



2022

Illinois Research and Agronomy Guide



*Featuring 2021 Research
and Results*



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• = Research Report



Introduction

Dear Grower-

We hope you find this inaugural edition of the Central and Northern Illinois Research and Agronomy Guide interesting and informative. The data contained in this publication was generated across our extensive testing network, which includes 15 Technology Development research locations and numerous fields of our farmer cooperators across the northern half of Illinois.

Bayer Crop Science employs thousands of agricultural scientists across the world, and conducts agronomic research in nearly every state in the U.S. This leads to large datasets that are often presented from a broad national perspective. This is valuable information. However, sometimes a geographically broad look does not perfectly translate to a local level.

Our goal with this compendium is to present a localized look at agronomic solutions and provide advice relevant to our state.

This collection of articles has been written by scientists, agronomists, and Bayer employees representing over 300 years of combined experience in agriculture. This is a true team effort with contributions from experts across all Bayer brands represented in Illinois. This collaborative approach allows us to take advantage of the diverse viewpoints and experience of our colleagues.

If you have any questions about this information, please feel free to contact the authors. QR codes appear throughout this publication link to additional resources for further learning. I encourage you to scan them to take a deeper dive into the subjects.

Above all, I wish you a safe, healthy, and productive 2022. As a company, we thank you for the opportunity to partner with you to drive agronomic success.



Brian Marcinkiewicz
Bayer Crop Science
Illinois Region Technology Development Lead



What is Bayer Technology Development?

The Bayer Technology Development group has 29 research locations totaling over 800 acres across Central and Northern Illinois, including large locations at Newark, Roanoke, and Warrensburg. Each site is agronomically unique. This allows us to test products across various yield environments, climate environments and soil types. Our research team applies a variety of research methods including small plots, strip trials, and large acre trials to collect data on our seeds and traits and crop protection technology. Each type of trial has specific benefits.



Tractor and planter ready to plant small plots.

Small plot trials help us gather randomized and replicated data across the state. These trials are implemented using the latest technology to increase reproducibility and accuracy. They are replicated across the country to capture datapoints from multiple growing conditions for Bayer's larger portfolio, but they also prove useful on the local level. For example, we are testing our latest corn rootworm technology on local fields with high rootworm pressure, testing our products for fungicide response, and exploring various soybean populations in different settings.

Planting a strip trial.

Small plot research is important; however, in some instances, it may not translate well to what farmers experience in their fields. Strip trials can be tailored to local farming practices and target specific challenges in the area. This larger trial size allows the use of commercial size equipment to plant and harvest plots in the same manner as farmers grow their crops. Strip trials were used to research fungicide timing and the control of tar spot. Also, 2021 marks the third year of testing in-furrow fungicide as part of a disease mitigation strategy to help prevent stalk, crown, and root rots.



What is Bayer Technology Development?

Plot combine harvesting a small-scale plot.

Field scale trials help develop disease management systems by evaluating the interaction between soybean genetics with varying levels of disease tolerance and chemistry in high disease pressure environments. Data are collected and analyzed with the Climate FieldView™ platform. The data generated helps support the modeling efforts in Climate FieldView™. Testing Climate FieldView™ recommendations helps improve the tailored solutions that are offered to growers.

Working alongside farmers ensures that we are adopting common farming practices in the area and keeps us connected with the latest technology that our customers have access to. Our fleet of equipment includes specialized research equipment as well as larger equipment with the same technology as the neighboring farms.

What really makes our research network effective is not the equipment, but the wide range of experts that we have on our team. As agronomic challenges arise, our research team stands poised with the experience and knowledge to help provide solutions to our farmer customers.

Amber Towle is an Agronomic Research Manager in Northern Illinois.

To learn more about Technology Development at Bayer, check out this [Focus on Agriculture interview](#) with Lisa Granadino, former Technology Development Lead at Bayer.



Using Technology in Product Development

Technology in agriculture continues to evolve at a rapid pace. At Bayer, we strive to innovate and implement new technology to generate the right products for the right acre. Northern Illinois has and continues to be a key region of investment for Bayer that supports multiple Seed Production, Breeding, Quality Testing, and Technology Development facilities.

Development of products such as XtendFlex® soybeans and SmartStax® PRO with RNAi Technology have harnessed the latest technology to expand the Bayer product lineup. Some of the technology implemented within Bayer that has helped to develop the products above include:

- Unmanned Aerial Vehicles (UAVs) – Continue to provide our team with additional high-quality data that was inaccessible before; from scouting plots and customer fields to generating stand count, plant height, and soybean maturity data for our breeders.
- Increased Trait Testing – Trained versions (i.e. SmartStax® Technology, VT Double PRO® corn) of our corn products are now tested in the field for two years prior to commercial advancement and launch. This is possible through improved screening in the lab allowing for faster trait integration in our pipeline.
- Protected Culture – Seed quantity and quality are large obstacles for any seed company when bringing new products to market. The recent opening of our seven-acre greenhouse in Arizona helps to improve our capacity and speed to find new products.
- Automation – Improving throughput and data quality within our pipeline continues to progress with automation, from robotic arms in our seed quality and testing lab to automated seed fillers packaging plots in a warehouse.
- Prescriptive Field and Nursery Operations – Investment in precision planting technology and harvest equipment continues to bring positive results to the team. One example is the use of state-of-the-art automated planters fitted with the latest technology to help enable testing protocols that weren't possible in the past.



Zak Swanson is a Technical Agronomist in Northern Illinois.

To learn more about how new corn and soybean products are developed, listen to this conversation with Tom Jury, head of North America Field Testing Operations at Bayer.



Planting plots with an automated research planter.



The Adoption of In-Season Imagery in Agriculture

In-season imagery helps growers pinpoint issues in their fields that can lead to decreased yield and profit potential and respond to the issues in real-time. These images are captured in many ways, from satellite imagery to unmanned aerial vehicles (UAVs).

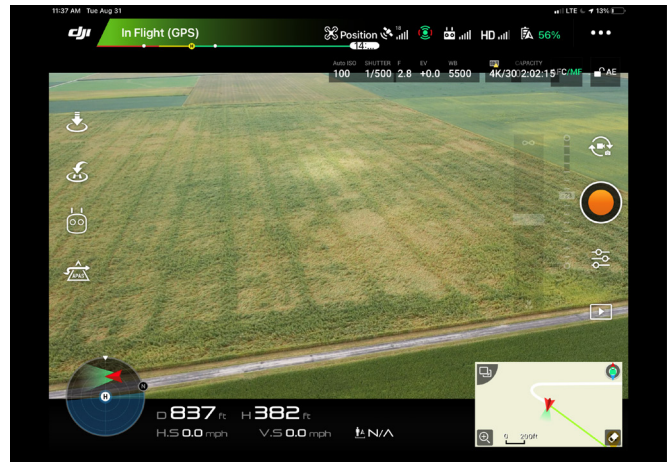
Satellite imagery can help provide a wide range of images throughout the growing season. With Climate FieldView™ platform, growers can easily move from one satellite image to the next to observe and identify the trends within their fields. Another feature of the satellite imagery offered in Climate FieldView™ is the ability to compare late-season images with yield maps. The functionality also helps provide growers with the ability to create yield maps if they are harvesting without a yield monitor on their combine.

UAVs have been used in agriculture for many years. As technology and data processing continues to advance, UAVs are increasingly proving their value. As with satellite imagery, UAVs can help growers pinpoint issues in the field. However, growers using UAVs do not have to wait for the image to reach their inbox and can take action almost immediately. Bayer has partnered with many UAV programs on the market to seamlessly pull UAV images into Climate FieldView™. The Bayer agronomy team is actively using Sentera and DroneDeploy to help make timely observations and to identify and resolve issues in fields. Using UAVs to capture in-season images can help growers respond quickly to challenges as they arise.

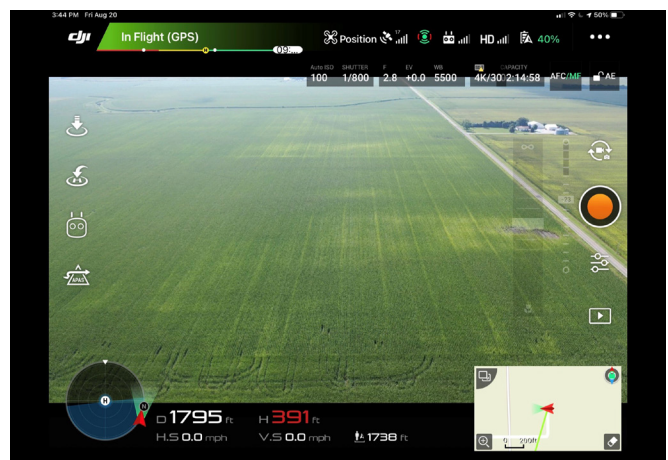
In-season imagery from satellites and UAVs continues to help growers monitor their crops throughout the growing season. Problems identified in these images can often be quickly addressed before they get worse. At Bayer, we continue to explore how these tools can be used to improve product development and bring added value to growers. In many cases, satellite and UAV imagery have become important management tools to help growers achieve high yield potential and help maximize profitability in their farming operations.



David Trainor is a Technical Agronomist with Bayer in Central Illinois.



Drone imagery of a field with downed corn. Image taken with the DJI GO 4 App.



Drone imagery of a field with inconsistent nitrogen application. Image taken with the DJI GO 4 App.



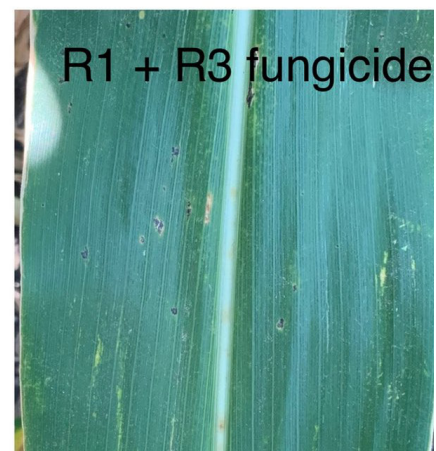
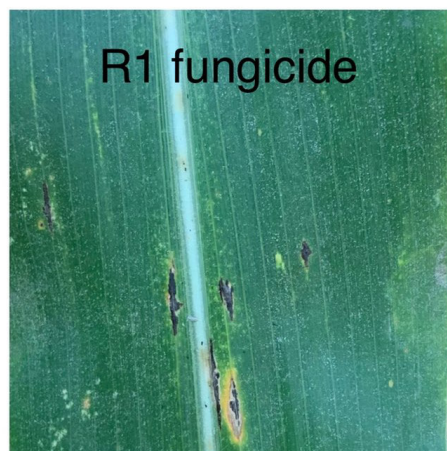
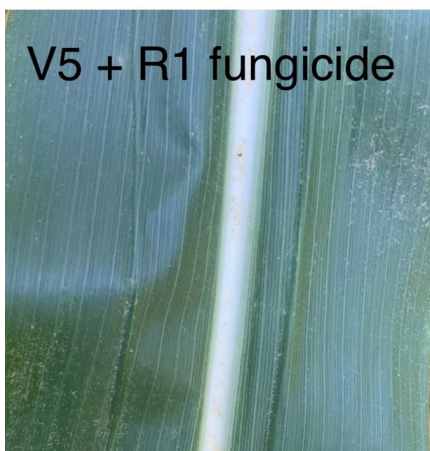
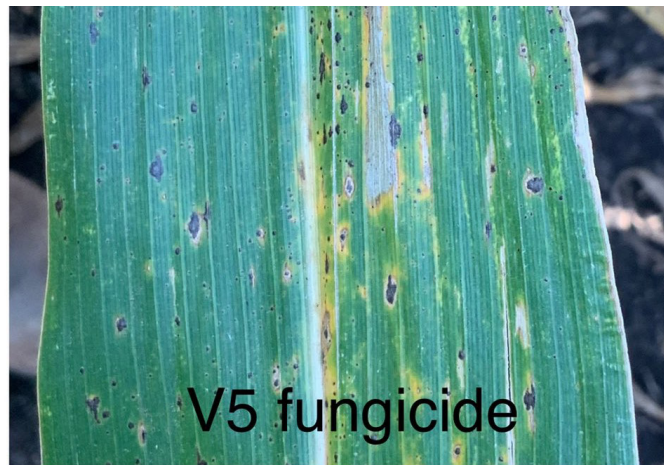
Reviewing 2021: What Worked and What Didn't?

The 2021 growing season was like many before it with areas of great yields and areas of poor yields. Many in Southern Illinois and Eastern Illinois will look back on 2021 and wonder how their crop reached those yield levels, looking to repeat the performance in 2022. Many in Northern Illinois will wonder how they raised a decent corn crop on ten inches or less of rain. Most in Western Illinois will want to forget about 2021, much like they would want to forget 2012, 2009, and 2005. One of the biggest variables in the growing season turned out not to be the drought in the northern tier of Illinois, or the many wind events that seemed to blow down more

corn every week, but the area in Western Illinois that was seemingly holding one of the biggest crops since 2018. That hope deteriorated for many during the month of August and left many farmers and seasoned agronomists wondering exactly what went wrong. We can review these cases to help understand what went right and what helped propel some to see better yields than others in these areas.

Management from start to finish was crucial. Tar spot came in with a vengeance to finish off an already stressed crop. Massive yield potential was built during the months of June and July requiring

near perfect weather to fill the sink demand. What went into building a big enough plant factory during the vegetative phase likely paid off in more bushels and better standability at harvest. For adequate late season grain fill, it is imperative to keep the corn plant healthy and taking up nutrients, otherwise the plant will reallocate stored reserves. If it runs out, it will cannibalize itself to make grain. Ultimately this happened to many in Western Illinois and the plant was out of reserves before black layer came. There were a few common themes in fields where farmers reported better than most in terms of final yields.



Representative leaf samples at different fungicide application timings.



Reviewing 2021: What Worked and What Didn't?

What helped –

- Drainage/Nitrogen Program
 - Heavy rain events took a toll on average nitrogen programs. Increased denitrification from multiple heavy rain events led to late season nitrogen shortages. A late July through early August rain can help buffer this as mineralization would kick in, but many parts of Western Illinois didn't have that timely rain. Early season Fusarium crown rot was also present in many fields with less than average drainage leading to more standability issues. Poorer PI soils with good slopes yielded as much if not more due to their ability to shed water early and retain moisture late.
 - Multiple applications of nitrogen helped mitigate variability and growers that aggressively replaced lost nitrogen units seemed to fare better with final yields.
- Fungicide Applications
 - For years we have been talking about high management corn and applying foliar fungicide in season. With high yield potential, tar spot being very prevalent this year, and crown rot more widespread, multiple fungicide passes helped protect yield and profit potential in 2021. Application timing at the beginning dent stage may have been profitable for some growers in heavy disease and tar spot areas. This is contrary to what many have always thought would be the economic cutoff for an application.
- Corn Product Selection
 - Corn product selection on the farm has always been about risk mitigation. For many in 2021 that struggled to reach adequate yields, often it was the older products that rose to the top in performance. Contrast that to record or near record areas where new products rose to the top. Disease pressure and fertility requirements play a part in the total yield potential of the field. The weather is typically the factor that determines the outcome. Product selection is a balance between yield potential and agronomics. Higher yield potential demands more management and more attention to fundamentals such as drainage, nitrogen, and base fertility. The higher we drive yield potential the more important weather becomes as we have less margin for error.
 - Looking forward to 2022, put the learnings from your farm and others into your notebook. We may not need to consult those in 2022, but we learned a few things that can help us prepare for future years.

Daniel Lundeen is a Technical Agronomist in Northwest Illinois.

The [Illinois Technology Development YouTube channel](#) contains videos with research summaries, season recaps, and other agronomic information.



Ears on the left represent a low-lying area with nitrogen loss, and ears on the right represent an area of the field with better drainage and less nitrogen loss.



Corn and Soybean Planting Timing Decisions

Trial Objective

- Widespread adoption of quality seed treatments in soybeans has led to increasingly early planting of soybeans by growers across the midwestern United States. For example, in 2021 by May 2, Illinois growers had completed 41% of soybean planting, compared to 14% average for the previous 5 years¹.
- Early in the planting season, growers are often faced with the decision of whether to plant corn or soybeans first.
- This research was conducted with a goal of understanding the risks and benefits of planting corn and soybeans at various timings throughout the spring.

Research Site Details

- Corn and soybeans were planted on simultaneous dates in both 2020 and 2021.
- In 2020, a 3.6 relative maturity (RM) soybean product was planted and in 2021 a 3.5 RM product was used.
- In 2020, a 114 day RM corn product was planted, while the 2021 data includes an average of 113 and 114 day RM corn products at each planting date.
- In both 2020 and 2021, heavy frost reduced the soybean stands in the earliest planting dates.

Location	Soil Type	Previous Crop	Tillage Type	Planting Date	Harvest Date	Potential Yield (bu/acre)	Seeding Rate (seeds/acre)
Roanoke, IL	Silt Loam	Corn	Conventional	3/7/20, 4/6/20, 4/20/20, 5/9/20, 6/1/20, 6/15/20	10/7/20, 10/15/20	75	140,000
Roanoke, IL	Silt Loam	Soybean	Conventional	4/6/20, 4/20/20, 5/9/20, 6/1/20, 6/15/20	9/24/20, 10/8/20, 10/20/20	240	36,000
Roanoke, IL	Silt Loam	Corn	Conventional	3/10/21, 4/6/21, 4/19/21, 5/3/21, 5/14/21, 5/24/21, 6/7/21, 6/15/21	10/18/21	75	140,000
Roanoke, IL	Silt Loam	Soybean	Conventional	4/6/21, 4/19/21, 5/3/21, 5/14/21, 5/24/21, 6/7/21, 6/15/21	9/15/21, 9/16/21, 9/30/21	240	36,000



Corn and Soybean Planting Timing Decisions

Understanding the Results

- To compare data across years, results are presented as a percentage of the maximum yield for the year and corn/soybean product.
- Although soybean stands can be reduced in early plantings (Figure 1), the surviving plants have additional time to grow compared to later plantings and can still attain high yields (Figure 2).
- In 2021, emerged soybeans endured freezing temperatures for 2 consecutive nights (Figure 3) after emergence, killing 25.9% of them. Final stand was 67,846 plants per acre, with a yield of 77.7 bushels/acre (98.9% of maximum).
- Soybean yield is consistently highest in early plantings, with a steady decline in progressively later plantings, while corn yield shows a peak with too early and too late plantings negatively impacting performance (Figure 4).
- These data support the increasingly accepted practice of planting soybeans early in the growing season and waiting until conditions are more favorable for planting corn.

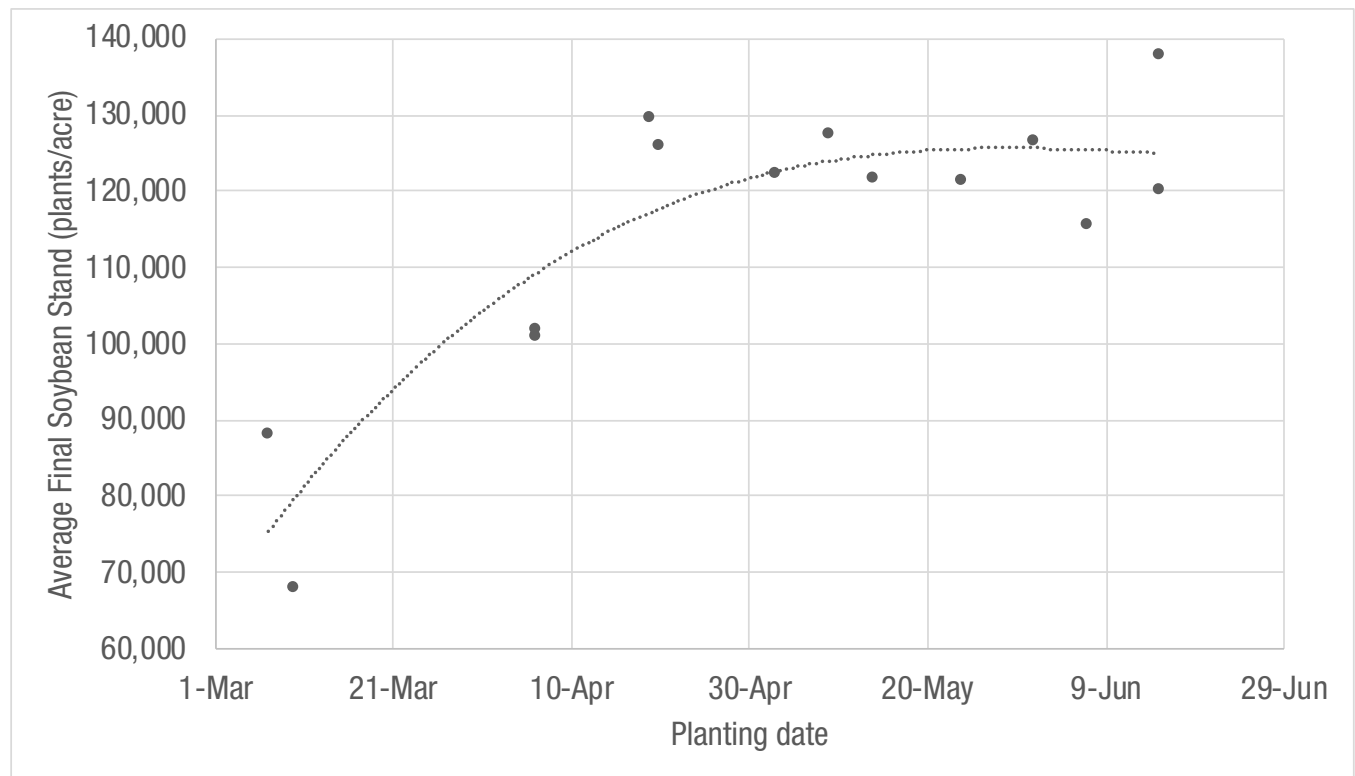


Figure 1. Average final soybean stands across planting dates and years (2020 and 2021).

