The North Central Soybean Research Program 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, basic biology, physiology, molecular biology, agri-technologies, and agronomic practices **contributes to farmer success** today and tomorrow.

NCSRP
NORTH CENTRAL SOYBEAN RESEARCH PROGRAM

ANNUAL REPORT
FISCAL YEAR 2024

FROM THE EXECUTIVE DIRECTOR

We are happy to share with you the 2024 NCSRP Research Annual Report. Here you'll find overviews of our mission, guiding principles, research objectives, and synopses of the fine basic and applied research, teaching, and Extension work funded with your soybean checkoff dollars.

I sincerely thank Suzanne Shirbroun for her many years of dedicated and insightful membership and leadership on the NCSRP Board. I also thank all 13 NCSRP board members for their volunteer service and commitment to funding, monitoring, and communicating important multi-institution and multi-disciplinary soybean research and results that benefit farmers and the industry.

The NCSRP has a long, recognized history of working with the United Soybean Board, many regional and state soybean boards, university researchers, Extension specialists, state soybean staff, and those in private industry to fund a variety of high priority and high impact research programs and projects. Large, ongoing research programs holistically address priority challenges and opportunities facing soybean farmers in their effort to produce the highest yielding, highest quality, and most sustainable soybeans. Smaller, shorter duration, and higher risk innovation projects help to identify and characterize new tools and technologies that will be turned into practical solutions and applications in the future.

Research, teaching, and Extension topics include:

- agronomics and cropping systems to improve production and profitability
- advanced breeding to enhance genetics that improve soybean yield, pest resistance, flood and drought tolerance, and seed quality
- basic studies to understand and improve agronomics and crop management systems that maximize inputs and manage insect pests, diseases and weeds
- new technologies for gene discovery and characterization
- management decision tools to improve, integrate and optimize production, sustainability, and profits.

NCSRP applies soybean checkoff funds contributed by nearly 355,000 farmers across the Midwest to support and communicate these important production research projects for the success of soybean farmers everywhere. The result is a sustained investment in the improvement of soybean farming and the soybean industry.

Ed Anderson, Ph.D.
eanderson@ncsrp.com

FROM THE PRESIDENT

Researchers continue to pursue the improvement of the tiny soybean as well as management practices that affect its production. And the pursuit is never-ending as our environment keeps shifting, and diseases and pests keep adapting for their survival.

The scientists behind the nine projects funded by the NCSRP in FY24 are just as relentless as those diseases and pests. The funded projects are continuations or finalizations of two- and three-year projects as the research is in-depth and difficult, if not impossible, to accomplish in only 12 months. The projects cover topics such as improving soybean cyst nematode resistance, increasing soybean genetic performance, finding better management approaches to increase soybean productivity, and reducing weed and pest pressures.

The NCSRP board is comprised of farmers and we always have our peers top-of-mind when considering how to best invest soybean checkoff dollars toward research. Results from the research plot to our fields may not be immediate, but when we review how far the soybean industry has come within the last decade and longer, the strides are immense. I am proud to know that NCSRP has been a part of these advancements.

Visit the Soybean Research & Information Network (SRIN) to learn more about these projects and others funded by Qualified State Soybean Boards (QSSBs). And for more in-depth information about research projects, go to the National Soybean Checkoff Research Database, which houses reports from projects conducted across the country. For easy access to both sites, scan the QR codes on page 7 in this report.

I'm grateful there are so many people working on behalf of farmers like me to help us maintain farming productivity and profitability. It has been an honor to serve as your NCSRP president.

