NCSRP

NORTH CENTRAL SOYBEAN RESEARCH PROGRAM

2022 RESEARCH REPORT

The NCSRP draws its funding for research from 13 state checkoff boards in the North Central United States. Farmer leaders, state staff and funded researchers work together to prioritize, monitor and communicate the basic and applied science efforts on behalf of more than 350,000 soybean farmers in the region, representing more than 85% of the nation's soybean production.

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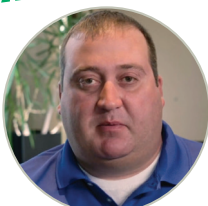**Justin Rone**
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FROM THE EXECUTIVE DIRECTOR

Welcome to the 2022 NCSRP Research Report. I am delighted that you have taken some time from your busy schedule to read and review this report. As always, the 13 NCSRP farmer board members, numerous state staff, university researchers and extension personnel, other contributors and partners have worked diligently to apply a portion of the soybean checkoff funds — contributed by more than 350,000 farmers across the Midwest — to support, track and report on the highest priority production research for short- and long-term success of soybean farmers everywhere.

Again in 2022, the NCSRP provided sustained funding for large, multi-disciplinary and multi-university basic and applied research programs. These projects are directed at increasing soybean genetic gain and yield potential, protection from soybean insect pests, disease pathogens, weeds and abiotic stressors, improved soybean agronomics and cropping systems, and the communication of soybean research. In addition, the NCSRP continued to provide national leadership through the U.S. Soybean Research Collaborative (USSRC). This program supports state QSSBs, regional organizations, and the United Soybean Board in looking up and down the soybean value chain to bring awareness and opportunities for novel research, tools, technologies and partnerships that increase farmer productivity, profitability, sustainability, and market options for soybeans and soybean products.

Finally in 2022, the NCSRP played a key role in developing a funded partnership with the Atlantic, South, and Mid-South regional organizations and USB to support a multi-regional soybean research project.

For more information on these exciting NCSRP research endeavors, please continue to read this report and visit the Soybean Research and Information Network (SRIN) website at soybeanresearchinfo.com. Thank you for your support of NCSRP and best wishes!

— Ed Anderson, Ph.D.
eanderson@iasoybeans.com

FROM THE PRESIDENT

This past agricultural season has been the same as it is nearly every year — filled with challenges. The North Central region has seen areas of drought, heavy rainfall, increased disease and insect pressure, and fluctuating soybean markets.

Scientists across the country are committed to studying improved technology and genetics to help us farm better under many circumstances. The NCSRP board, of which I've been proud to lead again this year, has funded numerous projects over the years that have helped me and my fellow farmers stay productive and profitable. We have made great strides in leveraging funds from Qualified State Soybean Boards (QSSBs) and collaborating partners to increase the investment in research that's most important to farmers.

In 2022, the NCSRP funded nine research projects covering topics from genetic gain to pest and disease management to weed control. The projects are multi-faceted, multi-state and multi-institutional — reflecting the true nature of what the NCSRP is about. I encourage you to visit the Soybean Research & Information Network (SRIN) website to learn more about these topics and projects. The SRIN is supported by NCSRP and is the central resource for research results in our region as well as other research across the country.

As the pandemic wanes and life returns to normal in the United States, the NCSRP Board continued to meet and work on your behalf for improved soybean production and health in both the short-term and the long-run. The research community behind the soybean is strong and committed to its improvement. The NCSRP Board is full of smart, enthusiastic soybean growers who are here to serve you. In my opinion, that's a winning combination.

Thank you for the opportunity to serve as your NCSRP president.

— Ed Cagney
FY22 NCSRP President

PROJECTS FUNDED IN FY2022

1. **An Integrated Approach to Enhance Durability of SCN Resistance for Long-Term Strategic SCN Management (Phase III)**

   Principal Investigator: Andrew Scaboo, University of Missouri

   The lack of genetic diversity in SCN resistance has increased its prevalence and reduced the effectiveness of current resistance sources. The project's objectives would enable scientists to develop more efficient SCN management practices. The main challenge of the project is to identify SCN virulence genes to understand how the nematode adapts to reproduce on resistance varieties. The team will then use these molecular markers to monitor nematode population shifts in the field. The team is also testing experimental lines developed by public breeders. The final objective is to continue to increase the genetic diversity of SCN resistance in commercially available soybean varieties.

