



# 5UPPORT

THE ACCOMPLISHMENT AND COMMUNICATION OF SOYBEAN RESEARCH THAT WILL ENHANCE GROWER

# PRODUCTIVITY, PROFITABILITY

AND ENVIRONMENTAL STEWARDSHIP ACROSS THE NORTH CENTRAL REGION; INCLUDING ILLINOIS, INDIANA, IOWA, KANSAS, MICHIGAN, MINNESOTA, MISSOURI, NEBRASKA, NORTH DAKOTA, OHIO, SOUTH DAKOTA AND WISCONSIN.



## NCSRP MISSION:

NCSRP will serve as a bridge between state and national soybean organizations and will be the recognized leader in funding and communicating basic and applied soybean research programs that are highly collaborative and uniquely appropriate in addressing soybean production, profitability and environmental sustainability for growers across the North Central Region.

### NCSRP GUIDING STATEMENTS:

- 1. NCSRP Executive Board will review overall program impact and success, and establish specific research priorities of regional importance on a five year cycle (e.g. key diseases, insects, production practices, etc.).
- 2. NCSRP funded programs and projects will not be redundant with current state (QSSB) or nationally (USB) funded programs, but may complement and extend state or nationally funded projects when addressing the common interests and needs of North Central Region soybean growers.
  - NCSRP will maintain communication and collaborative connectivity with state QSSB's and with the USB in order to maintain awareness of state and national soybean research priorities and funding.
  - Regional researchers submitting proposals for NCSRP funding must provide clear statements of research being funded by a QSSB or the USB.
- 3. Multi-year research project or program proposals will be accepted for funding consideration, but annual renewal will be predicated on successful generation and communication of meaningful annual results.
- 4. NCSRP emphasizes the collection, compilation and dissemination of research results through appropriate peer reviewed scientific meeting abstracts and journals, Extension publications, farmer-focused bulletins, appropriate websites (Soybean Research & Information Initiative) and databases (National Soybean Checkoff Research Database).

### COLLABORATIVE SOYBEAN RESEARCH OBJECTIVES AND PRIORITIES:

- 1. Soybean yield enhancement through genetic improvement and biotic and abiotic stress mitigation for the soybean maturity groups 0 IV.
  - Classical and molecular soybean breeding efforts that will enhance yield potential and yield stability clearly focused to the North Central Region.
  - Research that addresses the control of insects and diseases (defensive traits) of consistent or potentially significant economic impact across the North Central Region.
  - Research that addresses weed resistance to herbicides for species of common occurrence and threat across the North Central Region.
  - Research that address soybean response to water, nutrient, soil and environmental conditions unique to the North Central Region.
- 2. Soybean production practices that will increase yield, profitability and environmental stewardship issues and respond to the markets need for high compositional quality specific to the North Central Region.
  - · Corn / Soybean rotations
  - Plant populations, row spacing and input management
  - Water quality and Watershed planning
  - Cover crops
  - · Soybean production sustainability and life cycle assessment

### LETTER FROM THE EXECUTIVE DIRECTOR

The 2016 annual report for the North Central Soybean Research Program (NCSRP) is chock-full of exciting and collaborative regional program and project updates, commentaries from farmer board members and updates on important communications activities as well as the Soybean Research & Information Initiative (SRII) website.

I am proud to represent our 12-member-state-staff and soybean farmers in thanking you for taking time to peruse this report. We hope you gain a deeper understanding and appreciation for the interdisciplinary and collaborative multi-state basic and applied soybean research and outreach programs. Soybean farmer leaders from across the Midwest prioritize, fund and track this research, bringing the greatest return on soybean checkoff investments for all soybean farmers in the region.

"I am proud to represent our 12-member-state staff and soybean farmers in thanking you for taking time to peruse this report."



As the NCSRP enters its 25th year, the primary goal of enhancing and protecting soybean yields without compromising quality and maintaining sustainable production systems has not changed. All of the NCSRP contract-funded research and outreach programs of 2016 and 2017 represent efforts by the region's best and brightest university researchers to partner with each other, farmers and companies to utilize and leverage approximately \$4 million annually. These projects aim to improve soybean yield potential and resistance to yield-robbing disease pathogens like soybean cyst nematode (SCN), sudden death syndrome, charcoal rot, white mold, stem canker, *Phytophthora* and other soilborne seedling diseases. There are studies directed at enhancing nitrogen fixation, understanding the role of micronutrients for soybean growth and development, leveraging biological control agents for yield protection, assessing soybean fungicide programs and benchmarking optimum soybean agronomics and production strategies for the north central region. Finally, NCSRP supports studies to understand and manage insect pests such as aphids and how best to bring soybean research to farmers through ever-improving Extension and outreach efforts.

In this annual report, you will find several research highlights. We wish to especially draw your attention to NCSRP support of the SCN Coalition, aggressive and coordinated work to accelerate soybean genetic gain for increased yield, multi-state programs to assess soybean agronomics and cropping systems for best practices and work on current and emerging insect pests. Even the greatest research will have no impact if it isn't communicated and understood. Check out the NCSRP Extension Group report and the SRII website to see how scientists are communicating with farmers. For more information, contact me or other NCSRP state staff, NCSRP farmer board members and any of the NCSRP-funded university researchers.

Enjoy reading the 2016 NCSRP Annual Report!