Corn and Soybean Planting Timing Decisions

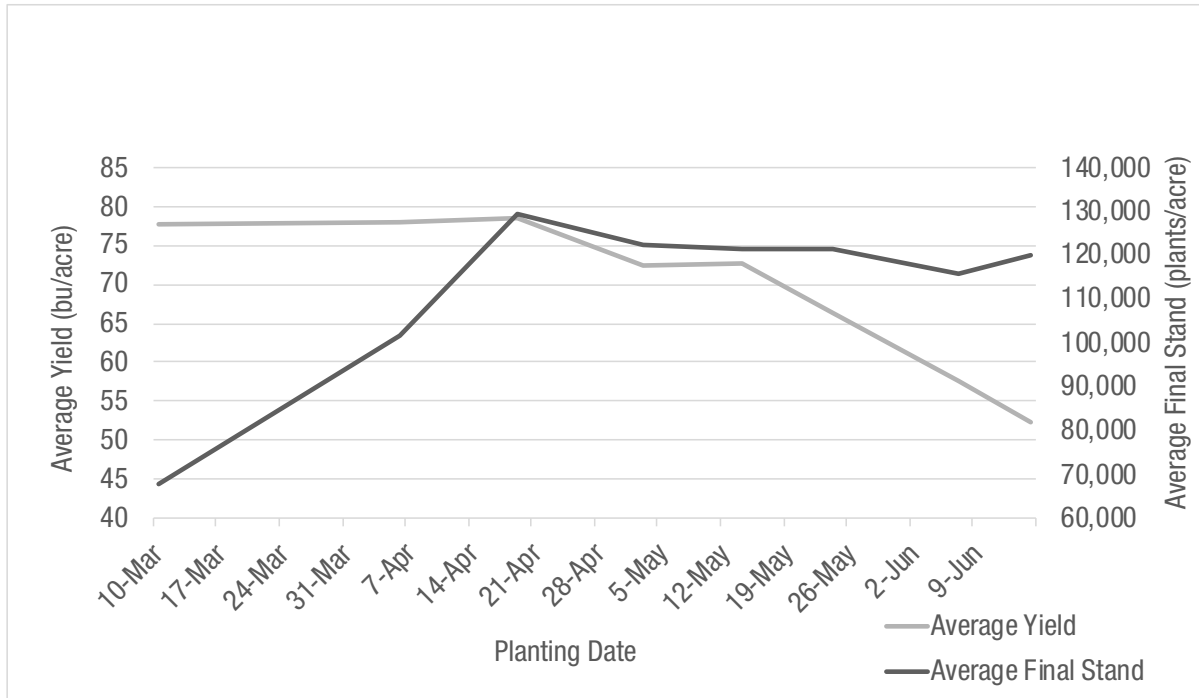


Figure 2. Average yield and average final stand count of 3.5 RM soybean across planting dates in 2021.



Figure 3. Frost on soybean seedlings after two consecutive nights of below freezing temperatures which resulted in a 25.9% stand reduction.

Corn and Soybean Planting Timing Decisions

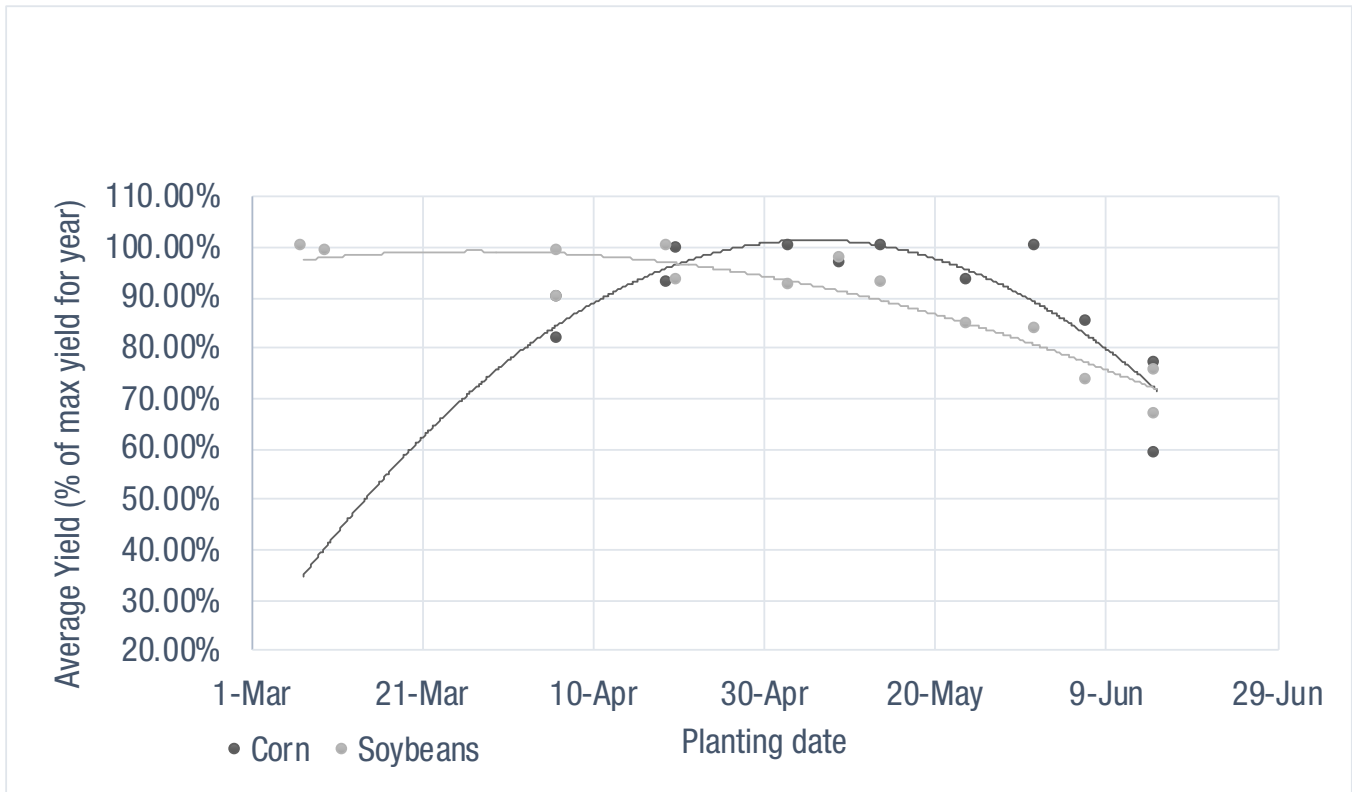


Figure 4. Relative performance of corn and soybeans at different planting dates combined over years in 2020 and 2021.

Key Learnings

- Generally, soybeans can be planted when soil moisture conditions are satisfactory, regardless of soil temperature and weather forecast. Corn, however, should only be planted when soil conditions (temperature and moisture) and the weather forecast are favorable.

Sources:

¹USDA National Agricultural Statistic Service. https://www.nass.usda.gov/Statistics_by_State/Illinois/Publications/Crop_Progress_&_Condition/2021/20210503-IL-Crop-Progress.pdf

Tar Spot in Illinois: What We Have Learned Six Years Later

The summer of 2015 saw our first interactions with tar spot disease of corn in Illinois. Since then, we have learned that it is not merely a cosmetic problem, but one that can cause substantial problems with reduced standability and decreased yield potential. While there is more to understand about this disease, there are a few key things that we've learned over the past few years.

Is it a “Complex”?

Tar spot has been termed “tar spot complex” as a result of studies in Mexico stating that a second pathogen is required for fisheye symptoms to appear, and yield loss only occurs if that secondary pathogen is present. However, in the U.S., researchers have not found the presence of that second pathogen, despite fisheye symptoms being present. Researchers are not exactly sure what causes the fisheye symptoms, but these symptoms have been present since 2015, and no other pathogen has been found to be causing it in the U.S.

Impact of Tar Spot--It's Not Just on Yield

It is no secret that tar spot can have a huge impact on yield potential. I have witnessed tar spot reduce yields by 60 to 80 bushels per acre or more in very severe instances, with moderate to heavy disease showing 20 to 30+ bushels per acre in yield loss. Those that have experienced heavy tar spot understand the large impact the disease can have on late season standability. Heavy incidence of disease not only causes lower yield potential, but also extremely hollowed-out stalks. In the process

of combating disease, corn plants divert resources from the stalk to fill grain to compensate for the lack of resources coming from infected leaves. This leaves plants highly susceptible to lodging from wind events. Unfortunately, farmers in Illinois have experienced just that: yield loss with flat fields. When making decisions to treat, it is important to consider standability and harvest efficiency, and not just yield.

Crop Rotation and Tar Spot

Crop rotation helps manage all sorts of insects and diseases. However, the impact of crop rotation and residue management for managing tar spot has been minimal. In fact, some of the heaviest instances of tar spot that I have seen were in rotated fields. I have also observed fields with very heavy tar spot that were planted out of corn the previous two years (soy-wheat-corn rotation). We are not sure why crop rotation hasn't made a big impact. It could simply be that the aggressiveness of the disease, coupled with the ability of the disease to move with wind and no robust genetic resistance overcomes any effect that crop rotation has. Prior to tar spot, we would put an emphasis on corn-on-corn fields when targeting fields for controlling foliar diseases with fungicides. Some have only treated corn-on-corn acres in the past and let rotated fields go. My ask is that growers in areas with a history of tar spot forgo that mentality. In my opinion, with this disease every acre is at risk when environmental conditions are conducive. If you're in an area that has had tar spot, be sure to keep an eye on every field, regardless of rotation!



Tar spot lesions with fisheye symptoms.

Tar Spot in Illinois: What We Have Learned Six Years Later

Managing Tar Spot with Fungicides

After the tar spot epidemic in 2018 across Northern Illinois and Southern Wisconsin, it became apparent that fungicides would play an integral role in managing the disease. Fields that suffered had estimated yield losses of 60 to 80 bushels and generally had one thing in common: they were not sprayed with a tassel-time fungicide. This combined with the numerous side-by-side fungicide treatments showed that spraying corn with fungicides consistently helped protect from yield loss due to tar spot.

While fungicides showed to help protect yield in many cases, we observed that under very heavy disease pressure, spraying a fungicide at VT (tassel) to R2 (blister) didn't always fully protect the crop from yield loss. This left some growers questioning the value of fungicides. There were many instances where fungicides were working, so it was clear that other factors were coming into play. Sometimes reduced control was linked to misapplication, but there were many others with substantial yield loss and standability concerns where applications were made correctly.

Proper Fungicide Timing

Many trials continue to support the VT fungicide application timing as the best time for managing tar spot in corn. In many years and situations, one application at this timing may remain sufficient. However, in very heavy years, as in 2018 and 2021, there have been instances where two



Field health imagery of two Illinois corn fields in 2021 affected by tar spot that compared one fungicide application with two fungicide applications after tassel.

applications have been necessary to help prevent further economic yield loss and to maintain standability and harvestability.

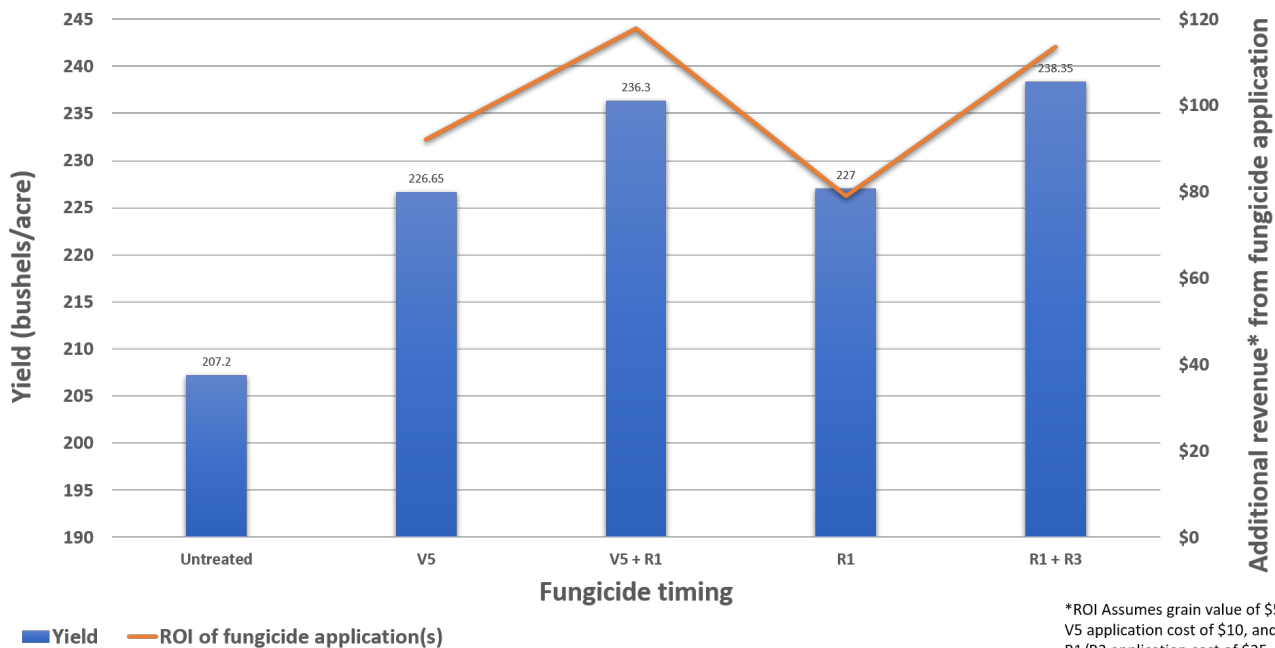
In 2021, we identified farmer fields that previously had a fungicide applied at the VT to R2 growth stages, and by mid-August continued to show increasing disease pressure. In several fields, a second fungicide application was made aerially in mid- to late August to test if applications made this late could be of benefit. Growth stages of these fields ranged from approximately R4.5 to R5+. Untreated areas (single application sprayed R1 to R2) were left to compare.

Results of this work showed that under heavy pressure, second applications, at a minimum, provided substantial standability benefits from reduced stalk cannibalization.

From a yield perspective, gains ranged from 5 to 20 bushels over a single VT application, for an average of 12.7 bushels of additional yield protection, plus improved standability and harvestability. Remember that these were fields identified with heavy pressure, so the likelihood of economic payoff is higher. Additional trials conducted internally and by universities have found that second applications are not always warranted, and lower disease pressure was a possible cause. Factors like maturity, planting date, corn product susceptibility and disease pressure play a role in whether a second application is warranted. What this ultimately shows is that with heavy disease pressure, secondary later applications can have an economic impact, even when made at up to and including R5.

Tar Spot in Illinois: What We Have Learned Six Years Later

Yield and ROI of various fungicide timings under moderate tar spot pressure at Roanoke, IL 2020-2021



Summary

At the end of the day, it is important to understand that tar spot is a manageable disease. Successful management of this disease relies on farmers being vigilant in looking at their fields, especially in the home stretch of the growing season. If farmers are experiencing above average rainfall and/or frequent heavy dews and high humidity during the mid to latter part of the growing season, then it is time to pay extra attention to their corn fields. Reach out to your local retailer, seed dealer, consultant, or local Bayer representative to help guide you through managing tar spot in the future.

	1st App Growth Stage	2nd App Growth Stage	1 App Yield (bu/ac)	2 Apps Yield (bu/ac)	Difference (bu/ac)
Trial 1- Princeton, IL	R2	R4.5	248	257	9
Trial 2- Princeton, IL	R2	R4.5	212	232	20
Trial 3- Lanark, IL	R1	R5	207	212	5
Trial 4- Lanark, IL	R1	R5	210	224	14
Trial 5- Lanark, IL	R1	R5	224	236	12
Trial 6- Gardner, IL	R2	R5	207	223	16
Average Yield Difference:					12.7

Fields were targeted with actively heavy tar spot pressure. Yields and yields differences were calculated using Climate FieldView region reports.

Illinois data from 2021 internal trials comparing fungicide application timing and one or two applications.

Jim Donnelly is a Technical Agronomist in Northern Illinois.

To learn about more research being done on overcoming the challenge of tar spot, listen to this [interview with Dr. Matthew Helm](#) with the USDA's ag research service.



Getting the Most Bang for Your Buck on Your Soybean Acres

Sustainability can be an overused buzzword that means different things at different times. Often overlooked however, is economic sustainability. Although most farmers enjoy their livelihood, their operation also must be profitable to continue doing what they love. This means that every agronomic decision should be made with return on investment (ROI) in mind.

When it comes to growing soybeans there are many decisions to be made throughout the year. Assuming sound agronomic decisions in other areas, there are two decisions that consistently show good return, and one costs nothing. They are early planting and an R3 (beginning pod) fungicide application. Other decisions, such as row spacing and planting population can affect profitability, but not to the same degree.

The trend in Illinois over the past several growing seasons has been to plant a larger proportion of the soybean crop earlier and earlier each year. Attendees at Agronomy Day at the University of Illinois this summer heard Dr. Fred Below explain that planting soybeans early is the single factor with the greatest impact on increasing yield. Our research has also borne this out over several years. The main driver that helps us plant soybeans earlier is the widespread adoption of treated seed. Protection is especially critical when the seeds may be in the soil three weeks or more before emergence.

Planting population and row width can also impact profitability. In our research, planting into 20-inch rows consistently provided an average yield increase of about a bushel an acre-- nice to have, but probably not a big enough incentive to replace equipment. We have also conducted extensive research on planting rates and found that yield potential increases by increasing the planting rate from 60,000 to 160,000 seeds/acre. Prior to 2021, using a crop value of around \$8/bushel, the most profitable planting rate was generally around 120,000 seeds/acre. If 2022 prices remain over \$13, higher planting rates may be more profitable. It should be noted that there is a distinction between planting rate and final stand. A final stand of 90,000 established plants after an early May frost would generally have a higher yield potential than replanting 140,000 seeds/acre.

In our research across seven locations from 2019 to 2021, we consistently observed a five bushel increase from a R3 fungicide application, leading to a ROI of around \$40/acre based on 2021 crop value and fungicide application cost. Most of these applications included insecticide in the tank, which is a common practice for many farmers. We observed a positive yield response, even in fields that were planted relatively late and had low overall disease pressure.

There are a lot of decisions to be made throughout the year, and each season differs from the one before. Planting soybeans as early as possible and when the conditions are right helps to set the foundation for maximum yield potential and can help increase profitability of other good management decisions. Protecting the crop with a fungicide is also critical when striving for maximum profitability.



Jason Carr is a Technical Development Representative in Northern Illinois.

[In this video](#), Preston Schrader and Jason discuss the agronomic decisions that increase profitability in soybeans.



How planting rate and fungicide application affect yield and disease development in soybeans

Trial Objective

- Improvements in soybean genetics, planting technology, and weed control systems have led to lower planting rate recommendations for soybean growers over the past decade.¹
- Fungicide use in soybeans is steadily increasing.²
- Some growers may wonder if fungicide is more beneficial in higher populations, which have a higher potential for disease development or vice versa.³
- The goal of this research was to determine how planting rate and fungicide application interact and affect yield and disease development in soybeans.