Suzanne Shirbroun
FY2024 NCSRP President

NCSRP BOARD OF DIRECTORS - FY24

Suzanne Shirbroun
PRESIDENT
Farmersburg, IA

David Clark
VICE-PRESIDENT
Springboro, OH

Matt Wagenson
SECRETARY/TREASURER
Bear Creek, WI

Ed Anderson
EXECUTIVE DIRECTOR

Brian Atteberry
Carmi, IL

Roger Bommer
Brookville, IN

Keith Miller
Great Bend, KS

Steve Koehman
Hamilton, MI

Gene Stoel
Chandler, MN

Justin Rone
Portageville, MO
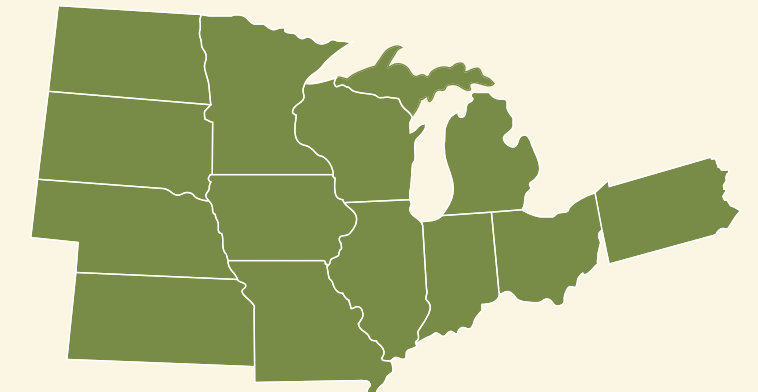
Mike Tomes
Utica, NE

Dallas Loff
Wahpeton, ND

Adam Schettler
Renfrew, PA

Bruce Haines
Mitchell, SD

PROJECTS FUNDED IN FY24

An Integrated Approach to Enhance Durability of SCN resistance for Long-term, Strategic SCN management (Phase III)

Principal Investigator: Andrew Scaboo
University of Missouri

Scientists continue to search within the soybean cyst nematode genome for new target genes that can help fight this problematic pathogen. The main challenge is identifying SCN virulence genes to understand how the nematode adapts to reproduce on resistant soybean varieties. The team is evaluating rotations of resistant gene combinations to provide farmers with additional tools for SCN resistance beyond PI 88788- and Peking-type varieties.

Mapping Soybean Protein and Oil Quality in Farmer Fields

Principal Investigator: Ignacio Ciampitti
Kansas State University

This project will develop a database to benchmark agronomic practices, genetics, management and environmental conditions for soybean yield, protein and oil content predictions at field levels that can lead to large-scale quality improvements. The team is developing an interactive simulation tool to show in-field predictions based on a combination of farmer-provided information and environmental data collected from farmer fields across 13 states.

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

This team's overall project goal is to develop improved strategies for sustainable management of major North Central soybean diseases. Soybeans are susceptible to an array of disease-causing pathogens that can result in significant costs for farmers and the potential for negative environmental impacts. Many factors can affect soybean pathogens including presence of susceptible host plants, weather, cropping systems, and fungicide resistance. The team will explore prediction tools for stem canker, sudden death syndrome, and frogeye leaf spot; and conduct foliar fungicide trials for white mold, frogeye leaf spot and *Diaporthe* diseases to better understand their biology and contribute data to integrated disease management strategies.

Research and Extension on Emerging Soybean Pests in the North Central Region

Principal Investigator: Kelley Tilmon
Ohio State University

This programmatic approach to integrated pest management involves collaborative work on soybean gall midge, stink bugs, and soybean aphids. The team will expand the soybean gall midge emergence monitoring program and screen germplasm for midge resistance traits to help with breeding soybean varieties that are midge-resistant. They will explore mowing and tillage as controls and conduct surveys to determine the midges' range. The team will also review stink bug sticky traps and pheromone lures for better scouting. They will explore soybean aphid management through suction traps and evaluate the impact of aphid-resistant soybean varieties. A new pest identified in Minnesota, the soybean tentiform leafminer, will be monitored for its management.

Site-Specific Weed Management with Precision Application Technology

Principal Investigator: Chris Proctor
University of Nebraska

Current herbicide broadcast applications deliver a constant distribution rate across an entire field. However, weed populations have great spatial variability influenced by several factors. With recent improvements of sensors and sprayer technologies, the ability to detect and treat weeds on a real-time, site-specific basis is feasible. The goal of this project is to evaluate the efficacy of a smart sprayer system through pre- and post-herbicide applications at both small and large plot studies. Greenhouse trials will be conducted to evaluate herbicide doses for spot-spray efficiency and efficacy.