Ed Anderson, Ph.D. Executive Director, NCSRP eanderson@iasoybeans.com

### LETTER FROM THE PRESIDENT

Each state wins in the field of research when there is collaboration. It is increasingly important to fund research on the regional level. North Central Soybean Research Program (NCSRP) has allowed each of the 12 member states to advance their research portfolio in order to gain more information rather than relying solely on their own states.

One accomplishment during my time serving on NCSRP is the advancement of the Soybean Research & Information Initiative (SRII) website. The ability of any farmer to access the SRII website and obtain information they might want to know about any NCSRP related project from disease to yield advancement is incredible.

"It was my privilege to serve as NCSRP president in 2016. I really enjoyed the last six years serving on the board and especially the last year being the leader of the organization."



Another NCSRP project that has brought a lot of value to farmers is the renewed emphasis on soybean cyst nematode (SCN). SCN is our number one yield-robber and is costing the soybean industry \$1.5 billion in lost income per year. The recent National SCN Conference and the upcoming SCN Coalition will ensure farmers continue to have options in the fight against this pathogen.

You will read about both of these projects and many others in the following pages. I hope by looking through this report, you too will see the value of collaborative regional research.

It was my privilege to serve as NCSRP president in 2016. I really enjoyed the last six years serving on the board and especially the last year being the leader of the organization.

I want to extend a sincere thank you to all the current and past NCSRP board members for their cooperation, dedication, contributions and friendships. I would also like to specifically thank our executive director Ed Anderson, other state staff and all the communication and administrative staff for their guidance and leadership.

In 2017, NCSRP will celebrate 25 years of research. None of the many regional research and Extension projects funded by the NCSRP would have been possible without the collaborative spirit of everyone.

It has been an honor to serve on NCSRP and I have truly enjoyed the experience.

Cliff Mulder NCSRP 2016 President





## **SCN COALITION: TAKE TWO**

Farmers, industry and academia were brought together by the growing need for a second SCN Coalition.

Millions of dollars have been spent to combat the most damaging soybean pathogen in North America. The defense discovered decades ago is beginning to falter and researchers are concerned about the challenges ahead. As a consequence, the North Central Soybean Research Program (NCSRP) dedicated nearly \$200,000 to support a coordinated project that brought together nearly 40 university, checkoff and private scientists and growers in mid-December to share management information and discuss the development of the second Soybean Cyst Nematode (SCN) Coalition.

"There's a long history with the SCN Coalition because in the 90s when it originally started SCN was causing a lot of yield loss and growers didn't have the information to manage it," said Sam Markell, Ph.D., associate professor and extension plant pathologist for North Dakota State University. "We're in almost the exact same situation again because resistance is starting to fail. We need to look at it a different way."

The original SCN Coalition lasted only a couple years, but in that time thousands of growers across the North Central United States began testing for SCN and actively managing it. However, those same management tools are not working as well as they used to, and many growers don't realize that the pathogen is changing.

This issue doesn't affect one state or even one region. As of December 2016, SCN had been confirmed in more than 30 states, Puerto Rico and Southern Canada. SCN continues to spread within the states and is being confirmed in new counties and fields every summer. Unfortunately, the pace of the spread isn't expected to slow down any time soon.

Not helping the issue are several challenges unique to the SCN pathogen and how it has been handled

over the last few decades. The most concerning of which, is farmer's apathy toward the situation. As part of a 2015 survey, researchers found that 45 percent of farmers didn't think identifying SCN was important and of these farmers, 69 percent didn't think SCN was a serious issue. This means not only is SCN the biggest yield robber for North American soybean farmers, but many farmers aren't aware of the damage being caused.

"Growers a generation ago quickly learned about SCN and started managing it with the best tools they had," said Markell. "Once something is under control and being managed you don't tend to actively think about it as much. The problem with SCN is that it's been changing so the old tools aren't as good, meaning the growers aren't managing it as well as they thought."

Other challenges facing SCN researchers include biology, population dynamics and the definition of resistant. The way SCN attacks a soybean plant is through the roots, so until the damage is extremely severe, the leaves and canopy may appear healthy. This means casual scouting would not determine the issue. Soil sampling, testing and egg counts are necessary to determine how severe the problem is.



Photo above: Rich Stessman, Iowa Soybean Association. Photo right: Joseph L. Murphy, Iowa Soybean Association



IN WHAT TYPE OF GENETIC RESISTANCE THEY WILL USE." GREG TYLKA, IOWA STATE UNIVERSITY





### SCN REPRODUCTION

To explain how severe the SCN problem can get if not caught early, Greg Tylka, Ph.D., Iowa State University, offered a math exercise. If half a cup of soil starts with 100 eggs, around half of those eggs will be female and produce 250 additional eggs each. Even with a 95 percent egg mortality rate, after three generations there would be 24,414 eggs in that same half-cup of soil. Depending on the environment, most north central states will experience three to six SCN generations in one growing season, so that number could be exponentially higher for some farmers.

"Every 24 days a new generation of SCN is born," said Tylka. "That means they can go from below the threshold to problematic very quickly."

### DEFINITION OF RESISTANCE

Many farmers who know they have an SCN issue are planting a 'resistant' variety, but what does resistant mean? In science the definition is less than 10 percent reproduction across a single generation, measured in a greenhouse test. Legally there is no definition for SCN resistance so a bag of seed with 75 percent (or higher) susceptibility could be labeled resistant.

