



Illinois Soybean Research Review

*Results from the 2025
Growing Season*

FieldAdvisor.org

Funded by the Illinois Soybean Checkoff



Abigail Peterson
Director of Agronomy, Illinois Soybean Association

ADVANCING ILLINOIS SOYBEAN PRODUCTION TOGETHER

The Illinois Soybean Association (ISA) Soybean Production Team is proud to present research results from the 2025 growing season. This booklet reflects our mission to advance cross-functional agronomic research and education that creates opportunities for Illinois soybean farmers to increase on-farm profitability and manage crop production risks. Guided by our farmer board and informed by statewide needs, this review highlights research conducted across diverse soil types and growing environments throughout Illinois. The teams behind these projects focused on some of the most prevalent soybean production challenges, delivering science-based insights that bring value back to farmers and help grow a stronger future for Illinois agriculture. We invite you to explore these findings and consider how they can support continued progress, resilience and success on your farm.

Most of all, we extend our heartfelt thanks to the farmers, researchers, Certified Crop Advisers and students whose dedication, collaboration and curiosity help bring this research to life.

TABLE OF CONTENTS

2	WELCOME
3	TABLE OF CONTENTS
4	QUANTIFYING CONSERVATION BENEFITS FOR ILLINOIS SOYBEAN FARMERS
6	VALIDATING MRTN RECOMMENDATIONS TO REDUCE TILE NITRATE LOSS IN CONVENTIONAL AND COVER CROPPING SYSTEMS
8	BENCHMARKING AND INTEGRATING SOIL HEALTH, WATER QUALITY AND CLIMATE-SMART FOOTPRINTS OF ILLINOIS SOYBEANS
10	EVALUATION OF A TARGETED CONSERVATION PLAN IN THE LAKE BLOOMINGTON WATERSHED
12	EVALUATING LEAF NUTRIENT TISSUE TESTING AND RELATION TO SOYBEAN GRAIN YIELD
14	ASSESSING THE IMPACT OF COVER CROPS ON SCN POPULATIONS IN FIELD CONDITIONS
17	SOYBEAN STEM PESTS: SURVEY, IMPACT, AND EDUCATION
19	RED CROWN ROT ROUNDUP: 2025 RESEARCH FINDINGS
22	DOCUMENTING THE EXTENT OF RESISTANCE TO GROUP 15 HERBICIDES IN ILLINOIS WATERHEMP POPULATIONS
24	INJURY POTENTIAL TO VERY EARLY PLANTED SOYBEANS FROM VARIOUS SOIL-RESIDUAL HERBICIDES AND ACTIVE INGREDIENTS
26	GENETIC ENGINEERING METHODS FOR SOYBEAN CYST NEMATODE CONTROL
29	UNDERSTANDING THE IMPORTANCE OF COVER CROP PLANTING DATES IN ILLINOIS ROW CROP PRODUCTION
33	UNIVERSITY OF ILLINOIS CROP SCIENCE VARIETY TRIALS-SOYBEAN PROTEIN AND OIL
34	FIRST STEP TOWARD LIMING RECOMMENDATIONS IN ILLINOIS
36	DIVERSIFYING GENETIC RESISTANCE TO SOYBEAN CYST NEMATODE
38	EVALUATION AND COMMERCIALIZATION OF SOYLEIC® VARIETIES IN ILLINOIS
40	SULFUR FERTILIZATION IN SOYBEANS
41	SOYBEAN TISSUE SAMPLING IN SULFUR FERTILIZATION TRIALS
43	ADAPTIVE MANAGEMENT FOR MAXIMIZING SOYBEAN PRODUCTION FOLLOWING CEREAL RYE TERMINATION
45	INTEGRATED MANAGEMENT STRATEGIES FOR MAXIMIZING SOYBEAN PRODUCTION IN CONSERVATION TILLAGE SYSTEMS
47	ENHANCING THE PROFITABILITY OF WHEAT-SOYBEAN DOUBLE CROPPING
49	FREE SCN TESTING FOR ILLINOIS SOYBEAN GROWERS
51	IMPROVING EFFICACY AND SUSTAINABILITY OF GLUFOSINATE FOR WATERHEMP MANAGEMENT
53	ASSESSING INSECT PEST EFFECTS ON YIELD AND ROI OF PEST CONTROL INPUTS
55	ACKNOWLEDGEMENTS

PROJECT NAME

QUANTIFYING CONSERVATION Benefits

FOR ILLINOIS SOYBEAN FARMERS

PROJECT LEADERS

Kaiyu Guan, University of Illinois;
Ziyi Li, University of Illinois



PROJECT LENGTH
2 years (2023 - 2025)

BUDGET
\$296,131

YEAR 2 RESULTS PURPOSE

Conservation benefits vary widely by location, but most information available to farmers is based on regional averages or limited experimental sites. This creates uncertainty when considering management changes, particularly as conservation incentives, sustainability metrics and ecosystem service markets continue to emerge. This research aimed to bridge the gap between field trials and practical farm decision-making. By combining soil, weather and crop data with modeling tools, this project provided Illinois growers with location-specific estimates of crop performance, greenhouse gas emissions, soil carbon outcomes and nitrogen losses. This information can help farmers make more informed conservation and management decisions and prepare for participation in emerging carbon and ecosystem service markets.

APPROACH

This project used remote sensing, field measurements and modeling to estimate conservation outcomes at field scale. Researchers combined soil, weather and crop data with algorithms and modeling tools to evaluate how different practices perform under practical farm conditions.

The model looked at past conditions from 2017 to 2021 and tested scenarios such as adding cover crops, adopting no-till, reducing nitrogen rates by 10% and improving application timing, as well as combining practices. Results included impacts on yield, soil carbon and greenhouse gas emissions, allowing for field-specific comparisons across management options.

Model results were validated using data from seven long-term corn and soybean rotation trials in Illinois from 1999 to 2021, where management practices and yields were well documented.

MULTI-YEAR RESULTS SUMMARY

Soybean-corn rotations reduced nitrogen losses and lowered nitrous oxide and ammonia emissions compared with continuous corn, reflecting improved nitrogen balance and less surplus inorganic nitrogen after harvest. Farmers considering a switch away from continuous corn should prioritize acres prone to nitrogen loss, such as tile-drained or seasonally wet fields, to reduce leaching and gaseous emissions.

Soybean-corn rotations also slowed soil organic carbon buildup or led to slight declines compared with continuous corn at standard nitrogen rates, likely due to faster decomposition of soybean residue. Pairing rotations with carbon-supporting practices such as winter cover crops, reduced tillage and residue retention can help support soil carbon.



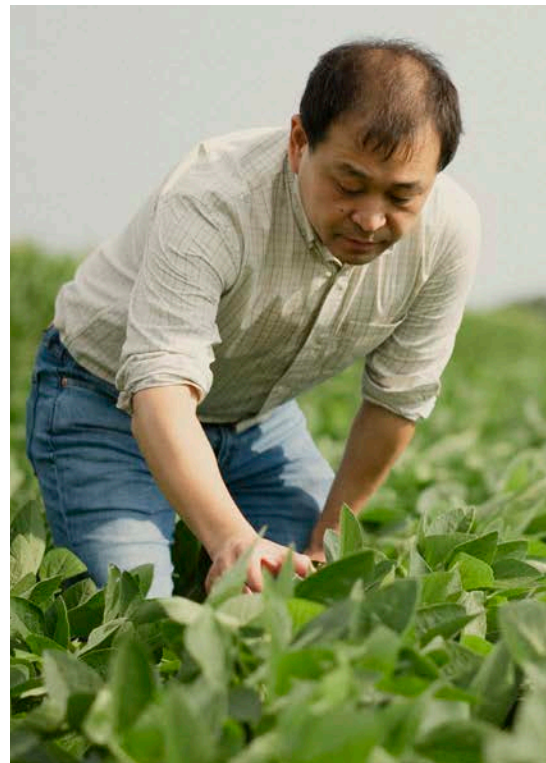


Findings from the nitrogen portion of the study showed that timing and inhibitors can matter as much as rate. Applying nitrogen closer to peak crop demand, such as spring application with early sidedress, and using a nitrification inhibitor improved nitrogen use efficiency, sustained or increased yield, and reduced nitrogen loss and emissions.

Fall nitrogen applications increased losses and reduced or destabilized yield, particularly in wetter springs, even at similar rates. These applications should be limited to situations when they are necessary and used with practices that reduce loss.

NEXT STEPS

The research team published one peer-reviewed article related to this research in the journal *Agriculture, Ecosystems & Environment* titled, "Comparing continuous-corn and soybean-corn rotation cropping systems in the U.S. central Midwest: trade-offs among crop yield, nutrient losses, and change in soil organic carbon." The team is preparing a second article focused on nitrogen management. Researchers also plan to expand this work beyond Illinois.



PROJECT NAME

VALIDATING
MRTN RECOMMENDATIONS
TO REDUCE TILE
NITRATE LOSS

IN CONVENTIONAL AND COVER CROPPING SYSTEMS

PROJECT LEADERS

Dan Schaefer, Illinois Fertilizer
and Chemical Association;
Emerson Nafziger, University of Illinois;
Lowell Gentry, University of Illinois;
Laura Gentry, Illinois Corn Growers Association



PROJECT LENGTH
2 years (2023 - 2025)

YEAR 2 REPORT
PURPOSE

Are farmers applying more nitrogen (N) than necessary? This project looked at the reliability of the Maximum Return to Nitrogen (MRTN) calculator to determine if following the MRTN recommendations could lower nitrate loss in a corn-soybean rotation without impacting yield. The research also included a cover crop component to see if nitrate losses could be further reduced without lowering yields.

BUDGET
\$158,000

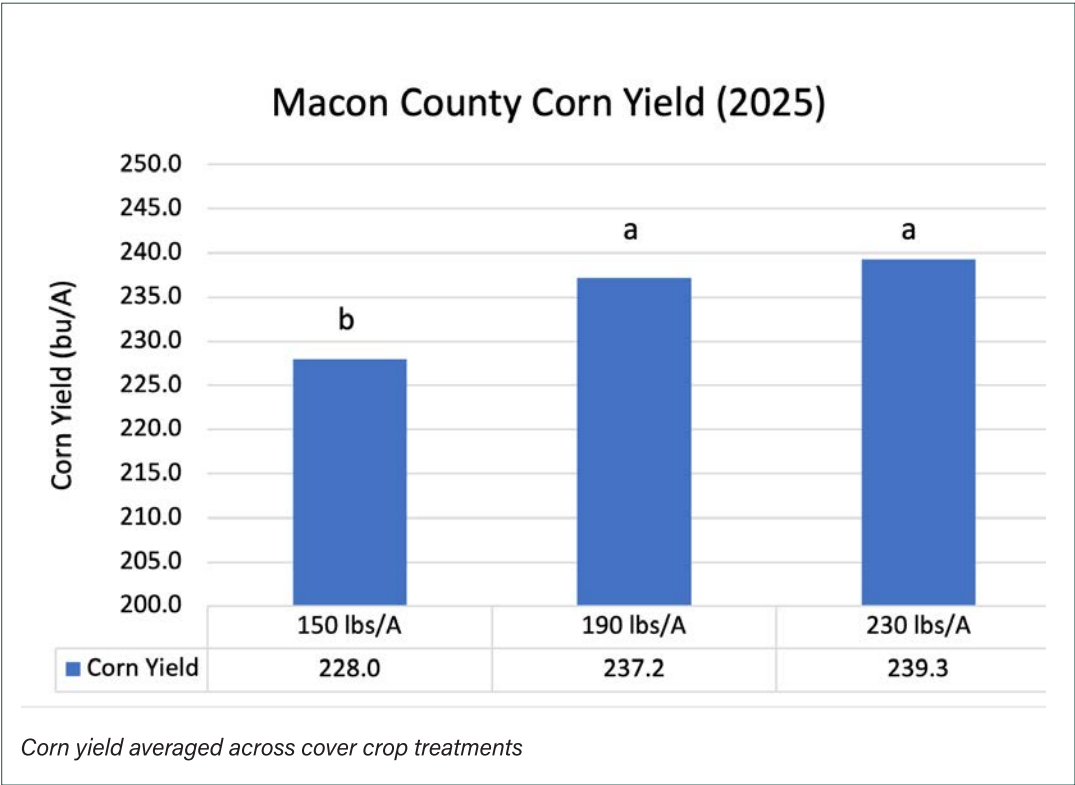
The budget amount listed is only what was contributed by the Illinois Soybean Checkoff over the two years. This project was a collaboration among Illinois Soybean Association, the Illinois Nutrient Research and Education Council and the Illinois Corn Growers Association.

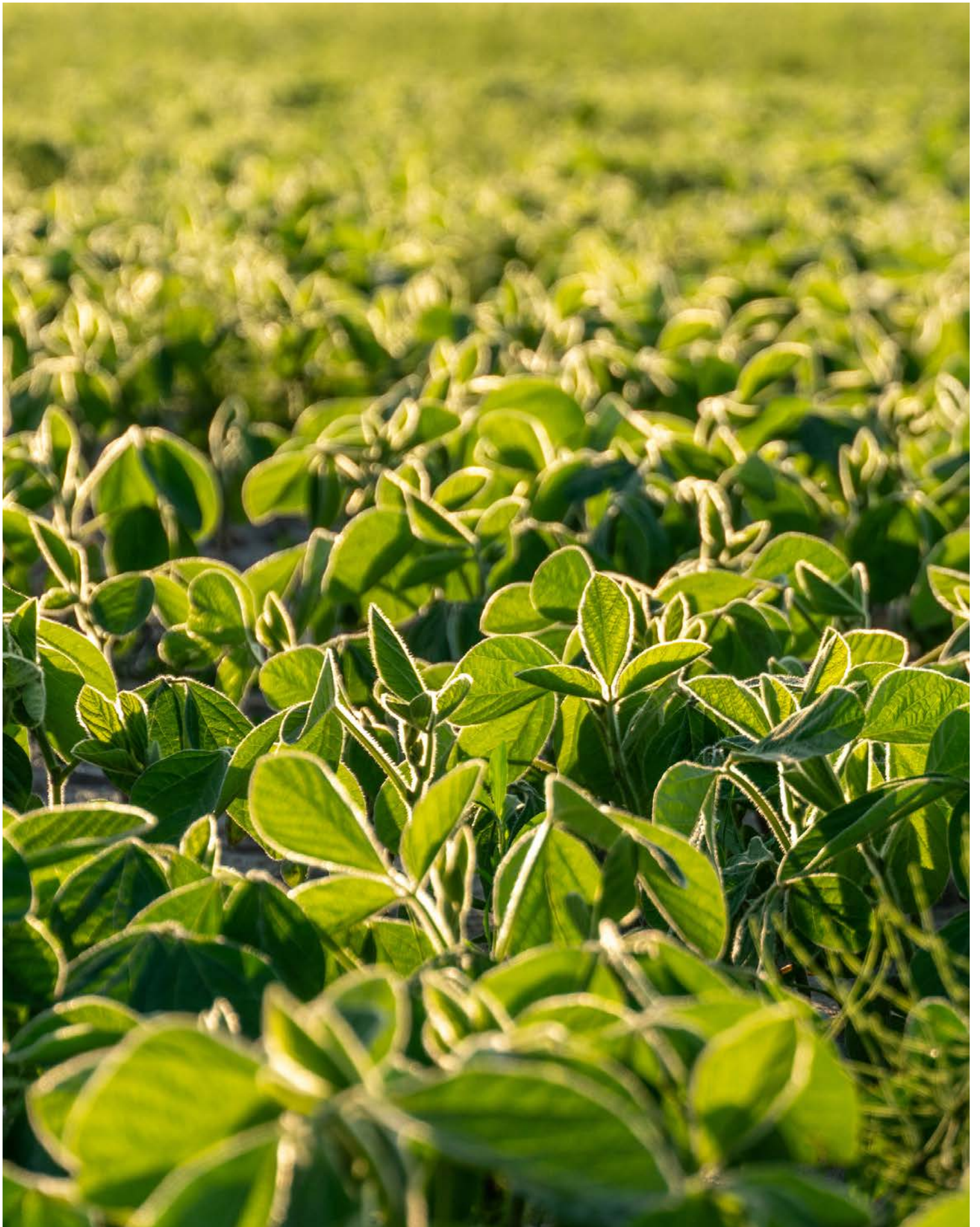
APPROACH

Both phases of a corn-soybean rotation were established in a tile-drained field in Macon County with 36 plots equipped with water quality monitoring equipment. Three N rates (150 lbs., 190 lbs., and 230 lbs.) were applied ahead of corn and replicated six times for a total of 18 plots. Half of the plots at each N rate included a winter barley cover crop planted ahead of the corn following soybean harvest. No fertilizer N was applied to the field during the soybean phase. Half of the 18 plots under soybean included a cereal rye cover crop planted following corn harvest. Tile water was collected regularly to monitor nitrate losses from all plots.

RESULTS

In 2025, minimal N loss (1-3 lbs./A) occurred across treatments due to dry weather conditions. As demonstrated in 2023 and 2024, the extra 40 lbs./A of fertilizer N did not pay for itself in increased corn yields. Corn yields were not affected by the presence or history of cover crops. Average across cover crop treatments in 2025, corn yields for N treatments (150N, 190N, and 230N), were 228, 237 and 239 bu/A. Soybean yields (92 bu/A field average) were excellent and unaffected by N treatment to corn or the presence of cereal rye. With minimal tile flow following fertilizer N application in the spring, N treatment differences were muted in this dry year.





PROJECT NAME

BENCHMARKING and Integrating Soil Health, Water Quality and Climate-Smart Footprints OF ILLINOIS SOYBEANS

PROJECT LEADER

Andrew Margenot,
University of Illinois



PROJECT LENGTH
3 years (2022 - 2025)

BUDGET
\$594,566

YEAR 3 RESULTS PURPOSE

Interest in sustainable crop production continues to grow, driven by private sector carbon markets, demand for low-carbon or climate intensity (CI) soybeans and corn, and government efforts to encourage implementation of regenerative agriculture. At the same time, farmers are facing increasing pressure to improve water quality but need to maintain profitability in an increasingly unfavorable economic climate. Practices like cover crops and conservation tillage address multiple goals, including soil health, water quality and carbon management, but present trade-offs. Navigating these trade-offs can benefit from quality, field-scale data of multiple pros and cons embedded in management decisions.

This project provides field-based data on sustainability benchmarks for soybean production in Illinois. It evaluates how soil health management practices affect soil health, water quality and greenhouse gas (GHG) emissions across regions and crop rotations.

The goal is to develop Illinois-specific benchmarks for soybean systems, including corn-soybean and corn-wheat/soybean rotations. These benchmarks will help farmers make more informed management decisions while supporting environmental stewardship and long-term profitability.

APPROACH

Researchers are evaluating the impact of cover crops and tillage (no-till vs. conventional) at three Illinois locations: southern Illinois (Ewing), central Illinois (Urbana) and northwestern Illinois (Monmouth). At the northwestern site, the rotation is a conventional corn-soybean rotation. At the southern and central sites, the rotations also include a double-crop wheat-soybean-corn rotation. Each phase is present each year for each treatment (e.g., the corn and the soybean of the rotation) so that weather effects can be separated out.

