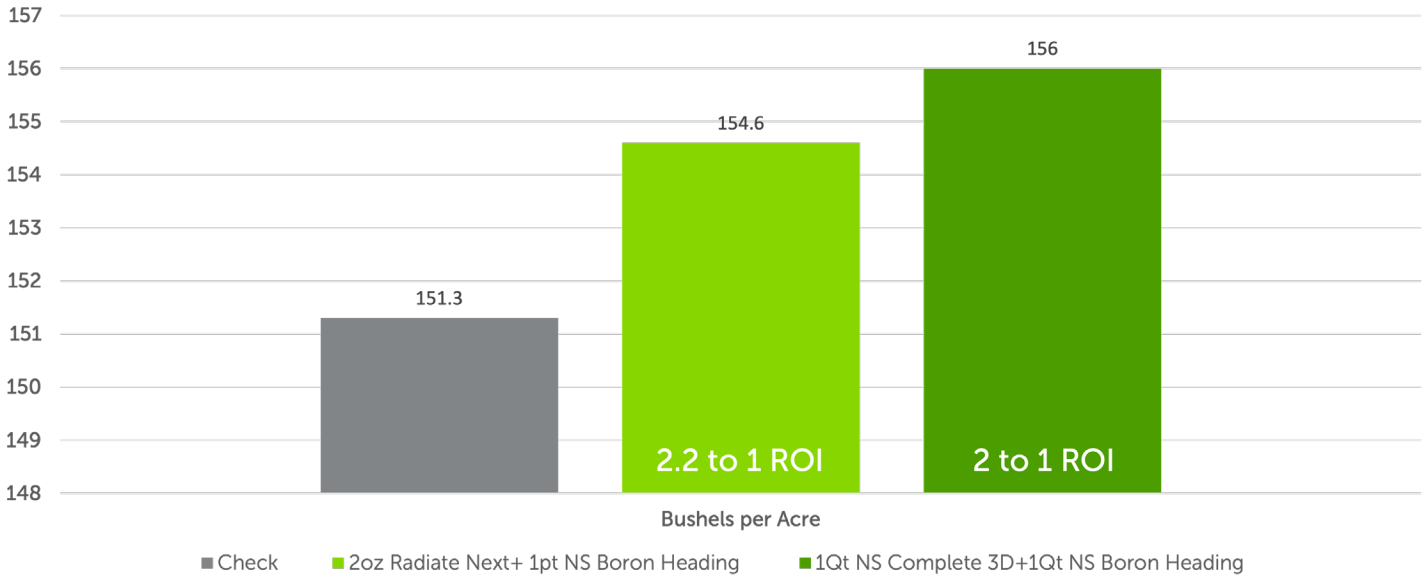
Timing: F4 - F9

NutriSync Copper

NUTRISYNC® COPPER (8-0-0 4.5CU) is a liquid foliar nutritional formulated with Loveland's premium foliar uptake technology to enhance the physiological activity and growth of copper demanding crops. The NutriSync platform helps plants more efficiently mobilize and utilize applied nutrients as well as those that are already within the plant, enhancing crop growth throughout the season.

Foliar Nutrition at Heading

(Min. 2 Reps.)



What We Learned:

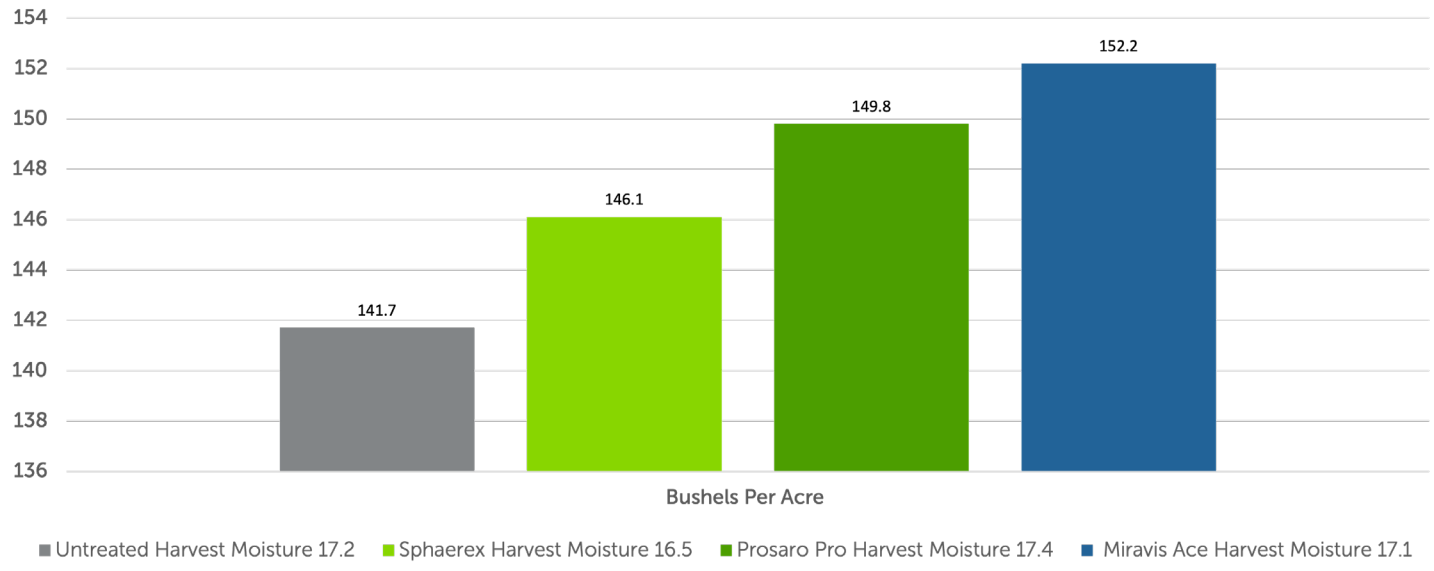
- Using a foliar nutrition product, such as Radiate Next, that contains a non-phyto Nitrogen source has shown significant ROI each year.
- Applying micronutrients at the heading stage have continued to show beneficial yield responses, while also correcting deficiencies.
- Ferti-Rain appled with NutriSync Boron + Radiate Next gave a 3.3 bushel yield response with a 2.2 to 1 ROI.
- NutriSync Complete 3D + NutriSync Boron provided a 4.7 bushel yield response with a 2 to 1 ROI.

Timing: Heading

RADIATE NEXT™ is a new foliar-applied plant growth hormone solution that drives root growth and development while increasing photosynthetic rate to improve energy production and realize higher yields. Applied at a low use rate and labeled for nearly every crop, RADIATE NEXT helps maximize performance below ground and now above.

Head Scab Fungicide Study

(Average of 3 Reps.)



What We Learned:

- A foliar fungicide is necessary for any wheat program to finish and protect your investment, with earlier applications controlling or preventing foliar diseases on the flag leaf.
- MiravisAce can be applied as early as 50% head emergence to pollination, but Prosaro Pro and Sphaerex need to be applied at Flowering 10.5.1
- All products provided a minimum 2 to 1 ROI

Timing: Heading 10.1 - 10.5

Miravis® Ace

MIRAVIS® ACE, powered by one of the highest performing SDHIs available, Adepidyn® technology, delivers best-in-class application flexibility and disease control. With Miravis Ace, you can control head scab in wheat, improve grain quality and increase profit potential. Gives you more flexibility to apply on time and protect both the main heads and tillers by allowing applications as early as 50% head emergence

PROSARO® PRO

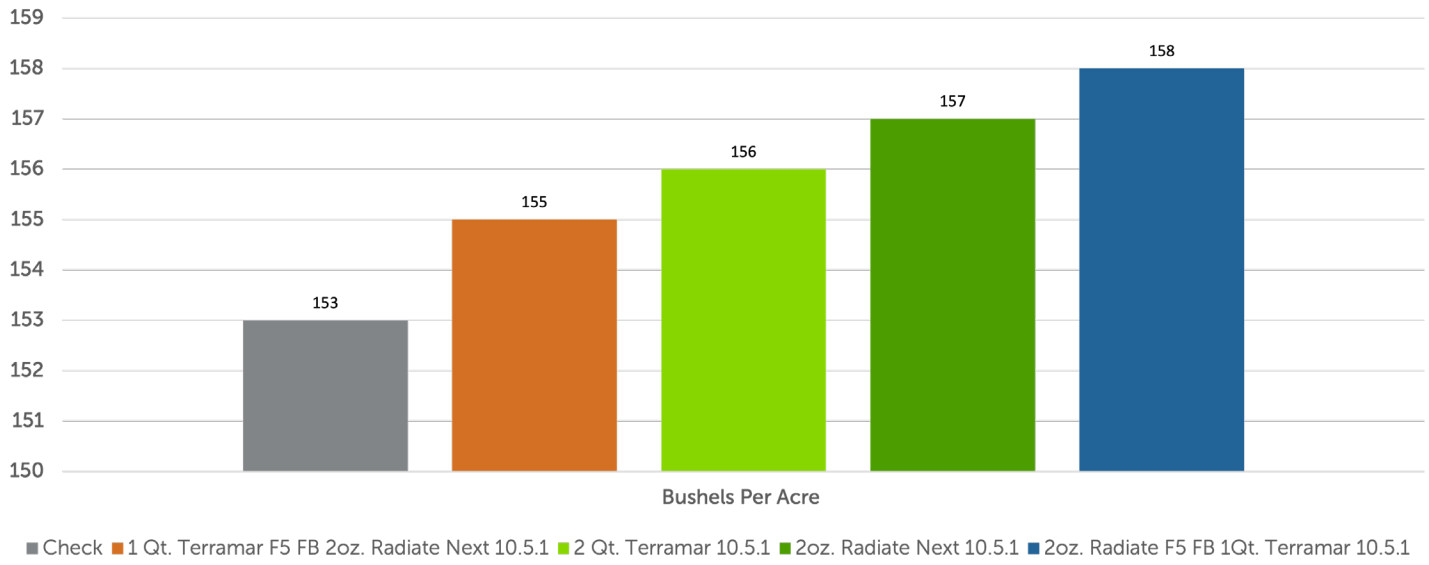
With the addition of fluopyram, PROSARO® PRO 400 SC fungicide offers better disease control and greater DON reduction relative to Prosaro® fungicide, leading to healthier plants and higher yield potential.

Sphaerex™ Fungicide

By combining two proven active ingredients, SPHAEREX™ wheat fungicide provides excellent control of wheat head scab, reducing D.O.N more effectively than any other product. Get higher yields and the best quality wheat when it arrives at the grain elevatorl.

Stress Mitigation Study

(Average of 3 Reps.)

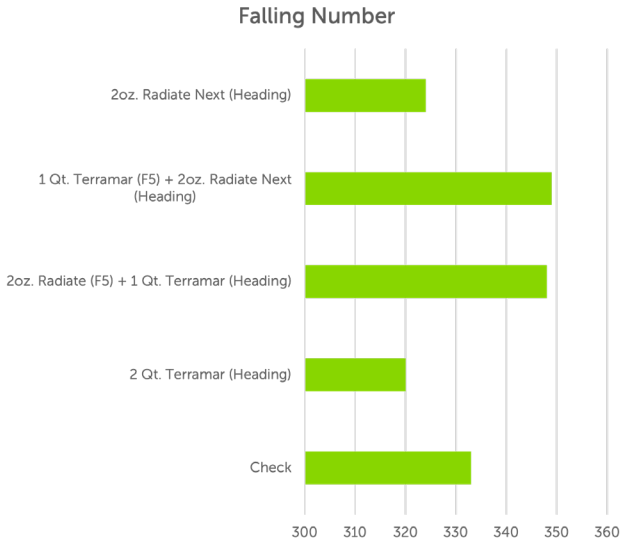


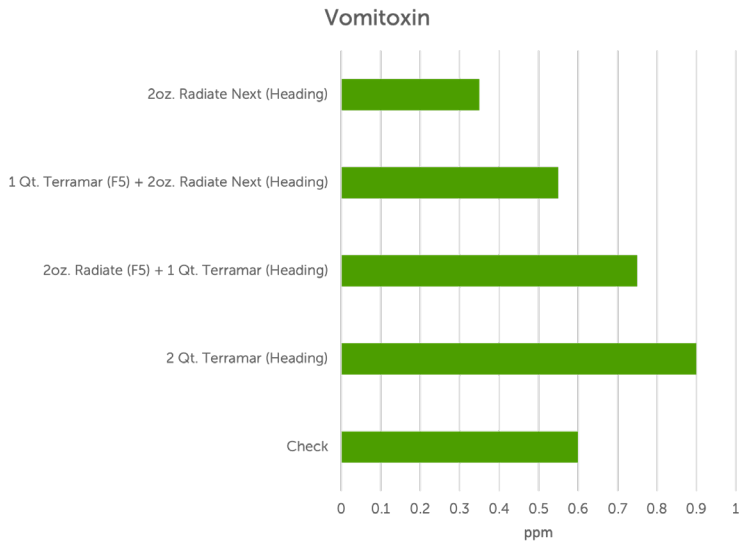
What We Learned:

- Induced stress at heading can decrease yield by 30-50% due to significant deterioration in the wheat florets.
- Early applications of stress mitigation products helps increase resistance to low temperatures after wheat begins rapid growth protecting key yield potential components such as: tiller, head number and size, and kernel number and size.
- While all applications increased yield in an already high yielding environment, Radiate Next gave a 4 bushel increase with a 4.5 to 1 ROI and Radiate + Terramar gave a 5 bushel increase with a 2.8 to 1 ROI

TERRAMAR® is a proprietary blend of biologically digested seaweed and leonardite designed to increase nutrient uptake, mitigate abiotic stress response, enhance CEC and chelation. Terramar delivers unique metabolic compounds to enhance microbial activity in the rhizosphere and improve plant response to stressful conditions. Terramar is compatible and complimentary with fertilizer systems to promote plant health and performance.

Wheat Sample Test





	PROTEIN CONTENT	FALLING NUMBER	VOMITOXIN
Check	10.7%	333	0.60 ppm
High Yield	**11.4%**	359	0.80 ppm
2 Qt. Terramar (Heading)	10.5%	320	0.90 ppm
2oz. Radiate (F5) + 1 Qt. Terramar (Heading)	10.7%	**348**	0.75 ppm
1 Qt. Terramar (F5) + 2oz. Radiate Next (Heading)	10.6%	**349**	**0.55 ppm**
2oz. Radiate Next (Heading)	10.6%	324	**0.35 ppm**

What We Learned:

- All products not only gave a yield response, but also enhanced grain quality.
- A combined use of Terramar and Radiate products was shown to increase the falling number, which is an inverse measurement of pre-harvest sprouting.
- Samples in which Radiate Next had been applied at heading significantly lowered vomitoxin levels of the grain. This results in a higher quality grain and longer storage capabilities

During this year's wheat harvest, six grain samples were caught and taken to Siemer Milling in Hopkinsville, KY to test for protein content, falling number, and vomitoxin level. This was to gather additional data regarding the effects of certain product applications and agronomic management practices in addition to their yield impact.

As can be seen from the graph, the grain from the Nutrien Knowledge Management System has a significantly higher protein content than the other samples. The average protein content for soft red winter wheat is 8.5%-10.5%. Although all our samples were high in protein, the high yield grain had almost a percentage point higher than the other samples. This is due to more nitrogen being applied to the high management wheat, since nitrogen is a major component of amino acids, the building blocks of protein. This increase in protein content not only results in a higher quality flour, but also increased revenue for farmers with contracts with milling companies.

Falling number is an inverse measurement of pre-harvest sprouting. A low falling number indicates that the enzymes in the kernel are actively breaking down carbohydrates to feed the seed. A high falling number in grain results in a better-quality flour. As can be seen in the graph, a combined use of Terramar and Radiate products was shown to increase the falling number in wheat. This is due to these products reducing stress within the wheat and contributing to an overall healthier plant.

The vomitoxin test measures the presence of the mycotoxin produced by Fusarium Graminearum, the fungus causing Fusarium head blight. Although all the samples were treated with Miravis Ace, grain samples in which Radiate Next was applied at heading, had significantly reduced vomitoxin levels. Lower vomitoxin levels in wheat result in a higher quality flour as well as providing farmers with longer storage capabilities for the grain.

This data demonstrates additional benefits derived from applying Terramar and Radiate products and using Nutrien Knowledge Management practices. Not only do these practices result in higher yields, but they also increase the quality and storage capacities of the grain produced.


JOHN DEERE
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R&D CORN PLANTING DATES

CORN VARIETY TRIAL

BF-1

April 17, 2023 – Population 36,000

Fertility – 4-gallons Pro-Germ, 2-gallons Kalibrate, 2 Qt Micro 500, 1Pt Iron, & Capture LFR

- Dry- 200 lbs. MES 10 + 100 lbs. Potash Treated w/ Titan XC 1pt/Ton.

Nitrogen – 35 units + 1-gallon AccesS at planting, 180 units + 3-gallon AccesS at V-6

Herbicide – 16oz FortiTRI + 48oz Makaze

- Followed by 1Pt Armezon Pro, 1Qt Atrazine 4L, 1.5oz Status, 1Qt Mad Dog, 0.7 oz Accent Q

Harvested – September 25, 2023

RESEARCH CORN TRIAL

April 18-19, May 4, 2023 – Population 36,000 DynaGro 55VC80

BF – 2,3,4,9

Fertility – Dry - 200 lbs. MES 10 + 100 lbs. Potash Treated w/ Titan XC 1pt/Ton.

Nitrogen – 35 units + 1-gallon AccesS at planting, 180 units + 3-gallon AccesS at V-6

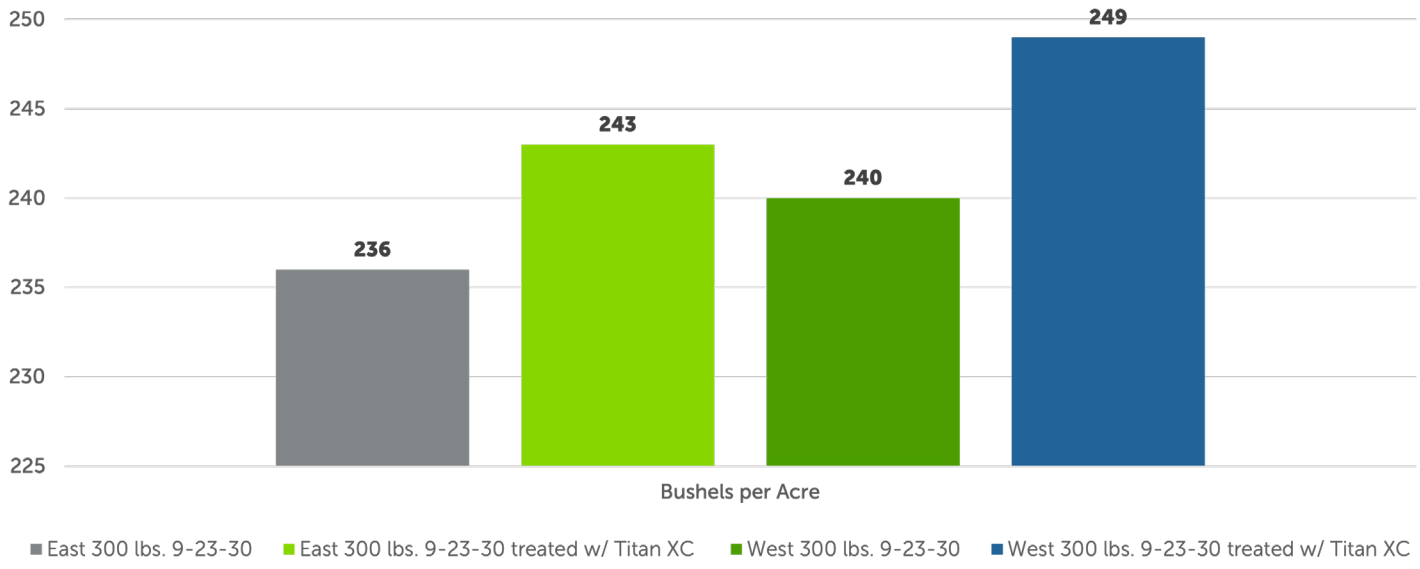
Herbicide – 16oz FortiTRI + 48oz Makaze

- Followed by 1Pt Armezon Pro, 1Qt Atrazine 4L, 1.5oz Status, 1Qt Mad Dog, 0.7 oz Accent Q, and 2oz Radiate.

Harvested – September 25-26, October 12, 2023

ROI'S CALCULATED AT $5.25 BUSHEL

Titan XC 1pt Per Ton Dry Fertilizer Enhancement Study on Different Soil Types



What We Learned:

- This year we studied the effect of Titan XC on two different soil types. The East portion of the field is a Nicholson soil with lower fertility. The West portion of the field is a Pembroke soil, having a higher fertility.
- Using Titan XC with the dry fertilizer blend increased yield for both soil types, giving a 7 bushel increase on the lower fertility soil and a 9 bushel increase on higher fertility soil.

Timing: Pre-planting

Titan XC 1pt Per Ton Dry Fertilizer Enhancement Study on Corn

(Average of 3 Reps.)

What We Learned:

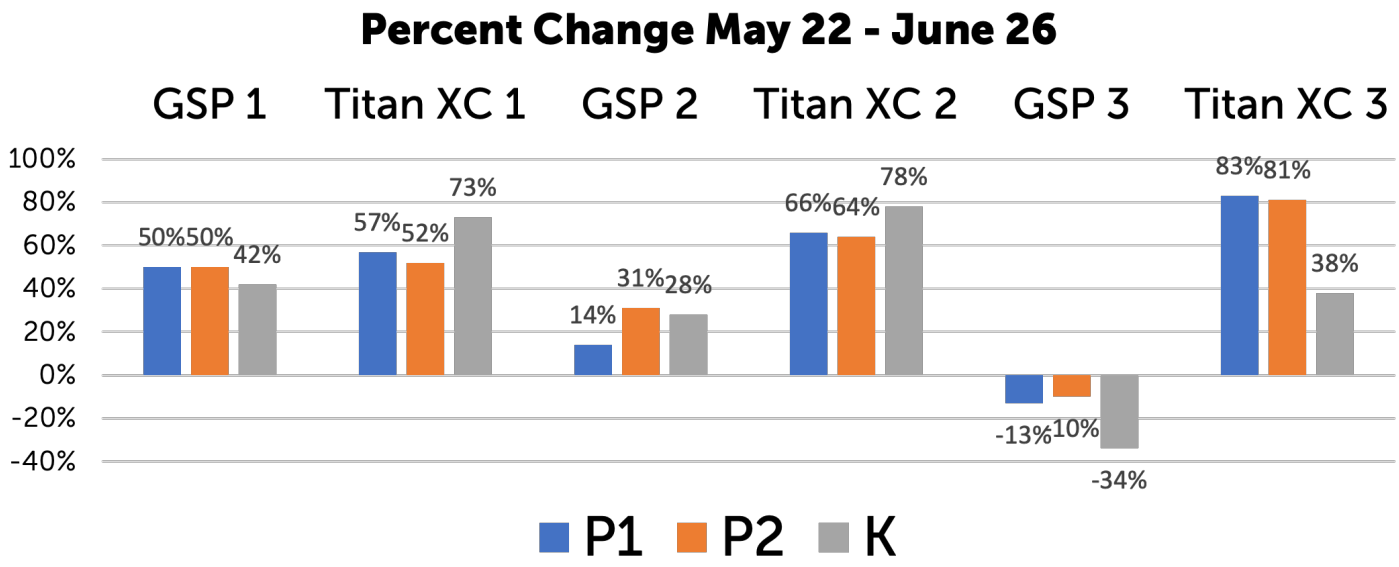
- Titan XC proves to be an excellent addition to any fertilizer blend
- Applying 300lbs of 9-23-30 treated with Titan XC lead to a five year average increased yield of 8.7 bushels with a 6 to 1 ROI

Timing: Pre-planting

TITAN XC

We have been studying the benefits of treating dry fertilizer with Titan XC on crop yield for five years on the Hopkinsville Innovation Farm. However, this year we began a four-year study monitoring the effect of consistent Titan XC application on soil nutrient levels in addition to yield.

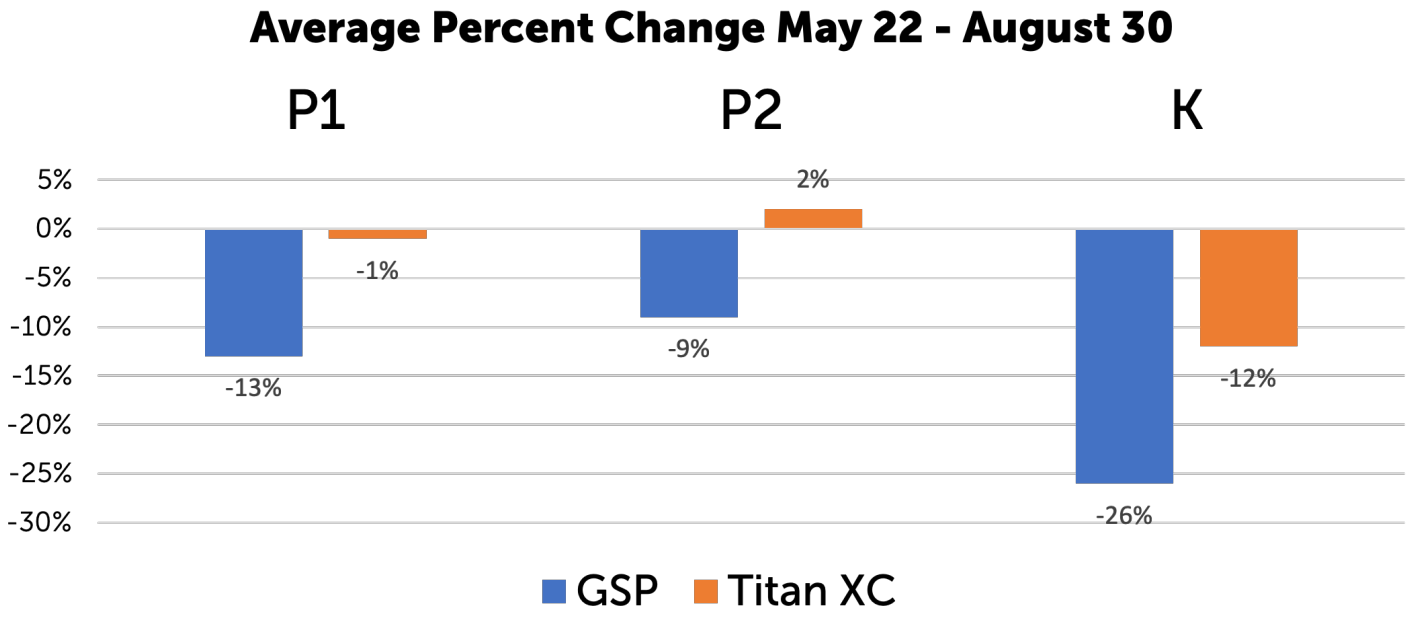
We applied 150 lbs. of DAP and 150 lbs. of Potash to the entire field. The trial contains three grower standard replications and three replications where the applied fertilizer was treated with 1pt/ton of Titan XC. Each replication is 60ft x 250ft. Monthly soil samples were taken in each replication to monitor the results and changes in nutrient levels of grower standard replications compared to Titan XC-treated replications.



As you can see in the above graph, from pre-fertilizer application in May to one month after fertilizer application in June, phosphorus and potassium nutrient levels increased across the field. However, the replications in which the fertilizer was treated with Titan XC showed a much greater increase in soil nutrients. This is due to the metabolites and bacteria in Titan XC breaking the bonds and freeing up nutrients in the applied fertilizer as well as nutrients already in the soil.

From June to August, nutrient levels declined in the soils of both grower standard replications and Titan XC replications due to plant uptake. Because more soil nutrients were present in replications in which fertilizer was treated with Titan XC, more nutrients were able to be taken up and utilized by the plants.

TITAN XC



The above graph shows the average percent change in soil nutrients of grower standard replications and Titan XC-treated replications throughout the growing season.

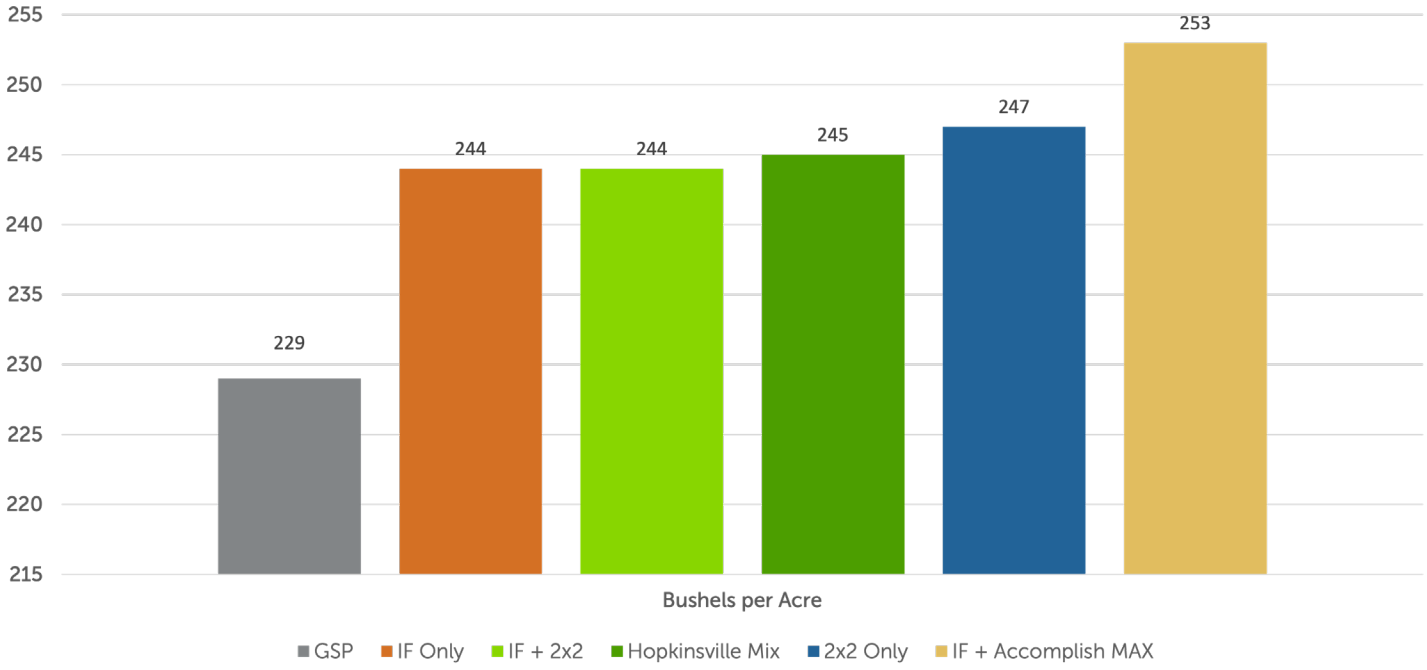
Over the course of the trial, nutrient levels decreased prior to our broadcast application due to plant uptake of the nutrients in the fertilizer. Although Titan XC applications allowed more nutrients to be taken up by the plant, Titan XC replications still showed more nutrients in the soil at black layer compared to GSP. Applying fertilizer treated with Titan XC not only allows for more nutrients to be available and utilized by plants, but it also buffers the depletion of soil nutrients.

Over the following years, we will continue to monitor the effects of repeated Titan XC applications on soil nutrients.

TITAN® XC uses concentrated biochemistry to "unlock" applied nutrients, making more of your dry fertilizer available sooner, getting your crops more of the nutrition they need. The broad range of biocatalyst compounds in Titan XC improves the efficiency of your dry fertilizer helping drive performance on your farm. The reliable ROI of Titan XC has been proven season after season, under various conditions, over a wide range of soils and crops.

Fertility Program Trial

(Average of 4 Reps.)



ALL TREATMENTS 215 UNITS OF N TOTAL

GSP	• 300LBS 9-23-30 • Cost - $105.00
In-Furrow Only	• 155# DAP + 50# MOP Treated with Titan XC • In-Furrow – 3 gal. Pro-Germ, 2 Qts. M500, 1 pt. Iron, 2 oz. Radiate • Cost - $102.50
In-Furrow + 2x2	• In-Furrow – 5 gal. Pro-Germ, 2 gal. Kalibrate, 2 Qts. M500, 1 Qt. Iron, 2 oz. Radiate • 2x2 – 10 gal. 32%, 2 gal. Altura, 1 gal. AccesS, 1 Qt Extract • Cost - $100.50
Hopkinsville Mix	• 270LBS 9-23-30 treated with Titan XC • 2x2 – 10 gallons 32%, 2 gal. Pro-Germ, 1 Qt Prologue, 2 Qts. AccesS, 1 Qt Blackmax 22 • Cost - $120.50
2x2 Only	• 155# DAP + 135# MOP Treated with Titan XC • 2x2 – 10 gal. 32%, 1 gal. Altura, 1 Qt Prologue, 2 Qts. AccesS, 1 Qt Blackmax 22 • Cost – 120.50
In-Furrow + 1 Qt Accomplish MAX	• 115# DAP + 50# MOP Treated with Titan XC • In-Furrow – 3 gal. Pro-Germ, 2 Qts. M500, 1 pt. Iron, 2 oz. Radiate • Cost - $112.00

Fertility Program Profit Comparison

What We Learned:

- The purpose of this trial was to compare various fertility programs each designed to enhance fertility and yield above grower standard practice.
- Each of these programs resulted in a yield significantly greater than GSP.
- Applying Accomplish MAX along with your in-furrow program gave a 9 bushel increase over the In-Furrow Only program, resulting in the highest profit per acre of the trial.

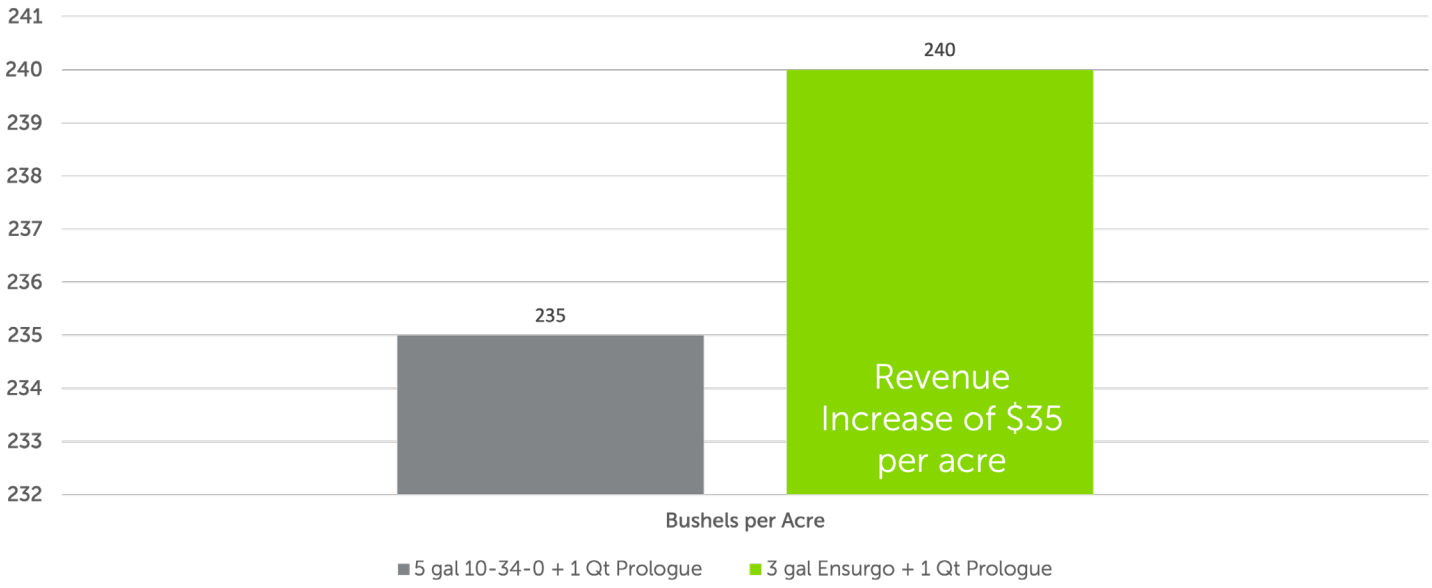
Timing: At plant

ACCOMPLISH MAX™

ACCOMPLISH MAX™ is a next-generation biocatalyst designed to improve nutrient availability and increase crop tolerance to environmental stressors like cold temperatures, drought and salinity from applied fertilizers. With Accomplish MAX, you'll get "More Nutrients, Less Stress."

In-Furrow Phosphorus Comparison

(Average of 3 Reps.)



What We Learned:

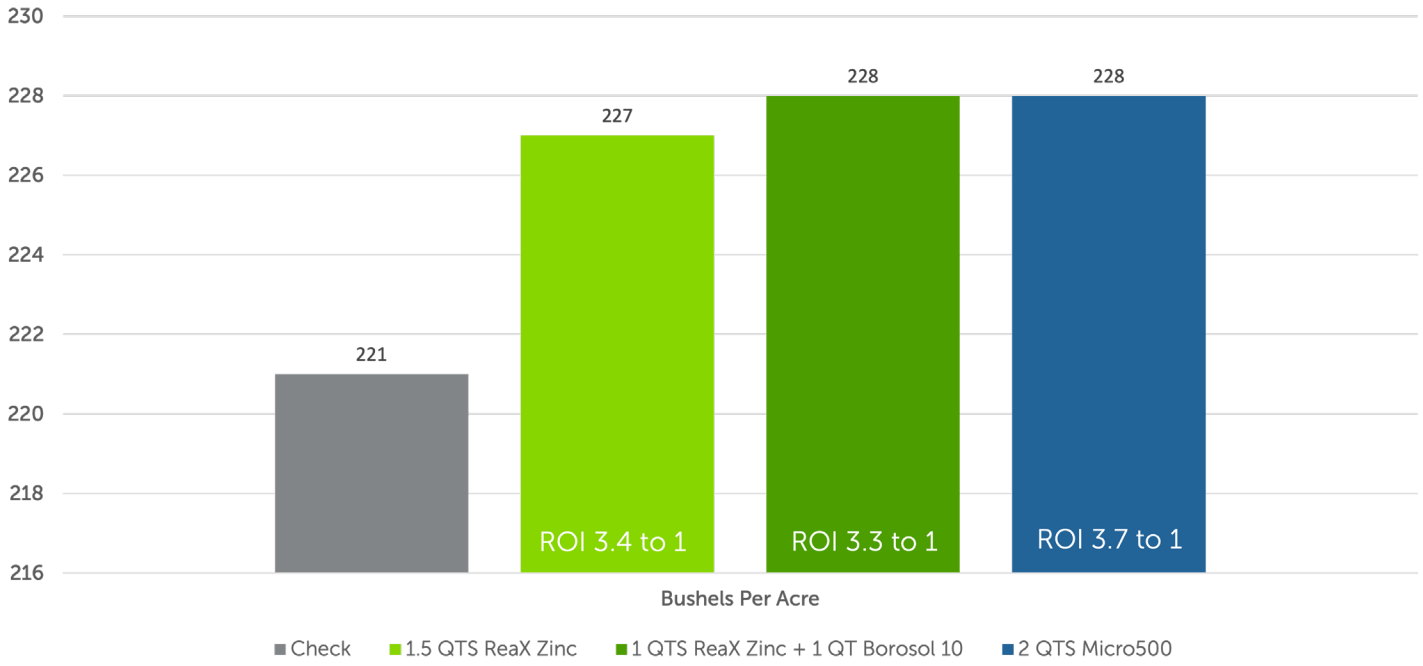
- Replacing 10-34-0 with Ensurgo resulted in a 5 bushel increase and added revenue of $35 per acre.

Timing: At plant

ENSURGO™ is a 7-24-2, 80% orthophosphate-based starter fertilizer containing proven Accomplish LM biocatalyst technology to help release stored nutrition in the soil, providing consistent value and establishing a reliable start to your crop.

2x2 Fertility Study Applied w/ 35 Units of N w/ 1 gal. Access

(Average of 3 Reps)



What We Learned:

- Adding nutrients, such as Zinc and Boron, to a 2x2 system is an easy and profitable way to increase yield, as all products resulted in an ROI greater than 3 to 1.

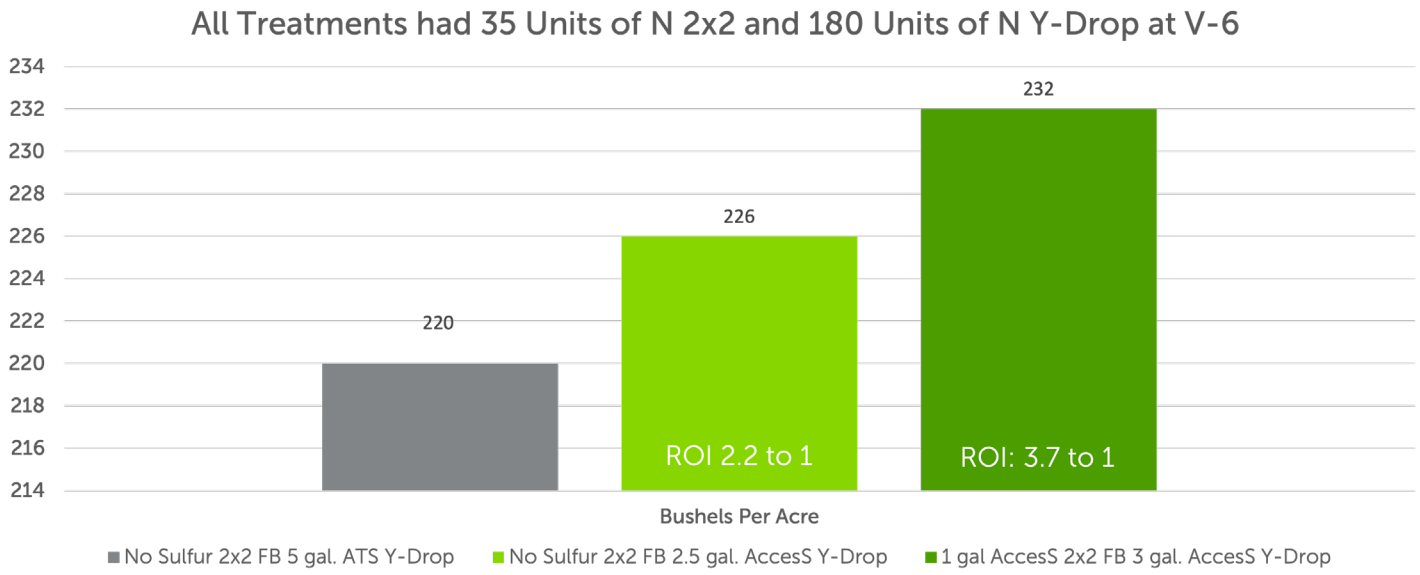
Timing: At plant

ReaX C² ZINC

REAX™ ZINC is a liquid zinc equally suited for at-planting, banded or foliar applications. Enhanced with C², soil health and plant performance technology, ReaX Zinc is designed to improve nutrient availability to meet the yield and quality goals of growers in a variety of growing conditions year after year

Sulfur Study Applied at Planting and Y-Drop

(Average of 3 Reps.)



What We Learned:

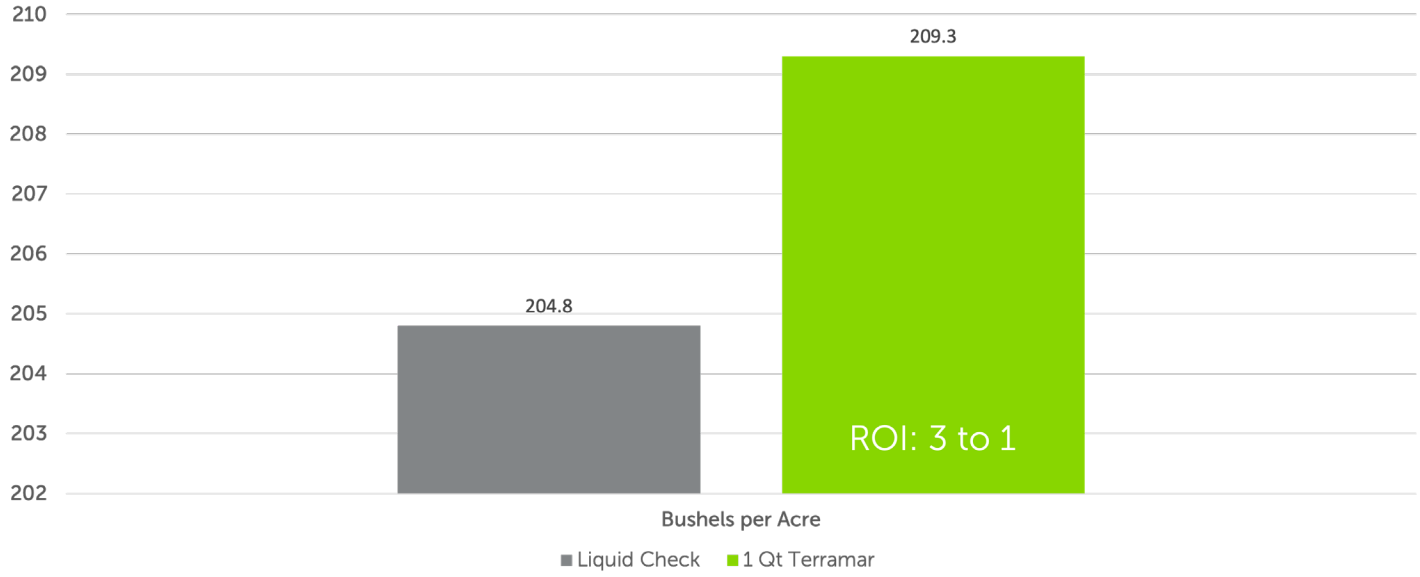
- This study compared two Sulfur sources and timing of application, with all treatments using Nitrain 2.0 as a stabilizer.
- Applying AccesS at Y-Drop gave a 6 bushel increase with an ROI of 2.2 to 1.
- AccesS applied at 2x2 and at Y-Drop gave a 12 bushel increase with a 3.7 to 1 ROI.

Timing: At plant – V6

ACCESS™ is AgroLiquid's high sulfur formulation intended for application anywhere 5 or more lbs. of sulfur are recommended. Research has shown that exclusive technology allow accesS™ to out-perform conventional sulfur products even when applied at reduced volume. These enhanced efficiencies make accesS™ both environmentally and economically responsible.

1Qt Terramar, Applied at V4

(Average of 3 Reps.)



What We Learned:

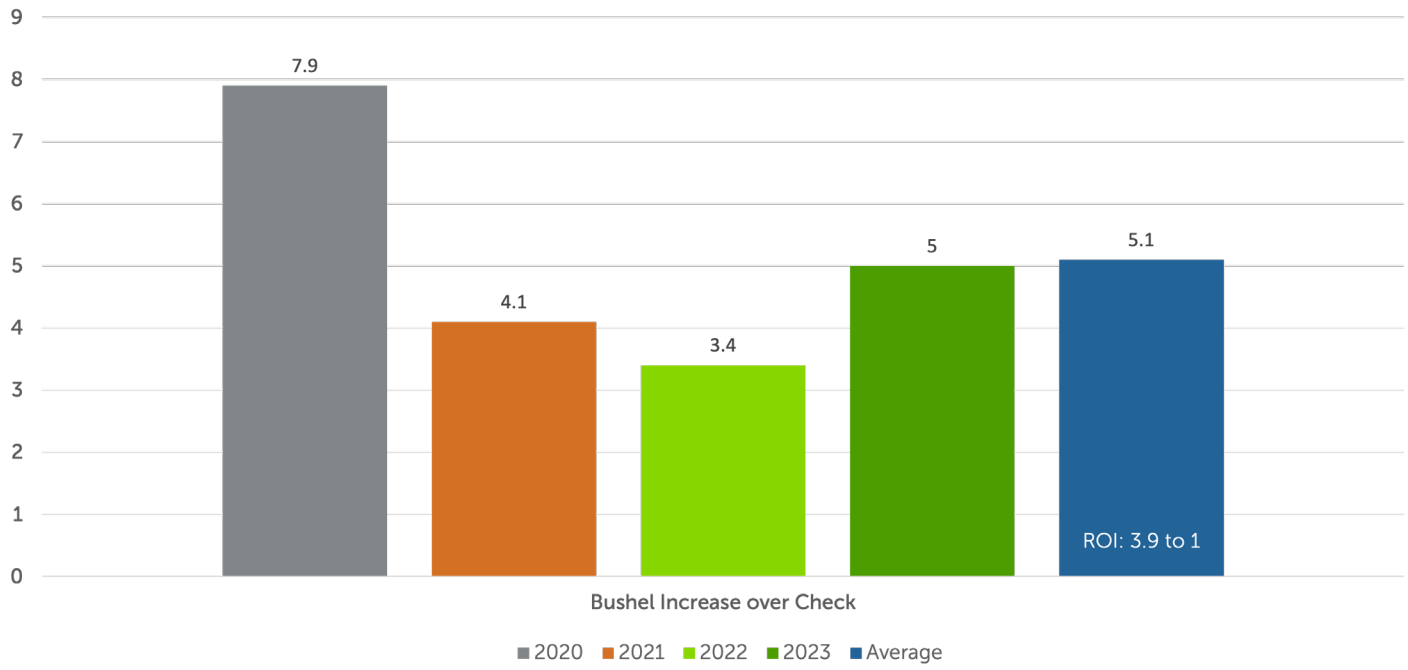
- Given the timing of application and lack of rainfall plus hotter temperatures for an extended period of time, Terramar was especially beneficial this season.
- Application of Terramar at V4 increased yield by 4.5 bushels with a 3 to 1 ROI.

Timing: V4

TERRAMAR® is a proprietary blend of biologically digested seaweed and leonardite designed to increase nutrient uptake, mitigate abiotic stress response, enhance CEC and chelation. Terramar delivers unique metabolic compounds to enhance microbial activity in the rhizosphere and improve plant response to stressful conditions. Terramar is compatible and complimentary with fertilizer systems to promote plant health and performance.

1 Qt ReaX Boron Foliar Four-Year Study, Applied at V4

(Minimum of 3 Reps.)



What We Learned:

- Boron is a critical micronutrient for corn, however due to being a highly mobile nutrient in the soil, prone to leaching and getting tied up in organic compounds, it is not always available for plant uptake.
- In certain situations, the right type of foliar Boron has shown to be the better application method.
- For the 2023 season, ReaX Boron changed from 10% to 5% Boron for improved storage and handling.
- ReaX Boron has shown a four year average yield gain of 5.1 bushels with a 3.9 to 1 ROI.