Experiment/Trial Design

- This research was conducted at Bayer Crop Science FOCUS sites in Illinois counties, Kendall, Woodford, McLean, and Macon from 2019 - 2021.
- 32 soybean products from 2.2-3.9 maturity group (MG) were planted, with different products used at different locations and in different years.
- All seed was treated with Acceleron® Seed Applied Solutions STANDARD and ILeVO® Seed Treatment.
- Seeding rates ranged from 60,000 to 160,000 planted seeds per acre.
- Four replications of this trial were planted at each location.
- Fungicide applied varied by location and trial year. All fungicides were applied at the R3 growth stage.
- Standard fertility and weed management practices were followed.
- The 2019 growing season was very cool and wet through early June, leading to delayed planting for many growers. Hot and dry conditions were prevalent in July and August, and excessive rainfall returned in September and October.
- In both 2020 and 2021, there was sufficient moisture in the early part of the growing season, but very dry conditions throughout August and into September.

How planting rate and fungicide application affect yield and disease development in soybeans

Location	Soil Type	Previous Crop	Tillage Type	Planting Date	Harvest Date	Potential Yield (bu/acre)	Seeding Rate (seeds/acre)
Roanoke, IL	Silt loam	Corn	Conventional	6/3/19	10/14/19	65	60,000; 80,000; 100,000; 120,000; 140,000; 160,000
Carlock, IL	Silt loam	Corn	Conventional	6/4/19	10/15/19	65	60,000; 80,000; 100,000; 120,000; 140,000; 160,000
Covell, IL	Silt loam	Corn	Conventional	5/20/19	10/14/19	65	60,000; 80,000; 100,000; 120,000; 140,000; 160,000
Roanoke, IL	Silt loam	Corn	Conventional	6/1/20	10/15/20	70	60,000; 80,000; 100,000; 120,000; 140,000; 160,000
Newark, IL	Silt loam	Corn	Conventional	6/2/20	10/16/20	70	60,000; 80,000; 100,000; 120,000; 140,000; 160,000
Covell, IL	Silt loam	Corn	Conventional	5/11/20	10/9/20	75	60,000; 80,000; 100,000; 120,000; 140,000; 160,000
Danvers, IL	Silt loam	Corn	Conventional	5/11/20	10/7/20	75	60,000; 80,000; 100,000; 120,000; 140,000; 160,000
Warrensburg, IL	Silt loam	Corn	Conventional	4/16/21	9/30/21	80	60,000; 80,000; 100,000; 120,000; 140,000; 160,000
El Paso, IL	Silt loam	Corn	Conventional	5/1/21	10/23/21	75	60,000; 80,000; 100,000; 120,000; 140,000; 160,000
Covell, IL	Silt loam	Corn	Conventional	5/8/21	11/7/21	75	60,000; 80,000; 100,000; 120,000; 140,000; 160,000



How planting rate and fungicide application affect yield and disease development in soybeans

Understanding the Results

- On average, across populations in the 3 years in this research, fungicide application provided an average yield increase of over 5 bushels and delivered additional profit of \$41.47 per acre (Figure 1).
- The most profitable configuration was a planting rate of 120,000 seeds/acre combined with an R3 fungicide application (Figure 1).
- Without a fungicide application, a seeding rate of 160,000 seeds/acre was required for maximum yield and profitability potential. This rate provided \$42.60 less income per acre than the 120,000 rate with fungicide applied (Figure 1).
- Disease pressure was also fairly low in this trial. Overall, fungicide application helped reduce disease development by around 20% based on general disease ratings (Figure 2). This rating incorporates both disease incidence and severity, with a rating of 1 indicating no disease, and 9 being worst.

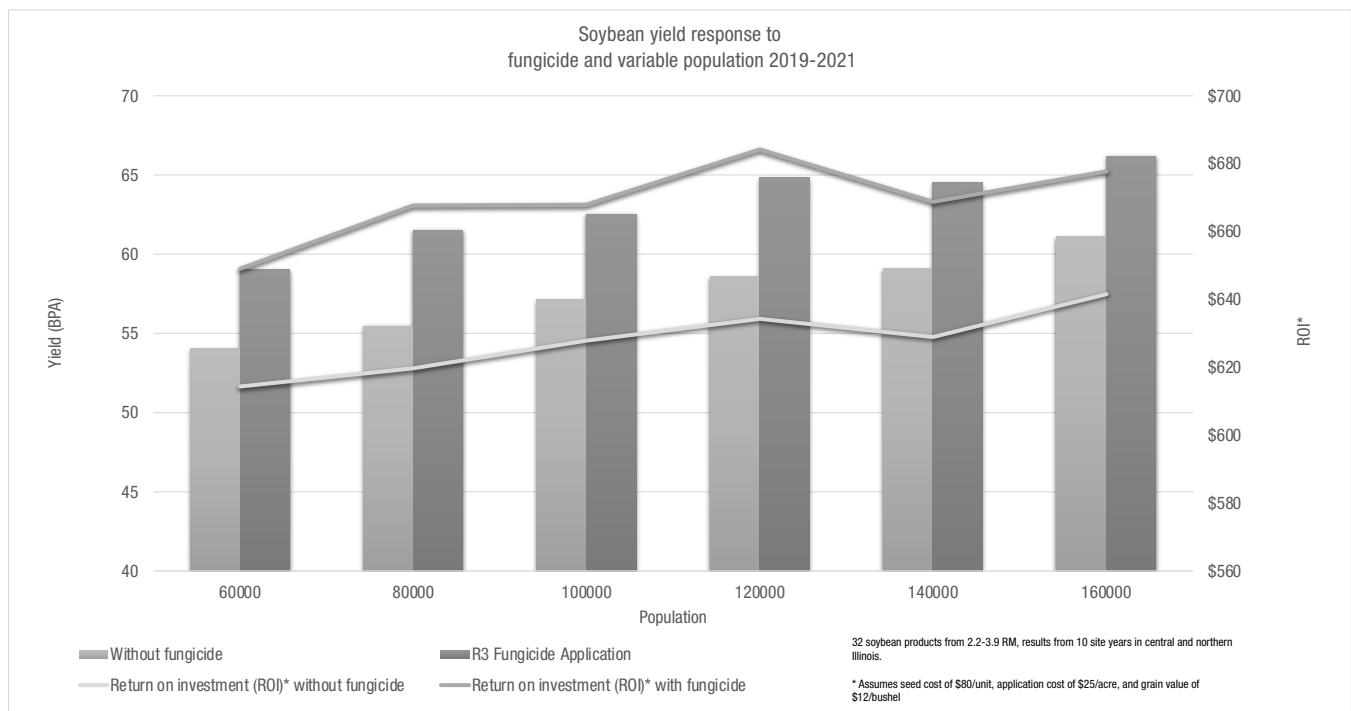


Figure 1. Average yield response of soybean to fungicide application and plant population, 2019-2021.

How planting rate and fungicide application affect yield and disease development in soybeans

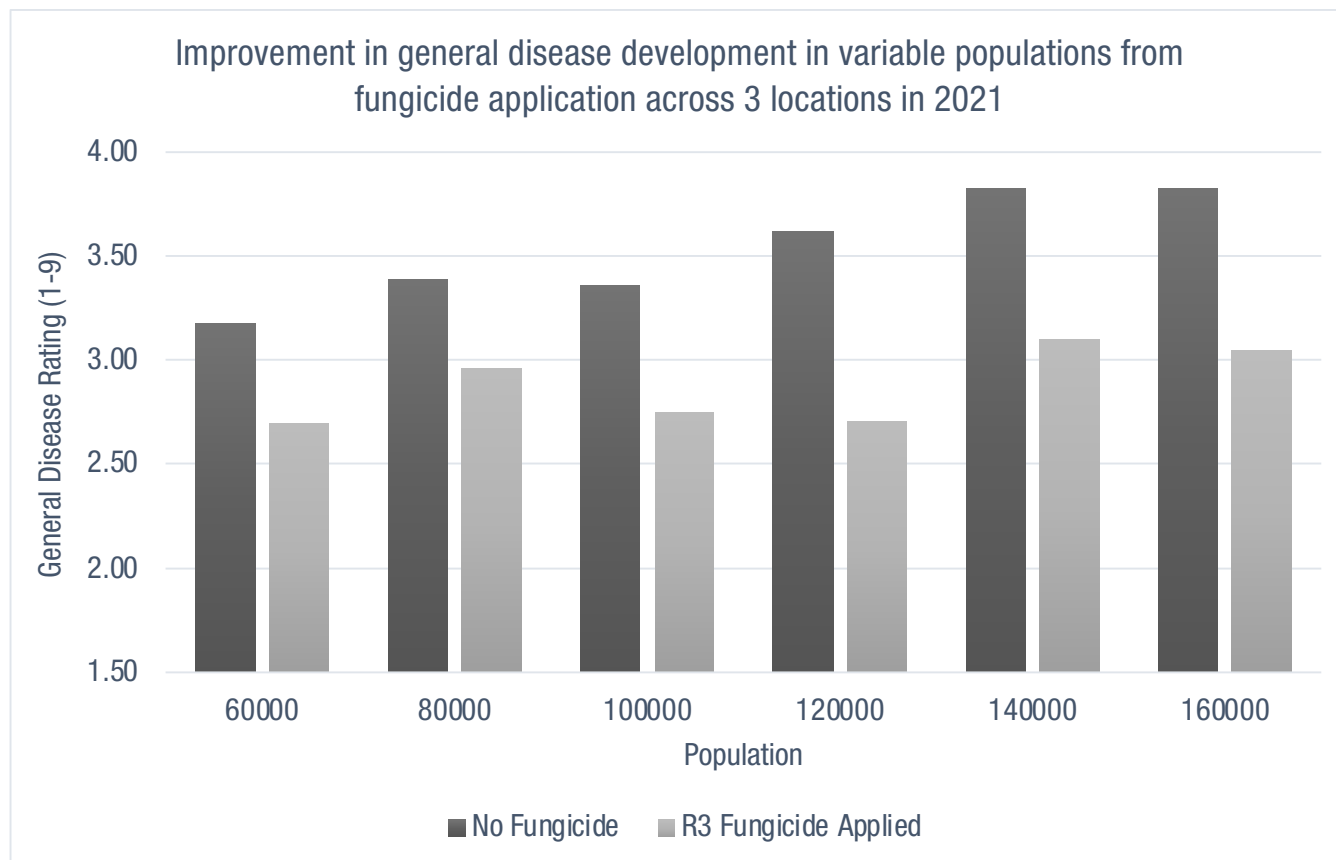


Figure 2. Effect of fungicide on disease development in variable plant populations across 3 locations in 2021.

Key Learnings

- Higher populations can lead to increased yield potential but may also increase the risk of disease development.
- The results of this study show that fungicide application at the R3 growth stage resulted in an increase in yield potential across planting populations, even when disease pressure was not high. Understanding how these benefits help contribute to return on investment is beneficial to help growers get the most out of soybean products.
- In this study, planting soybeans at populations of 120,000 to 160,000 seeds/acre combined with the use of a foliar fungicide at R3 should be considered to help maximize both yield and profit potential.

Sources:

¹Pedersen, P. Optimum plant population in Iowa. Iowa State University. https://crops.extension.iastate.edu/files/article/OptimumPlantPop_000.pdf

²Geisler, L.J., and Miller, J.J. 2017. Managing foliar diseases in soybean. Nebraska Extension. <https://extensionpublications.unl.edu/assets/html/g1862/build/g1862.htm>

³Porter, S. 2019. Five reasons to stop your higher soybean population. Illinois Soy Advisor. <https://www.ilsoyadvisor.com/on-farm/ilsoyadvisor/5-reasons-stop-your-higher-soybean-population>

Should I plant today? How Early to Plant Soybeans and Corn

When it comes to planting date, it is much easier to look back after experiencing issues like poor emergence, loss of stand, and late season crown rot and identify when we should not have been planting. As an agronomist and researcher, my goal is to identify some of those days before they turn into replant conversations.

Throughout the region, an increasing number of soybean acres are being planted before corn. This is a result of a robust dataset collected throughout Illinois over multiple years, supporting higher yield potential with early planted soybeans. Locally, we have implemented several planting date trials where early planted soybeans won the plot and without showing a concerning loss of stand. Earlier planted soybeans have more opportunity to add vegetative growth, including more mainstem nodes, before they enter the reproductive phase and start setting and filling pods. This has shown to be a real advantage when it comes to yield potential. If conditions are fit with a favorable forecast and the soybeans are treated with a high-quality seed treatment, I often make a recommendation to plant soybeans first.

While early planted soybeans can be advantageous, planting in March every year may not be ideal. Early planting should follow the recommendations of the typical planting window – when there is adequate but not too much moisture, a general warming trend in soil temperatures, and a favorable forecast. Some years early planting is the first week of April. Some years that early planting window will

be pushed back due to weather. Regardless of what the calendar says, planting at the front end of your planting window can help maximize yield potential.

In addition to the potential yield advantage with early planted soybeans, planting soybeans first can help prevent planting corn when we shouldn't. Soybeans are a little more forgiving and can lose a little more stand, whereas corn is not as flexible. Adequate stand establishment in corn helps to drive yield potential, which begins with ideal soil conditions at planting. The last few seasons have really demonstrated what damage can occur when corn is planted too early into cool, wet conditions. Poor conditions at planting can impact the crop from imbibition chilling injury at germination, to seeding diseases at emergence, and later into the season with increased crown rot severity. Cool and wet conditions around planting, along with compaction and poor drainage, are contributing factors to crown rot. Planting corn in the middle of our planting window, when soybean planting is complete, is one way to help decrease the risk of cool wet planting conditions and increase the chance of a better stand.

Corn yield potential is more dependent on ideal stand establishment, which can lead to more variability for an ideal planting window. The perfect time to plant one year, may be a time to avoid planting the next year. It is especially important to monitor soil conditions and the forecast, and plant based on those factors rather than the calendar. Planting soybeans at the front end of the planting window



can help allow more flexibility for planting corn at the right time to maximize emergence and give the crop the best start possible. There is compelling data to support planting soybeans earlier, which may become a standard practice, and not a trend in Illinois.



Rachel Willis is a Technical Agronomist in Northern Illinois.

Watch [this video](#) for more information on early planted soybeans.



A long-term research project evaluating the benefits of early planted soybeans

Trial Objective

- Largely due to the widespread adoption of treated soybean seed, growers now plant soybeans increasingly earlier than ever before. For example, Illinois farmers had 41% of their soybean crop planted by May 2, 2021, compared to the previous 5-year average of 14%.¹
- This research was conducted with a goal of understanding not only the yield impact of planting soybeans at different dates, but also the agronomic characteristics which enable early planted soybeans to have higher yield potential.
- The main driver of yield potential increase in early planted beans is the ability for the plants to create more nodes before flowering². We measured the number of nodes created and days to flowering to better understand this interaction.

Research Site Details

- This research was conducted at Bayer Crop Science FOCUS sites in Illinois counties, Kendall, Piatt, Sangamon, and Woodford from 2018-2021.
- Five soybean products, ranging in relative maturity (RM) from 2.6 to 3.6 were evaluated, although not all products were planted at every location or in every year.
- All seed was treated with Acceleron® Seed Applied Solutions STANDARD and ILeVO®.
- Standard fertility and weed management practices were followed, and plots were harvested as they matured.

A long-term research project evaluating the benefits of early planted soybeans

Location	Soil Type	Previous Crop	Tillage Type	Planting Date	Harvest Date	Potential Yield (bu/acre)	Seeding Rate (seeds/acre)
Roanoke, IL	Silt loam	Corn	Conventional	4/25/18, 5/8/18, 5/23/18	9/24/18, 10/4/18	70	140k
Auburn, IL	Silt loam	Corn	Conventional	5/2/18, 5/22/18	9/29/18	70	140k
Monticello, IL	Silt loam	Corn	Conventional	5/1/18, 5/14/18, 6/1/18	10/23/18	70	140k
Roanoke, IL	Silt loam	Corn	Conventional	4/9/19, 4/23/19, 5/7/19, 5/18/19, 6/3/19, 6/18/19	10/9/19, 10/23/19	70	140k
Roanoke, IL	Silt loam	Corn	Conventional	3/7/20, 4/6/20, 4/20/20, 5/9/20, 6/1/20, 6/15/20	10/7/20, 10/15/20	70	140k
Monticello, IL	Silt loam	Corn	Conventional	4/8/20, 4/23/20	10/6/20	70	140k
Newark, IL	Silt loam	Corn	Conventional	4/8/20, 4/23/20, 5/8/20, 5/29/20	10/15/20	65	115k
Roanoke, IL	Silt loam	Corn	Conventional	3/10/21, 4/6/21, 4/19/21, 5/3/21, 5/14/21, 5/24/21, 6/7/21, 6/15/21	10/18/21	75	100k, 120k, 140k

Understanding the Results

- To compare data across years, results are presented as a percentage of the maximum yield for the year, location, and product. The highest yields are attained from earlier planting, with a steady decline as the season progresses. (Figure 1).
- Although it is possible for later planted soybeans to attain satisfactory yield, there is much greater yield variation than in fields which are planted earlier (Figure 1).
- Stand reduction can occur in early planting situations (Figure 2), but as shown in this research, the earlier plantings can have greater yield potential than later ones, even with lower final populations.
- Flowering date in soybeans is influenced by daylength and is often assumed to occur on a specific date regardless of planting date, but multiple factors combine to influence the actual date at which flowering occurs³. Figure 3 illustrates that the period between planting and flowering is greatly reduced when planting later.
- The earlier soybeans are planted, the more time they have to grow vegetatively and create nodes which are the foundation for maximizing yield potential (Figure 4).