Soil health is monitored through several biological, chemical and physical measurements, meaning that the project will enable identification of which indicators are most versus least sensitive to short-term (two- to four-year) changes in practices. Water quality is assessed by measuring nitrogen and phosphorus leaching. Greenhouse gas emissions (carbon dioxide, nitrous oxide and methane) are measured regularly throughout the year, so long as soils are not frozen.

Yield data is also collected to evaluate how these practices affect productivity, and thus profitability.

RESULTS

Results from the 2025 growing season (year three) were still being analyzed at the writing of this report.

Preliminary findings from the first two years show that soil type, especially organic matter levels, plays a major role in determining which practices provide the greatest benefit.

Soil respiration (also referred to as CO₂ burst or C mineralization) has been the most responsive soil health indicator across sites, particularly in detecting crop rotation, but was not necessarily sensitive to tillage or cover cropping practices after a full two-year rotation. In other words, rotation type matters more than tillage or cover cropping for the assessed soil health indicators and two years in. This may, and is likely to, change over the coming years of continued practices. Double-crop wheat-soybean systems increased soil respiration, suggesting potential soil health benefits, especially in southern Illinois where the system can also be profitable.

After two years, no consistent differences in greenhouse gas emissions or carbon credit potential were observed among conservation practices, in part due to high variability. This provides a basis for caution when navigating claims on C credits.

Research technician Grecia Romero collects a soil sample during Fall 2025 at field site in southern Illinois.



Results also highlight the need for caution when interpreting soil health tests. Test results do not consistently reflect management practices such as tillage or cover crops. Soil respiration was the only indicator that showed a consistent response, particularly in double-crop systems. Given the relatively high cost of soil health tests, saving testing dollars for long-term (at least more than two years) practice adoption may be merited.

Wheat appears to provide soil health benefits despite lower residue levels, likely due to root activity that remains in the soil after harvest, similar to a cover crop.

NEXT STEPS

This project is currently in its fourth year of funding from the Illinois Soybean Checkoff program, with additional funding from other sources. Researchers plan to use soil aggregate stability data to help develop a smartphone app that estimates soil structure from simple field tests. Data from more than 600 soil samples collected across the three sites will be used to train and validate the tool for Illinois-specific conditions. The research team is also using soil aggregate data from 200 plots/year for the timber soils and prairie soils covered by the three sites to calibrate the smartphone SLAKES app used to assess soil aggregate stability. The intent is to see how well this free app can be used by Illinois farmers to estimate aggregate stability on their fields, and if calibration to Illinois soil types can improve accuracy.

Two peer-reviewed articles are in preparation, with three additional publications expected before the project concludes.

Research technician Grecia prepares to sample greenhouse gases (carbon dioxide, methane, ammonia and nitrous oxide) emitted from soils at one of three field experiment sites assessing tillage and cover cropping practices on climate intensity of soybean production.



PROJECT NAME

EVALUATION OF A TARGETED Conservation Plan

IN THE LAKE BLOOMINGTON WATERSHED

PROJECT LEADERS

Shalamar Armstrong,
Purdue University;
Rabin Bhattarai, University of Illinois;
Jackie Kraft, McLean County Soil and
Water Conservation District; **Ross Fogle,**
USDA Natural Resources Conservation Service;
Joseph Darter, City of Bloomington;
Michael Ruffatti, Purdue University



PROJECT LENGTH

1 Year (2024 - 2025)

BUDGET

\$137,750

(Contributed by the Illinois
Soybean Checkoff program. The
City of Bloomington contributed
additional funds to this project.)

YEAR 1 RESULTS

PURPOSE

Nitrogen (N) loss from the Upper Mississippi River Basin (UMRB) contributes to the hypoxic zone in the Gulf of Mexico, making it an ongoing environmental concern for row crop agriculture. While small-plot research shows cover crops can reduce N loss, adoption at the watershed scale remains a challenge.

This project evaluates whether targeting conservation practices, such as cover crops and reduced tillage, on high-risk fields within the Lake Bloomington watershed can improve overall water quality.

Rather than measuring average impact across the watershed, the team uses Nutrient Loss Risk Analysis (NLRA) to identify “hotspots” most vulnerable to nutrient loss through surface and subsurface drainage. These areas are then prioritized for conservation practice adoption.

APPROACH

This research takes place in the agricultural and tile drained dominated Lake Bloomington watershed in central Illinois, where cropping systems make a major contribution to nutrient loss. The watershed is 43,100 acres in size.

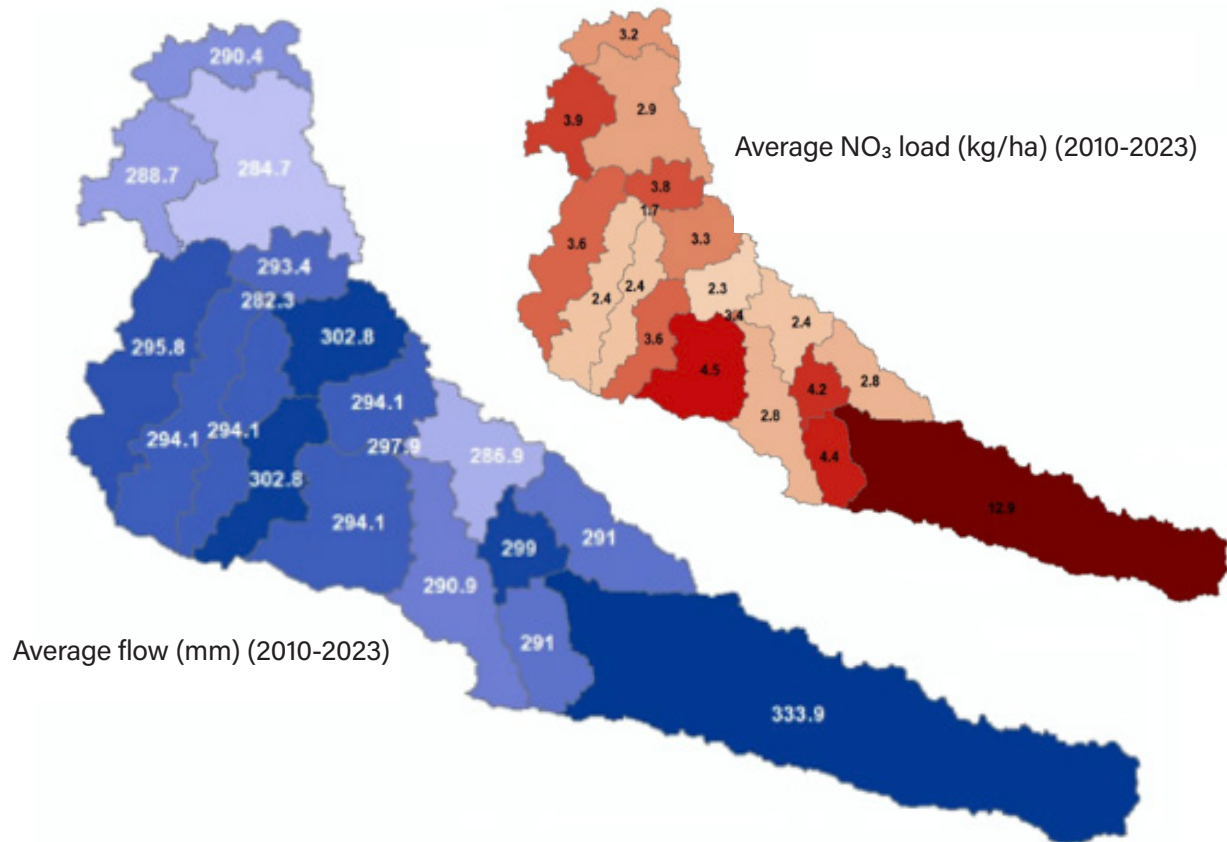
From 2010 to 2023, researchers collected weekly water samples from Money Creek, the main tributary to Lake Bloomington, analyzing nitrate, ammonia, total phosphorus and several other factors. Precipitation and stream discharge were also estimated during this period. This data was used in the Soil and Water Assessment Tool (SWAT) model to conduct NLRA. The model divided the Lake Bloomington watershed into subwatersheds and identified areas most susceptible to nitrate loss.

In spring 2025, continuous water quality monitoring equipment was installed in Money Creek to better measure data over time. The team also hosted a “Farm to Filtration” watershed tour in McLean County to demonstrate how tile drainage and cover crops play a role in nutrient runoff management and water quality. Following these efforts, the team worked directly with farmers in the identified subwatershed to ask them if they would participate in adopting cover crops or reduced tillage. Farmers received \$65/ac for adopting cover crops and \$30/ac for adopting reduced tillage.

RESULTS

Data from 2010 to 2023 showed no significant change in precipitation or total stream flow (surface and subsurface). However, nitrate concentrations in stream water trended downward over time. Average nitrate concentration during the 13-year period was 6.6 mg/L, with a range of 0-36 mg/L.

Based on where a farm is in the stream network and the inherent soil properties, certain farms have the capacity to discharge more or less water and nitrate to the watershed outlet. NLRA results showed that fields near headwaters have greater potential for water loss and nitrate loss. Approximately 17% of the watershed (7,676 acres) was identified as higher risk, having the potential to deliver significantly more discharge and nitrate to the basin outlet relative to the other portions of the watershed, totaling 43,100 acres. A total of 4,918 acres were classified as highly susceptible to nitrate loss and are considered hotspots.



Above: Maps of the discharge and nitrate hotspots within the Lake Bloomington watershed in central Illinois. The darker color indicates greater potential to be a hotspot.

Farmers adopted conservation practices on 10% of these hotspot acres for fall 2025. An additional 115 acres of reduced tillage were implemented, all of which also included cover crops. In total, 16% of the highest-risk acres received targeted conservation practices across six farms.

NEXT STEPS

This project was renewed for 2025-2026 funding from the Illinois Soybean Checkoff program, currently in its second year. The team is continuing to monitor instream water quality data to determine the impact of the targeted conservation on the ground in the Lake Bloomington watershed. Farmer recruitment for conservation practice adoption will take place in fall of 2026.

PROJECT NAME

EVALUATING Leaf Nutrient Tissue Testing

AND RELATION TO SOYBEAN GRAIN YIELD

PROJECT LEADERS

Connor Sible,
University of Illinois;
Fred Below, University of Illinois;
Eric Morsink, University of Illinois



PROJECT LENGTH
2 Years (2023 - 2025)

BUDGET
\$131,806

YEAR 2 RESULTS
PURPOSE

Soybean and corn farmers often focus their attention on crop nutrient requirements to ensure the crop always has what it needs to achieve a desired yield level. Tissue sampling is a common approach to see how the crop is progressing and if nutrients are sufficient or deficient. The lab then analyzes these tissues for nutrient concentrations and provides recommendations if the status of the leaf is below, at or above desired thresholds. Standard guidance recommends sampling the “most recently mature trifoliate,” but this definition varies among labs and agronomists.

This research aims to better define the most recently mature trifoliate and evaluate whether it is the best approach for in-season nutrient management. The study also examines whether alternative tissue sampling methods across the soybean canopy and throughout the growing season provide a more accurate assessment of nutrient status. Improved sampling methods could lead to more informed nutrient decisions and potentially higher yields.

APPROACH

Each year, a small-plot trial has been conducted at the University of Illinois Crop Sciences and Research Education Center on campus, planted to soybeans with no fertilizer (soil supply) or with a base rate of fertilizer (to ensure sufficiency). Sampling began at the V7 soybean growth stage, collecting the top two trifoliates, consistent with current recommendations. Sampling then continued every two growth stages (V7, V9, V11 through V21).

In addition to standard sampling, researchers collected trifoliates from lower canopy positions at each stage. For example, at V13, samples included both the top nodes (12 and 13) and lower nodes (10 and 11; 8 and 9; 6 and 7). This allowed comparisons between traditional sampling and alternative canopy positions.

The study also compared plots with and without fertilizer to evaluate nutrient uptake. In year two, fertilizer was labeled with isotopes to track whether nutrients were absorbed from fertilizer or soil and how they moved within the canopy.

RESULTS

Despite drier conditions in 2025 compared to 2024, yields remained high. Unfertilized plots averaged 87 bushels per acre, while fertilized plots averaged 91 bushels per acre. These results were comparable to the first year, strengthening the dataset.

Data from both years shows that trifoliates continue accumulating biomass as new nodes develop (Table 1), challenging the notion that a fully expanded trifoliate represents the “most recently mature.”

2024 and 2025 data similarly show the trifoliates of the lower nodes are maturing more quickly than those of

Nodes Collected	Vegetative (Reproductive) Stage Collected								Nodes Average
	V7 (R1)	V9 (R2)	V11 (R2)	V13 (R2)	V15 (R2)	V17 (R3)	V19 (R4)	V21 (R6)	
	pounds per acre								
20 & 21	-	-	-	-	-	-	-	292	298
18 & 19	-	-	-	-	-	-	365	411	388
16 & 17	-	-	-	-	-	386	474	502	454
14 & 15	-	-	-	-	455	521	575	583	533
12 & 13	-	-	-	459	558	611	648	625	580
10 & 11	-	-	520	604	596	637	669	565	599
8 & 9	-	486	632	613	578	595	-	-	580
6 & 7	385	507	494	483	428	-	-	-	459
Cumulative	385	993	1646	2157	2614	2751	2731	2978	
p-value	-	0.065	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	
LSD (Nodes)	-	23	18	23	21	23	20	66	

Table 1. Leaf biomass per acre, per set of nodes within the canopy at various growth stages throughout the season in 2025. The presented data is the average across the unfertilized and fertilized treatments and is color-coded within row to identify when a set of nodes achieved their highest biomass (green) as compared to their lowest biomass (red).



Standard tissue test sampling methodology of the most recently mature trifoliates.

the upper nodes. For example, the lower nodes peak in leaf biomass early and then start to lose their dry matter via remobilization to the developing pods. At the same time, the upper leaves continue to put on biomass through the end of the season because they are less shaded and continue to grow even into later reproductive stages, as demonstrated with the coloring in Table 1.

REGARDING TISSUE TESTING, THESE RESULTS SUGGEST TWO KEY POINTS:

1. Sampling a node lower than normal may be a more accurate representation of leaf maturity.
2. Early-season leaf development has a different pattern than late-season leaf development. Leaves sampled at different growth stages may require different

approaches, as consistently sampling the top may not be most accurate for every growth stage.

In 2024 and 2025, nutrients (N, P, K, S, Zn, B, Mn, Cu) moved out of leaves at different timings. Nitrogen tended to accumulate in the leaves for about four growth stages after node establishment before being remobilized to developing pods. In contrast, phosphorus moved more quickly, often within two growth stages, particularly in the lower canopy, with slightly delayed movement in the upper canopy. Non-mobile nutrients such as boron showed little movement from the leaves.

Results from the first two years showed that both leaf maturity and nutrient concentrations and content vary by canopy position and by nutrient. These findings suggest that a single approach, such as always sampling the “most recently mature trifoliolate,” may not be best suited for all scenarios.

As this project enters its third year, the team will integrate the grain yield by node position with nutrient concentrations to identify which leaves and timing best correlates with yield. This work aims to develop an improved tissue sampling method with current industry standards.

NEXT STEPS

This project is currently underway for its third and final year with funding from the Illinois Soybean Checkoff program. With the conclusion of year three, the researchers plan to publish these results in a scientific journal and create an Extension fact sheet with the findings and recommendation updates.

The team is seeking additional funds to work towards phase two of this research, where they will compare their updated recommendations on sampling approach to the current industry standard by sending in samples and making in-season applications based on the tissue test results of the two approaches.

Lastly, this project generated a new collaboration with Daren Mueller at Iowa State University, where Connor Sible is a collaborator on updating the soybean foliar disease portfolio, funded by the United Soybean Board. While diseases can cause leaf symptomology, nutrient imbalances can also create leaf lesions, complicating diagnosis of the problem to be biotic (disease) or abiotic (nutrient) when in the field.

PROJECT NAME

ASSESSING

the Impact of Cover Crops on SCN Populations in Field Conditions

PROJECT LEADERS

Jason Bond,
Southern Illinois University;
Ahmad Fakhoury, Southern Illinois
University; John Pike, Pike Ag, LLC



PROJECT LENGTH
3 years (2022 - 2025)

BUDGET
\$249,398

FINAL REPORT PURPOSE

Soybean cyst nematode (SCN) is the leading plant-parasitic nematode in U.S. soybean production. In Illinois, SCN is present in more than 80% of fields and in every county. It can survive in fields for years, even without soybeans. Once identified, management practices that keep populations below the damage threshold help farmers protect yield and profitability.

Much of the genetic resistance in commercial varieties comes from a single source, PI 88788. Today, more than 70% of infested Illinois fields have SCN populations that are no longer managed by PI 88788 varieties. Practices such as crop rotation and cover crops can help manage these virulent populations while also improving soil health and reducing erosion.

This research evaluated how SCN populations respond to certain cover crop species and varieties across Illinois to better understand how cover crops can be used as a tool to manage SCN.

APPROACH

The research began in fall 2022 and concluded in fall 2025, spanning three growing seasons, with cover crop trials established across Illinois. The research team used 13 established cover crop trials across Illinois in Williamson, Hamilton, St. Clair, Franklin, Pike and Warren counties. After the first season in 2022 – 23, efforts focused on locations in Franklin and St. Clair counties with consistent SCN population densities.

Soil samples were collected at cover crop establishment and termination, typically in the fall and the following spring. SCN cysts and eggs were measured using standard soil extraction and counting methods. At each location, multiple planting dates and cover crop seeding rates were used. Initial analysis showed planting and termination dates, as well as cereal rye seeding rates, had little effect on SCN counts. The remaining analysis focused on comparing cover crop treatments with no-cover treatments.

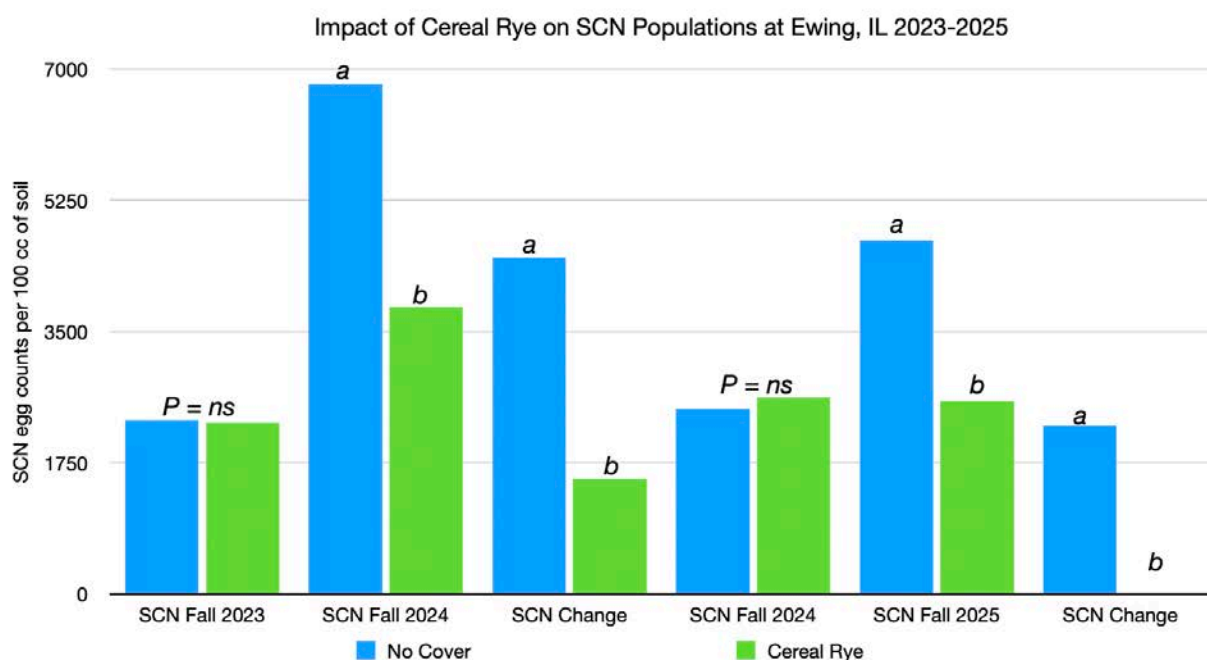
MULTI-YEAR RESULTS SUMMARY

Although SCN is widespread in Illinois, not all fields have populations high or consistent enough to measure changes over time. This was observed at several locations, where impacts on SCN populations were not measurable.