Research presented at the coalition showed that in a greenhouse study examining the level of reproduction on 61 different soybean varieties, 58 of which were labeled resistant, all but one of them allowed reproduction above the 10 percent scientific threshold. With the same varieties in a field setting, 40 of the 61 varieties allow high rates of reproduction. In other words, the majority of those varieties tested were technically not resistant.

"The problem with SCN is that it's been changing...Meaning the growers aren't managing it as well as they thought"

- Sam Markell, North Dakota State
University

### GENETICS

Adding to the resistance problem is the fact that the nematode is overcoming the two most common resistant soybean breeding lines, PI 548402 (commonly known as Peking) and PI 88788. Or stated another way, SCN populations are becoming resistant to the resistance. Reproduction rates of SCN on both sources of resistance have risen above the scientific threshold in most areas. In the early 90s there was almost no reproduction on the varieties with Peking and PI 88788 resistance, but overuse is leading to resistance problems for many farmers.

"There is a lack of resistance diversity in commercially available varieties leaving farmers with little to no choice in what type of genetic resistance they will use," said Tylka. "The usefulness of traditional resistant varieties will continue to decline and unfortunately new varieties with novel sources of genetic resistance aren't readily available."

All of these factors led to the need for the second SCN Coalition. The first part of which was to bring a diverse group of academia, industry and commodity groups together with farmers to discuss how to combat this pathogen. The event began with the 2016 National SCN Conference and concluded with the SCN Coalition meeting. Two days of research presentations and discussions led to a greater understanding among all of the groups of the collaboration that will need to take place to effectively manage SCN.



All 12 of the NCSRP states are involved in this project along with Kentucky, Oklahoma, Tennessee and Virginia, as well as a university in Ontario, Canada.

### BREEDING FOR YIELD

Soybeans have a long way to go to catch up with the yield growth in corn, but NCSRP researchers are up to the task.

One of the most frustrating issues in the soybean industry is the slow rate of yield gains when compared to corn. A project funded by the North Central Soybean Research Program (NCSRP) hopes to change that by emphasizing collaboration, genetics and other technologies.

An "Initiation of a genomic selection pipeline for public soybean breeders in the North Central Region," project led by Aaron Lorenz, Ph.D., University of Minnesota, was funded last year. For 2017, the NCSRP Board approved a \$1.1 million project that expanded the scope of the work and research team as part of a larger, three-year project to increase the rate of genetic soybean yield gains. Each of the following years, if approved, will also require investments in excess of \$1 million.

The willingness to invest so much in a breeding project didn't come as a surprise to NCSRP Executive Director Ed Anderson, Ph.D.

"It's what farmers have been asking for," Anderson said. "We are driving that return on investment that we always talk about. This is *the* breeding for yield project."

Given their strategic goals to increase and protect soybean yield, the NCSRP has always made significant investments in breeding for increased yield potential. Previously, contract research dollars were distributed across several independent or loosely coordinated projects. Anderson said the organization previously funded multiple yield research studies that totaled about the same amount of money.

To improve collaboration, leverage expertise and reduce redundancy, NCSRP leaders decided that one coordinated, multi-disciplinary and multi-university yield program would ultimately garner better results.

The 2016 project was funded at approximately \$369,000 and focused on genetic variation, breeding cycle time and sizes of breeding populations. In addition, breeding performance evaluations were analyzed as targets that would benefit from an integration of genomics and whole-genome genotyping with multi-location yield testing, phenotyping and selection.

The 2016 project, led by Lorenz, will be carried forward into 2017 under a new name. Led by Leah McHale at The Ohio State University and entitled, "Increasing the rate of genetic gain for yield in soybean breeding programs," the project is a collaboration among seventeen researchers from nine Midwestern universities.

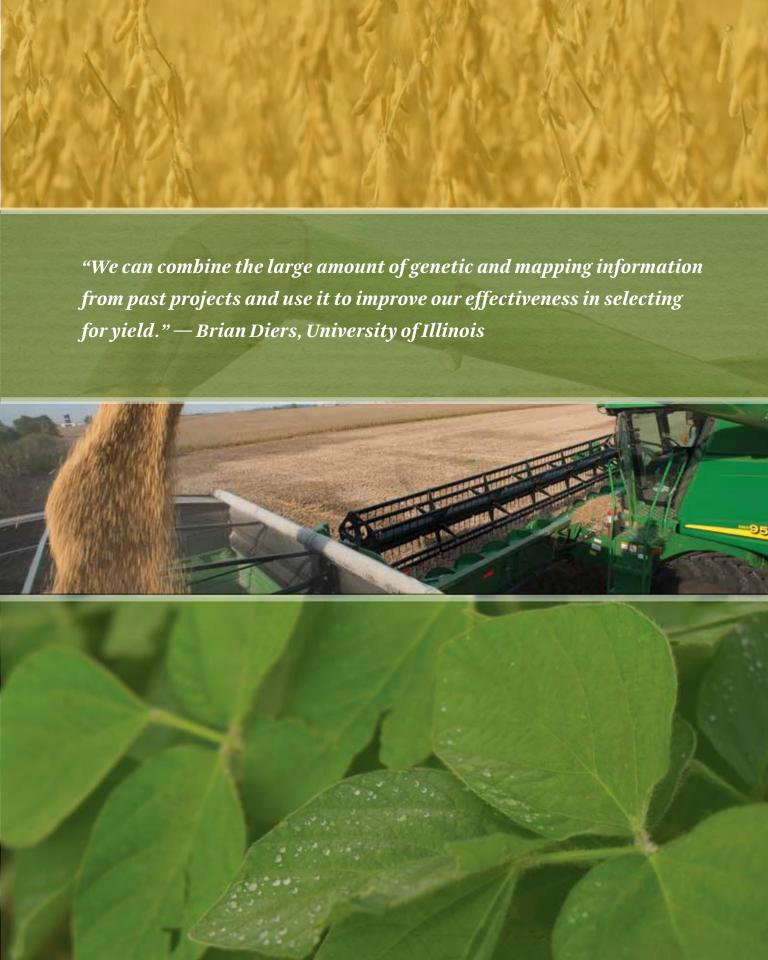
Brian Diers, Ph.D., a soybean breeder in the Department of Crop Sciences at the University of Illinois who is working on the project, said previous checkoff-funded programs helped develop new genomic tools that breeders will use as part of the new yield research.