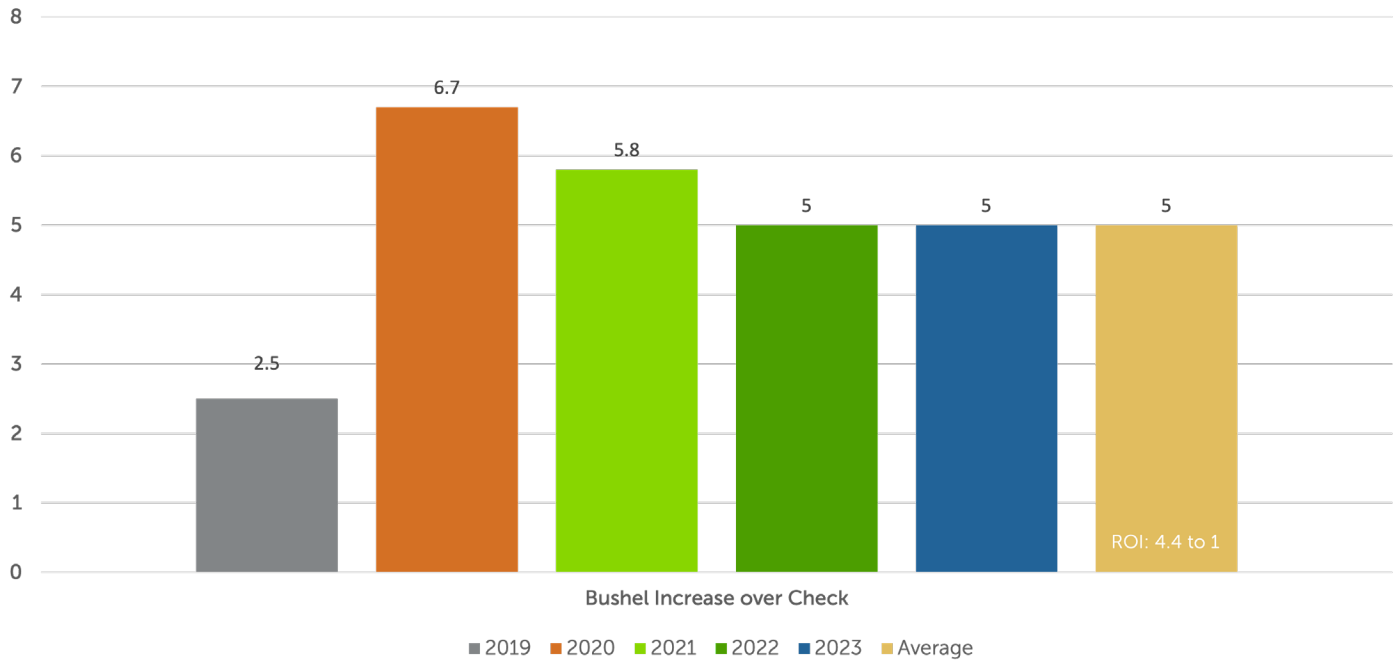
Timing: V4

ReaX C² BORON

REAX™ BORON 5% is an enhanced boron built with unique C² Technology to support soil health and plant performance. ReaX Boron is a 5% liquid boron designed for at-planting and banded applications with foliar flexibility and to improve overall nutrient availability to meet the yield and quality goals of many growers in a variety of growing conditions.

24oz NutriSync Boron Foliar Five-Year Study, Applied at V4

(Minimum of 3 Reps.)



What We Learned:

- Boron can aid seed production as well as respiration in the plant.
- This five year study shows NutriSync Boron has an average yield gain of 5 bushels with a 4.4 to 1 ROI.

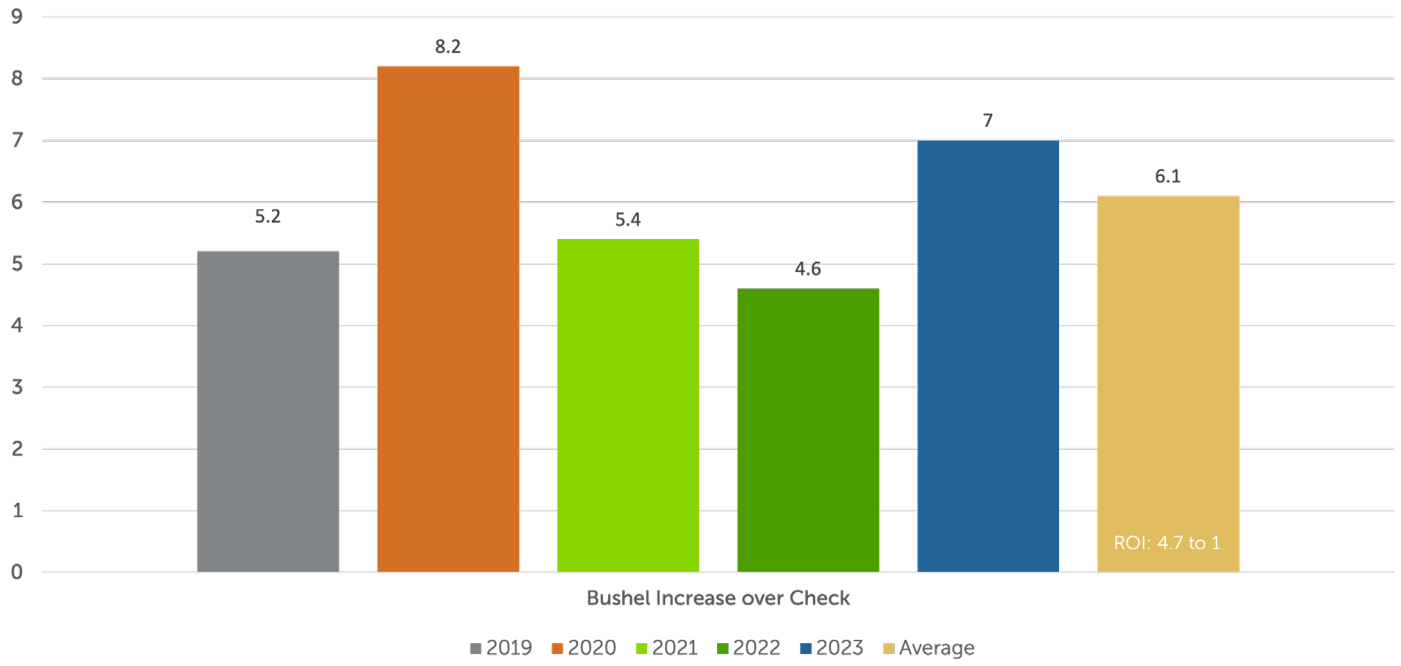
Timing: V4

NutriSync Boron

NUTRISYNC® BORON 5% is a unique foliar technology specifically designed to enhance plant physiological activities and growth of various crops. NutriSync remobilizes nutrients within the plant, especially to growing parts of the plant. NutriSync technology has been proven to increase assimilation, mobilization, and utilization of nutrients inside the plant.

24oz NutriSync Sulfur Foliar Five-Year Study, Applied at V4

(Minimum of 3 Reps.)



What We Learned:

- Sulfur is essential in corn growth for seed production, photosynthesis, chlorophyll formation, and nitrogen fixation.
- Although 20 lbs. of Sulfur was applied with our Nitrogen program, a foliar application of NutriSync Sulfur gave a significant yield increase.
- Over the five year study, NutriSync Sulfur applications led to an average yield increase of 6.1 bushels with a 4.7 to 1 ROI.

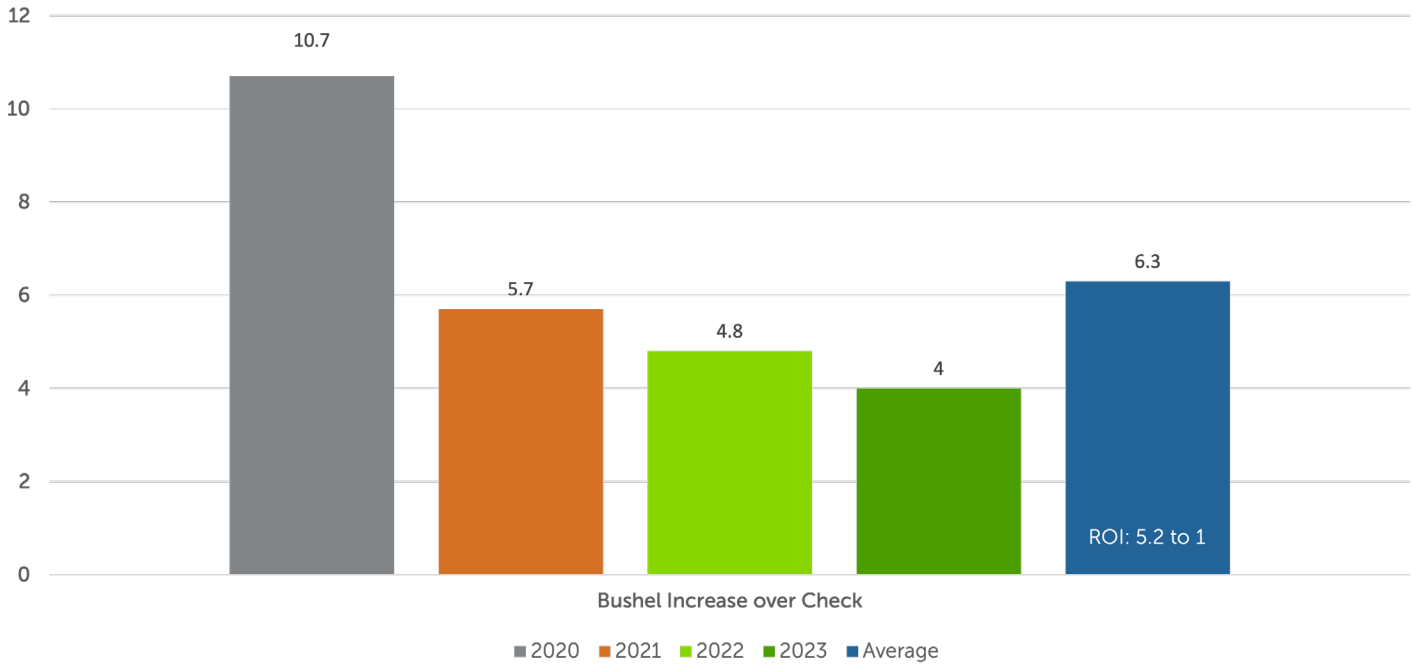
Timing: V4

NutriSync Sulfur

NUTRISYNC® SULFUR (6-0-0 6.3S) is a liquid foliar nutritional designed to enhance the physiological activity and growth of crops where sulfur is critical to yield and quality. This enhanced nutrient technology helps plants more efficiently mobilize and utilize applied nutrients as well as those that are already within the plant, enhancing crop growth throughout the season.

1 Qt ReaX Zinc Foliar Four-Year Study, Applied at V4

(Minimum of 3 Reps.)



What We Learned:

- Zinc is a critical micronutrient early in a plant's life for promoting enzyme and metabolic reactions.
- The application of Reax Zinc over four years has given an average yield increase of 6.3 bushels with a 5.2 to 1 ROI.

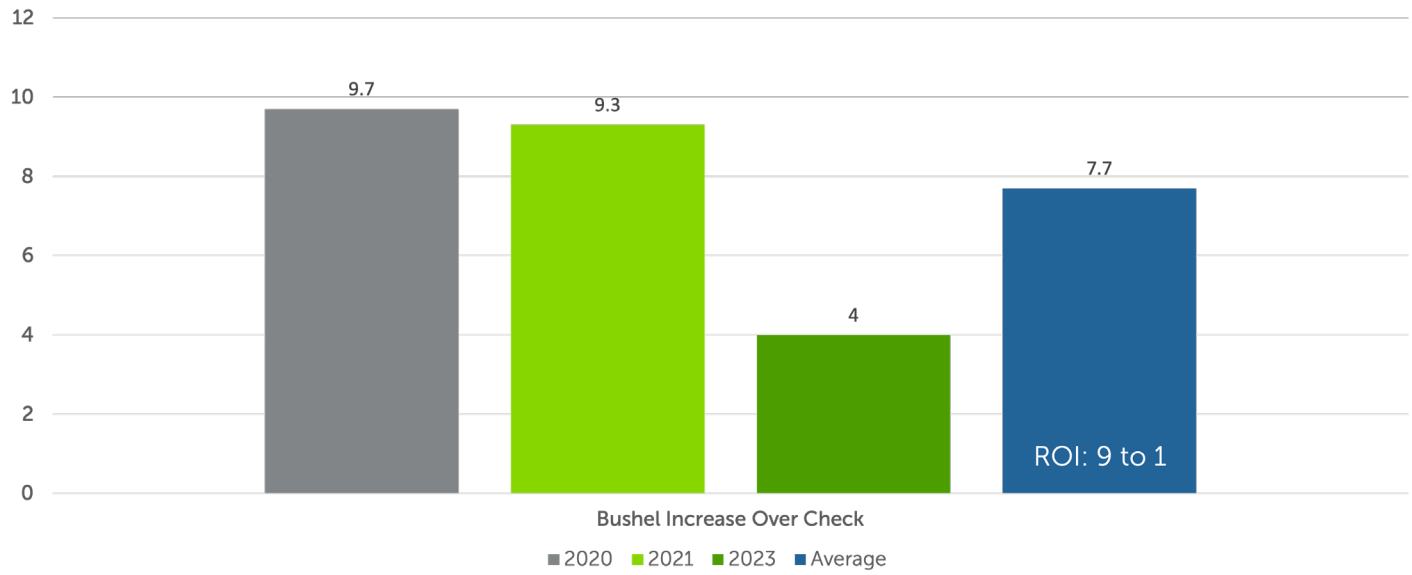
Timing: V4

ReaX C² ZINC

REAX™ ZINC is a liquid zinc equally suited for at-planting, banded or foliar applications. Enhanced with C², soil health and plant performance technology, ReaX Zinc is designed to improve nutrient availability to meet the yield and quality goals of growers in a variety of growing conditions year after year

24oz NutriSync Zinc Foliar Three-Year Study, Applied at V4

(Minimum of 3 Reps.)



What We Learned:

- Although we applied 2 Qts. Micro 500 in-furrow, there was still yield to be gained by applying foliar zinc. High yields cannot be achieved without this small yet powerful micronutrient.
- NutriSync Zinc had an average yield increase of 7.7 bushels and a 9 to 1 ROI.

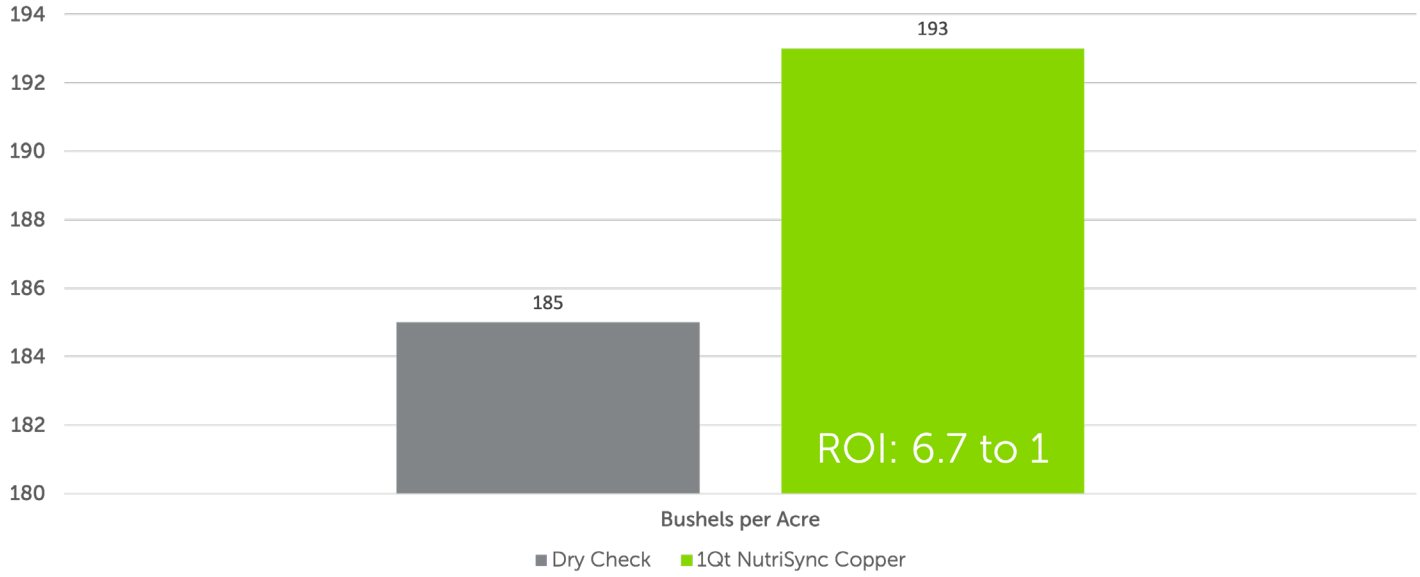
Timing: V4

NutriSync Zinc

NUTRISYNC® ZINC (0-0-0 6ZN) is a unique liquid foliar nutritional that promotes the physiological activity and growth of crops that demand zinc. Powered by NutriSync proprietary nutrient transport technology, NutriSync Zinc helps plants more efficiently mobilize and utilize applied nutrients as well as those that are already within the plant, enhancing crop growth throughout the season.

1 Qt NutriSync Copper Study, Applied at V4

(Average of 3 Reps.)



What We Learned:

- This study was to determine if Copper can increase yield in corn as it has proven to in wheat.
- Copper supports chlorophyll and seed production, while promoting healthier plants due to its fungicidal like properties, leading to better quality and higher yield potentials.
- Applying NutriSync Copper increased yield by 8 bushels per acre with a 6.7 to 1 ROI.

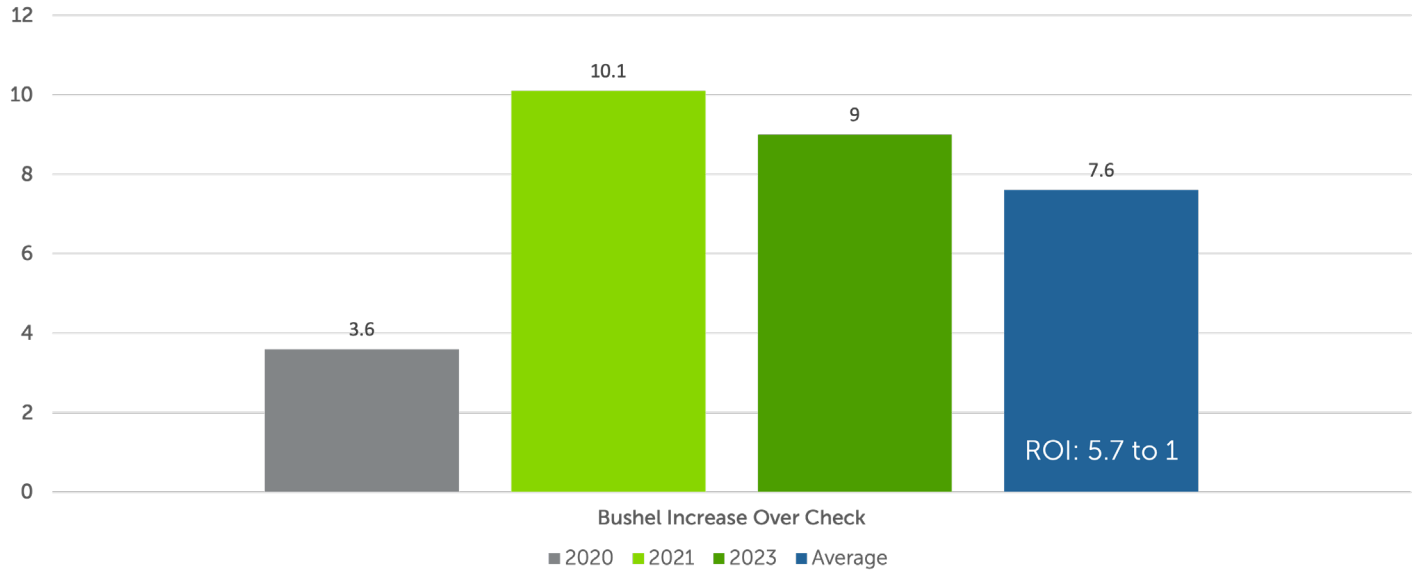
Timing: V4

NutriSync Copper

NUTRISYNC® COPPER (8-0-0 4.5CU) is a liquid foliar nutritional formulated with Loveland's premium foliar uptake technology to enhance the physiological activity and growth of copper demanding crops. The NutriSync platform helps plants more efficiently mobilize and utilize applied nutrients as well as those that are already within the plant, enhancing crop growth throughout the season.

24oz NutriSync Magnesium Foliar Three-Year Study, Applied at V4

(Average of 3 Reps.)



What We Learned:

- Magnesium is essential for photosynthesis and uptake of additional nutrients, such as phosphorus, in a plant.
- For many years, magnesium has been a limiting factor at the Hopkinsville Innovation Farm.
- Over the last three years, foliar application of NutriSync Magnesium led to an average yield increase of 7.6 bushels with a 5.7 to 1 ROI.

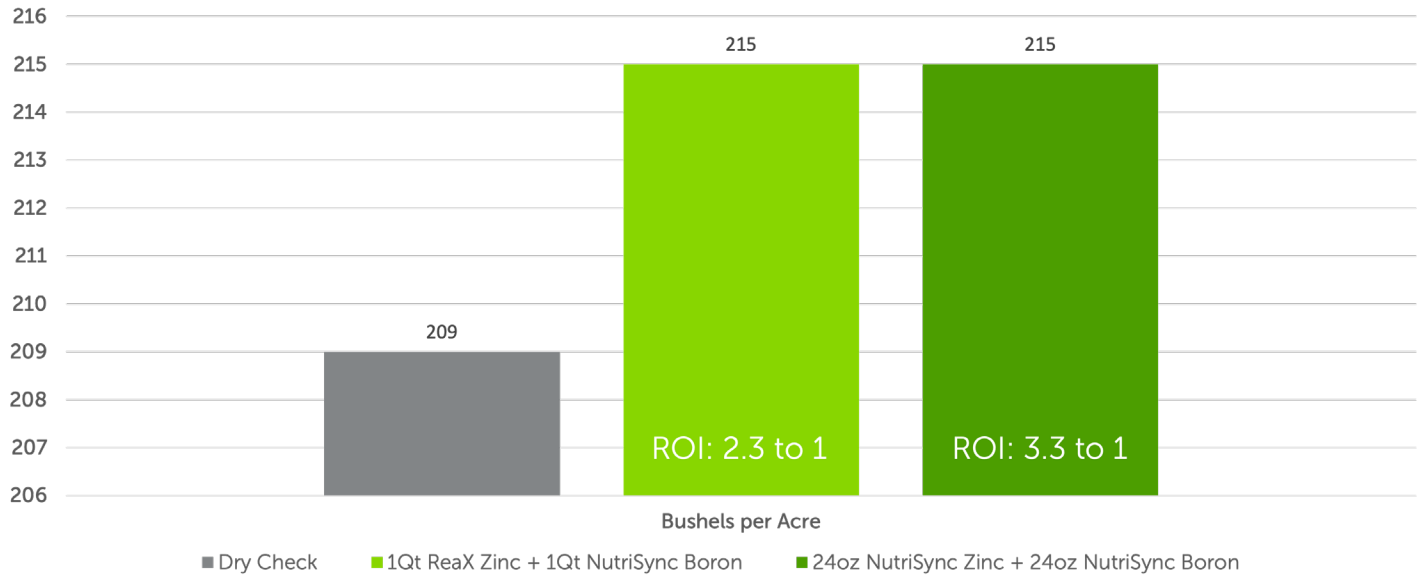
Timing: V4

NutriSync Magnesium

NUTRISYNC® MAGENSIUM (0-0-0 5% Mg) is a unique liquid foliar nutritional that enhances the physiological activity and growth of crops that demand magnesium. Powered by NutriSync enhanced nutrient transport technology, NutriSync Magnesium helps plants more efficiently mobilize and utilize applied nutrients as well as those that are already within the plant, enhancing crop growth throughout the season.

Zinc + Boron Foliar Nutrition, Applied at V4

(Average of 3 Reps.)



What We Learned:

- The purpose of this study was to determine if there was a yield gain when two micronutrients, Zinc and Boron, were applied together.
- Both applications provided a yield gain of 6 bushels per acre, but NutriSync Zinc gave the largest ROI of 3.3 to 1.

Timing: V4

NutriSync Zinc

NUTRISYNC® ZINC (0-0-0 6ZN) is a unique liquid foliar nutritional that promotes the physiological activity and growth of crops that demand zinc. Powered by NutriSync proprietary nutrient transport technology, NutriSync Zinc helps plants more efficiently mobilize and utilize applied nutrients as well as those that are already within the plant, enhancing crop growth throughout the season.

NutriSync Boron

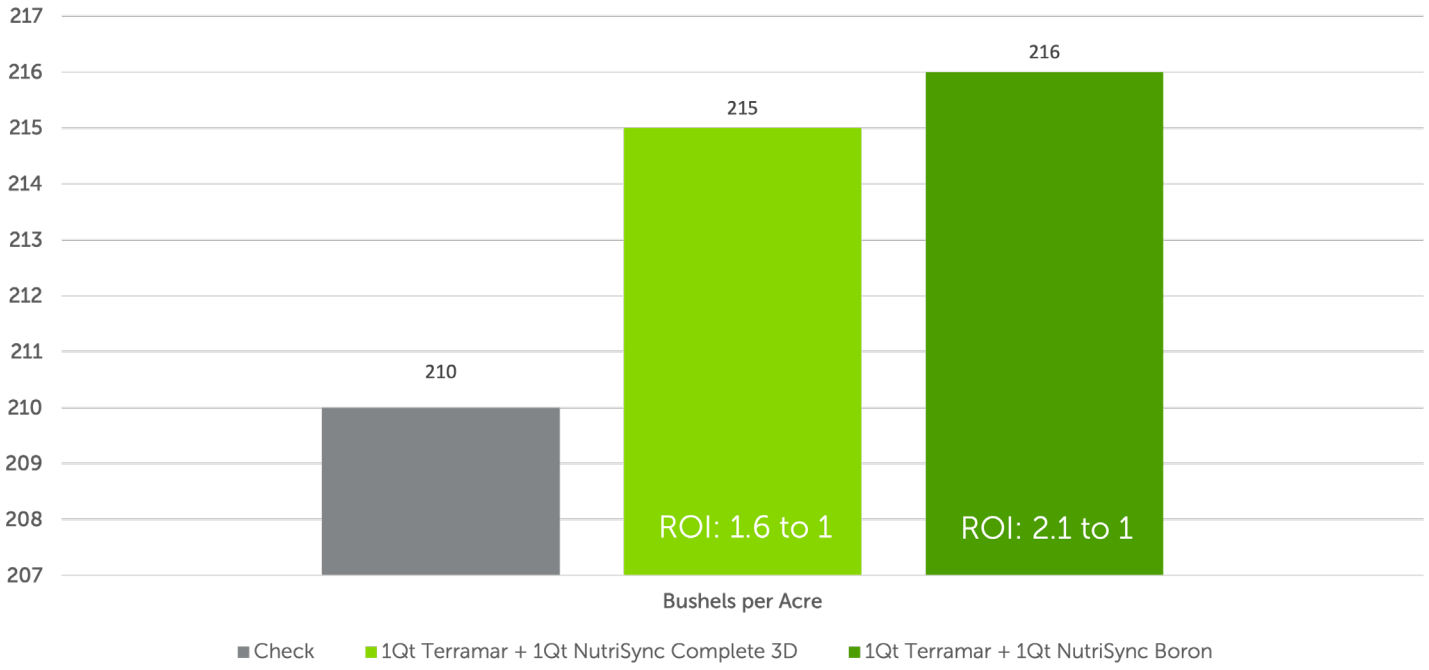
NUTRISYNC® BORON 5% is a unique foliar technology specifically designed to enhance plant physiological activities and growth of various crops. NutriSync remobilizes nutrients within the plant, especially to growing parts of the plant. NutriSync technology has been proven to increase assimilation, mobilization, and utilization of nutrients inside the plant.

ReaX C² ZINC

REAX™ ZINC is a liquid zinc equally suited for at-planting, banded or foliar applications. Enhanced with C^2, soil health and plant performance technology, ReaX Zinc is designed to improve nutrient availability to meet the yield and quality goals of growers in a variety of growing conditions year after year

Terramar and Foliar Nutrition, Applied at V4

(Average of 3 Reps.)



What We Learned:

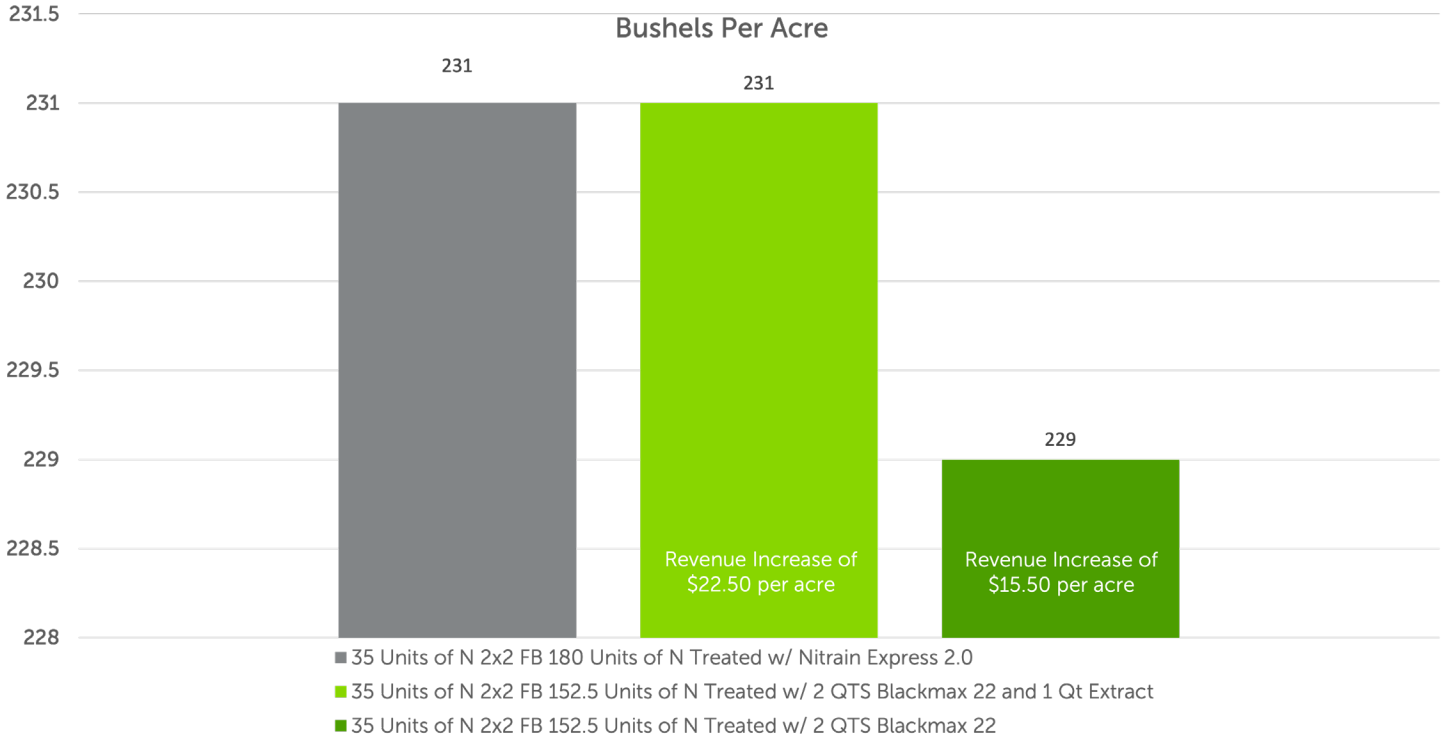
- Combining Terramar along with NutriSync nutritional products provided additional benefits to the plant and increased yield.
- Using Terramar and NutriSync Complete 3D gave a 5-bushel yield increase with a 1.6 to 1 ROI.
- Applying Terramar with NutriSync Boron gave a 6-bushel yield increase with a greater ROI of 2.1 to 1.

Timing: V4

TERRAMAR® is a proprietary blend of biologically digested seaweed and leonardite designed to increase nutrient uptake, mitigate abiotic stress response, enhance CEC and chelation. Terramar delivers unique metabolic compounds to enhance microbial activity in the rhizosphere and improve plant response to stressful conditions. Terramar is compatible and complimentary with fertilizer systems to promote plant health and performance.

NITROGEN REDUCTION STUDY

Nitrogen Reduction Study Using C2 Technology, Applied w/ Y-Drop at V-6
(Average of 3 Reps.)



What We Learned:

- The goal for this study was to reduce Nitrogen application by 27.5 units, while also adding Blackmax 22 to maintain yield and increase revenue.
- When Nitrogen was reduced but Blackmax 22 + Extract were applied, yield remained consistent and revenue increased by $22.50 per acre.
- Reduced Nitrogen + Blackmax 22 slightly decreased yield but still increased revenue by $15.50 per acre.

Timing: V6

EXTRACT Powered by Accomplish® is a proprietary blend of proven fertilizer biocatalyst – Accomplish LM and a nitrogen source, designed to help growers not only manage crop residue but also easily and effectively optimize the release of nutrients from residue and those in the soil.


SEED

R&D SOYBEAN PLANTING DATES

SOYBEAN VARIETY TRIAL & FULL SEASON SOYBEAN TRIAL

May 11-24, 2023: Population 135,000 Dyna-Gro 41EN72

Seed Treatment: Equity Vayo

Fertility: 2 gal. Pro-Germ, 1 gal. Sure-K, 1 qt Micro 500, 1 qt Liberate Ca, 1 qt Accomplish MAX

- Dry - 200 lbs. MES 10 + 100 lbs. Potash Treated w/ Titan XC 1 pt/Ton

Herbicide: 1 qt Liberty, 1 qt Mad Dog, 6 oz Intensity pre.

- Followed by 1 qt Liberty, 1 qt Mad Dog, 3.25 oz Zidua SC

Fungicide: 13.7 oz Miravis Top, 4.5 oz Endigo

Harvested: October 25-26, 2023

RESEARCH DOUBLE CROP SOYBEAN TRIAL

June 27-28, 2021: Population 150,000 Dyna-Gro 41EN72

Seed Treatment: Equity Vayo

Fertility: 2 gal. Pro-Germ, 1 gal. Sure-K, 1 qt Micro 500, 1 qt Liberate Ca

Herbicide: 3 pt Dogfight, 1 qt Liberty, 1 qt Enlist, 3.25 Zidua SC

Fungicide: 6.5 oz Magistrate, 4.5 oz Endigo

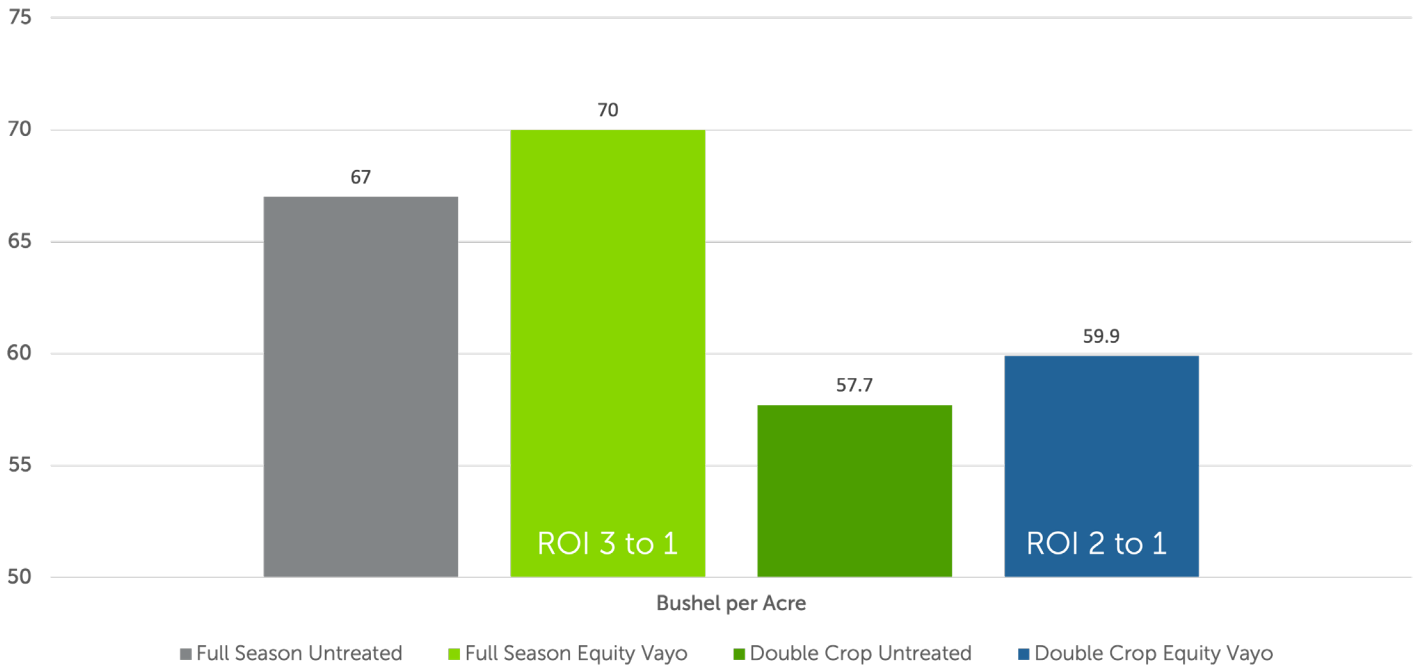
Harvested: November 3, 2023

ROI'S CALCULATED AT $13.50 BUSHEL

SEED TREATMENT STUDY

Equity Vayo on Full Season and Double Crop Soybean

(Average of 4 Reps.)



What We Learned:

- Through its six-way formulation including five fungicides and one insecticide, Equity Vayo provides protection from soil-borne diseases including Pythium and Phytophthora and controls a broad spectrum of insects.
- Utilizing Equity Vayo seed treatment provided a 3-bushel increase on full season soybeans, giving a 3 to 1 ROI, and a 2.2 bushel increase on double crop soybeans, giving a 2 to 1 ROI.

Timing: Pre-plant

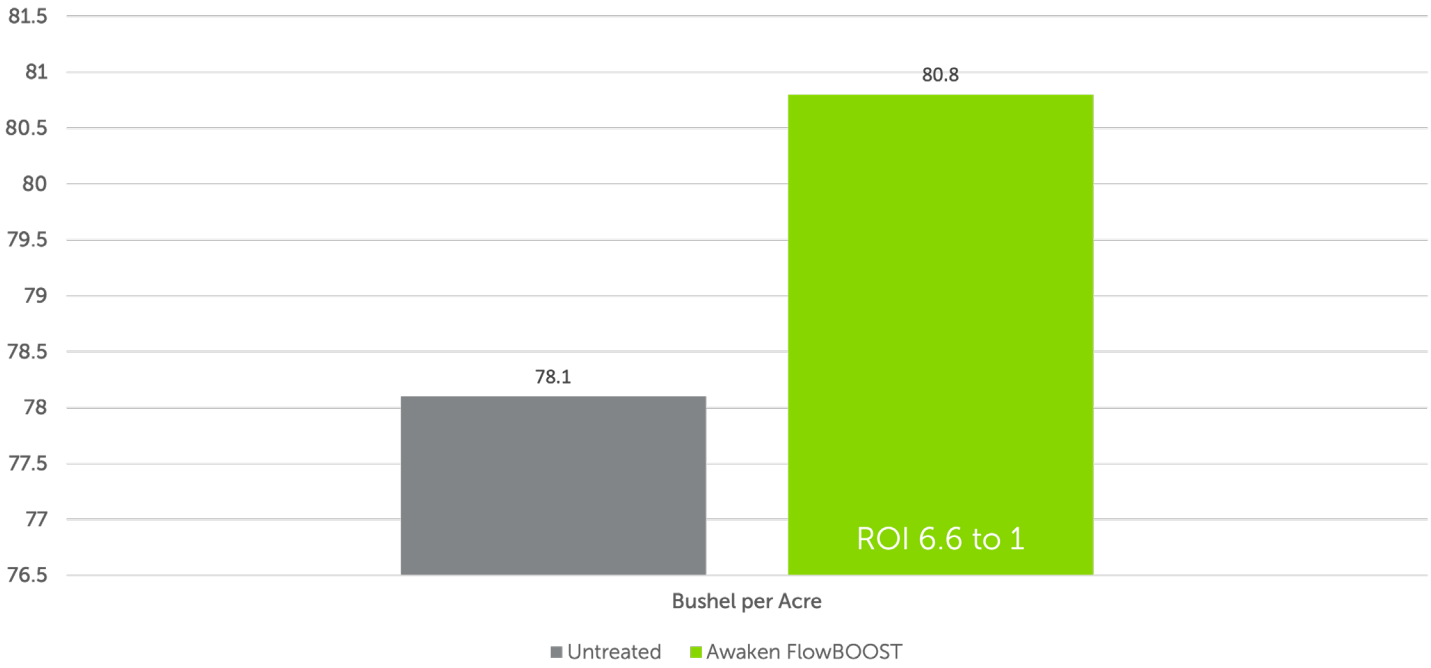
EQUITY VAYO

EQUITY VAYO® is the next generation of seed treatments from Loveland Products. This is an in-can formulation with a potent six-way insecticide + fungicide seed treatment for soybeans. Equity Vayo delivers multiple modes of action to help fight soil born disease resistance, improved control of pythium and phytophthora, and controls a broad spectrum of insects. Growers can have the confidence every seed planted with contribute to maximum yield potential on every acre.

SEED TREATMENT STUDY

Awaken FlowBOOST on Full Season Soybean

(Average of 2 Reps.)



What We Learned:

- Awaken FlowBOOST has a guaranteed analysis of Macro and Micro Nutrients.
- P2O5 – 5%, Fe – 1%, Mn – 3%, Mo – 2.5%, Zn – 10.5%, with a use rate of 3 oz/unit of seed.
- The treatment with Awaken FlowBOOST returned a 2.7 bushel increase with a 6.6 to 1 ROI.

Timing: Pre-plant

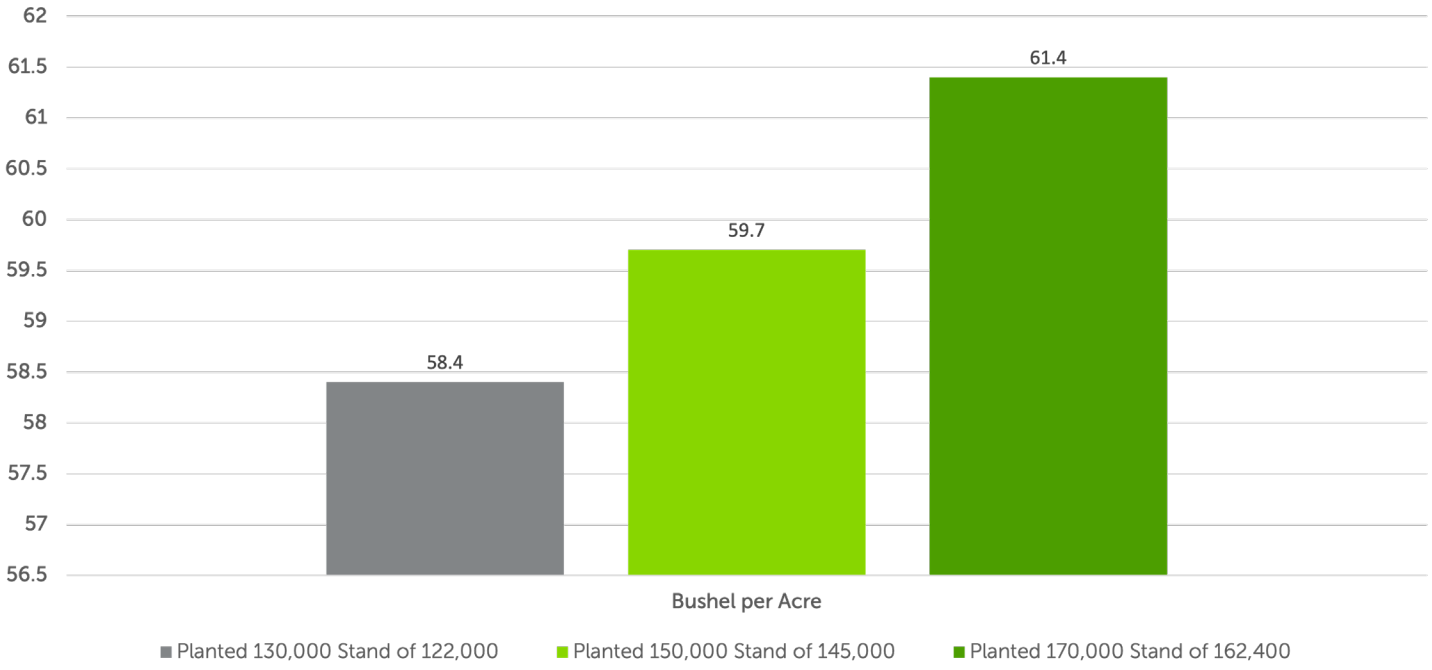
Awaken FlowBOOST

AWAKEN® FLOWBOOST is a premier seed lubricity agent available from Loveland Products. It contains a unique blend of nutrients to help promote early season growth and nutrient uptake. Additionally, it provides top tier seed lubrication to achieve better seed singulation, as well as extremely low dust-off properties

POPULATION STUDY

30-Inch Row Double Crop Population Study

(Average of 2 Reps.)



What We Learned:

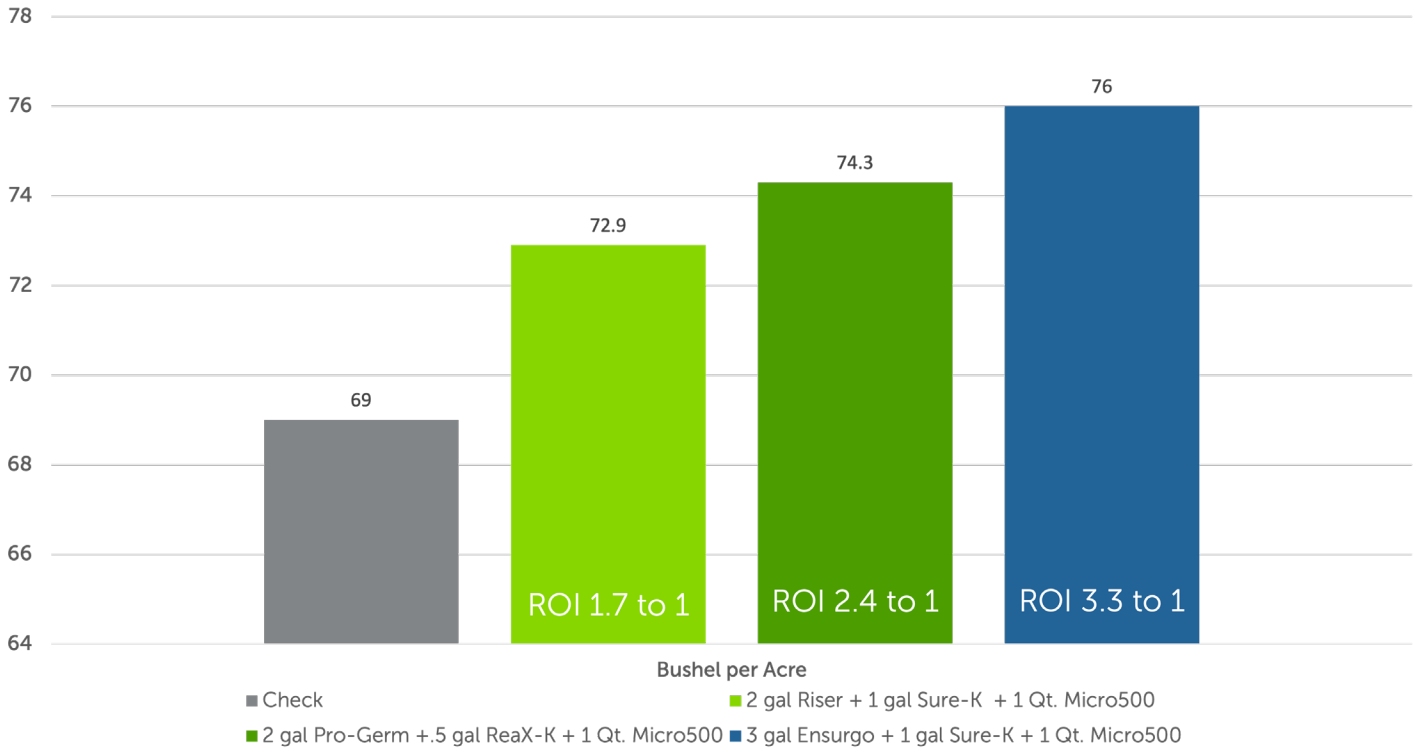
- This study evaluated different planting populations for double crop soybeans.
- Although the 130,000-stand saved money on seed compared to the standard 150,000, it overall lost $5.94 per acre due to reduced bushels.
- The stand of 170,000 required a larger investment in seed cost, but generated an additional $11.33 per acre compared to the 150,000.
- In a double crop situation, a higher planting population seems to be more profitable. In this case, more is better than less.

Timing: At Plant

IN-FURROW FERTILITY

In-Furrow Fertility on Full Season Soybean

(Average of 3 Reps.)



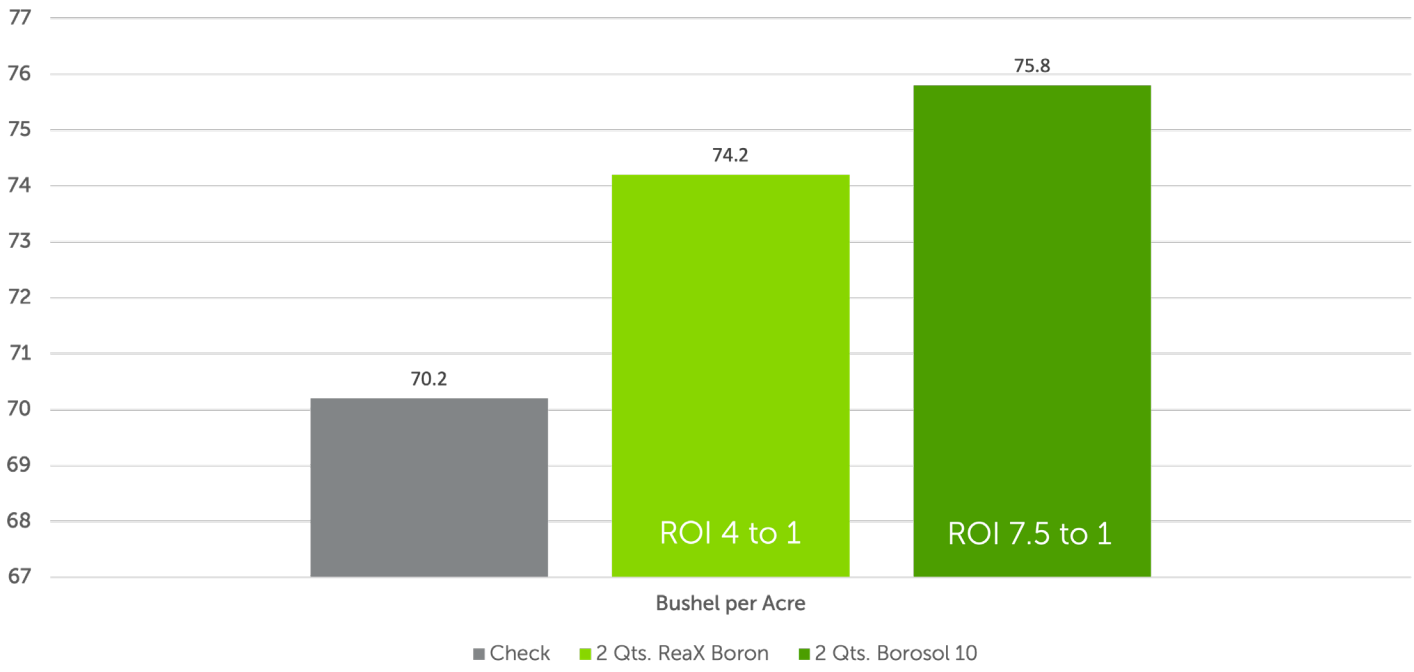
What We Learned:

- In the past, various in-furrow products have been tested on soybeans that have provided yield gain, but not a positive ROI.
- This year our in-furrow trials not only led to yield gain, but also a positive ROI of 1.7 or greater.
- The Ensurgo application provided a 7 bushel yield increase with the highest ROI of 3.3 to 1.