At the Ewing Demonstration Center in Franklin County, cereal rye reduced SCN populations by about 45% in the second and third growing seasons. Field plots at this location had moderate to high SCN population densities, ranging from 2,000 to 6,000 eggs per 100 cc of soil.

At the Belleville Research Center in St. Clair County, similar cereal rye trials showed no statistically significant impact on SCN across all three growing seasons. This may be partly due to lower SCN populations at Belleville compared to Ewing, ranging from 110 to 459 eggs per 100 cc of soil.





Within each interval, columns with different letters are statistically different $p < 0.05$.

$P = ns$, differences in treatments are not statically significant.

At the Henry White Farm in St. Clair County, cereal rye, annual ryegrass, crimson clover and triticale reduced SCN populations, but only during the 2024-2025 growing season.

As with any production practice or control measure, reductions in SCN populations with cover crops are not always consistent. In this research, cover crops did not always reduce SCN, but they did not increase populations.

Farmers should consider using cereal rye, annual rye grass or possibly other cover crop species in fields with moderate to high SCN populations. This practice helps protect and maximize other SCN management options, including resistant varieties, seed-applied nematicides and non-host rotation.

NEXT STEPS

This research will be published in a peer-reviewed journal. Next steps include identifying the biological and/or chemical soil properties responsible for reducing SCN populations. The team also secured funding from the USDA National Institute of Food and Agriculture (NIFA), in partnership with Michigan State University, to examine the impact of cover crop species on SCN in microplots.





PROJECT NAME

SOYBEAN Stem Pests: SURVEY, IMPACT, AND EDUCATION

PROJECT LEADERS

Ahmad Fakhoury,
Southern Illinois University;
Jason Bond, Southern Illinois University;
Nick Seiter, University of Illinois; Kelly Estes,
Illinois Natural History Survey



PROJECT LENGTH
4 years (2021 - 2025)

BUDGET
\$323,023

FINAL REPORT PURPOSE

This project addressed a key issue for Illinois soybean growers: identifying common insect pests, diseases and associated pathogens affecting soybean stems. The disease portion, led by Ahmad Fakhoury and Jason Bond at Southern Illinois University, combined grower surveys with pathogen identification from symptomatic stems to determine prevalent stem diseases, assess grower concerns and identify pathogens present in Illinois soybean fields. This information will help farmers improve scouting, variety selection and management to reduce the impact of stem diseases.

The insect portion, led by Nick Seiter and Kelly Estes at the University of Illinois, focused on *dectes* stem borer and soybean gall midge. *Dectes* stem borer is an established pest that appears to be increasing in importance in Illinois, and researchers evaluated its distribution and relationship to yield loss. Soybean gall midge is a potential invasive pest not yet found in the state; early detection would improve the state's ability to rapidly respond if it is identified.

DISEASE FOCUS AREA

APPROACH

This project combined a statewide survey of soybean producers with field sampling and molecular identification of stem-infecting fungi.

In 2022, an online survey was distributed to soybean producers, agricultural consultants and industry professionals to assess reported incidence of key stem pests and diseases, management history, perceived risks and preferences for extension services. A total of 71 responses were analyzed to summarize grower observations and concerns.

To complement the survey, symptomatic soybean stems were collected from 58 Illinois counties in 2022 and 2023 (see Figure 1). Pathogens were identified using laboratory methods. This approach combined grower input with direct identification of pathogens associated with stem diseases in Illinois. Isolated fungal pathogens were also stored for future research.

RESULTS

This study found *Diaporthe* species, particularly *Diaporthe longicolla*, *Diaporthe caulivora*, and *Diaporthe sojae*, were the most prevalent soybean stem pathogens in Illinois, present in 75% of samples, especially in warmer, wetter southern regions. Incidence increased with higher temperatures and peaked with moderate to high rainfall, aligning with their preference for warm, moist conditions during the reproductive stages R3–R6. These pathogens are associated with Phomopsis seed decay, Northern stem canker, and pod and stem blight.

Other pathogens, including *Fusarium* species, associated with root rot and stem rot, and *Macrophomina phaseolina*, associated with charcoal rot, were also present but occurred independently of *Diaporthe*, indicating no interaction. Most infections were single, but severity increased with multiple biotic stresses, such as stem borer damage alongside *Diaporthe*.

Under favorable conditions, fungicides provided limited protection from *Diaporthe* species in some fields. Management practices, including prior crop rotations and cover crops like cereal rye, did not eliminate risk but may help reduce disease severity.

These findings highlight the need for an integrated approach to managing *Diaporthe*-related stem diseases, including scouting, resistant varieties, optimized harvest timing and managing stem borer populations to reduce yield loss.

INSECT FOCUS AREA

APPROACH

As part of the Illinois Natural History Survey's annual statewide insect pest survey, Kelly Estes and her team surveyed Illinois soybean fields for soybean gall midge and decates stem borer adults. Each season, personnel surveyed several hundred corn and soybean fields. In 2025, this included 200 soybean fields across 45 Illinois counties.

Members of the Seiter lab focused on surveying decates stem borer larvae. From 2021 to 2023, no-till fields across the state, particularly in southern Illinois, were surveyed in the fall to identify where larvae were most prevalent as they prepared to overwinter. In summer 2025, the Ewing Demonstration Center in Franklin County and the Orr Research Station in Pike County were selected for more intensive sampling due to established populations. Instead of a single end of season sample, soybean residue was collected throughout the summer to track lifecycle development of overwintered larvae, including when pupae and adults appeared.

RESULTS

After three years and several hundred fields sampled, soybean gall midge was not found in Illinois. Farmers should continue monitoring neighboring states, but this potential invasive pest is unlikely to impact Illinois in the near term.

Adult and larval populations of decates stem borer were most prevalent in south-central Illinois, where no-till and reduced-till soybean production are common (Figure 2). Farmers in this region, including Marion, Franklin, Jefferson and Washington counties should monitor fields for larval infestation as harvest approaches. Fields with more than 30% of plants infested should be prioritized at harvest to reduce lodging, as this insect girdles stems ahead of winter.

In 2025, residue surveys showed decates stem borer adults appeared in late June and continued through early July. This information helps Illinois farmers better understand risk and timing of adult emergence. Scouting should begin in late July to August, after adults have emerged, eggs are laid and larvae begin to develop.

NEXT STEPS

From a disease perspective, researchers plan to submit two scientific articles to peer-reviewed journals. They are also pursuing additional funding to address questions resulting from this study.

From an insect perspective, a multi-state project funded by the North Central Soybean Research Program is evaluating chemical control options for decates stem borer, along with its impact on yield from stem tunneling and lodging. Stem tunneling is currently thought to have limited impact on yield.

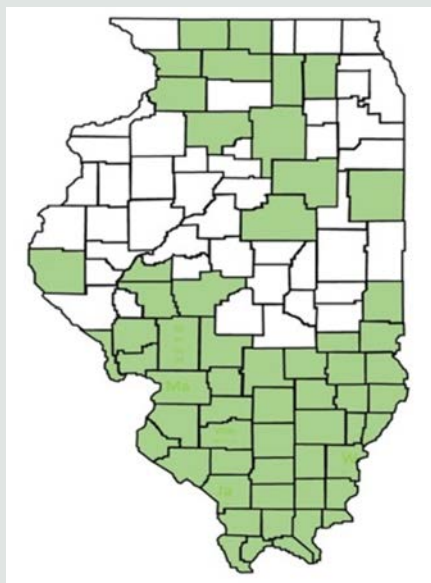


Figure 1. Samples were collected from 58 counties across Illinois during the 2022 and 2023 growing seasons.

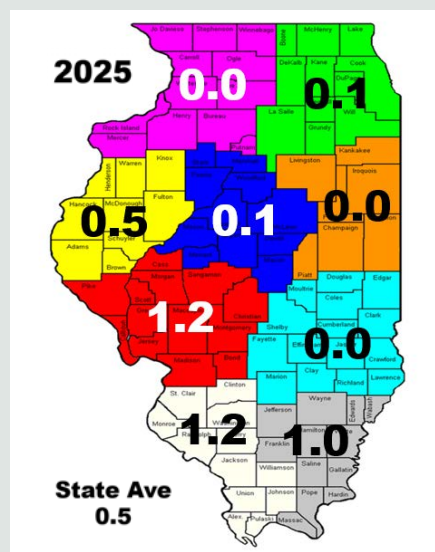


Figure 2. Average decates stem borer counts (adults per 100 sweeps) by crop reporting district.

PROJECT NAME

RED CROWN ROT Roundup: 2025 RESEARCH FINDINGS

PROJECT LEADER

Boris Camiletti,
University of Illinois



PROJECT LENGTH
1 Year (2024 - 2025)

BUDGET
\$97,796

YEAR 1 RESULTS PURPOSE

Red crown rot (RCR), caused by the fungus *Calonectria illicicola*, poses a significant threat to soybean fields across Illinois with potential yield losses of up to 50%. Despite its impact, RCR may be underestimated because its symptoms are often confused with Sudden Death Syndrome (SDS). Limited county-level assessments also create uncertainty about how widely the disease has spread and how severe it is.



APPROACH

Boris Camiletti and his team at University of Illinois studied three objectives in 2025 to help growers manage RCR. The research team used greenhouses, outdoor courtyards and growth chambers at the University of Illinois Urbana-Champaign campus, along with field trials in Pike, Madison and Macoupin Counties.

1. When are soybeans most vulnerable to RCR, how does the presence of soybean cyst nematode (SCN) change disease risk and what management tools are available that can reduce yield loss in high-pressure fields?

Researchers conducted greenhouse and outdoor courtyard experiments, inoculating plants with RCR at specific timings and SCN levels to evaluate effects on root infection and plant performance. Field trials were also established in RCR-infested plots in Pike County and three naturally-infected commercial fields to assess commercially available seed treatments (Saltro®, ILEVO® and CeraMax®) under real production conditions. Across all experiments, researchers measured disease severity, plant growth and yield data to compare disease pressure and management outcomes.

2. How can satellite and drone imagery, combined with machine learning, identify where RCR is present, how severe it is and which areas of a field are most at risk?

Researchers collected satellite and drone imagery from Illinois soybean fields with known RCR pressure and paired it with field disease measurements to train a machine learning model to detect canopy-level disease patterns. The model was then applied to commercial fields to identify disease hotspots and guide ground checks and field trial placement. As additional field data were collected, the model was refined and validated to improve accuracy and reliability.

3. Which, if any, commercially available biological products provide RCR suppression and yield protection in soybeans?

Researchers tested a range of commercial biological seed treatments in growth chamber and outdoor courtyard pot experiments. Seeds were planted in either healthy or RCR-infested soil. Researchers measured plant growth, disease severity and yield to evaluate product performance. Laboratory tests also assessed efficacy and to confirm the identity and quality of the bacteria in the commercial products.

RESULTS

OBJECTIVE 1:

Greenhouse and outdoor courtyard experiments showed early RCR infections cause the greatest yield loss in soybeans, though infections through the R1 growth stage can also significantly reduce yield. No consistent positive interaction was found between SCN and RCR, under the conditions tested, indicating SCN alone does not necessarily increase RCR severity.

Field trials showed fungicide performance varied by product and environment; however, among registered seed treatments, Saltro® consistently provided the strongest disease suppression and the best yield performance in RCR-infested fields. ILEVO® and CeraMax® showed moderate disease suppression, although product efficacies varied across locations.

Farmers should prioritize early-season protection, as early infections result in the greatest yield loss, while recognizing infections through R1 can still reduce yield. Fields with a history of RCR should be planted with proven fungicide seed treatments, with Saltro® providing the most consistent suppression and yield protection among registered products.

Because SCN was not shown to increase RCR severity in the SCN-resistant variety tested, there is currently no evidence to support an integrated management plan. However, this work was

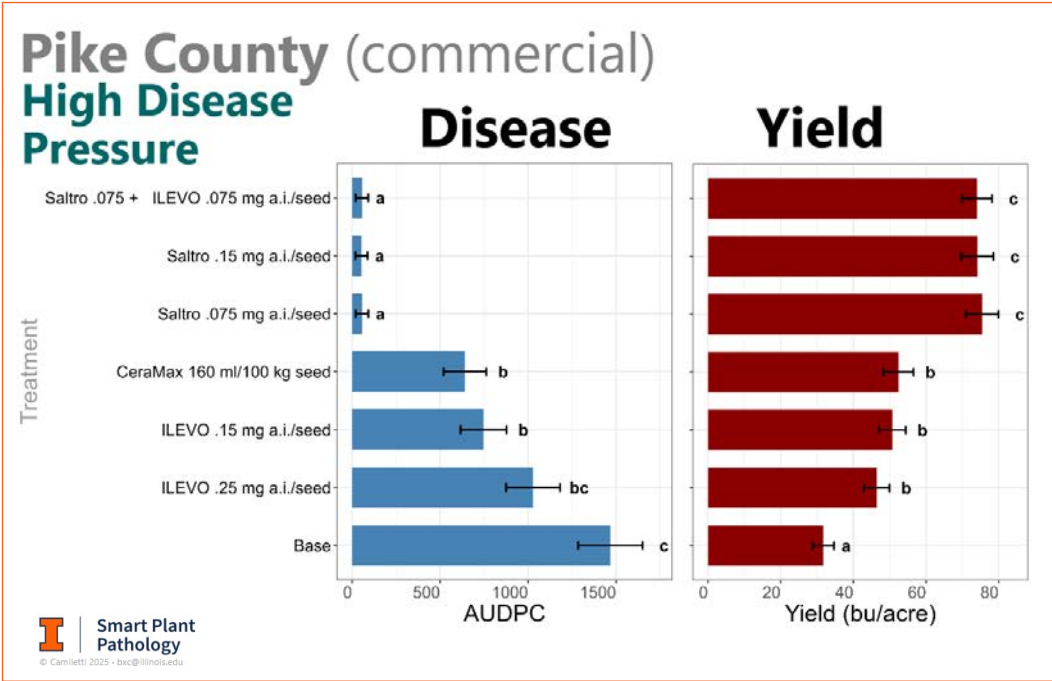
conducted using a single SCN-resistant variety, and further research across additional varieties is needed to confirm that no interaction exists between these pathogens. In the meantime, RCR risk should continue to be addressed aggressively in infected fields. This approach should be applied across entire fields with a known history of RCR, especially in high-yield or high-value acres where yield loss risk is greatest.

OBJECTIVE 2:

The model identified RCR hotspots in commercial Illinois soybean fields, enabling researchers to place field trials where disease pressure was highest. This demonstrates the technology can reliably detect disease activity without relying solely on traditional scouting.

With additional ground-truthing, the model was refined and validated, achieving about 80% accuracy in identifying disease patterns across fields. This allows farmers to use imagery-based maps as an early warning system to locate problem areas, monitor disease spread and evaluate management outcomes over time.

Farmers should consider using satellite imagery to identify RCR hotspots rather than relying solely on in-field scouting. These maps can guide targeted scouting, helping confirm disease presence early and inform decisions on fungicide treatments, seed selection or other management practices. This approach is especially valuable for medium to large operations where full-field scouting is impractical, and disease may go undetected until yield loss occurs.



Over time, repeated mapping can help identify consistent high-risk areas and support long-term management and variety decisions.

OBJECTIVE 3:

Several biological products showed partial suppression of RCR in growth chamber and greenhouse experiments; however, control was inconsistent and much lower than that of standard chemical seed treatments.

Products with potential were advanced to courtyard pot trials that more closely mimic field conditions, but no biological consistently provided reliable suppression. Combined disease ratings and seed weight data showed current commercial biological seed treatments alone are not sufficient to manage RCR.

The findings indicate biological products alone cannot reliably control RCR or replace proven chemical seed treatments. While some products showed limited activity, none consistently provided meaningful protection beyond standard fungicide seed treatments. For fields with a history of RCR, farmers should prioritize chemical seed treatments and consider biologicals only as supplements if future products demonstrate clear added value.

NEXT STEPS

Work on RCR in Illinois continues in 2026. Camiletti's team is preparing scientific articles from this research and seeking additional funding and industry partners to accelerate the development of improved RCR management tools for Illinois soybean farmers.

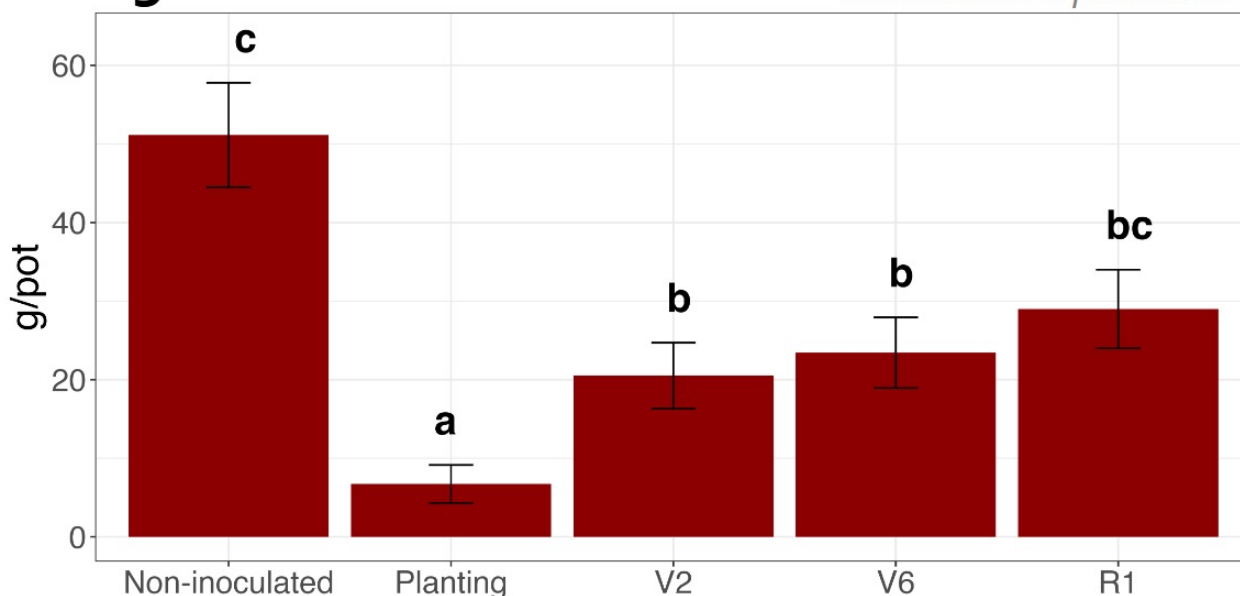
OBJECTIVE 1: Researchers are combining SCN-by-RCR interaction studies with field trials to identify products, including the recently registered seed treatment Victrato®, and application strategies that provide the most reliable control.