"This is *the* breeding for yield project. It's bringing a lot of expertise to tackle the problem." — Ed Anderson, NCSRP Executive Director





Photo above left: Indiana Soybean Association, Photo above right: Allie Arp, Iowa Soybean Association, Photos on opposite page: Jospeh L. Murphy, Iowa Soybean Association



Once methods to improve yield are developed at universities, they will be shared with the private sector so they can take advantage of the developments from this research.

Here are the project's four main objectives:

# Increase selection intensity and decrease non-genetic sources of variability

The plan is to improve selection accuracy via more precise and predictive testing of new potential varieties based on plant growth, behavior and yield under varying environmental conditions and maturity groups.

# Increase selection intensity and decrease the length of breeding cycles through genomic selection

This integrates genomic, phenotypic and environmental data to model and predict the performance of potential varieties that can decrease the time required to develop varieties and therefore accelerate product development.

# Increase diversity for genes that can increase yield

The research addresses the fundamental limitation of soybean breeding: A lack of genetic diversity in the commercial soybean gene pool. Exotic soybean germ plasm and close soybean relatives will be more closely studied to find yield genes and other beneficial traits.

# Develop advanced analytical methods to consistently separate genetic yield potential from other variables

These variables would include the environment, agronomics and plant stressors in order to consistently estimate actual annual genetic yield gain.

Diers is optimistic that yield rate-of-gain improvements will occur.

"With improved models, we should be able to discard potential varieties early in the breeding process that are unlikely to yield well," Diers said. "That should speed breeding gains."

According to the project overview, soybean yields have increased, on average, .43 bushels per acre per year. Conversely, corn yields have generally increased 1 to 1.2 bushels per acre annually.

Researchers and farmers hope the venture will eventually increase the annual rate of genetic gain by .5 bushel per acre, so the annual rate more closely mirrors corn. If that happens, the return on investment will be huge.

Last year 83 million acres of soybeans were harvested nationwide, according to government statistics. An extra .5-bushel-per acre would have equaled 41.5 million bushels of soybeans. At \$10 per bushel, that equates to an extra \$415 million of revenue for soybean farmers.

Experts say yield is a difficult trait to select for in soybeans, more so than corn. Plant physiology and composition is different and it takes more energy to produce a pound of soybeans than corn.

But Anderson said the task isn't insurmountable. The new, highly integrated and collaborative project will help.

"It's leveraging interdisciplinary approaches — classical and molecular breeding, computational biology, engineering, agronomy and environmental science," Anderson said. "It's bringing a lot of expertise together to tackle a problem."

In addition to Ohio and Illinois, researchers from Indiana, Iowa, Kansas, Michigan, Minnesota, Missouri and Nebraska are contributing to the project.

Soybean yields have increased, on average, .43 bushels per acre per year.

**LAST YEAR** 

# 83 MILLION ACRES

OF SOYBEANS WERE HARVESTED NATIONWIDE, ACCORDING TO GOVERNMENT STATISTICS. AN EXTRA .5-BUSHEL-PER ACRE WOULD HAVE EQUALED 41.5 MILLION BUSHELS OF SOYBEANS.

AT \$10 PER BUSHEL, THAT EQUATES TO AN EXTRA

\$415 MILLION OF REVENUE FOR SOYBEAN FARMERS.



# SOLVING THE SOILBORNE DISEASE MYSTERY

Research funded by NCSRP is looking at elusive soilborne diseases and how to combat them.

Soilborne disease can be mysterious and elusive — often showing up in strange places and not reacting to treatments. Two studies funded by the North Central Soybean Research Program (NCSRP) are seeking to solve the mystery behind these diseases

One study seeks to understand and diagnose seedling diseases while the other is taking a long look at the pathogen resistance to genes that have traditionally provided protection against stem rot. Both studies will provide farmers with more information and options for managing soilborne diseases.

### **Seedling diseases**

When a seedling disease appears it can be very hard to determine what is causing the disease and how to treat it. This lack of information and delay often results in yield loss.