Timing: At plant

2x2 Boron Study on Full Season Soybean

(Average of 3 Reps.)



What We Learned:

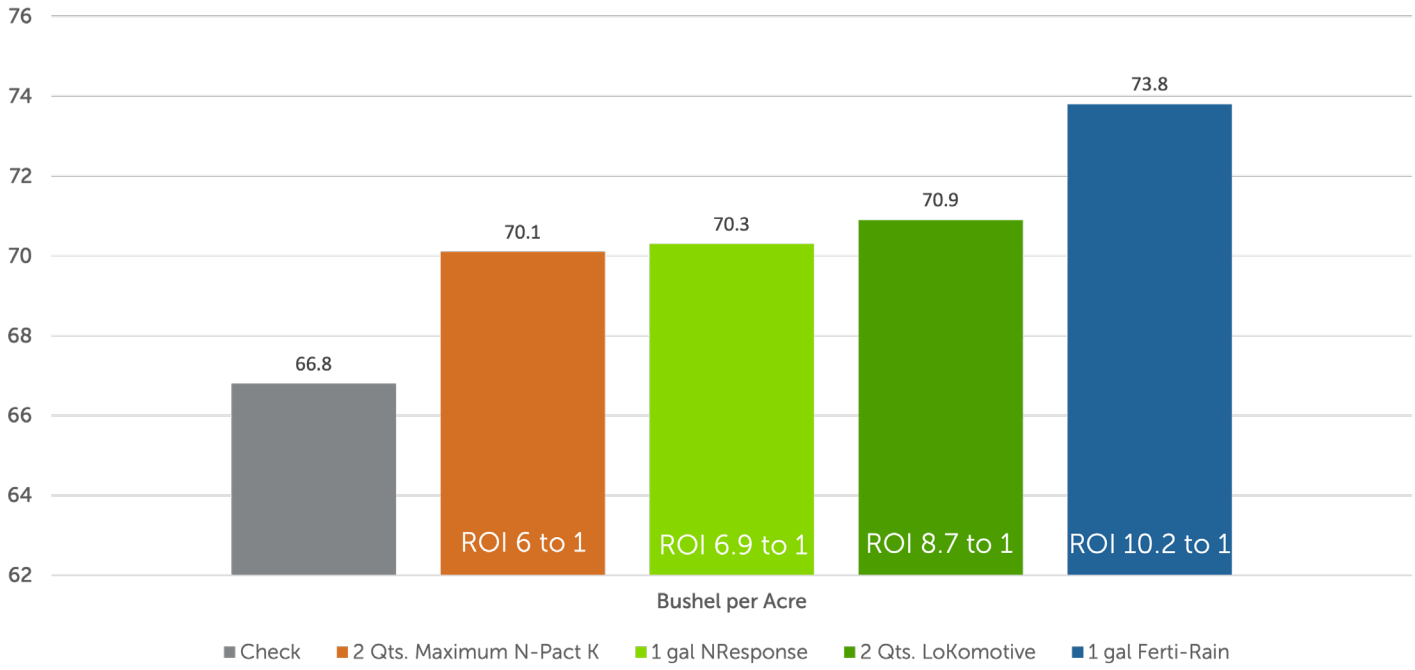
- In an attempt to improve plant health and increase yield, two different Boron products were applied with our 2x2 system.
- Tissue samples taken at R3 showed that both Boron applications increased the nutrient level significantly over the check.
- ReaX Boron increased yield by 4 bushels with an ROI of 4 to 1.
- Borosol 10 showed the highest Boron level in the tissue sample and provided the greatest yield increase of 5.6 bushels with a 7.5 to 1 ROI.

Timing: At Plant

B-ppm	34.00						**Check**
B-ppm	40.00						**ReaX Boron**
B-ppm	45.00						**Borosol 10**
PETIOLES		VERY LOW	LOW	OPTIMUM	HIGH	EXCESSIVE	

Foliar Nutrient Study at R3 on Full Season Soybean

(Average of 2 Reps.)



What We Learned:

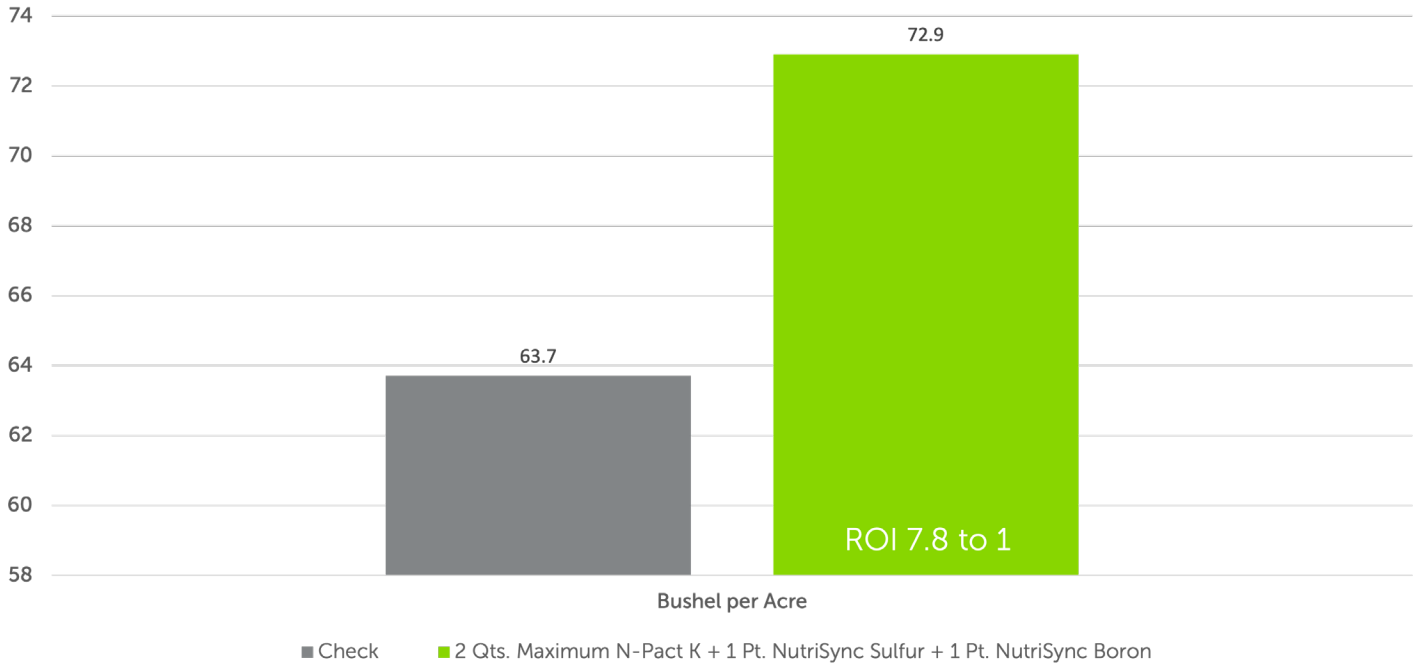
- This study compared the affects of different foliar nutrition products on full season soybeans.
- All products provided a positive impact on yield as well as a 6 to 1 ROI.

Timing: R3

Maximum N-PACT® K 12-0-12

MAXIMUM N-PACT® K is an enhanced slow-release nitrogen which provides a stable source of foliar nitrogen with the addition of potassium for increased uptake, translocation and utilization of nitrogen and potassium, with excellent crop safety and increased stress tolerance.

Foliar Potassium and Micros at R3 on Full Season Soybean



What We Learned:

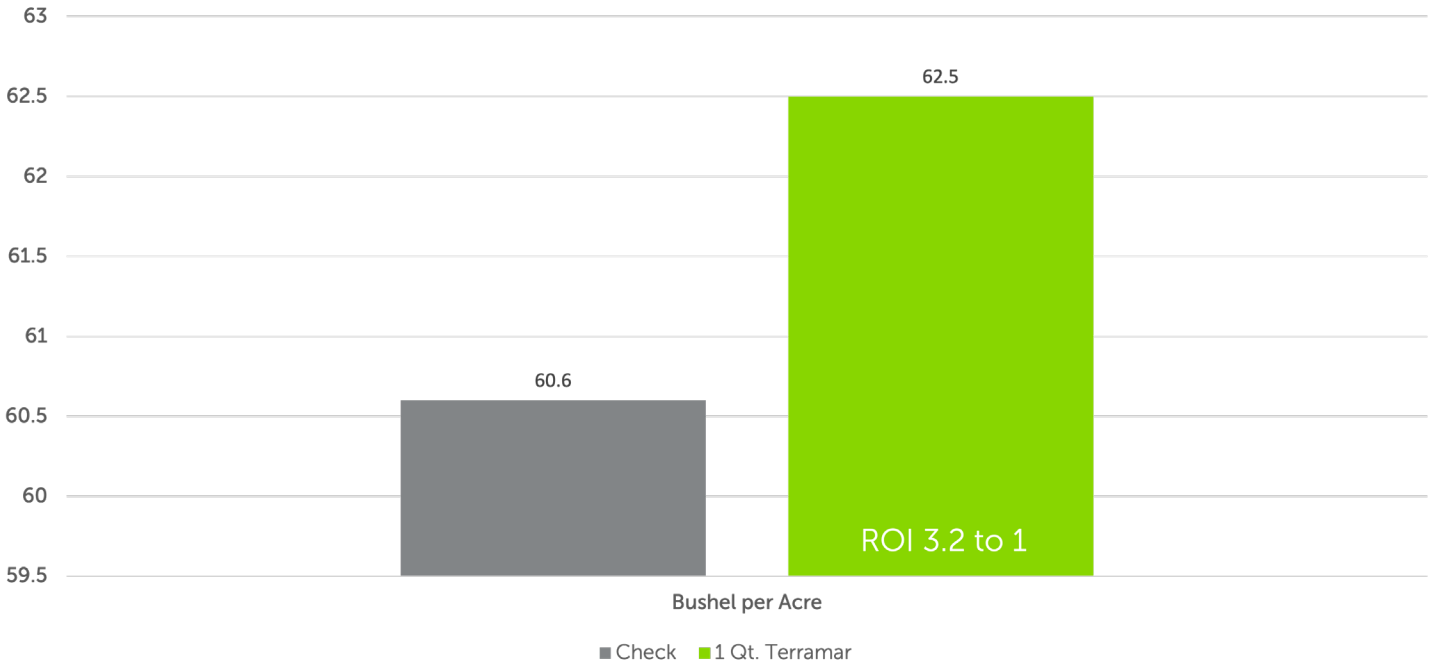
- This foliar combination study of macro and micronutrients focused on plant resilience, seed set, and nitrogen fixation.
- As seen in tissue samples taken at R3, these foliar products provided nutritional needs for the plants, with all nutrient levels being at optimum or greater levels.
- This foliar application increased yield by 9.2 bushels and had a 7.8 to 1 ROI.

Timing: R3

Total N	6.41						Very High
Total P	0.47						High
Total K	1.96						Optimum
MACRONUTRIENTS		**VERY LOW**	**LOW**	**OPTIMUM**	**HIGH**	**EXCESSIVE**	
Ca	0.97						Optimum
Mg	0.44						Optimum
Na	0.00						Optimum
S	0.36						Optimum
MICRONUTRIENTS		**VERY LOW**	**LOW**	**OPTIMUM**	**HIGH**	**EXCESSIVE**	
Zn-ppm	35.00						1 qt/A NutriSync Zn 0-0-0 or ReaX Zn 1 qt/A
Mn-ppm	103.00						High
Fe-ppm	101.00						Optimum
Cu-ppm	11.00						Optimum
B-ppm	49.00						Optimum
PETIOLES		**VERY LOW**	**LOW**	**OPTIMUM**	**HIGH**	**EXCESSIVE**	

Terramar at R3 on Double Crop Soybean

(Average of 2 Reps.)



What We Learned:

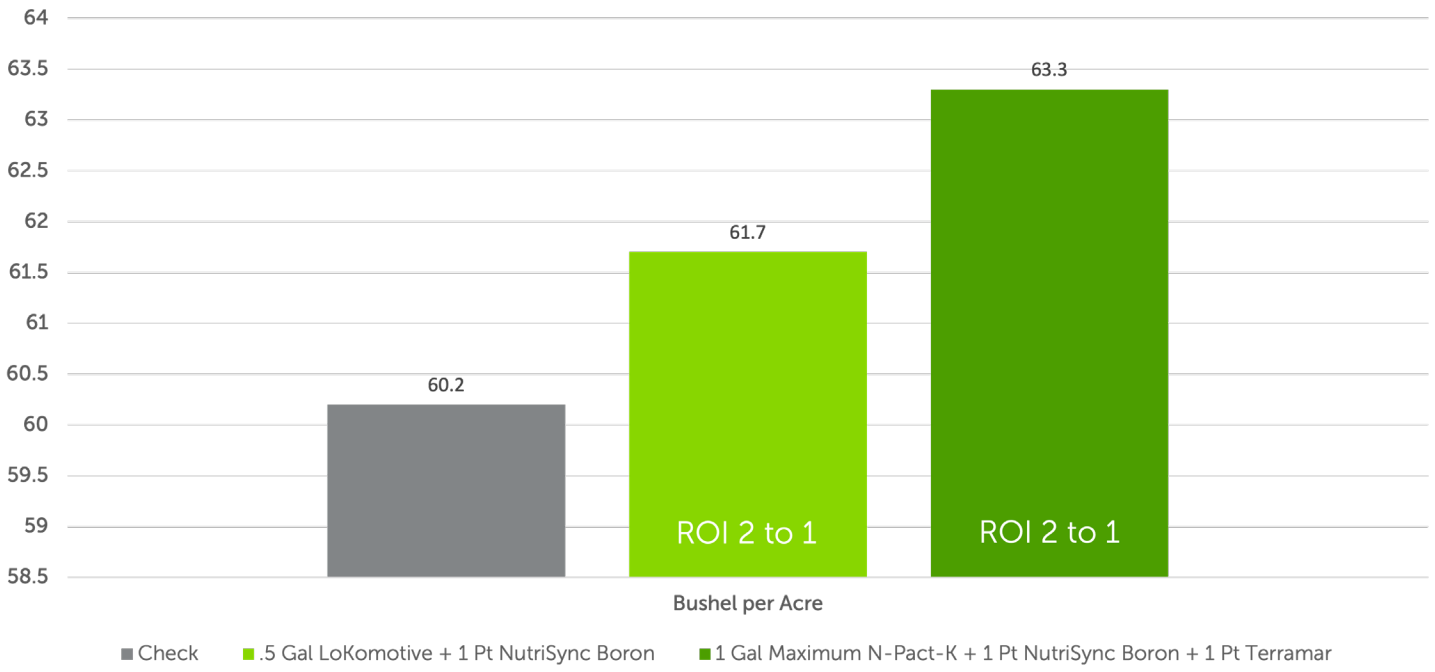
- Applied on double crop soybeans, Terramar increased yield by 1.9 bushels with a 3.2 to 1 ROI.

Timing: R3

TERRAMAR® is a proprietary blend of biologically digested seaweed and leonardite designed to increase nutrient uptake, mitigate abiotic stress response, enhance CEC and chelation. Terramar delivers unique metabolic compounds to enhance microbial activity in the rhizosphere and improve plant response to stressful conditions. Terramar is compatible and complimentary with fertilizer systems to promote plant health and performance.

Foliar Enhancement Study on R3 Double Crop Soybean

(Average of 2 Reps.)



What We Learned:

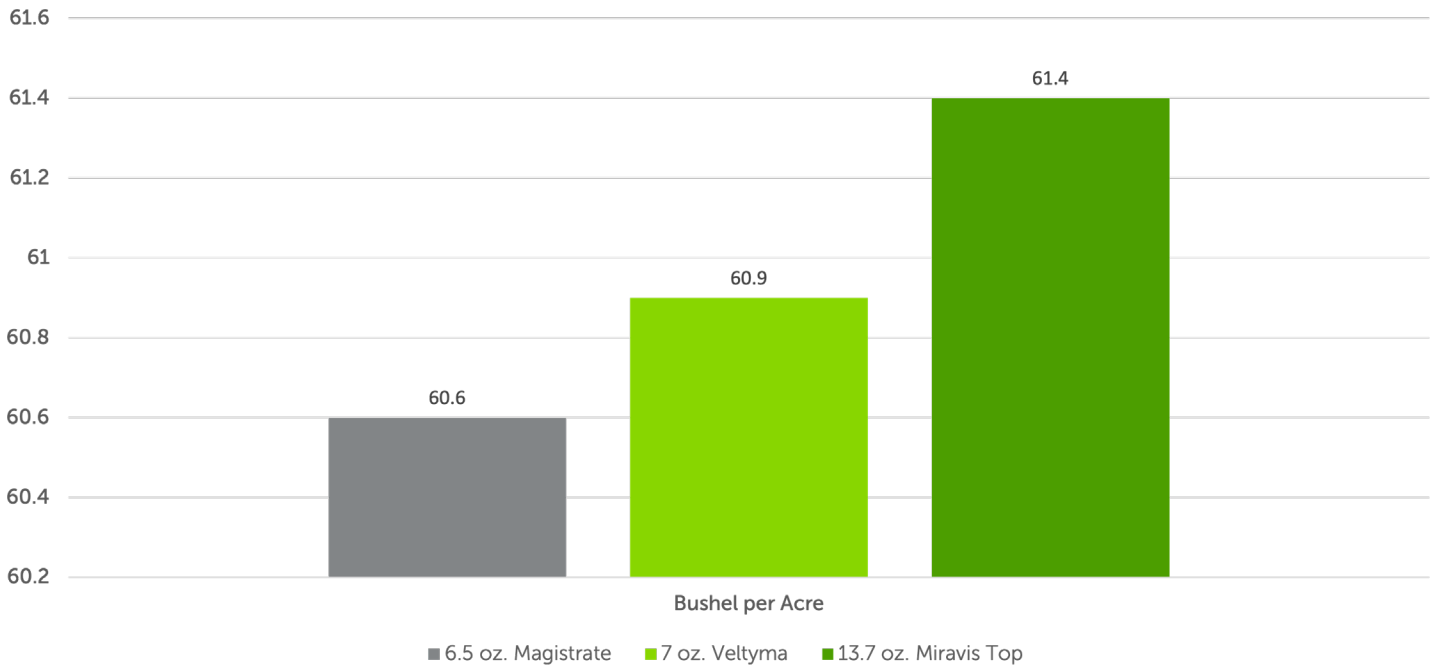
- This was a combination study of different potassium sources along with NutriSync Boron to potentially increase yield. Terramar was also included in an attempt to maximize yield.
- Both treatments increased yield and had a 2 to 1 ROI.

Timing: R3

PROTECTING YOUR INVESTMENT

Double Crop Soybean Fungicide Study

(Average of 2 Reps.)



What We Learned:

- In this study, we are comparing three different branded fungicides.
- All three are good choices for maximizing yield and protecting your investment.

Timing: R3

MAGISTRATE® is a mix of azoxystrobin, trifloxystrobin and prothioconazole. The multiple active ingredients control a wide range of foliar diseases and offer an excellent resistance management tool.

VELTYMA fungicide contains a unique active ingredient, Revysol® fungicide, the first and only isopropanol azole. Revysol fungicide delivers broader, stronger, longer disease control. The unique molecular structure provides stronger binding, rain-fast performance and excellent efficacy.

MIRAVIS® TOP fungicide, custom-built with one of the highest-performing SDHI molecules available to protect yield and ROI potential. Binds to the waxy layer of the leaf for extended residual control and rainfastness to protect foliage throughout the canopy, resulting in optimum photosynthesis and maximum pod fill.

NOTES:

OWENSBORO, KY

WHEAT CORN SOYBEAN

The Nutrien Ag Solutions Innovation Farm-Owensboro resides in Daviess County, Kentucky. Through the loyal support and cooperation from local farmer Rod Kuegel, we operate on 120 acres that consists of 7 different soil types, all consisting of deep silt loams. The farm is made up of gently rolling, well drained soils that allows us to produce reliable trial data. In recent years, this farm was managed as a long term no-till environment with residues from corn, soybeans, and wheat. The farm is tiled on 50-foot centers to aid in the drainage and performance of the various research projects conducted at this site. We now have a facility on site that will allow us the opportunity to conduct various field days and clinics regardless of what mother nature may bring. Our new facility provides growers and cooperators an excellent on-site venue for training and education

What We Do

Across 120 acres, we conduct nearly 80 trials each year on corn, wheat, and soybeans. The farm is devoted to testing commercially available products, as well as new products coming down the pipeline. All of our research is done at field scale, using full size equipment, in order to give growers confidence that these products and systems will work on their farms and not just in small, controlled settings. Products being tested consist of both proprietary (Dyna Gro and Loveland Products) and those of our vendors. We evaluate and showcase products that work well individually and together. We're crafting a systems approach where every decision, from pre-plant to harvest, must work together with one goal in mind: Maintaining season long profitability for our customers and their farms.

Field days and trainings continue to be instrumental in our day-to-day operations. The success of our growers is crucial to our success, which is why we offer a plethora of events throughout the growing season. These events are not only used to educate growers on new products, but to train our own employees on new products, practices, and technologies. The modern world of agriculture is advancing at a rapid pace, so it is important that we utilize our innovation farm to validate and showcase these practices in order to help growers make the best economic and agronomic decisions on their farm.

Weather, Disease, and Insects

Our 2023 growing season started in a timely manner. We planted our first soybeans on April 4th and the bulk of our corn was planted around April 10th. Conditions in early April were ideal for early planting, but that quickly changed and we began to experience cool wet conditions in the latter half of the month. In the months of May and June the crops suffered from a lack of adequate rainfall. We experienced roughly 5 weeks of no rain and we didn't recover adequate soil moisture until the 1st week of July. This dry period made typical drought induced nutrient deficiencies, such as potassium,

apparent. We also saw sulfur deficiencies earlier in the growing season, which has become increasingly more noticeable in recent years. During July and August, we experienced typical weather conditions from a heat and precipitation aspect. In terms of disease, we experienced relatively low pressure in both corn and soybeans until late in the reproductive stages. Temperatures in the latter half of August trended downwards, allowing for excellent grain fill.

In light of cool conditions following our first planting window, the crop experienced slow growing conditions. Due to our historical no-till practices, our soybean crop suffered from extensive slug damage and required a significant amount of replant. (Please see pages 96-97 for more information regarding slug damage and remediation). Other prevailing pests early in the season were wireworms and cutworms. Our corn crop received an in-furrow insecticide across all acres to protect against major insect damage, which helped us avoid a major replant situation on corn. Even with adequate protection applied, minute feeding was observed in multiple places. As we approached the reproductive stages of our soybean crop, we saw an abundance of stink bugs, Dectes stem borer, and Japanese beetles. An insecticide application was made at R3, yet we experienced high levels of feeding ramp back up later in the season. We saw higher than average levels of Dectes stem borer compared to previous years.

Conclusion

Overall, the 2023 growing season brought a unique blend of challenges and blessings. As you peruse the trials conducted at the Owensboro Innovation Farm this year, keep the above information in mind. As always, we strive to keep a balance between economics and agronomics in our recommendations. With this in mind, we publish and encourage rates and timings that yield a positive return on investment. We hope that you gain knowledge and insight to continue growing a profitable crop in 2024 with the help of us at Nutrien.

OWENSBORO WEATHER

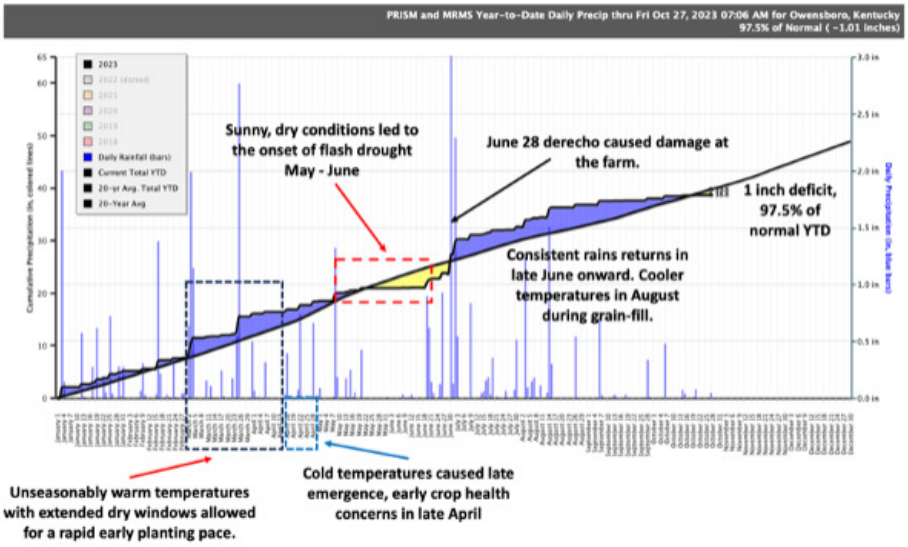
Unseasonably warm temperatures and periods of dry conditions led to a rapid, early planting pace regionally. Temperatures turned much colder in the final two weeks of April which led to late emergence and early crop health concerns. While a late freeze did not occur, overnight low temperatures fell into the mid-30s on April 21-24, with cool temperatures and highs only in the 60s through the end of the month.

A blocked jet stream pattern across the eastern half of North America in May and June forced the active late-spring storm track south and west of the region. Higher atmospheric pressure and northwesterly jet stream flow overhead led to a sunny, dry pattern allowing for the rapid onset of flash drought. In some instances, deep soil moisture remaining from early spring rains was able to carry crops until rain returned in late June. Additionally, while there were brief periods of summertime heat, the absence of prolonged excessive heat likely prevented further crop stress during this period of drought.

Unfortunately, as is often the case, drought came to a violent end with a rash of severe storms in the final days of June. A derecho, a long-lived severe storm complex, impacted the Owensboro farm during the early morning hours on June 29th, 2023, causing some structural damage.

With drought concerns mitigated by late July and August attention turned to temperatures. There were again brief periods of excessive heat, but extended runs of cooler temperatures between hot spells led to good grain fill.

As we close out the 2023 growing season, mild and quiet weather in early fall have provided favorable conditions for harvest and fall field activities.



WHEAT

Planting Date: 10-14-2022

Variety: Dyna Gro - 9151

Tillage: Minimum Till

Fertility:

- Nitrogen
  - » 50 units NexBlu S 1st shot
  - » 70 units NexBlu S 2nd shot

Herbicide:

- Fall- Axiom 6 oz/A + Tombstone 2.1 oz/A
- Spring- Harmony Extra 0.9 oz/A + Metribuzin 2 oz/A + Tombstone 2.1 oz/A + Palisade 12 oz/A

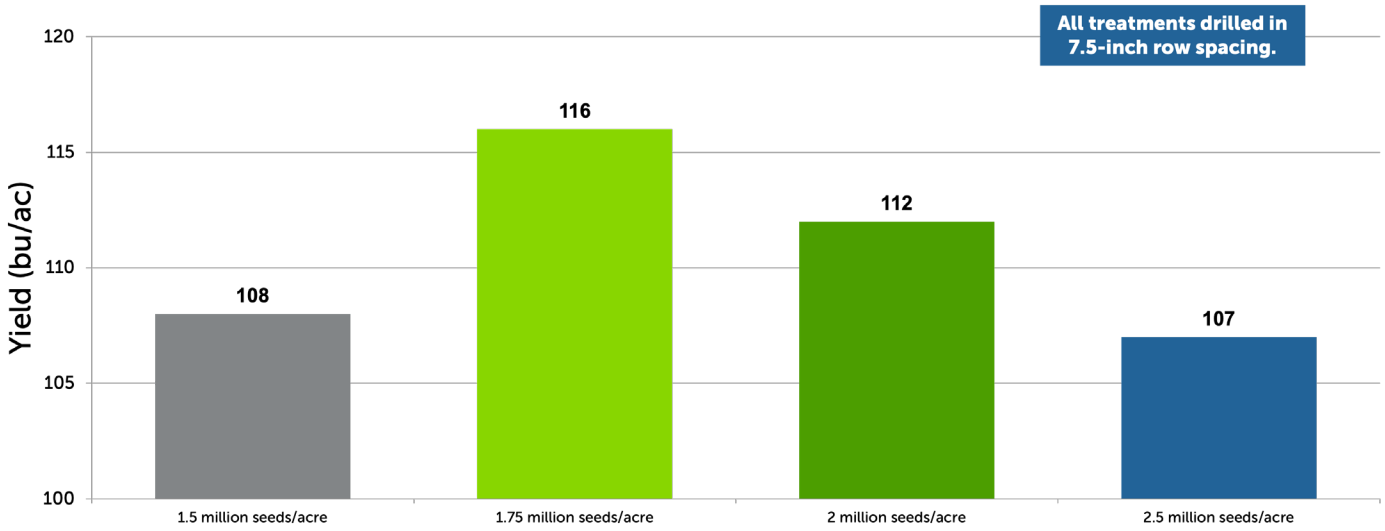
Fungicide:

- Magistrate 6.5 oz/A Feekes 6
- Miravis Ace 13.7 oz/A + Warrior II 2.1 oz/A Feekes 10.5.1

Harvest Date: 6-26-2023

ROI'S CALCULATED AT $7 / BU

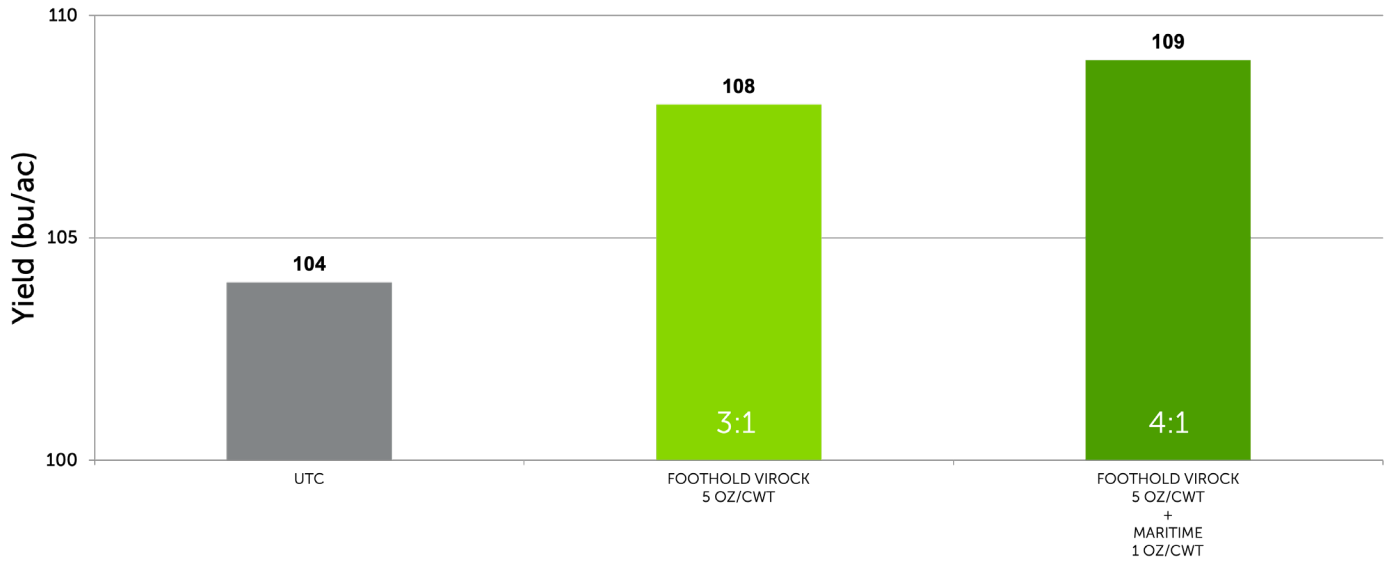
Wheat Seeding Rate Study



What We Learned:

- The standard planting rate across much of the soft red wheat region has been 1.5 million seeds/acre, however recent studies suggest that increased seeding rates may capture higher yields with today's genetics.
- Higher seeding rates tend to increase the percentage of heads arising from main stems, which are typically larger and have more spikelets (grain development sites) than those arising from tillers.
- Increasing the seed rate to 1.75 million seeds/ac resulted in an 8 bushel yield increase, while seed rates of 2 million and 2.5 million seeds/acre diminished yield response.
- No specific conclusions can be drawn from this first year study, the data's numerical trend hints that wheat populations above traditional norms may be justified.

Maritime-Enhanced Seed Treatments in Wheat



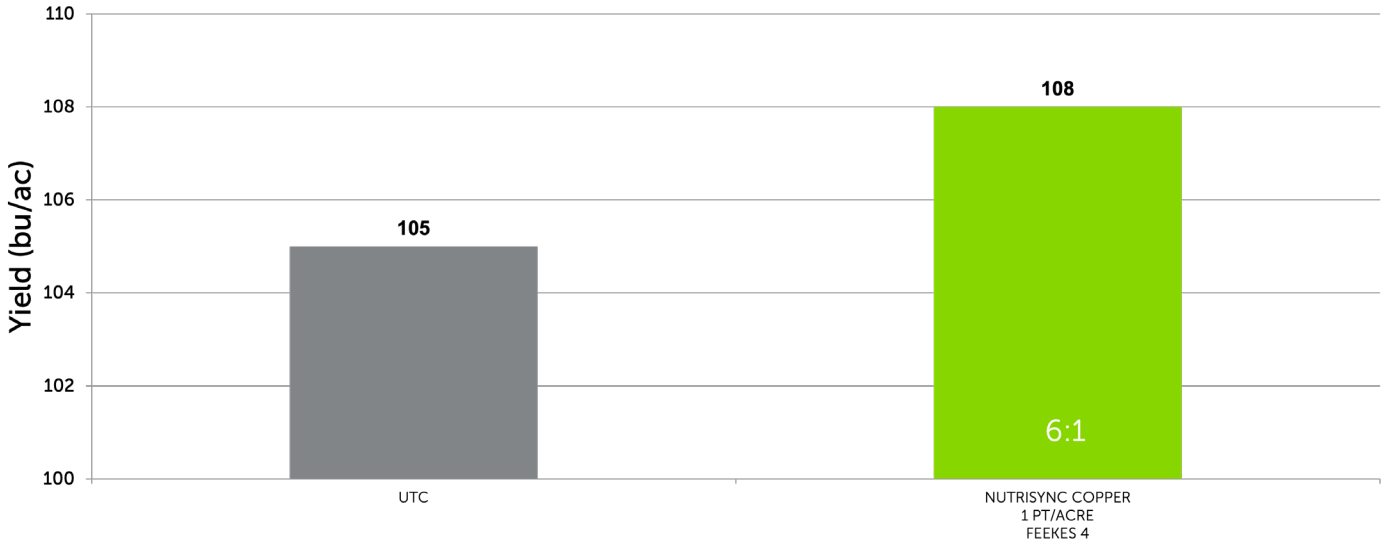
What We Learned:

- The objective of this study was to determine if Maritime has an additive yield impact beyond that typically observed with a standard wheat treatment alone.
- Foothold Virock is a premium wheat seed treatment featuring both fungicide and insecticide components. Maritime is being used to buffer abiotic stress, such as cold/wet soil conditions.
- Foothold Virock increased yield by 4 bushels while Maritime + Foothold Virock increased yield by 5 bushels and improved ROI.

MARITIME™ is a highly soluble biological extraction of kelp. This unique extraction process produces a broad range of plant-available compounds and active byproducts (primary and secondary metabolites that increase nutrient and plant functioning). Bio-active compounds positively impact soil health, crop and rhizosphere interactions, improve nutrient uptake, and improve plant tolerance to stress.

DYNA-SHIELD® FOOTHOLD® VIROCK® is a combination of the insecticide Imidacloprid and the three fungicides Metalaxyl, Tebuconazole and Fludioxonil for early season protection of seedlings against insect injury and soilborne diseases for barley and wheat.

Foliar Copper in Feekes 4 Wheat



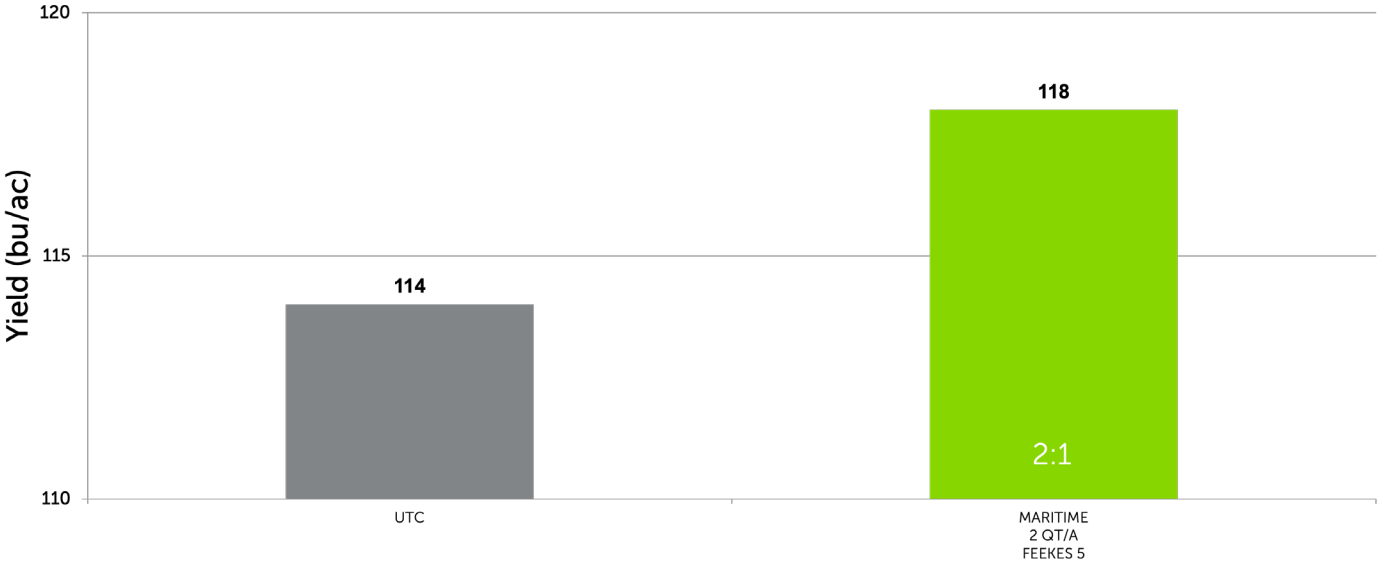
What We Learned:

- NutriSync Copper applied at Feekes 4 proved highly effective in boosting yield and generating a strong ROI with a 3 bushel increase.
- Previously, wheat grown on medium-to-finer textured soils in this region, including silt loams at the Owensboro farm, typically have not responded to supplemental Copper.
- Soil Copper level was at the low end of the optimum range (1.7 lbs/ac) at the site when the trial began, showing the importance of Copper levels in soil and tissue samples.

NutriSync Copper

NUTRISYNC® COPPER (8-0-0 4.5CU) is a liquid foliar nutritional formulated with Loveland's premium foliar uptake technology to enhance the physiological activity and growth of copper demanding crops. The NutriSync platform helps plants more efficiently mobilize and utilize applied nutrients as well as those that are already within the plant, enhancing crop growth throughout the season.

Foliar Maritime in Feekes 5 Wheat



What We Learned:

- This study was initiated to evaluate the benefits of Maritime as a foliar treatment at traditional herbicide timing.
- Maritime gave a 4 bushel yield increase, generating an additional $11.50 of net revenue per acre.
- The yield response is likely due to reduced plant stress in a highly variable weather pattern following application.

MARITIME™ is a highly soluble biological extraction of kelp. This unique extraction process produces a broad range of plant-available compounds and active byproducts (primary and secondary metabolites that increase nutrient and plant functioning). Bio-active compounds positively impact soil health, crop and rhizosphere interactions, improve nutrient uptake, and improve plant tolerance to stress.

CORN

Planting Date: April 10th - May 2nd

Variety: Dyna Gro- 55VC80 and 54VC34

Fertility:

- 3 gal/ac Riser, 6.8 oz/ac Sniper LFR (In-Furrow)
- Nitrogen- 240 units UAN Pre-Plant Stabilized with Nitrain 2.0 (1 qt/ton)

Herbicide:

- Burndown- Makaze 40 oz/ac, Salvo 12 oz/ac
- Pre-Emerge- Acuron 2.5 qt/ac
- Post-Emerge- Halex GT 3.6 pt/ac, Makaze 20 oz/ac

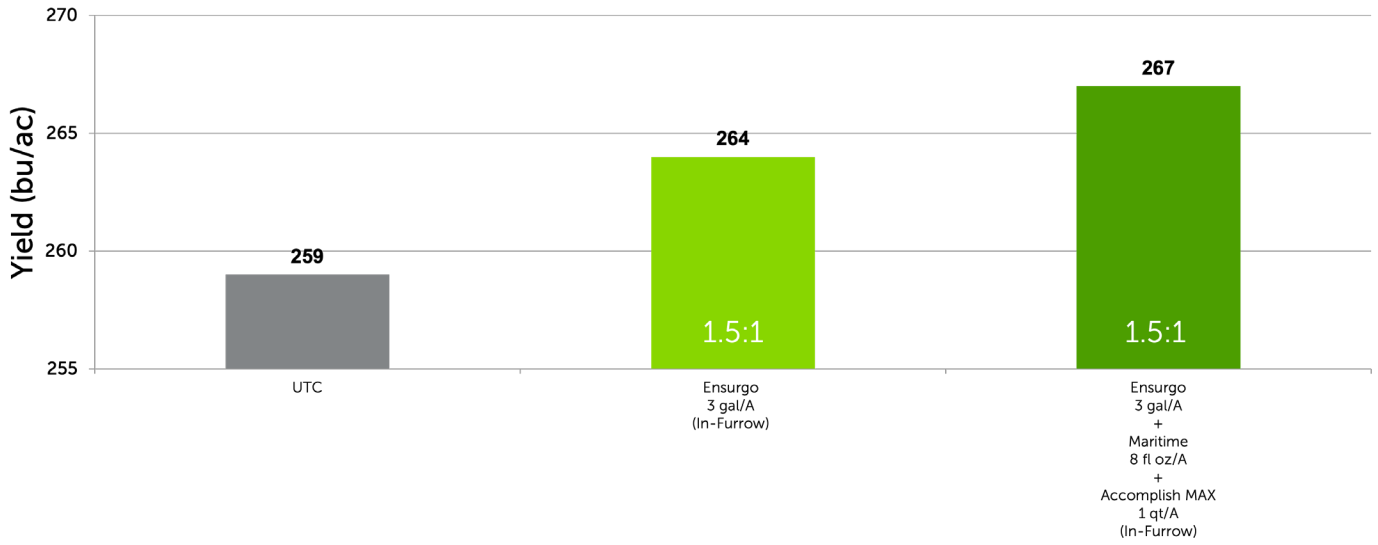
Fungicide:

- VT- Trivapro 13.7 oz/ac, Tombstone 2.8 oz/ac

Harvest Date: 9/19-9/26

ROI'S CALCULATED AT $5.25/BU

Ensurgo-Based In-Furrow Programs in Corn



What We Learned:

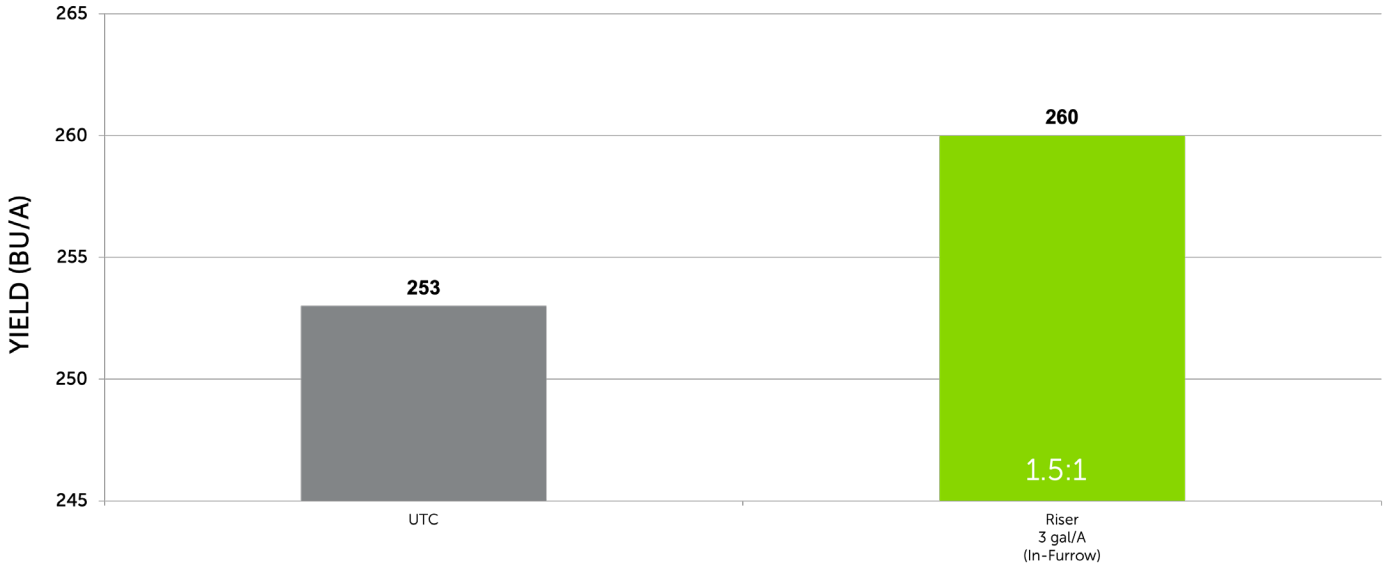
- This study utilizes Ensurgo as a base starter fertilizer with Maritime and Accomplish MAX added to mitigate abiotic stress and drive nutrient mineralization.
- Ensurgo alone provided a healthy ROI and a 5 bushel yield increase.
- Ensurgo + Maritime + Accomplish MAX increased yield by 8 bushels and net revenue by $5.31 per acre.

MARITIME™ is a highly soluble biological extraction of kelp. This unique extraction process produces a broad range of plant-available compounds and active byproducts (primary and secondary metabolites that increase nutrient and plant functioning). Bio-active compounds positively impact soil health, crop and rhizosphere interactions, improve nutrient uptake, and improve plant tolerance to stress.

ACCOMPLISH MAX™ is a next-generation biocatalyst designed to improve nutrient availability and increase crop tolerance to environmental stressors like cold temperatures, drought and salinity from applied fertilizers. With Accomplish MAX, you'll get "More Nutrients, Less Stress."

ENSURGO is a 7-24-2, 80% orthophosphate-based starter fertilizer containing proven Accomplish LM biocatalyst technology to help release stored nutrition in the soil, providing consistent value and establishing a reliable start to your crop.

Riser Starter Fertilizer in Corn

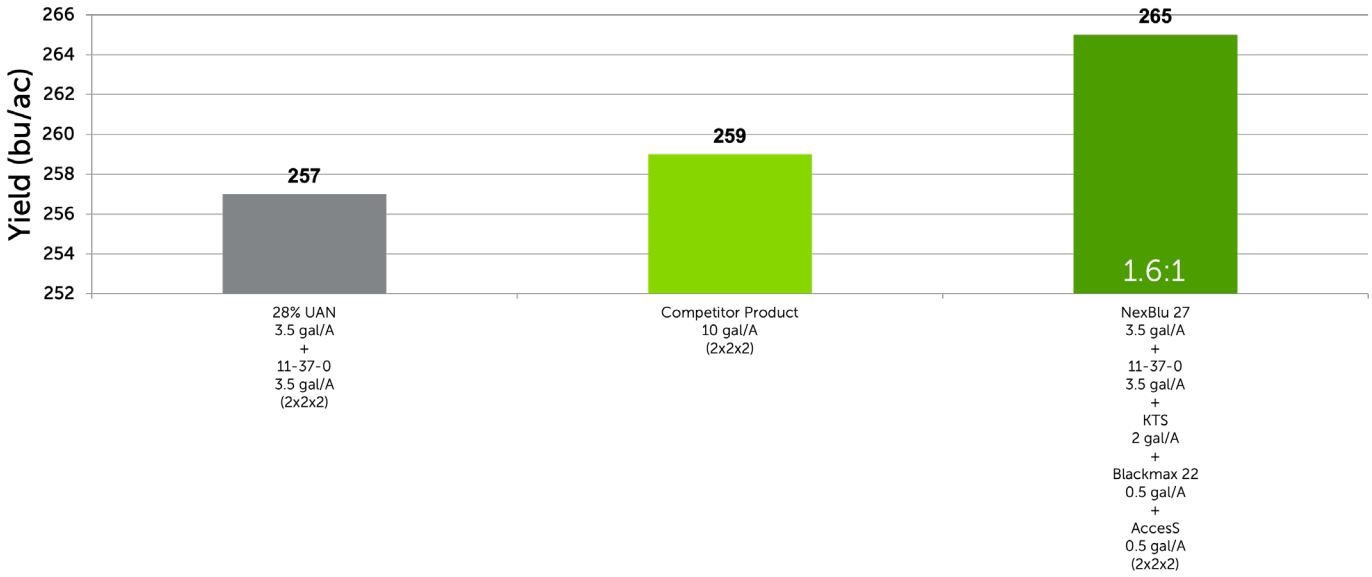


What We Learned:

- This study was to demonstrate starter fertilizer's potential benefits when used beyond traditional early planting dates.
- The trial was planted on May 2nd under near ideal conditions for rapid seed germination and seedling growth.
- There was a general absence of environmental stress the first few weeks after planting, but Riser applied in-furrow still increased yield by 7 bushels and net revenue by $12.75 per acre.
- Results reaffirm value of placing phosphorus and key micronutrients in-furrow at any planting date to increase root mass and position plants for increased water and nutrient absorption through the growing season.

RISER® (7-17-3 with Zn, Mn, Cu & Fe) is a low salt, root zone safe, at-plant starter fertilizer designed for banded and in-line application. Riser contains Acetate Technology and a chelated suite of micronutrients. Riser applied at-planting provides essential nutrients to tender emerging crops.