OBJECTIVE 2: The next phase will expand the number of fields and environments used for training to improve model reliability across soil types, varieties and growing conditions. This will help transition the tool from a research prototype to a practical system for tracking disease spread, identifying high-risk zones and guiding targeted scouting and management decisions.

OBJECTIVE 3: Researchers will evaluate whether biologicals add value when combined with proven chemical seed treatments. The Illinois Soybean Checkoff program has funded a FY26 project, now underway, to assess combinations of biological products with chemical seed treatments such as Victrato® and ILEVO® under greenhouse and field conditions.

Early Infections Resulted in the Lowest Seed Weight

Greenhouse experiments



Smart Plant
Pathology

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Preliminary Data

PROJECT NAME

DOCUMENTING the Extent of Resistance to Group 15 HERBICIDES IN ILLINOIS WATERHEMP POPULATIONS

PROJECT LEADERS

Aaron Hager, University of Illinois
Travis Wilke, University of Illinois



PROJECT LENGTH
2 years (2023 - 2025)

BUDGET
\$103,572

FINAL REPORT PURPOSE

Group 15 herbicides are important components in Illinois soybean and corn weed management programs. Additionally, the practice of “layering” a residual herbicide in soybean during the application of postemergence herbicides relies exclusively on Group 15 herbicides. Researchers in the weed science program at University of Illinois confirmed the first global occurrence of resistance to Group 15 herbicides in a broadleaf weed species. However, the extent of resistance in Illinois waterhemp populations was unknown.

This project aimed to estimate how widespread Group 15 resistance is in Illinois waterhemp populations by collecting seed from across the state and screening populations with S-metolachlor (Dual II Magnum) to generate a resistance ratio.



APPROACH

In fall 2023, researchers collected waterhemp seed from fields in approximately 84 Illinois counties, with additional samples submitted by soybean growers. Each accession (a group of waterhemp plants grown from seed collected at a single field location) was evaluated in the greenhouse using a discriminating dose of the Group 15 herbicide, S-metolachlor, a rate that controls susceptible populations but allows resistant plants to survive.

The selected rate allowed about 45% emergence in a known resistant population. Populations exceeding 45% emergence were advanced to dose-response testing to confirm resistance and calculate resistance levels.

RESULTS

Of the waterhemp populations collected for this study, 44% advanced to dose response experiments. This suggests resistance to Group 15 herbicides in Illinois waterhemp is common.

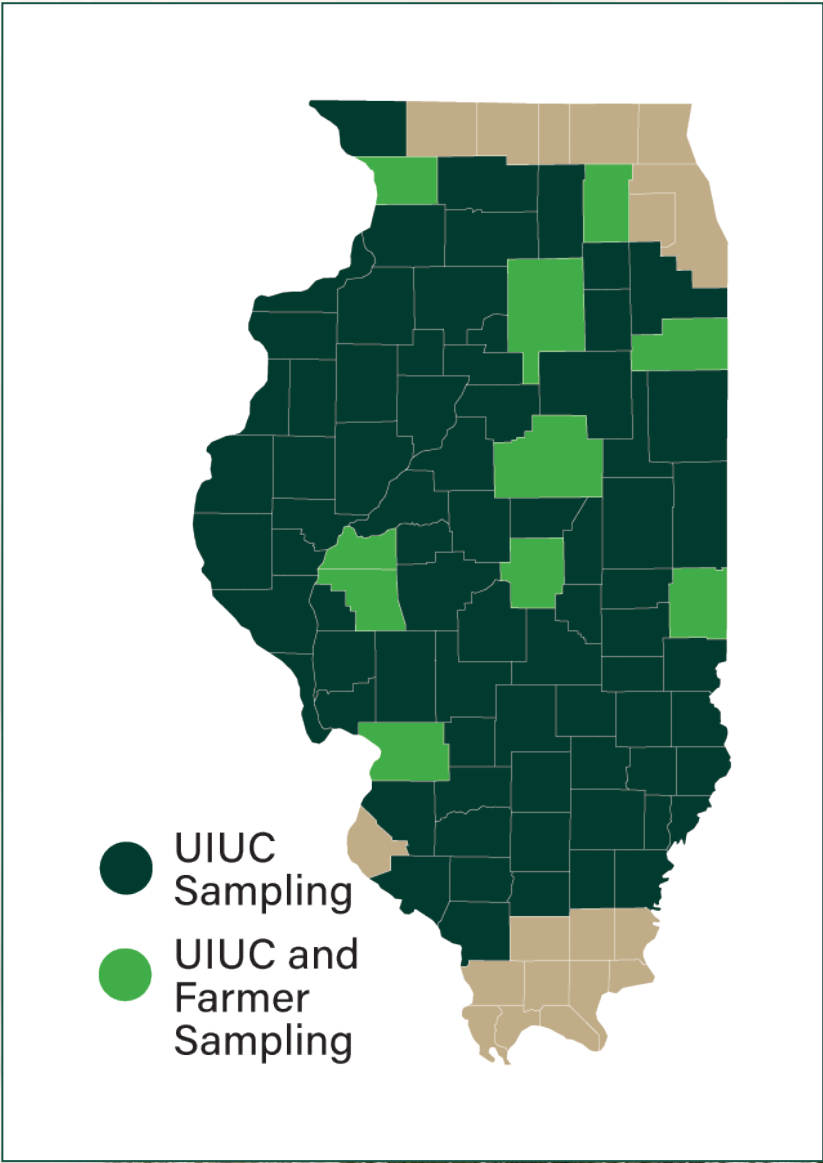
The findings from this study provided evidence that Group 15 herbicides users should closely monitor their fields so timely postemergence herbicide applications can be made while emerged waterhemp plants are small. In other words, timing a postemergence herbicide application based solely on the number of days/weeks since planting is not recommended.

Illinois farmers who implement other practices to limit waterhemp seed production stand a higher chance of remaining profitable in the future compared with those who rely only on chemical options.

NEXT STEPS

With funding from the Illinois Soybean Checkoff program, these populations have been shared with Patrick Tranel at University of Illinois who initiated molecular biology experiments to identify the gene(s) responsible for resistance to Group 15 herbicides. If these genes are identified, future research will attempt to develop rapid assays to verify resistance in submitted plant samples, similar to those Tranel developed for PPO and glyphosate resistance.

Previous research with Group 15 resistance suggested these populations also were resistant to Group 27 herbicides (HPPD inhibitors) and Group 4 herbicides (2,4-D and dicamba, for example). The research team has initiated additional greenhouse research with the populations from this project to determine if this “correlation” exists among a larger number of Group 15-resistant populations.



PROJECT NAME

Injury Potential TO VERY EARLY Planted Soybeans FROM VARIOUS SOIL-RESIDUAL HERBICIDES AND ACTIVE INGREDIENTS

PROJECT LEADERS

Aaron Hager, University of Illinois
Logan Miller, University of Illinois



PROJECT LENGTH
2 years (2023 - 2025)

BUDGET
\$26,783

YEAR 2 RESULTS PURPOSE

Soybeans planted earlier are more likely to emerge in cool, wet conditions. These conditions, along with certain preemergence (PRE) herbicides, can increase the risk of stand loss and crop injury. This project aimed to understand whether specific commercial PRE herbicides or active ingredients are more likely to injure soybeans and reduce yield. Evaluating a range of commercial PRE herbicides will help identify products or herbicide groups farmers may want to avoid when planting early. With this information, farmers can build weed control programs that protect crop safety while maintaining effective weed control.

APPROACH

Field research was conducted over two growing seasons in Champaign (2024 and 2025) and one in Perry (2025), using soybean variety 33XF3 with a base seed treatment of Acceleron® in both years. Treatments included several commercially available herbicide premixes applied at 1x labeled rates at planting. In Champaign, early planting occurred April 15, 2024, and April 12, 2025, while conventional planting took place May 19, 2024, and May 17, 2025. The Perry location had a single planting date of March 26, 2025. Sudden death syndrome (SDS)-treated (ILEVO®) and non-SDS-treated soybeans were included across all PRE treatments and planting dates. Researchers recorded soybean injury, stand counts and plant height throughout the season, along with yield. Yield data was not collected at the Perry site.

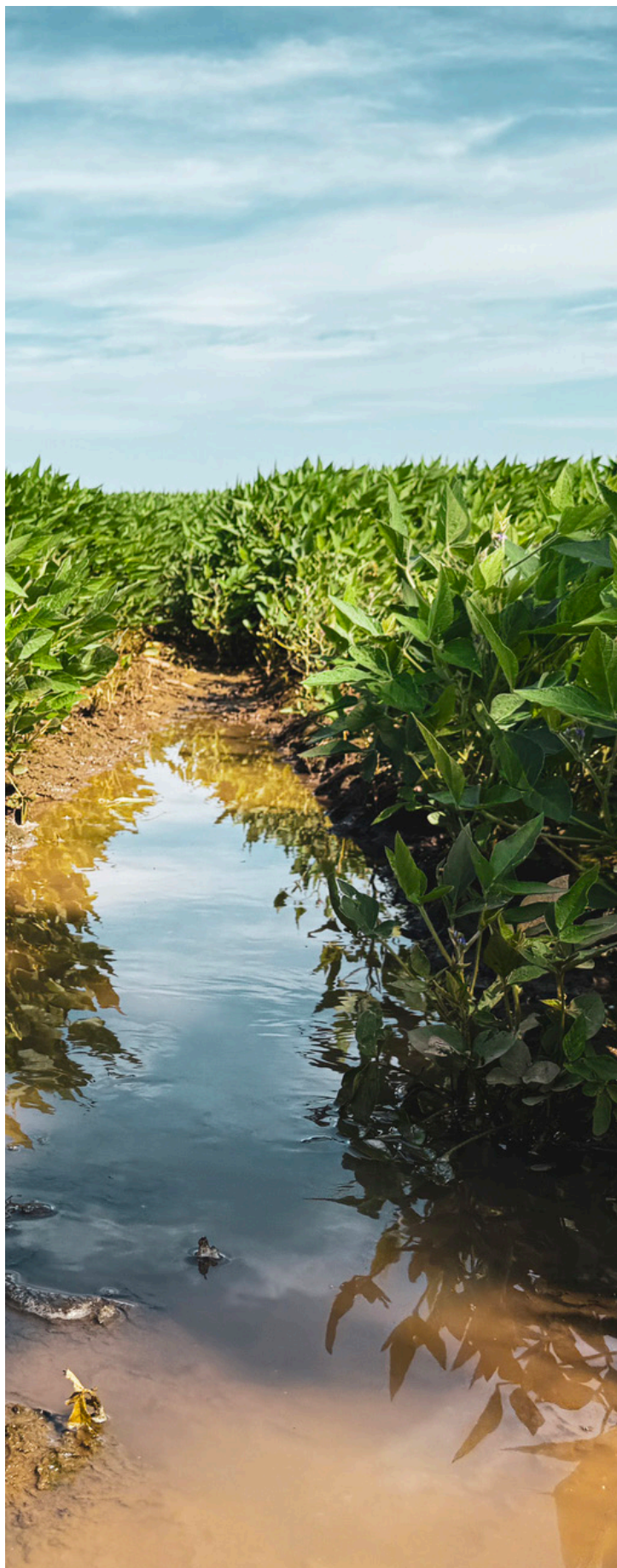
RESULTS

At Champaign in 2024 and Perry in 2025, PPO-based herbicide premixes (Authority®, Fierce®, etc.) caused the most soybean injury. However, in Champaign in 2025, PPO based products caused little to no injury.

Differences in rainfall timing and total precipitation likely drove these results. Compared with 2024, soybeans in Champaign in 2025 experienced more favorable early-season growing conditions, with no excessive rainfall. In Perry in 2025, soybeans took 26 days to emerge, compared with 13 days in Champaign. This delayed emergence reduced stands at Perry regardless of treatment, while stands in Champaign were not affected. As in 2024, PRE herbicide had no effect on soybean yield in Champaign in 2025 (Table 1). Unlike 2024, the early planting date in 2025 (April 12) did not outperform the conventional planting date (May 17).

Results for SDS-treated (ILEVO®) soybeans were mixed. In 2024, May-planted ILEVO® soybeans had an average yield reduction of 11 bu./ac, along with significant stand loss, while April-planted soybeans showed no yield difference.* In 2025, ILEVO® did not affect yield or plant





stand in May-planted soybeans. However, in April-planted soybeans, ILEVO® increased yield by 4.5 bu./ac compared with non-SDS treated soybeans.

Results from the second year reinforced a key takeaway from year one: Weather during and shortly after soybean emergence remains the most important factor influencing soybean injury and stand reduction.

Farmers can select PRE herbicides that best fit each field based on weed species, seed treatment and soil characteristics, including drainage, pH and organic matter. Because field conditions vary, choosing the right PRE herbicide for each field can help maintain effective weed control while minimizing crop response. Fields prone to standing water are particularly at risk for herbicide injury, especially with early planting. Additional factors such as soil texture, surface crusting and residue levels may also influence crop response, and differences in soil type between locations (e.g., Perry vs. Champaign) may contribute to variability in results.

NEXT STEPS

Researchers are repeating this study in 2026 in Champaign and Perry without funding from the Illinois Soybean Checkoff program.

Early Planted Soybean Response at Champaign and Perry, IL

PRE Treatment ^a	CI 7 DAE ^b	CI 14 DAE	Yield ^c
NTC	2	0	74
Authority Edge	9*	5*	75
Authority First	7*	4*	75
Authority Supreme	7*	3	83
Boundary	3	1	75
Broadaxe	6	3	74
DFF + Mauler	6	7*	81
Dual II Magnum	2	1	76
Fierce EZ	7*	4*	76
Fierce XLT	8*	5*	N/A
Kyber	7*	4*	77
Metribuzin 75 DF	2	0	N/A
Moccasin MTZ	2	1	74
Prefix	2	1	75
Preview	5	2	75
Tendovo	3	1	75
Tripzin	3	1	76
Zidua Pro	6	3	76

Figure 1.

a: Data averaged over both ILevo treatments.

b: CI = Crop Injury, DAE = Days after emergence. Significantly more crop injury than NTC indicated by * at P < 0.05.

c: Soybean yield data only from Champaign in 2024 & 2025. Fierce XLT and Metribuzin 75 DF only included at Perry.

**Note: The 2025 Annual Insights Report included results from the first year of this project. Due to a data analysis error, the reported 5-6-bu./ac yield loss should have been 11 bu./ac.*

PROJECT NAME

Genetic Engineering METHODS FOR SOYBEAN CYST Nematode CONTROL

PROJECT LEADER

Matt Hudson, University of Illinois



PROJECT LENGTH
1 Year (2024 - 2025)

BUDGET
\$75,186

YEAR 1 REPORT PURPOSE

Soybean cyst nematode (SCN; *Heterodera glycines*) remains the most economically damaging soybean pest, responsible for billions of dollars in yield losses annually. In the U.S., SCN consistently ranks as the leading cause of yield reduction, often without visible symptoms. Current management relies on crop rotation, resistant cultivars and limited chemical use. However, SCN populations are adapting to widely used resistance sources, including PI 88788 and Peking. Nematicides are costly and may provide inconsistent control.

This project aims to identify SCN genes that could be targeted to reduce population. The long-term goal is to develop more precise, durable control strategies that help protect soybean yield.



APPROACH

This research is being conducted in a laboratory at University of Illinois Urbana-Champaign. SCN progresses through several life stages, from egg to juvenile to adult. Identifying and collecting each stage can be challenging. In the first year of this project, researchers refined growth and timing to reliably collect SCN at key growth stages under varying conditions, including temperature and soybean variety in order to identify the genes that regulate the production of male and female nematodes.

The team also optimized methods to extract SCN from soybean roots, allowing for consistent recovery of feeding juveniles and adults for further study.

In addition, researchers developed new methods to analyze gene activity from individual SCN, including refining and publishing a set of genome sequences (a pangenome) for SCN, to allow them to identify genes in Illinois SCN samples. This approach provides more precise information on how the nematode develops and reproduces, which may help guide future management strategies.

RESULTS

Researchers established a reliable system to grow SCN under controlled conditions. Growth chamber conditions were optimized to support both soybean plants and SCN populations, ensuring a consistent supply of nematodes for experimental use. This foundation was essential for all subsequent work.

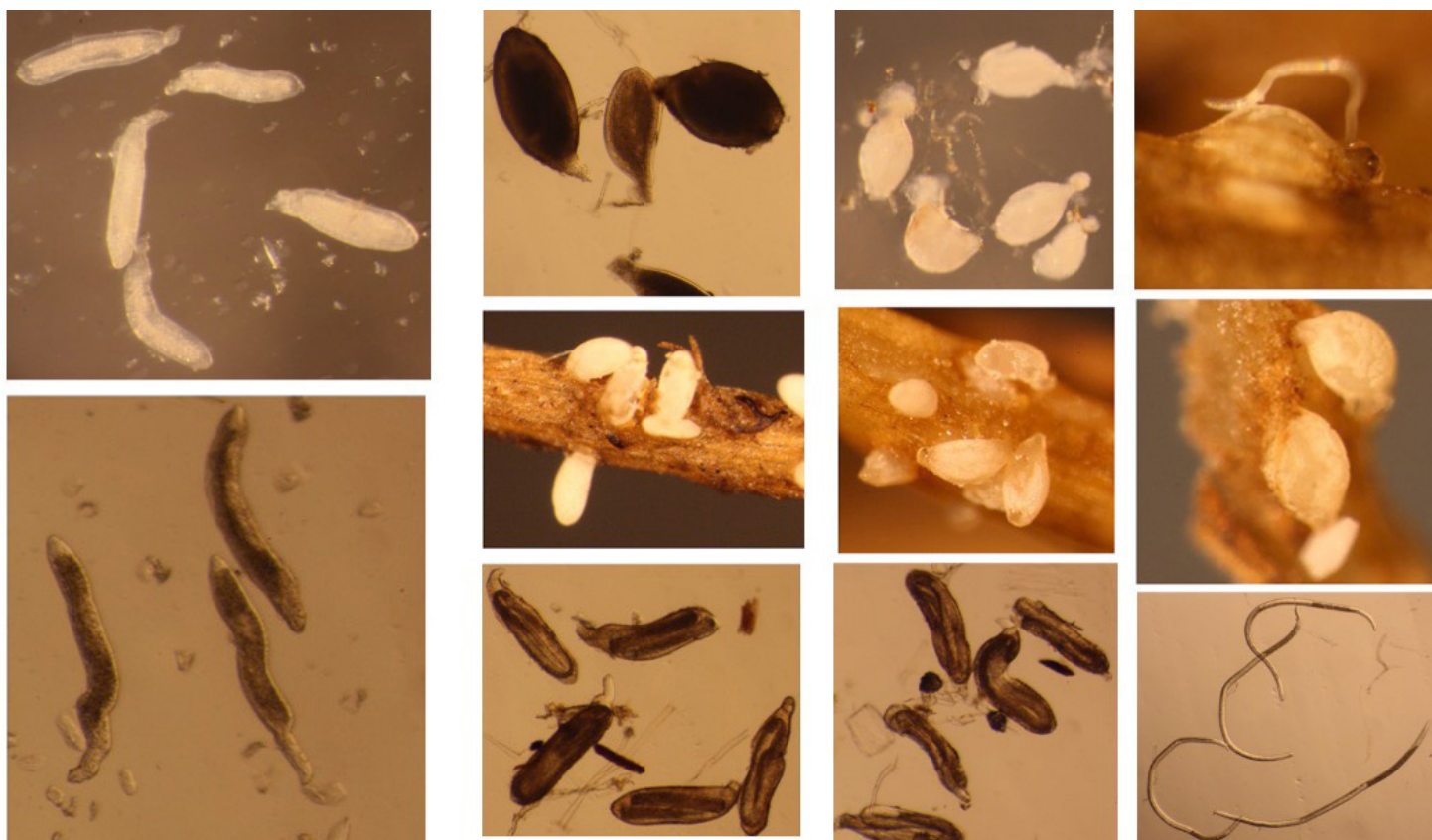
Last summer, RNA was collected from all targeted stages, including juvenile and adult males and females. RNA samples were sequenced, creating a valuable resource for SCN research. Researchers completed and published the SCN pangenome and, using this information to identify genes, completed the first single-worm RNA-seq analysis conducted across the full life cycle of a plant-parasitic nematode.