Jason Bond, Ph.D., professor at Southern Illinois University – Carbondale, is leading a study titled "Seedling Diseases: Biology, Management and Education" to help provide information on how farmers can identify, treat and manage the challenges presented by seedling disease.

Identification of a specific disease can be extremely difficult. Bond's project is working to make the process easier by providing a polymerase chain reaction (PCR) template that compares a sample of the disease to the 10 most common pathogens, providing a diagnosis in less than 24 hours.

"Having access to this information would be huge for farmers as they make decisions about treatment and replant," Bond said. "We are currently in the evaluation phase of the study, but we are looking forward to making this available to disease clinics throughout the entire country." Bond and his collaborators are also looking at the biology of pathogens causing diseases. The complexity of the issue is of particular interest because each field and farm can differ to extremes. Each field is a mix of good and bad organisms and can be influenced by cropping history, temperature and timing.

# "Having access to this information would be huge for farmers as they make decisions about treatment and replant," Bond said.

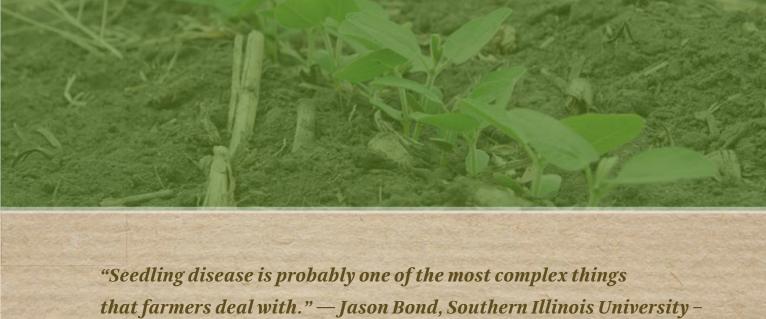
"Seedling disease is probably one of the most complex things that farmers deal with on their farms," Bond said. "Everything they do from rotation, to cover crops, varieties planted, etc. all those things have a big impact on whether farmers see seedling diseases and how severe they might be. They need to be aware of where disease is on their farm since these diseases typically show up in the same place year after year."

Bond reiterates that the best information a farmer can have is from trials on his or her own farm.





Photo above left: University of Wisconsin, Photo above right: University of Minnesota, Photos on opposite page: Jospeh L. Murphy and Allie Arp, Iowa Soybean Association



 $that farmers\ deal\ with."-Jason\ Bond, Southern\ Illinois\ University-$ Carbondale



"Once farmers have tested a product on their farm and observed the way it performs, that is more valuable information than 100 Extension people or crop advisors because no one is more of an expert on a farm than the farmer," Bond said. "So often we want someone to tell us, but the best data is what farmers see in their own fields."

States collaborating on the project include Iowa, Kansas, Michigan, Minnesota, Nebraska, North Dakota and South Dakota.

#### Stem rot

Farmers have been battling *Phytophthora* caused seedling diseases and stem rot for almost 60 years, but the pathogen keeps changing and is undergoing yet another evolution.

Anne Dorrance, Ph.D., professor at The Ohio State University, and a team of investigators across the NCSRP region are looking at how resistance has evolved and what new combinations of genes will protect against the changing pathogens in a study titled "Characterization of *Phytophthora sojae* and *Phytophthora sansomeana* populations in the North Central Region and an assessment of management strategies."

Historically, the disease has been managed with single resistance genes, but the genes have been over-used and the pathogens are adapting, according to Dorrance.

A study from 2012 was the launching point for the research and provided some initial evidence that the resistance genes used in many of today's soybean varieties are no longer effective. Dorrance and collaborators are building on that study by looking at a new group of genes to see how resistant pathogens respond.

"Preliminary data supports that there will be differences across the NCSRP region," Dorrance said. "It is important that each state start to work to evaluate their individual area."

Additionally, once genes are identified, it takes a while to work them into soybean varieties that are available on the market. Dorrance advises farmers to consider resistance issues when making seed selections.

"As farmers are buying seed for the next year, they shouldn't just focus on the yield data," she said. "Focus on the package that will fit the farm. Knowing what problems there are will save a lot of money down the road. We don't know what type of weather we will get this year, but if a farmer knows their cyst populations and *Phytophthora* pressures and focuses on that, they can make sure the check marks are in the right column when looking at seed. It will save a lot of yield."

Farmers in the North Central region who have seen *Phytophthora* or have had stem rot issues and are interested in participating in the study can contact Dorrance at dorrance1@osu.edu or call 330-202-3560.

States participating in the study include Illinois, Indiana, Iowa, Kansas, Michigan, Minnesota, Nebraska, Ohio and South Dakota.

"Preliminary data supports that there will be differences across the NCSRP region," Dorrance said. "It is important that each state start to work to evaluate their individual area."



Photo above: Jospeh L. Murphy, Iowa Soybean Association

# BENCHMARKING PRODUCTION: REGIONAL PROJECT LOOKING TO CLOSE SOYBEAN YIELD GAP

The difference may be closer than previously thought.

The average soybean yield in the North Central region of the United States is around 45 bushels per acre, yet some producers consistently attain yields near or greater than 80.

This "yield gap" between average farm yield and higher yields by individuals has become the focus of a study co-led by Patricio Grassini, Ph.D., University of Nebraska cropping system specialist, and Shawn Conley, Ph.D., University of Wisconsin soybean and wheat extension specialist.