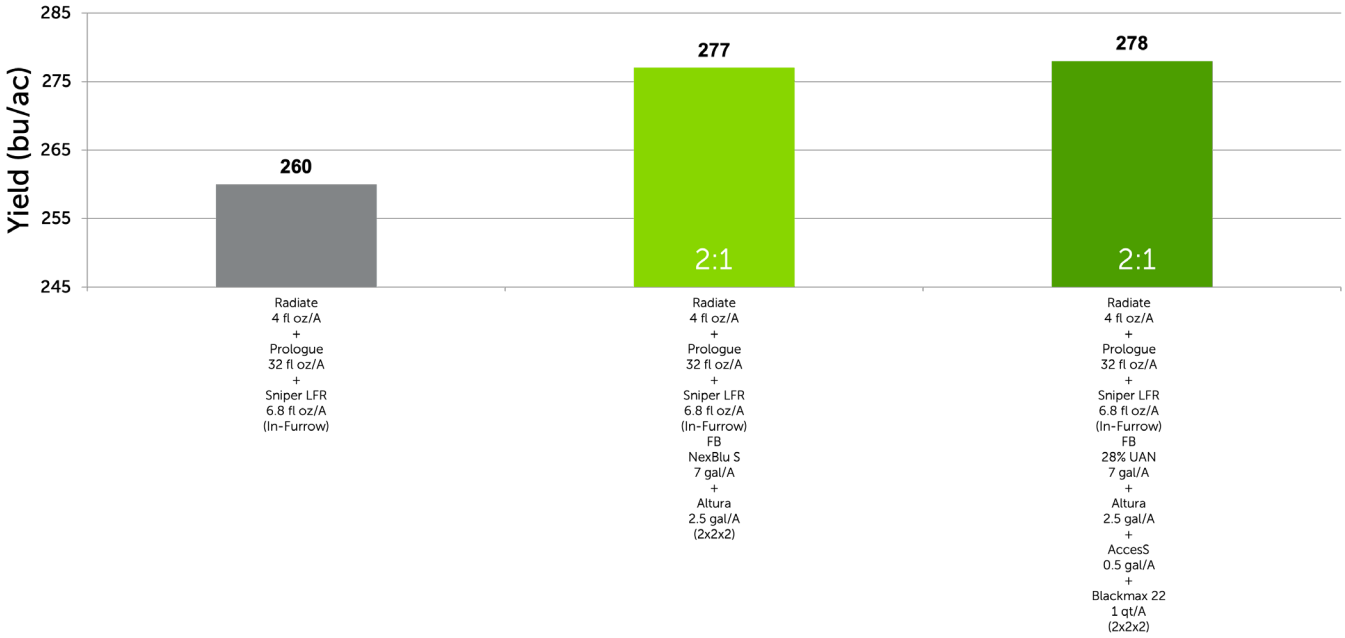
Enhanced 2x2x2 Programs in Corn



What We Learned:

- Utilizing 2x2x2 application systems facilitate safely banding higher nutrient amounts on both sides of the row at planting, without fear of germination and emergence issues due to higher fertilizer salt indexes.
- Dual banding positions nutrients for optimal root interception and absorption early in plant development, before they reach nutrients from a typical broadcast or side-dress application.
- The effective analysis of each treatment is as follows: Treatment 1 is 19-20-0, Treatment 2 is 14-14-4-5S, and Treatment 3 is 13-14-6-4.5S with trace Zinc, Manganese and Iron.
- The custom blend for increased nutrient use efficiency and soil microbial activity in Treatment 3 generated a net revenue of $34 per acre over the competitor product.
- This study highlights Nutrien Ag Solutions' ability to customize and blend enhanced fertility mixes that meet each customer's unique needs.

In-Furrow + 2x2x2 At-Plant Nutrition Programs in Corn



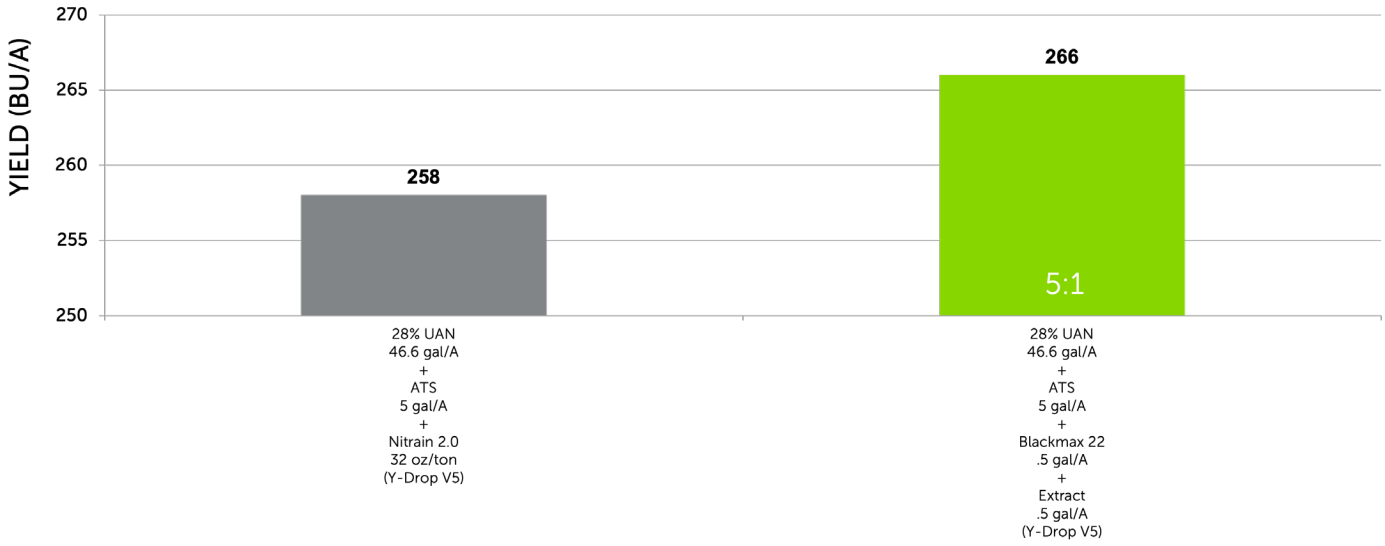
What We Learned:

- Outfitting corn planters with both in-furrow and 2x2x2 fertilizer delivery systems has been a growing trend of late for two compelling reasons. First, the combination facilitates meeting seedlings' immediate nutritional and stress protection needs at emergence with in-furrow placement of low-salt, seed-safe starters, plant growth regulators (PGRs) or other products. Secondly, the dual banding aspect of 2x2x2 systems permits applying larger fertilizer quantities on both sides of the row for highly efficient, extended nutrient uptake as the crop progresses vegetatively.
- In-furrow application of Radiate + Prologue + Sniper LFR formed the study's base treatment. Radiate is Loveland's popular PGR; when placed with the seed it spurs outstanding early plant vigor and root growth, including increased development of root hairs essential for water and nutrient absorption. Loveland's Prologue combines two technologies that improve phosphorus (P) solubility and availability to the plant; it also contains zinc for supporting excellent early root growth and other critical plant functions. Sniper LFR insecticide protects against a broad spectrum of secondary pests such as wireworm, black cutworm and grubs.
- It's noteworthy that apart from the Zn in Prologue, the base treatment contained no other nutrients. It was largely designed to quickly propel and protect the young root system, while aligning with the 2x2x2 programs to make them more efficient in carrying the actual fertility load. For example, Prologue in-furrow supported improved uptake of the P supplied by Altura banded in the 2x2x2 programs.
- The 2x2x2 applications in Treatments 2 and 3 targeted a nitrogen-to-sulfur ratio of 10:1 to guide efficient plant utilization of both nutrients. The NexBlu S + Altura combination in Treatment 2 delivered organic acids (carbon-containing compounds), carbohydrates and a biochemical fertilizer catalyst that together fostered increased uptake and efficiency of N, P, S and other nutrients to drive higher yields.
- Treatment 3 essentially replaced the NexBlu S in Treatment 2 with a combination of 28% UAN and AccesS, a sulfur-containing product. The addition of Blackmax 22 in Treatment 3 also gave it a slightly higher load of organic acids compared to Treatment 2.
- Treatment 2 resulted in an increase of 17 bushels and $45.46 in net revenue per acre, while Treatment 3 resulted in an increase of 18 bushels and $43.92 in net revenue per acre.

SIDE-DRESS ENHANCEMENTS AT V5

Blackmax 22, Extract & the Y-Drop System

Nitrogen Use Efficiency Study In Corn

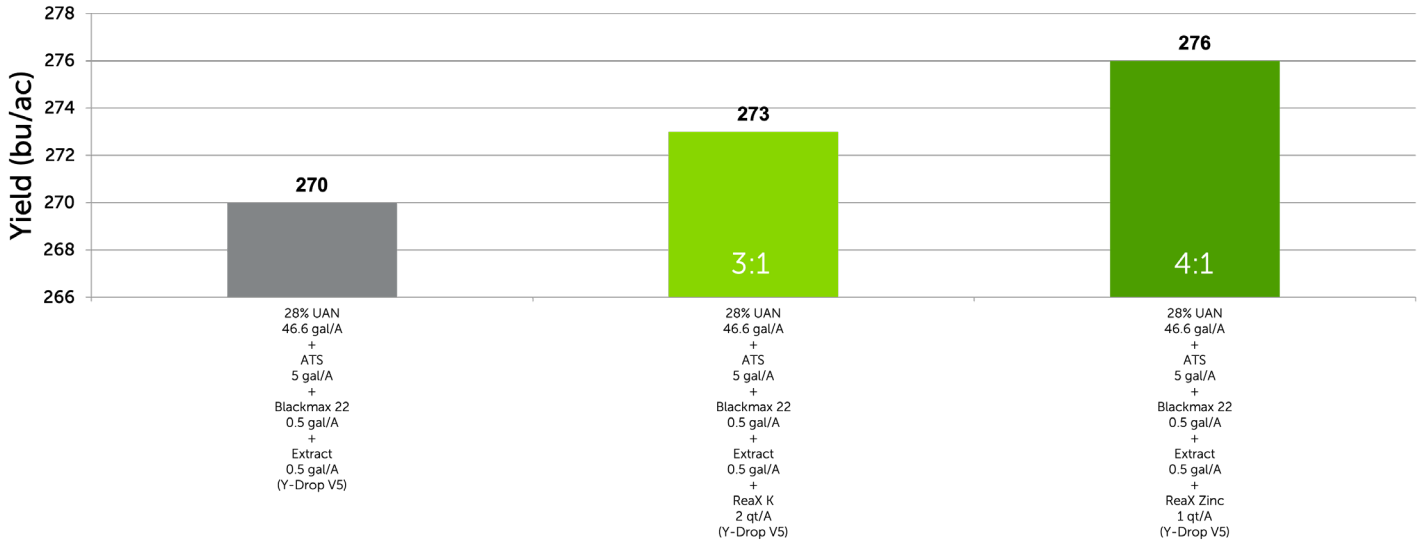


What We Learned:

- Both treatments received 60 lbs. actual Nitrogen/acre at preplant as surface-applied UAN protected with Nitrain 2.0 against volatility loss and an additional 146 lbs. actual Nitrogen/acre at V5 with a Y-drop side-dress application.
- Extract and Blackmax 22 previously have been well documented for their respective activity in improving nitrogen use efficiency. While Nitrain 2.0 is an excellent urease inhibitor, it lacks the added benefits these products offer.
- Extract accelerates release of nutrients trapped in old crop residue or bound in the soil. Blackmax 22 enhances existing nutrient mineralization from organic matter and promotes beneficial microbe growth.
- Treatment 2 provided an increase of 8 bushels and $29.23 net revenue per acre.
- Over the past two years, the Owensboro farm as averaged a 7 bushel increase and 5 to 1 ROI when applying Blackmax 22 and Extract with Nitrogen at side-dress.

SIDE-DRESS ENHANCEMENTS AT V5

Enhanced Y-Drop Side-Dress Treatments in V5 Corn

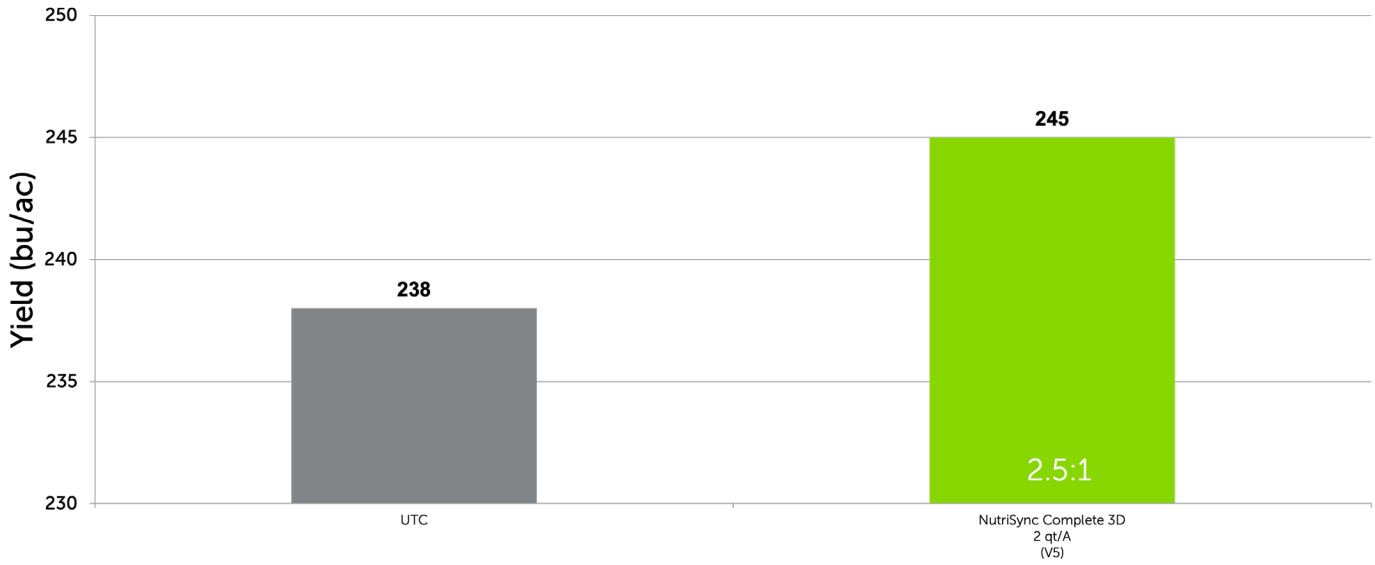


What We Learned:

- This study examines the potential benefits of additional nutrients with Nitrogen side-dress programs already enhanced with Extract and Blackmax 22, which have demonstrated positive results over the past 2 years.
- Both treatments received 60 lbs. actual Nitrogen/acre at preplant as surface-applied UAN protected with Nitrain 2.0 against volatility loss and an additional 146 lbs. actual Nitrogen/acre at V5 with a Y-drop side-dress application.
- The addition of ReaX K improved yield by 3 bushels with an ROI of 1.5 to 1 for a net revenue of $5.25 per acre, while adding ReaX Zn improved yield by 6 bushels with an ROI of 4 to 1 for a net revenue of $24 per acre.
- Prior to the start of the trial soil tests showed Zn was deficient, proving the side-dress application in Treatment 3 was very effective.

FOLIAR NUTRITION AT V5

NutriSync Complete 3D in V5 Corn



What We Learned:

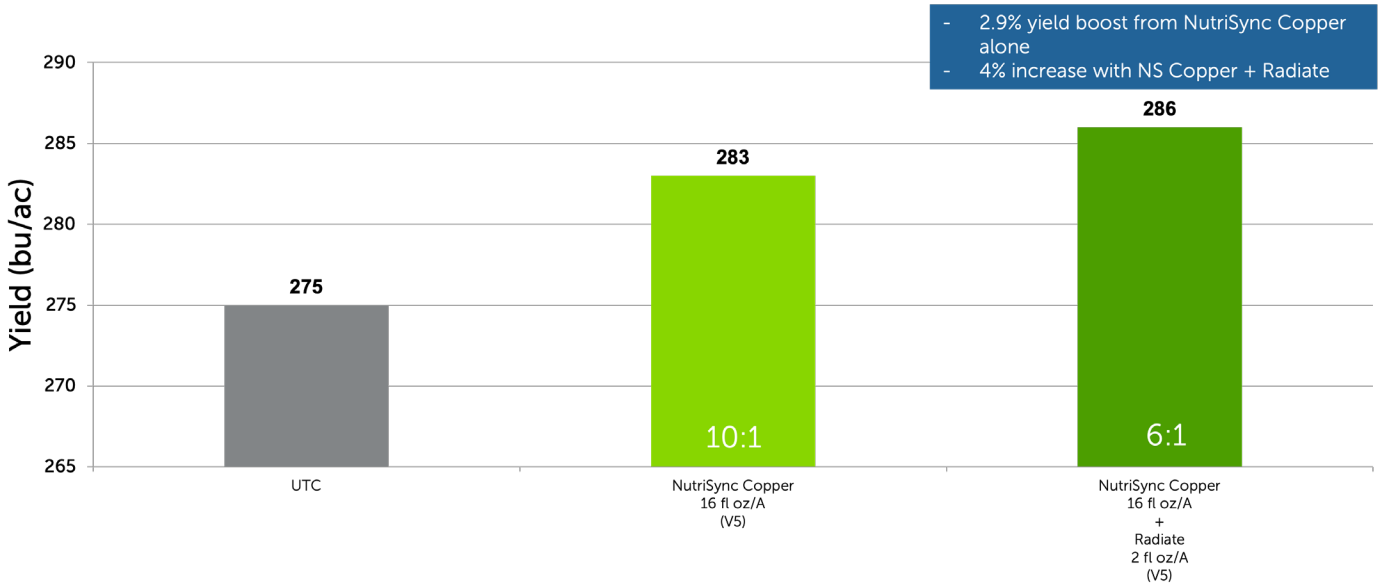
- NutriSync Complete 3D is an excellent addition to a post emergence corn herbicide application.
- When applied at V5, NutriSync Complete 3D boosted corn yield by 7 bushels with an ROI of 2.5 to 1 generating $21.75 more net revenue per acre.
- Across the three recent growing seasons, each very different than the other, NutriSync Complete 3D has performed consistently, delivering an average 6.3 bushel yield response and 2 to 1 ROI.

NutriSync Complete 3D

NUTRISYNC® COMPLETE 3D (10-4-6 with Zn, Mn, Cu, Fe, B, Co & Mo) is a fully formulated foliar nutrition tool powered by NutriSync, Loveland's premium foliar transport technology, and contains key macro- and micronutrients. NutriSync technology helps growers Load, Haul and Deliver nutrients critical for growth and development to areas that are most needed – providing better utilization of nutrients to fulfill plant demands.

FOLIAR NUTRITION AT V5

Foliar Copper in V5 Corn



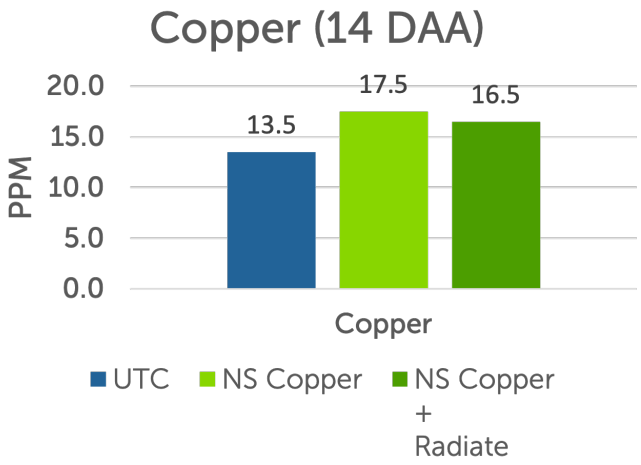
What We Learned:

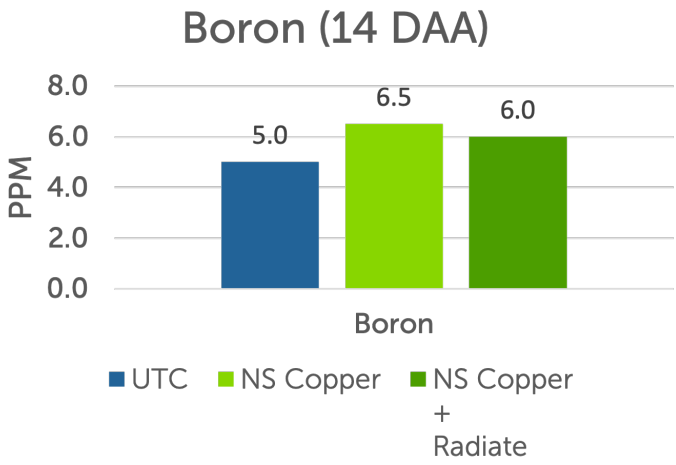
- Corn grown on medium-to-finer textured soils in this region typically has not responded significantly to supplemental Copper fertilization, however recently responses on coarse-textured, lower CEC soils has been noted.
- The soil Copper level was at the low end of optimum range when the trial began, proving a V5 application is highly effective at bolstering yield, improving micronutrient mobility and generating a strong ROI.
- NutriSync Copper not only improved the corn tissue Copper level at 14 days after application, but also the Boron, Zinc and Manganese levels as well.
- The addition of Radiate further increased the yield response and net revenue, supporting the need for additional Copper fertility studies in corn.

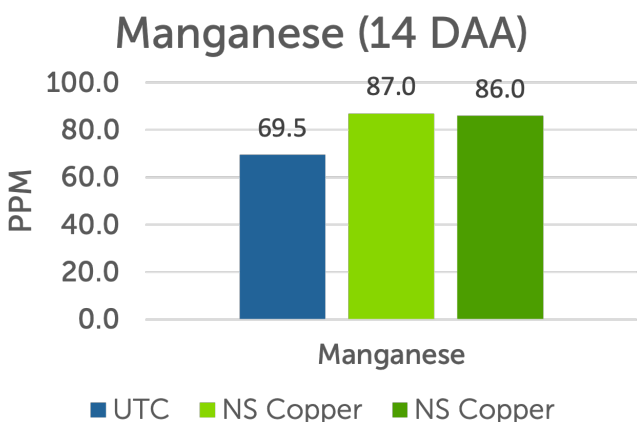
NutriSync Copper

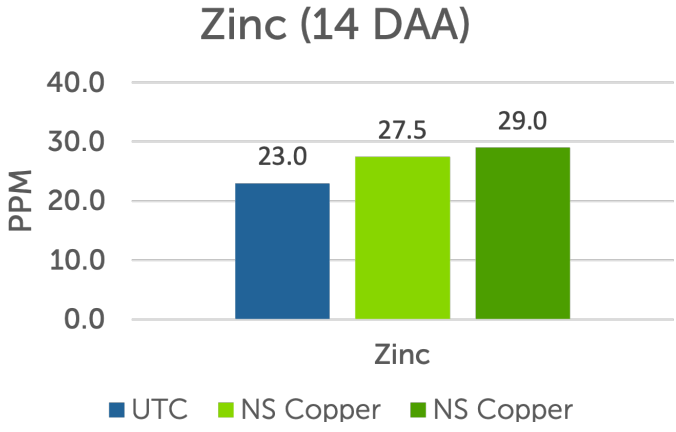
NUTRISYNC® COPPER (8-0-0 4.5CU) is a liquid foliar nutritional formulated with Loveland's premium foliar uptake technology to enhance the physiological activity and growth of copper demanding crops. The NutriSync platform helps plants more efficiently mobilize and utilize applied nutrients as well as those that are already within the plant, enhancing crop growth throughout the season.

Micronutrient Tissue Levels[1] Following NutriSync Copper Treatment





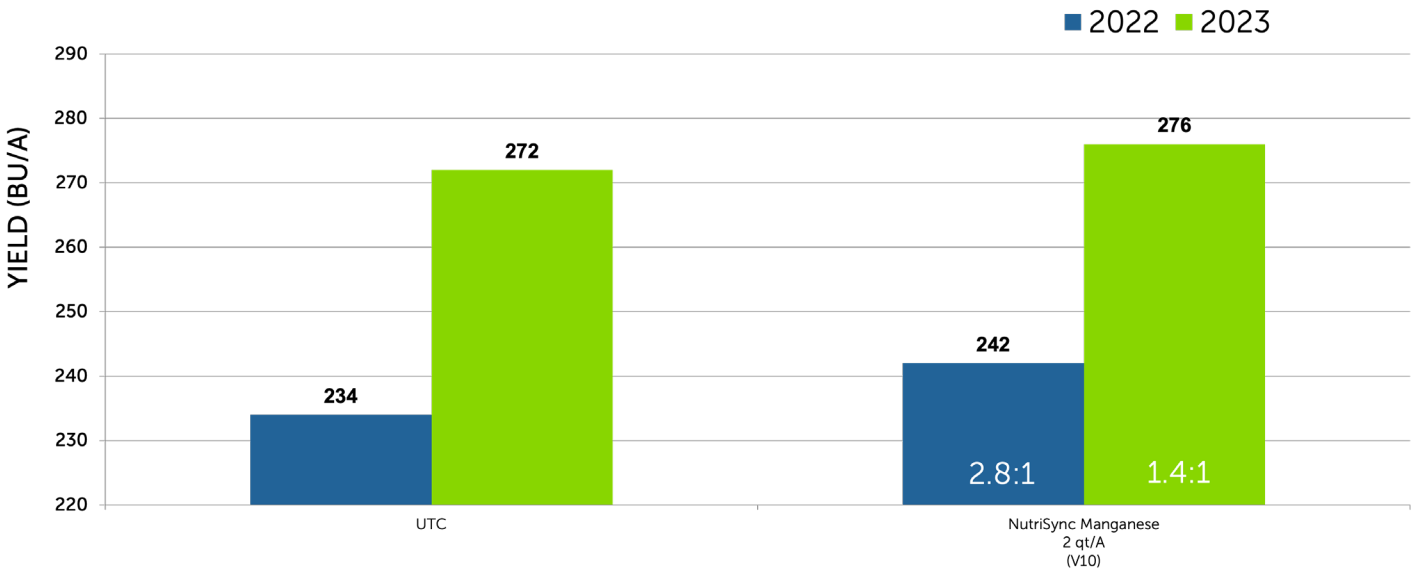




[1]Tissue levels of other essential nutrients (N, P, K, Mg, Ca, S and Fe) were not significantly affected by the treatments at 14 days after application (DAA).

FOLIAR NUTRITION AT V10

NutriSync Manganese in Corn



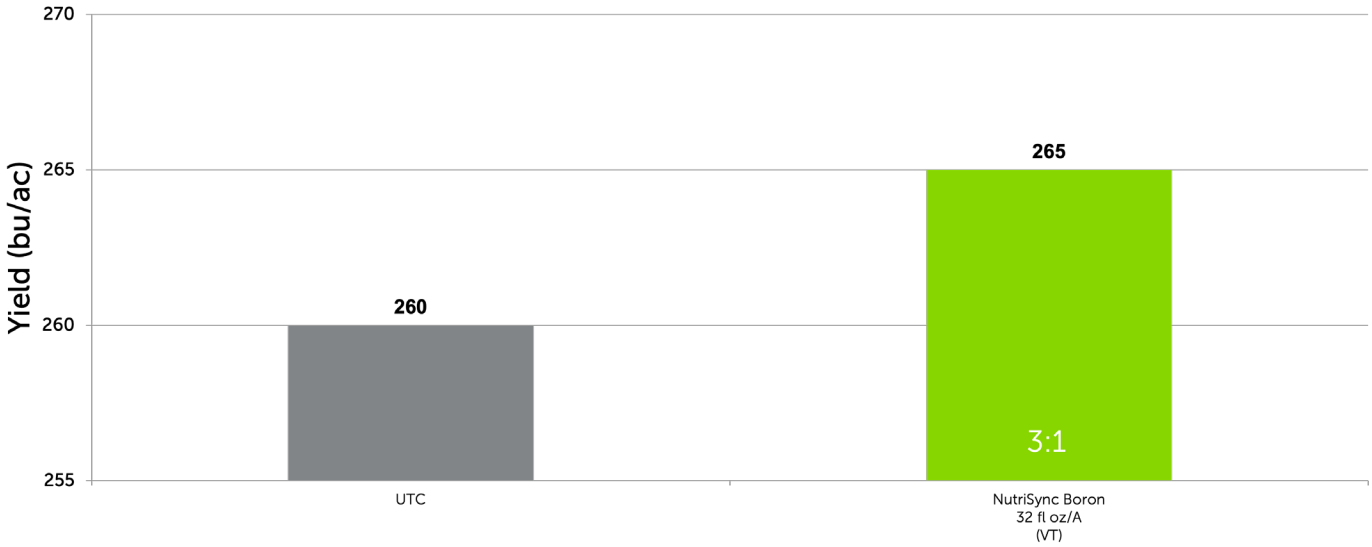
What We Learned:

- Manganese is essential to chlorophyll production and photosynthesis for carbohydrate metabolism, redox reactions, enzyme activation and hormone balancing.
- A pre-application tissue test showed Manganese levels were sufficient, but the NutriSync Mn treatment showed a nutrient level increase of 5 ppm tested 14 days after application and increased yield by 4 bushels per acre.
- After four consecutive years of NutriSync Mn testing the average yield response has been 7 bushels with an ROI of 2.5 to 1 when applied at V10.

NutriSync Manganese

NUTRISYNC® MANGANESE 3% efficiently delivers manganese to enhance plant physiological activities and support growth of various crops. NutriSync remobilizes nutrients within the plant, especially to growing parts of the plant. NutriSync technology has been proven to increase assimilation, mobilization, and utilization of nutrients inside the plant.

Foliar Boron in VT Corn



What We Learned:

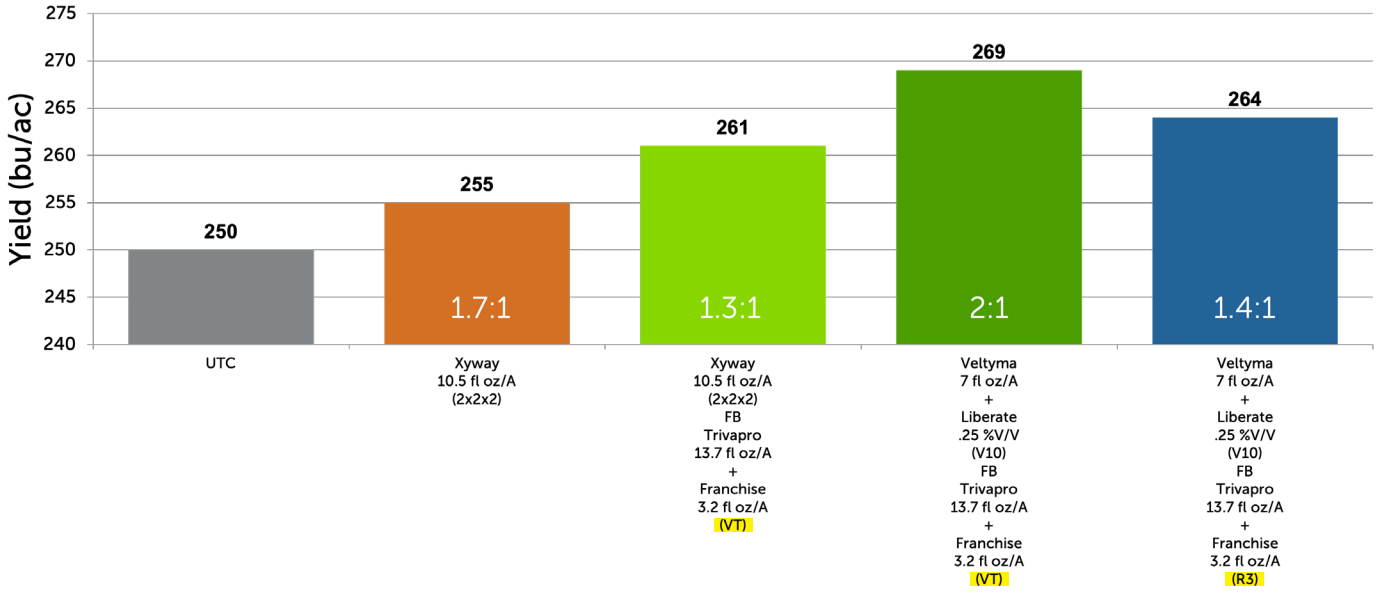
- Boron is naturally immobile in the plant, but increases pollen and silk viability and aids protein synthesis, carbohydrate metabolism, hormone formation and sugar movement.
- NutriSync Boron features Loveland's "Nutrient Transport Technology" that increases movement of this immobile micronutrient to plant growing points where it is needed most.
- When applied at VT, NutriSync Boron increased yield by 5 bushels resulting in an ROI of 3 to 1 and additional net revenue of $18.07 per acre.
- From 2020 to 2023, NutriSync Boron has performed consistently when applied at VT, resulting in a four year average yield increase of 4.3 bushels per acre and 3 to 1 ROI.

NutriSync Boron

NUTRISYNC® BORON 5% is a unique foliar technology specifically designed to enhance plant physiological activities and growth of various crops. NutriSync remobilizes nutrients within the plant, especially to growing parts of the plant. NutriSync technology has been proven to increase assimilation, mobilization, and utilization of nutrients inside the plant.

SEASON LONG DISEASE PROTECTION

Sequential Fungicide Programs in Corn

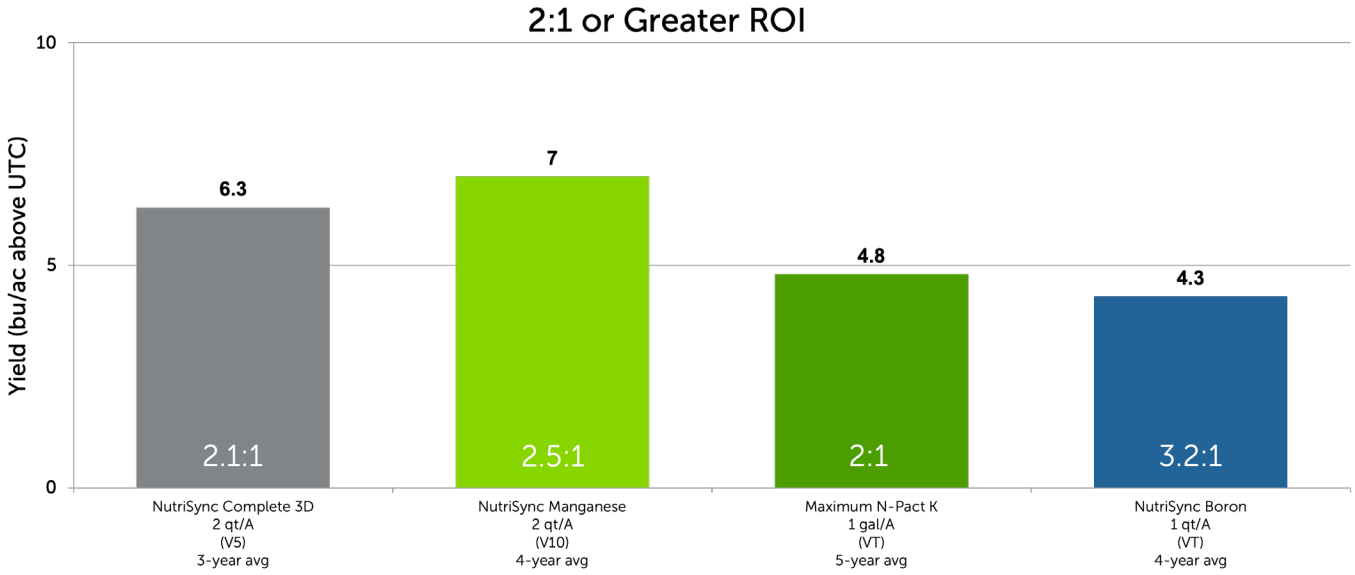


What We Learned:

- Study designed to evaluate potential merits of multiple, in-season corn fungicide applications.
- Overall, corn disease pressure during 2023 at the Owensboro Innovation Farm could best be described as moderate, especially during crop reproductive stages.
- All treatments produced positive yield responses and ROIs.
- Data corroborates long-term observations within the corn industry that the VT growth stage remains the optimal application timing for achieving superior yield response from foliar fungicides in most circumstances.

Corn Foliar Nutritionals

Multi-Year Performance Consistency *(multi-year averages)*



What We Learned:

- Several foliar nutritionals in the Loveland Products portfolio have demonstrated consistently positive impacts on corn yield and ROI over multiple testing seasons at the Owensboro Innovation Farm.
- Whether attempting to correct in-season deficiencies or simply pushing a crop's overall nutritional status, growers can apply these products with confidence that they'll consistently deliver strong results across a diverse range of field and weather environments.

NutriSync Complete 3D

NUTRISYNC® COMPLETE 3D (10-4-6 with Zn, Mn, Cu, Fe, B, Co & Mo) is a fully formulated foliar nutrition tool powered by NutriSync, Loveland's premium foliar transport technology, and contains key macro- and micronutrients. NutriSync technology helps growers Load, Haul and Deliver nutrients critical for growth and development to areas that are most needed – providing better utilization of nutrients to fulfill plant demands.

NutriSync Manganese

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NutriSync Boron

NUTRISYNC® BORON 5% is a unique foliar technology specifically designed to enhance plant physiological activities and growth of various crops. NutriSync remobilizes nutrients within the plant, especially to growing parts of the plant. NutriSync technology has been proven to increase assimilation, mobilization, and utilization of nutrients inside the plant.

Maximum N-PACT K 12-0-12

MAXIMUM N-PACT® K is an enhanced slow-release nitrogen which provides a stable source of foliar nitrogen with the addition of potassium for increased uptake, translocation and utilization of nitrogen and potassium, with excellent crop safety and increased stress tolerance.


AVENGER

SLUG ENCOUNTER AT NUTRIEN INNOVATION FARM PROVES INSIGHTFUL

Slugs continue to be a perennial threat to soybean plant establishment. If anything, springtime encounters with this menacing mollusk appear to be growing worse.

In 2017, an intense slug outbreak forced farmers across several western Kentucky counties to replant an estimated 150,000 soybean acres at an expense of roughly $7 million. Though episodes aren't always as geographically concentrated and serious as that one was, slugs come calling in soybeans somewhere every year.

The Nutrien Innovation Farm at Owensboro, KY had its own run-in with this pest in spring 2023. Early- to mid-April brought favorable weather and soil conditions for planting several of the farm's soybean trials, which were no-tilled into cornstalks.

Initial germination and emergence were good. But a stretch of cooler weather just after mid-April slowed soybean seedling growth considerably. And it was then the farm's staff noticed stands in some areas of their research plots were backsliding. It didn't take long to discover the cause.

"We scouted and found a substantial population of newly-hatched slugs was consuming plant tissue at a faster rate than the soybean seedlings were able to grow, compensate and get ahead of the pest," says farm manager Ryan Neely.

His observation parallels a common theme surrounding environments that favor slug activity. Though wet/cool conditions after planting are poor for soybean plant development, they're great for slugs. They typically are most active in April through June. Slugs feed primarily at night and on cloudy days. To avoid sun exposure, they keep their slime-covered bodies hidden beneath residue, soil clods or unsealed seed furrows.

A small, juvenile slug will take from three to five months to reach adulthood. But it's newly hatched specimens that typically are most damaging to crops.

That's precisely what Neely and his staff saw. "High numbers of small slugs, initially about ¾- to 1-inch long, were attacking and feeding on soybean cotyledons as soon as they emerged and unfolded," he explains. "When finished with the cotyledons, slugs moved to the apical meristem where the unifoliate leaves were attempting to open and ate them, too. That destroyed seedlings' growing points and reduced stand counts."

The fact these were no-till soybeans emerging in cornstalks only aided the slugs' activity. Work at the University of Kentucky (UK) and elsewhere consistently shows heavy old crop residue contributes to greater slug numbers by keeping soils cool and moist. Soil temperatures in early spring under high residue can easily be 10 to 15°F cooler than in clean-tilled fields. High relative humidity, which also

favors slug development, tends to be significantly greater under thick residue, too.

The Innovation Farm first attempted to bring their slug problem under control by broadcasting Deadline M-Ps (Mini-Pellets) at 10 lbs/ac on the affected areas. Deadline M-Ps is a molluscicide "bait" comprised of the active ingredient metaldehyde. Prior to 2023 it was not approved for use on soybeans in Kentucky. However, a 24(c) Special Local Need label since was granted that permits Deadline M-Ps use in that state for slug control in soybeans through March 16, 2028.

How did it perform? "Deadline worked very well," reports Neely. "Where the spread pattern was good, it quickly stopped slug activity and gave the remaining soybean seedlings an opportunity to release and grow off.

"Unfortunately, windy conditions at application time hurt the spread pattern in a few areas, effectively reducing the Deadline rate. Slug activity remained serious in those spots. Since this was a research environment in which uniform stands are vital to ensure statistical accuracy, we decided to tear the original, slug-damaged stand up with a vertical tillage tool and replant. That resulted in a good stand" Neely explains.

However, he quickly adds that had this been a commercial soybean field, the overall plant population originally preserved by the Deadline treatment would have been adequate to justify keeping it and not replanting. "The molluscicide did its job," he reiterates. "It was just small holes in the spread pattern that forced us to replant in a research setting."

A 2021 UK study also confirmed molluscicide efficacy. Researchers there evaluated Deadline M-Ps and Sluggo, the latter slug bait featuring the active ingredient iron phosphate. Both products gave significant slug reduction for about 9 days following treatment versus the untreated control. Nine days often is a sufficient protective window for soybean seedlings to achieve adequate growth and essentially "outrun" slugs even if their activity resumes after molluscicide efficacy wanes.

The UK study found that the molluscicides not only killed slugs, but also reduced egg laying among surviving female specimens.

Various reports also indicate dry potash fertilizer may be somewhat effective killing slugs via salt desiccation activity. But potash's efficacy appears limited only to slugs physically present at treatment time and has no effect on egg laying when compared to true molluscicides. Furthermore, in fields where potassium soil test levels already are adequate to support crop yield goals, spreading potash to slow down slugs wouldn't be viable from a nutrient use efficiency standpoint.

Back at the Owensboro farm, Neely and his staff already are pondering their 2024 slug control strategy. Though they'd prefer to manage their test plots under a continuous no-till regime, slugs may force them toward some degree of tillage, especially when plantings soybeans early in cornstalks.

SOYBEANS

Planting Date: April 12th - May 18th

Variety: Dyna-Gro 38XF22 and 41EN72

Herbicide:

- Burndown- Makaze 40 oz/ac Salvo 12 oz/ac
- Pre-Emerge- 3 pt/ac Tribal, Intensity One 1 pt/ac
- Post-Emerge- Intensity One 1 pt/ac, Forfeit 280 1 qt/ac

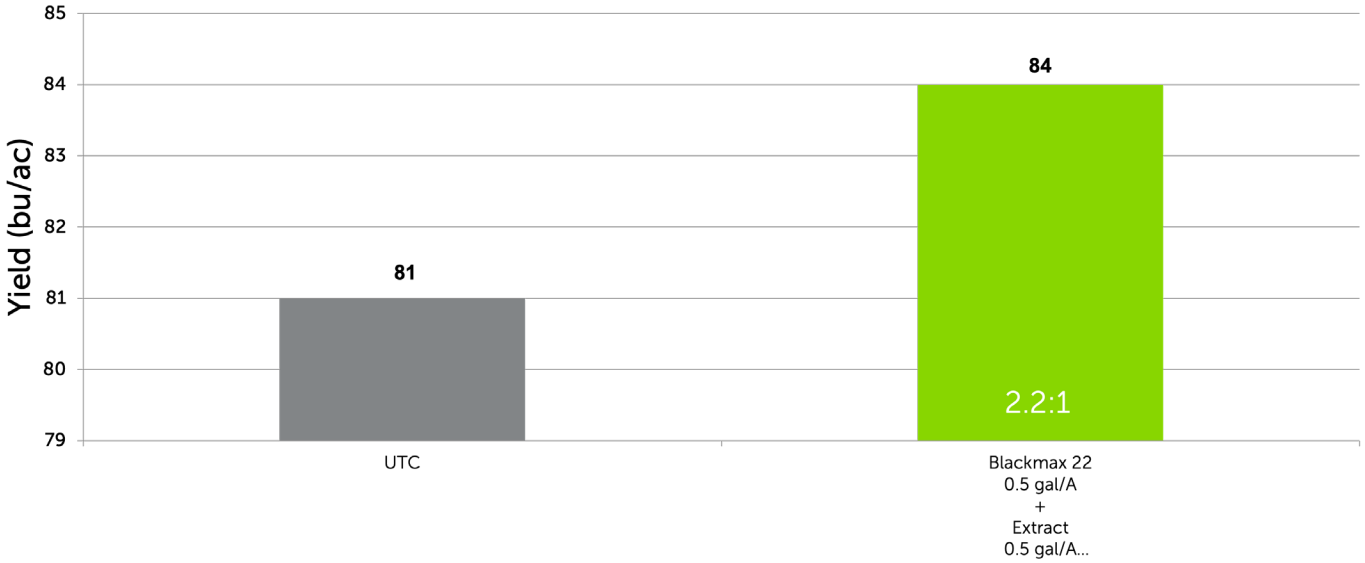
Fungicide:

- R3 Application of Miravis Top 13.7 oz/ac and Swagger 8 oz/ac

Harvest Date: 9/29-10/18

ROI'S CALCULATED AT $13.50/BU

Blackmax 22 + Extract at Burndown in No-Till Soybeans



What We Learned:

- The combination of Blackmax 22 and Extract improves soil properties, nutrient efficiency, and nutrient release from previous crop residue.
- Both products blend and perform well with burndown or pre-emergence herbicide applications
- This combination applied at burndown increased yield by 3 bushels and net revenue by $23.50 per acre for an ROI of 2.2 to 1.

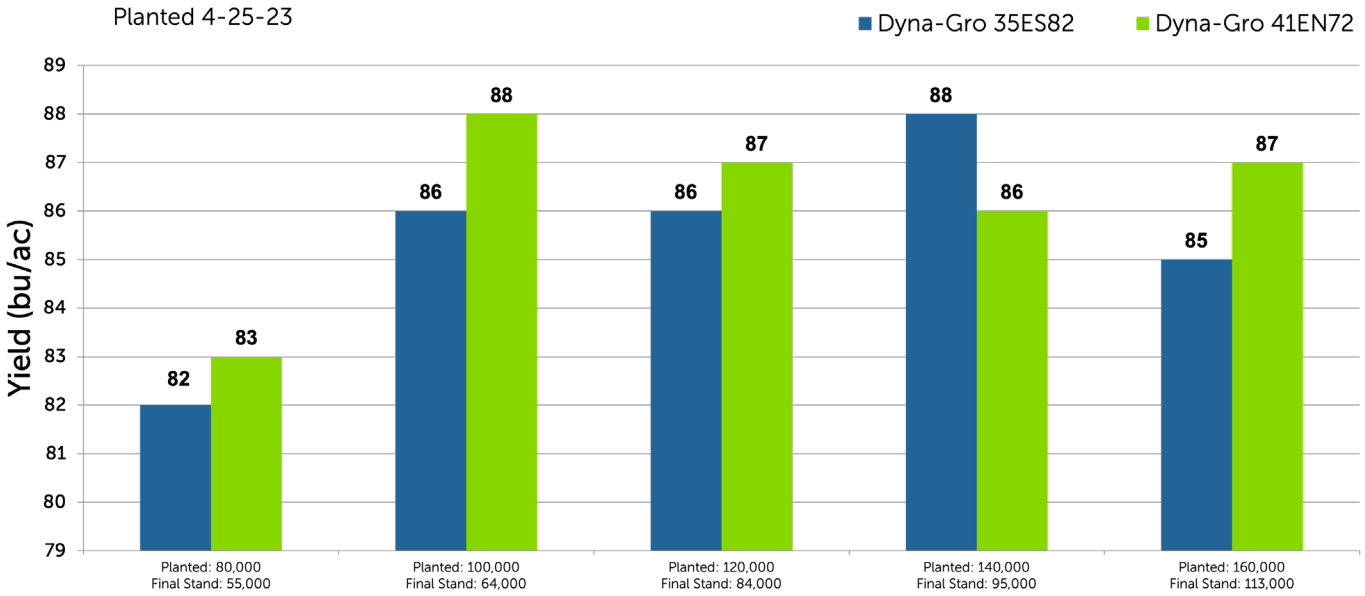
BLACKMAX® 22

BLACKMAX® 22, built with C^2 Technology, is a proprietary combination of extracted carbon and carbohydrates that reacts with your fertility program to increase nutrient availability and support positive soil attributes. As part of your fertilizer program, this powerful combination of extracted carbon and carbohydrates fosters beneficial soil microbe growth to strengthen your crop fertility program.

EXtract POWERED BY Accomplish

EXTRACT Powered by Accomplish® is a proprietary blend of proven fertilizer biocatalyst – Accomplish LM and a nitrogen source, designed to help growers not only manage crop residue but also easily and effectively optimize the release of nutrients from residue and those in the soil.

Variety x Population Study in Soybeans

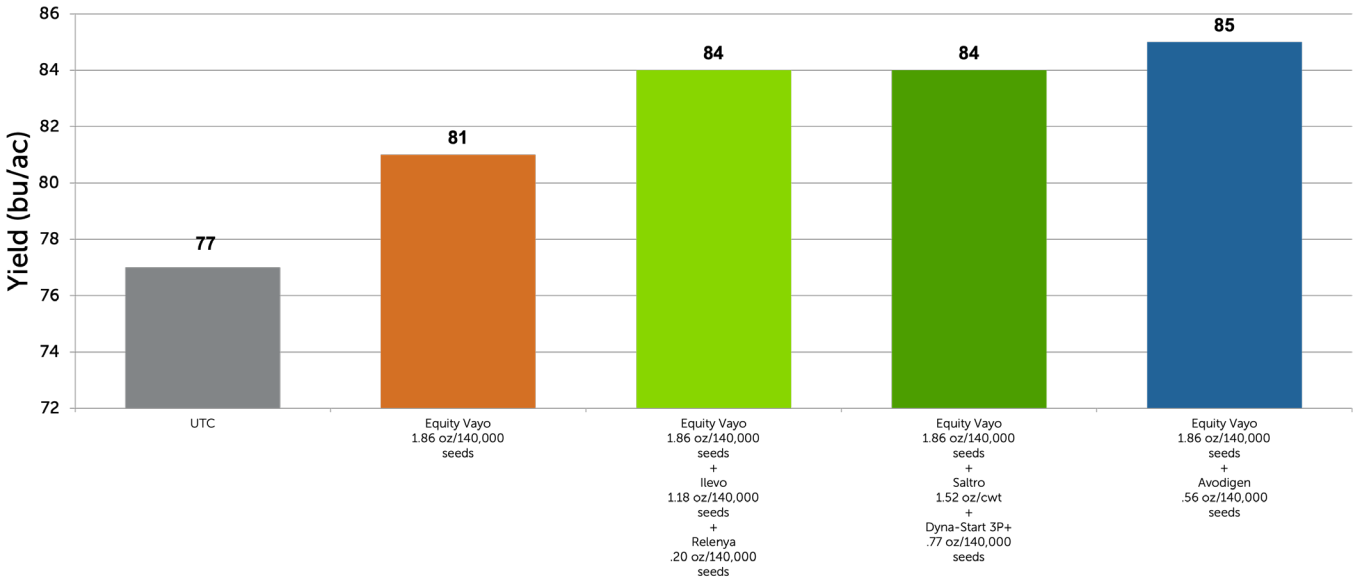


What We Learned:

- This study was part of an ongoing evaluation to determine optimal seeding rates in 15-inch row soybeans under early planting conditions.
- Cold soil temperatures and considerable slug damage during emergence and early seedling development stages uniformly reduced stands an average of 30%.
- Much like a similar study conducted at this location in 2022, no major yield differences were observed between seeding rates ranging from 80K to 160K. However, when the actual stand fell below 60K, there was a modest but statistically significant yield decrease.
- Apart from discouraging planting 80K or fewer seeds per acre at early planting dates, we otherwise make no specific seeding rate recommendations. However, data from the Owensboro farm and many other sources indicates full yield potential for a given field environment still can be achieved with final stands as low as about 60K. That's provided plants are uniformly spaced and a good weed, disease and insect control program is in place alongside a proper fertility regimen.
- Under good management, judicious use of lower seeding rates provides opportunities to reallocate dollars to other agronomic aspects of the soybean production budget.