This work helps identify genes tied to SCN development and reproduction, including the first genes linked to sex determination. Over time, these findings could support new tools to reduce SCN populations, improve the durability of resistant varieties and help protect soybean yield while lowering input costs. Researchers also found genes likely involved in how SCN feeds on and interacts with soybean plants, pointing to potential targets for future control strategies.

Early trials also show that soybean variety and some crop inputs may influence the ratio of male to female SCN. Because females drive reproduction, shifting this balance could help reduce SCN populations over time.

NEXT STEPS

This project received an additional year of funding through the Illinois Soybean Checkoff program and is currently underway. The team has already published two peer-reviewed articles in scientific journals from the first year of this project.



Images of male and female nematodes isolated using new methods.

Modern Genomics Reshapes Soybean Cyst Nematode Research: Integrating Host Resistance, Nematode Virulence, and Functional Discovery

<https://doi.org/10.1094/MPMI-10-25-0150-FI>

Pangenome analysis of nine soybean cyst nematode genomes reveals hidden variation contributing to diversity and adaptation

<https://doi.org/10.1186/s12864-025-12493-x>



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publications.





*Clover planting date trial before corn
(Belleville, 2025)*

PROJECT NAME

UNDERSTANDING THE IMPORTANCE OF COVER CROP Planting Dates IN ILLINOIS ROW CROP PRODUCTION

PROJECT LEADERS

Nathan Johanning, University of Illinois Extension; Talon Becker, University of Illinois Extension



PROJECT LENGTH
3 years (2022 - 2025)

BUDGET
\$200,589

FINAL REPORT PURPOSE

One of the biggest challenges with cover crops in corn-soybean systems is timely fall planting during harvest. In addition, agronomic recommendations for many cover crop species, such as planting windows and winter survival, are not well-researched.

The project evaluated the performance of common cover crops planted before and after soybeans across multiple planting dates and seeding rates. The goal was to refine regional recommendations on planting timing, winter survival and spring stand to help farmers improve cover crop performance.

APPROACH

Illinois Extension conducted trials at five Illinois locations: Monmouth, Perry, Belleville, Ewing and Urbana (2024 only).

The two research trials focused on:

1) CEREAL RYE AHEAD OF SOYBEAN

This trial evaluated cereal rye (Hazlet) planted into corn stubble at:

- Seeding rates: 30, 60, 90 and 120 lb./A of pure live seed (PLS)
- Planting timings: early, mid and late (late September through mid-November)

Two termination timings were tested:

- Early: 2-3 weeks before planting (18-24) inches tall
- Late: at soybean planting

2) CLOVER AHEAD OF CORN

This trial evaluated:

- Balansa clover (Fixation) at 5 lb. PLS/A
- Crimson clover (AU Sunrise) at 10 lb. PLS/A

Cover crops were planted in soybean stubble at early, mid and late fall timings. Most sites terminated at planting, with some including an early termination treatment.

Limited establishment occurred at Ewing (2023) and Monmouth (2023 and 2025), so no clover data was collected at those locations.

ADDITIONAL TRIAL:

Cover crop systems for soybeans (Belleville, 2025 only)

A separate study compared multiple cover crop systems, including cereal rye, winter wheat, annual ryegrass and multi-species mixes. Data included biomass, soybean population and yield when planting green.



MULTI-YEAR RESULTS SUMMARY

CEREAL RYE BIOMASS

Planting date had the greatest impact on biomass. Earlier planting consistently produced more growth (*Figure 1*).

- 30-60 lbs./A maximized biomass for early- and mid-planting dates.
- 90 lbs./A was needed for late planting.
- Biomass roughly doubled between early and late termination.

Even late-planted cereal rye at lower rates produced meaningful biomass. Most treatments exceeded 3,500-4,500 lbs./A, a common target for weed suppression.



2023-2025 Cereal Rye Biomass at Different Seeding Rates, Planting Dates, and Termination Timings

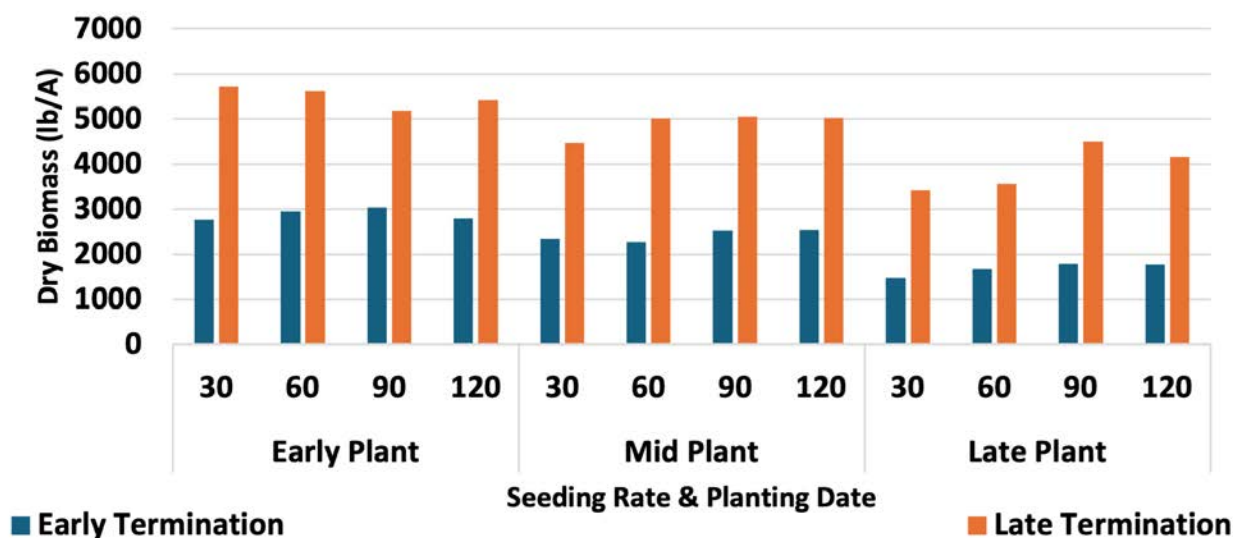


Figure 1 – 2023-2025 Cereal Rye Biomass at Different Seeding Rates, Planting Dates and Termination Timings

SOYBEAN YIELD AND POPULATION

Results varied by location (Table 1):

- No yield or population differences at Belleville, Ewing and Urbana
- Lower populations at higher cover crop seeding rates at Perry
- At Monmouth, yields decreased as cover crop seeding rates increased

Termination timing influenced yield:

- Early termination improved yields in about half of trials
- No difference in the remaining trials

Weather conditions, especially drought, played a major role. These results reinforce the need to adjust termination timing based on spring conditions. Early termination remains the best approach for farmers new to cover crops.

2023-2025 soybean yield with cereal rye seeding rates at research locations.

Seeding Rate (lb/A)	Locations				
	Belleville	Ewing	Monmouth	Orr	Urbana
	Yield (bu/A)				
0	51.9 NS*	38.1 NS*	76.6 a**	65.9 a**	61.8 NS*
30	50.3	35.9	66.4 b	60.9 b	66.4
60	51.5	36.9	61.5 c	60.7 b	66.5
90	50.6	34.9	61.2 c	63.2 ab	63.2
120	50.8	35.4	61.2 c	62.4 ab	63.8

*No significant differences between any treatments in this column.

**Numbers within this column followed by the same letter are not significantly different ($p = 0.05$).

Table 1 – 2023-2025 soybean yield with cereal rye seeding rates at research locations.



CLOVER BIOMASS

Biomass declined with later planting dates for both species.

- Balansa clover generally produced more biomass than crimson clover.
- Balansa performed better on poorly drained soils (Ewing, Belleville).
- Crimson performed better on well-drained soils (Perry).
- Both species performed adequately at Urbana.

For best results, clover should be planted before mid-to late October.

CORN YIELDS AND POPULATION

No differences were observed across species, planting dates or termination timing.



SOYBEAN COVER CROP SYSTEMS (BELLEVILLE ONLY)

Cover crop performance varied by species and mix.

- Annual ryegrass and multi-species mixes produced the most biomass (often >5,000 lbs./A).
- Rapeseed and radish did not survive 10/25/24 planting date and would require earlier planting for successful establishment.
- The four-species mix produced the highest soybean yields.

Several multi-species treatments outperformed the no-cover control.

NEXT STEPS

Future research will expand to additional cover crop species and mixtures in soybean and corn rotations. Findings from the 2025 Belleville trial are being used to refine expanded studies in 2026. This project identified the need for more work on cover crop termination timing strategies in soybeans.

Results will be published in peer-reviewed journals and shared through Illinois Extension events and in collaboration with Field Advisor.

PROJECT NAME

UNIVERSITY OF ILLINOIS CROP SCIENCE VARIETY TRIALS SOYBEAN Protein and Oil

PROJECT LEADERS

Clay Harper, University of Illinois;
Darin Joos, University of Illinois



PROJECT LENGTH
4 Years (2021 - 2025)

BUDGET
\$97,409

YEAR 4 RESULTS PURPOSE

The University of Illinois Variety Testing program has a long history of providing the Illinois agricultural community with data on corn, soybean and wheat hybrids and varieties, along with forage crops and sorghum. This invaluable source of information provides guidance to farmers deciding which hybrids and varieties to plant each season. Farmers can access this information at vt.cropsci.illinois.edu.

The Variety Testing team evaluated whether differences in protein and oil content among soybean varieties could improve the competitiveness of Illinois soybean growers in global soybean markets.

APPROACH

Protein and oil content of each soybean plot were measured in real time during harvest using a near-infrared spectroscopy (NIR) device mounted on the program's research combine as part of the plot weight collection system. This approach provides high-quality data without requiring grain samples to be collected and analyzed later in a lab, improving harvest efficiency. In 2025, soybean variety testing was conducted at eight Illinois locations: Freeport, DeKalb, Monmouth, Goodfield, Perry, Urbana, Belleville and St. Peter.

RESULTS

Results showed measurable differences in protein and oil content among soybean varieties.

Farmers can use the data available at vt.cropsci.illinois.edu to select varieties with higher protein or oil content based on their target market. This information may be especially useful for growers selling into specialty markets that prioritize specific grain attributes.

Processors also can use the data to select preferred varieties based on intended soybean use.

NEXT STEPS

The University of Illinois Variety Testing program continues to evaluate varieties each year and seeks additional entries to widen the database.

NOTE: Project durations reflect confirmed funding records beginning in FY22. This project may have received funding prior to this period.



PROJECT NAME

FIRST STEP Toward Liming RECOMMENDATIONS IN ILLINOIS

PROJECT LEADERS

Andrew Margenot, University of Illinois; Yuhei Nakayama, University of Illinois; Robert Miller, Agricultural Laboratory Proficiency Program, and Fertilizer Recommendations & Support Tool Lime Project Coordinator; Mx. Ezra Moses, University of Illinois



PROJECT LENGTH 2 years (2023 - 2025)

BUDGET \$50,333

is the total two-year project budget, funded by the Illinois Soybean Association, Illinois Corn Growers Association, Illinois Farm Bureau, Illinois Fertilizer and Chemical Association and Illinois Certified Crop Adviser.

YEAR 2 RESULTS PURPOSE

Liming recommendations in the Illinois Agronomy Handbook have not been updated in decades, and do not account for the now-common use of buffer pH to estimate the liming requirement. While most U.S. states, including neighboring Iowa, Michigan, Indiana and Ohio, base recommendations on buffer pH tests, Illinois relies on soil water pH and broad soil classifications based on organic matter (proxied by color) and cation exchange capacity. While a reasonable estimate of reserve acidity, this current approach may introduce error in estimating how much lime is needed to neutralize active (soil water pH) and reserve acidity, which is what buffer pH tests are intended to measure. Because buffer pH tests are already part of routine commercial soil testing, updating Illinois recommendations using new calibration data and buffer pH tests will help growers more accurately determine liming requirements and increase profitability.

APPROACH

Researchers reevaluated Illinois liming recommendations by:

1. Collecting and characterizing 36 soils representative of Illinois croplands across a range of soil pH values (3.8 to 6.5).
 - Measuring key soil properties, including water pH, salt pH, buffer pH, texture, organic matter and Mehlich-extractable nutrients.
 - Evaluating common buffer pH tests used in surrounding states, including: Sikora, Sikora-2, Adams-Evans and modified Mehlich methods.
2. Conducting a lab incubation study on 24 of the 36 soils with soil water pH below 6.5 to estimate lime requirement and calibrate soil pH tests.
 - Applying seven lime rates (0-6 tons/a) and measuring resulting soil water pH after an eight-day incubation – the gold standard approach for lab-based calibration of lime rate and soil pH change.
 - Using these results to calculate lime requirement to achieve a soil water pH of 6.5 and to calibrate buffer pH test to lime rate for the target soil pH desired.
3. Conducting 11 on-farm trials (7 in 2025, 4 in 2026) in central-southern Illinois to evaluate soil pH and yield response to lime rates of 0-3 tons/ac, and for additional field-scale validation of lab-based buffer pH calibration. Soil pH and yield are being tracked for two years following the lime application since lime impacts on yields may be delayed.

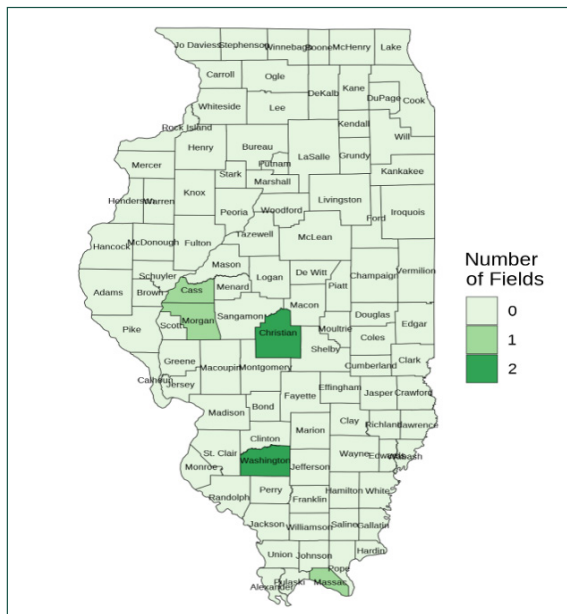


Figure 1: Ongoing On-Farm Trial Locations by Illinois County

RESULTS

Lime requirements for the 24 soils ranged from 0 to 3 tons/ac based on lab results. Buffer pH methods more accurately predicted the lime requirements than water pH. Accuracy improved further when soil properties such as organic matter and texture were included.

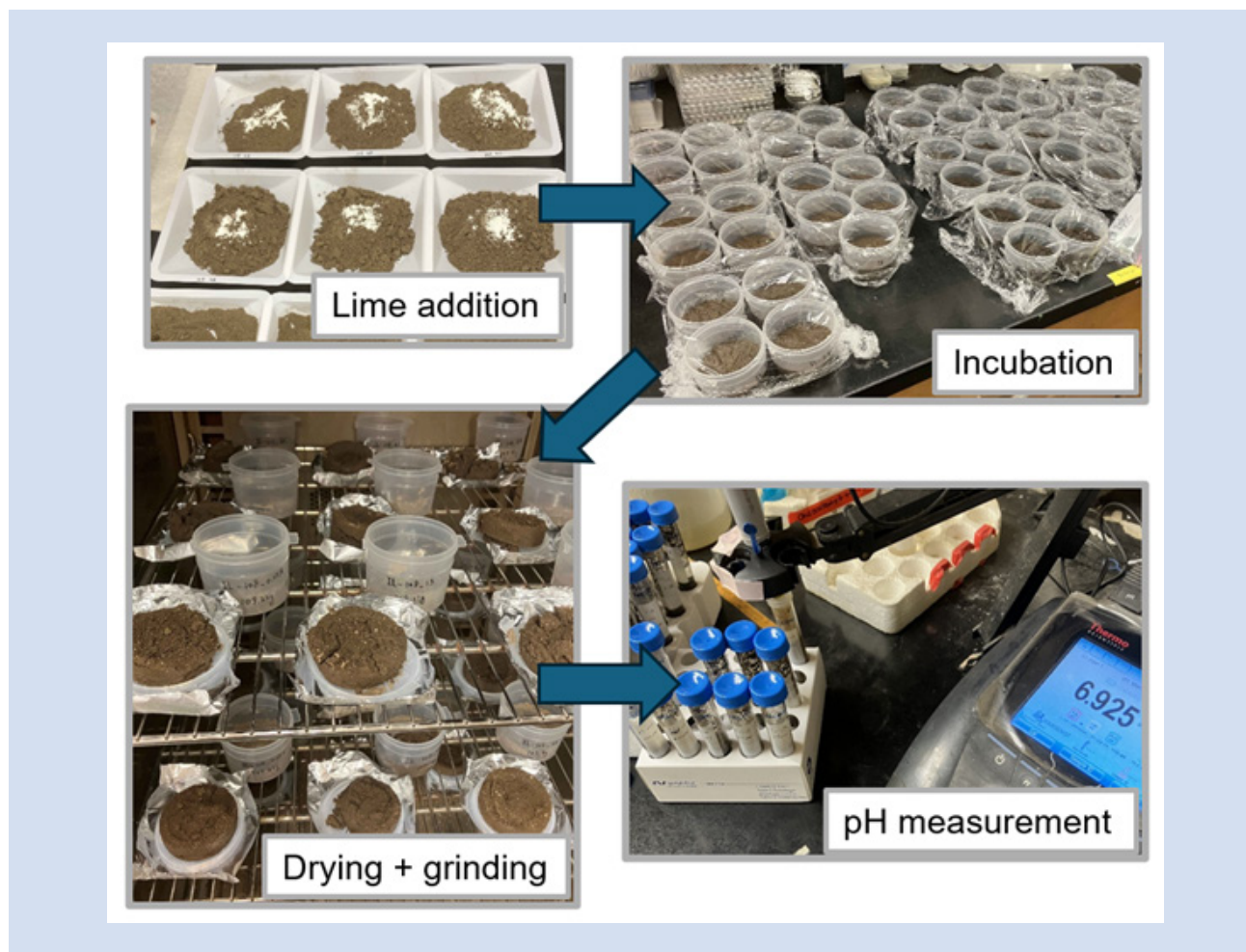
Current Illinois recommendations, despite relying on water pH, performed reasonably well but tended to overestimate lime needs. Recommendations from other states (e.g., Delaware and Kentucky) particularly those using Sikora and modified Mehlich buffer pH methods, were generally more accurate. That said, the soil color+texture with water pH approach of the current Illinois recommendations is "close enough," especially given the lower cost than buffer pH testing. For truly accurate lime rates, however, buffer pH testing is needed.