The project was funded by the North Central Soybean Research Program (NCSRP) in 2016 and 2017 with extra support from the Nebraska Soybean Board and the Wisconsin Soybean Marketing Board. The multistate project studies soybean yield and management practices across a total of ten states. Identification of key management factors can be leveraged by farmers to improve agronomics and management for yield and profitability in their operations.

"We believe that when producer reports are available for thousands of fields, over many years, it is possible to discern the yield impact of individual factors," said Grassini. "The relative importance of these factors in the context of commercial-scale fields and within the range of cost-effective management practices being used by producers is where the true value is."

The most common approach to identifying yield-limiting factors in producer fields involves conducting on-farm trials, in which researchers selectively apply different input levels or management practices in small experimental plots or larger replicated strip trials. For this study, Grassini and Conley took a different approach. They collected and analyzed self-reported yield and management data from producers.

In year one of the three-year study, data were collected from 3,568 soybean fields planted in the 2014 and 2015 growing seasons. Research covered 311,300 acres

and 10 states in the North Central region.

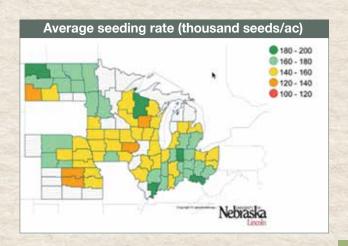
While results are still being analyzed at the time of publication, a few trends have emerged:

- Narrow row spacing (less than 22 inches) is prevalent across the Midwest
- Most farmers are using seeding rates between 140,000 and 180,000
- · Very few farmers use a starter fertilizer
- · Most farmers are using a seed treatment
- Very few farmers know if soybean cyst nematode is present in their fields

The ultimate goal of the study is to narrow the yield gap to help farmers improve their overall profitability.

"You first want to know what farmers are doing and then try to benchmark their yields and practices against what they should be doing to achieve top yields in a given state," said Conley. "There are no silver bullets to boost yields."

In addition to Grassini and Conley, the project includes collaborators in eight other states: Illinois, Indiana, Iowa, Kansas, Michigan, Minnesota, North Dakota and Ohio. The 10 states account for 70 percent of U.S. domestic soybean production and 25 percent of soybean production globally.



# INSECT PEST RESEARCH A FOCUS FOR NCSRP

Researchers are looking at both harmful and helpful insects in ground-breaking research.

The North Central Soybean Research Program entomology project led by Kelley Tilmon, Ph.D., has a long history of working to solve existing and new insect problems in soybeans.

Comprised of 18 research and extension scientists in 12 states, Tilmon, an associate professor at The Ohio State University, and her team, seek to find economical and sustainable solutions for insect pest management.

"We want to stay a step ahead and deal with these problems proactively," Tilmon said. "Our goal is to

find pest management solutions for profitability that are sustainable for soybean producers over the long-term."

Tilmon shared an update on the following objectives but noted education and communication



Photo: Iowa State University

are an important component in this project. Her team provides regular progress updates and articles so farmers can make educated management decisions.

"We take our outreach very seriously," Tilmon stated. "I think sometimes lack of outreach is an Achilles heel with agricultural research; but a positive of our project is that communication is incorporated into our budget from the start."

## Insecticidal seed treatment return-on investment (ROI)

Farmers are accustomed to paying as much as seven dollars per acre for insecticidal seed treatments. But does the investment pencil-out over conventional scouting and integrated pest management (IPM).

Tilmon, along with researchers from eight other NCSRP states are collaborating to answer that question. Data gathered thus far suggests it does not.

"We've found that there's a much higher probability of economic return with an IPM approach including scouting and applying a foliar insecticide," Tilmon stated. "Not only does it offer a better chance for a return, but there is a greater overall net return. "

### Contribution of pollinators to soybean yield

As a self-pollinated crop, soybeans don't depend on insects to produce; but one study shows that bee pollinators may further improve yield.

"For a long time people assumed that pollinators had nothing to do with soybean yield," Tilmon said. "But there's more and more evidence that that's not true."

Tilmon and her team have found more than 60 different pollinator species in soybean fields across the North Central region. Tilmon and NCSRP researchers are evaluating the benefit of these pollinators to soybeans. Some studies suggest a healthy pollinator community can increase yield by as much as 10 bushel per acre.

Studies like these help demonstrate protecting pollinators goes beyond saving the bees — it can save the bottom line.

#### **Additional studies**

Economic return of aphid-resistant soybean varieties, aphid resistance to pesticides and emerging pest challenges like stink bugs are also included in NCSRP entomology research. Additional information and results can be found on soybean researchinfo.com.

Along with Ohio, other NCSRP states collaborating on the entomology project include Illinois, Indiana, Iowa, Kansas, Missouri, Minnesota, Nebraska, North Dakota and South Dakota.

## COMMUNICATING RESEARCH

Research not communicated well is not good research. Some scientists are working to improve how research is shared.

Having the latest information is critical for the success of farmers, but research results are often delayed until a project is fully completed. This leaves a lag between when research could have the most impact and when it is actually implemented. Researchers funded by the North Central Soybean Research Program (NCSRP) hope to change that.