A long-term research project evaluating the benefits of early planted soybeans

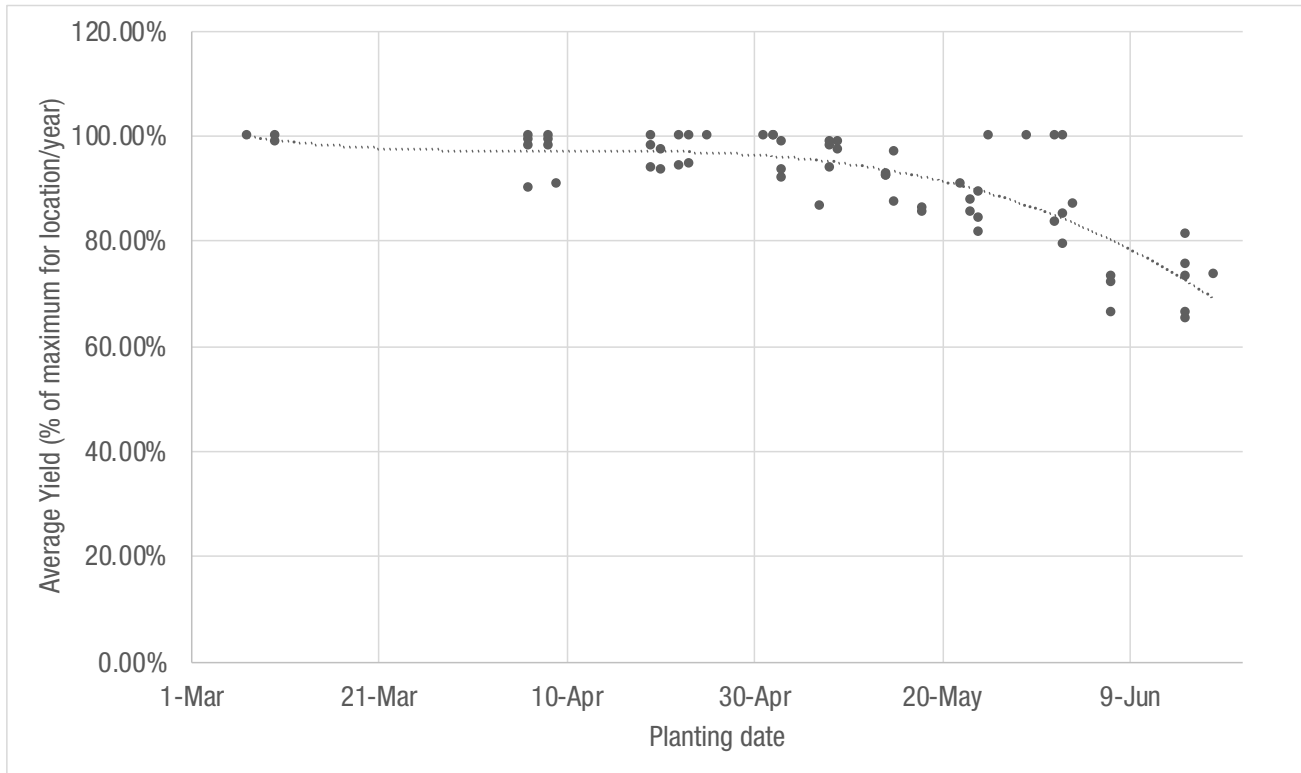


Figure 1. Average soybean yield response to planting date combined over years, 2018

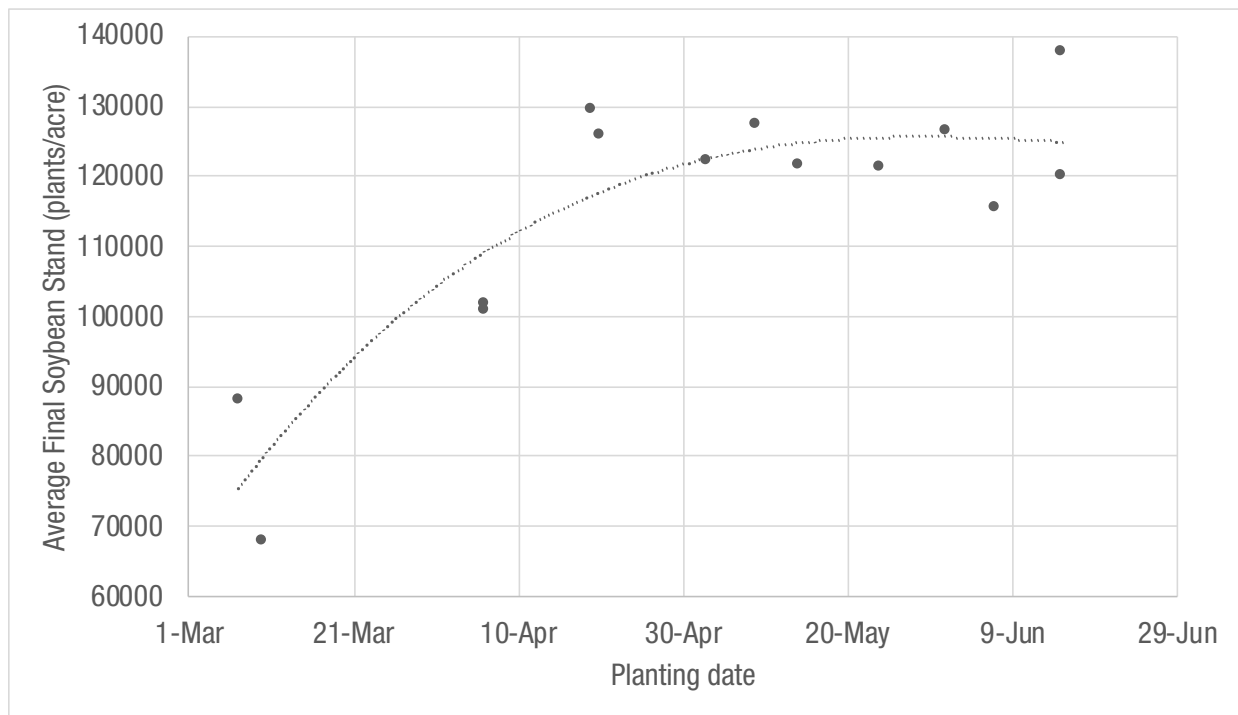


Figure 2. Average final soybean stands of 140,000 planted population across multiple planting dates, 2020-2021



A long-term research project evaluating the benefits of early planted soybeans

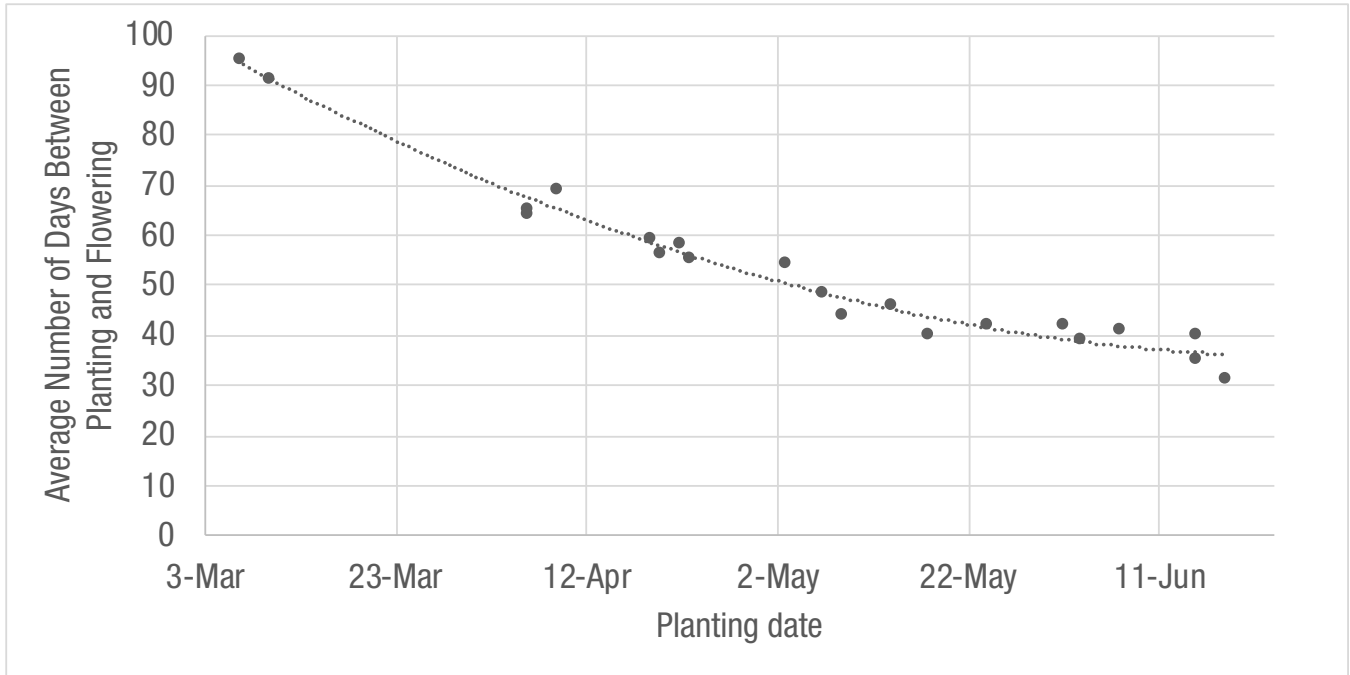


Figure 3. Average number of days to flower in soybeans based on planting date, 2019-2021.

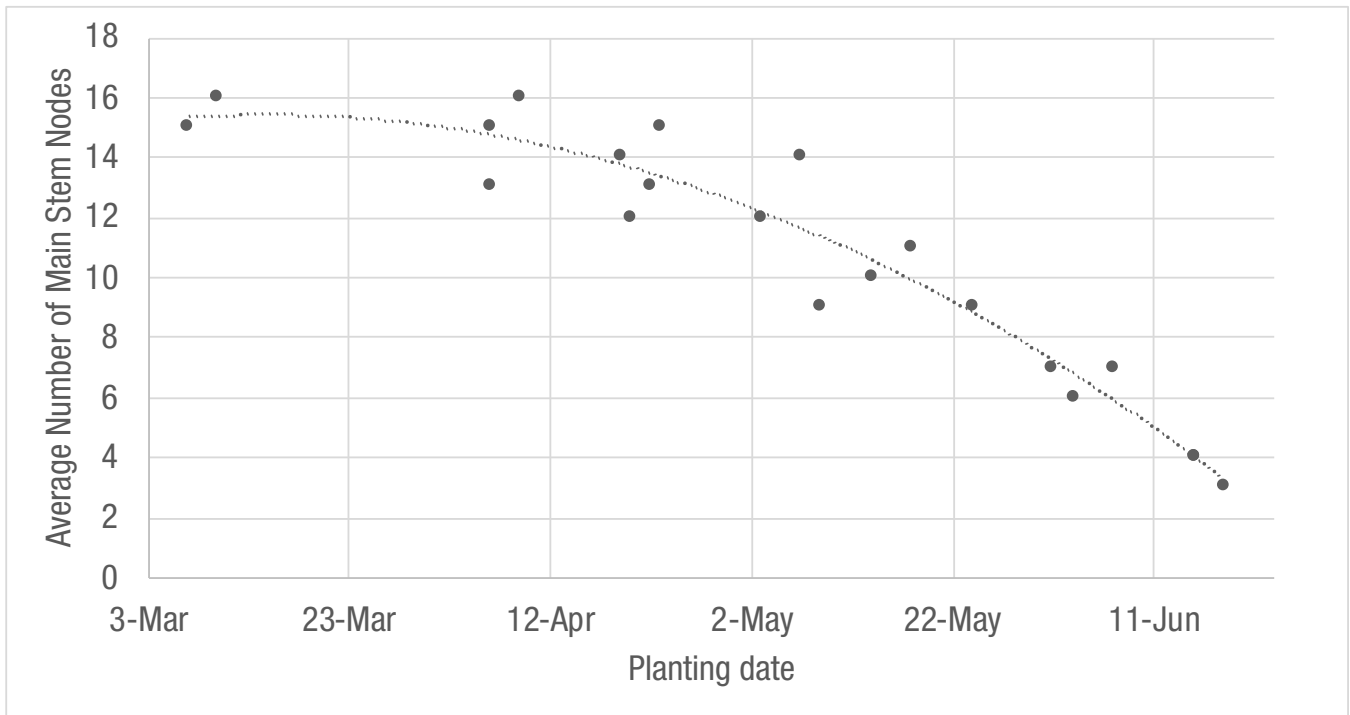


Figure 4. Effect of planting date on average number of main stem nodes created by July 10, 2019-2021.

A long-term research project evaluating the benefits of early planted soybeans

Key Learnings

- Although sometimes later planted beans attain satisfactory yield, there is much greater variation than in fields which are planted earlier.
- This research found that even though there was not always a large yield advantage to planting earlier, there was rarely a yield penalty. To reach maximum yield potential, it is critical that seeds are properly protected with quality seed treatment⁴
- This research found that early planted soybeans have a longer period between planting and flowering, providing higher yield potential by creation of additional nodes. Conversely, later planting dates have reduced the time between planting and flowering, and less yield potential.

Sources

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

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



Should I replant my soybeans?

Trial Objective

- As midwestern farmers continue to plant soybeans progressively earlier than ever before, the risk of emerged seedlings encountering frost increases.
- Largely due to the widespread adoption of treated soybean seed, growers now plant soybeans increasingly earlier than ever before; Illinois farmers had 41% of their soybean crop planted by May 2, 2021 compared to the previous 5-year average of 14%¹
- These early planting dates increase the risk of frost damage to emerged seedlings. The median date of the last 32°F freeze is April 25 in Woodford County² where this research was conducted.
- The goal of this research was to help growers make replant decisions when stands are reduced by frost or other factors.

Experiment/Trial Design

- This research was conducted at the Bayer Crop Science FOCUS site in Woodford County in 2020 and 2021.
- A 3.6 relative maturity (RM) soybean product was planted in 2020 and a 3.5 RM variety in 2021.
- Plots were planted as early as soil conditions allowed in the spring. In 2020, a significant frost occurred on May 2, and in 2021 temperatures below 28°F occurred on consecutive days of April 20 and 21. The “replant” comparisons were planted as soon as soil conditions allowed after the frosts.
- All seed was treated with Acceleron® Seed Applied Solutions STANDARD and ILeVO®.
- Standard fertility and weed management practices were followed, and plots were harvested as they matured.

Location	Soil Type	Previous Crop	Tillage Type	Planting Date	Harvest Date	Potential Yield (bu/acre)	Seeding Rate (seeds/acre)
Roanoke, IL	Silt loam	Corn	Conventional	3/7/20, 5/9/20	10/7/20	70	140,000
Roanoke, IL	Silt loam	Corn	Conventional	3/10/21, 5/3/21	10/18/21	75	140,000

Understanding the Results

- Figure 1 highlights the importance of evaluating frost damage over a period of several days, as many severely damaged plants can survive and even thrive (Figure 1).
- Over the two years included in the study, an average of 77,957 plants remained after frost, while an average of 124,775 remained in the replant comparison (Figure 2).
- In both seasons, the surviving plants were fairly evenly distributed across the trial area.
- Even with significantly reduced overall stand (which was a result of both delayed emergence and frost damage to the seedlings), the March plantings outperformed the replants by an average of 3.5 bushels/acre (Figure 2).



Should I replant my soybeans?



Figure 1. Damage and regrowth in soybean seedlings after heavy frost on morning of April 21, 2021.

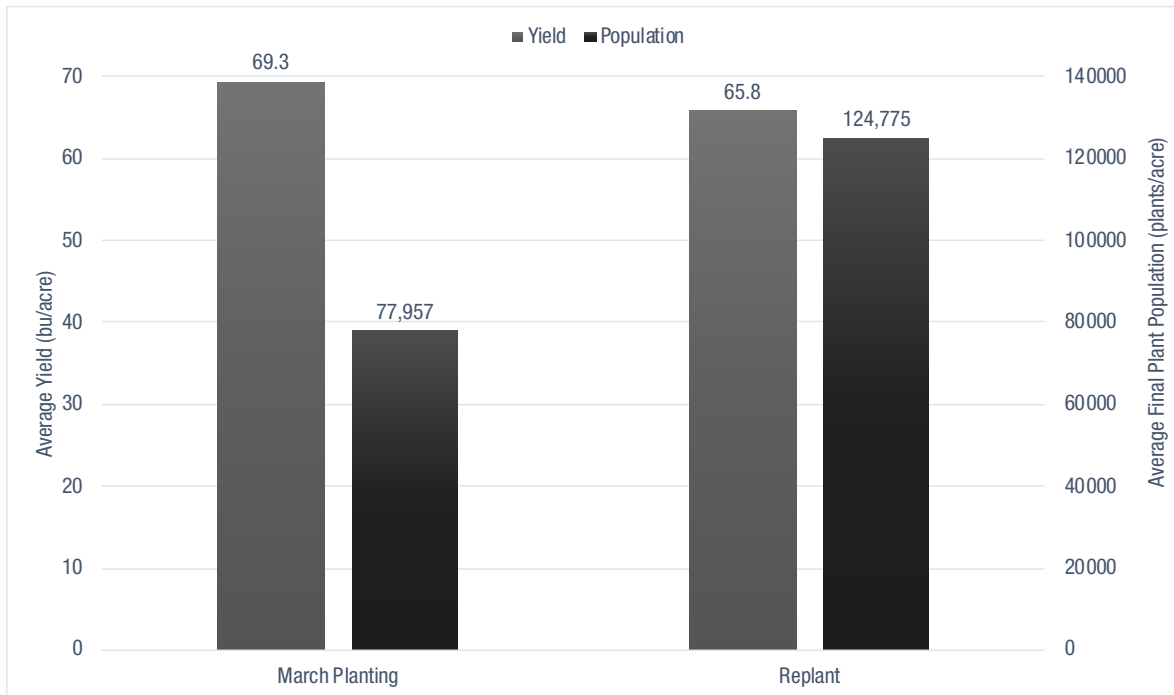


Figure 2. Soybean yield of original planting with reduced stand after frost damage versus replanted soybeans, 2020-2021.

Should I replant my soybeans?

Key Learnings

- When evaluating frost damage, it can take several days to determine the extent of the loss³.
- In this study, due to soybeans ability to branch and produce additional podding sites with increased room to grow, the lower final population with an earlier planting date outperformed the higher population planted later.

Sources

¹USDA National Agricultural Statistic Service. https://www.nass.usda.gov/Statistics_by_State/Illinois/Publications/Crop_Progress_&_Condition/2021/20210503-IL-Crop-Progress.pdf

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³Potter, B., Bongard, P., Naeve, S., and Gunsolus, J. 2018. Spring Frost. University of Minnesota Extension. <https://extension.umn.edu/growing-soybean/spring-frost>



Considerations for Weed Management in Early-Planted XtendFlex[®] Soybeans

Over the years, growers in Illinois have been shifting to planting soybeans before corn to help push the timing of planting to earlier in the season. Several factors have contributed to this shift including better equipment, increased seedling vigor due to seed treatments, increased yield potential, and favorable market prices. However, with a shift to earlier planting dates there are different weed management challenges to consider.

With early planting dates of late March to early April, using the same weed management program and application timings that are recommended for late April to mid-May plantings may be a mistake for several reasons. Early planted soybeans tend to stay in the ground for a longer period than May-planted soybeans (emergence can be delayed for three weeks or even longer). Now consider the recommendations for later-planted soybeans, which consists of a strong preemergence (PRE) program at planting followed by a residual postemergence (POST) application up to 21 days after the PRE was applied to allow for overlapping residuals. This usually means your POST application occurs at the V2 to V3 growth stage. If these recommendations are followed for early-planted soybeans, then the following problems may occur:

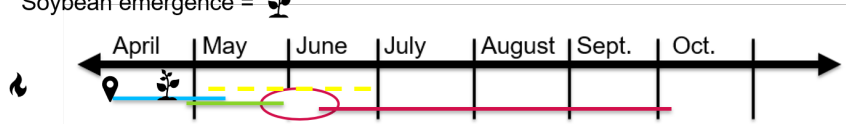
- If the PRE at planting is a strong PPO inhibitor (group 14) and ALS inhibitor (group 2) or LCFA inhibitor (group 15) combination that is typically used for waterhemp control, then we are more likely to see increased phytotoxicity response and stand loss due to the increased time in cool, wet soils and the stress from the PRE application.
- Residual herbicides applied in early April can run out of steam by the time peak waterhemp emergence begins in early May. If tillage or a burndown application was made prior to the at planting application, then the residual compound may not provide a lot of control. If the soybeans are not emerging, then the conditions are less than favorable for emergence of problematic weed species as well.
- If we try to overlap residuals with the POST application, then the application will occur closer to emergence. This can leave the crop vulnerable mid-season when the residual runs out at about V5 to V6 without a full canopy and we see late season breaks. Essentially, if you plant a month early, plan for an extra month of weed control.

- Burndown/tillage = 🌿
- Planting = 📍
- Pre = ———
- Overlapping residual post = ———
- Soybean canopy = ———
- Waterhemp peak emergence = - - - - -
- Soybean emergence = 🌱



Ideal soybean weed control system for waterhemp (*Amaranthus tuberculatus*).

- Burndown/tillage = 🌿
- Planting = 📍
- PRE = ———
- Overlapping residual POST = ———
- Soybean canopy = ———
- Waterhemp peak emergence = - - - - -
- Soybean emergence = 🌱










Weed control system in early-planted soybean for waterhemp (*Amaranthus tuberculatus*) if not adapting weed management strategy to early-season planting.

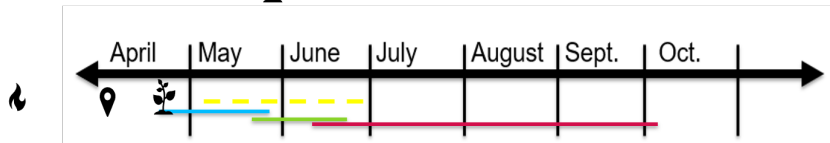
What are potential weed control options? With XtendFlex[®] soybeans, there are several ways to approach the problem. First, to help visualize some of these scenarios, I put together timelines of how a season normally progresses and how varying application timings can influence various factors for residual overlaps and reaching canopy in high weed pressure situations. Keep in mind that these bars will inevitably shift (for example the canopy bar will likely be placed more to the right on the timeline in most years).











Considerations for Weed Management in Early-Planted XtendFlex[®] Soybeans

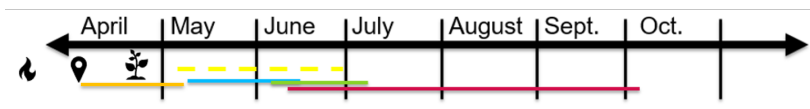
Option 1: Delay the PRE residual herbicide application to help increase control by targeting when the weeds are more likely to begin emerging. For example, apply products like Warrant[®] Ultra herbicide combined with XtendiMax[®] herbicide with VaporGrip[®] Technology* (a restricted use pesticide) at emergence to V2. This can help with knockdown and residual control further into the growing season to have a residual overlap closer to V4 to V5 without putting too much pressure on un-emerged soybeans. This method can also be used with other group 15 herbicides tankmixed with metribuzin, but the application must occur before the soybeans emerge to avoid metribuzin response. If glufosinate or XtendiMax are not used in the POST application, then avoid using fomesafen-containing products in the PRE application so it is available for use in a POST application. Fomesafen should only be applied once per year to avoid carryover issues.