2. **Boots on the Ground: Using Data-Driven Knowledge for Profitable Soybean Management Systems**

   Principal Investigator: Shawn Conley, University of Wisconsin-Madison

   This project will address return-on-investment of soybean management issues at the field level, including pre-plant pest management, seeding rates and costs, and other input factors. The goal is to develop a database tool with three years of farmer management information from the North Central region, as well as yield data, soil properties, weather and remote sensing information. The outcomes include a profit optimization evaluation to identify optimum management practices for increased profitability, and a subset of selected farms that will demonstrate the developed tool.

3. **Comparison of Non-Chemical Control Methods as Part of an Integrated Weed Management Strategy in Soybean**

   Principal Investigator: Kevin Bradley, University of Missouri

   Weeds with multiple herbicide resistances and a lack of new chemistries have resulted in the need to assess and integrate non-chemical weed control methods with herbicides for more effective weed management programs. The project evaluates weed electrocution in six states with the Annihilator 6R30 weed zapper as a method of preventing weed seed production for common Midwest weeds. A second non-chemical treatment is included at each location as a comparison to electrocution, such as in-row cultivation, hand weeding, windrow burning, weed seed grinding mills, and others.

4. **Mapping Soybean Protein and Oil Quality in Farmer Fields**

   Principal Investigator: Ignacio Ciampitti, Kansas State University

   Attention to soybean seed quality is increasing among farmers, agronomists and commodity traders. Higher nutritional content of U.S. soybeans can help in marketing efforts and increase their economic value. Measuring soybean protein and oil content used to require laboratory analysis of collected seed samples. Recent projects in Kansas and Iowa focused on calibrating near infrared (NIR) sensors to produce soybean quality maps. This project will develop a database to benchmark agronomic practices, soybean genetics, management and environmental conditions for soybean quality predictions at regional levels that can lead to large-scale improvements in soybean quality. By the end of the project, the team intends to have an online interactive simulation tool to show in-field predictions based on remote-sensed data and seed quality collected from the sites.

5. **Multi-Dimensional Approaches for Improved Productivity, Sustainability, and Management of Major Soybean Diseases in the North Central U.S.**

   Principal Investigator: Damon Smith, University of Wisconsin-Madison

   Soybeans are susceptible to an array of disease-causing microbes that can result in significant costs for the farmer and the environment. The goal of this project is to develop improved strategies for the sustainable management of major soybean diseases in the North Central region. Many factors can affect soybean pathogens including weather changes, cropping systems, and fungicide resistance. Researchers will explore prediction tools for stem canker and sudden death syndrome; monitor fungicide resistance; and conduct foliar fungicide trials for white mold, frogeye leaf spot and *Diaporthe* diseases to better understand the biology of emerging soybean diseases.

6. The Second SCN Coalition: Building on Economic Impact

Principal Investigator: Samuel Markell, North Dakota State University

The SCN Coalition continues its expansion and this project will focus on communications efforts to explain research developments that answer the 'why' questions, and expand the voice of growers such as in the "Let's Talk Todes" videos. The SCN Coalition will include other economically important nematodes to soybeans, such as the root-knot nematode, and diseases impacted by SCN. This expansion is consistent with the National Soybean Nematode Strategic Plan. Project objectives include maintaining and recruiting industry partners; management of the coalition including training, educational materials development, and meeting facilitation; and the continuation of communication with media, farmers and partners.

7. Soybean Entomology in the North Central Region: Research and Extension on Emerging Soybean Pests

Principal Investigator: Kelley Tilmon, Ohio State University

This project involves collaborative research work on four main areas: soybean gall midge; easier scouting methods for stink bugs; aphid-resistant soybean varieties and virulence management; and extension and outreach.