"Research is conducted by many entities, not all of which require reporting outputs to end users," a proposal for the project titled "Soybean Extension Group: Bringing science to farmers" noted. "Our group bridges the gap between research and Extension and provides farmers with the most up-to-date information."

Previously the North Central Disease Study Group, the researchers expanded to provide additional information to farmers. Led by Kiersten Wise, Ph.D., Purdue University, a group of nine from across the Midwest have made a commitment to bridge the gap between research and Extension. Their goal is to provide farmers and other stakeholders with the most up-to-date information about soybean management. The newly named Soybean Extension Group will now provide agronomic and pest information.

The group has already developed 13 publications in the form of papers, scouting cards or fact sheets. Those publications have been downloaded more than 68,000 times and incorporated into a DuPont Pioneer training course. Researchers are relying on feedback from farmers and other users for topics of future publications in addition to areas where they see a need. Cercospora leaf blight, soybean viruses and fungicide resistance in soybean foliar diseases are just a few of the topics they hope to cover in the coming year.

"The project is continuing previous work and expanding to address new areas," the most recent report said. "Incorporating agronomic and insect information and developing new integrated publications," are important to the continuous improvement of the group.

In addition to increasing the subjects covered in traditional publications, the new group will also have a larger presence online. Researchers involved in the project will dedicate time to the improvement and updating of content on the Soybean Research & Information Initiative site (SRII). They will also produce new content for the site. As one of the NCSRP's largest communication vehicles, this commitment to keeping SRII updated is important.

Other states involved in the project include Iowa, Michigan, Nebraska, Ohio and Wisconsin. In addition to the NCSRP investigators, collaborations with universities in Kentucky and Ontario, Canada are helping expand the variety of information researched and the reach of the publications.

Cercospora leaf blight, soybean viruses and fungicide resistance in soybean foliar diseases are just a few of the topics they hope to cover in the coming year.



Photo: University of Wisconsin



Photo: X. B. Yang, Department of Plant Pathology, Iowa State University

# SRII CONTINUES TO INFORM AND EDUCATE

NCSRP's most used platform helps farmers across all 12 member states.

The main communications medium of the North Central Soybean Research Program (NCSRP) continues to be the Soybean Research & Information Initiative (SRII website).

"Making the latest research and information available to our soybean farmers is a great asset," said Keith Kemp, NCSRP director from Ohio. "With all the information you have at your fingertips, it's giving you a tremendous edge on soybean production that other grain farmers don't have."

Twenty-two research progress stories were added to the Research Highlights section in 2016. The updates are intended to provide information that is directly useful to farmers in their decision-making process. The stories always include links to web, print, or video resources for background or more detailed information. These progress reports provide soybean producers an overview of the topics and the quality of research being done with their checkoff dollars.

A unique feature of SRII is the Soybean Resource Library, a valuable collection of current publications, field guides, videos and webinars on soybean production in the north-central region. Most of the collection is from land-grant university Extension programs and other checkoff-funded research.

Publications added to the library in 2016 covered topics such as fungicide and seed treatment efficacy, preemergent herbicide treatments and numerous scouting brochures. To stay up-to-date on the latest in NCSRP- and other checkoff-funded research, visit soybeanresearchinfo.com.

### **Digging deeper**

When a new research highlight is posted on SRII, it is also uploaded directly to the homepage of the National Soybean Checkoff Research Database (soybeanresearchdata.com), to provide farmers and researchers outside the region with updates as well.

"The National Soybean Checkoff Research Database was funded by the United Soybean Board and was developed as a way to build upon and enhance previous databases of checkoff-funded basic and applied research," said NCSRP executive director, Ed Anderson, Ph.D.

"It serves as a useful source of historic and current research proposals, budgets, results and listings of the researchers conducting the work. This centralized information brings knowledge to farmers, staff and researchers in order to drive the greatest return-on-investment, ensure that research results are being used and decrease redundancy in the execution of future research projects."

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director, Ed Anderson, Ph.D.



soybeanresearchdata.com



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Conglet Comm Season

Staying on top of all the latest ag fechnology, field data and research can be overwhelming. That's why the Sophean Research & Information Initiative, formerly the Plant Health initiative, continually provides you with access to expert information and news about seybean pests, diseases, and agronomics. The aim of this check off-funded website is to communicate the en-poing progress and current understanding coming from your active and wide-ranging U.S. soybean research programs. Please visit often!

ABOUT NCSRP SOYBEAN DISEASES SOYBEAN PESTS DIAGNOSTIC TOOLS AGRONOMICS

Common (annual process)

Search SRII for detailed information on soybean diseases, pests, tools and agronomics.

Scroll through the Research Highlights, where research projects are showcased on SRII each month.

### NCSRP NORTH CENTRAL SOVERAN



The North Central Soybean floscarch Program, a collaboration of 12 state soybean associations, invests soybean checkelf funds to improve yields and profitability via university research and extension. Vialit Site

NCSRP MISSION: Our mission is to maximize producer returns to occurrent management of the popular research efforts, minimizing duplication of recearch, and assuring that regional research projects are targeted at problems of the North Central soybean producer.

#### PARTNERS:

University of Binois Southern Binois University Iowa State University Kansas State University Michigan State University University of Minnesota University of Missouri University of Nebraska North Dakota State University Onio State University Pundue University South Dakota State University University of Wissounsin

Your Soybean Checkoff. Delivering Results.