- Burndown/tillage = 
- Planting = 
- PRE = 
- Overlapping residual POST = 
- Soybean canopy = 
- Waterhemp peak emergence = 
- Soybean emergence = 



Early-season soybean weed control of waterhemp (*Amaranthus tuberculatus*) if adapting system to early planting. Option 1: Delay PRE residual herbicide until emergence or shortly after emergence (increases pressure on herbicides but reduces cost).

- Burndown/tillage = 
- Planting = 
- Early POST = 
- Overlapping residual POST = 
- Soybean canopy = 
- Waterhemp peak emergence = 
- Soybean emergence = 
- PRE with burndown or at planting = 



Early-season soybean weed control of waterhemp (*Amaranthus tuberculatus*) if adapting system to early planting. Option 2: Lighter PRE residual herbicide for a planned three pass.

Option 2: This option may increase cost but may help to improve resistance management. For areas with earlier emerging weed species, consider adding a single active ingredient option (group 15, 5, or 3) at planting to avoid negative crop response and to provide control until soybean emergence. Then continue with a planned two pass post program with overlapping residuals.

Both options rely on starting clean and staying clean. It is important to steward the tools available and to shift toward being more proactive than reactive when it comes to application timings and management strategies. Starting off on the right foot with a weed control program and taking the pressure off POST programs is KEY to successful weed management!

Cody Evans is a Crop Protection Technology Development Representative with Bayer.

For a fascinating discussion of the history of weed management, check out this [Focus on Agriculture episode](#).



Effect of soybean seeding rate and row spacing on yield and profitability

Trial Objective

- Improvements in soybean genetics, planting technology, and weed control systems have led to lower planting rate recommendations for soybean growers¹ over the past decade.
- Although yields generally increase with increasing planting rates, commodity prices affect which planting rate will be most economical.
- This research was conducted with a goal of understanding the impact of plant population and row spacing on yield and grower profitability.

Experiment/Trial Design

- This research was conducted at Bayer Crop Science FOCUS sites in Illinois counties, Kendall, Dekalb, and Woodford from 2019-2021.
- Sixteen 2.2-2.9 maturity group (MG)soybean products were planted, with different soybean products used in different years.
- Seeding rates ranged from 60,000 to 160,000 planted seeds per acre.
- Four replications of this trial were planted at each location and year.
- The 2019 growing season was very cool and wet through early June, leading to delayed planting for many growers. Hot and dry conditions were prevalent in July and August, and excessive rainfall returned in September and October.
- In both 2020 and 2021, there was sufficient moisture in the early part of the growing season, but very dry conditions throughout August and into September.

Location	Soil Type	Previous Crop	Tillage Type	Planting Date	Harvest Date	Potential Yield (bu/acre)	Seeding Rate (seeds/acre)
Roanoke, IL	Silt loam	Corn	Conventional	6/3/19	10/14/19	70	60,000; 80,000; 100,000; 120,000; 140,000; 160,000
Newark, IL	Silty clay loam	Corn	Conventional	6/8/19	10/25/19	65	60,000; 80,000; 100,000; 120,000; 140,000; 160,000
Roanoke, IL	Silt loam	Corn	Conventional	6/1/20	10/15/20	70	60,000; 80,000; 100,000; 120,000; 140,000; 160,000
Waterman, IL	Silt loam	Corn	Conventional	5/21/21	10/22/21	70	60,000; 80,000; 100,000; 120,000; 140,000; 160,000
Roanoke, IL	Silt loam	Corn	No-till	5/20/21	10/12/21	70	60,000; 80,000; 100,000; 120,000; 140,000; 160,000



Effect of soybean seeding rate and row spacing on yield and profitability

Understanding the Results

- On average, over the 3 years in this research, the highest yielding configuration was 160,000 seeds/acre, planted in 20-inch rows (Figure 1).
- Based on soybean grain value of \$12/bushel, the most profitable planting configuration is also 160,000 planted seeds/acre in 20-inch rows (Figure 1).
- When a soybean commodity value of \$8/ bushel is used for calculations (Figure 2), a planting rate of 160,000 seeds/acre is still the most profitable. However, the profitability curve is relatively flat at planting rates from 120,000 to 160,000

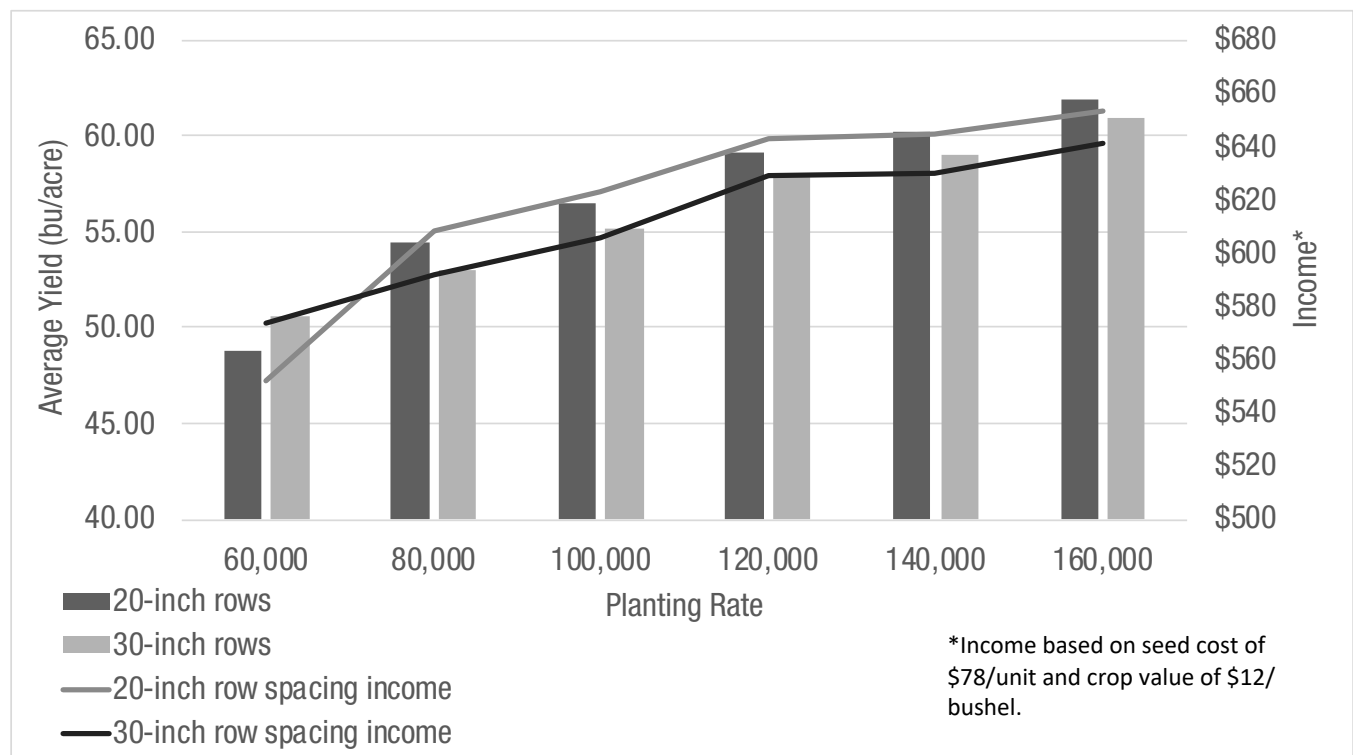


Figure 1. Average soybean performance and profitability under different row widths and seeding rates in Illinois, 2019-2021.

Effect of soybean seeding rate and row spacing on yield and profitability

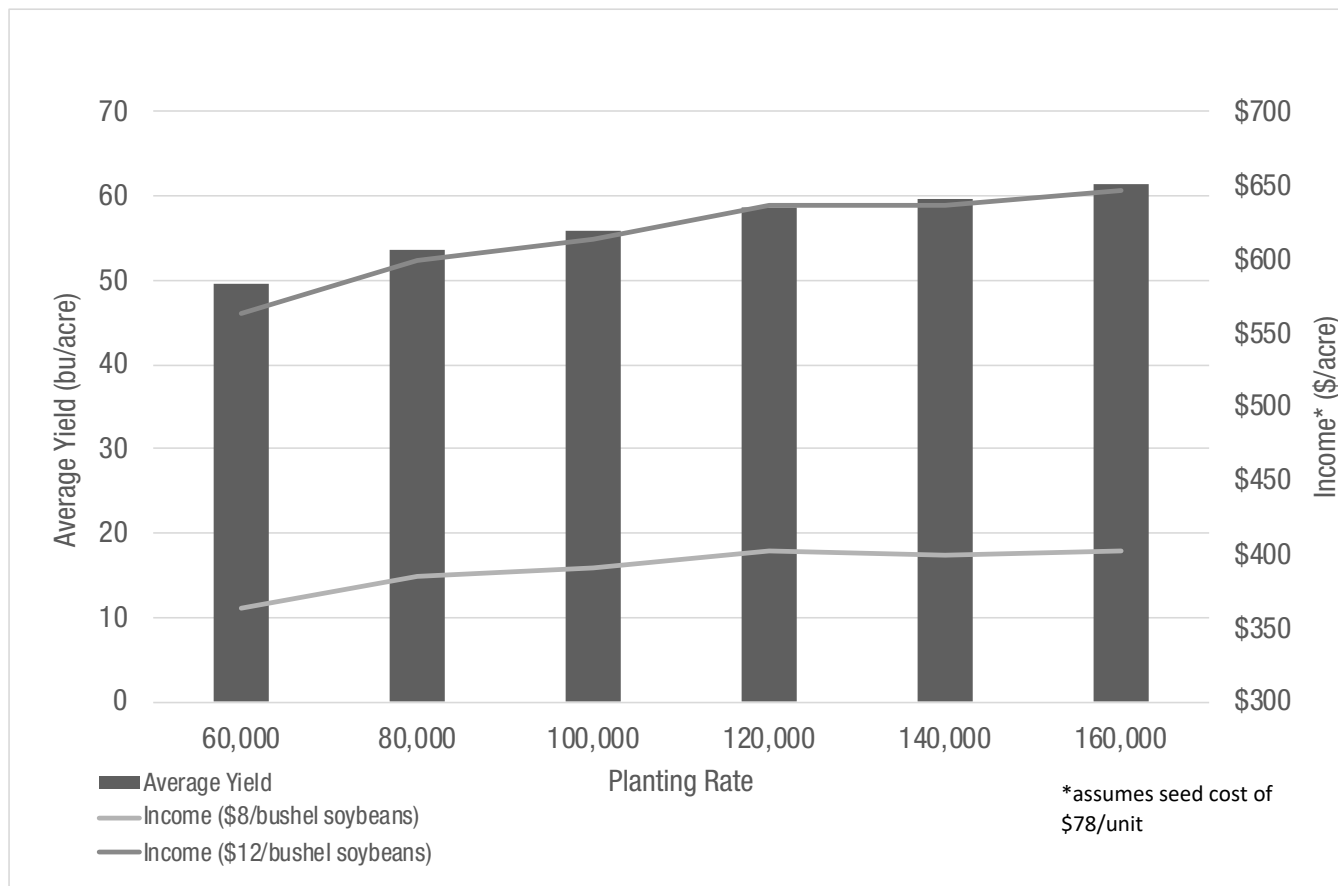


Figure 2. Effect of commodity price on average profitability of different planting rates in Illinois, 2019-2020.

Key Learnings

- Although the average planting date in this research was later than growers would typically wish to plant, the results are representative of what we see in earlier plantings; there is typically less yield effect related to a correlation between planting dates and planting rates than generally accepted.
- Although a planting rate of 120,000 seeds/acre will sometimes be sufficient to maximize profitability, growers wishing to increase yield or anticipating higher commodity prices may increase planting rates up to 160,000 without incurring much additional risk from an income perspective.

Sources

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²Pedersen, P. Optimum plant population in Iowa. Iowa State University. https://crops.extension.iastate.edu/files/article/OptimumPlantPop_000.pdf



SDS or Brown Stem Rot?

Once again in 2021, soybeans proved to be extremely resilient. Early planted soybeans were exposed to multiple freeze/frost events. Then we saw several heavy rains that resulted in floods that provided favorable conditions for phytophthora and diaporthe. As the season went on, we experienced one of the largest Brown Stem Rot (BSR) outbreaks in recent memory, coupled with some Sudden Death Syndrome (SDS) and White Mold. For good measure, we finished up with torrential rains and heavy winds. This caused lodging in many soybean fields, complicating harvest. Despite these challenges, growers were ultimately pleased with their yields in many cases.

Since we had widespread SDS and BSR in 2021, I would like to compare these diseases, which are often confused with one another when relying solely on foliar symptoms.

- Causes
 - SDS - Cool wet conditions early in the year along with early planted soybeans (both of which we had a lot of in 2021) can be drivers of this disease.
 - BSR – This pathogen infects later in the season than SDS. Development is favored by cool wet weather during pod-fill followed by hot, dry weather in mid-late August (this was a very common weather pattern in Central Illinois in 2021).
 - Both SDS and BSR can overwinter in soybean residue and in the soil.
- Identification:
 - Foliar symptoms
 - SDS and BSR can have a VERY similar interveinal chlorosis foliar symptoms (Figure 1).
 - When the leaves die, do the leaves remain on the plant or fall off? In the case of SDS, leaves will fall off and plants will look like they were browsed by deer. Plants that hold on to dead, droopy leaves indicate BSR.



Figure 1. Interveinal chlorosis symptoms of sudden death syndrome (left) and brown stem rot (right).

SDS or Brown Stem Rot?

- Stems
 - Splitting the stems of BSR infected plants longitudinally reveals a dark, chocolate-brown discoloration of the pith with a distinctive “ladder rung” pattern (Figure 2). By contrast, in plants that have sudden death syndrome with the same leaf symptoms, the cortex of the stem remains normal white to pale-green.
 - SDS symptoms can show up in the stem as browning of the stem instead of the pith (Figure 3).



Figure 2. Split soybean stem on the left shows the chocolate brown pith with ladder rung pattern that often indicates brown stem rot.

- Roots
 - SDS will infect the roots. Dig or pull the plant out of the ground to determine if the root is rotten. If you see fuzzy or powdery white or blue growth on the upper portions of the roots, this is indicative of SDS. Plants infected with SDS may break off at the soil level when trying to pull them.
 - BSR does not infect the roots, so they should appear healthy.



Figure 3. Sudden death syndrome can cause browning of stem cortex but the pith stays white.

- Management
 - SDS
 - Fungicidal seed treatments can help to manage SDS. However, there are a limited number of active ingredients that are effective against this pathogen. The two most used in soybeans are ILeVO® (flupyrim) and pydiflumetofen.
 - Low lying areas with heavy water or compaction are more prone to SDS.
 - Soybean product selection can play a primary role in resistance as well.
 - There is no in-season treatment for SDS.
 - BSR
 - If there is a field history of BSR, make sure to select a soybean product with a good tolerance/resistance.
 - Poorly drained fields are more prone to BSR.
 - Continue to rotate to non-host crops like corn.
 - Watch your SCN (soybean cyst nematode) levels because the two can interact together.



Figure 4. The fungus that causes sudden death syndrome may appear as blue fungal growth (spore masses) on the main or tap root of the soybean plant. Photo courtesy of Daren Mueller, Iowa State University, bugwood.org.



Austin Edwards is a Technical Agronomist in east central Illinois.



Effect of row width and planting rate on yield, lodging, and disease development in soybeans

Trial Objective

- Improvements in soybean genetics, planting technology, and weed control systems have led to lower planting rate recommendations for soybean growers over the past decade.¹
- The goal of this research was to determine how planting rate and row spacing interact and affect lodging, disease development, and yield in soybeans

Experiment/Trial Design

- This research was conducted at Bayer Crop Science FOCUS sites in Illinois counties: Kendall, Dekalb, and Woodford from 2019-2021.
- Sixteen 2.2-2.9 maturity group (MG) soybean products were planted, with different products used in different years.
- Soybean products were all treated with Acceleron® Seed Applied Solutions STANDARD + ILeVO® Seed Treatment
- Seeding rates ranged from 60,000 to 160,000 planted seeds per acre.
- Four replications were planted at each location.
- Standard fertility and weed management practices were followed.
- The 2019 growing season was very cool and wet through early June, leading to delayed planting for many growers. Hot and dry conditions were prevalent in July and August, and excessive rainfall returned in September and October.
- In both 2020 and 2021, there was sufficient moisture in the early part of the growing season, but very dry conditions throughout August and into September.

Location	Soil Type	Previous Crop	Tillage Type	Planting Date	Harvest Date	Potential Yield (bu/acre)	Seeding Rate (seeds/acre)
Roanoke, IL	Silt loam	Corn	Conventional	6/3/19	10/14/19	70	60,000; 80,000; 100,000; 120,000; 140,000; 160,000
Newark, IL	Silty clay loam	Corn	Conventional	6/8/19	10/25/19	65	60,000; 80,000; 100,000; 120,000; 140,000; 160,000
Roanoke, IL	Silt loam	Corn	Conventional	6/1/20	10/15/20	70	60,000; 80,000; 100,000; 120,000; 140,000; 160,000
Waterman, IL	Silt loam	Corn	Conventional	5/21/21	10/22/21	70	60,000; 80,000; 100,000; 120,000; 140,000; 160,000
Roanoke, IL	Silt loam	Corn	No-till	5/20/21	10/12/21	70	60,000; 80,000; 100,000; 120,000; 140,000; 160,000



Effect of row width and planting rate on yield, lodging, and disease development in soybeans

Understanding the Results

- On average, over the 3 years in this research, yield increased with increased planting rates (Figure 1).
- The highest yielding configuration was 160,000 seeds/acre, planted in 20-inch rows (Figure 1).
- Except for the lowest planting rate of 60,000 seeds/acre, soybeans planted into 20-inch rows exhibited higher yields than those planted in 30-inch rows (Figure 1).
- Although lodging pressure was low in this trial, we saw increased lodging at higher seeding rates. Row width had no effect on lodging severity (Figure 2).
- Disease pressure was also low in this trial. Overall, disease pressure was lower in the 30-inch row spacing than 20-inch and increased with increasing populations (Figure 3).

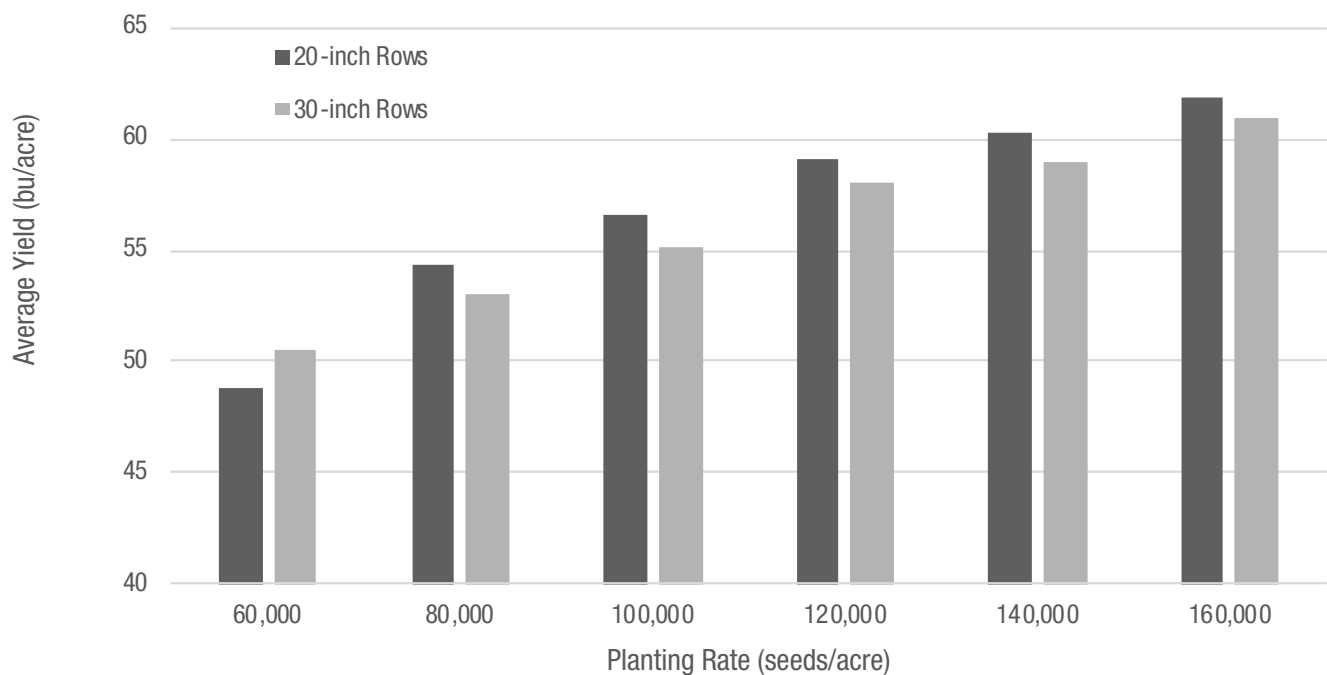


Figure 1. Average soybean yield at different row widths and seeding rates, 2019-2021.