The SCN Coalition: Building on the Impact of Public-Private Partnerships

Principal Investigator: Samuel Markell
North Dakota State University

Despite improvements in understanding and management, data suggests that many farmers can still improve yield when incorporating SCN management tools. This project builds on past success and will focus on the economics of SCN, highlight research advances of its management, and expand information on other economically important nematodes, such as the root-knot nematode, and diseases exacerbated by SCN.

SOYGEN3: Building Capacity to Increase Soybean Genetic Gain for Yield and Composition Through Combining Genomics-assisted Breeding with Characterization of Future Environments

Principal Investigator: Aaron Lorenz
University of Minnesota

The overall goal of this project is to advance genomics-assisted breeding to develop soybean varieties for improved yield and composition. The team will continue to develop and enhance genomics-assisted breeding resources for routine application in public soybean breeding programs. They will test methods for predicting cultivar performance in target environments; and test whether modeling structural variants improved genomic predictions for yield and seed composition.

SoyRenSeq: A Novel Approach for Disease Resistance Gene Discovery and Application for Soybean Improvement

Principal Investigator: Jianxin Ma
Purdue University

The goals of this project are to explore, apply, and optimize RenSeq (resistance gene enrichment sequencing) technology for faster identification of candidate genes conferring resistance to soybean pathogens in the Midwest; and for accelerated development of disease-resistant soybean cultivars by precise resistance gene selection. When fully developed and validated, this technology can be applied by all soybean breeders and bio-technologists across many areas for soybean improvement.

Using Data-Driven Knowledge for Profitable Soybean Management Systems

Principal Investigator: Shawn Conley
University of Wisconsin

This collaborative project addresses soybean management issues and their return-on-investment at the field level, including pre-plant pest management, seeding rates and costs, and other inputs. The goal is to develop a database management decision tool with information from farmers in the North Central region collected over three years. The tool includes yield-impacting factors such as soil properties, weather and remote sensing data. The outcome will be an interactive tool for farmers to apply best management practices to maximize soybean yield and profit at the field level, which includes in-field variability.

Collaborative Projects

The following projects are being conducted in collaboration with United Soybean Board, Mid-South Soybean Board, Southern Soybean Research Program, Atlantic Soybean Council and North Central Soybean Research Program

Developing and Releasing High-Yielding Soybean Varieties/Germplasm with Climate-Resilience and Genetic Diversity Across Maturity Groups 00 to 7

Principal Investigator: Bo Zhang,
Virginia Tech

Development and Expansion of Disease Management Decision-Making Tools Across Multiple Soybean Regions

Principal Investigator: Carl Bradley,
University of Kentucky

Field Phenotyping Using Machine Learning Tools Integrated with Genetic Mapping to Address Heat and Drought Induced Flower Abortion in Soybean