On-farm trials showed soil pH increased from fall 2024 to spring 2025, but differences among lime rates were not evident at that time. By fall 2025, higher lime rates (2-3 tons/ac) resulted in greater pH increases compared to lower rates. Soybean yields in 2025 ranged from 68 to 71 bu./ac and did not differ by lime rate.

Farmers can continue using the Illinois Agronomy Handbook recommendations for liming with reasonable accuracy. However, more accurate lime recommendations can be achieved using Sikora/SMP or Mehlich-3 buffer pH tests. The Adams-Evans method is not recommended, as it consistently underestimated lime requirements.

NEXT STEPS

On-farm and small-plot lime rate trials are needed, pending funding, to calibrate buffer pH tests with lime rates at field-scale. This next step will allow researchers to develop lime rate recommendations for Sikora and Mehlich-3 buffer pH tests, which have proven appropriate for Illinois soils. Researchers are partnering with GROWMARK, Inc. to identify additional on-farm trial locations – and welcome any interested farmers in partnering for on-farm lime rate evaluations. Additional funding is needed to expand the number of trials, improve confidence in lime rate calibrations and evaluate soybean vs corn yield response to lime rate timing. Additionally, Margenot and his team are preparing results to publish in peer-reviewed scientific journals.



PROJECT NAME

DIVERSIFYING Genetic Resistance to Soybean Cyst NEMATODE

PROJECT LEADER

Eliana Monteverde,
University of Illinois



PROJECT LENGTH
1 Year (2024 - 2025)

BUDGET
\$55,714

YEAR 1 RESULTS PURPOSE

Soybean cyst nematode (SCN) remains the leading yield-limiting pest for Illinois soybean farmers, causing significant economic losses every year. Most commercial soybean varieties rely on resistance from a single genetic source, PI 88788, which has been widely used for decades. As a result, SCN populations across Illinois have adapted, reducing the effectiveness of this resistance and limiting reliable management options.

This research aims to develop and test soybean lines with new combinations of resistance genes to improve SCN control. By diversifying resistance beyond PI 88788, the goal is to provide Illinois farmers with high-yielding varieties that offer stronger, more durable protection against a wider range of SCN populations. The work also provides improved germplasm to private companies for future variety development.

APPROACH

Researchers are developing soybean lines with new combinations of SCN resistance genes. Using molecular markers, they select plants with targeted three- and four-gene resistance stacks. These lines are advanced through greenhouse, winter nursery and field trials, including preliminary two-row and advanced four-row yield tests across multiple Illinois locations. Only lines that combine strong SCN resistance with competitive yield potential are moved forward for variety release.

RESULTS

Early results show that stacking multiple resistance genes improves protection across a wider range of SCN populations. These gene combinations have also been successfully incorporated into high-yielding soybean backgrounds, indicating farmers may not need to sacrifice yield for stronger resistance.

This work is expected to deliver new, conventional soybean varieties with more durable SCN resistance. These lines will be available for licensing by private companies, allowing them to add herbicide tolerance and other value-added traits.

New soybean varieties with multiple SCN resistance genes are in development and may offer improved, longer-lasting protection compared to current options.

Once available, these varieties should be used as part of an integrated SCN management plan that includes soil testing and rotating resistance sources. Planting varieties with different resistance genetics, rather than relying solely on PI 88788, can help slow SCN adaptation and protect yield over time.

These varieties may be especially useful in fields with known SCN pressure or a history of yield loss. However, early adoption across all fields can help limit future SCN buildup and reduce long-term risk.

NEXT STEPS

This project is funded through the Illinois Soybean Checkoff program and is underway in 2026. Varieties with the four-gene resistance stacks are currently being evaluated in field plant rows.

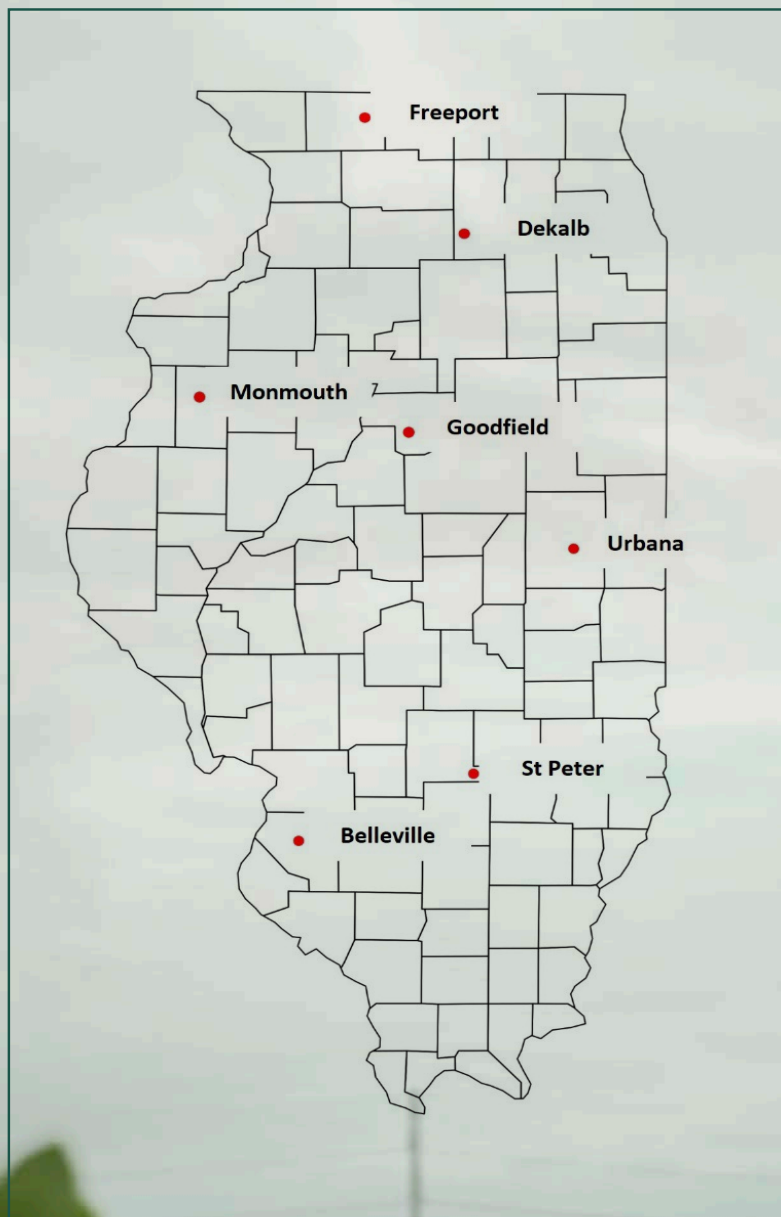


*Figure 1:
Locations of
variety trials for
SCN-resistant
varieties
developed by the
Soybean Breeding
Program at the
University of
Illinois.*



PROJECT NAME

EVALUATION and Commercialization of SOYLEIC® VARIETIES IN ILLINOIS

PROJECT LEADER

Eliana Monteverde,
University of Illinois



PROJECT LENGTH
4 Years (2021 - 2025)

BUDGET
\$269,646

YEAR 4 RESULTS PURPOSE

Most Illinois producers grow soybeans primarily for the commodity market. However, rising input costs and price volatility continue to pressure profitability. To improve financial returns, farmers need access to varieties that offer premium opportunities and expanded market options.

This research focuses on developing and commercializing soybean varieties with improved oil quality. These varieties carry the SOYLEIC® trait, defined by more than 80% oleic acid and less than 3% linolenic acid (high oleic, low linolenic, or HOLL). This trait supports premium markets and helps broaden soybean use. The goal is to provide Illinois farmers with competitive, high-yielding options that offer additional revenue potential beyond traditional commodity soybeans.

NOTE: Project durations reflect confirmed funding records beginning in FY22. This project may have received funding prior to this period.

APPROACH

Researchers developed SOYLEIC® varieties using traditional breeding methods. The process combines two genes that increase oleic acid content and two genes that reduce linolenic acid. Breeding lines with this four-gene combination are identified using genetic markers. A near-infrared reflectance (NIR) machine is used to evaluate oil composition at the individual seed level. Field testing expanded in 2024 with SOYLEIC® varieties evaluated across 11 Illinois locations, an increase from previous years.

RESULTS

The University of Illinois soybean improvement program advanced several new lines in 2024 and 2025.

Eight new lines were sent to Puerto Rico for seed increase.

Yield data from both 2024 and 2025 regional trials across the Midwest (10 locations) showed University of Illinois SOYLEIC® lines performed comparably to Corteva™ Plenish® and high-yielding Pioneer® checks. They also performed better than most lines from other public programs. These lines will be increased, along with another 21 University of Illinois SOYLEIC®-developed varieties that were released in previous years. (Table 1 and 2)

A total of 22 advanced lines tested in 2024 were evaluated regionally in 2025. Most matched or exceeded the top-yielding check in those trials.

All lines include soybean cyst nematode resistance genes, and some also carry a low saccharides trait, which can improve feed digestibility for livestock.

In 2025, researchers evaluated 116 advanced and 326 preliminary HOLL lines, along with approximately 5,000 plant rows and 51 breeding populations.

These results indicated SOYLEIC® varieties can compete with current commercial options while offering added value through oil quality traits. This research impacts farmers who are interested in growing soybean varieties that will earn them a premium for being both non-GMOs and having the SOYLEIC® trait.

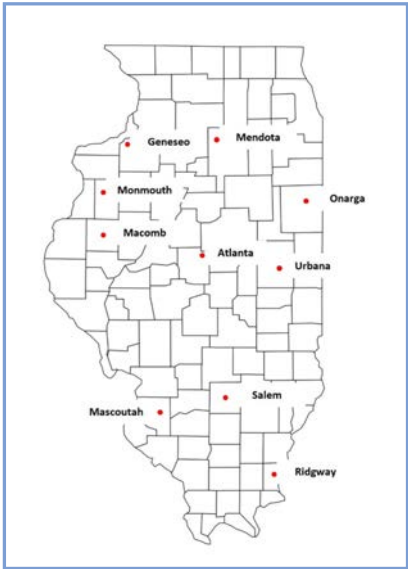
The Illinois SOYLEIC® breeding program continues to produce high-quality lines that are competitive with commercial standards and are gaining recognition across the region.

NEXT STEPS

The work on SOYLEIC® varieties continues in 2026 with support from the Illinois Soybean Checkoff program. In 2026, there were opportunities to grow University of Illinois SOYLEIC® varieties on a contract basis. In future years as the number of varieties increase, these opportunities should expand.

In 2026, Beck’s Hybrids acquired the license rights to SOYLEIC® varieties, which are now part of Beck’s portfolio. This creates an opportunity for significantly broader commercialization and farmer adoption. However, the activities proposed in this project will remain aligned with the existing breeding program at Illinois and will not impact current goals, structure or operations.

Figure 1:
Locations of
variety trials for
SOYLEIC varieties
developed by the
Soybean Breeding
Program at the
University of
Illinois.



Variety	Average Yield (bu/ac)	% of mean commodity check	% of mean Plenish check	RM	Oleic%	Linolenic%
LD21-7914	68.2	102%	102%	2.3	83.8	2.1
LD20-09131	70.1	104%	103%	2.6	83.2	2.4
LD21-9470	73.9	102%	107%	3.1	84.4	2.2
LD21-3429	74.1	96%	104%	3.5	82.4	2.3
LD21-3449	75.4	98%	106%	3.5	84.3	2.1
LD21-3582	72.6	94%	102%	3.7	83.7	1.9
LD21-3593	73.5	95%	103%	3.8	84.2	2.1
LD21-3598	73.2	95%	103%	3.8	84.0	2.1

Table 1. Yields of SOYLEIC lines that were increased in 2024.

Variety	Average Yield (bu/ac)	Number of locations	% of mean commodity check	% of mean Plenish check	% of mean Enlist check	RM
LD21-7914	79.3	12	97	104	-	2.3
LD20-09131	84.4	10	101	106	-	2.6
LD21-9470	80	15	102	103	101	3.1
LD21-3429	78.8	12	101	102	103	3.5
LD21-3449	79.7	12	102	103	104	3.5
LD21-3582	74.1	12	96	96	97	3.7
LD21-3593	74.4	12	97	97	98	3.8
LD21-3598	74.3	12	95	95	97	3.8

Table 2. Results from the 2025 trials conducted across multiple locations in Wisconsin, Nebraska, Iowa, Illinois, Indiana and Ohio continue to highlight the strong performance of University of Illinois soybean varieties. The varieties ranked among the top-yielding entries across the trials, outperforming many varieties from other public breeding programs while consistently achieving more than 80% oleic acid and less than 3% linolenic levels. All varieties also contain SCN resistance and remained competitive with Corteva™ check varieties.

PROJECT NAME

SULFUR FERTILIZATION in Soybeans

PROJECT LEADER

Illinois Soybean Association's
On-Farm Trial Network



PROJECT LENGTH

1 Year (2024 - 2025)

BUDGET

\$52,145

YEAR 1 RESULTS

PURPOSE

The Illinois Soybean Association (ISA) On-Farm Trial Network evaluated whether sulfur fertilization can reliably enhance soybean yield across diverse environments in Illinois. Declining atmospheric sulfur deposition has raised questions about in-season sulfur supply, particularly given its role in protein synthesis, nitrogen fixation, chlorophyll production and seed quality. About 60% of sulfur taken up by corn and soybeans is removed with harvested grain. Soybeans require the most sulfur during reproductive stages, making consistent yield response to supplemental sulfur a key question for farmers.

APPROACH

Field-scale trials of at least 40-acres compared 30 lbs./ac of spring-applied ammonium thiosulfate (ATS) or ammonium sulfate (AMS) with untreated control strips.

Trials were conducted across multiple Illinois environments. ISA staff evaluated sulfur applications at 18 sites across 15 Illinois counties. A total of 17 trials were established, with yield data collected from 16 sites. Each site included four replications of the control and a sulfur (ATS or AMS) treatment, resulting in a total of eight plots at most locations, with only one of the trial participants choosing to apply AMS. One site consisted of control and both sulfur treatments (ATS and AMS) for a total of 12 plots. A specific emphasis was placed on evaluating sulfur response under early planting conditions; however, significant spring rainfall may have hindered or delayed sulfur application and planting in southern Illinois.

At four locations, nitrogen was added to the control strips to match sulfur-treated strips and isolate sulfur response. Each site included four replications.

ISA collected soil samples, R1 tissue samples, field observations and yield monitor data. Farmers provided five years of historical management records and 2025 field data.

RESULTS

Yield response to sulfur was inconsistent across sites and sulfur provided little to no yield advantage at sites that had received moderate to high sulfur application in 2024. In addition, the corresponding spring soil tests at these sites indicated adequate to elevated sulfur concentrations. Notably, neither planting date nor estimated crop sulfur demand appeared to influence sulfur yield response.

In Bureau County, 14.4 lb./ac of ATS increased yield by 7.4 bu/ac on sandy, low organic matter soils with lower pH, conditions that increase sulfur deficiency risk.

In Champaign County, ATS improved yield by 3.4 bu/ac in a high organic matter, high-residue, cover-cropped field under lower rainfall.

In Knox County, both ATS and AMS were evaluated. AMS outperformed ATS by 3.2 bu/ac. AMS provides immediately available sulfate sulfur, while ATS contains both sulfate and elemental sulfur, which requires time to become available. Overall, AMS increased yield by 1.5 bu/ac on a fall tilled, high organic matter field with high residue.

Based on these results, it appears that soil texture, along with weather and residue loads with high carbon-to-nitrogen (C:N) ratios, may have hindered mineralization and influenced sulfur yield response in fields that did not previously have sulfur application.

NEXT STEPS:

In 2026, the ISA On-Farm Network continues to evaluate sulfur's impact on soybean yield across Illinois using an updated trial protocol, with a greater emphasis of including a balancing rate of nitrogen on the control treatments.



PROJECT NAME

SOYBEAN TISSUE SAMPLING in Sulfur Fertilization Trials

PROJECT LEADER
Illinois Soybean Association's
On-Farm Trial Network



PROJECT LENGTH
1 Year (2024 - 2025)

BUDGET

This project did not have a standalone budget and was included within the Sulfur Fertilization Trial.

YEAR 1 RESULTS PURPOSE

Tissue samples were collected across Illinois within selected Illinois Soybean Association (ISA) on-farm trials at the soybean R1 growth stage to assess nutrient status, primarily sulfur. Soybeans take up sulfur primarily as sulfate SO_4^{2-} , the formula of sulfate, which is transported to actively growing, nearly fully expanded leaves and has limited movement once in the plant. Sampling the most recently matured trifoliate provides information into sulfur availability at the time of sampling and helps compare sulfur treated and non-sulfur treated plots.

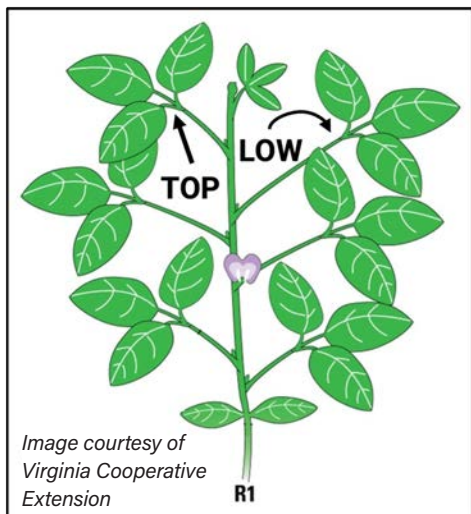


Image courtesy of
Virginia Cooperative
Extension

APPROACH

Illinois Soybean Checkoff-funded research conducted by Fred Below and Connor Sible at the University of Illinois is reevaluating which trifoliate leaf best represents soybean nutrient status at sampling. To align with this work, ISA's On-Farm Trial Network collected the most recently matured trifoliate (fully expanded, dark green, and leaflets no longer touching), labeled TOP, and the trifoliate immediately below it, labeled LOW. This approach evaluated which leaf position better captured sulfur differences that translated into soybean yield response.

The ISA On-Farm Trial Network collected R1 soybean tissue samples at 11 of 17 sulfur trial locations across Illinois. At each location, 25 trifoliate leaves were collected from 25 successive soybean plants within a uniform row and replicated four times for both the control and sulfur (ATS or AMS) treatments.

RESULTS

Tissue samples were used to evaluate nutrient concentration, dry weight and nutrient content at the R1 soybean growth stage. Sulfur applications increased tissue sulfur concentrations at R1 across sites and sample locations (Figure 1).

Higher sulfur concentration at R1 did not consistently result in significantly higher soybean yields at individual sites (Table 1). However, the largest increase in sulfur concentration, observed at Champaign County, did result in significantly higher soybean yields (Table 1).