PROTECTING YOUR INVESTMENT

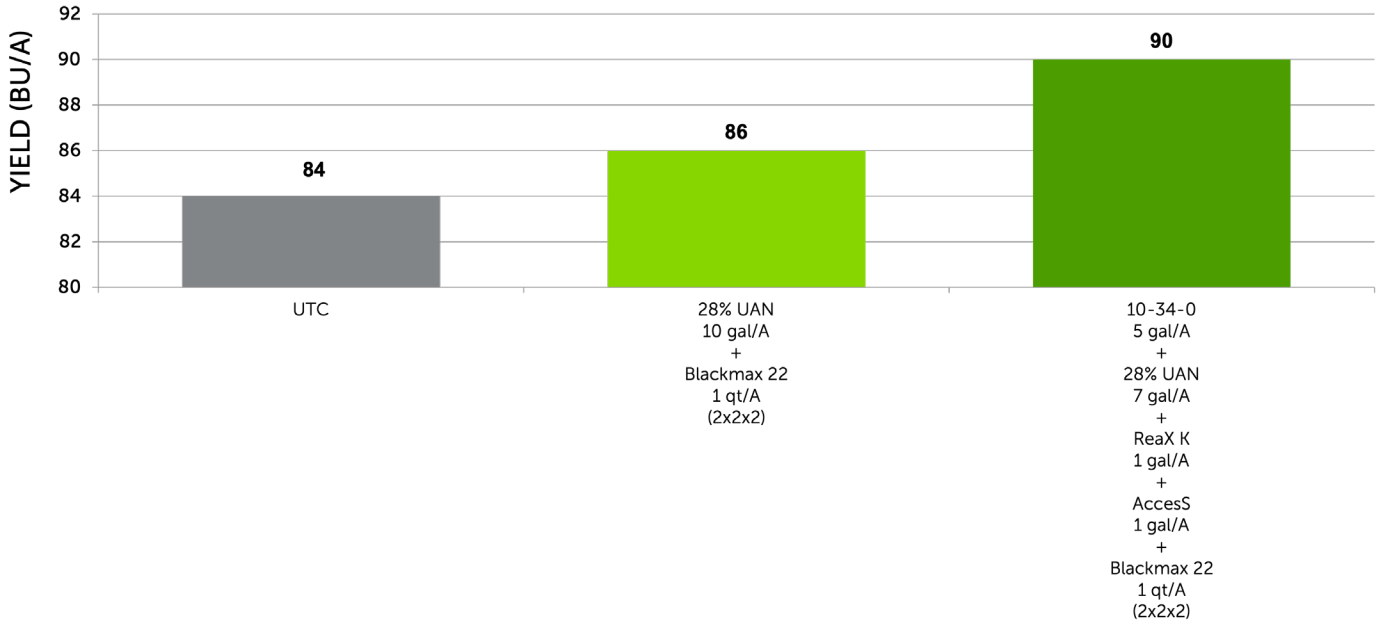
Seed Treatment Evaluation in Soybeans



What We Learned:

- Study showcases the efficacy of Loveland's premium soybean seed treatment product, Equity Vayo, both alone in conjunction with additional premium seed treatment offerings from other industry partners.
- The co-trend toward earlier soybean planting and lower seeding rates greatly increases the need to protect germinating seeds and seedlings from disease and insect pressure under soil and weather conditions that often are less than ideal for rapid growth and stand establishment.
- Seed treatments are one of the easiest and most cost-effective ways to provide early-season pest protection and ensure uniform, quality stands.
- Equity Vayo combines five fungicides (from five different mode of action groups) and an insecticide in a package that offers best-in-class Pythium control as well as excellent broad-spectrum control of other seedling diseases and key insects.
- Avodigen is an FMC biofungicide/bionematicide that offers protection from seedling blights and suppresses nematodes. It is highly compatible with Rhizobial inoculants and synthetic fungicide/insecticide seed treatments.
- Relenya and Ilevo are BASF offerings. Ilevo protects against Soybean Cyst Nematode and Sudden Death Syndrome. Relenya provides an additional fungicide component powered by Revysol.
- Syngenta's Saltro provides direct protection against Sudden Death Syndrome with indirect influence on SCN.
- Dyna-Start 3P+ from Loveland Products combines a Rhizobial inoculant, biofungicide and a package of plant growth regulators and biostimulants. It promotes faster germination, quicker root growth, increased root nodulation and nitrogen fixation, and inhibits or surpresses certain soilborne fungal pathogens that attack root systems.
- All treatments generated increases from 4-8 bushels per acre with ROIs exceeding 3 to 1.

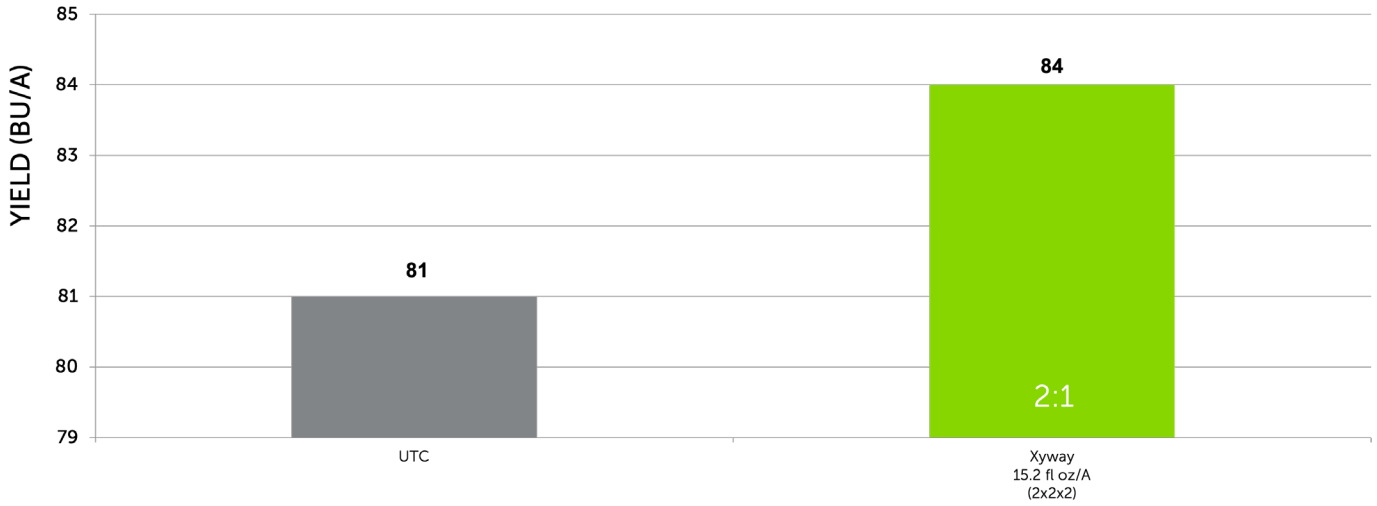
2x2x2 Programs in Soybeans



What We Learned:

- Though fertilizer placement in or near the seed furrow has not been common practice in soybean production systems, questions about the concept arise from growers each year.
- Drawing on available equipment at the Owensboro farm, this simple study examined a 2x2x2 placement configuration in which nutrients were dual banded down both sides of the row at planting.
- Since prior studies at the farm have shown benefits to supplemental nitrogen (N) application in high yielding soybean environments, a base treatment featuring 30 lbs/ac actual N as 28% UAN enhanced with Blackmax 22 was selected (Treatment 2). Other work has indicated 30 lbs of N at planting will not interfere with the activity of Rhizobia japonicum bacteria and normal root nodulation and N fixation processes.
- Treatment 3 added phosphorus, potassium and sulfur sources while holding the Nitrogen rate at 30 lbs/acres, as all nutrients are used in large quantities in high yielding environments.
- Treatment 2 delivered a 2 bushel yield increase and $6.13 in net revenue per acre, while Treatment 3 delivered a 6 bushel yield increase and $18.32 in net revenue per acre.

Xyway 2x2x2 in Soybeans

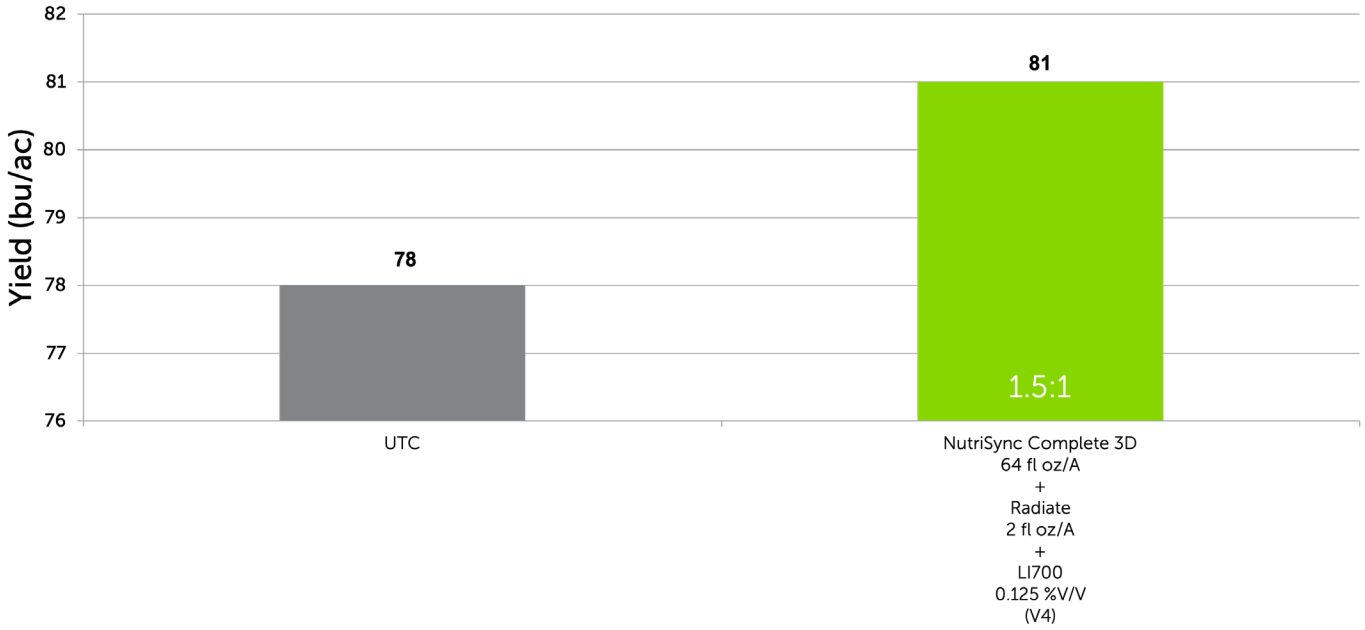


What We Learned:

- The Xyway (flutriafol) fungicide label now permits banding the product beside the row – not in direct contact with seed – in soybeans at planting.
- This study evaluated Xyway's efficacy at a full labeled rate when dual banded on both sides of the row with a 2x2x2 configuration.
- Xyway is systemic and readily taken up via root absorption as soybean plants grow. It provides season-long protection against foliar fungal pathogens listed on the label.
- Xyway at a full rate boosted yield 3 bu/ac (3.7%) and generated a 2:1 ROI. Results validate the product's efficacy when banded beside the row.
- Other Xyway rates and programs – perhaps involving nutritionals – will be evaluated going forward.

FOLIAR NUTRITION AT V4

NutriSync Complete 3D in V4 Soybeans



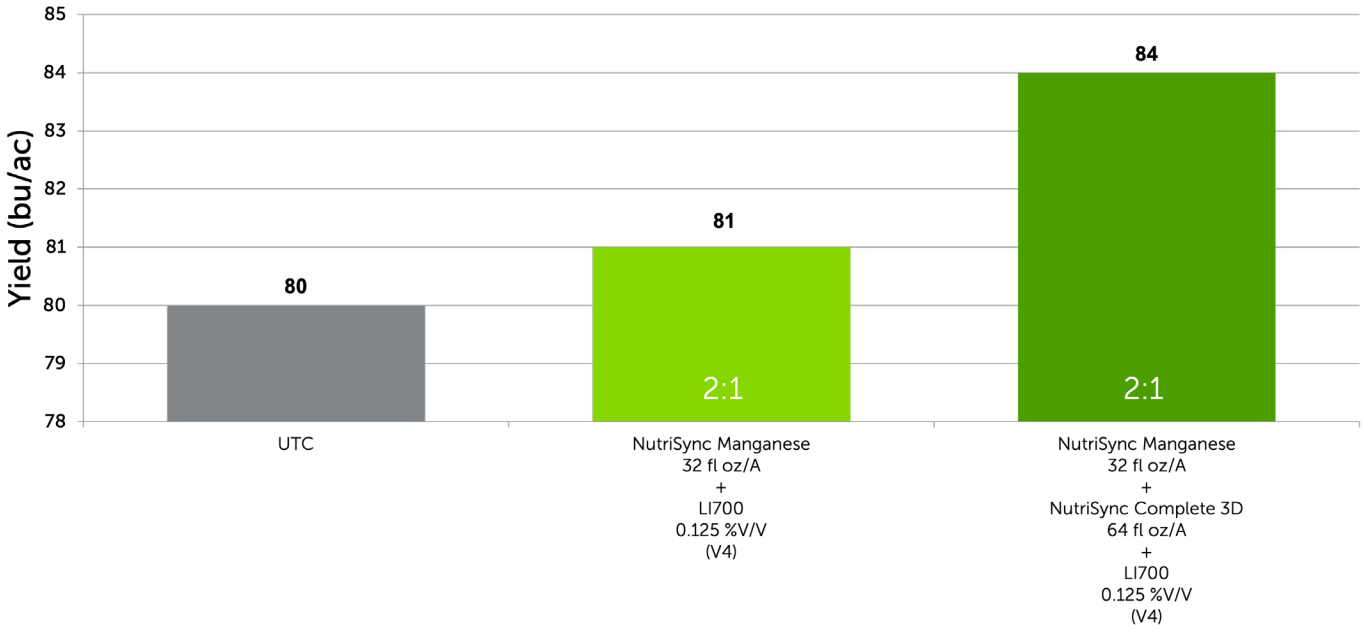
What We Learned:

- NutriSync Complete 3D is an excellent foliar nutritional to pair with post emergence herbicide applications in both corn and soybeans.
- In this trial NutriSync Complete 3D delivered a 3 bushel yield advantage and returned $1.50 for every dollar invested.
- NutriSync Complete 3D has generated a five year average yield response of 2.3 bushels and 2 to 1 ROI.

NutriSync Complete 3D

NUTRISYNC® COMPLETE 3D (10-4-6 with Zn, Mn, Cu, Fe, B, Co & Mo) is a fully formulated foliar nutrition tool powered by NutriSync, Loveland's premium foliar transport technology, and contains key macro- and micronutrients. NutriSync technology helps growers Load, Haul and Deliver nutrients critical for growth and development to areas that are most needed – providing better utilization of nutrients to fulfill plant demands.

Foliar Manganese in V4 Soybeans



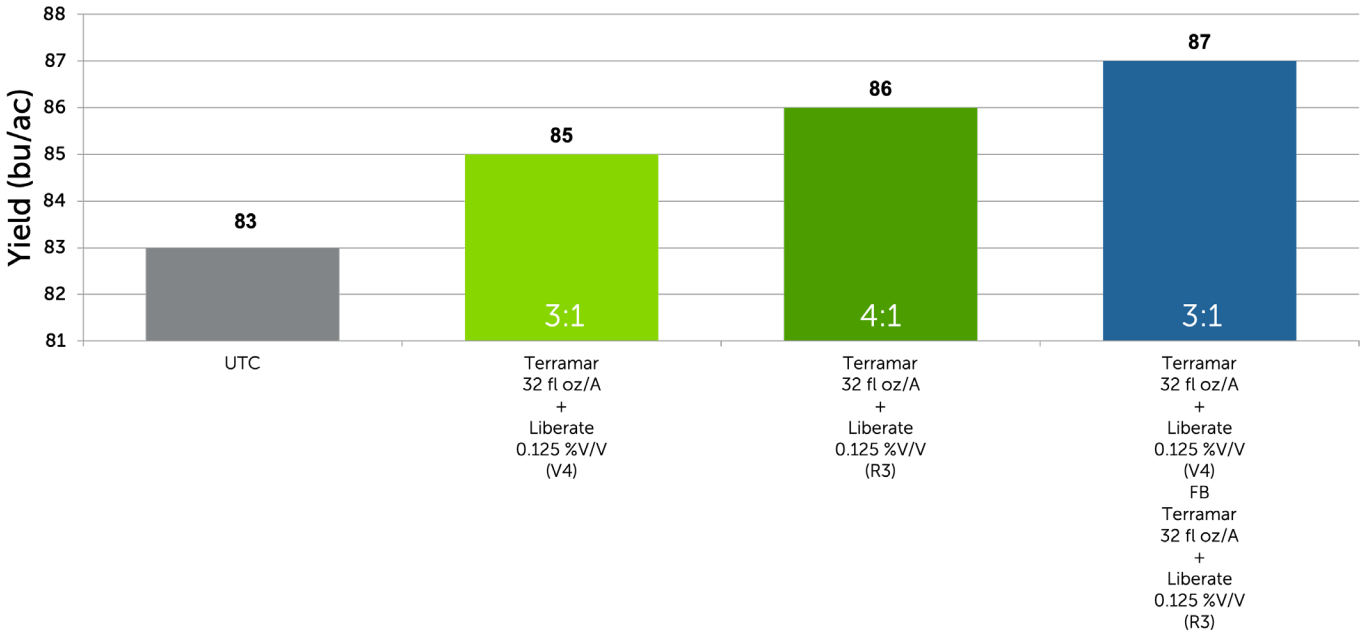
What We Learned:

- Manganese is essential to chlorophyll production and photosynthesis for carbohydrate metabolism, redox reactions, enzyme activation and hormone balancing.
- Treatment 2 increased yield by 1 bushel per acre with a 2 to 1 ROI, while Treatment 3 increased yield by 4 bushels with a 2 to 1 ROI.
- All treatments showed sufficient Manganese levels in tissue tests 14 days after application, however Treatments 2 and 3 had levels 7 ppm higher.
- Applications of NutriSync Manganese has resulted in an average yield increase of 1.8 bushels and 2 to 1 ROI.

NutriSync Manganese

NUTRISYNC® MANGANESE 3% efficiently delivers manganese to enhance plant physiological activities and support growth of various crops. NutriSync remobilizes nutrients within the plant, especially to growing parts of the plant. NutriSync technology has been proven to increase assimilation, mobilization, and utilization of nutrients inside the plant.

Foliar Terramar in V4 and R3 Soybeans



What We Learned:

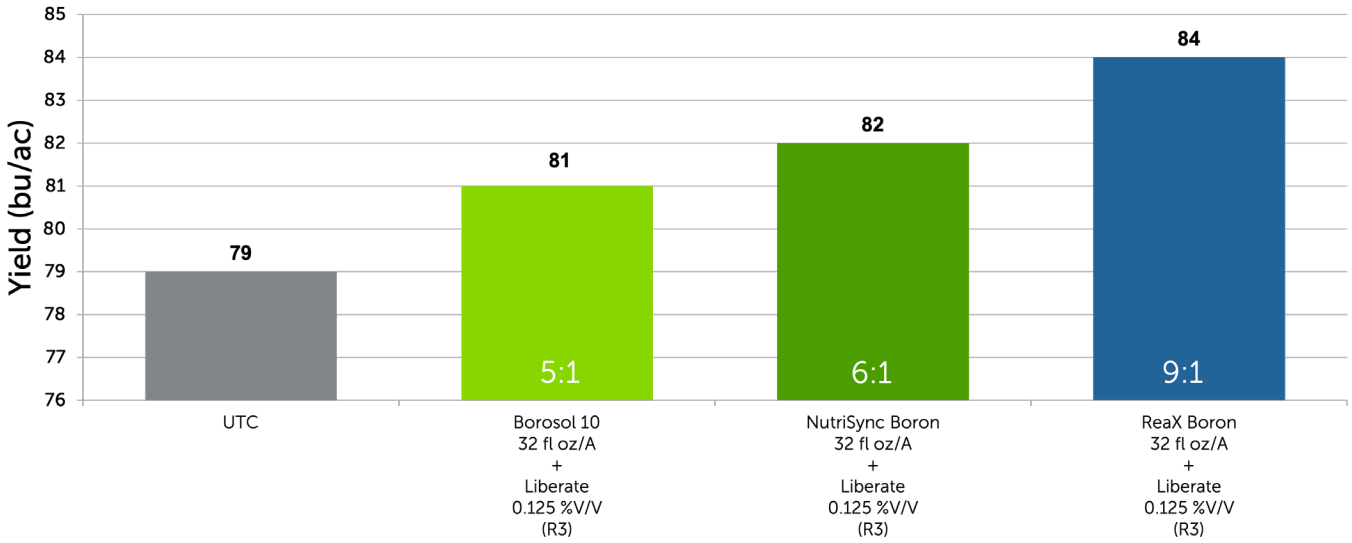
- Terramar is compatible with many tank mixes, effective across a wide range of crop growth stages. It optimizes plant performance by reducing abiotic stress and enhancing nutrient uptake.
- Treatment 2 generated an additional $17.71 in net revenue per acre, while Treatments 3 and 4 generated an additional $31.21 and $35.42, respectively, in net revenue per acre.

TERRAMAR® is a proprietary blend of biologically digested seaweed and leonardite designed to increase nutrient uptake, mitigate abiotic stress response, enhance CEC and chelation. Terramar delivers unique metabolic compounds to enhance microbial activity in the rhizosphere and improve plant response to stressful conditions. Terramar is compatible and complimentary with fertilizer systems to promote plant health and performance.

LIBERATE® is an uptake enhancing surfactant blend. Liberate is designed for use with pesticides that recommend a non-ionic surfactant, and works especially well with systemic chemistry, reducing driftable fines.

FOLIAR NUTRITION AT R3

Foliar Boron in R3 Soybeans



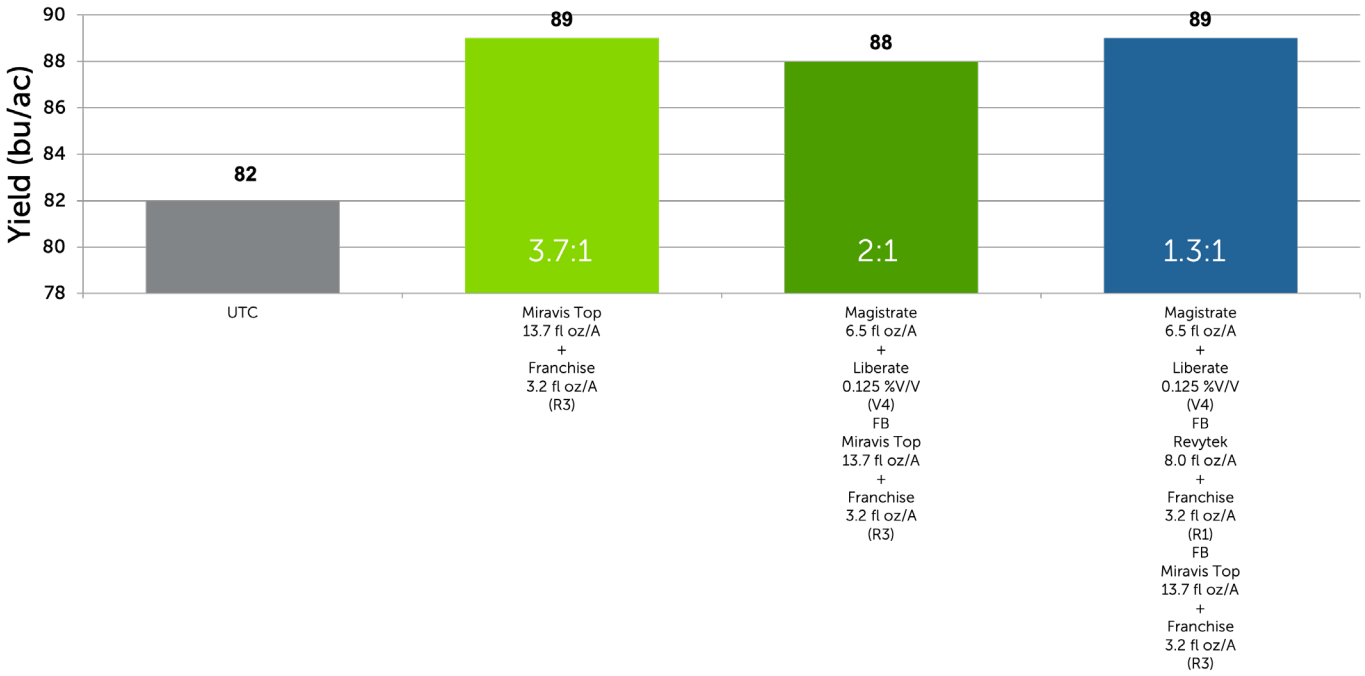
What We Learned:

- This study highlights the performance of basic and premium foliar boron products in soybeans.
- Boron is naturally immobile in the plant, but promotes flowering, pollination, grain fill and yield.
- Pre-plant soil tests indicated that Boron levels were on the low side of adequate, but tissue tests 14 days after application showed an increase in Boron levels for all treatments.
- Using a premium foliar Boron product, like NutriSync Boron and ReaX Boron, aids in mobilization of a naturally plant immobile nutrient to key growing points.
- Treatment 2 increased yield by 2 bushels, while Treatments 3 and 4 increased yield by 3 and 5 bushels respectively, with all providing excellent ROIs.
- NutriSync Boron has a three year average increased yield of 2.2 bushels and 4 to 1 ROI.

NutriSync Boron

NUTRISYNC® BORON 5% is a unique foliar technology specifically designed to enhance plant physiological activities and growth of various crops. NutriSync remobilizes nutrients within the plant, especially to growing parts of the plant. NutriSync technology has been proven to increase assimilation, mobilization, and utilization of nutrients inside the plant.

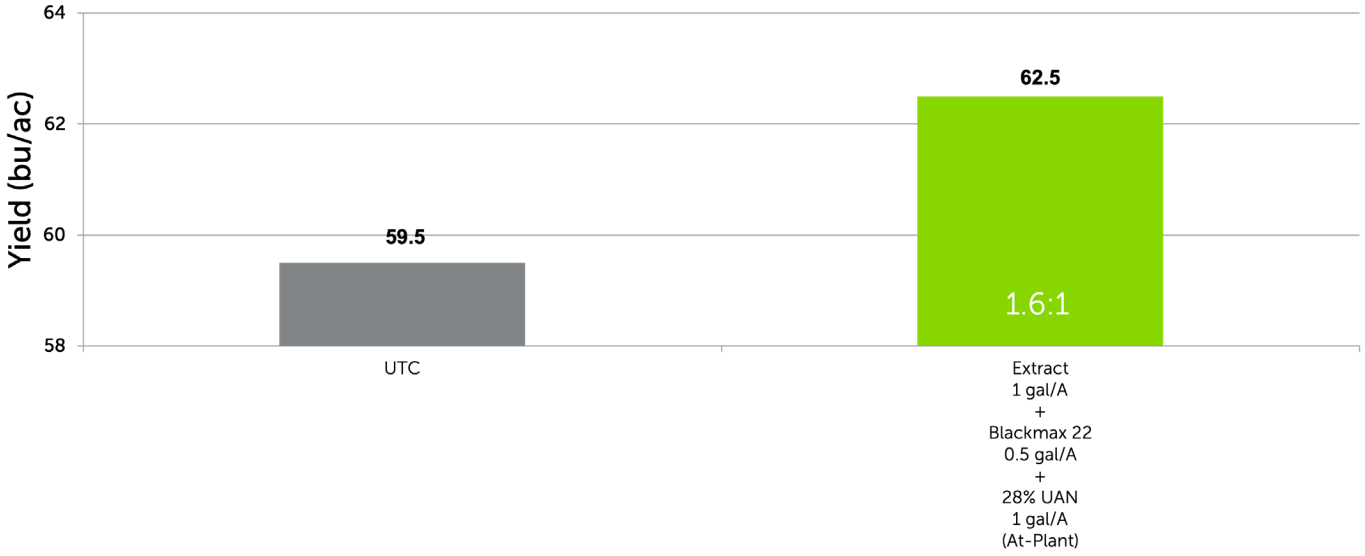
Sequential Fungicide Programs in Soybeans



What We Learned:

- This study was designed to address customer questions about potential benefits of multiple fungicide applications in soybeans, however minimal foliar disease pressure was observed.
- There was a 7 bushel per acre yield response to a single fungicide treatment at traditional R3 timing, but due to limited disease pressure, no additional advantage was gains with either of the two pass programs.
- Sequential treatments will be studied in 2024 with an emphasis on reproductive growth stages.

Extract on Wheat Stubble Ahead of Double-Crop Soybeans



What We Learned:

- Double-crop soybeans are largely deprived of nutrients bound within wheat residue, due to wheat straws high carbon-to-nitrogen ratio, making it slow to degrade.
- The combination of Blackmax 22 and Extract accelerates wheat stubble breakdown, promoting faster nutrient recycling, improved soil properties and nutrient efficiency.
- Broadcasting the combination on wheat stubble at planting improved double-crop soybeans yield by 3 bushels and net revenue by $15.15 per acre.

BLACKMAX® 22

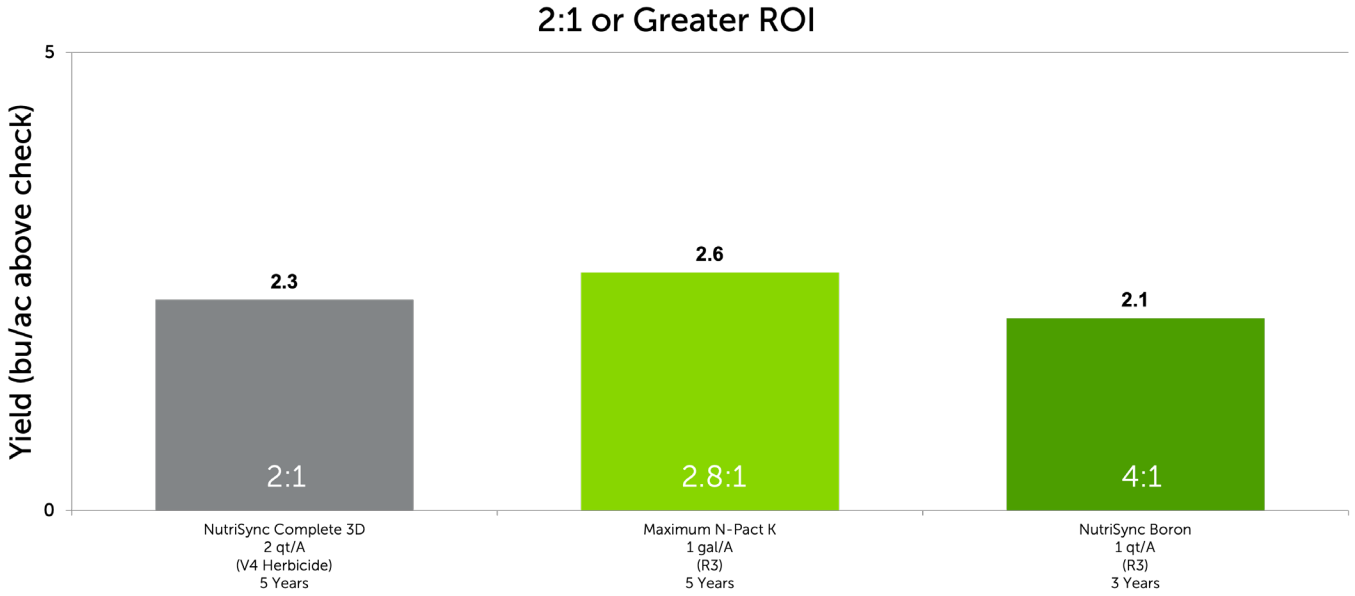
BLACKMAX® 22, built with C² Technology, is a proprietary combination of extracted carbon and carbohydrates that reacts with your fertility program to increase nutrient availability and support positive soil attributes. As part of your fertilizer program, this powerful combination of extracted carbon and carbohydrates fosters beneficial soil microbe growth to strengthen your crop fertility program.

Extract Powered by Accomplish®

EXTRACT Powered by Accomplish® is a proprietary blend of proven fertilizer biocatalyst – Accomplish LM and a nitrogen source, designed to help growers not only manage crop residue but also easily and effectively optimize the release of nutrients from residue and those in the soil.

Soybean Foliar Nutritionals

Multi-Year Performance Consistency



What We Learned:

- Several foliar nutritionals in the Loveland Products portfolio have demonstrated consistently positive impacts on soybean yield and ROI over multiple testing seasons at the Owensboro Innovation Farm.
- Whether attempting to correct in-season deficiencies or pushing a crop's overall nutritional status, growers can apply these products with confidence they'll deliver strong results across a diverse range of field and weather environments time after time.

NUTRISYNC® COMPLETE 3D (10-4-6 with Zn, Mn, Cu, Fe, B, Co & Mo) is a fully formulated foliar nutrition tool powered by NutriSync, Loveland's premium foliar transport technology, and contains key macro- and micronutrients. NutriSync technology helps growers Load, Haul and Deliver nutrients critical for growth and development to areas that are most needed – providing better utilization of nutrients to fulfill plant demands.

NUTRISYNC® BORON 5% is a unique foliar technology specifically designed to enhance plant physiological activities and growth of various crops. NutriSync remobilizes nutrients within the plant, especially to growing parts of the plant. NutriSync technology has been proven to increase assimilation, mobilization, and utilization of nutrients inside the plant.

MAXIMUM N-PACT® K is an enhanced slow-release nitrogen which provides a stable source of foliar nitrogen with the addition of potassium for increased uptake, translocation and utilization of nitrogen and potassium, with excellent crop safety and increased stress tolerance.


CAUTION
CUIDADO


KINCAID
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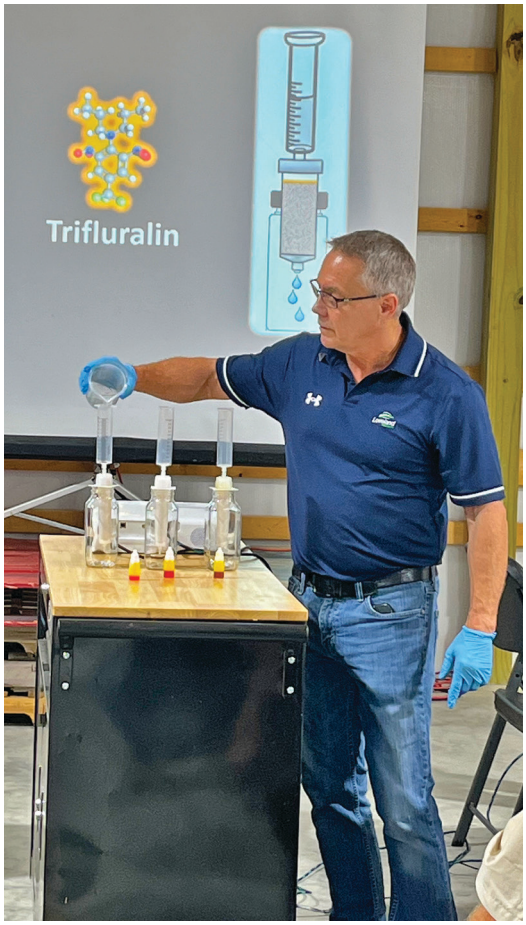
9750STS


Trifluralin

CORN VARIETY TRIALS

2022 CORN YIELD TRIAL SUMMARY

VARIETY	RANKING	AVE. YIELD	Hickman, KY	Adam, TN	Salem, KY	La Center, KY	La Center, KY	Mayfield, KY	Dyersburg, TN	Massac, IL	Fayettville, TN	Viola, TN	Dutton, AL	Adairville, KY	Trenton, KY
DG 54VC34	1	183.6	213.3	201	184.7	208.3	136.2	124.4	127.3	248.4	244.8	201.3	197.6	178.7	178.3
DG 55VC80	2	183.4	218.6	190.5	189.2	219.6		129.2	124	202.8	228.1	203.1	215.3	176.3	175.6
DG 54VC14	3	176.3	202.2	195.9	177.3	202	151.1		116.9	235.3		184.8		170.3	151.1
DG 50VC09	4	176.2	190.4	229.7	166.4		155.3	169.3		190.7		185.4	188.2	187.8	204.8
DG 52VC63	5	175.8	189.9	186.6	172.5			157.8	123.1			197.6		168.8	193.3
DKC 65-95	6	173.9	212.7	172	184.1	205.3	165		126.3			210.1		174.1	179.5
DkC 63-57	7	173.8	179.9	187.2	157.3	186.4	143.2				224.7	182.7		170.3	184.4
DG 58VC65	7	173.8	228.7	205	188.5	215.5		83.2	121.8	236.1	228	207.1	198.3	170.3	168.7
DG 57TC29	8	173.6	235.8	187.3	156.8				135.4			205.5		176	177
DG 57VC53	9	171.7	225.7	208.8	159			101.8	89.6		220.8	191.2	196.7	176.2	155
P 1289AM	10	162.3	210.4	180.5	168.9		142	133.2	113.5		209.5	188.4		171.8	166.6
P 1511AM	11	157.3	202	203.7	182.8		130.9	101.9	96.6		220.3	184.9		162.3	108.2
NK1082-5222	12	156.3	184.4	178.4	183				105.7			164.3		152.6	156.4
NK1677-3110	13	145.7	202.1	205.7	160.9				80.9			181.8		159.3	128.3
DGCX22111TC		177.5											194.4		
DG 53TC23		199.5								213.7			210.6		
DGCX22116TC		200.3								241.5			199.4		
Average Yield Across All Hybrids			210.4	195.2	160.6	206.1	146.2	125.1	113.4	224	225.1	177.5	200	171.1	166.2

2023 CORN YIELD TRIAL SUMMARY

VARIETY	RANKING	AVE. YIELD	Ucity, TN	Martin, TN	Mayfield, KY	Mayfield, KY	Sedalia, KY	Murray, KY	Hickman, KY	Dyersburg, TN	Clinton, KY	Dutton, AL	Princeton, KY	Hopkinsville, KY	Elkton, KY	Hopkinsville, KY	Crofton, KY
DKC68-35	1	246.41	221.5	231	262	241.7	275	196.6	229.5	202.4	245.8	244.1	239.2	261.9	270.6	233.7	228.8
D58VC74	2	241.34	210.6	229.7										232.5	239.2		221.5
D54VC34	3	240.77	216.3	240.1	247.2	240.7	267.1	210.3	227.3	205.6	252.3	222.9	249.7	252.2	256.2	230.7	239.1
P1718 AM	3	240.77	219.3	249.2	241.1	231.4	266.2	234.3	219.5	210.6	264.5	222.5	220.2	265.7	244.9	228.2	214.9
D57TC29	4	238.52	221.2	249.1			254.7	212.8	224.9	212.4	269	242.5	253	262.1		221.4	237.9
D55VC80	5	238.24	215.2	267.3	240.3	243.1	254.4	217.9	223.8	209.4	244.4	223.1	223.6	251.2		227.9	216.2
D56TC44	6	235.87	200.8	256.4			266.4	210.6	217.7	216.4	237.5	238.8	228	240	267.7	212.6	226.6
D52VC63	7	231.71	207.3	254.5			259.3	231	221.9		248	236.9	232.3	231.3		217.5	225
D53VC54	8	231.36	202	246.7	229.6	235.2		214.3					246.6	245.2	255.9	209.4	222.3
P1170 AM	9	230.49	223.8	225.6	234.3	230.7	261.8	238.6	218.1	205	261.1	220.8	229.8	226.9	234.7	214.7	227.1
D50VC09	10	230.17	216.3	232.2	242.7	220.7	268.2	209.5	200.9	194.9	256.2	230.1	240	222.2	235.7	219.6	225.5
D57VC53	11	229.95	195.7	220.5			246.3	200.4	202.3		250	236.9	241.6	234.9		222	216.2
DKC62-70	12	229.68	209.7	229	239.8	225.8	259	190.5	212.7	194.5	226.9	247.1	240	239.4		226	225.5
D53TC23	13	228.82	209.2	242.1			252.8	205.3	211.3	195.2	232	233.3	233.5	233.9		221	233.6
D58TC94	14	228.55						248.9						212.5			220.4
D45TC55	15	218.53	196.1				248.8					228.2		212.5		211.2	209.7
Average Yield Across All Hybrids		**233.82**	210.7	241	242.1	231.6	259.3	215.8	217.5		251	232.9	233.2	237.2	248.5	219.5	223.5

YIELDS CALCULATED IN BUSHEL PER ACRE

CORN VARIETY TRIALS

2022 CORN YIELD TRIAL SUMMARY (CONT.)

Hopkins-ville, KY	Dresden, TN	Portland, TN	Lewisburg, KY	La Center, KY	Trenton, KY	Crofton, KY	Murray, KY	Crofton, KY	Hopkins-ville, KY	Hoptown, KY	Hillsboro, TN	Pelham, TN	AVE. YIELD	RANKING	VARIETY
198.8	158.3	208.8	172.1	175.7	222.8	205.7	111.8	163.5	173.4	166.8	185	187.8	183.6	1	DG 54VC34
197.6	141.4	190.5	189.6		220.6	173.7	126.1	172	184.1	158.1	164.3	212.8	183.4	2	DG 55VC80
199.7	130.5	202		158	193.5	218.6	91.8	156.5	179.3	197.6	156	208.6	176.3	3	DG 54VC14
177.5	125.4	189.1	201.4	144.9	176.3	182.2	102.9	164.9	184.3	192.7	167.5	177.4	176.2	4	DG 50VC09
195.6	127.6	226.8	195.2		187.1	189.2	110.9	153.1	194.5	174.8	181.4	191.4	175.8	5	DG 52VC63
189.5	124.1	172.7	194	178.7	214.3	184	109.3	165	172.7	169	126.8	197.2	173.9	6	DKC 65-95
174.5	145	178.1	195.5		171.9	195.1	99.7	146.5	173.7	187.1	167	200.2	173.8	7	DkC 63-57
187.3	104	178.3	179.8		167.9	204.9	101.1	190.2	166.8	188.9	173.7	178.7	173.8	7	DG 58VC65
198.2	130.2	170.5	123.6		230.6	192.8	93.6	190.8	194.1	167.1	158.9	174.8	173.6	8	DG 57TC29
184.4	112.6	159.9	192.3	176.7	189.2	202.1	107.3	183.9	185.5	182.1	170.9	179.5	171.7	9	DG 57VC53
183.9	133.1	181.1	182.5	149.2	173.3	156	70.8	134.7	158.2	191.3	136.5	198.1	162.3	10	P 1289AM
162.3	109.1	145.3	173.3	140.8	195.3	203.3	82.4	130.8	168	183.4	139.7	190.8	157.3	11	P 1511AM
174.3	124.5	179.6	175.9		124.4	191.8	84.7	146.5	136	190.7	135.2	182.9	156.3	12	NK1082-5222
156.5	93.9	139.6	141.5		157.2	170.8	42.3	144.6	149.1	163.1	121.7	169.7	145.7	13	NK1677-3110
									189.8		156.1	170.2	177.5		DGCX22111TC
									190.2		193.2	189.8	199.5		DG 53TC23
									199.4		177.3	184.2	200.3		DGCX22116TC
184.3	125.7	180.2	178.2	160.57	187.5	190.7	98.6	160.2	176.5	179.5	161.5	187.9			**Average Yield Across All Hybrids**

2023 CORN YIELD TRIAL SUMMARY (CONT.)

Viola, TN	Trenton, KY	Pembroke, KY	Adams, TN	Franklin, KY	Pembroke, KY	Adairville, KY	WT Princeton, KY	WT Pembroke, KY	WT Adairville, KY	WT Bowling G., KY	Russellville, KY	Cadiz, KY	Guthrie, KY	Pelham, TN	AVE. YIELD	RANKING	VARIETY
238.7	264.2	291.4	235	231.1	241.7	257.2	271.2	275.1	278.5	244.9	273.7	220.1	240.1	245.7	246.41	1	DKC68-35
	241.8						266.1	271.9	266.6	238.5	246.4			231.3	241.34	2	D58VC74
216.3	254.4	270.2	232	225.2	235.4	260	265	264	266.5	231.2	258.9	216.1	235	235.3	240.77	3	D54VC34
208.6	240.8	274.1	235.2	231.8	227.3	254.6	278.7	285.5	268.1	242.1	247.8	228.7	237.8	229.5	240.77	3	P1718 AM
209.7	239.9	281.4	239.1	234.2	223.7	246.8						234.4		238.9	238.52	4	D57TC29
214.9	244.6	274.2	222.5	221	229.6	267.7	271.2	261.1	259.3	241.1		228.2		239.3	238.24	5	D55VC80
	225.7	264.1	227.1	241	224.5	246.8	260.8	258.5	262.5	231.5	239.5	220.9	235.6	210.7	235.87	6	D56TC44
213.3	247.8	264.7	238.3	224	212.2	237.7						214.4		216.9	231.71	7	D52VC63
225.2	238.8	256.1	215.2		210.2	246.4	244.2	231.9	242.7	224.5	242.3	215.3	229	223.7	231.36	8	D53VC54
203.4	250.5	254.3	228.8	223.2	198.4	229.5	247.4	248.4	282.5	211.6	236.8	203.3	231.9	211.9	230.49	9	P1170 AM
207.1	251.4	261.6	245.3	210.3	191.9	232	263.5	256.5	250.7	224.9	241.1	208.6	230.5	215.1	230.17	10	D50VC09
226.4	227.1	268.5	226.3	237.6	213.9	239.7	260.7	250.8	242	223.5		218.8		216.7	229.95	11	D57VC53
202.9	236.6	253.4	235.1	238.6	216.2	239.5	253.8	259.8	265.2	215.6		205		213.9	229.68	12	DKC62-70
215.4	241.7	253.9	233.3	209.8	203.4	244.8	246.4	252.4	261.5	225.8		213.6		215.3	228.82	13	D53TC23
	233.5												234.1	221.9	228.55	14	D58TC94
	245.1													196.7	218.53	15	D45TC55
213.2	240.2	268.2	233.1	227.3	217.7	246.4	253.1	253.5	257.9	228	248.1	217	233.9	225.3	**233.82**		**Average Yield Across All Hybrids**

YIELDS CALCULATED IN BUSHEL PER ACRE

SOYBEAN VARIETY TRIALS

ENLIST SOYBEANS TRIALS 2022							
VARIETY	RANKING	AVE. YIELD	Pelham,TN	Viola, TN	Hoptown,KY	Crofton,KY	Lewisburg,KY
NK 44-Q5E3	1	85.75	103.7	95.7	69	80.3	65.9
DG S41EN72	2	82.94	99.1	96.4	65.9	76.5	61.2
NK 45-V9E3	3	82.7	98.8	92	61.9	73.6	62
DG S43EN61	4	80.87	92.2	87.5	66.9	78	63.3
DG S48EN73	5	80.35	92.4	91.1	56.3	79	58.4
DG S45ES10	6	79.2	91.3	89.5	65.8	67.4	60.8
DG S39EN19	7	79.18	7	82.5	62	79.5	55.2
DG S46ES91	8	78.85	92	87	57.8	68.3	59.3
DG S49EN12	9	77.62	90.5	91	53.2	67.1	58.2
DG S51EN62	10	75.44	82.8	88.2	55.5	63.6	55.6
Average Yield Across All Hybrids		**78.42**	93.6	90	61.4	73.3	59.9

ENLIST SOYBEANS TRIALS 2023								
VARIETY	RANKING	AVE. YIELD	Hillsboro, TN	Hickory, KY	Viola, TN	Hopkinsville, KY	Farmington, KY	Cadiz, KY
NK S42-A6E3s	1	85.75	74.6	90.1	92.4	77.9	79.7	66.4
DG S45ES10	2	80.54	71.4	99.6		89.5	82.5	
DG S41EN72	3	80.18	67.2	94.5	84.5	83.7	66.1	70.5
NK S44-Q5E3S	4	79.06	70.1		93.4	84.3	75.7	67
DG CX23743ES	5	78.1	68.8	87.9		84.8	79.9	73.9
P 42A84	6	77.75	57.8	102.1		88.1	82.8	71.9
DG CX22645EN	7	77.1	64.6	94.5	77.4	85.8	73.6	66.7
DG S49EN12	8	76.88	69.3			73		72.3
Xo 4772E	9	75.73	69.3	88.1	85.5	75.3	69.9	66.3
DG S48EN73	10	74.05	60.6	87.9	81.2	79.4	68.1	67.1
Xo 4522E	11	71.53	55.3	96.3		90.4	73.4	69
DG S51EN62	12	67.1	56.4			77.8		
Average Yield Across All Hybrids		**77.87**	64.8	94.1		82.9	74.1	

YIELDS CALCULATED IN BUSHEL PER ACRE

SOYBEAN VARIETY TRIALS

XTEND FLEX SOYBEAN TRIALS 2022

VARIETY	RANKING	AVE. YIELD	Martin, TN	Gracey, KY	Clinton, KY	Hoptown,KY	Murray, KY
DG S47XF23S	1	70.6	74.3		81	69.1	58.3
DG S43XS70	2	69.9	73		80.3	73.3	53.2
NK 44-J4XF	3	69.5	78.6	67.9	78.1	68.9	54.1
DG S40XF21S	4	67.9	68.8	65.8	77.2	72	55.9
DG S45XF02	5	67	76.3		73.9	61.9	56.1
DG S49XF43S	6	66.6	72.3	65.5	71.5	64.5	59.6
DGCX22344XF	7	65.8	68.5	62.6	73.1	69.9	55.2
DG S46XF31S	7	65.8	75.4	61.2	72.3	64.1	56.3
DGCX22751XF	8	65	75	60.7	69.9	62.8	56.8
DG S42XF93S	9	64.1	67.4	61.8	70.1	68	53.5
DG S48XF61S	9	64.1	74.2	60.8	66.7	61	58.1
DG S47XF52	10	63.2	66.9	57.6	73.4	61.1	57
DG S49XF82S	10	63.2	70.9	56.4	66.4	59.2	
DGCX22646XF		70	73.3		73.4	63.3	
Average Yield Across All Hybrids		**65.9**	72.5	62	73.4	65.7	56.2

XTEND FLEX SOYBEAN TRIALS 2023

VARIETY	RANKING	AVE. YIELD	Troy, TN	Martin,TN	Sedalia,KY	Hopkinsville	Dresden,Tn	Murray, Ky	Crofton,Ky	Mayfield,KY
DG SX23343XF	1	77.4	86.5	55.2	66.3	86.2	64.8	70.4	93.8	96.3
AG 48XF3	2	77	83	60.9		91.7	62.3	57.6	89.2	94.3
DG S47XF23S	3	76.3	85.5	60.4	58.2	93.8	69.1	57.5	89.6	97
NK 44-J4XF	4	75.5	84.7	66.4		83.8	68.8	61.2	88.2	
NK 47-Z1XF	5	73.2	82.3	53.8		87.3	68.2	62.5	85.3	
S46XF31S	6	72.3		63.2		87.6	65.7	61.6	83.4	
DG S45XF02	7	71.5	78.4	63.5	56.8	80.6	66.8	60.6	82.2	83.3
AG 43XF2	8	71.4	86.8	62.2		54	61.4	57.5	91.4	87
DG S49XF43S	9	70.9	84.3	57	59.8	84.4	63.7	55.7	80.9	81.4
P 42A96X	10	69.7	82.2	59.7		75.5	61.3			
DG S49XF82S	11	69.1	82.5	57.6		83.3	61.2	51.2	78.9	
DG SC23350XFS	12	69		56.5		80.5	66.1	54.3	88	
DG S42XF93S	13	68.9	82.3	59.4	58.7	74.7	65.8	61.9	79.4	
DG SX23341	14	67.5	81.9	58	59.3	75.1	58.1	44.7	84.9	78.6
DG S51XF84S	14	67.5		54.8		89.2	58.5			
Average Yield Across All Hybrids		**71.8**	83.4	59.2		83.4	64.1	58.2	84.5	

YIELDS CALCULATED IN BUSHEL PER ACRE

NOTES:

CHAMPAIGN, IL

CORN

SOYBEAN

The Champaign Innovation Farm is a 285-acre agricultural facility located at the southern end of Champaign, near the Champaign airport. It was purchased in 2019 and has since undergone various improvements, including the reconfiguration of waterways to optimize water flow, pattern tiling for monitoring purposes, and the installation of control structures to manage water flow and create different environmental conditions.