Effect of row width and planting rate on yield, lodging, and disease development in soybeans

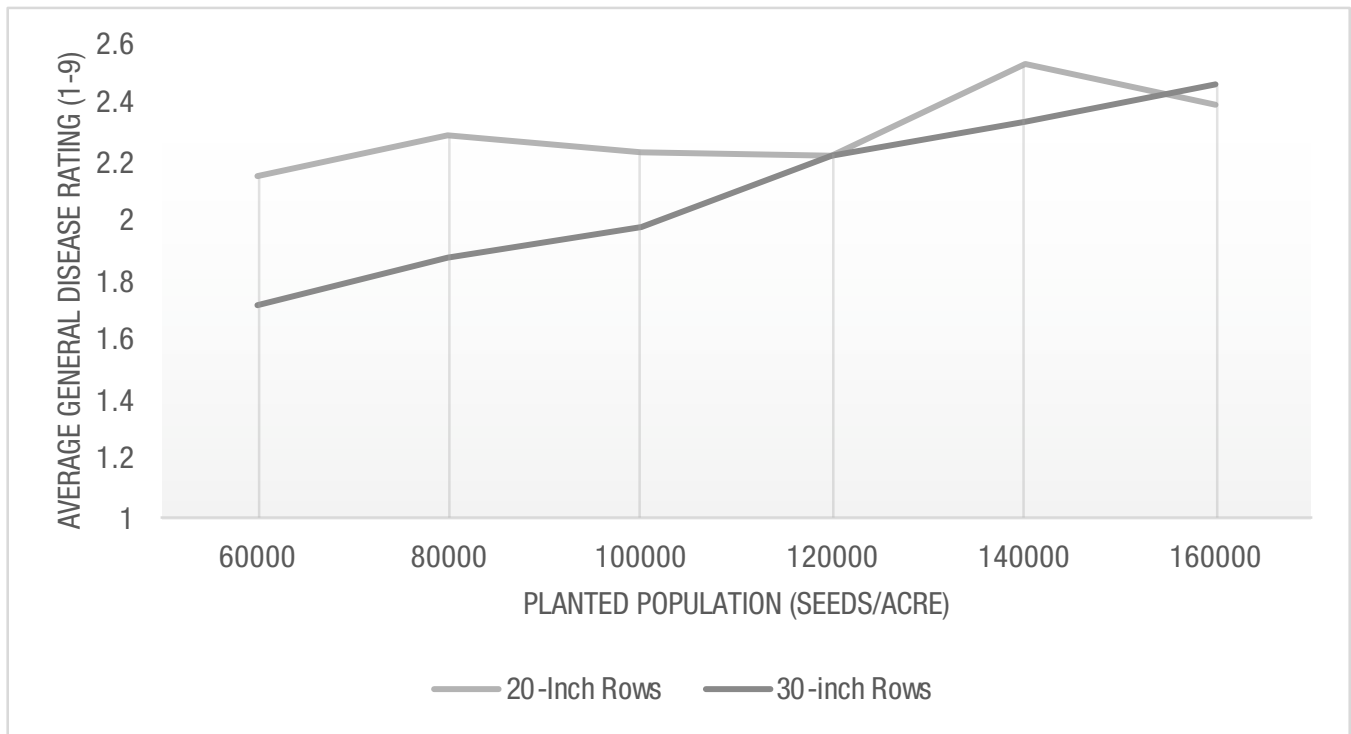


Figure 2. Effect of row width and planting rate on soybean lodging, 2020-2021.

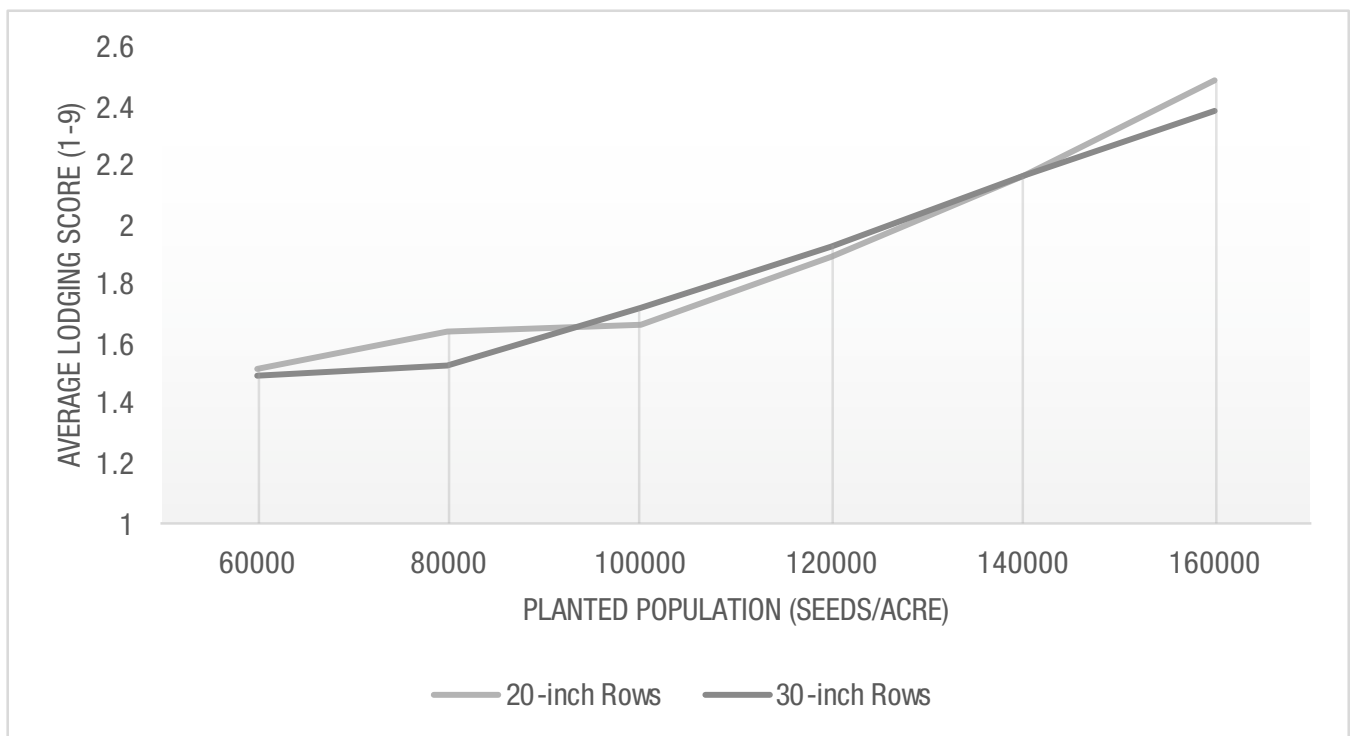


Figure 3. Effect of row width and planting rate on soybean disease development, 2020-2021.

Effect of row width and planting rate on yield, lodging, and disease development in soybeans

Key Learnings

- Soybean growers can capture additional yield by planting soybeans into 20" rows.
- Higher populations lead to increased yield, but also increase the risk of agronomic problems such as lodging and disease development.

Source

¹Pedersen, P. Optimum plant population in Iowa. Iowa State University. https://crops.extension.iastate.edu/files/article/OptimumPlantPop_000.pdf



Understanding the Potential Benefits of Defoliating Soybeans

Could defoliation be the next step in managing high yield soybeans? Possibly. Soybean defoliation is not a new concept. Growers in the South routinely apply desiccants to indeterminate soybean varieties to aid in harvest. Applications of desiccants or defoliant to these group V soybeans are made when roughly 65% of the pods are brown to help the crop reach an even, acceptable harvest moisture in less than 14 days after application.

In the Midwest, defoliating soybeans could help:

- Improve harvest of varieties with good late season health (green stems). These varieties can have higher yield potential, but may be challenging to harvest.
- Allow the use of a slightly fuller season variety than what is generally grown in an area. Currently growers are reluctant to push maturity because of the risk of late harvest.
- Move the harvest window one to two weeks earlier. This shift in harvest date can generally mean more “good bean harvest days” with longer daylight hours and lower humidity.
- Result in a more uniform crop to harvest. By defoliating the crop there can be fewer green stems and foliage running through the combine. This can lead to a more efficient harvest and fewer “lima” beans.
- Offset maturity delays from foliar fungicide applications. Foliar fungicides can help increase soybean yield potential, but also delay maturity. A properly timed defoliation could help offset the negative effects of keeping the crop green and healthy.
- Increase cover crop success. If the soybean crop can be harvested a week sooner, the longer window after harvest could be the difference in the successful establishment of a cover crop.

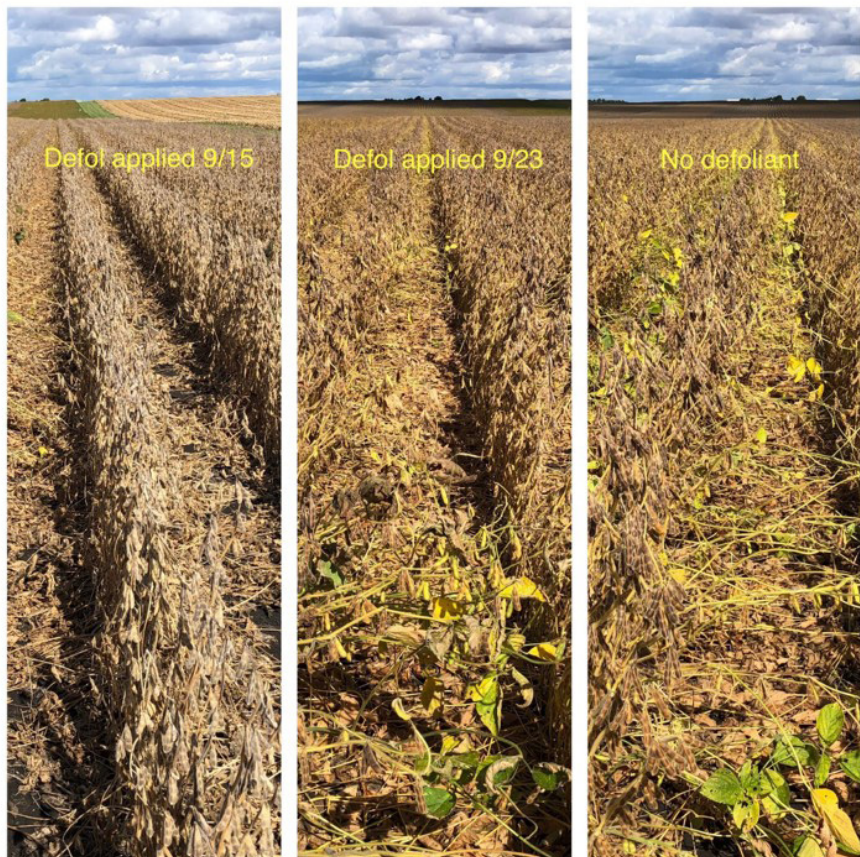


Figure 1. Soybean desiccants help aid in harvest.

Research at the Roanoke Technology Development site is helping to determine if defoliating soybeans is a practice that could be adapted here in the Midwest. The preliminary results look promising, but continued testing is necessary to help determine the spray timing with the most impact on harvest moisture while maintaining the yield potential of the crop.

Mark Schultz is a Customer Business Advisor in North Central Illinois.

Watch a YouTube video discussing this research with [this link](#):



Evaluating the use of defoliant to improve soybean harvest

Trial Objective

- Some high-yielding soybean products have good late season health which can manifest itself in green stems, making them more difficult to harvest.
- Use of a defoliant may help dry out the plants faster and allow greater ease of harvest.
- There may be other situations in which a defoliant could provide benefits including facilitating the use of fuller season soybeans, improving harvest timing, or increasing odds of cover crop establishment through an earlier harvest.
- This research project was designed with a goal of evaluating the impact of defoliant application on soybean yield and harvest timing.

Experiment/Trial Design

- This research was conducted at Bayer Crop Science research sites in Illinois Counties: Adams, Woodford, Stark, Dekalb, and Kendall.
- Eight soybean products ranging from 2.7 to 3.8 maturity group (MG) were used, with different products at each location.
- Standard fertility and weed management practices were followed.
- Defol® 5 (sodium chlorate) was applied at a rate of 4.8 quarts/acre in a 20 gallon/acre carrier volume.
- Defoliant was applied at the R6.5 growth stage, which occurs 7-10 days after R6 and is defined as the timing in which the seed easily separates from the protective membrane within the pod¹.
- Late September and early October were hot and dry across the northern half of Illinois, leading to quicker than normal soybean maturation.
- Plots were harvested as soon as feasible after reaching maturity.

Location	Soil Type	Previous Crop	Tillage Type	Planting Date	Harvest Date	Potential Yield (bu/acre)	Seeding Rate (seeds/acre)
Roanoke, IL	Silt loam	Corn	Conventional	4/14/21	10/18/21	75	140,000
Liberty, IL	Silt loam	Soybean	Conventional	5/5/21	9/23/21	85	140,000
Bradford, IL	Silt loam	Corn	Conventional	4/6/21	9/17/21	85	140,000
Waterman, IL	Silty clay loam	Corn	Conventional	5/14/21	10/18/21	70	140,000
Newark, IL	Clay loam	Corn	Conventional	5/27/21	10/23/21	70	140,000



Evaluating the use of defoliant to improve soybean harvest

Understanding the Results

- There was no negative association between defoliant use and soybean yield (Table 1). Overall, the average yield of the treated strips was 69.2 bu/ acre, while the untreated strips averaged 68.7 bu/acre.
- There was no significant difference in moisture between treated and untreated (Table 1). It should be noted that most of the locations were not able to be harvested immediately when maturing, so the grain moistures had time to equalize.
- A fairly large range in maturity response to defoliant was observed, ranging from no benefit to 9 days, with an average of 2.4 days earlier (Table 1). This response was probably confounded by abnormally rapid maturation of the soybean crop across the state in 2021.

Location	Maturity Group	Defoliant Application Date	Harvest Date	Days Saved at Harvest	Defoliant Yield (bu/ acre)	Untreated Yield (bu/ acre)	% Moisture (defoliant)	% Moisture (Untreated)
Waterman, IL	2.7	9/24/21	9/27/21	3	63.6	63.2	12.4	12.6
	2.8	9/24/21	10/4/21	9	63.7	59.5	13.1	12.9
	3.5	9/24/21	9/29/21	4	63.1	61.3	12.2	12.4
Newark, IL	3.6	9/11/21	9/20/21	0	65.4	65.6	12.4	12.5
	3.5	9/11/21	9/20/21	0	64.8	61.7	12.5	12.4
	3.7	9/11/21	9/20/21	0	65.4	62.7	12.0	12.0
	3.8	9/11/21	9/20/21	0	65.9	68.3	12.4	12.2
Bradford, IL	2.7	9/10/21	9/17/21	0	85.0	86.0	11.9	11.8
Roanoke, IL	3.5	9/16/21	9/22/21	9	76.6	76.2	10.0	9.8
	4.5	9/22/21	10/13/21	1	65.8	69.0	10.4	10.6
Liberty, IL	3.8	9/16/21	9/23/21	0	82.1	81.9	12.0	12.6
Average				2.4	69.2	68.7	11.9	12.0

Key Learnings

- Defoliant application can be made without negatively impacting soybean yield in situations where it would potentially benefit a grower’s operation.
- Benefits to harvest timing may vary based on application time and fall weather.

Source

Irby, T., Allen, T., Bond, J., Catchot, A., Gore, J., Cook, D., Krutz, J. Golden, B., 2016. Identifying late season soybean growth stages. Mississippi State University Extension. <https://www.mississippi-crops.com/2016/08/19/identifying-late-season-soybean-growth-stages/>



Acceleron® Seed Applied Solutions - Protecting Your Most Valued Input

I still like to think I'm not that old of guy, but when I reflect on the advances in the business of farming over the past 20 years, it makes me feel as though I've lived a lifetime. Working with my grandpa growing up, I can recall him saying that the seed is planted in short sleeve weather and harvested in long sleeve weather. Significant advances in breeding, germplasm, and seed applied treatments have flipped this script. Early planting (given that the conditions are fit) helps provide a high yield potential for both corn and soybeans. The connection with earlier planting dates and the advancements of seed treatments and biologicals is strong and makes the need for understanding seed treatment options and benefits even more important.

For the purposes of this article, I will take a deeper look at the Bayer corn seed treatment offerings to provide a better understanding of the benefits and value added to the bag. Our goal is to provide a broad spectrum and agronomically complete offering of fungicide, insecticide, nematicide, and biologicals that help to deliver protection from pests and diseases while offering plant growth enhancement potential. These product offerings and combinations of active ingredients have been vigorously tested to help deliver agronomic benefit, value, and optimum performance.

2022 Acceleron® Seed Applied Solutions for Corn

Acceleron® for corn has maintained a very durable and consistent offering over the past several years, yet there have been significant updates and investments made in recent years to further enhance the offerings.

Fungal Diseases

Acceleron® Seed Applied Solutions ELITE with Enhanced Disease Control (EDC) was introduced in the DEKALB® brand line-up in 2014 and has since been made available as an upgrade option on select Channel® brand and Stone Seed™ brand corn products as well. Products treated with Acceleron® Seed Applied Solutions ELITE with Enhanced Disease Control offers a 3.7 Bu/A* advantage on average with enhanced early to mid-season disease control due to the reduction of infections caused by *Fusarium*, *Rhizoctonia solani* and *Colletotrichum graminicola*.

*Results from seven years of internal trials comparing hybrids treated with and without Enhanced Disease Control. N=598

Disease Protection				Insect Protection	Insect/Nematode Protection	BioRise™ Corn Offering
Acceleron® D-342 Fungicide Seed Treatment	Acceleron® DC-309 Fungicide Seed Treatment	Acceleron® D-281 Fungicide Seed Treatment	Enhanced Disease Control (EDC)	Acceleron® IC-609 Insecticide Seed Treatment	Poncho® Votivo®	Acceleron® B-360 ST
Prothioconazole	Metalaxyl	Fluoxastrobin	High rate of Prothioconazole and Fluoxastrobin in combo with Metalaxyl at the base rate	Clothianidin	Clothianidin Bacillus firmus I-1582	LCO SP104
<p>Exclusive fungicide combination provides protection against:</p> <p><i>Fusarium, Rhizoctonia, Pythium</i></p>			<p>Enhances early to mid season disease control due to the reduction of infections caused by <i>Fusarium</i>, <i>Rhizoctonia</i>, and <i>Colletotrichum</i> (pathogen that leads to anthracnose stalk rot)</p>	<p><i>Grape colaspis</i> <i>Seedcorn maggot</i> <i>Wireworm</i> <i>White grub</i> <i>Black cutworm</i></p>	<p><i>Root-knot Nematodes</i> <i>Needle Nematodes</i> <i>Dagger Nematodes</i> <i>Lesion Nematodes</i> <i>Lance Nematodes</i> <i>Spiral Nematodes</i> <i>Stunt Nematodes</i> <i>Stubby Root Nematodes</i></p>	<p>Increases -</p> <ul style="list-style-type: none"> • Functional root volume • Water and nutrient uptake through the roots <p><small>*Studies demonstrated that Acceleron® B-360 ST increased mycorrhizal colonization by 85.1%</small></p>

2022 Acceleron Seed Applied Solutions Products
*2017 Monsanto/Novozymes Growth Chamber Trials



Acceleron® Seed Applied Solutions - Protecting Your Most Valued Input

Insects and Nematodes

Poncho®/Votivo® Insecticide-
 Poncho/Votivo is the standard for insect control and nematode suppression in corn. Research has found a 5.1 bu./acre increase* from 250 of Poncho® Insecticide to the 500 rate. SmartStax® Technology corn products are treated with the 500 rate of insecticide. Votivo® insecticide continues to be an industry standard in broad spectrum nematode suppression in corn and is applied to all SmartStax® corn products.