At that location, increases in sulfur concentration were more indicative of soybean yield response than sulfur content (Table 1). This finding may benefit growers, as tissue sample results from commercial laboratories are typically reported as concentrations.

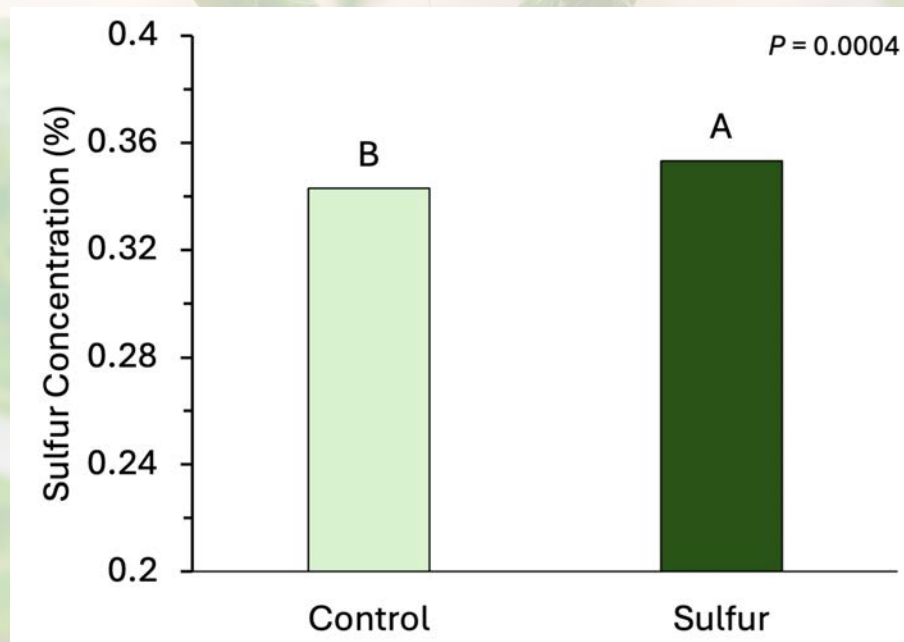


Figure 1. Soybean R1 sulfur concentrations as affected by no sulfur (control) or preplant sulfur applications.

County	$\Delta^{\dagger}$				Yield bu/acre
	Tissue Sulfur Concentration		Tissue Sulfur Content		
	Top	Low	Top	Low	
	%		mg		
Champaign	4.0*	3.7*	2	2	4.0*
Vermilion	3.7*	2.0*	6	3	2.4
Peoria	-1.2	-1.5	-1	-1	0.7
Effingham	0.8	1.8*	1	7*	0.7
Crawford	0.5	2.5*	1	5*	-0.1
McLean	1.0*	0.2	2	0	-0.8
Piatt	1.3	0.8	1	3	-1.0
Montgomery	-0.3	-2.0*	-5*	-9*	-0.8
Menard	0.5	0.5	2*	5	-1.7
Effingham	0.8	2.3*	3	7*	-2.7

$\dagger$ All values are displayed as the difference between sulfur treated and untreated control plots

* Significantly different from the no sulfur control

Table 1. Change in R1 soybean tissue sulfur concentration, content and grain yield in response to preplant sulfur applications at multiple counties across Illinois in 2025.

PROJECT NAME

Adaptive MANAGEMENT FOR MAXIMIZING Soybean Production FOLLOWING CEREAL RYE TERMINATION

PROJECT LEADERS

Giovani Preza Fontes,
University of Illinois;
Sofia Canafoglia, University of Illinois;
Shalamar Armstrong, Purdue University



PROJECT LENGTH
3 Years (2022 - 2025)

BUDGET
\$230,736

FINAL REPORT PURPOSE

Many growers are interested in using cereal rye cover crops for their soil and environmental benefits. However, questions remain about short-term effects on soybean performance, especially nutrient availability.

This study evaluated soybean yield following cereal rye, how cereal rye influences nitrogen (N) and sulfur (S) availability, and whether these nutrient dynamics influence yield. The goal was to provide practical, data-driven guidance to help farmers manage cereal rye while maintaining productivity.

APPROACH

The project was conducted at the University of Illinois Research Centers near Monmouth (Warren County), Perry (Pike County), Urbana (Champaign County) and the Ewing Demonstration Center (Franklin County), within a corn-soybean rotation. Each trial had eight treatments: cereal rye versus no cereal rye, each combined with four different fertilizer treatments as shown in Table 1.

Cereal rye was terminated approximately two weeks before soybean planting at all locations. Researchers measured rye biomass and nutrient content prior to termination. Soil samples were collected to establish fertility baselines and assess N and S use by the cover crop. Fertilizer treatments were broadcasted preplant. Soybeans were planted in 30-inch rows at 140,000 seeds/ac. Plant tissue biomass samples were measured at V4 and tissue testing was conducted at R2. At harvest, grain was analyzed for oil and protein, and yields were adjusted to 13% moisture.

RESULTS

Cereal rye aboveground biomass at termination ranged from about 500 to 2,100 lbs./acre. Carbon to nitrogen (C:N) ratios ranged from 14:1 to 39:1, with higher ratios increasing the potential for temporary nitrogen tie-up during residue breakdown.

Cereal rye reduced early-season soybean growth, with soybean biomass 4% to 25% lower at the V4 stage compared to no-cover control. This was likely due to lower stands in Perry and Urbana, highlighting the importance of proper planter setup when planting into cover crop residue. At Monmouth, the addition of N and S fertilizer increased soybean biomass.

Although cereal rye reduced soybean tissue N concentrations at the R2 growth stage, N and S concentrations remained above established sufficiency levels. Soybeans met their nutritional requirements through biological nitrogen fixation and soil organic matter mineralization. Fertilizer applications increased tissue N and S levels but did not consistently improve yield.



Yield response varied by location:

- Monmouth: Soybeans yielded about 11% less following cereal rye without fertilizer, but this difference disappeared with N, S or N+S applications.
- Perry: Yield was not affected by cereal rye. Sulfur applications reduced yield for unknown reasons.
- Urbana: Cereal rye reduced yield by about 5.5%, and fertilizer did not improve yields.
- Ewing: No yield differences were observed. Wet conditions delayed planting and reduced overall yields.

Seed protein increased slightly with fertilizer at Monmouth, while oil content was unaffected across all sites.

Overall, N and S applications did not consistently improve soybean yield following cereal rye. Responses were site-specific and not predictable enough to support routine fertilizer use. In most environments, soybeans met their nutritional needs through biological nitrogen fixation and soil organic matter mineralization without supplemental fertilizer.

Results suggest growers should avoid routine N and S applications following cereal rye unless a response is expected. A practical approach is to test fields through on-farm trialing.

Simple strip trials using about 20-30 lbs. of S per acre from a soluble source, such as gypsum, ammonium sulfate or ammonium thiosulfate, can help determine if a field is responsive. This allows farmers to make decisions based on their own specific soils, management history and cover crop performance.

NEXT STEPS

The research team is currently writing an article to publish in a peer-reviewed scientific journal. The results have also already been widely shared to growers through Illinois Extension field days and winter meetings, as well as to the broader research community at two national conferences.

Treatment factors	Description
Cover crop:	
1. Cereal Rye	Most grown cover crop in the region
2. No cereal rye	Prevalent practice
Fertilizer management:	
1. Unfertilized control (UTC)	Unfertilized plots to evaluate soil N and S supply
2. Sulfur (S)	20 lbs. S/A broadcast at planting (Pelletized Gypsum)
3. Nitrogen (N)	40 lbs. N/A broadcast at planting (Urea)
4. N+S	Combination of 20 lbs. S/A and 40 lbs. N/A

Table 1. Description of the treatments evaluated in this study.

Cover crop	Fertilizer	Monmouth (2024-2025)	Perry (2024-2025)	Urbana (2023-2025)
None	UTC	79.2 ab	70.9	69.0
None	N	79.0 a	72.4	68.1
None	S	81.6 ab	63.6	69.4
None	N+S	80.8 ab	69.8	69.3
Cereal rye	UTC	70.3 c	72.2	65.5
Cereal rye	N	79.6 ab	66.7	66.6
Cereal rye	S	79.2 ab	67.3	64.3
Cereal rye	N+S	84.2 a	70.5	65.3

Table 2. Average soybean yield (bushels per acre) at Monmouth, Perry and Urbana across the 2024-2025 growing seasons. Treatment means followed by different letters are significantly different at $p < 0.1$.

PROJECT NAME

Integrated MANAGEMENT STRATEGIES

FOR MAXIMIZING SOYBEAN PRODUCTION IN
CONSERVATION TILLAGE SYSTEMS

PROJECT LEADERS

Giovani Preza Fontes,
University of Illinois;
Federico Rolle, University of Illinois;
John D. Jones, University of Illinois;
Dan Schaefer, Illinois Fertilizer and Chemical Association;
Jacob Vossenkemper, Twin State Inc.; Moein Javid, Southern
Illinois University; Amir Sadeghpour, Southern Illinois University



PROJECT LENGTH
2 years (2023 - 2025)

BUDGET
\$291,591

YEAR 2 RESULTS
PURPOSE

Conservation tillage and cover crops are key components of sustainable cropping systems. They reduce soil erosion, improve soil structure and build soil carbon over time. However, planting soybeans into heavy corn residue or cereal rye cover crops can slow early growth and may reduce yield compared to conventionally tilled fields.

The primary goal of this research was to determine whether growers can maintain high yields using reduced tillage and cover crops. A second objective was to evaluate whether starter fertilizer (nitrogen and sulfur) can offset early-season challenges such as cool soils, heavy residue and slow early growth.

Table 1. Partial net returns for each tillage-cereal rye system across site-years. Gross revenue was estimated assuming a soybean price of \$11/bushel.

APPROACH

Field trials were conducted in 2024 and 2025 at eight sites across Illinois and eastern and north-central Iowa. Grain yield was measured at all sites, while Illinois locations also included detailed soil and plant measurements. Soil organic matter at Illinois sites ranged from 2.2 to 4.2%, with pH, phosphorus (P), and potassium (K) at adequate levels.

- 12 treatment combinations were studied, including four tillage systems:
- Conventional tillage (CT)
 - Strip-tillage (ST)
 - No-tillage (NT)
 - No-tillage with a cereal rye cover crop (NT+CR)

- Each system included three starter fertilizer strategies:
- Unfertilized control (UTC)
 - 15 lb. of nitrogen (N)/ac
 - 15 lb. N plus 10 lb. Sulfur (S)/ac (N+S)

Starter fertilizer was applied at planting using a 2x2 placement. N was applied as UAN (32%), and S as ammonium thiosulfate (ATS 12-0-0-26).

RESULTS

Across Illinois sites, soybeans showed an early-season response to starter fertilizer at the V4 growth stage, particularly in reduced tillage and cereal rye systems where cool soils and heavy residue can limit early growth. Applying N at planting increased early-season biomass by approximately 27 lb./ac compared to the unfertilized control and improved early canopy development.

However, this early advantage did not persist. By the R2 growth stage, tissue N and S levels were statistically similar across all treatments and exceeded established sufficiency ranges. This indicates soybeans met nutrient needs through biological nitrogen fixation and soil organic matter mineralization without starter fertilizer.

Soybean yield ranged from 52 to 93 bu/ac across sites and years. Starter fertilizer did not significantly increase yield in any tillage or cover crop system. Occasional increases of 2–5 bu/ac occurred, mainly in no-till with cereal rye, but results were inconsistent and not predictable enough to support broad recommendations.

Tillage op.	Tillage-CR cost \$ / acre	Soybean yield bu/acre	Gross revenue -----\$ / acre-----	Partial net return
CT	34.8	74	814	779
ST	26.1	74	814	788
NT	0	73	803	803
NT + CR	55	73	803	748

Differences among tillage systems were minimal. Across the eight sites, CT and ST averaged 74 bu/acre, while NT and NT+CR averaged 73 bu/acre. These results show soybeans in reduced tillage and cereal rye systems performed similarly to conventional tillage. For growers considering reduced tillage and cover crop, these early results indicate soybean yields can be maintained during early years of adoption, even in high-yield environments across central and northern Illinois.

Table 1 shows estimated partial net returns from each tillage system. Overall, the highest net return was under NT (\$803/acre), followed by ST (\$788/acre) and CT (\$779/acre). The NT+CR had the lowest partial net return (\$748/acre) because of the higher cost associated with cover crop management, estimated at \$55/acre. State

and government cost-share programs may help offset the cost of conservation practices. In years of low commodity prices and high input costs, practices that maintain yield while reducing field operations can improve profitability and support soil conservation.

NEXT STEPS:

This research is in its third year and is funded by the Illinois Soybean Checkoff program. The team is preparing scientific articles for peer-reviewed journals. Findings have also been shared with Illinois soybean growers through winter meetings and summer field days, as well as with the broader agronomy and soil fertility community through regional and national conferences.



V4 soybean sampling at Monticello, Piatt County on June 2, 2025.

PROJECT NAME

Enhancing THE PROFITABILITY of wheat-soybean DOUBLE CROPPING

PROJECT LEADER

Jessica Rutkoski,
University of Illinois



PROJECT LENGTH
2 years (2023 - 2025)

BUDGET
\$49,893

YEAR 2 RESULTS PURPOSE

This research aims to improve profitability of wheat double-crop soybean systems across Illinois by helping growers and seed companies identify elite early-maturing wheat varieties that allow earlier soybean planting.

In its second year, the project builds on 2024 work evaluating elite early wheat varieties. Earlier harvest can help growers plant double-crop soybeans sooner, but early wheat often yields less due to a shorter growing season and increased risk of spring freeze during reproductive stages.

The research focuses on balancing wheat yield, maturity and soybean performance. It provides data on yield, jointing time and maturity to support variety selection and guide future breeding efforts.

APPROACH

Wheat trials were conducted in Urbana and St. Peter, Illinois, with additional locations contributing yield data, but not phenology data.

Researchers evaluated:

- Jointing date (start of reproductive growth)
- Maturity date (physiological maturity)
- Yield performance

Entries included:

- Commercial varieties from the University of Illinois Official Variety Trial (OVT)
- Experimental varieties from seed companies submitted to a Preliminary Screening Trial (PST) designed to better characterize new varieties.

Additional research examined:

- Remote sensing to predict jointing timing
- Senescence rates and their relationship to yield and maturity

Results are published in the OVT report (vt.cropsci.illinois.edu) or shared directly with seed companies.

RESULTS

As in 2024, wheat varieties in 2025 showed a nine-day range in maturity across Illinois, including an eight-day range in northern Illinois and a 10-day range in southern Illinois. This spread gives growers an opportunity to select earlier-maturing varieties and potentially plant double-crop soybeans up to one week sooner.

Unlike in 2024, no relationship was observed between jointing time and yield in 2025, due to the weather being consistently cool followed by consistently warm temperatures. However, early-jointing varieties remain at greater risk for damage from late spring freezes, and growers should consider this risk when selecting varieties. Following up from 2024, researchers found remote sensing can be used to predict when jointing occurs and could be a useful tool to enhance variety development or to optimize the timing of spring nitrogen applications.



In northern Illinois, maturity time and yield were significantly related, with later varieties showing higher yield. However, in southern Illinois, yield and maturity time were not related. The trade-off between yield and maturity time appears to be greater in northern Illinois than in southern Illinois. It is important to weigh the impact of both yield and maturity on total profitability when making wheat variety selection decisions.

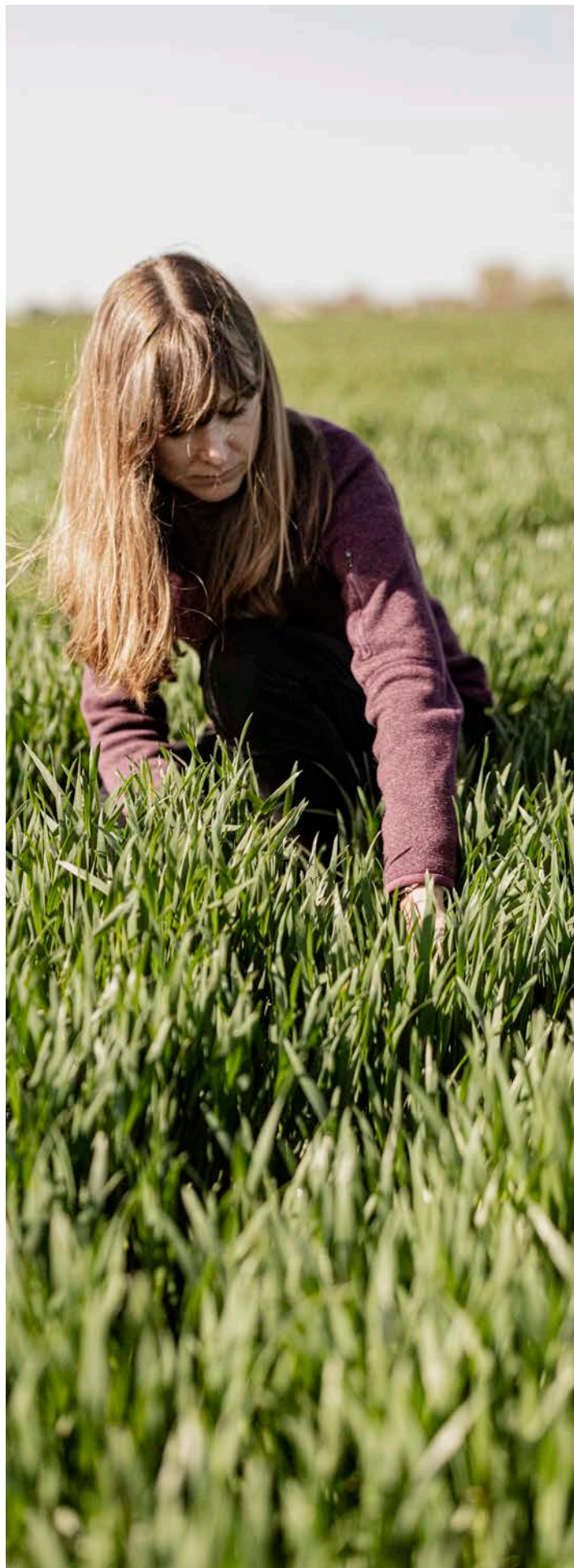
Data from 32 varieties in the PST showed most entries were medium-early maturity or earlier. Five varieties were early jointing in St. Peter, while only one met that threshold in Urbana. The research team received positive feedback on the results from the trial participants.

Among experimental breeding lines from six public programs, researchers observed a wide range in the timing and rate of senescence, the process by which plants die. Ongoing work is finding that there may be an ideal senescence pattern that improves yield without delaying maturity.

Overall, this research reinforces the importance of OVT data to select wheat varieties that balance early maturity, strong yield potential and reduced freeze risk through normal or later jointing, along with at least moderate scab resistance.

NEXT STEPS

This research continues for a third year in the 2026 growing season with funding from the Illinois Soybean Checkoff program. The research team is using other funds from U.S. Department of Agriculture's National Institute of Food and Agriculture to examine how timing and rate of senescence affects yield. The team is creating factsheets to share these results with the public, and they are preparing a scientific article on their findings about using remote sensing to predict jointing time. Additionally, they are developing many new early wheat lines every year and sharing the best ones with seed companies for potential brand labeling.