The farm primarily grows corn and soybeans in a 50/50 rotation, divided into 24 blocks that follow the contours of the landscape, with significant elevation differences. These features allow for comprehensive testing and data collection aligned with five main principles: Equipment, Technology, People, Products, and Practices. Understanding these principles helps deliver valuable data, insights, and recommendations that can be customized for various agricultural operations and maximize the use of technology.

Despite challenges in the 2023 growing season, which included a delayed planting and a period of limited rainfall, the farm achieved a successful outcome. Soybeans across all trials and treatments averaged just under 70 bushels per acre, while corn across various trials and treatments yielded an average of just under 245 bushels per acre.

CHAMPAIGN WEATHER

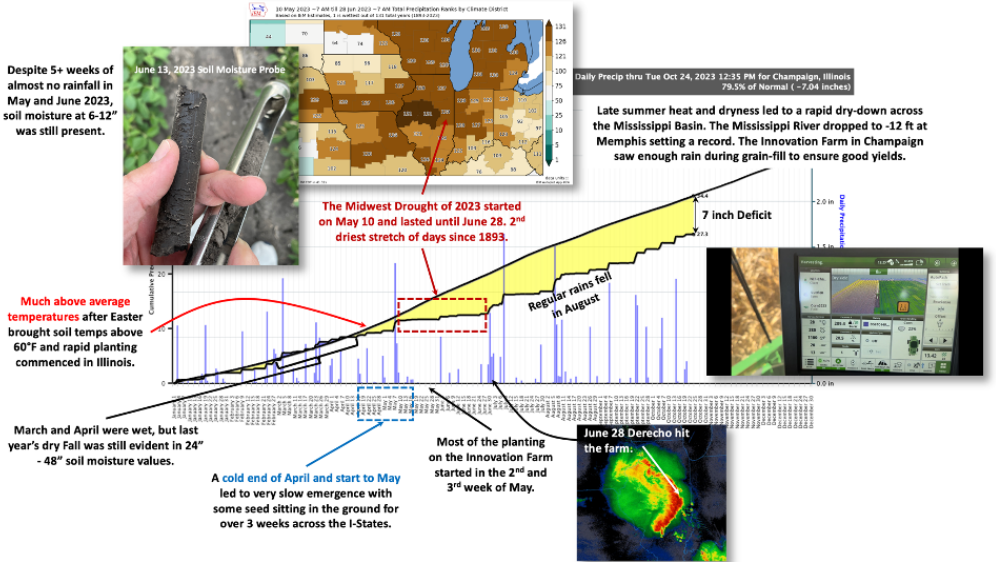
You will not find a good analog for the weather in 2023 for the Midwest – especially at the Champaign Innovation Farm. This year's yields are a true testament to seed technology and the right soil management strategies.

The weather was less than cooperative... The ten days following Easter brought drier weather and much above normal temperatures which prompted a lot of Illinois farmers to get in early. But the normal last frost dates are in mid-May and the early planting efforts were not rewarded this year as late-April and early-May temperatures brought frost and cold, wet soils which delayed emergence up to 4 weeks for some.

The Innovation Farm was planted at the start of the 2023 Midwest Drought when the Bermuda High shifted to Europe and a large high-pressure cell built into Canada. Winds came from a rare direction for May and June as they persistently blew across Illinois from the Northeast. The rain shut off for almost 6 weeks on the Innovation Farm and instead of clouds covering the skies, smoke from prolific wildfires throughout Canada filled the air. May 10th to June 28th currently stands as the second driest stretch of days in the East Central Climate District since records began in 1893.

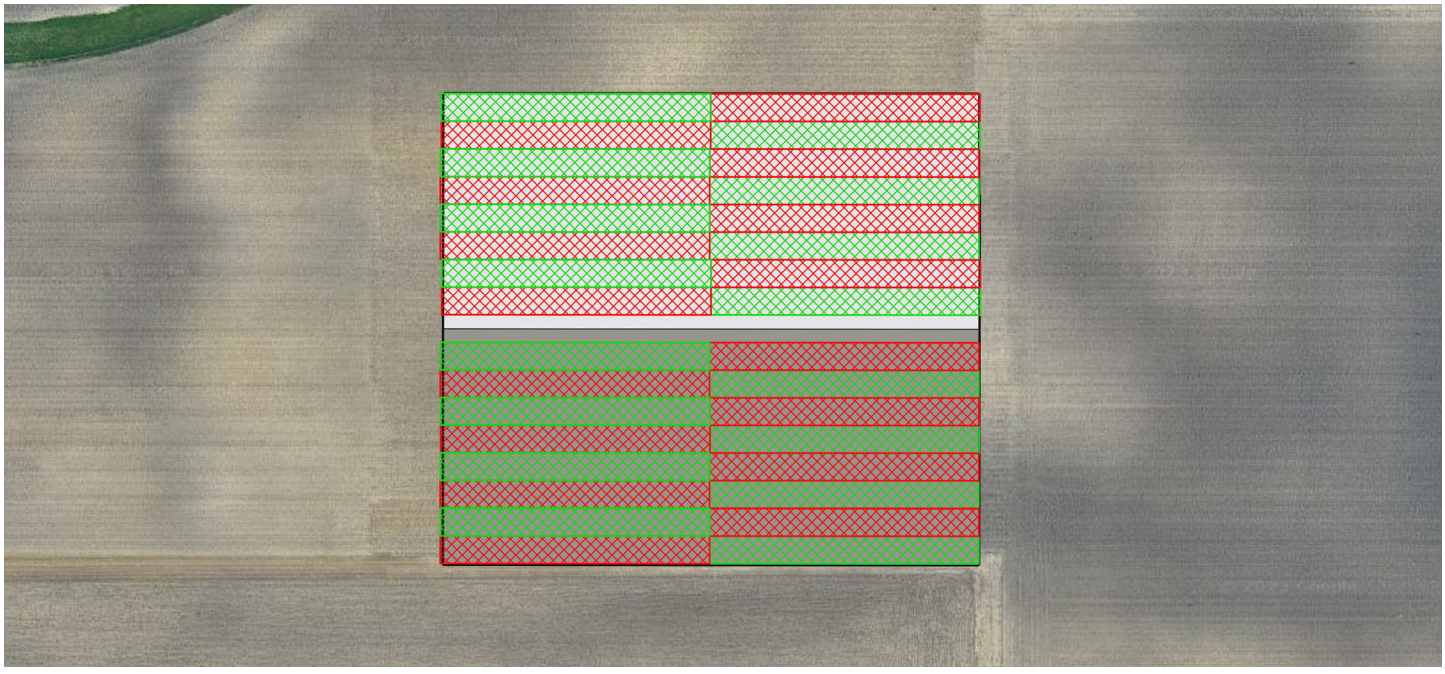
Drought never breaks gently. On the morning of June 28, 2023, a complex of storms over Nebraska raced east toward the Mississippi River producing a large and damaging swath of winds that exceeded 100 mph at times. More regular rains returned to finish pollination and early grain fill and the Innovation Farm avoided serious heat stress.

Late summer weather was drier and quite warm at times, but that mostly helped the crop dry down faster which opened early harvest windows in the Midwest. Harvest pace was fast though as very heavy rains in late October threatened to shut harvest windows down for 6-10 days. However, despite multiple sources of weather stress this year, harvest data show decent yields! Much of this success can be attributed to farm management, application timing, and outstanding genetics.

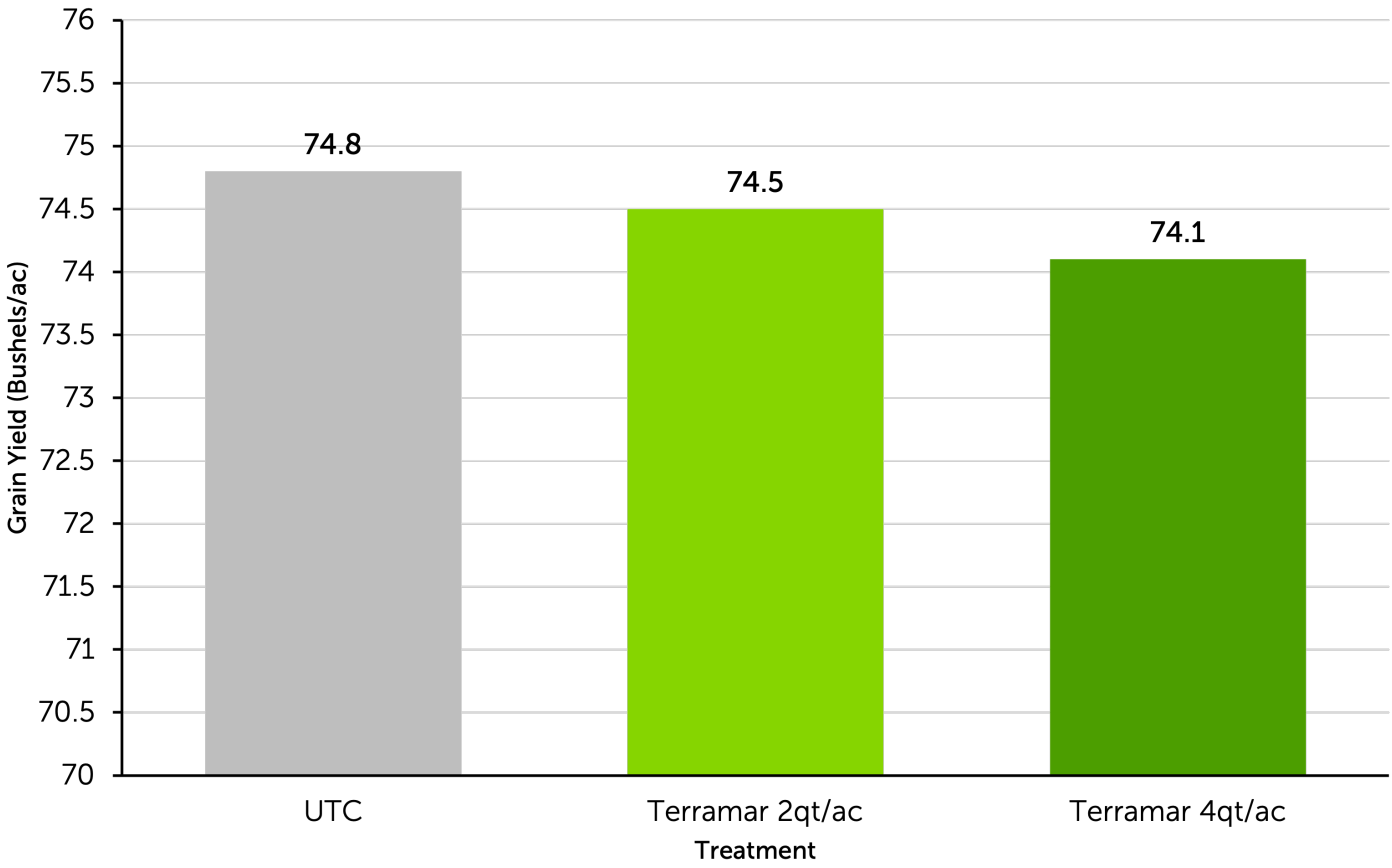


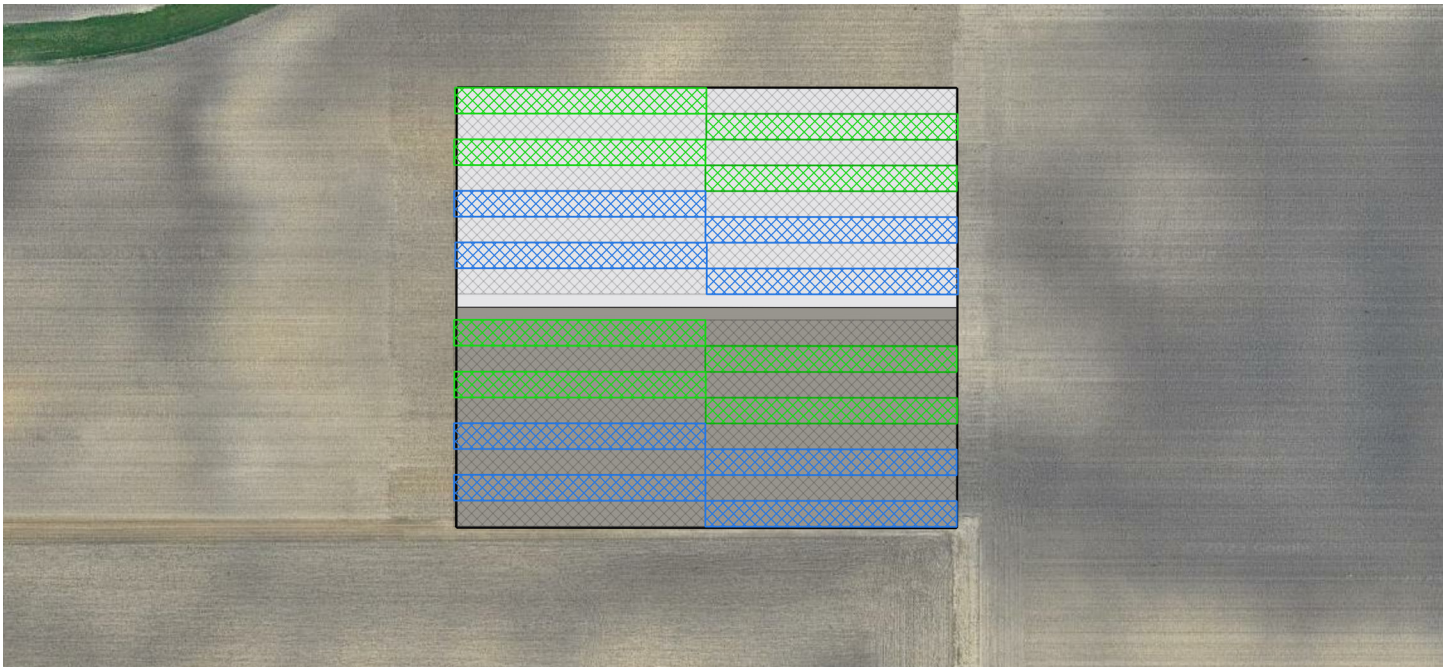
SOYBEAN FOLIAR TRIAL

Foliar applications to soybeans continues to grow and become standard practice. Many farmers have made a fungicide application with or without a foliar nutritional at R3 a standard practice. This trial focused on adding Terramar with the goal of further advancing the soybean system currently utilized. This was a replicated design that utilized the latest in equipment technology and the use of prescriptions in the equipment controllers to maximize execution and data capture. The technology utilized in this trial performed flawlessly. The application timing was R1 for the soybeans with two different rates. There was no statistical difference in yield across the trials compared to check. It should be noted this blocks performance ranged from 74.1 bushels/ac to 74.8 bushels/ac. This is compared to the overall farm avg of just less than 70 bushels/ac.



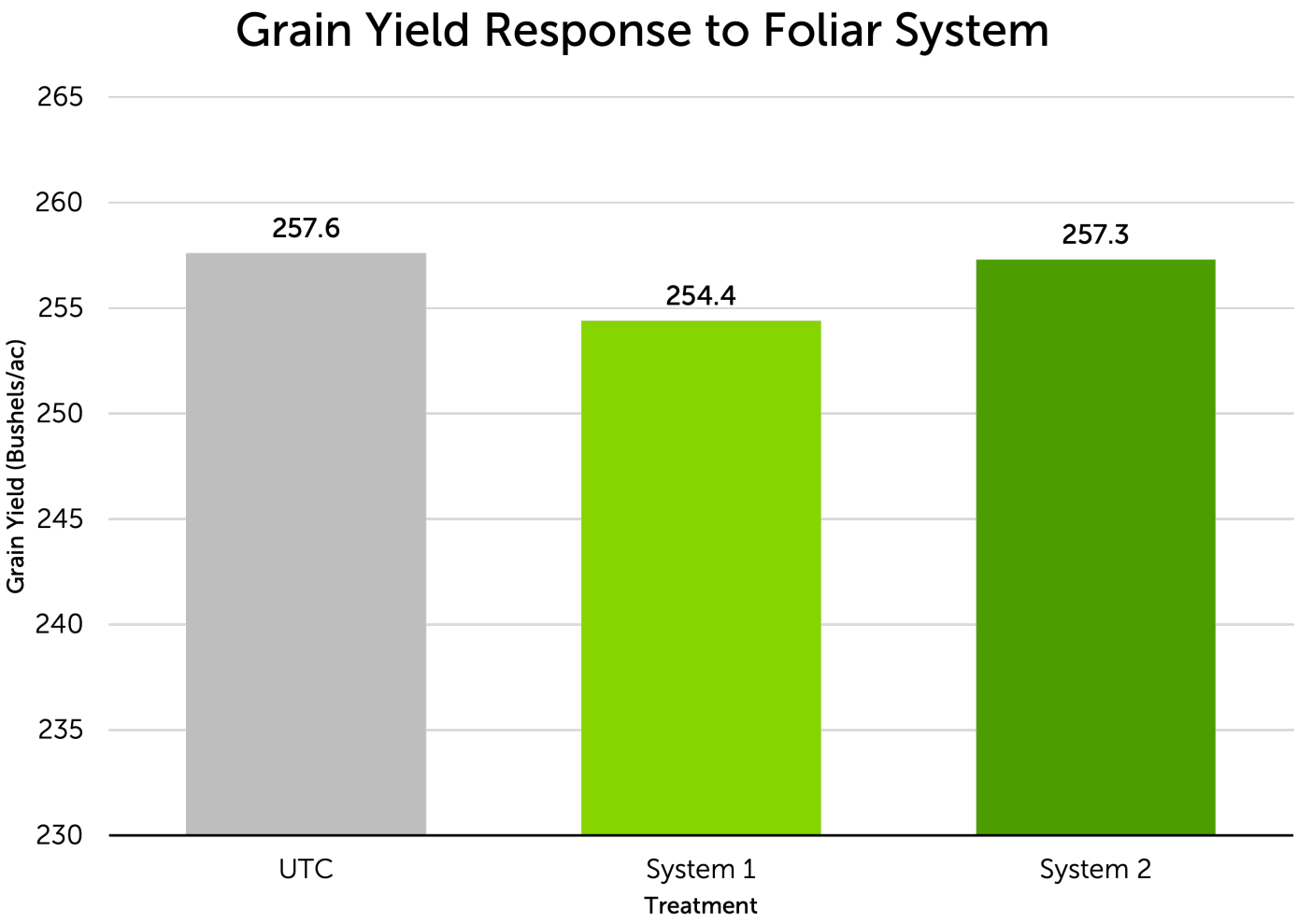
Grain Yield Response to Terramar





CORN FOLIAR SYSTEMS TRIAL

Foliar applications and the opportunities they provide have and continue to increase every year. System trials and their potential benefits of multiple or layered applications are at the forefront of this opportunity. This idea is easily understood when looking at weed management 2 pass vs 1 pass and the layering or combination of products to manage weed resistance. The utilization of multiple applications of nitrogen to deliver nutrition would be an example of a system approach to enhancing crop production. This was a replicated design that used the latest in equipment technology and the use of prescriptions in the equipment controllers to maximize data capture. The technology utilized in this trial performed flawlessly. However, the two systems tested in this trial provided no statistical difference in yield. It should be noted the yield range for this trial was 254.4 bushels/ac to 257.6 bushels/ac. Although no differences were seen this year, the value to this concept has been demonstrated several time and should continue to be investigated.


Grain Yield Response to Foliar System
265
260
255
250
245
240
235
230
Grain Yield (Bushels/ac)
257.6
254.4
257.3
UTC
System 1
System 2
Treatment

PLANTER CAPABILITIES + OUTREACH

A small portion of the farm was dedicated to showcasing a modern row crop planter's capability to accurately execute complex multi-hybrid/variety seeding prescriptions. Using two different corn hybrids a multi-hybrid planting prescription was planted in the image of the Nutrien "N" logo. It was also completed using soybean varieties and the Echelon "e" logo. The accuracy of the prescription execution were astonishing and illustrated how variable rate seeding technology has progressed over the last decade. Additionally, a great opportunity was presented to help The Atkins Group Clearview Farm located in Champaign, IL plant a sunflower maze for the community using the same technology described above.

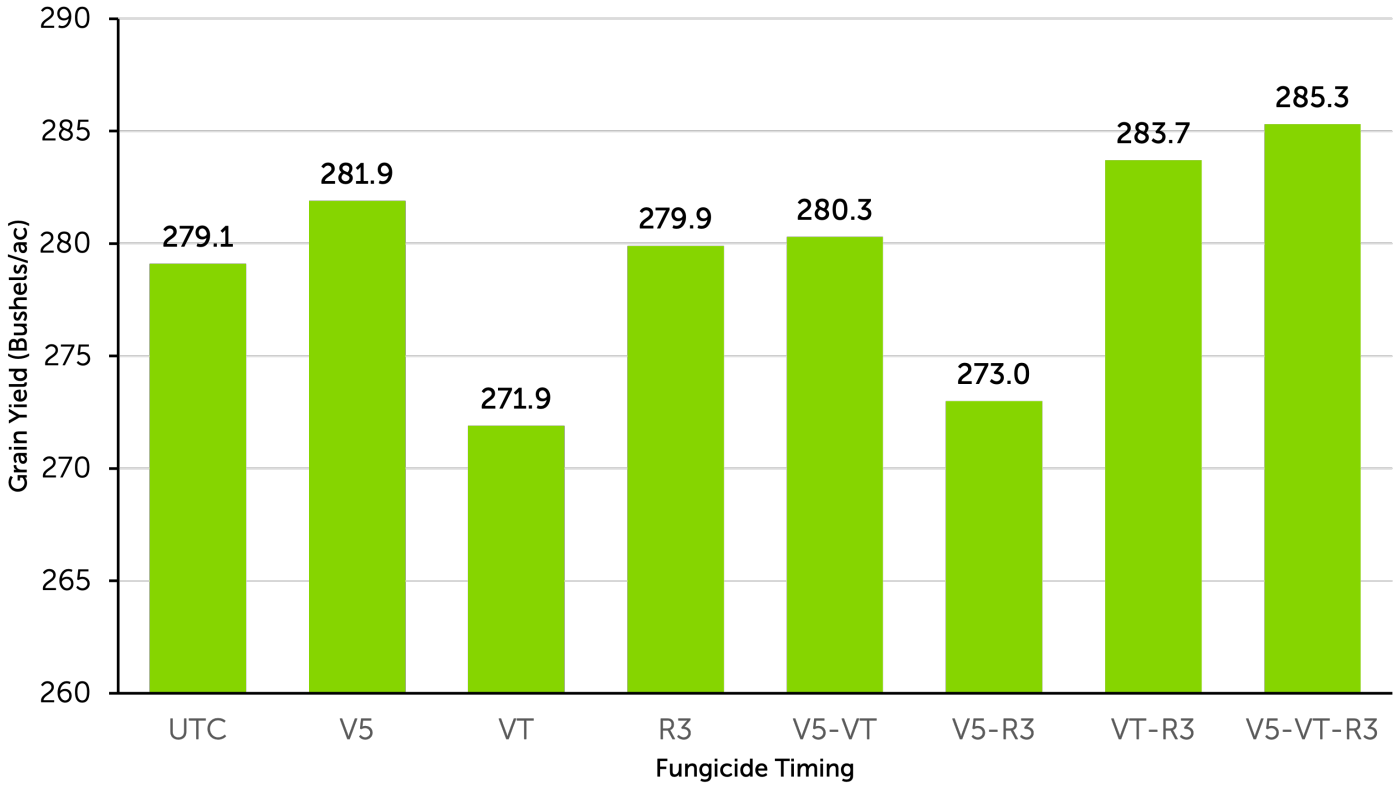
Clearview Farm 2023 Sunflower Maze

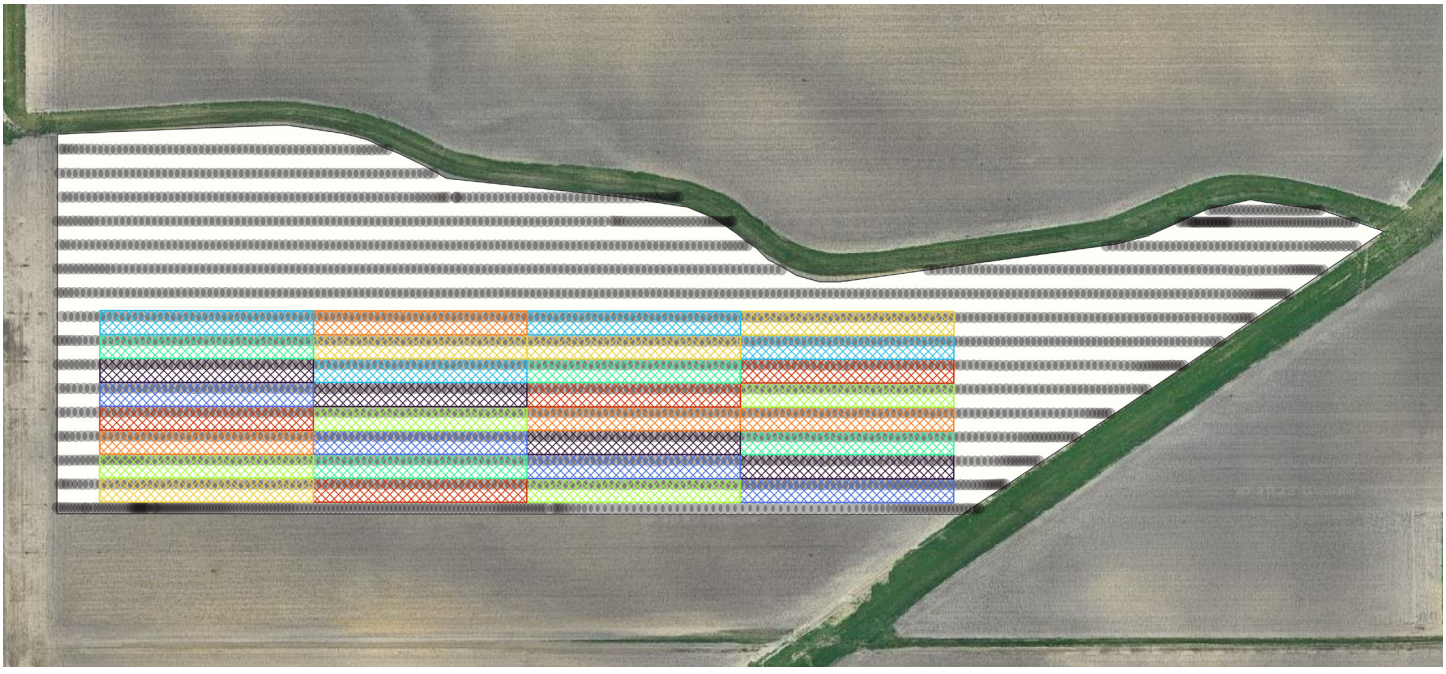
TAR SPOT MANAGEMENT

- 1 Hybrid –DKC64-21RIB
- 8 Fungicide Treatments– Control, V5, VT, R3, V5-VT, V5-R3, VT-R3, V5-VT-R3
- Fungicide- Satori® (V5)- 6 oz/acre, Delaro® Complete (VT, R3)- 12 oz/acre

In 2015, tar spot was identified in the US and has aggressively spread throughout the Corn Belt. With limited understanding of the pathogen, management tactics are still being evaluated. Currently, fungicides are the primary method of control, and multiple applications may be required for disease suppression. A trial was conducted in 2023 to gain insight into fungicide timing and the potential impact it can have on tar spot control and grain yield. The 2023 growing season experienced below average precipitation with higher-than-normal temperatures, neither of which are conducive for tar spot development. Little to no tar spot was found in the trial, limiting the conclusions related to fungicide timings and tar spot management. Grain yield varied by fungicide treatment but did not show consistent yield response. This was common with fungicide across the farm perhaps due to the high temperatures and limited precipitation. The average yield for this trial was 279.4 bu/acre over 35 bu/acre higher the corn average for the Champaign farm. The limited treatment responses were likely driven by the above average yield environment and no presence of disease, including tar spot. If tar spot was experienced in 2023 and may be a concern for 2024 consider the following management practices:

1. Crop Rotation
2. Select tolerant corn hybrids
3. Manage residue if considering corn-on-corn
4. Plan on multiple fungicide applications

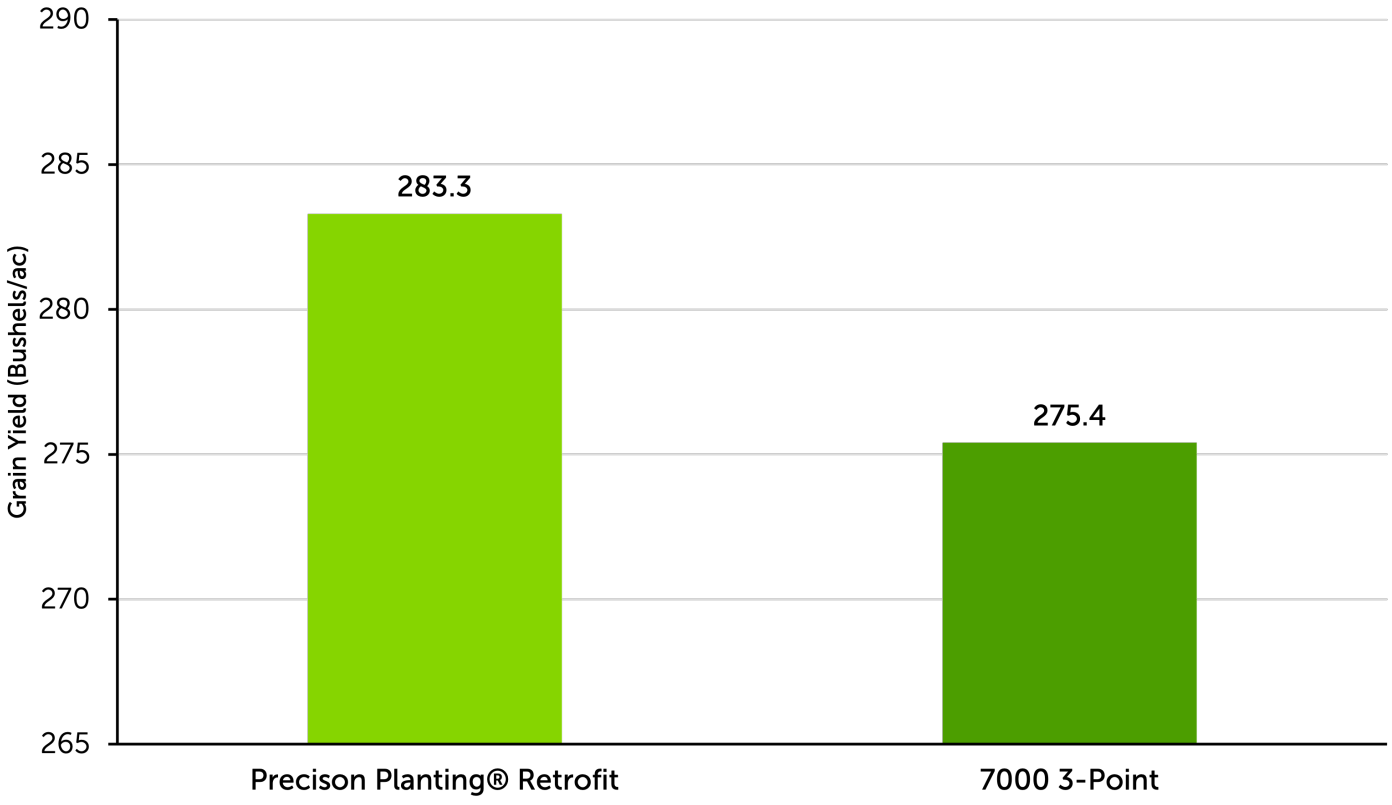

Grain Yield by Fungicide Timing
290
285
280
275
270
265
260
Grain Yield (Bushels/ac)
279.1
281.9
271.9
279.9
280.3
273.0
283.7
285.3
UTC
V5
VT
R3
V5-VT
V5-R3
VT-R3
V5-VT-R3
Fungicide Timing

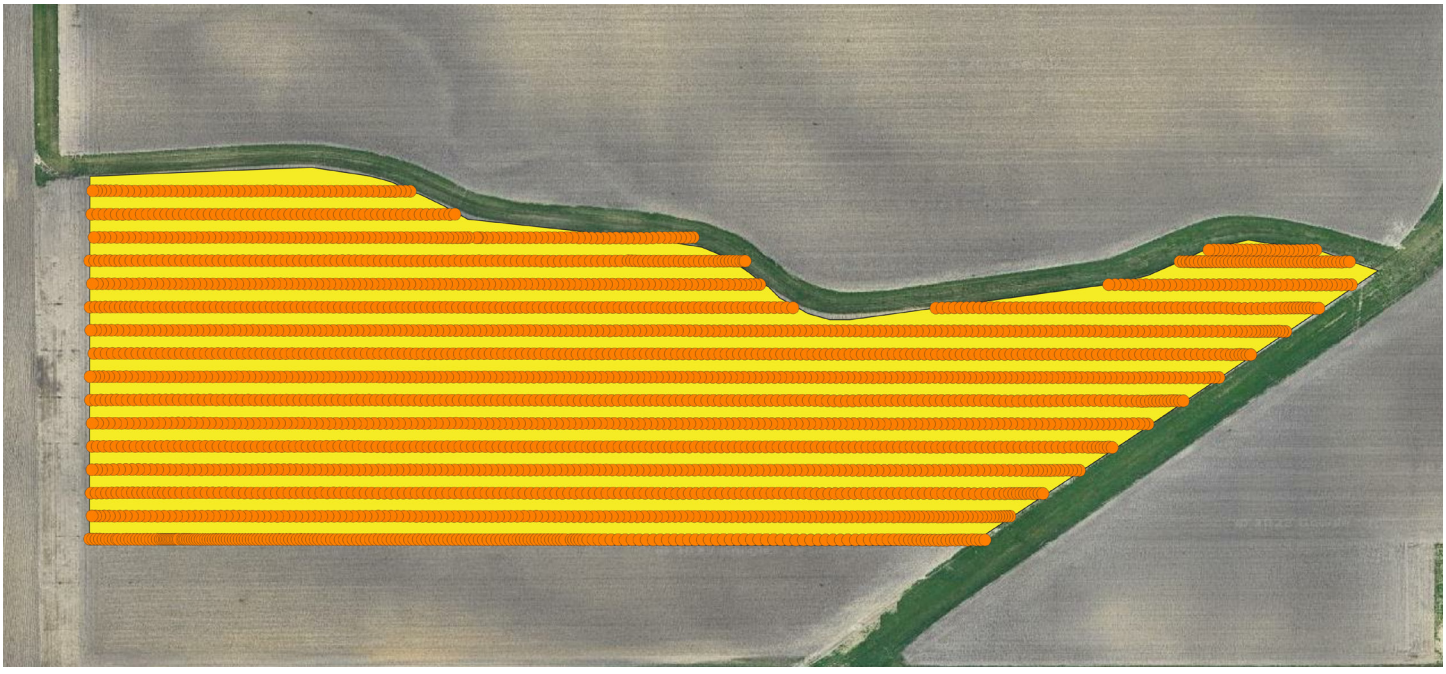


DOES PLANTER TECH PAY?

- 1 Hybrid-DKC64-21RIB
- 2 Planters:
  1. John Deere 8 row 7000 3-point mounted finger pick-up
  2. John Deere 8 row Precision Planting Retrofit pull-type
- Planted at 4.5 mph

Working with a student from the local Unity FFA Chapter, a trial was conducted to compare past planter technology to state-of-the-art technology available on row crop planters today. The "old" technology included finger pick-up meters, spring adjust downforce, and standard seed tubes. The "new" Precision Planting upgrades are numerous on the planter but for comparison include vacuum, electric V-Set seed meters, hydraulic downforce, and SpeedTube®. Planter speed was kept the same for both planters. The trial was planted as a side-by-side for comparison. Grain yield was 7.9 bushels per acre higher for the Precision Planting retrofit planter. The positive impact on grain yield was likely due to improved seed-to-soil contact and more consistent seed depth with the use of the hydraulic downforce system. Additionally, singulation was also likely improved with the use of the electric seed metering system and SpeedTube®. This work illustrates the value that can be gained by investing in new planter technology. Farmers thinking about upgrading planting equipment should consider the technology listed above. Planting is the most important practice on the farm as it ensures an adequate crop stand can be established and managed. Beyond the technology discussed above, consider investing in technology to allow for faster planting speeds. Planting windows are getting earlier, and being able to plant more efficiently can be a great asset to optimizing grain yield.

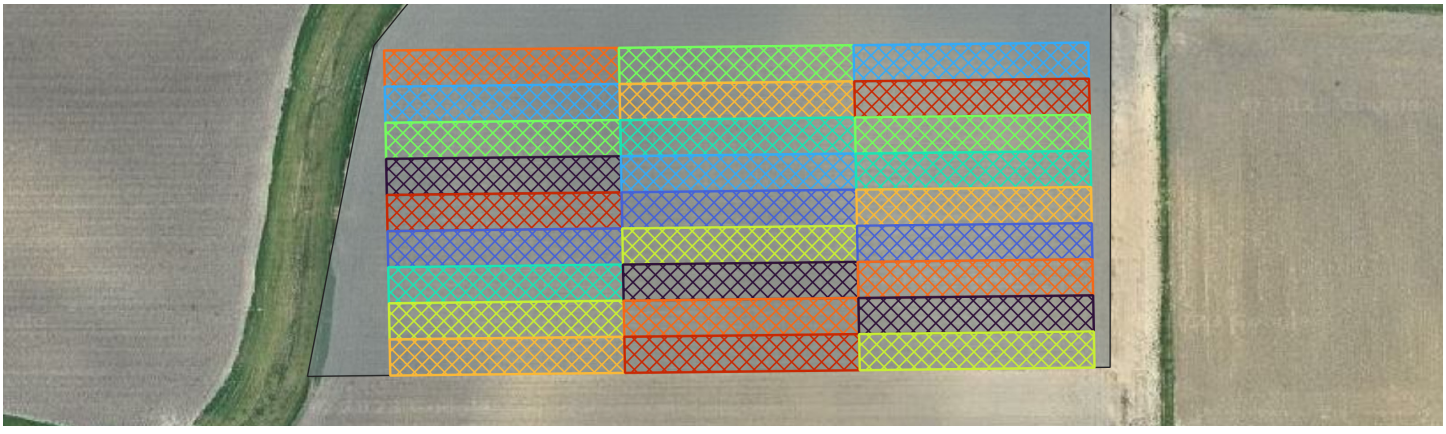

Planter Technology Influence on Corn Yield
290
285
280
275
270
265
Grain Yield (Bushels/ac)
283.3
275.4
Precison Planting® Retrofit
7000 3-Point



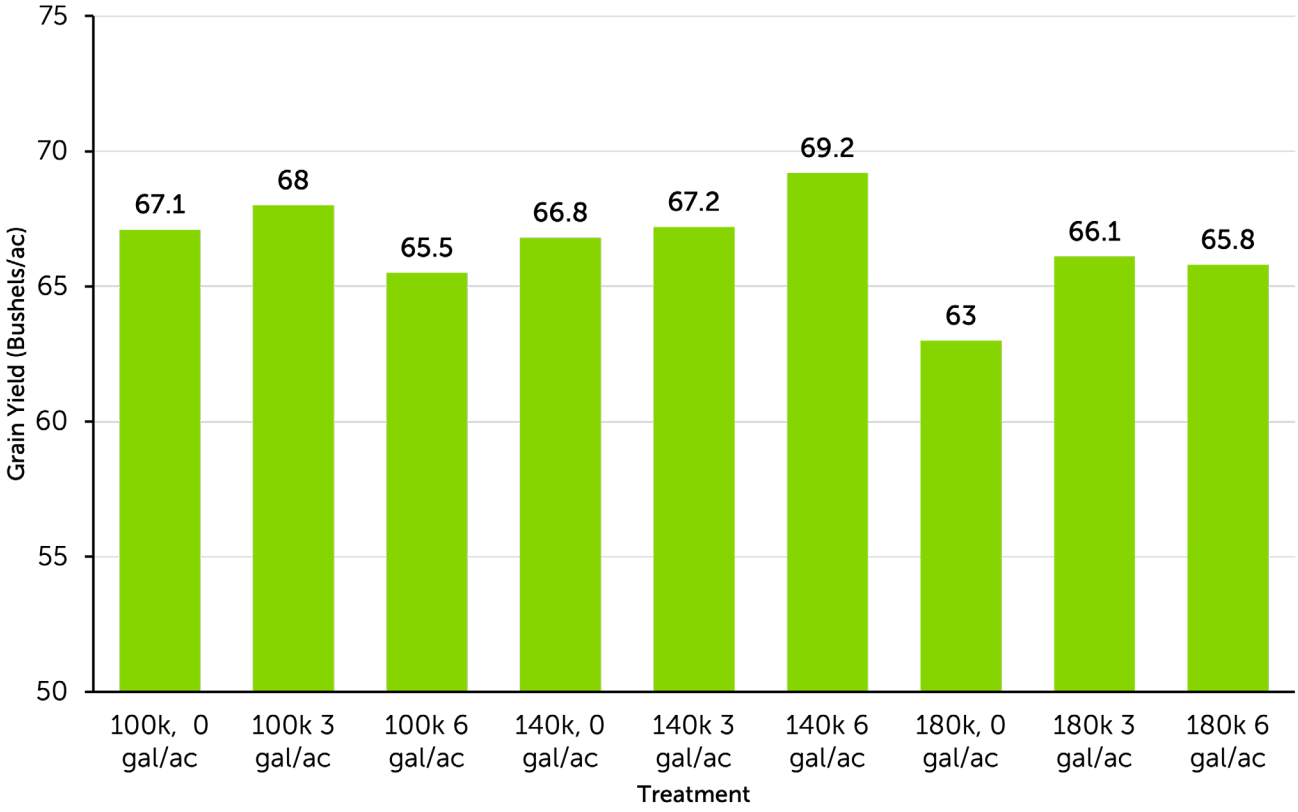
SOYBEAN STARTER / POPULATION

- 1 variety– Asgrow 35XF1
- 3 Starter Rates- 0, 3, 6 gal/acre
- 3 Seeding Rates 100K, 140K, 180K

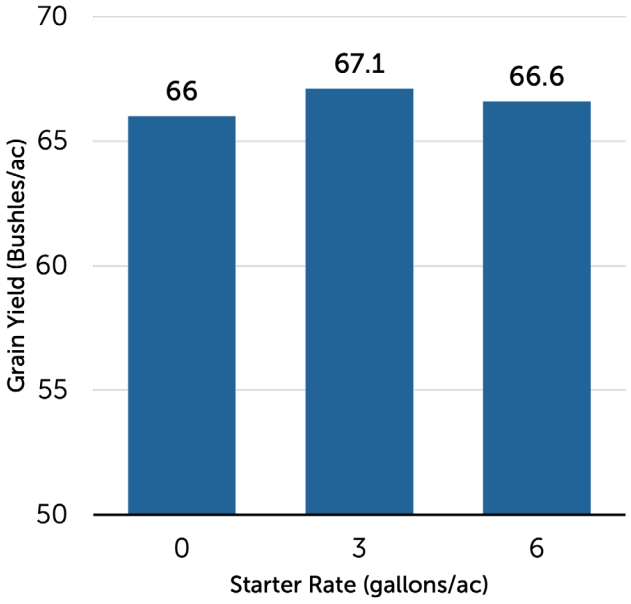
Starter fertilizer applications have been extensively studied in corn systems, but farmers have started asking more questions related to starter fertilizers' potential benefit in soybean production. This trial was established to better understand how different starter fertilizer rates and soybean seeding rates may impact soybean management. Positive response to starter fertilizer tends to occur more in northern regions with cooler climates as early season root growth can be slowed. Salt burn is a concern with starter, especially with in-furrow applications. Soybeans show more sensitivity to salt burn than corn which must be taken into consideration when using starter with soybeans. In most years starter fertilizer will thin stand slightly due to the salt injury, however, there is little to no impact on grain yield. There was no difference in grain between starter rates ranging from 66 bu/acre (0 gal/acre) to 67.1 bu/acre (3 gal/acre). Similar results were observed with seeding rates and their respective interactions. The limited response to starter fertilizer was likely due to ideal soil conditions at planting. The later planting date provided warm soils conducive to early season growth and development. Ideal soil conditions and warm temperatures at planting tend to show limited response to starter fertilizer. Farmers considering implementing a starter fertilizer in their soybean production system should first test on a small acreage to find optimum starter rate. Select a low salt starter to minimize the potential of salt burn. Recognize the potential for stand loss with in-furrow application which can impact final grain yield. Applying in 2x2 (2 inches to the side and 2 inches below) is a safer method for fertilizer delivery if there are concerns related to salt burn and stand loss.