#### RESEARCH HIGHLIGHTS

Progress of a Genomic Selection "Pipeline" for Public Soybean Breeders in the North Central Region

Sat Feb 4, 2017



by Aaron Lorenz, Soybean Breeder, University of Microsofa

The aim of plant breeding has always been to link phenotype with genocype. Our selections to date are based mainly on phenotype – the yield of a soybea line over many years and locations – so we can be confident that it will perform at that level in farmers' fields.

Because it is both necessary and expensive to generate this field data, we are putting it to maximum use by also collecting genetypic data of the lines and using it in the selection process. A powerful approach to make use of genomic information for selective breeding is through a method called genomic prediction and selection. Read more...

#### Soybean Aphid Genome Complete!

Fri. Jan 27, 2017



by Andy Michel, Field Crops Entomologist, Ohio State

in the course of generating DNA sequences with projects funded by The Ohio Soybean Council and The North Central Soybean Research Program, we were able to sequence the entire soybean aphild genome.

This genome represents the 4th aphild species with a completely described genome (in addition to the pea aphild, Russian wheat aphid, and green peach spid). It will further advance our ability to identify soybean aphild genes responsible for overcoming resistant soybean.

and hopefully lead to a wider use of aphid-resistant soybean. Read more...

#### Update on the Efficacy of Fungicide Programs on Charcoal Rot Development

Tue, Dec 20, 2016



by Kiersten Wise, Soybean Plant Pathologist, Purdue University

New seed and foliar fungicide programs and fungicide products have been marketed to protect scybeans against soll-borne diseases and plant stress. In a



SOYBEAN CHECKOFF RESEARCH DATABASE Search and explore all U.S. soybean checkoff research projects. Visit the National Soybean Research Database



CURRENT NCSRP-FUNDED RESEARCH Our model is collaborative, muti-state research. Here are the latest

projects and progress reports. View the NCSRP funded research projects



VIEW THE 2015 NORTH CENTRAL SOYBEAN RESEARCH PROGRAM REPORT



Read new NCSRP publications online\_Click Here For More SCOUTING FOR SUDDEN View the National soybean Checkoff Research Database to get detailed information on research projects throughout the country.

The SRII resource library houses hundreds of publications and materials that can easily be downloaded to any device.

# FARMER COMMENTS

### **Craig Converse - South Dakota**

Belonging to the North Central Soybean Research Program (NCSRP) has benefited South Dakota by leveraging our checkoff dollars to work on projects that are not only important here, but throughout the upper Midwest region. Working together on large research projects we can accomplish more than what each individual state can do alone. This reduces the redundancy of each state working on similar projects and focuses the farmers' checkoff dollars on projects that will have the greatest benefit for the region.

### Dave Rodibaugh - Indiana

Many of the challenges in soybean production are common throughout the North Central region. It makes sense to pool dollars and talent to achieve results. The staff is committed to encouraging cooperation among researchers and the directors are earnest in pursuit of research projects that will address real needs.

#### Cecil DeMott - Missouri

I personally believe in NCSRP because I like the regional approach to solve relevant issues with multi-state researchers.

### Keith Kemp - Ohio

NCSRP is a great way for all of us to collaborate with all of our research people and work together to spend our dollars wisely, rather than each researcher working on their own. Funneling all our projects to a central source and having all researchers collaborate together is a great tool. It's the best money spent to get money back on your dollars in research because we're coordinated so well.



MATT DANUSER
Marion, ND



CRAIG CONVERSE Brookings, SD



LARRY TONNIGES
Utica, NE



RON OHLDE Palmer, KA









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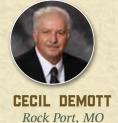
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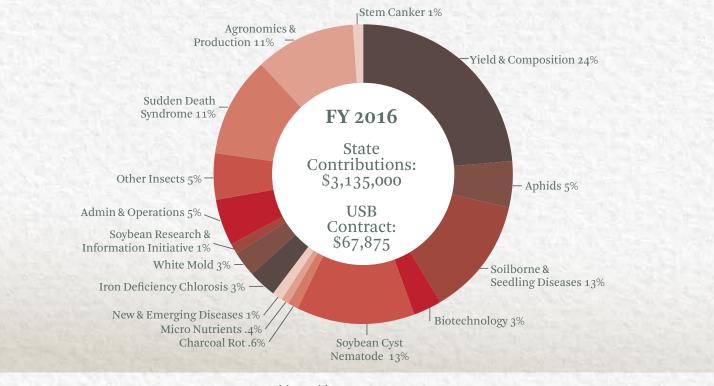


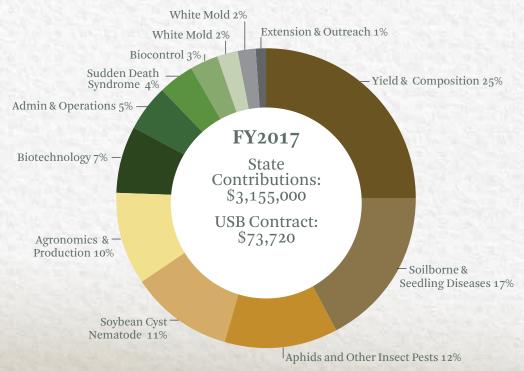














### North Central Soybean Research Program

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