PROJECT NAME

FREE SCN TESTING FOR ILLINOIS SOYBEAN Growers

PROJECT LEADER

Nathan Schroeder,
University of Illinois



PROJECT LENGTH
2 years (2023 - 2025)

BUDGET
\$156,729

YEAR 2 RESULTS PURPOSE

While soybean cyst nematode (SCN) is widely recognized across Illinois and can reduce yield, the lack of visible aboveground symptoms can create a false sense of security. SCN has become more challenging in recent years as populations have adapted to overcome the most commonly used source of genetic resistance, PI 88788. Funded by the Illinois Soybean Checkoff, this program provides testing at no cost, eliminating financial barriers and enabling farmers to make field-specific SCN management decisions.

APPROACH

SCN testing was available to farmers and agronomists in Illinois through Nathan Schroeder's lab. Sample kits could be requested by emailing freescntesting@illinois.edu and included instructions for collection. Samples could be submitted with prepaid shipping or dropped off in person. They were analyzed for SCN egg counts, and results were emailed to farmers with general management recommendations. More information is available at publish.illinois.edu/freescntesting.

Samples with high SCN egg counts are further evaluated in a greenhouse assay to determine which resistance sources are effective against local populations. This process takes two to three months, and results from the first year of testing in 2024 are now available. Schroeder also follows up with farmers who have very high egg counts to discuss potential management adjustments.

RESULTS

In fiscal year 2025, 1,016 samples were collected from 43 counties, with 71% testing positive for SCN.

Since this program began in 2023, more than 2,500 samples have been collected from 74 counties. Overall, 74% of fields tested positive, with an average egg count of 1,053 eggs per 100 cm³ of soil (see map).

No clear statewide hotspot was identified. However, central Illinois had statistically higher SCN levels (1,345 eggs/100 cm³ soil) compared to northern (849) and southern Illinois (1,113).

Fields near major rivers also had statistically higher counts than non-river counties (1,626 vs 870), likely due to sandy soils and potential movement of SCN along waterways. Some inland counties, such as McLean County, also showed elevated levels.

Since 2023, researchers have completed 39 greenhouse tests to evaluate SCN resistance. All tested populations were able to reproduce on PI 88788, the most commonly used source of resistance. While PI 88788 still performs better than susceptible varieties, continued use may allow SCN populations to increase over time.

Additionally, 31% of populations reproduced on Peking resistance, up from 7% in a 2018-19 survey. This suggests SCN populations may also be adapting to Peking, even though it is used less frequently.

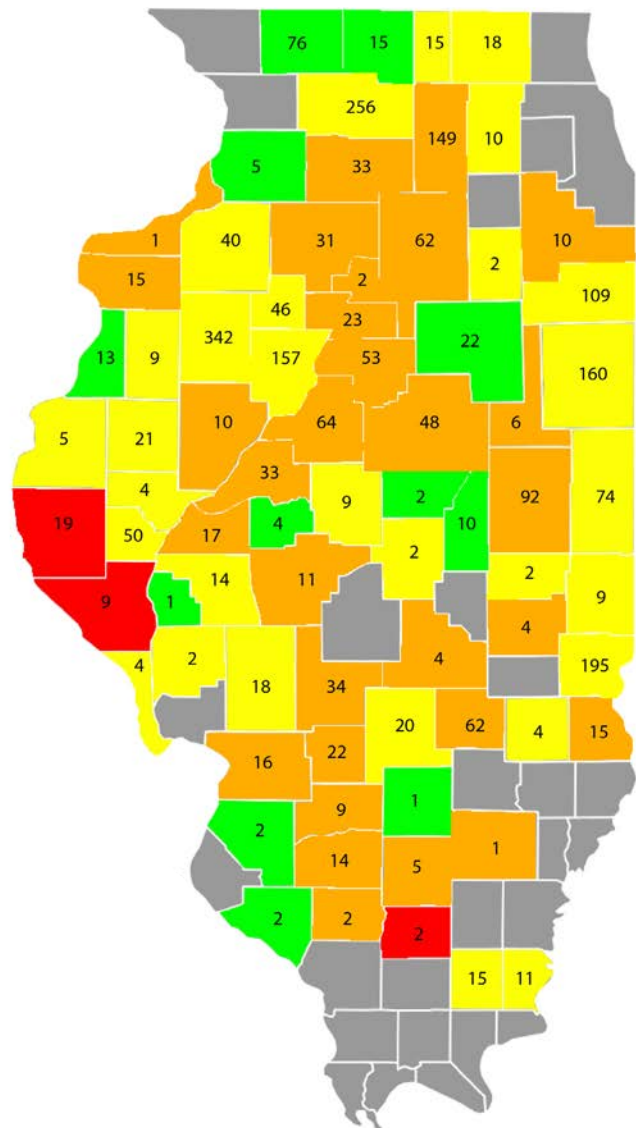
Fields with low egg counts can generally continue current management and retest in a few years. In fields with high egg counts, especially those using PI 88788 varieties, farmers should consider rotating to a different source of resistance and using additional SCN management strategies.

NEXT STEPS

Free SCN sampling will continue in 2026. Updates to the processing system are expected to shorten turnaround time, and added questions on recent planting history will help SCN data analysis.



Soybean cyst nematode on soybean roots.



■ >5,000 eggs/100 cm³

>1,000 eggs/100 cm³

Yellow >200 eggs/100 cm³

 <200 eggs/100 cm³

■ No data

Sample size per county in map

PROJECT NAME

Improving

EFFICACY AND SUSTAINABILITY OF GLUFOSINATE FOR WATERHEMP MANAGEMENT

PROJECT LEADERS

Patrick Tranel, University of Illinois;
Aaron Hager, University of Illinois



PROJECT LENGTH
1 year (2024 - 2025)

BUDGET
\$68,867

FINAL REPORT PURPOSE

Reports of poor waterhemp control following glufosinate application are increasing. Does this mean populations are becoming resistant? It is known that glufosinate efficacy is dependent on environmental and application conditions. Do the same conditions that provide optimal control of a sensitive population also provide optimal control of a resistant population? This study evaluated these important questions to maintain efficacy of glufosinate herbicide for waterhemp control.



APPROACH

Researchers conducted three studies:

1. Dose-response experiments comparing glufosinate performance on susceptible and resistant waterhemp under varying temperature, humidity and light conditions, with applications made at midday and evening.
2. Molecular analysis to better understand the mechanism of glufosinate resistance.
3. Field trials in Carroll County, Illinois, to evaluate glufosinate efficacy against a suspected resistant population.

Most research was conducted in greenhouse studies at the University of Illinois Urbana-Champaign, with one on-farm trial in Carroll County, where an unconfirmed resistant waterhemp population is located.

RESULTS

Glufosinate-resistant waterhemp is now confirmed in Illinois.

Susceptible waterhemp was better controlled under warm temperatures. In contrast, resistant populations were better controlled under cooler temperatures, likely because they metabolize glufosinate more quickly at higher temperatures, resulting in worse control.

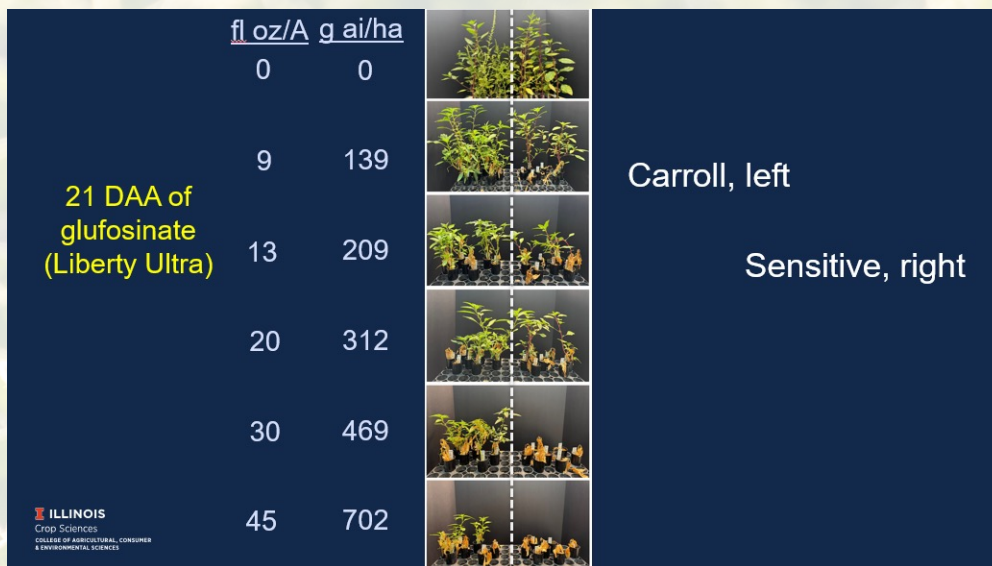
Environmental conditions can significantly affect glufosinate performance. Midday applications under clear, humid and cooler conditions may provide optimal control of waterhemp populations with both resistant and sensitive biotypes and reduce selection for resistance, but additional research is needed.

To protect and sustain the use of glufosinate, herbicides should be used as part of an integrated weed management strategy. Glufosinate should not be used as a stand-alone postemergence herbicide.

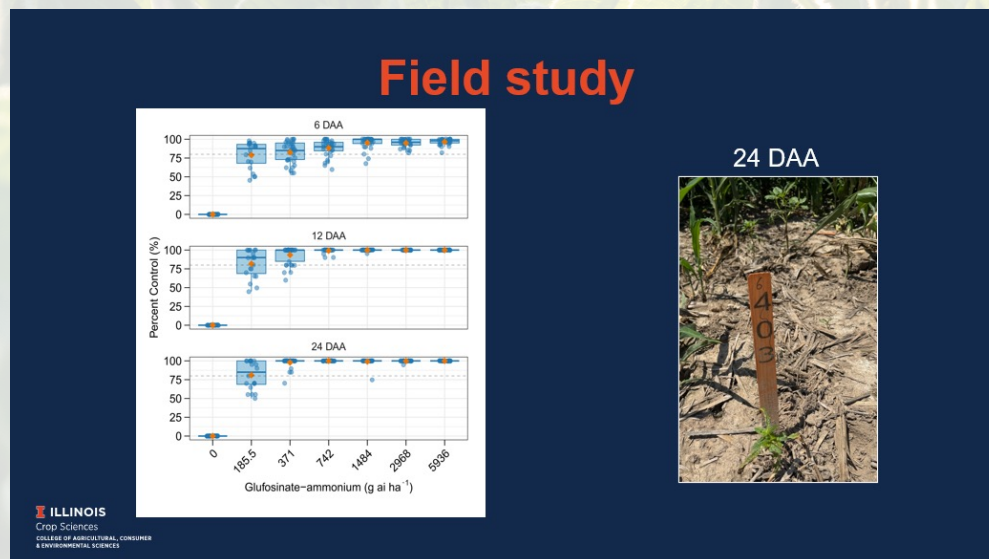
These findings can help farmers and applicators troubleshoot inconsistent glufosinate performance in the field.

NEXT STEPS

Researchers are publishing two peer-reviewed publications in scientific journals in 2026 and will continue this work with funding from the Illinois Soybean Checkoff. Ongoing research aims to better understand resistance mechanisms and improve glufosinate performance. Additional studies with private companies will focus on molecular and genetic approaches.



Results from a greenhouse trial demonstrating that a suspect resistant population from Carroll County survived significantly higher rates of glufosinate than did a sensitive population.



A field trial in Carroll County confirmed some of the plants in this waterhemp population are resistant to glufosinate.



PROJECT NAME

Assessing INSECT PEST EFFECTS ON YIELD and ROI of Pest Control Inputs

PROJECT LEADERS

Nick Seiter, University of Illinois
and Illinois Soybean Association
On-Farm Trial Network



PROJECT LENGTH
2 Years (2023 - 2025)

BUDGET
\$229,701

YEAR 2 RESULTS

PURPOSE

This project evaluates whether insecticide applications in soybeans result in a positive economic return and which insect species cause measurable injury. Many insecticides are applied prophylactically, either as seed treatments or at specific growth stages, without corresponding to actual insect populations. Insect pests are sporadic, often do not reach economically damaging levels and are unpredictable in timing. The goal is to better inform input decisions by providing recommendations on when and where an insecticide is needed based on research data.



APPROACH

This research evaluated insecticide use across multiple field environments to determine when and where applications are warranted. Treatments (Table 1) included insecticide seed treatments, foliar applications at set growth stages and untreated plots. Beginning in 2025, an additional treatment applied insecticide only at Urbana and Monmouth when established economic thresholds were reached. In 2025, additional locations were added through Illinois Soybean Association's (ISA) On-Farm Trial Network and collaborated with Seiter's research team.

Trials were conducted at university research farms and ISA on-farm trials across Illinois:

- University of Illinois Orr Agricultural Research and Demonstration Center, Baylis, IL
- University of Illinois Crop Sciences Research and Education Center, Champaign, IL
- University of Illinois Northwestern Illinois Research and Demonstration Center, Monmouth, IL
- Illinois Extension Ewing Demonstration Center, Ewing, IL
- Four ISA On-Farm Trials near Gibson City, La Harpe, Pittsburg, and Boody, IL

Insect populations and crop injury were monitored throughout the growing season at every site, including visual estimates of defoliation. Yield data was collected from all the treatment plots.

RESULTS

Over two years and 14 site-years, insect populations and foliar injury remained below economic thresholds, and insecticide treatments rarely influenced pest densities or crop performance.

Of the seven locations with replicated yield data in 2025, only two showed yield differences among treatments. The differences in yield have not followed a clear pattern at any site, suggesting insect pests were not the reason for the difference. Additionally, an analysis of all the sites detected no yield response to insecticide use. So far, this research has shown no benefit to the automatic insecticide applications often used in Illinois soybeans. Instead, growers should consider applying insecticides only when economic thresholds are met and avoid applications when pests are not present at damaging levels.

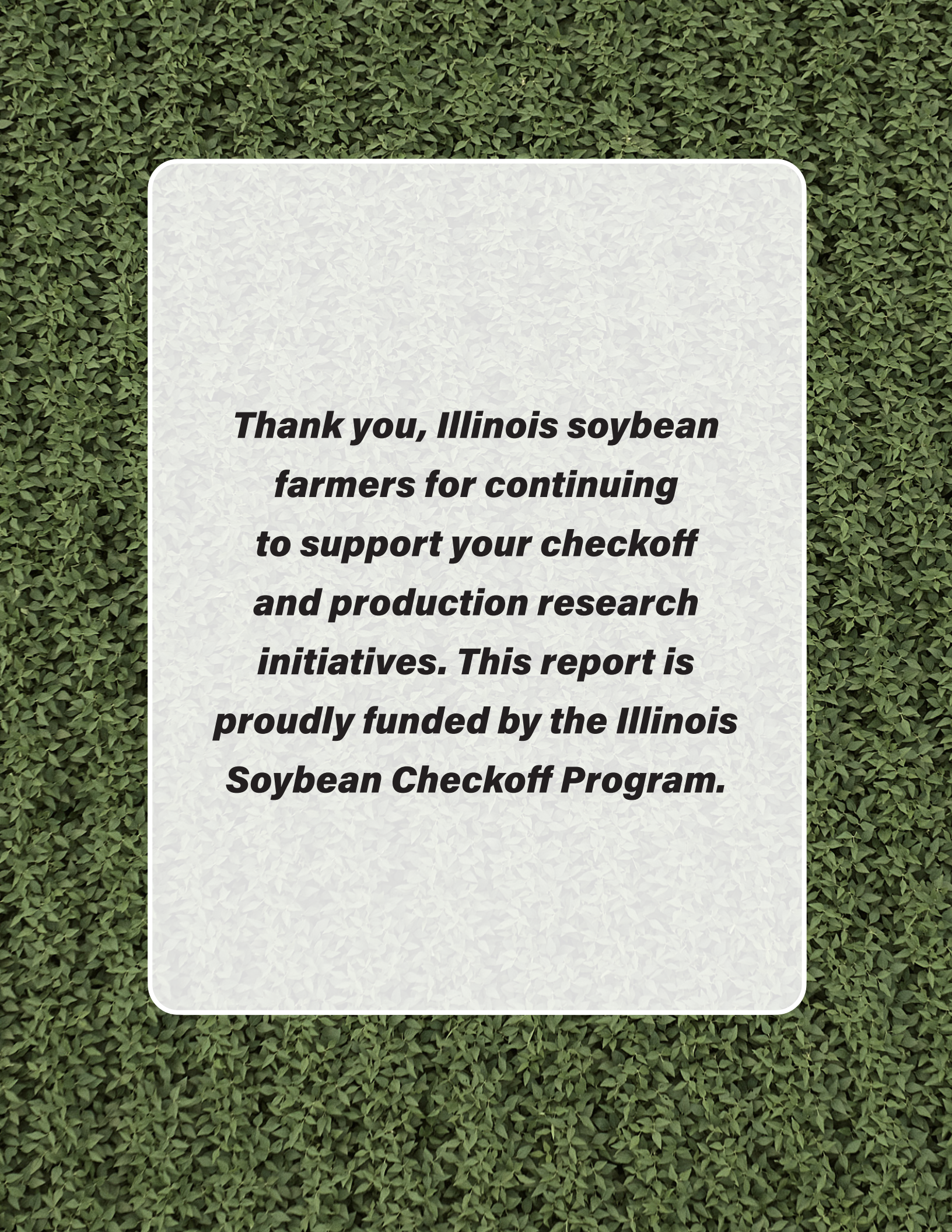
NEXT STEPS

This project is in its third year with funding from the Illinois Soybean Checkoff, with plans to pursue continued support in 2027. A graduate student will lead the project and prepare a peer reviewed journal article and extension materials based on the results.

Table 1: 2025 Experimental design, treatment and replication arrangement by site.

Location	Farm type (application method)	Treatments	Number of replicates
Urbana	Research (ground rig)	No insecticide (x 2); Insecticide seed treatment; IST + R5*; Spray at threshold (not reached)	4
Monmouth	Research (drone)	No insecticide; Insecticide seed treatment; R3 foliar application; R5 foliar application; IST + R3 + R5*; Spray at threshold (not reached)	4
Orr	Research (drone)	No insecticide; Insecticide seed treatment; R3 foliar application; R5 foliar application; IST + R3 + R5*	4
Ewing	Research (drone)	No insecticide; Insecticide seed treatment; R3 foliar application; R5 foliar application; IST + R3 + R5*	3
Gibson City	Commercial (drone)	R3 foliar application; R3 + R5*	4
La Harpe	Commercial (drone)	No insecticide; R3 foliar application*	4
Pittsburg	Commercial (drone)	R3 foliar application*; R3 + R5	4
Boody	Commercial (drone)	No insecticide: R5 foliar application*	4

**Broadcast applications used at each site were as follows: Warrior II Zeon at 1.96 fl oz/a (2.08 lb lambda-cyhalothrin per gallon, Syngenta Crop Protection, Greensboro, NC) was used for all treatment applications at Champaign, Monmouth, Ewing, Baylis, Boody, and Gibson City; Bifen 2EC Select at 6.4 fl oz/a (2 lb bifenthrin per gallon, Prime Source LLC, Middlesex, NC) was used for the R5 application at Pittsburg; and Fastac CS at 3.8 fl oz/a (0.83 lb alpha-cypermethrin per gallon, BASF Corporation, Research Triangle Park, NC) was used for the R3 application at La Harpe.*



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