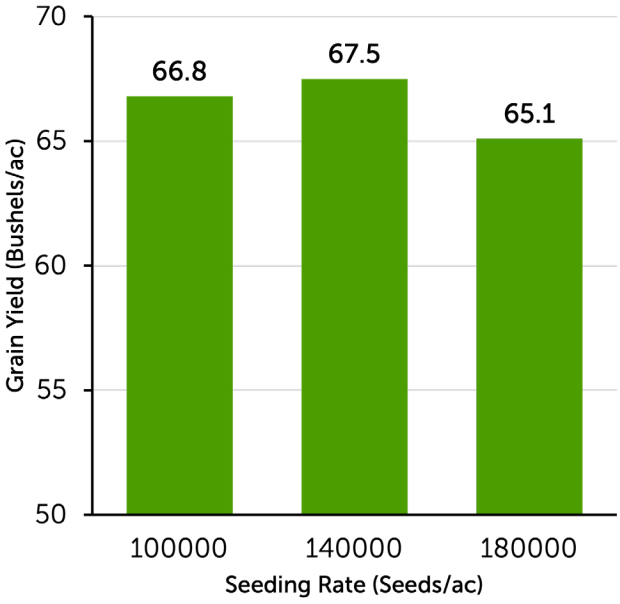
Grain Yield Response to Population Response and Starter Rate



Grain Yield Response to Starter Rate



Grain Yield Response to Soybean Population



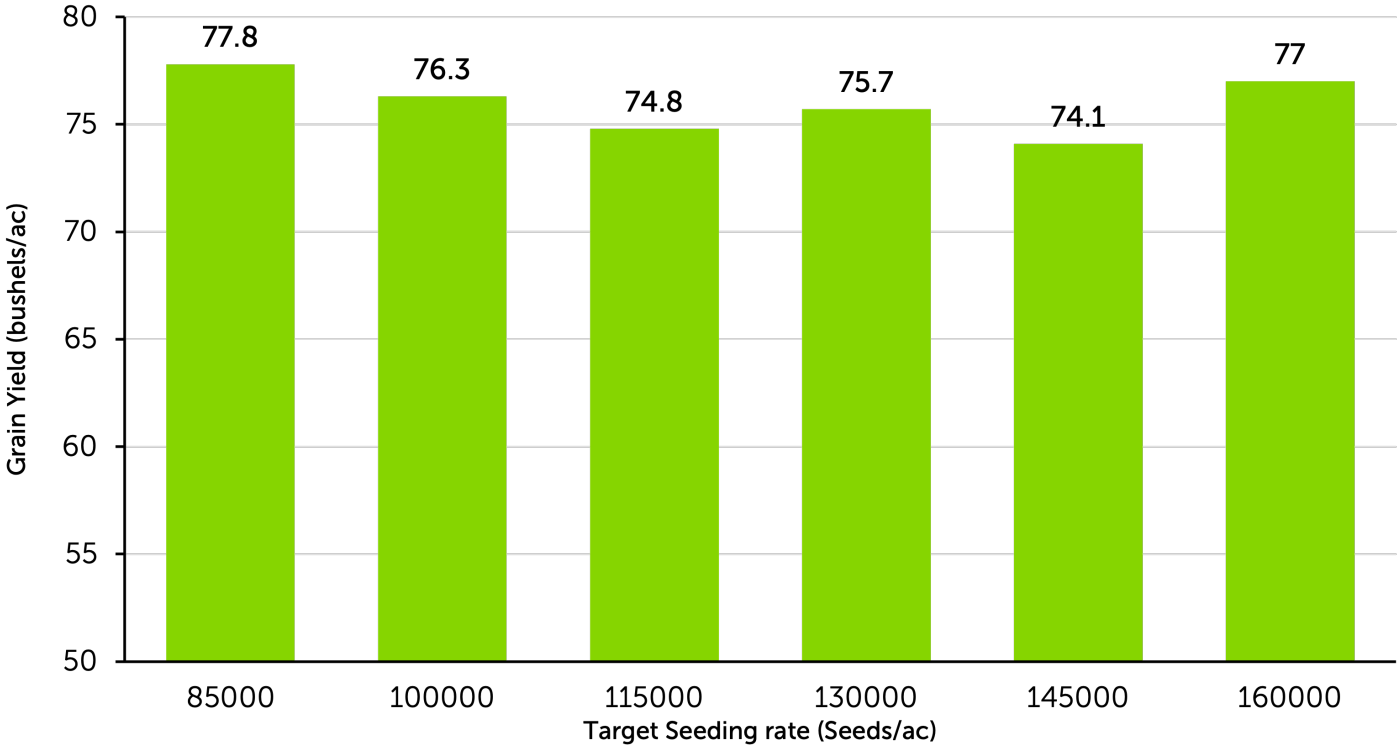
SOYBEAN POPULATION + FUNGICIDE RESPONSE

- 2 varieties– Dyna-Gro 35ES82, Asgrow 35XF1
- 6 Seeding Rates- 85K, 100K, 115K, 130K, 145K, 160K
- Fungicide treatment- Untreated, Delaro® Complete (R3)- 8 oz/acre

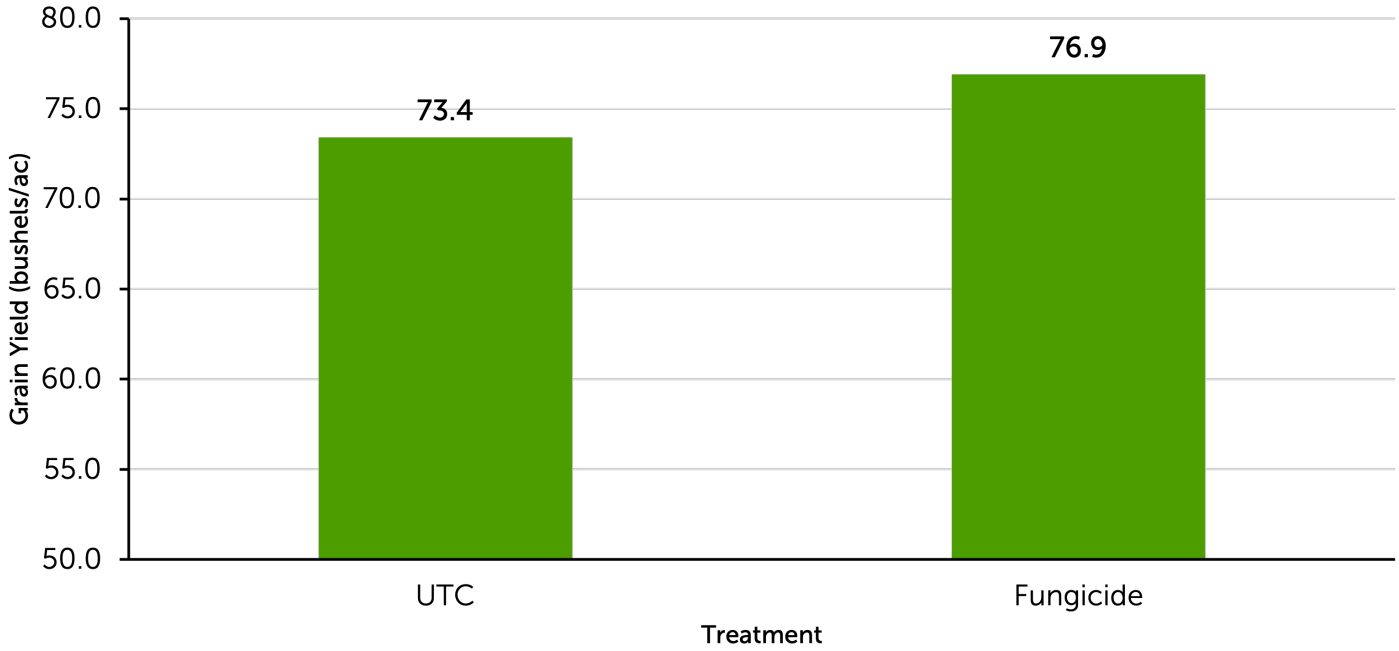
Soybean population management has become a topic of interest as more farmers have upgraded planters and seeders with variable rate capabilities. Unlike corn, farmers are interested in lowering populations while maintaining or increasing yield levels through additional management practices. To better understand the impacts of population management in soybean a replicated study was conducted at the Champaign Innovation Farm in 2023 focusing on soybean population response and fungicide management. Soybean grain yield was not impacted by lowering population, as 85K seeds/acre was the highest yielding treatment. Yield response to population ranged from 74.1 bushel per acre to 77.8 bushel per acre with no statistical significance found between treatments. Fungicide provided a 3.5 bushel increase compared to the untreated check, with yield response being similar regardless of population. These results illustrate that soybean population can likely be lowered while maintaining current levels of yield. It should be noted that when lowering population other management practices should be considered to ensure those populations are protected from stress that could reduce stand. The following practices should be considered when considered when growing any soybean crop and especially when lowering seeding rates.

1. Select soybean varieties with adequate tolerance/resistance to local stressors
2. Full suite seed treatment that includes insecticide, fungicide, and sudden death syndrome suppression
3. In-season fungicide application at R3
4. In-season nutritionals to help minimize potential plant stress

Yield Response to Population

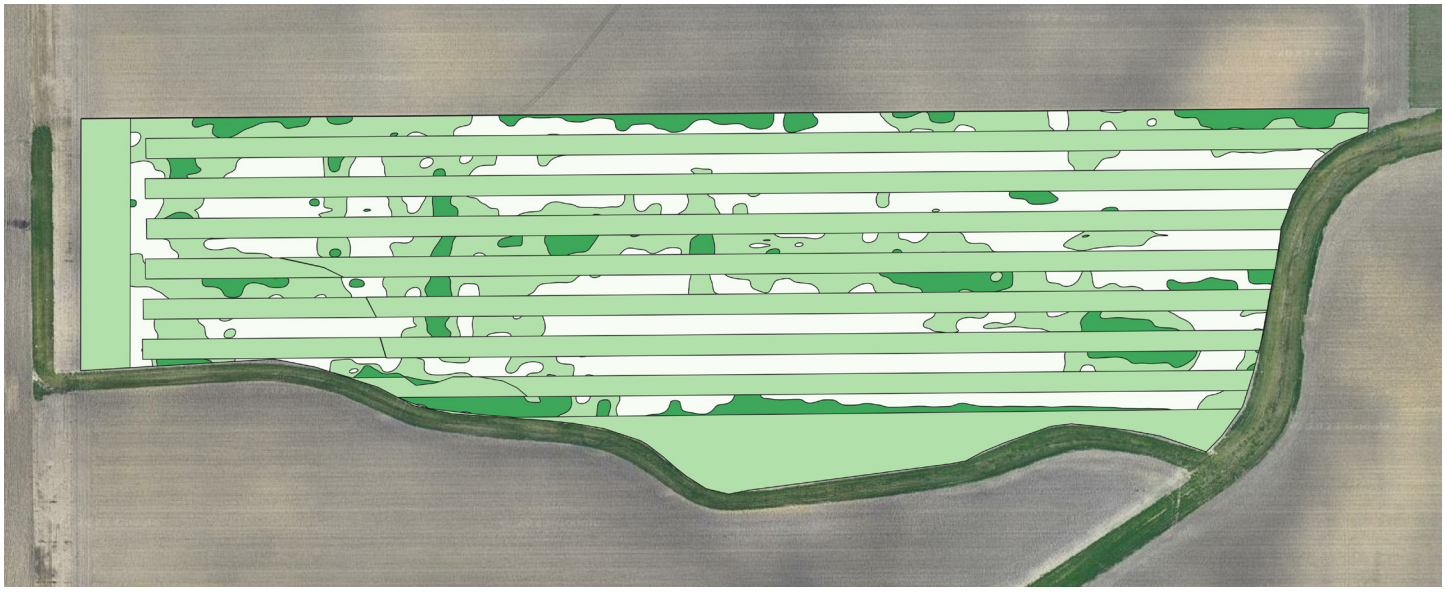


Yield Response to Fungicide

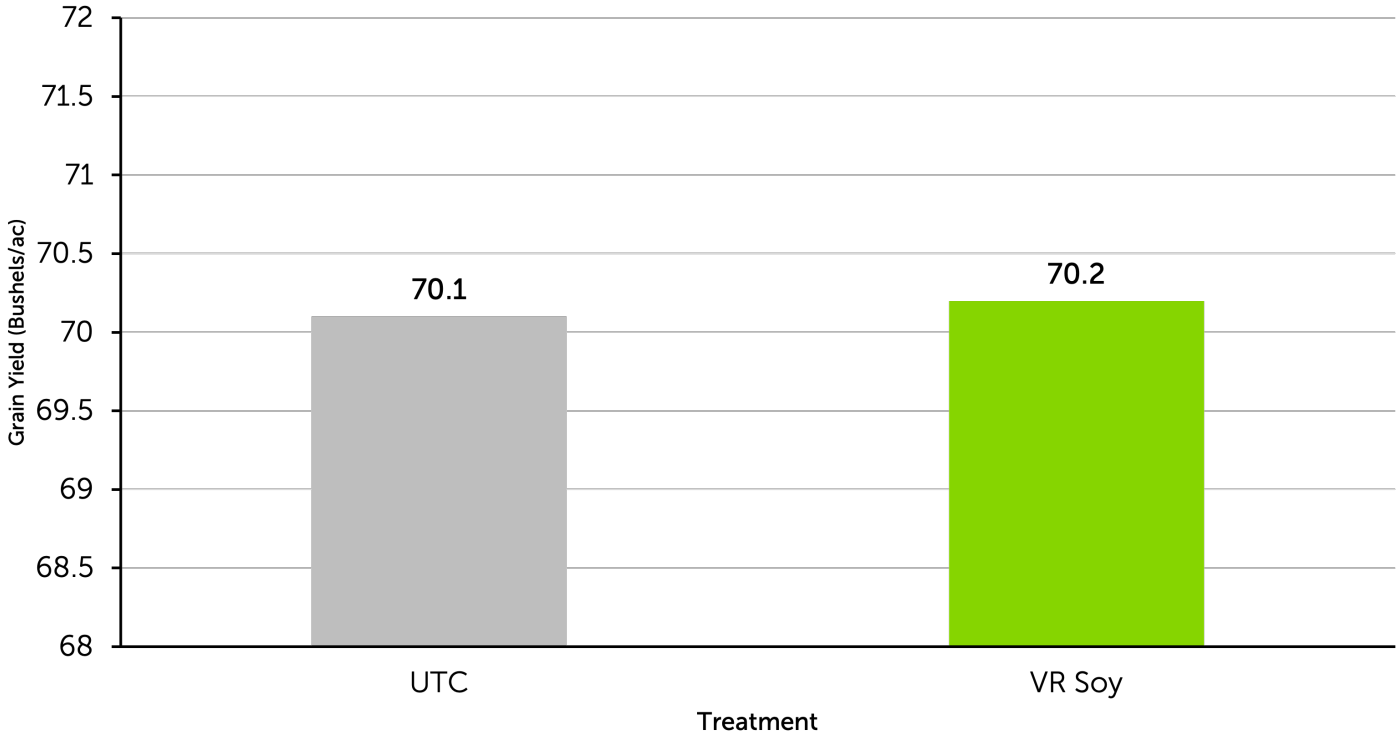


IMPROVING SOYBEAN MANAGEMENT THROUGH VARIABLE RATE SOYBEAN SEEDING

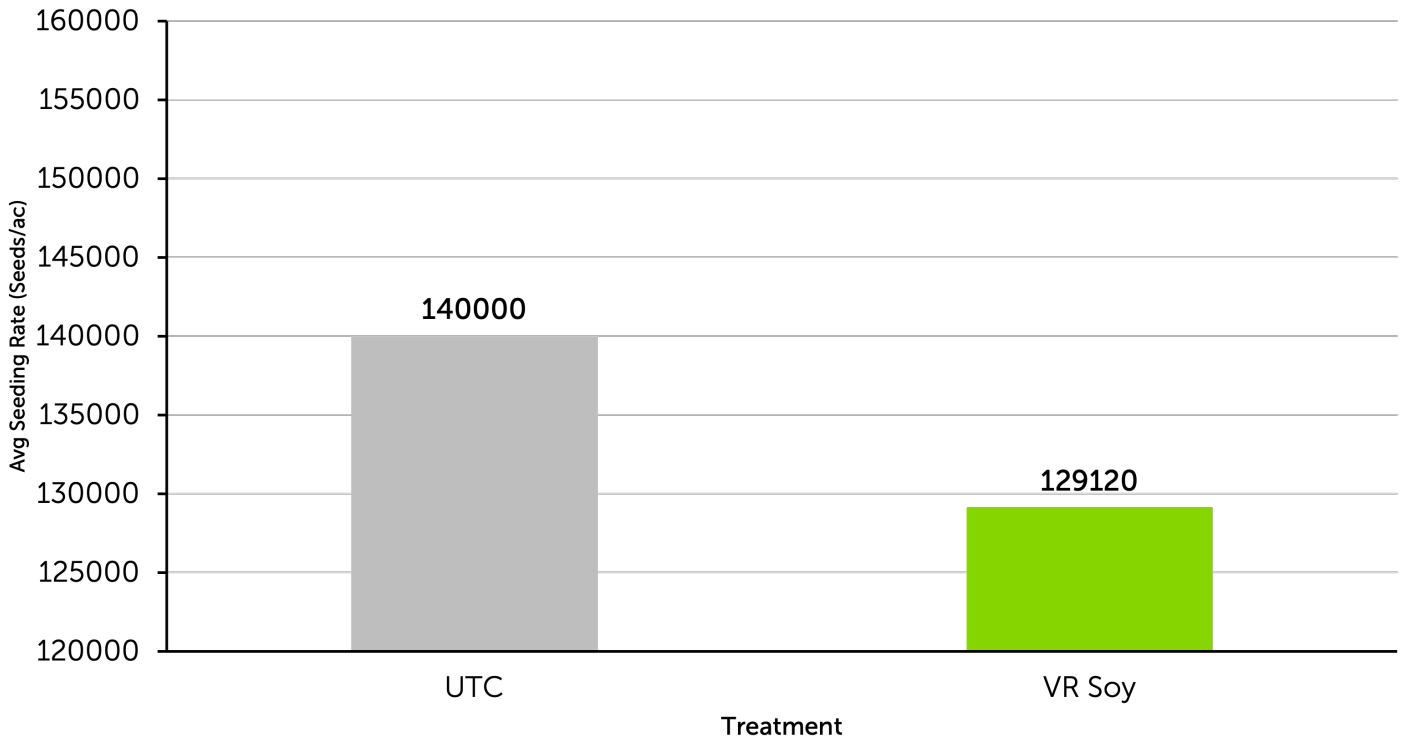
With increased adoption of variable rate planting and seeding technology farmers have become interested in understanding how to better manage soybean population. To provide a solution Nutrien has spent the last several years testing different variable rate soybean management strategies to provide an improved recommendation back to their customers. Through that work a new methodology has been developed that utilizes spatial data related to topography, landscape position, and water movement to provide a comprehensive variable rate prescription to our customers on a field-by-field basis. Prescription seeding rates varied from 120K-160K seeds/acre with average population being approximately 129K seeds/acre. The control treatment was the current standard of 140k seeds/acre. Prescription seeding rates were assigned based on potential yield stress derived from the spatial layers shown below. Higher populations were assigned to high stress areas (low yield environment) of the field. Low seeding rates were assigned to areas of the field with low stress (high yield environment). The trial was designed as strip trial with alternating strips of the assigned prescription beside a flat rate strip of 140K seeds/acre. Results indicated no difference in grain yield between both treatments. The standard rate and VR prescription yielded 70.1 and 70.2 bushels per acre, respectively. Our results for 2023 are like past years' data in that yield is similar when VR prescription is used compared to a standard rate of 140K seeds/acre. These results suggest there is opportunity to both implement VR soybean and lower population while maintaining high levels of grain yield.



Grain Yield by Treatment



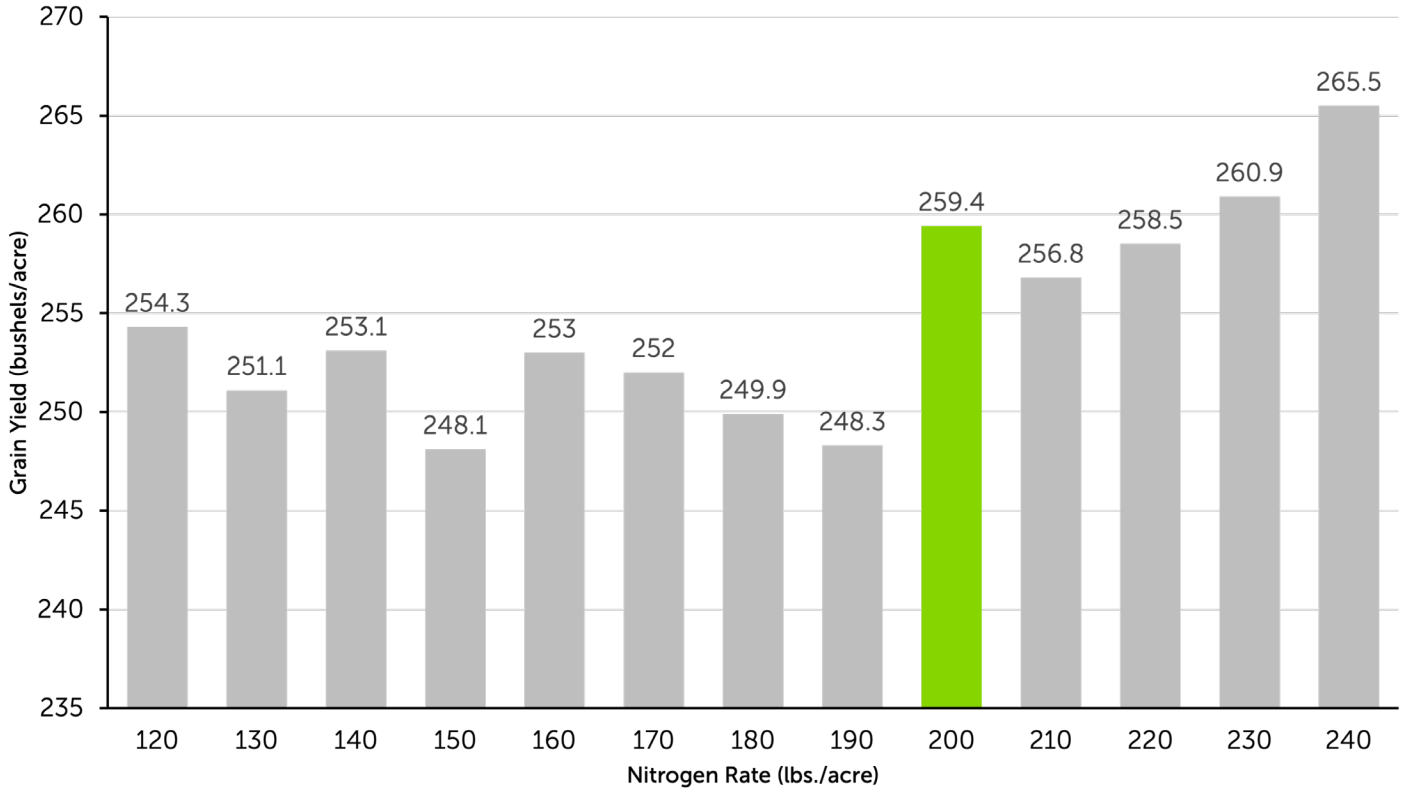
Average Seeding Rate

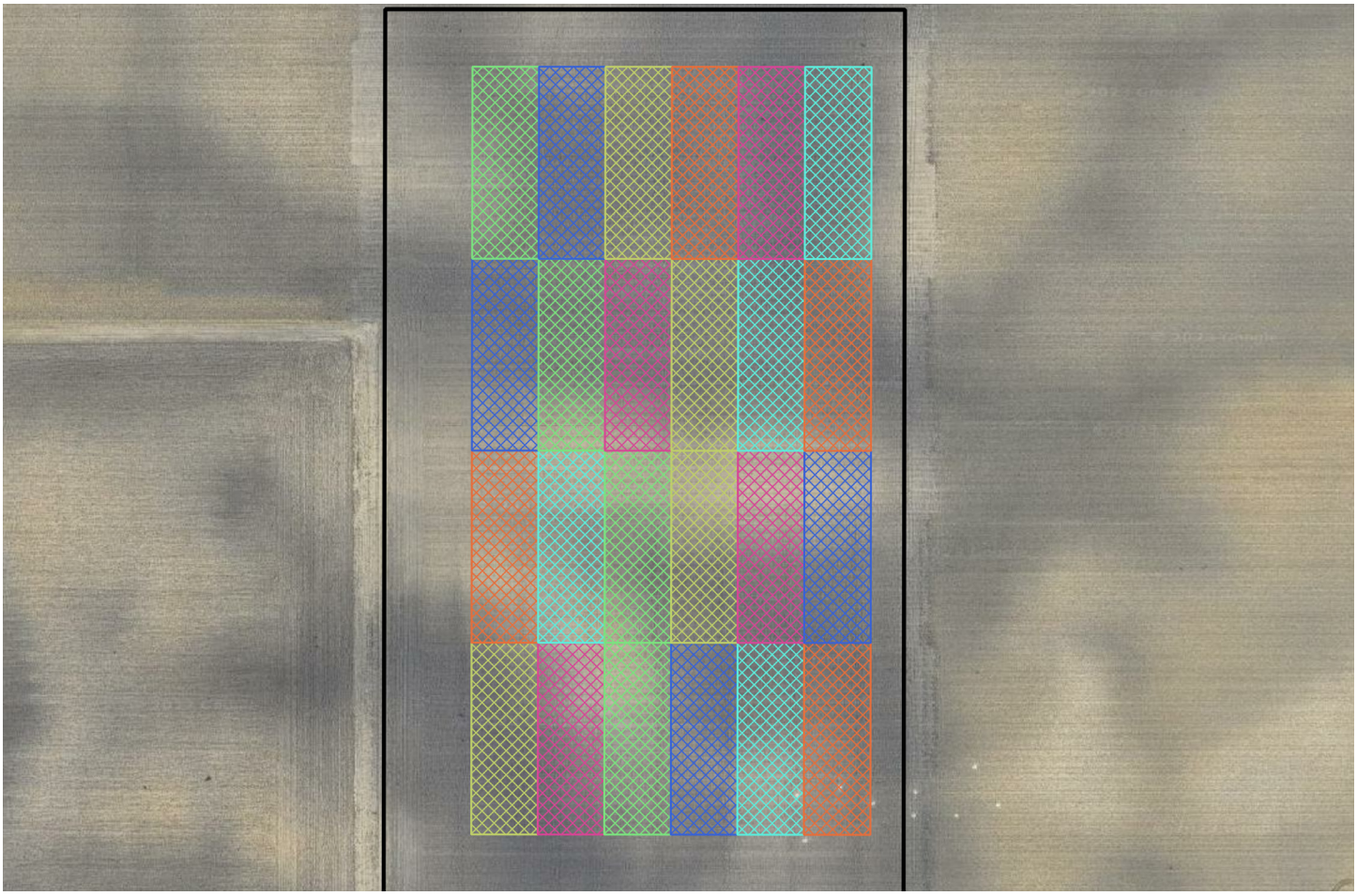


UNDERSTANDING NITROGEN RATE RESPONSES IN CORN

- 2 Hybrids – D56TC44RIB, DKC64-21RIB
- Nitrogen Rates (lbs/acre) – 120-240 lbs/acre on 10 lbs increments
- 120 units of N pre-plant (UAN 32%)
- Side-dress y-drop (UAN 32%) per each practice in a single prescription

Nitrogen (N) is one of the largest input expenses in corn production and requires numerous considerations when deciding on an optimum rate. Rate response is dependent on multiple variables including crop rotation, application timing, N source, soil organic matter (OM), and equipment availability. In addition, N costs have risen, requiring more diligence in deciding on an optimum rate to ensure a positive ROI. Due to an equipment issue, an N study focused on utilizing N models was lost, however, there was numerous application rates that had been applied which was analyzed to understand N response for the Champaign Innovation Farm. Average grain yield for the trial was 254.7 bu/acre. The data shows the variation in response to N rates but illustrates the value of high OM on the farm. The farm's average OM is 4.3%. Application of ultra-high N rates did not provide additional economic yield. This is a single year of data and requires several more years to truly arrive at an optimum N rate. The study does illustrate the value of high OM and allowing a soil to provide a crop with mineralized N which can help in reducing N rates when the opportunity exits.


270
265
260
255
250
245
240
235
Grain Yield (bushels/acre)
254.3
251.1
253.1
248.1
253
252
249.9
248.3
259.4
256.8
258.5
260.9
265.5
120
130
140
150
160
170
180
190
200
210
220
230
240
Nitrogen Rate (lbs./acre)



NOTES:

WINTERVILLE, MS

CORN SOYBEAN COTTON RICE

The Nutrien Innovation Farm in Winterville, MS is situated in the heart of the Mississippi alluvial flood plain or as it is more commonly known, the Delta. In the early 1800's much of the Mississippi Delta was still covered in canebrakes and cypress knees. Early settlers traveled the various creeks and streams that traversed the landscape until they found some "high ground" on which to establish a farmstead. It turned out that these higher grounds next to creeks and bayous also happened to be some of the most fertile lands, not only in the Delta, but quite possibly the world. Centuries of flood events from the Mississippi River deposited sediment collected from nearly half of the continental United States. These events created a topsoil that in many areas exceeds six feet in depth creating a near ideal environment for deep rooted crops such as cotton. However, over the last few decades cotton acres gradually began to give way to corn, soybean and rice.

In the late 1980's Ciba-Geigy purchased a 200-acre tract near Winterville, MS and established the Delta Research Station to conduct research and test products for agricultural use. Today the Nutrien Innovation Farm is the proud owner of this site conducting trials and demonstrating sustainable agricultural practices in cotton, corn, soybean, and rice. The Innovation Farm is also home to the Dyna-Gro cotton breeding program. The purpose of the Nutrien Innovation Farm system is to promote profitable and sustainable agricultural practices while demonstrating the Whole Acre Solution Nutrien can offer to its grower customers.

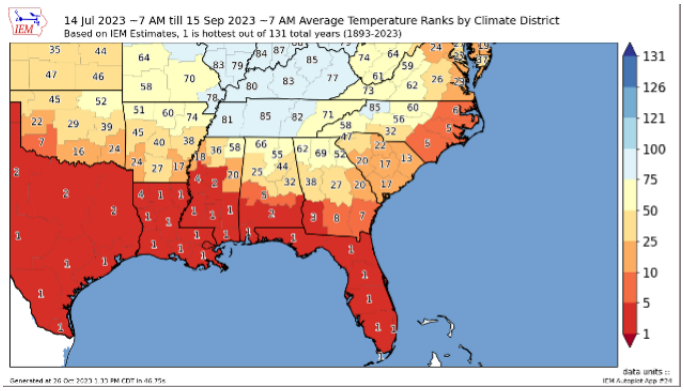
WINTERVILLE WEATHER

Nestled in the heart of the Mississippi Delta, the Winterville Innovation Farm experiences a wide range of weather impacts characteristic of the Southern US. Like any year, 2023 brought its own set of challenges. A warm and wet spring delayed planting as some fields collected standing water. In late March, the Rolling Fork, MS, tornado, rated an EF4, devastated communities just 40 miles to the southeast. Winterville lies in the heart of "Dixie Alley" which is prone to long-track violent tornadoes in Spring.

The pattern turned seasonal as the first half of summer brought friendly weather for crops in the area. Unfortunately, that changed in August with the onset of heatwaves and drought across the southern Mississippi River Valley. Daytime temperatures exceeded triple-digits on multiple occasions along with overnight lows routinely pushing above 77°F – stressing crops. We've found that traditional Growing Degree Day (GDD) calculations fail to capture heat-stress related to warm temperatures typical of the Southern US. To better understand the impact of these southern heatwaves on Corn and other crops, our team initiated research on alternative metrics like Stress Degree Days (SDD) and other crop stress indices. Fortunately for acreage across the Delta, many fields are irrigated and can better mitigate heat stress during critical reproductive windows.

The wider drought conditions across the Mississippi River Watershed once again reduced the river -- which flows just a few miles from the farm -- to near record low levels at the USGS reporting station in Memphis, TN. As of this writing (10/24/2023) 93% of the state was experiencing severe drought or worse with the Winterville farm fortunate enough to be in the Moderate Drought classification. There may be good news for the river however, recent rains across the Central US, and a wetter long-term forecast across the Mid-South has increased the likelihood those river levels recover for busy autumn barge traffic.

As our attention shifts toward the late fall and winter forecast, our focus is on the strengthening El Niño in the Pacific. We know from historical data that winter precipitation often increased across the Southern US during El Niño episodes. Long-range forecasts from the ECMWF for November, and the Climate Prediction Center's forecast for this winter (Dec/Jan/Feb) suggest that Mississippi and the farm could see above normal rainfall.



CORN

Planting Date: 4-20-2023

Seeding Rate: ~34,500 seed/ac

Fertilizer: 255 lbs N Total
- 41-0-0-4 @ 185 lbs/ac - Planting
- 28-0-0-5 @ 45 gal/ac + 1 gal/ac CarbN – V5
- 46-0-0 @ 100 lbs/ac – VT

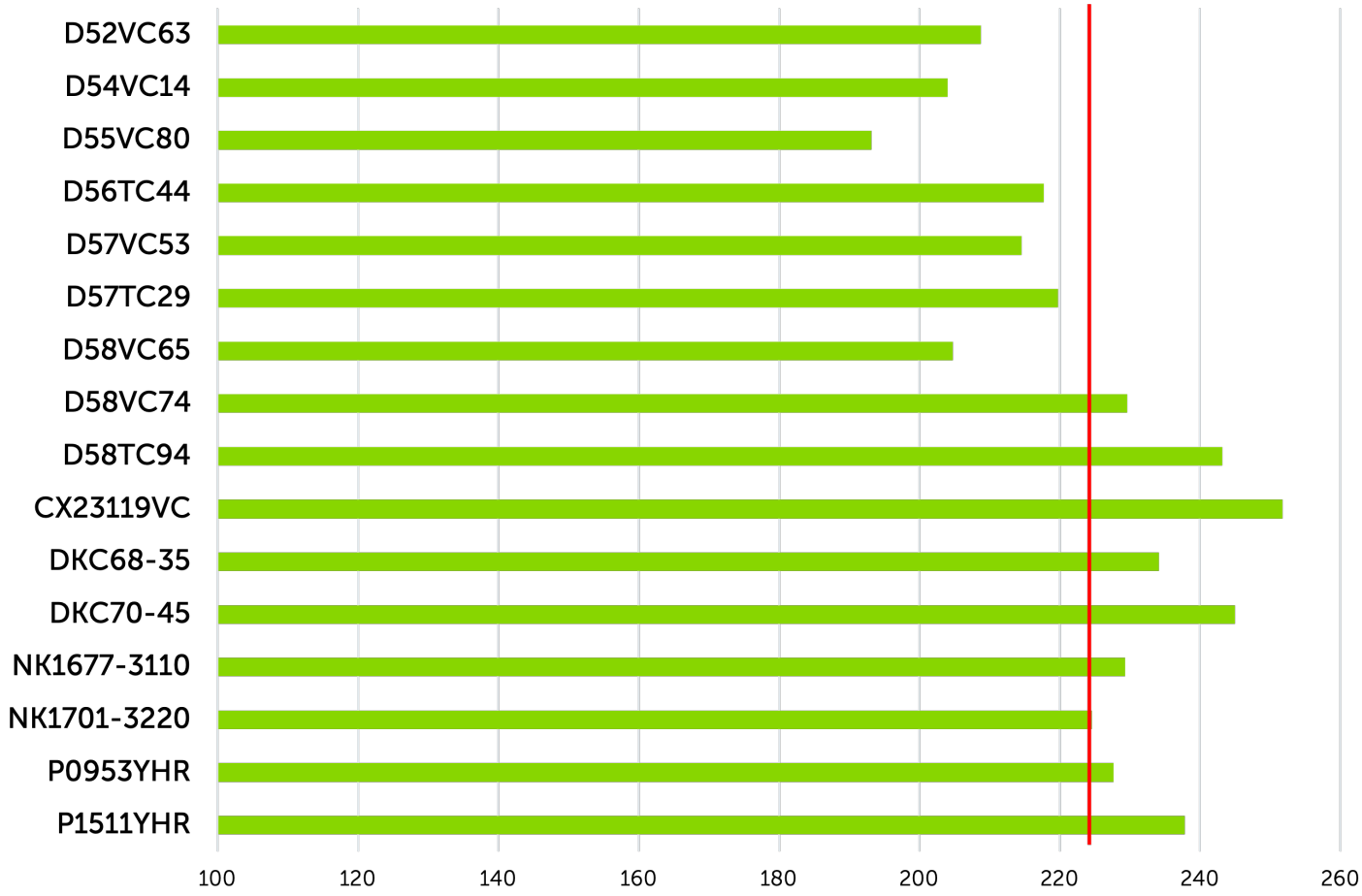
Herbicide:
- 16 oz/ac Fortitri + 32 oz/ac Atrazine – Pre-emerge
- 64 oz/ac Halex GT + 32 oz/ac Atrazine – V4

Nutritional:
- 32 oz/ac NutriSync Complete 3D – V4

Fungicide:
- 13.7 oz/ac Trivapro + 2 oz/ac Franchise – VT

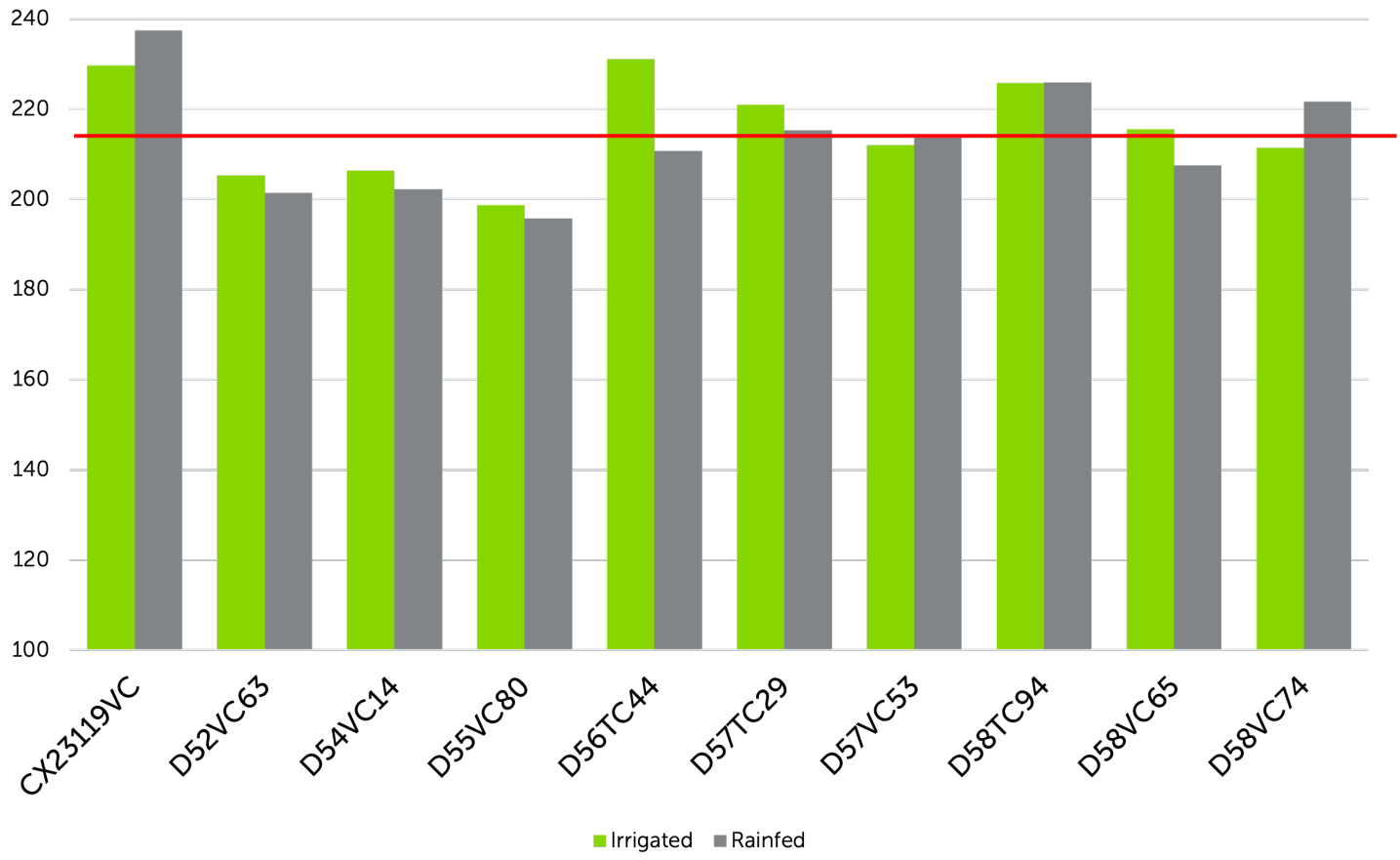
Harvest Date: 8-29-2023

Road Show – Corn Variety Trial



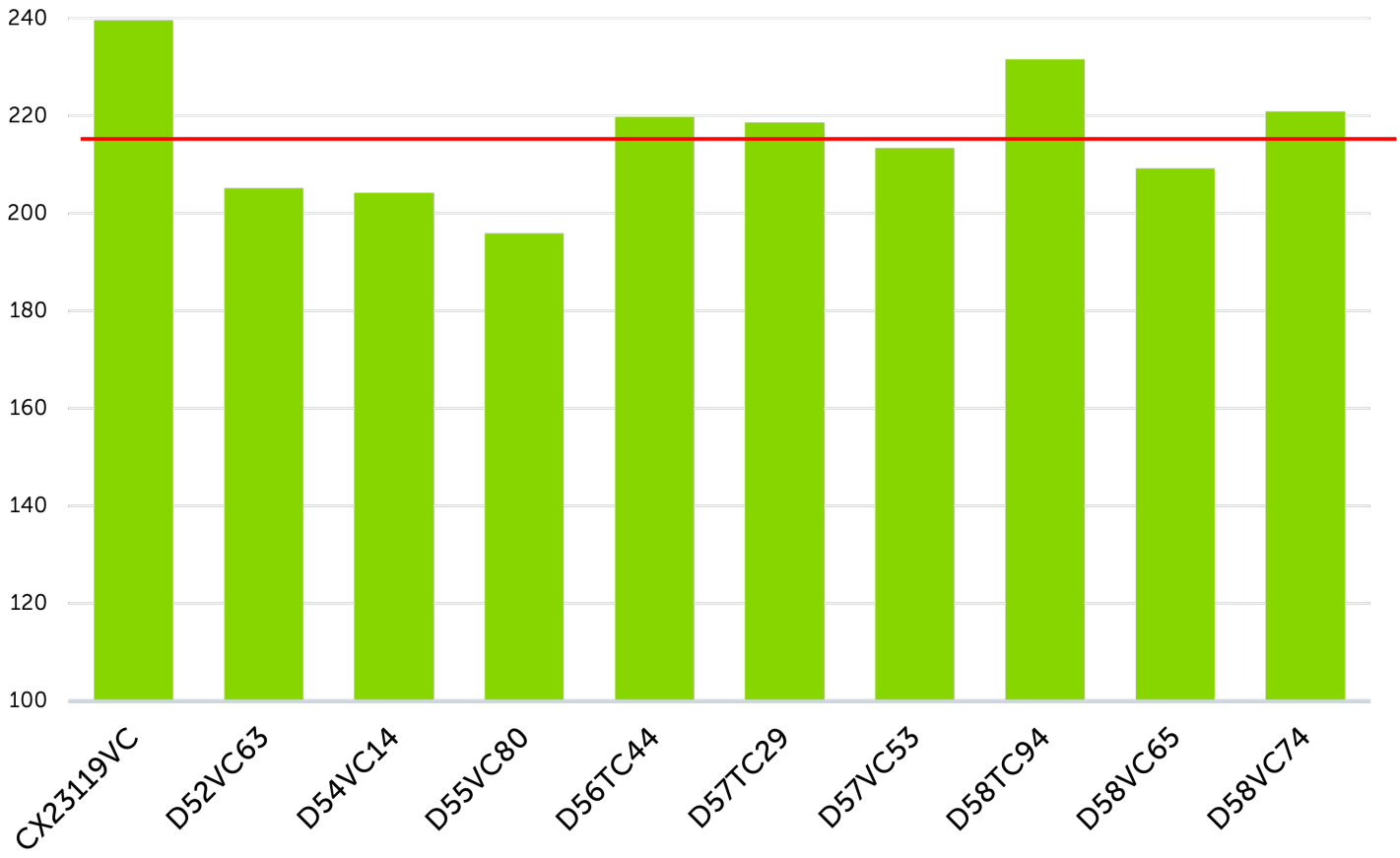
Trail Average 224 bu/a

Irrigated vs Rainfed – Corn Trial



Trial Average 214 bu/a

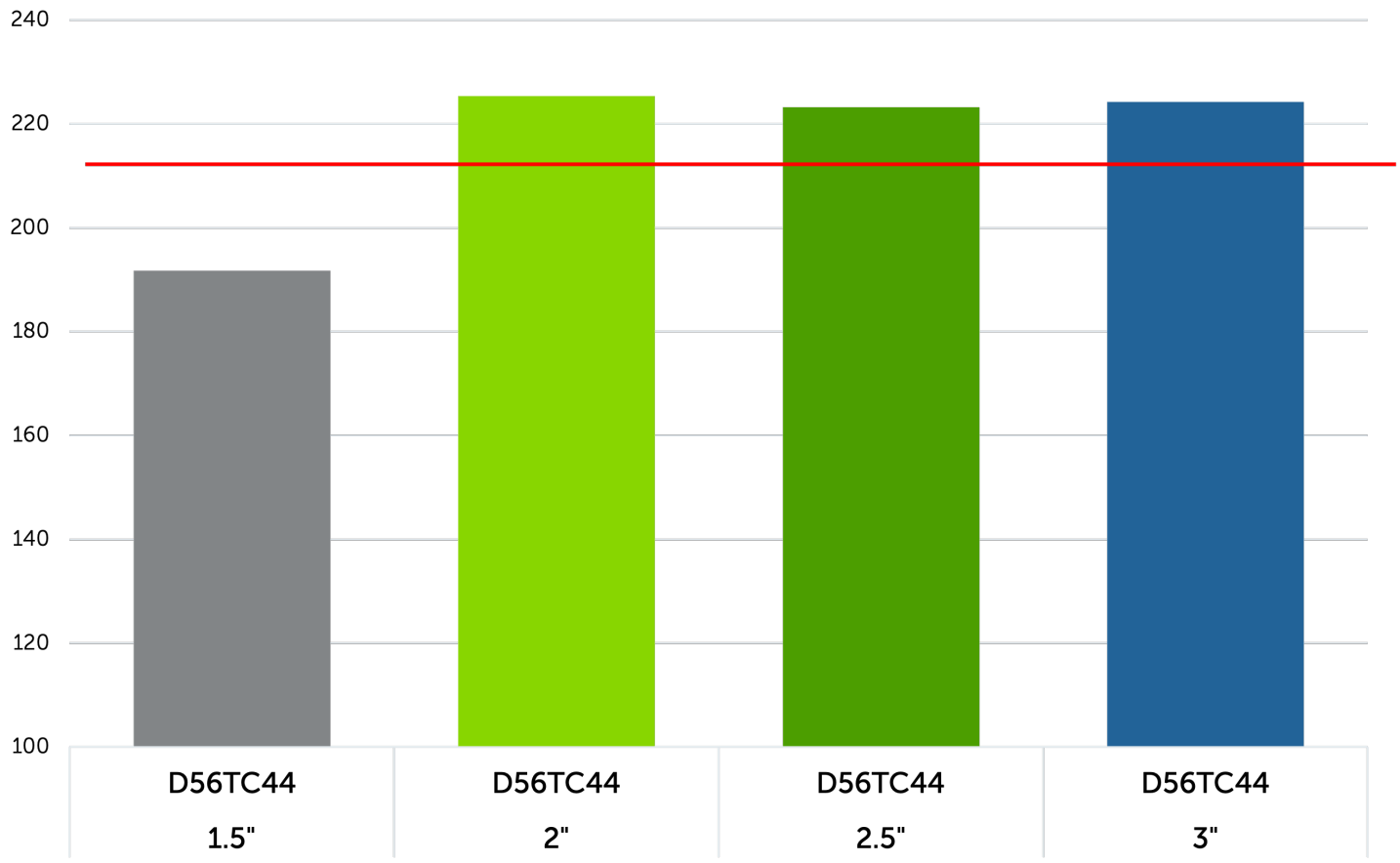
Dyna-Gro Corn Averages



Average 216 bu/a

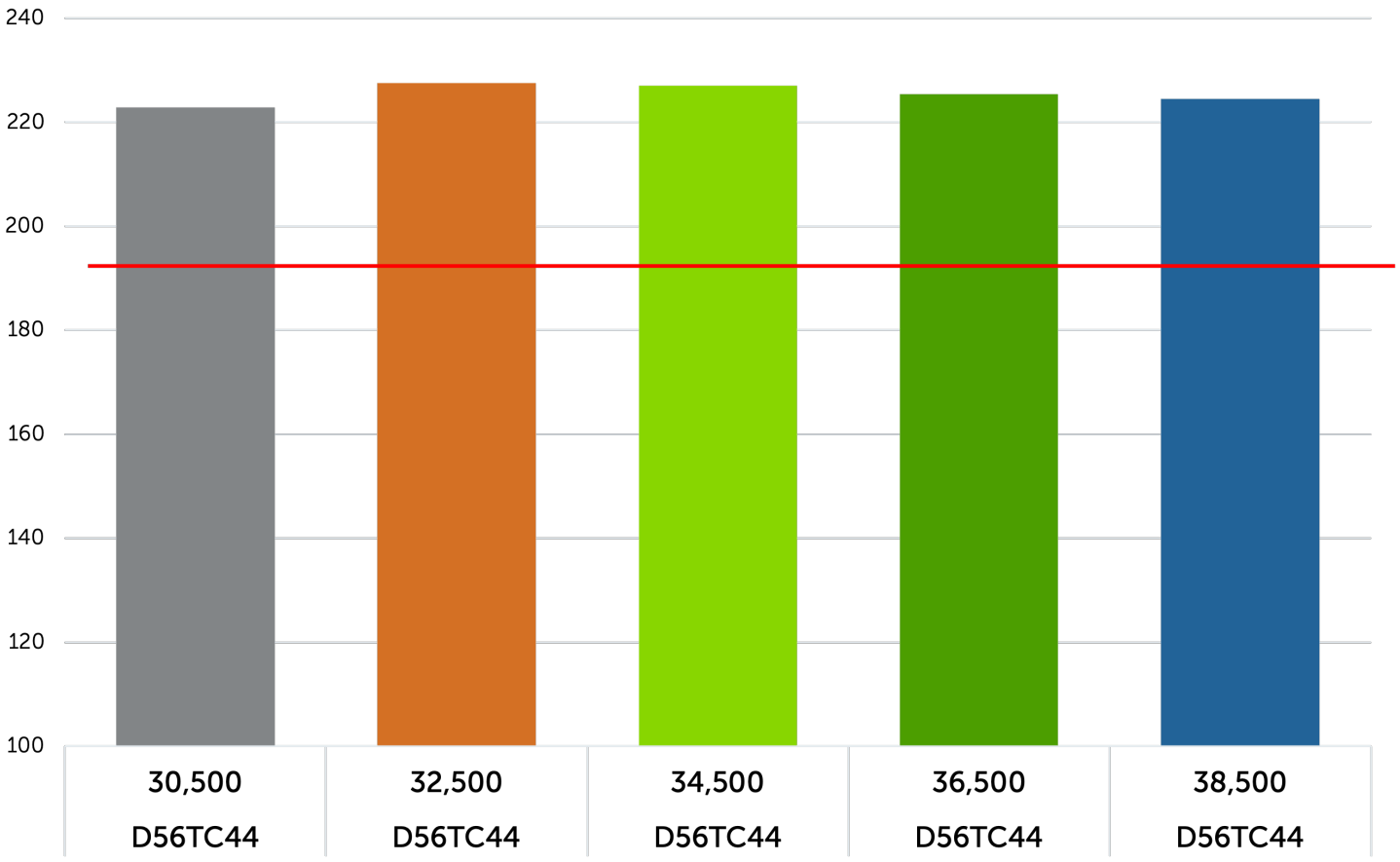
Data averaged across three on-farm trials

Planting Depth – Corn Trial



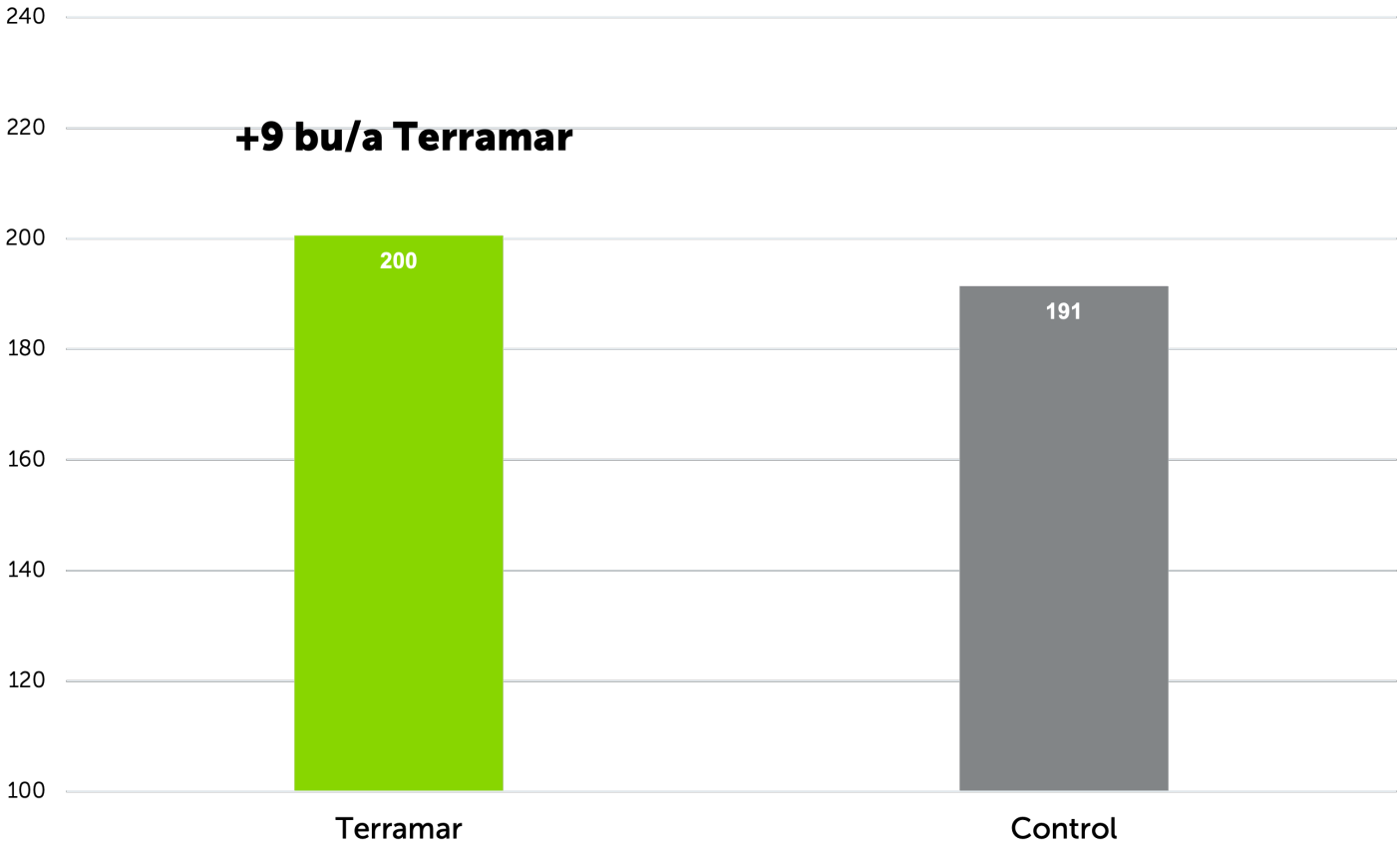
Trial Average 216 bu/a

Population – Corn Trial



Trial Average 225 bu/a

Terramar – Corn Trial



Applied 32 oz/acre Terramar to V5 corn in 10 gal water/acre

NOTES:

SOYBEAN

Planting Date: 4-25-2023

Seeding Rate: ~140,000 seed/ac

Fertilizer:
- Ammonium Sulfate @ 90 lbs/ac - Planting

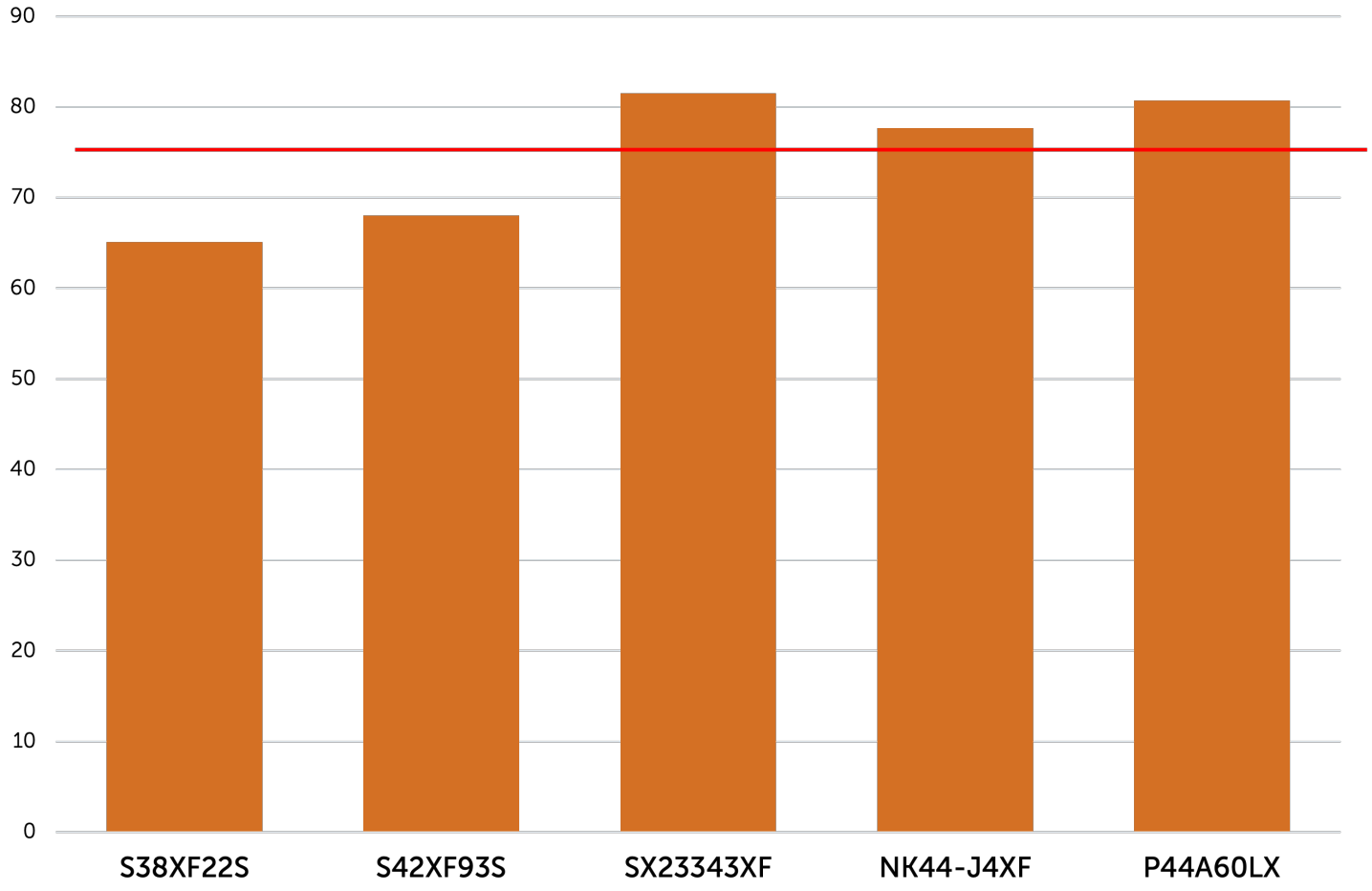
Herbicide:
- 32 oz/ac Intimidator – Pre-plant
- 24 oz/ac Prefix + 32 oz/ac Roundup PowerMax 3 + 2 oz/ac Radiate – V2
- 32 oz/ac Liberty – V4

Nutritional:
- 32 oz/ac NutriSync Complete 3D – V2

Fungicide:
- 13.7 oz/ac Miravis Top + 2 oz/ac Franchise – R2

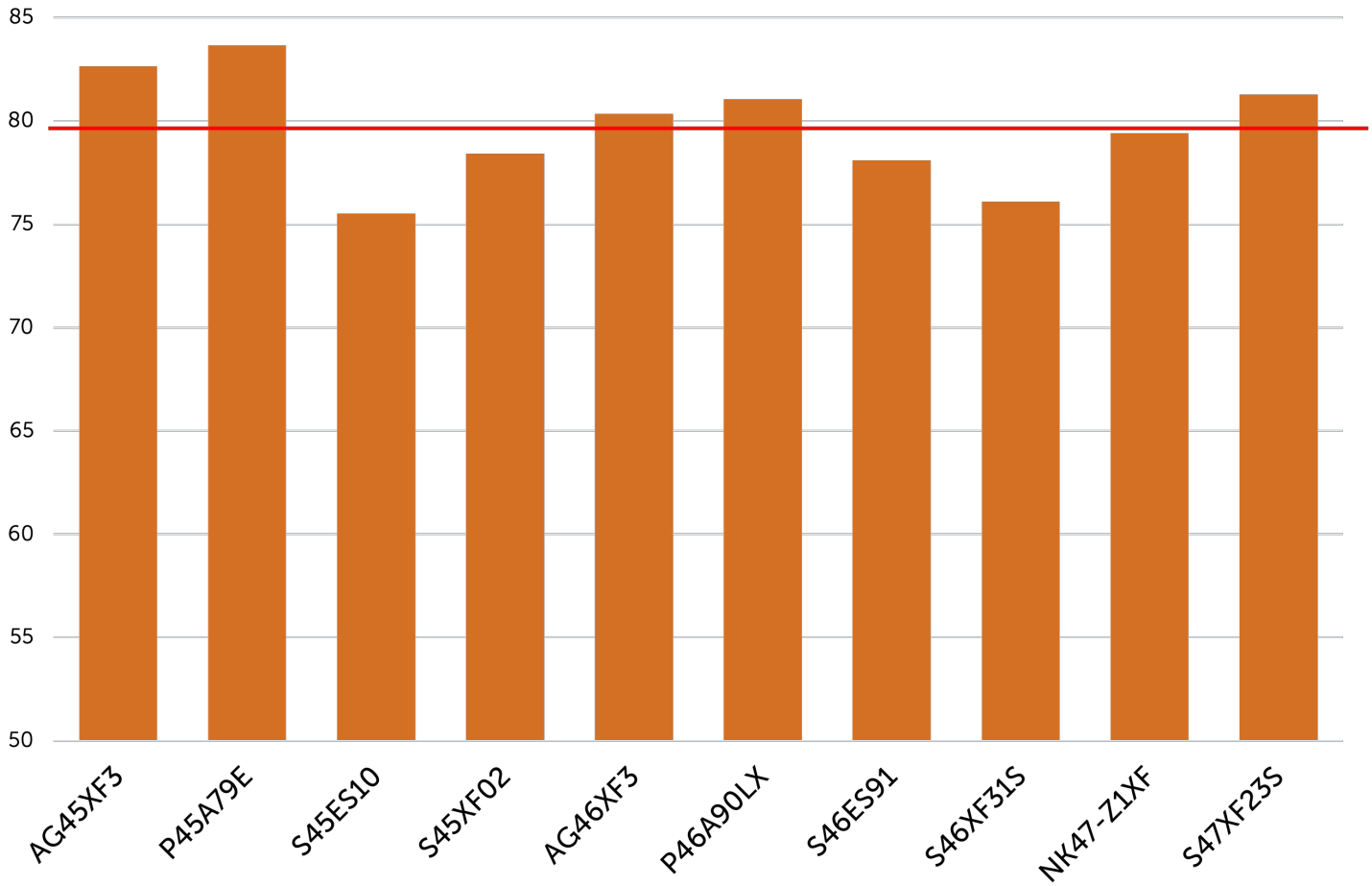
Harvest Date: 9-18-2023

Early-MG Soybean Variety Trial



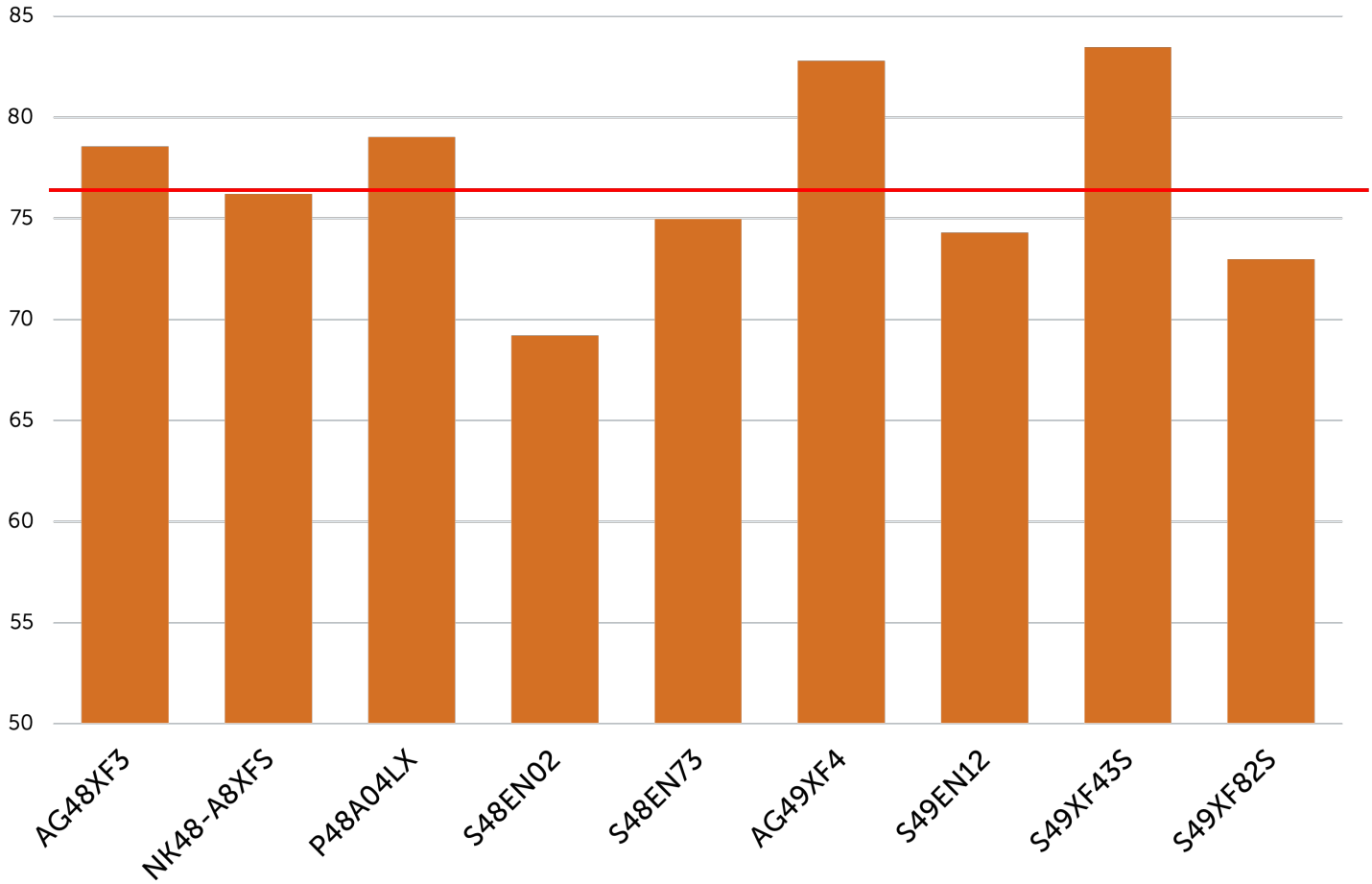
Average 74.6 bu/a

Mid-MG Soybean Variety Trial



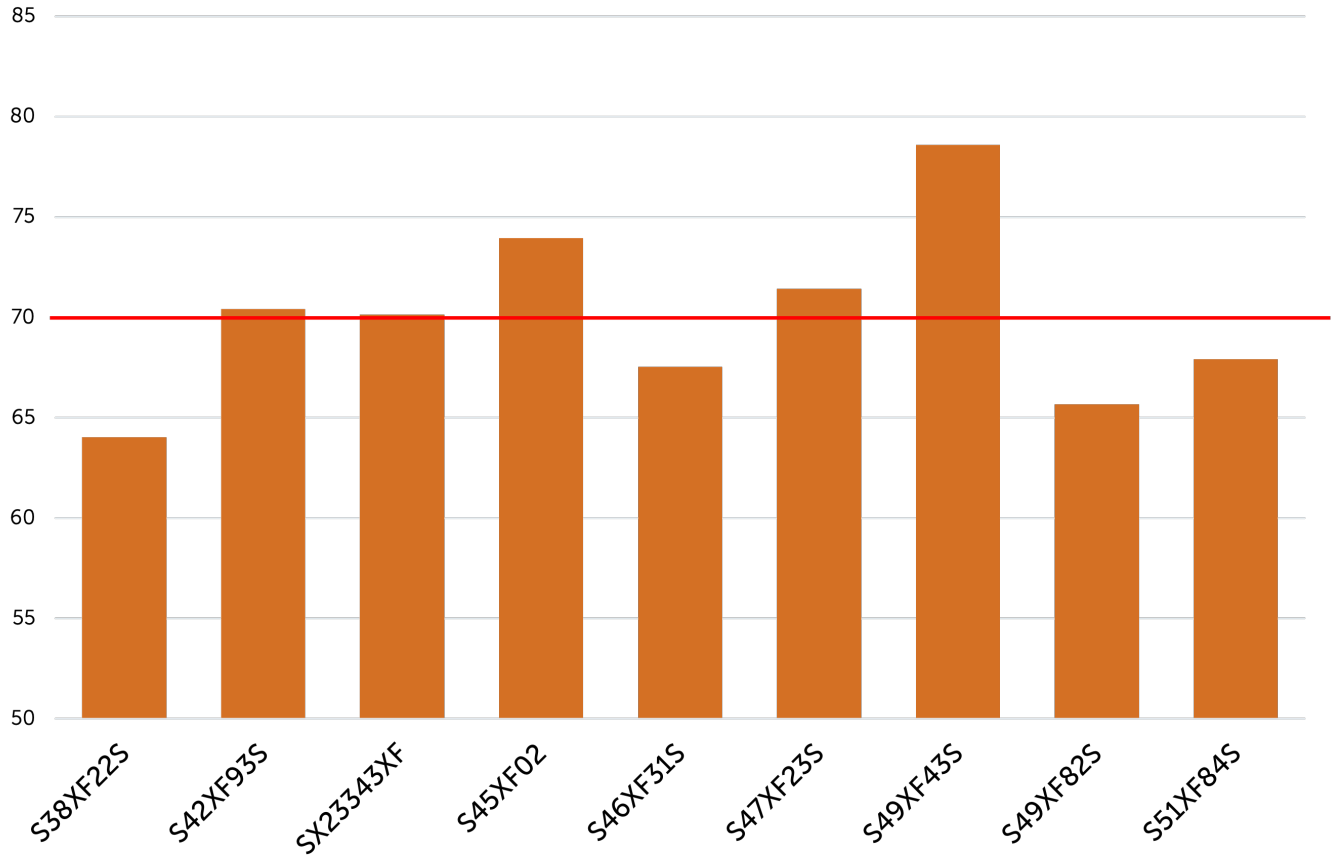
Average 79.7 bu/a

Late-MG Soybean Variety Trial



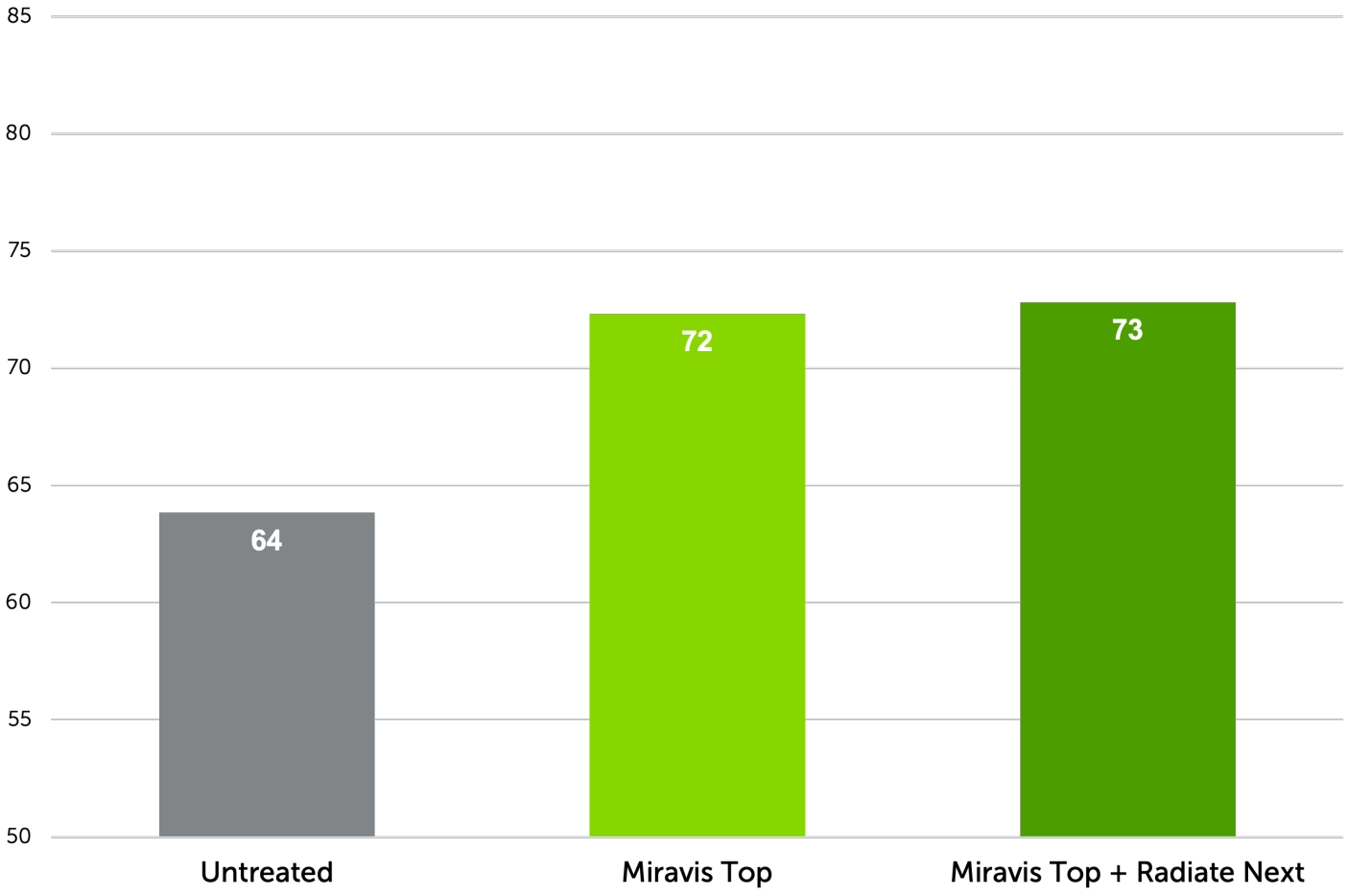
Average 76.8 bu/a

Dyna-Gro Road Show Soybean Variety Trial



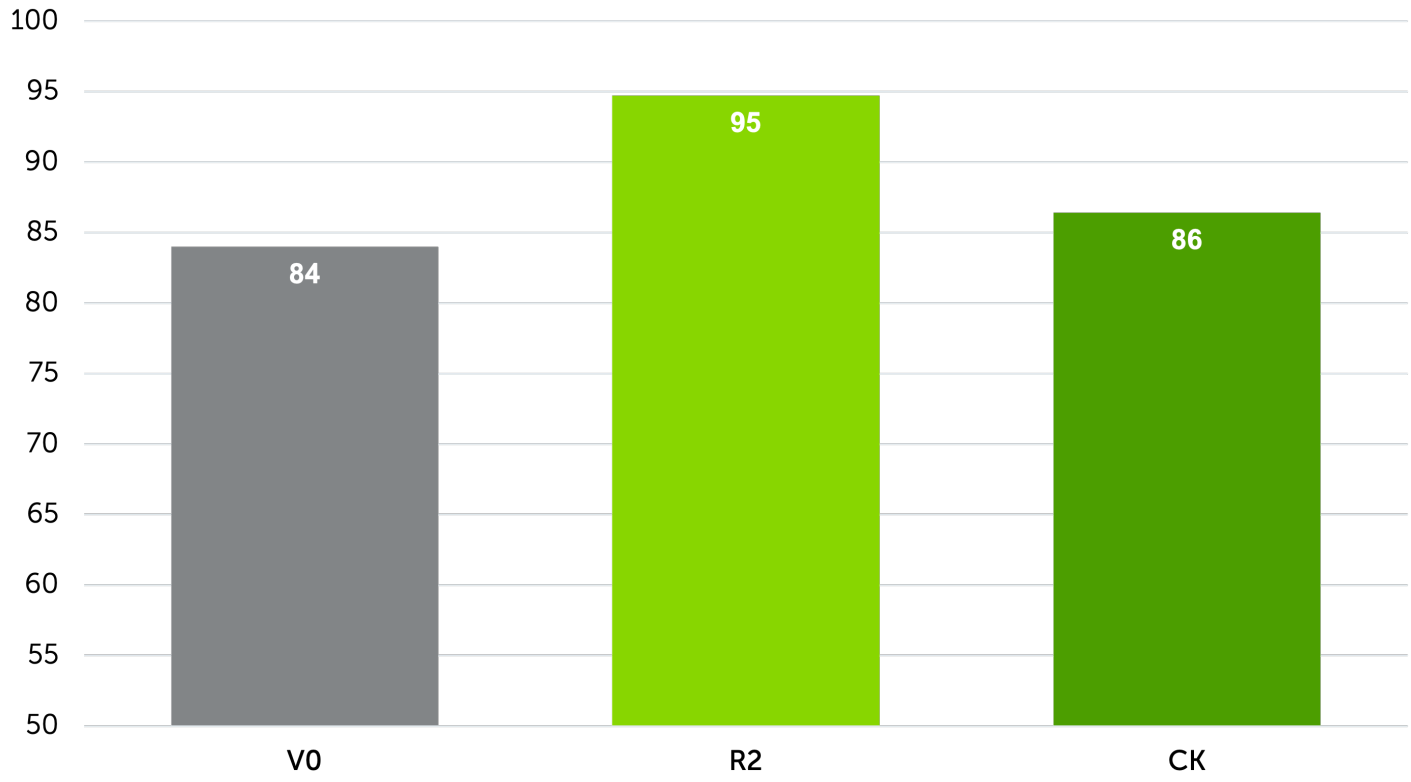
Average 70 bu/a

Fungicide x Radiate Next Trial



Miravis Top – 8 bushel Advantage Over Untreated
Miravis Top + Radiate Next – 9 bushel Advantage Over Untreated

AMS Trial



90 lbs ammonium sulfate applied at planting (V0) or bloom (R2)

NOTES:

COTTON

Planting Date: 5-15-2023

Seeding Rate: ~34,000 seed/ac

Fertilizer:
- 28-0-0-5 @ 28 gal/ac + 1 gal/ac CarbN – Pinhead Square

Herbicide:
- 16 oz/ac Reflex – Pre-plant
- 16 oz/ac Brake + 16 oz/ac Cotoran – Pre-emerge
- 32 oz/ac Roundup PowerMax 3 + 20 oz/ac Medal – V3
- 32 oz/ac Liberty – V5
- 2.0 oz/ac Zidua + 32 oz/ac Diuron – Layby

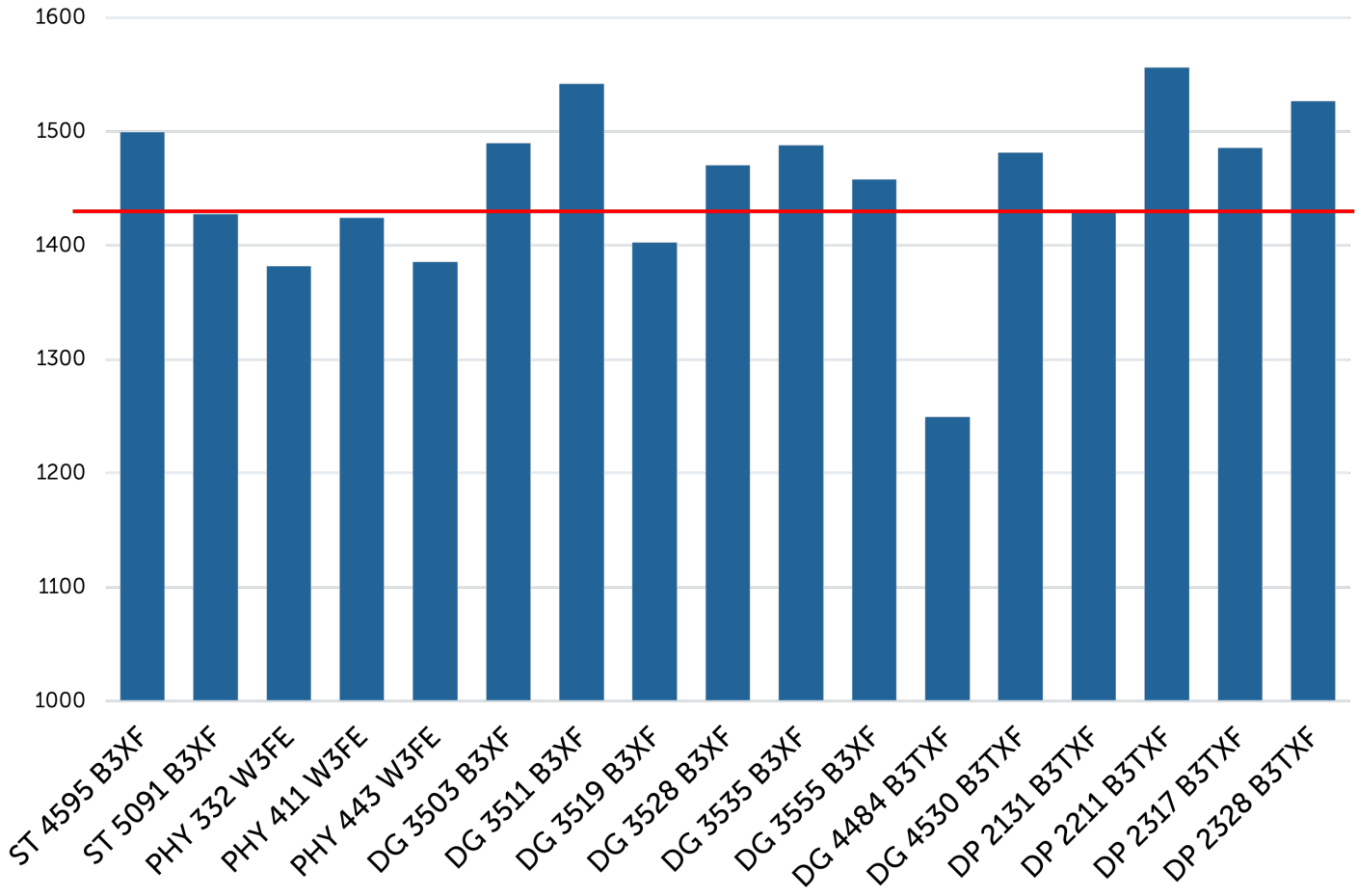
Nutritional:
- 16 oz/ac NutriSync Boron + 64 oz/ac Lokomotive – V2

Plant Growth Regulators:
- 12 oz/ac Potenza – 6/23/23
- 12 oz/ac Potenza – 6/29/23
- 8 oz/ac Mepiquat – 7/11/23
- 8 oz/ac Mepiquat – 7/17/23
- 12 oz/ac Mepiquat – 7/28/23
- 20 oz/ac Mepiquat – 8/10/23
- 20 oz/ac Mepiquat – 8/16/23

Insects managed as needed

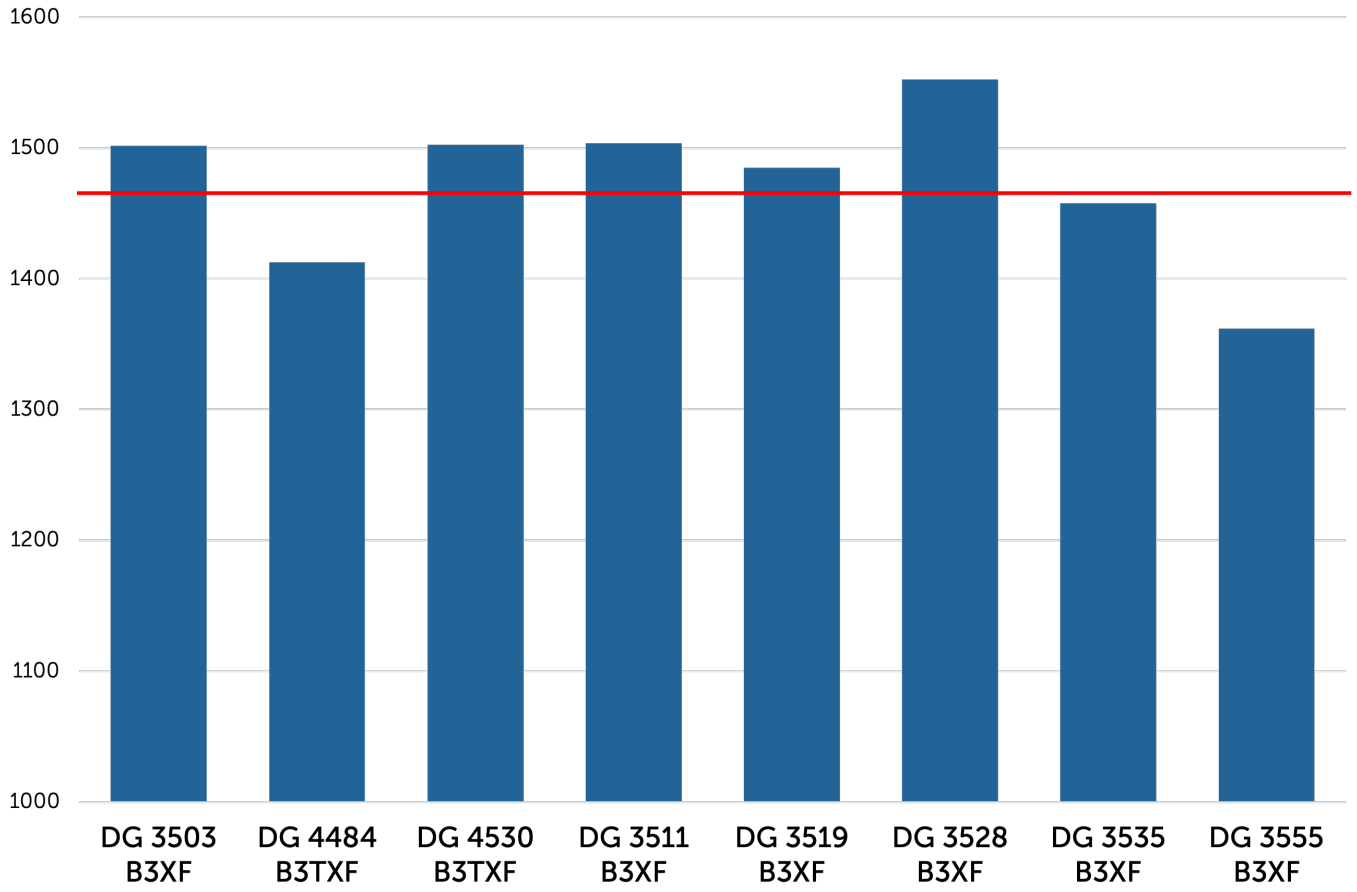
Harvest Date: 10-12-2023

Cotton Variety Trial



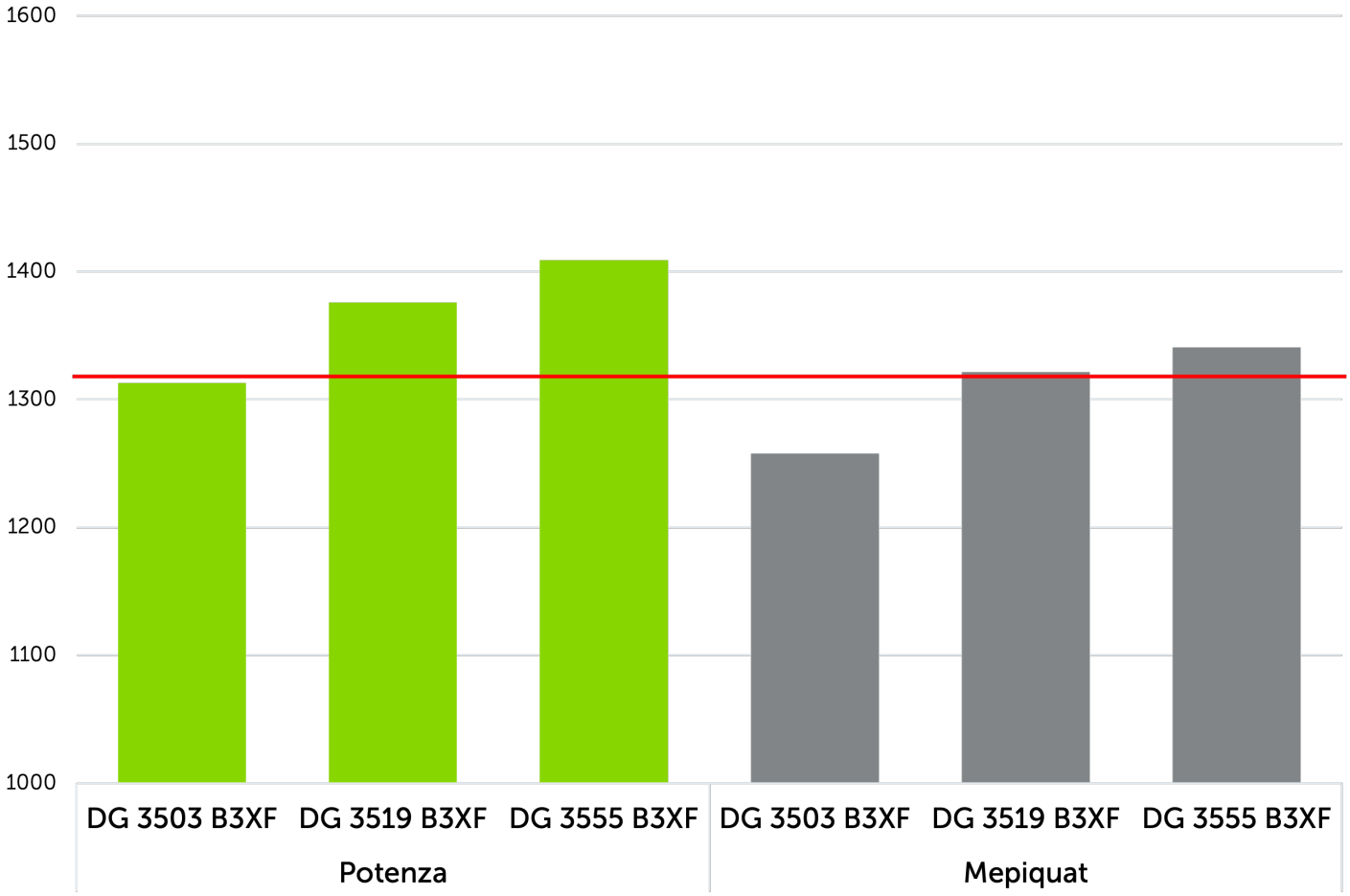
Average 1453 lbs/a

Dyna-Gro Road Show Cotton Variety Trial



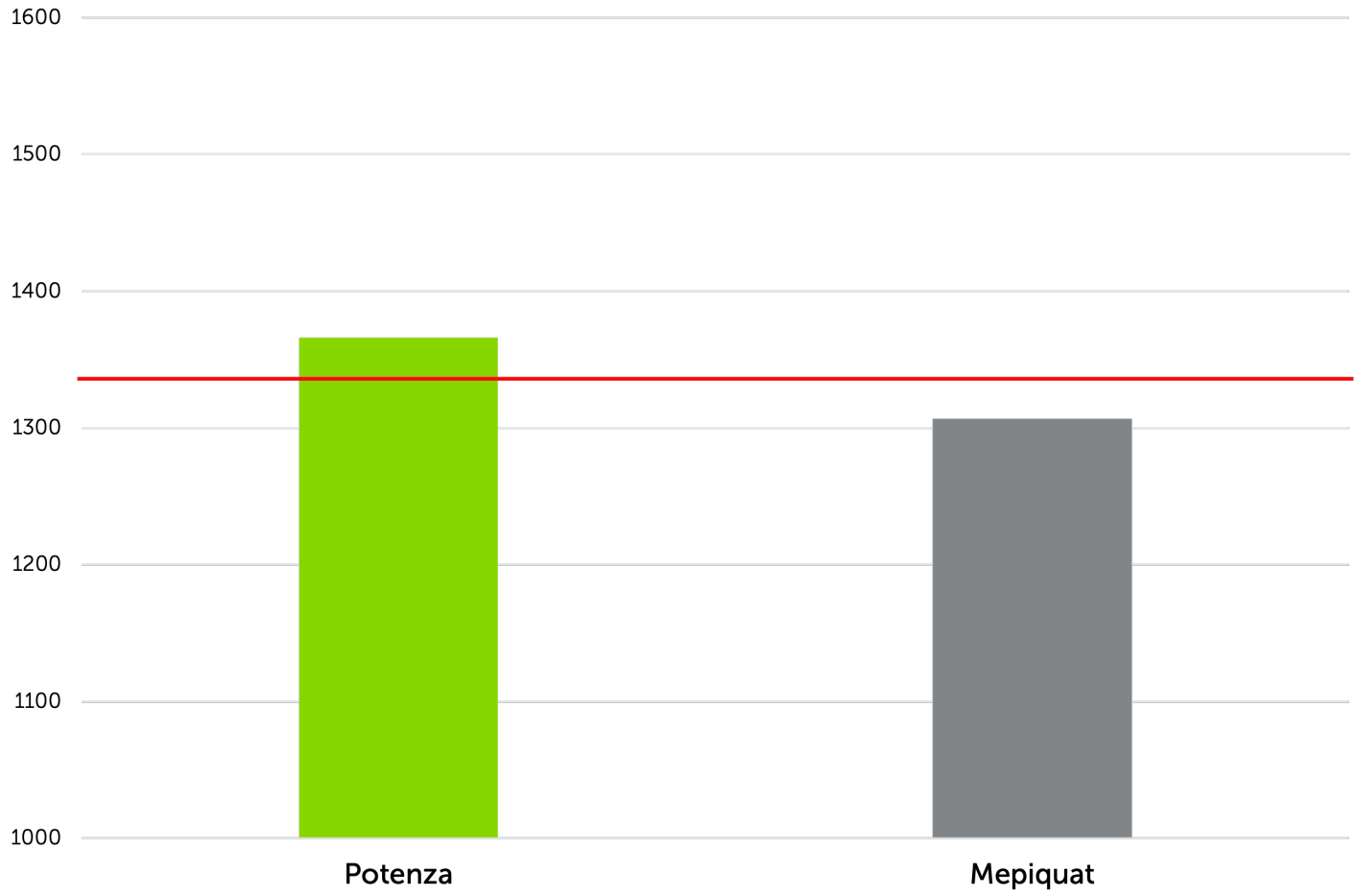
Average 1472 lbs/a

Potenza x Cotton Variety Trial



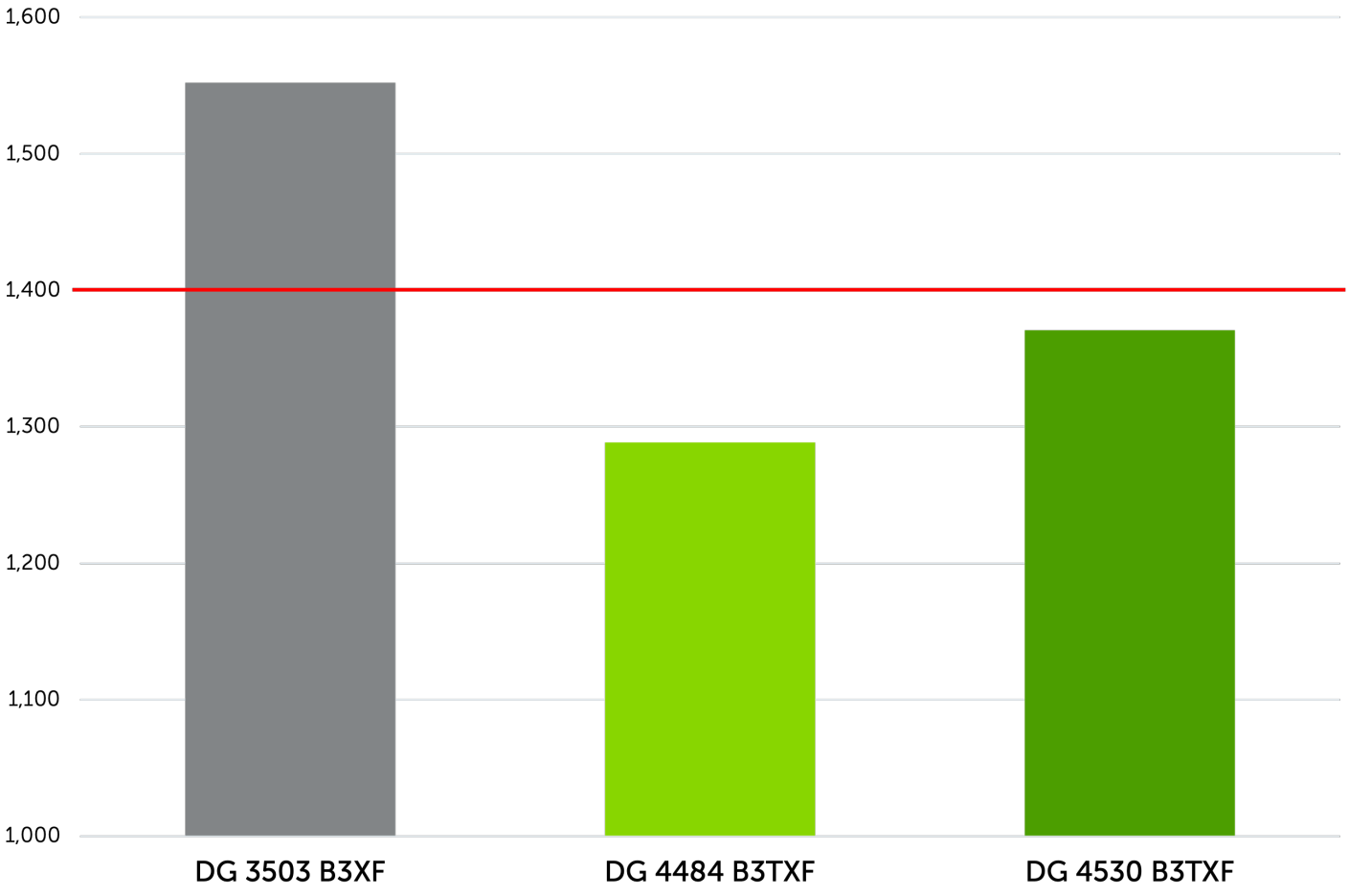
Average 1336 lbs/a

Potenza x Cotton Variety Trial



Average 1336 lbs/a

ThryvOn Cotton Variety Trial



Average 1404 lbs/a

RICE

Planting Date: 4-18-2023

Row Spacing: 7" drill on 38" beds

Variety: Dyna-Gro 263L ~45 lbs/ac

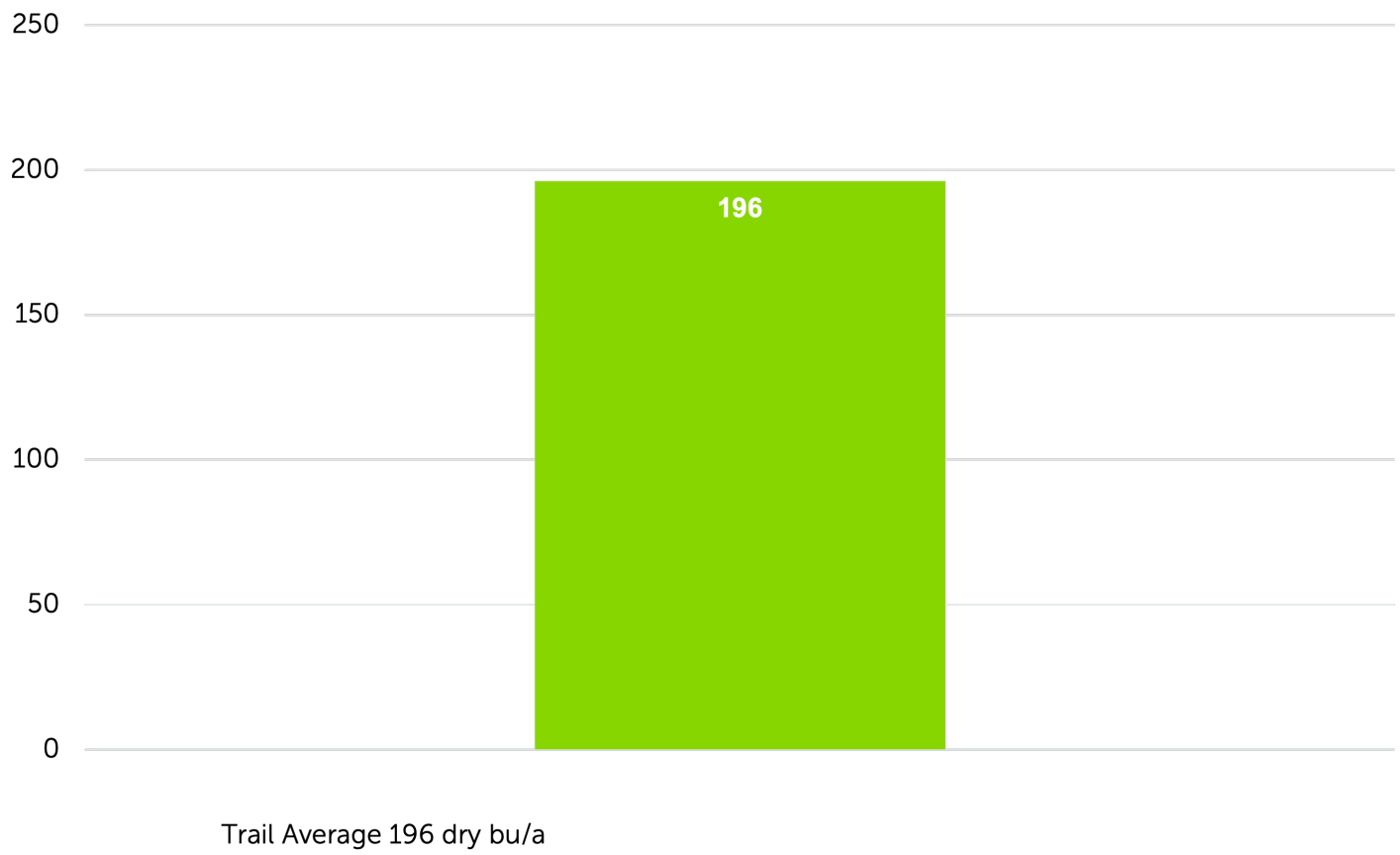
Fertilizer:
- 41-0-0-4 @ 100 lbs/ac – 4 leaf rice
- 46-0-0 @ 100 lbs/ac – +7 days
- 46-0-0 @ 100 lbs/ac – +14 days
- 46-0-0 @ 100 lbs/ac – +21 days

Herbicide:
- 16 oz/ac Command + 3 oz/ac Sharpen – Pre-emerge
- 38 oz/ac Stealth – 3 leaf rice
- 32 oz/ac Rinde – tiller

Fungicides:
- 15 oz/ac Amistar Top + 2 oz/ac Franchise – VT

Harvest Date: 9-9-2023

Dyna-Gro 263L Yield



Trail Average 196 dry bu/a

ACKNOWLEDGMENTS

We are grateful for the support of our various partner companies

- ADAMA
- AMVAC
- BASF
- Bayer CropScience
- Corteva
- Dyna-Gro Seed
- FMC
- Loveland Products
- NK Seeds
- SePRO
- Syngenta

SPECIAL THANKS!

- Allen Scott
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- Matt Cordell
- Scott Greenwalt
- Phil Michener
- Ty Fowler
- Scott Cummings
- Wade Thompson
- Nick Crouch
- Mark Kinsey

DISCLAIMER

Yield performance among varieties can vary greatly based on location, environmental factors, and a host of other variables. Final planting intentions should not be based solely on this individual data set or any other single trial or location. Varietal performance should be evaluated across as many locations and data sources as possible prior to making final varietal selection. The information generated in this report was collected based on sound agronomic practices and common grower standards. No bias was afforded to any one brand or variety.

NOTES:

NOTES:

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ENVIRONMENTAL
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RESEARCH AT THE SPEED OF FARMING

3005 Rocky Mountain Ave, Loveland, CO 80538