The soybean gall midge objectives include expanding the emergence monitoring program, and screening germplasm for midge resistance traits to help with breeding midge-resistant varieties. The team will look at mowing and tillage as cultural controls. Also, the team will conduct surveys in new areas to determine the midges' range. A second objective includes monitoring stink bugs using sticky traps and pheromone lures as possible alternatives to sweeping vegetation for better scouting. Objective three includes work with aphid insecticide resistance and testing new chemistries. Lastly, the results of these studies will be communicated to farmers to help them employ best management practices.

8. SOYGEN 2: Increasing Soybean Genetic Gain for Yield and Seed Composition by Developing Tools, Know-how and Community Among Public Breeders in the North Central U.S.

Principal Investigator: Leah McHale, Ohio State University

The SOYGEN2 (Science Optimized Yield Gains across Environments) team is working to add value to the Northern Uniform Soybean Trials (NUST), which have been conducted since 1941. They will add environmental data to NUST, and add genotypic data to the NUST and the SCN Regional Trials. The second objective focuses on the development and use of high-throughput genome-wide genotyping technologies and making these tools widely available. Objective three will evaluate different breeding methods that target areas of trait improvement such as yield and seed protein content. Breeders will test methods to determine which are most viable to improve genetic gains. The fourth objective is to complete and follow-up the evaluation of diverse soybean genotypes from the USDA Soybean Germplasm Collection to obtain high-quality phenotype and environmental data.

9. Weed Seedbank Depletion: Investigating an Overlooked Benefit of Cover Crops

Principal Investigator: Sarah Lancaster, Kansas State University

Cover crops are an accepted weed management practice for their ability to reduce emergence and growth of weeds such as Palmer amaranth and waterhemp. There is little information about how cover crops affect the viability of weed seeds present in the soil. Reducing the weed seedbank has potential to improve management of herbicide-resistant weeds by reducing weed density in the years following cover crop usage. This project will investigate Palmer amaranth and waterhemp seed germination in plots with and without a cereal rye cover crop. Germination results will be evaluated from seeds at field sites in five states.

Individual research project summaries can be found online at:

ncsrp.com/annual-reports/

COLLABORATIVE CULTURE

NCSRP research projects awarded in FY22 involve:

98 Principal Investigators and Co-PIs
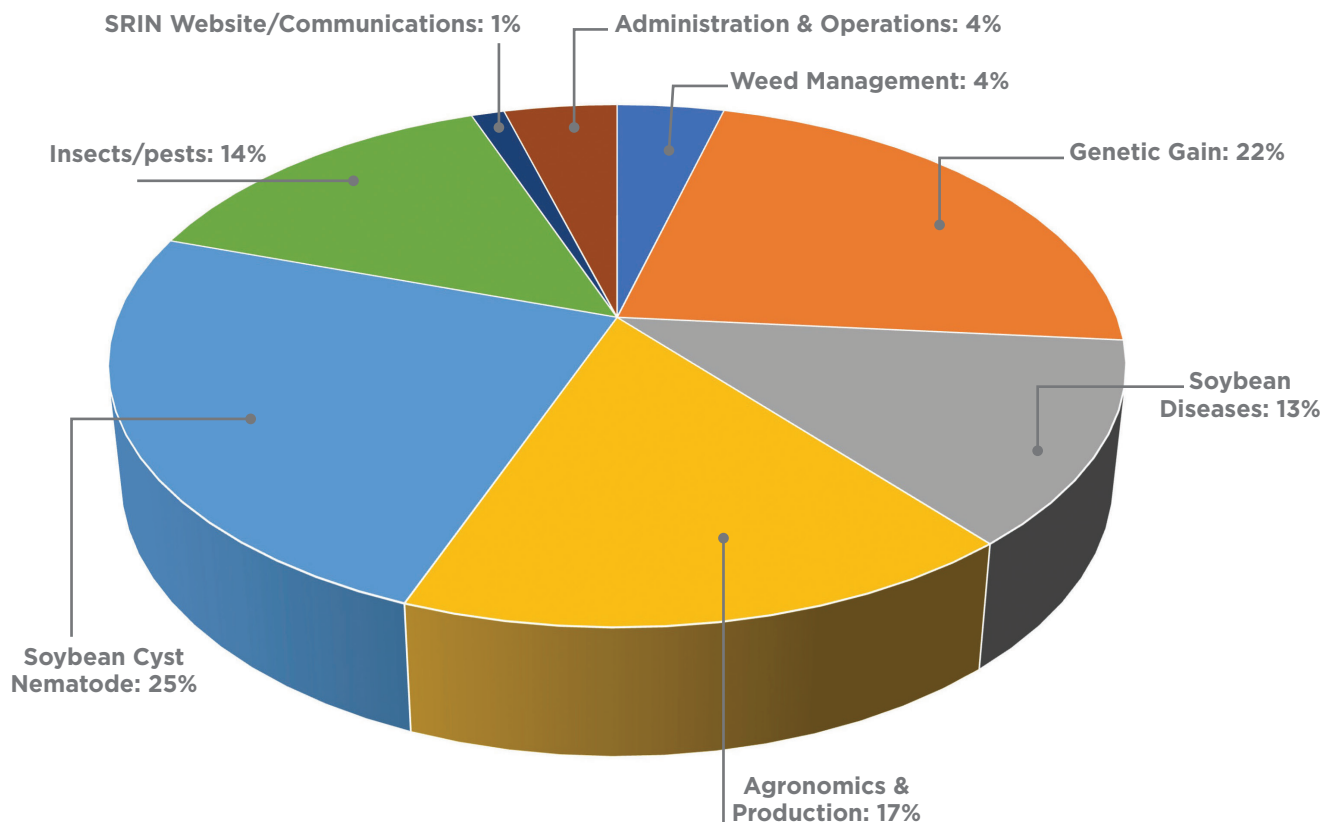
18 Universities and extension programs

18 Organizations or agencies

FY2022 BUDGET

State Contributions: $3,979,954
USB Partial Support for Operations and SRIN: $133,975

- SRIN Website/Communications: 1%
- Administration & Operations: 4%
- Weed Management: 4%
- Genetic Gain: 22%
- Insects/pests: 14%
- Soybean Diseases: 13%
- Soybean Cyst Nematode: 25%
- Agronomics & Production: 17%

The North Central Soybean Research Program (NCSRP) is recognized as a leader in multi-state collaborative research and outreach efforts to support soybean farmers and drive the soybean industry forward. The focus of NCSRP is soybean production research and extension outreach. NCSRP's emphasis on enhancing and protecting soybean yield through genetics and agronomic practices contributes to soybean farmer success today and tomorrow.

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.

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. NSCRP 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 QSSBs and the USB 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 abstracts and journals, extension publications, farmer-focused bulletins, appropriate websites (Soybean Research & Information Network) and databases (National Soybean Checkoff Research Database).

Collaborative Soybean Research Objectives and Priorities:

1. Soybean yield and quality enhancement through genetic improvement and biotic and abiotic stress mitigation for 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) with consistent or potentially significant economic impacts 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 addresses soybean response to water, nutrients, soil and environmental conditions unique to the North Central region.

2. Soybean production practices that will increase yield, profitability and environmental stewardship issues specific to the North Central region.

- Soybean–corn rotations
- Plant populations, row spacing and input management
- Water quality and watershed planning
- Cover crops and other conservation agronomy
- Soybean production sustainability and life cycle assessment and life cycle assessment.

SOYBEAN RESEARCH & INFORMATION NETWORK

SoybeanResearchInfo.com

Your go-to resource for NCSRP and other checkoff funded research results. The Soybean Research & Information Network (SRIN) site includes information about agronomics, pests and disease management, as well as videos, publications and more.

SRIN is administered by NCSRP and is supported by the United Soybean Board and other state and regional soybean boards.

Want the scoop on the latest soybean research?

Use this QR code to sign up for the SRIN monthly newsletter. It connects you with research results and practical information on timely agronomic topics, video insights from farmers and researchers, and more.

National Soybean Checkoff Research Database
SoybeanResearchData.com

Take a deeper dive into checkoff-funded research. Read about funded projects and their technical reports from the researchers themselves.

The National Soybean Checkoff Research Database is funded by the United Soybean Board to help all stakeholders find information about national soybean research projects funded by the soybean checkoff.

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