*average corn yield advantage over 900 trials that took place from 2007-2017 across a wide geography with varying insect and nematode pressures.

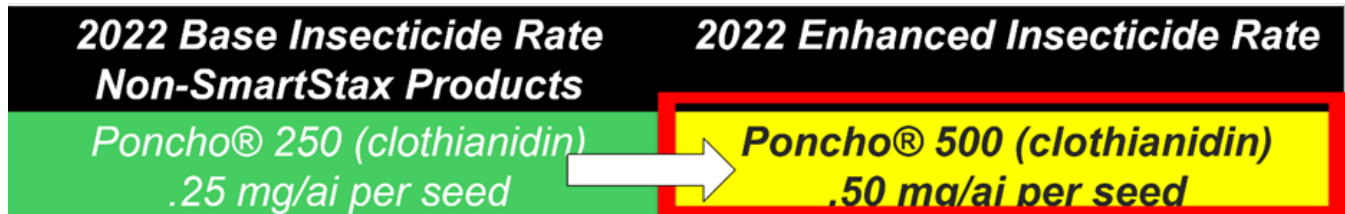


Control Without Enhanced Disease Control



Control With Enhanced Disease Control

Collinsville, IL demonstration plot



Biologicals

BioRise® Corn Offering was introduced in 2017 and has become a standard offering across the Bayer branded corn portfolio. If you are like me, you may be inclined to have more interest in what we see above ground (plant/ear) vs. below ground (roots). However, the root system and the interaction with soil biology is powering the entire plant and the BioRise® Corn Offering can help increase the plants functional root volume and can help provide increased water and nutrient uptake through the roots.*

*2017 Monsanto/Novozymes Growth Chamber Trials

Jeff Moser is a Seed Growth Advisor with Bayer in Illinois.



Crown Rot Management

In the fall of 2018, many growers in west central IL started to have issues with crown rot. Ever since, awareness of the issue has been spreading across the Midwest along with the disease. Recognizing there was little known about the disease or management solutions, we did some trial work to see what we could learn.

For a little background, crown rot is caused by a fungal pathogen. Predominantly fusarium is the culprit, but occasionally other pathogens are in play. The initial infection happens early in the corn's life cycle, generally in cooler, damper soils. As the season progresses and other stresses come into play, the visual symptoms start to show up. In general, the disease typically shows up during grain fill as the crop approaches maturity causing a premature plant death, which is what we refer to as ghosting (Figure 1).



Figure 2. Deterioration of corn crown due to crown rot.

As the crown of the plant starts to deteriorate from the infection, the movement of water and nutrients becomes more and more limited, like the pinching of a straw. In severe cases, the crown of the plant dies, shutting off all flow of water and nutrients from the roots.

Once the crown is dead, the plant starts to cannibalize itself to pack assimilates into the grain. This cannibalization is what leads to the ghosting. The plants will go from green to a silvery color, and then turn brown in a matter of a few days. The rotting of the crown and the premature death can lead to other stalk rot pathogens setting in, yield losses, lower test weight grain, and ultimately standability issues as the fall progresses.

Over the past 3 years, several field trials have been conducted to find best crop management methods to suppress crown rot in the field. The trials have included comparisons between susceptible and tolerant corn products, application of different in-furrow fungicides at planting, a variety of seed treatment packages, and foliar fungicide applications at V5/V6 and VT/R1 growth stages.

At the onset of this trial work, growers had a choice of what seed treatment package they wanted on some of their corn products. We offered either Acceleron® Seed Applied Solutions BASIC or Acceleron® Seed Applied Solutions ELITE with Enhanced Disease Control. In three years of local research, the upgrade to Acceleron® Seed Applied Solutions ELITE Seed Growth Products, which contains the Enhanced Disease Control fungicide package, is now standard on DEKALB® brand corn products, and has shown the ability to help manage high levels of pressure of Fusarium which will help set the crop up for a healthy start. This sets the foundation for other management practices throughout the season to help keep the plants



Figure 1. Premature plant death is the visual symptom of corn rot commonly referred to as ghosting.

healthy and defend against possible crown rot infection. The single best method we can deploy to combat stalk damage and yield loss from crown rot in corn is to use a VT/R1 fungicide. To be fully transparent, the VT fungicide application has no efficacy against fusarium crown rot itself. However, it does help alleviate other stresses the corn plant has to endure to help keep the crown rot at bay. The late season stresses are a trigger mechanism for crown rot and utilizing fungicide at the VT/R1 growth stage can help reduce the amount of late season stresses.



Crown Rot Management

Another simple method we can use is an early fungicide application at the V5/V6 growth stage. This application cannot and should not replace the VT/R1 application; it is complimentary. In our trials, it isn't as impactful at reducing the amount of ghosted plants as Acceleron® Seed Applied Solutions ELITE with Enhanced Disease Control seed treatment or a fungicide application at VT growth stage, but it has helped to consistently deliver a positive return on investment. If you are looking for something else to add to your arsenal to combat crown rot, consider adding a fungicide with herbicide application at the V5/V6 growth stage.

Unfortunately, in-furrow applications of fungicides have not proven as beneficial in our trial work as one may expect. Some have shown benefit in helping to reduce the number of ghosted plants, some of have shown a yield benefit, but rarely have any of them been able to deliver a positive return on investment. One of the biggest limiting factors with the in-furrow fungicide products is that most of them cannot be mixed with starter fertilizer and require water to be their carrier. I have not seen enough benefit yet to justify making the investment in a liquid system on your planter. That said, if you were already considering a liquid system for the benefit of starter fertilizer itself, then maybe this provides a reason to fully commit.

As we analyze our data sets, one glaring thing we have noticed (see Figure 3) is that each management method tested shows an increased impact on a more susceptible corn product than it does on a more tolerant corn product.

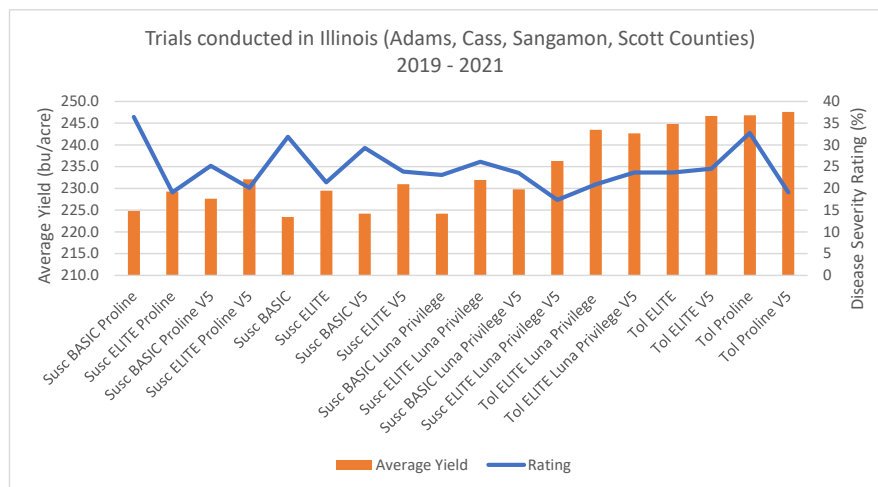


Figure 3. Effect of seed treatment and fungicide products and application timing on crown rot development and yield. Susc = Susceptible corn product, Tol = Tolerant corn product, BASIC = Acceleron® Seed Applied Solutions BASIC. ELITE = Acceleron® Seed Applied Solutions ELITE with Enhanced Disease Control, Proline = Proline® fungicide, Luna® Privilege = Luna® Privilege fungicide

The reason for this is because the inherent health of that more tolerant corn product is doing most of the heavy lifting in combatting crown rot. We have little data to truly differentiate one product from another, but generally, corn products that have better foliar disease tolerances fare better against crown rot. Like the previously discussed benefit of fungicide application at VT/R1 growth stage, alleviating stresses during grain fill can help keep crown rot at bay.

There are several key takeaways when summarizing our data and experiences. First, there are no silver bullets. There are management tools that can help minimize crown rot, but nothing will eliminate it. There have also been situations where growers utilized all available tools, and still had high levels of infection and ghosted plants at yield robbing

levels. Secondly, utilizing multiple management options such as seed treatments, fungicides, and tolerant/resistant corn products helps lower the infection from crown rot and protect yield potential. Early in the season, tools like corn product selection, seed treatment, in-furrow applications, and fungicide applications at V5/V6 growth stage help to limit the level of initial infection. Later in the growing season, our goal is to reduce stress in the plant with foliar fungicides, late-season nitrogen applications, and/or micro-nutrient packages.



Chris Kallal is a Technical Agronomist at Bayer in west central Illinois.

Getting the Most From Your Fertility Investment

Prices of nitrogen, phosphate, and potash fertilizers have increased dramatically in recent months. It is unclear how long these higher fertilizer prices will last but many feel the pressure to stretch the fertilizer dollar. Every situation is different but here is a list of items that can help manage costs, but more importantly, help ensure the best possible return on investment (ROI) on your fertility investment.

1. **Soil Testing** – Relative to the cost of fertilizer, soil testing is very inexpensive and can help identify areas that may not require additional fertility in the short term.
2. **Soil pH** – Soil pH is one of the less glamorous but arguably most important parts of soil fertility. When pH is in balance (6.2-6.4), nutrient availability in soil is maximized (Figure 1).
3. **Use yield data accurately spread fertilizer based on removal rate**- One of the best uses of GPS yield monitor data is in perfecting the fertility program. This allows accurate replacement the nutrients removed based on yield.

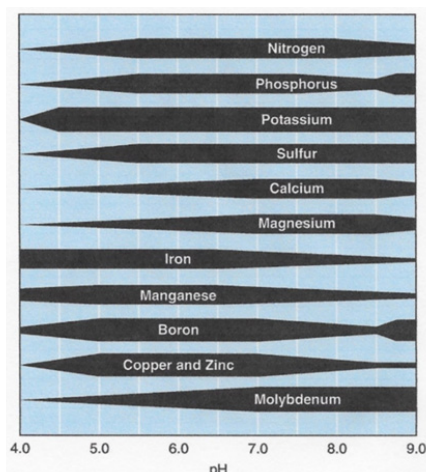


Figure 1. Nutrient availability based on soil pH.

4. **Make full use of GPS/VRT application technology** – A vital component of any efficient fertility program is the ability to adjust application based on soil and/or yield variability.
5. **Consider spreading each year** – The more fertilizer applied at one time the less efficient it will be. Fertilizing for every crop has many benefits that can help offset the additional application costs (especially during times of very high prices).
6. **Don't be afraid to make a withdrawal from the fertility bank account** – If soil tests do not indicate a need for additional fertilizer, foregoing maintenance and building fertilizer applications can help get you through a



short-term fertilizer price spike. When prices regulate, regular maintenance and build-up applications can be resumed to help replenish soil nutrient reserves.

7. **Just use less** – If you are uncomfortable with the idea of turning the dial to zero, consider applying a factor of your choosing to your fertilizer script. For example, on my own farm this fall I decided to shave rates by applying $\frac{3}{4}$ crop removal rate instead of the normal full amount.

Lance Tarochione is a Technical Agronomist in west central Illinois.



Ask the Agronomist sessions with Lance and other agronomic content can be found on this [YouTube channel](#).



Results from the Corn Rootworm Areawide Study

Corn rootworm is a persistent and economically significant pest of corn in the Midwest and is often given the moniker the \$1 billion bug. During the summer of 2021, many growers across northern Illinois reported both western and northern corn rootworm adults in corn and soybean fields.

We conducted a survey of corn rootworm adult population densities across the Midwest in 2021. Our primary objective was to determine the range of economic western corn rootworm densities to help predict which areas would have the highest likelihood of pressure in 2022. This information helps farmers make informed decisions when considering below-ground insect feeding protection.

The survey was accomplished with the cooperation of many farmers, dealers, and employees of Bayer Crop Science as well our extensive licensee network. We extend our thanks to them for helping us conduct this valuable survey.

Scouting for corn rootworm adults in soybeans and corn was conducted from the last week in July through the third week in August using yellow sticky traps (Pherocon® AM traps). Traps were placed at the field edge and replaced weekly for the duration of the survey.

We sampled a total of 1291 fields in 2021, with a large proportion of those in IL (Figure 1). The data are presented geographically where color indicates the average number of beetles per trap per day. An observation greater than 2 beetles/trap/day indicates the probability for economic injury the following year if control measures are not implemented.

Our 2021 survey results indicate an expansion of the range of corn rootworm in northern Illinois (Figure 2). Thus, we believe there is an increased risk potential for corn rootworm larval injury in 2022 corn planted after corn and some first-year corn fields in almost any Illinois county north of I-80. In 2021, 38% of fields sampled were above the economic threshold- up from 22% in 2020. Additionally, 52% of continuous corn fields sampled were above threshold- up from 33% in 2021! Perhaps most astonishing was the jump in first year corn field sampling which jumped from 4% in 2020 to 17% in 2021 which indicates variant rootworm pressure is currently on the rise.

CRW 2021 Data, All Fields (N=1291)

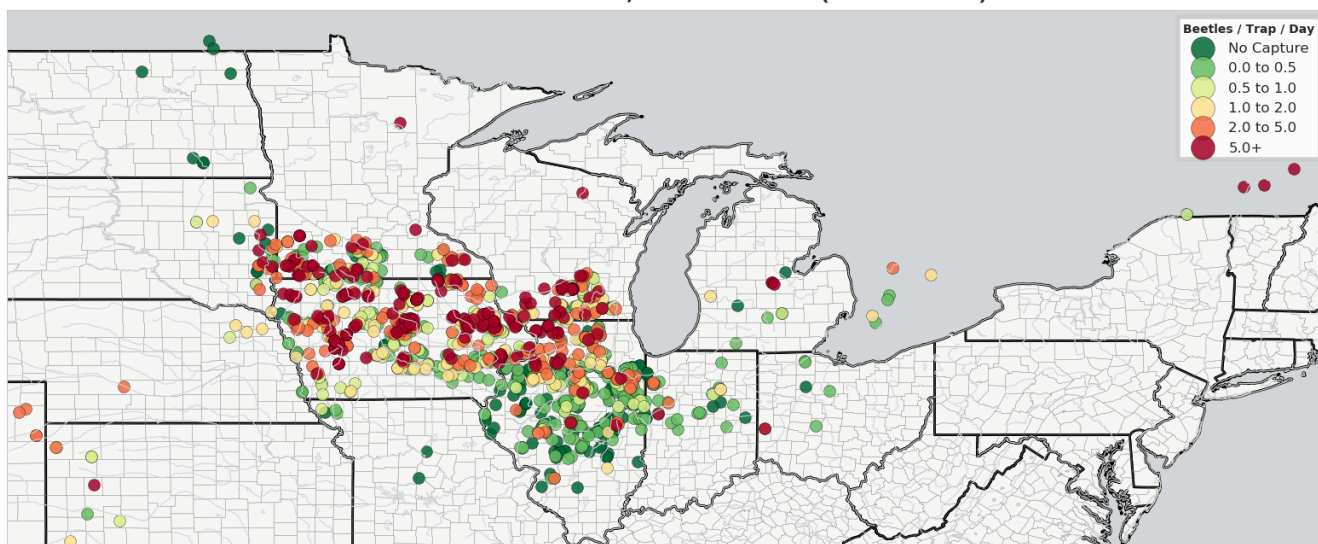


Figure 1. Distribution of corn rootworm beetle monitoring locations in 2021.

Results from the Corn Rootworm Areawide Study

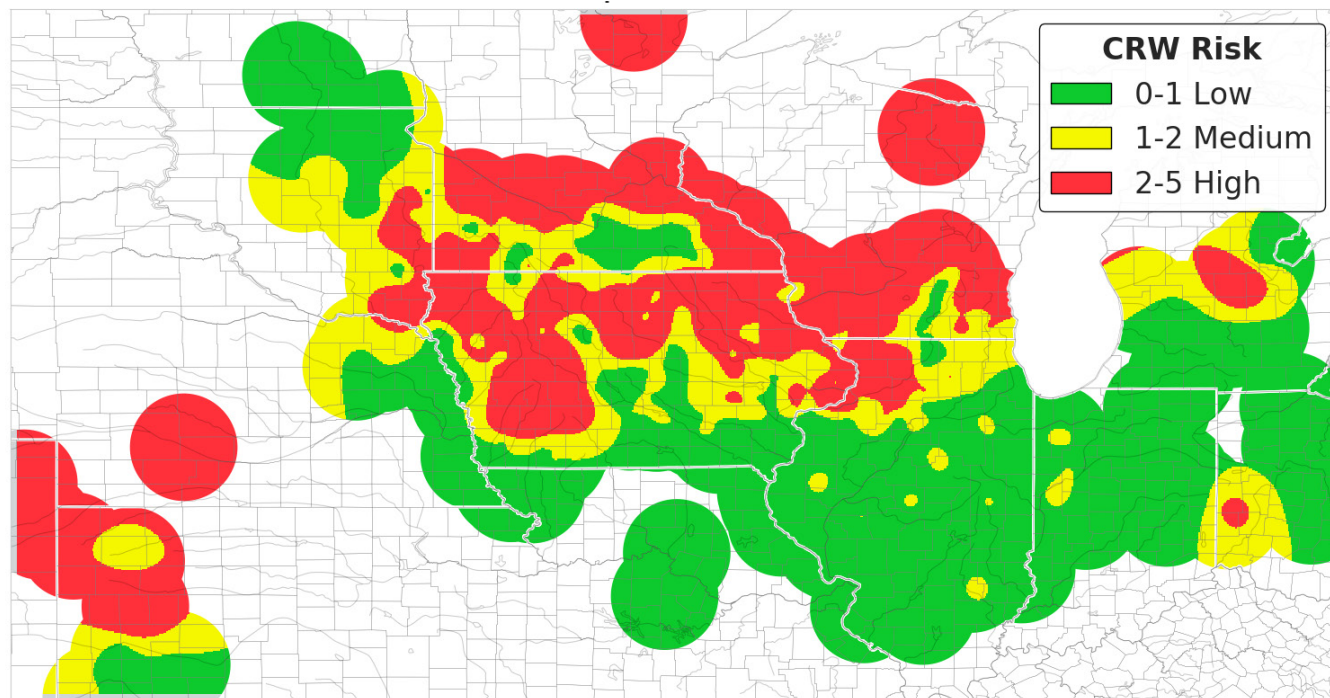


Figure 2. 2022 Corn Rootworm (CRW) Pressure Forecast from 2021 Beetle Monitoring Project.
An observation greater than 2 beetles/trap/day indicates the probability for economic injury the following year if control measures are not implemented.

Growers should not base their management decisions for 2022 strictly on the results of this survey. The best way to predict the potential for rootworm larval injury in corn is to deploy sticky traps on your corn and soybean fields. If you did not monitor beetles in 2021 and wish to in 2022, contact a Bayer representative for sticky traps and guidance. As the prevalence of this pest is likely to continue to increase, growers are also encouraged to step up their efforts to monitor for western corn rootworm larval injury on corn planted in 2022.

Preston Schrader is a Technical Development Representative in central Illinois.

For an in-depth discussion of the corn rootworm outlook for 2022, check out [this video](#).



Food Grade Corn - From Bag to Bag

What makes food grade corn? How does it differ from what I normally produce and sell to my local elevator? What do I need to do to produce food grade quality corn? This article will help answer these questions and likely more when it comes to food grade corn and the food grade market.

First things first, what is food grade corn?

Food grade corn is going to become an ingredient for human consumption. From a food processor's standpoint, they are looking at purchasing an ingredient, not just a commodity. Because of this, food processors often like to select their ingredients (corn in this case) with certain characteristics such as a product with a high hard endosperm content, high test weight, lower moisture, minimum handling damage (cracks or breaks), and be clean of disease and foreign material.

Corn product selection is a key component when it comes to meeting the needs of processors. Product selection starts with the breeding process within Bayer. Bayer takes great pride in developing products to meet the unique needs of food grade products. Products are selected and tested to ensure that the needs are met for both the processor and the farmer. It is then grown locally, tested, and submitted to processors for their approval. Many processors have a select list of corn products they will accept without further testing.

What do I need to do differently to produce food grade quality corn?

In many cases, that answer is simple, nothing. Growers who have high management practices are generally already doing everything that is needed to grow good food grade quality corn. Fertility, corn product selection (as described above) disease protection, harvest practices and drying practices are all key when it comes to grain quality.