Principal Investigator: Krishna Jagadish,
Texas Tech University

Quantifying Nitrogen Credits From Soybean

Principal Investigator: Michael Mulvaney,
Mississippi State University

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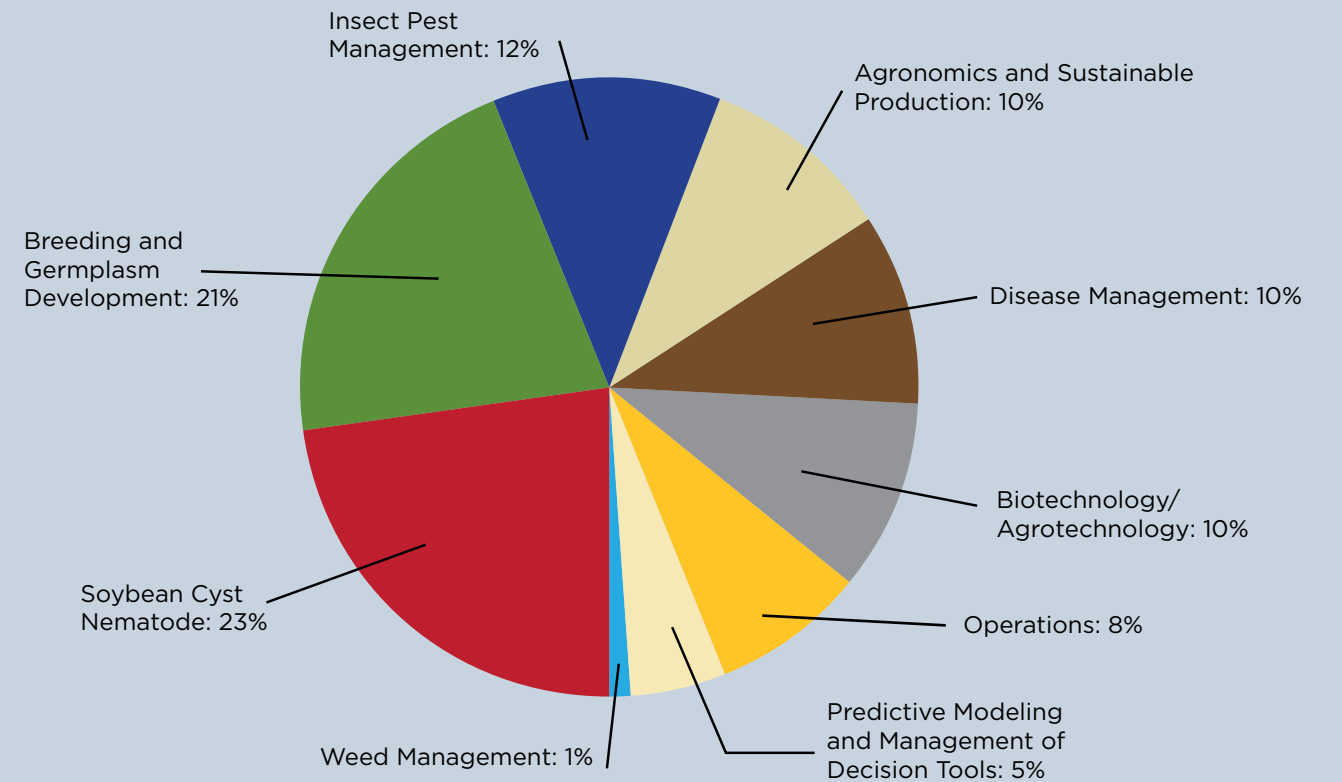
- Soybean–corn rotations
- Plant populations, row spacing and input management
- Water quality and watershed planning
- Cover crops and other conservation agronomy
- Soybean production sustainability and life cycle assessment

FY2024 BUDGET

Checkoff amount invested in production and applied research = $4,844,446

State Contributions = $4,645,000

USB Partial Support for Operations and SRIN = $199,446

Pie chart segments:
- Insect Pest Management: 12%
- Agronomics and Sustainable Production: 10%
- Disease Management: 10%
- Biotechnology/Agrotechnology: 10%
- Operations: 8%
- Predictive Modeling and Management of Decision Tools: 5%
- Weed Management: 1%
- Soybean Cyst Nematode: 23%
- Breeding and Germplasm Development: 21%

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.

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.

NCSRP

NORTH CENTRAL SOYBEAN RESEARCH PROGRAM

1255 SW Prairie Trail Parkway
Ankeny, Iowa 50023

Funded by the soybean checkoff

ILLINOIS SOYBEAN ASSOCIATION

INDIANA SOYBEAN ALLIANCE®

IOWA SOYBEAN Association

KANSAS SOYBEAN COMMISSION

MICHIGAN SOYBEAN COMMITTEE

MISSOURI SOYBEANS

MINNESOTA SOYBEAN GROWERS ASSOCIATION

NEBRASKA SOYBEAN BOARD

ND SOYBEAN COUNCIL

OHIO SOYBEAN COUNCIL

PSB Pennsylvania Soybean Board

SOUTH DAKOTA SOYBEAN CHECKOFF

WISCONSIN SOYBEAN MARKETING BOARD

UNITED SOYBEAN BOARD™