We have all heard of the essential nutrients for plant growth and maybe have even heard of Liebig's Law of the Minimum. This plays a key role in grain quality. Making sure we have all the essential nutrients in sufficient quantity is vital. For example, if we have 400 pounds of nitrogen, but no available sulfur, then we can only yield as high as the natural sulfur content in the soil. The essential nutrients are not only key to yield potential, but also to grain quality. In many cases, if a corn product is deficient on available nutrients, it will try to find a source (normally within itself) to meet that need. Therefore, nutrient deficiency can result in issues with stalk quality, roots, and grain quality.

It is important to monitor the condition of food-grade corn during the growing season for disease pressure, especially those diseases known to produce mycotoxins which can impact crop yield potential and the acceptability of food-grade corn for processing.

Selecting a field with lower disease pressure or one that has been rotated from a cover crop or a legume can help minimize potential issues. Starting with a high-quality seed treatment for management of insects and disease can help protect season-end plant health as well. Some geographies and environments (depending on the weather pattern that year) may also require multiple foliar fungicide applications. Foliar fungicide applications at the V5 growth stage followed by a VT-R1 growth stage application can help protect grain quality and yield potential.



Food Grade Corn - From Bag to Bag

What can we do to protect our investment in this crop during harvest and grain storage?

Cracks and broken kernels can hurt a quality score when delivered to a processor. Proper adjustments of the combine will help minimize these issues. A wider concave setting and lower rotor speed than what is recommended by the manufacturer is a great place to start. As harvest proceeds, start to increase the speed of the rotor and tighten the concave to get the proper setting for that ideal quality. Increasing fan speed as necessary can help reduce the amount of foreign material (FM) in the grain as well. Flushing equipment by harvesting the border rows first will help rid excess FM from the combine and other harvest equipment.

Storage and drying are the final key components prior to delivery. Safe and effective storage of corn is an important step to preserve quality, prevent damage from molds and insects, and ensure food safety of harvested grain.

Starting with a clean bin may seem like common sense but it's worth mentioning. Ensuring all previous grain, mold, insects and foreign material are removed from the bin is critical. Checking augers and other transfer equipment can help prevent an issue later during delivery. Uniformly drying and cooling grain to ambient temperature can help maintain quality as well. Driers should be kept 110 degrees or cooler and be sure to use high volumes of air. Drying at higher temperatures can increase the number of stress cracks in the grain. Many processors like the grain at 14.5% moisture or lower at delivery but never store grain over 15%. Sealing the bin after it has been filled will help keep moisture, rodents, and insects out during storage. Monitor grain temperature and moisture (digitally if possible) to avoid rapid moisture and temperature variations, especially in the fall and spring.

Growing food grade quality corn can be rewarding. These are just a few tips that have shown to help growers be successful in producing food grade quality corn and it's always beneficial to ask others what works in their operation as well. The main things to keep in mind are to select quality approved corn products and ensure they have adequate fertility and disease protection. Follow that up with careful harvesting and storage management, and you have just taken corn from a seed bag to a grocery bag!



Randy Niver is a Technical Agronomist in east central Illinois.



The Journey for Weed Management in Corn for 2022 and beyond – Are we there yet?

In today's ever-changing complicated world of Integrated Weed Management (IWM) the question at the end of each season is what the heck was that? Yes, each year is unique. It can feel as though Mother Nature is always changing the rules. Bayer's focus on farmer-centric solutions spans our broad product portfolio, at a time when new tools in crop protection couldn't be more important. Farmers are facing increasing challenges managing pests and Bayer is working to provide solutions that set them up for success in the future.

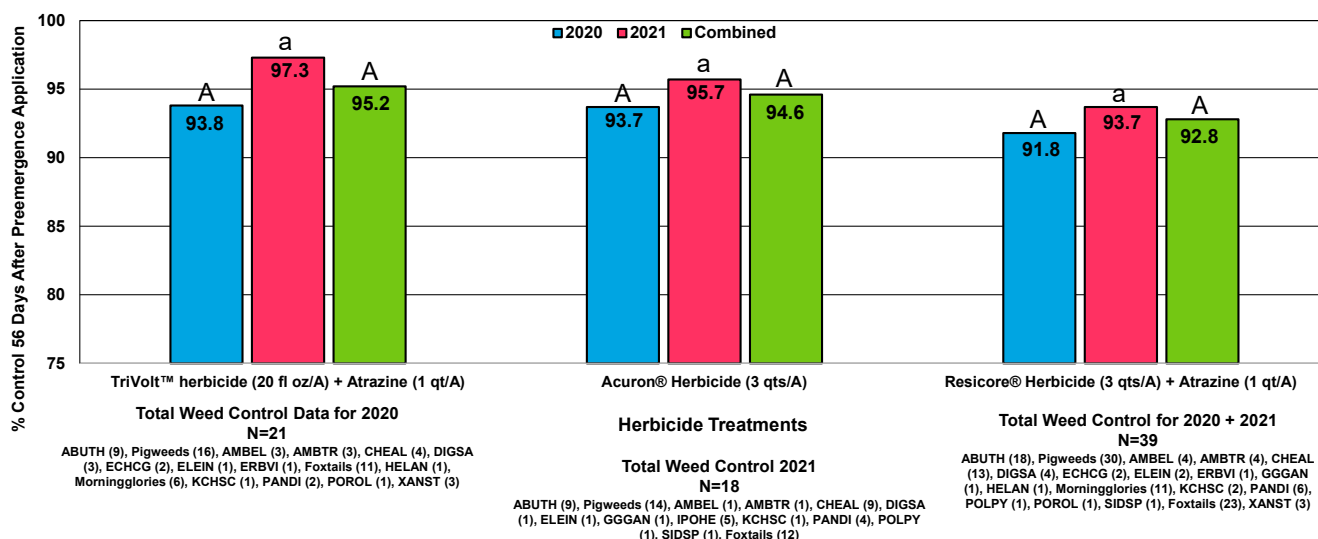
Those of us that live and breathe the world of IWM and try to stay ahead of the resistance curve are always looking to adapt to the new "normal" that will soon change again.

Bayer has invested decades and dollars to develop herbicide products that contain multiple sites of action (SOA) to help control broadleaf and grass weed species.

Our current portfolio in corn alone contains 6 SOA groups (groups 2, 4, 5, 9, 15, and 27). We recommend using 4 to 6 SOA's in various combinations both pre- and post-emergence to help mitigate selection pressure risks associated with herbicide application.

Coming soon, the latest brand launch from Bayer will be TriVolt™ Herbicide (pending state approval). TriVolt is a preemergence herbicide that offers powerful weed control with three different effective SOA to control weeds with burndown

and season-long residual until crop canopy through variable weather conditions. TriVolt will contain the Crop Safety Innovation (CSI) Safener which contributes to its broad compatibility with popular corn products. The CSI Safener allows plants to better withstand herbicidal activity, which can lead to increased root growth and plant health. The safener has both soil and foliar uptake, which make the safener active in both pre- and early post-applications. The CSI Safener allows TriVolt to be used on any soil with greater crop compatibility and allows application through V2 growth stage corn.



* No statistical differences were observed within colored columns ($\alpha = 0.05$)

Figure 1. Internal and academic research trials in 2020 and 2021 showed similar residual weed control performance from TriVolt™ Herbicide* compared to Acuron® Herbicide and Resicore® Herbicide 56 days after preemergence applications. Research trials included 50 site locations in 17 states across the Corn Growing Region in 2020 and 2021.

TriVolt™ herbicide is not currently available for commercial sale. Commercialization is dependent on multiple factors, including successful conclusion of the regulatory process. The information presented herein is provided for educational purposes only and is not and shall not be construed as an offer to sell, or a recommendation to use, any unregistered pesticide for any purpose whatsoever. It is a violation of federal law to promote or offer to sell an unregistered pesticide. © 2022 Bayer Group.



The Journey for Weed Management in Corn for 2022 and beyond – Are we there yet?



New SOA for **Palmer Amaranth** and Waterhemp

PPO - Resistant Palmer Amaranth at Marion (AR) – Picture taken on 06/13/17 – 34 DAA



Sulfentrazone
(Group 14, PPO)



Pyroxasulfone
(Group 15, VLCFA)



Diflufenican (“BAY 478”)
(Group 12)
Excellent control of Palmer Amaranth
Carpetweed
(controlled by premix partners)

3

/// BAY 478 /// Product Overview /// May 2021

Diflufenican (“BAY 478”) is not registered for sale or use in the United States. Commercialization is dependent on multiple factors, including successful conclusion of the regulatory process. The information presented herein is provided for educational purposes only, and is not and shall not be construed as an offer to sell, or a recommendation to use any unregistered pesticide for any purpose whatsoever. It is a violation of federal law to promote or offer to sell an unregistered pesticide. ©2021 Bayer Group. All rights reserved.

Figure 2. Diflufenican will provide a new site of action in the Bayer weed management pipeline for North America for management of waterhemp and Palmer amaranth. These pictures were taken in 2017 in Marion, AR illustrating control of PPO- resistant Palmer amaranth with applications of sulfentrazone (left), pyroxasulfone (center), and diflufenican (right). The area within the red circle (right) shows carpetweed that was not controlled by diflufenican, but will be managed by premix partners.

Finally, looking at the future pipeline, Bayer is planning to bring a new tool to growers in North America through the active ingredient diflufenican, pending EPA approval. Diflufenican has been used for years in Europe to manage broadleaf weeds in crops such as lentils and winter cereals. Pending EPA approval, it will provide a new site of action to help tackle troublesome weeds like Palmer amaranth and waterhemp in soybeans and corn in North America and will be another tool for farmers to add to their weed management plans. The best weed management practice is a balanced approach utilizing herbicides with multiple sites of action and management plans that cover multiple years and crops to help avoid weed resistance issues.



Daren Bohannon is a Crop Protection Technical Development Representative for Bayer in Illinois.



Frequently Asked Questions About Short Stature Corn

What is the Smart Corn System?

Bayer's Smart Corn System, currently under development, marks a potential transformational shift in corn production. With short stature corn hybrids at the heart of this next game-changing innovation, the Smart Corn System will combine the inherent benefits of these corn hybrids with tailored agronomic recommendations and digital services to help growers better manage risk and unlock yield potential in the face of an ever-changing climate.

Bayer is exploring multiple technology approaches for this product concept; however, the breeding trait approach is the most advanced in the pipeline and will be the first to launch in North America. We are encouraged by initial trial data, which will be assessed, validated, and quantified in the years of research to come. We anticipate the system will continue to evolve over time to provide even more value to growers.

What are the expected benefits of short stature corn as part of the Smart Corn System?

The most often referenced benefit is standability. Through breeding innovation, short stature corn hybrids significantly increase tolerance to lodging and greensnap.*

Another benefit that is easily observed is the ease of in-season management. Shorter height allows for more flexible timing and the ability to use ground application of crop inputs, like fungicides, insecticides, and nitrogen.

*Based on Bayer internal trials 2018-2020 across a range of environments (535 locations, 16 states).

How long have you been working with short stature corn?

First generation products were tested in very small quantities around 10 years ago. This was using a very limited testing footprint. More recently, testing has been very broad across geographies and yield environments.

What is the yield potential?

Research trials conducted by Technology Development (TD) have shown a similar yield potential but an enhanced opportunity to unlock additional yield potential by optimizing crop inputs, planting densities, and field placement. Bayer has extensively tested the breeding version of short stature corn hybrids in R&D and Market Development and expanded testing in 2021 across a range of geographies and environments (including in Illinois).

Can it work in my normal corn production system?

Our research would indicate yes! In our trials, short stature corn is comparable to our current corn products in traditional production systems. Bayer Technology Development has tested many different row configurations and standard populations and realizes that the Smart Corn System may entice growers to "step into" higher management production systems to unlock further yield potential.

Is this short stature corn a fit for all growers?

As with any technology, the answer to this depends on the grower. We believe the Smart Corn System has the potential for a broad acre fit across the U.S. corn belt. But everything a grower would consider selecting standard height corn products (disease response, stalk and root strength, drydown, trait package, etc.), should be a part of the grower's decision process.

How much shorter are short stature corn hybrids compared to current standard height corn hybrids in the marketplace?

Short stature corn products are developed to be approximately one-third shorter than standard height corn hybrids. The exact height will vary by hybrid and environment; however, the target plant height will be $\leq 7'$ and target ear height will be $\geq 2'$ to maintain compatibility with standard ground equipment.

Are you working with academics on development of the Smart Corn System?

Yes, absolutely. Bayer has ongoing collaborations with several academic groups to better understand the potential agronomics and sustainability benefits of short stature corn hybrids. The Crop Physiology Lab at the University of Illinois has been working with short stature corn for several years and has some very interesting findings that they will be publishing and presenting soon.



Frequently Asked Questions About Short Stature Corn

Dr. Below's lab has looked at nitrogen and fertility needs, row spacing and density, and foliar protection as ways of increasing the yield potential of short stature corn and is excited about the potential it has on impacting growers across the Corn Growing Region. For more information on results, visit <http://cropphysiology.cropsi.illinois.edu/>.

Will the short stature corn products be stacked with biotech traits before it reaches the market?

Yes, the commercial offerings for the short stature corn will be combined with similar trait package offerings as are available in our standard height corn product portfolio.

When will I be able to plant short statured corn on my farm?

Several products with commercial trait packages are evaluated in breeder locations annually. There will be trial work with Technical Agronomists conducted soon. Bayer is planning for potential Ground Breakers® Field Trials of the breeding trait short stature corn hybrids with growers in the U.S. central corn belt to co-develop the Smart Corn System as early as 2023, pending product availability. Specific launch timing, system offerings, available trait packages and other details are still being determined.



Dave Shenaut is a Technical Development Representative at Bayer located in north central Illinois.



Dear Mr./Ms. Farmer,

I have the privilege of writing you a short letter about choices.

First, I want to thank you and all other farmers that purchased Bayer products last season for making the choice to allow us to work with you. In farming there are a finite number of seasons and as a farmer's wife, I see firsthand how much care and calculation goes into every decision for your operation. It is an honor that Bayer products are a choice you may make this season.

Within these pages are articles from some of the smartest people we have working in agriculture today. They share the science behind the choices you can make to help combat many of the issues you may face on your farm including weeds, disease, and drought. At Bayer every field is considered unique. We never assume there is one perfect solution for all your acreage because we know that back 40 acres can be very different in soil type and weed pressure than the "Rays" farm 20 miles north. Bayer has a broad portfolio of products and so many choices can sometimes be confusing. However, there is a strategy in offering so many products. This variety of product lineup allows for great flexibility in offering individualized solutions to combat the differing issues in your operation. We know that additional complexity can require more time. The Bayer PLUS Rewards program* offers incentives to farmers for looking at their operation field by field utilizing the appropriate mix of herbicide, fungicide, and insecticide products as needed. The conversation always needs to start with the agronomic needs of each field. The rewards are there because of the smart agronomic choices you make with Bayer.

Within this book there are many selections to consider: from trait to product, from active ingredient to brand. We know you have a lot of options and we hope the Bayer PLUS Rewards program is there to offer an additional return on the choices made for your fields.

The last thing I will say is this: Thank you. I know it's not easy, I know there are hard days, exhausting days, days you give up family time or work late into the night. But there are also rewarding days, days you are proud and there are many who don't even know all that you do to keep food on their table. Thank you for making the choice every day to be a farmer.

Best of luck in the upcoming season,



Kim Helgen
Bayer PLUS Lead

* See program terms and conditions for full details at www.MyBayerPLUS.com.



Kim Helgen is an Illinois native and wife to a 5th generation farmer. Kim has been with Bayer for over 10 years in a variety of roles from sales to supply chain to marketing. Kim has an undergraduate degree from the University of Illinois and an MBA from Washington University in St. Louis.



Legal Statements

This material may contain “forward-looking statements” based on current assumptions and forecasts made by Bayer management. Various known and unknown risks, uncertainties and other factors could lead to material differences between the actual future results, financial situation, development or performance of the company and the estimates given here. These factors include those discussed in Bayer’s public reports which are available on the Bayer website at <http://www.bayer.com/>. The company assumes no liability whatsoever to update these forward-looking statements or to conform them to future events or developments.

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XtendiMax® herbicide with VaporGrip® Technology is part of the Roundup Ready® Xtend Crop System, is a restricted use pesticide and must be used with VaporGrip® Xtra Agent (or an equivalent volatility reduction adjuvant). For approved tank-mix products (including VRAs and DRAs), nozzles and other important label information visit XtendiMaxApplicationRequirements.com.

SmartStax® PRO corn products will be commercially available for the 2022 growing season.

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

FOR CORN, EACH ACCELERON® SEED APPLIED SOLUTIONS OFFERING is a combination of separate individually registered products containing the active ingredients: BASIC plus Poncho®/VOTIVO® Offering for corn: metalaxyl, prothioconazole, fluoxastrobin, clothianidin, Bacillus firmus I-1582. ELITE plus Poncho®/VOTIVO® Offering for corn: metalaxyl, ethaboxam, clothianidin, and Bacillus firmus I-1582; prothioconazole and fluoxastrobin at rates that suppress additional diseases. BASIC Offering for corn: metalaxyl, prothioconazole, fluoxastrobin, ethaboxam, and clothianidin. ELITE Offering for corn: metalaxyl, ethaboxam, and clothianidin; and prothioconazole and fluoxastrobin at rates that suppress additional diseases. BioRise® Corn Offering is the on-seed application of BioRise® 360 ST. BioRise® Corn Offering is included seamlessly across offerings on all class of 2017 and newer products.

FOR SOYBEANS, EACH ACCELERON® SEED APPLIED SOLUTIONS OFFERING is a combination of separate individually registered products containing the active ingredients: BASIC Offering: metalaxyl, flupyroxad, and pyraclostrobin. STANDARD Offering: metalaxyl, flupyroxad, pyraclostrobin, and imidacloprid.

The distribution, sale, or use of an unregistered pesticide is a violation of federal and/or state law and is strictly prohibited. Not all products are approved in all states.

BioRise® Corn Offering is the on-seed application of BioRise® 360 ST.

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


IMPORTANT IRM INFORMATION: RIB Complete® corn blend products do not require the planting of a structured refuge except in the Cotton-Growing Area where corn earworm is a significant pest. See the IRM/Grower Guide for additional information. Always read and follow IRM requirements.

Performance may vary, from location to location and from year to year, as local growing, soil and weather conditions may vary. Growers should evaluate data from multiple locations and years whenever possible and should consider the impacts of these conditions on the grower’s fields.

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

Contact your Bayer retailer, refer to the Bayer Technology Use Guide, or call the technical support line at 1-844-RRXTEND for recommended Roundup Ready® Xtend Crop System weed control programs.

Balance® Flexx, Corvus® and XtendiMax® are restricted use pesticides. Not all products are registered for use in all states and may be subject to use restrictions. The distribution, sale, or use of an unregistered pesticide is a violation of federal and/or state law and is strictly prohibited. Check with your local dealer or representative for the product registration status in your state. Services and products offered by Climate LLC are subject to the customer agreeing to our Terms of Service. Our services provide estimates or recommendations based on models. These do not guarantee results. Agronomists, commodities brokers and other service professionals should be consulted before making financial, risk management and farming decisions. More information at Climate.com/legal/disclaimer. FieldView™ is a trademark of Climate LLC. Herculex® is a registered trademark of Dow AgroSciences LLC. ILeVO®, LibertyLink®, LibertyLink® and the Water Droplet Design®, Poncho®, Poncho®/Votivo® and Votivo® are trademarks of BASF Corporation. Respect the Refuge and Corn Design® and Respect the Refuge® are registered trademarks of National Corn Growers Association. Acceleron®, Balance®, Bayer, Bayer Cross, BioRise®, Corvus®, Delaro®, DiFlexx®, Luna Privilege®, Proline®, RIB Complete®, Roundup Ready 2 Technology and Design™, Roundup Ready 2 Xtend®, Roundup Ready 2 Yield®, Roundup Ready PLUS®, Roundup Ready®, SmartStax®, Trivolt™, VaporGrip®, VT Double PRO®, Warrant®, XtendFlex® and XtendiMax® are trademarks of Bayer Group. All other trademarks are the property of their respective owners. For additional product information call toll-free 1-866-99-BAYER (1-866-992-2937) or visit our website at www.BayerCropScience.us. Bayer CropScience LP, 800 North Lindbergh Boulevard, St. Louis, MO 63167. ©2022 Bayer Group. All rights reserved.



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





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