

Minnesota corn
check-off research drives
innovation



Minnesota**Corn**

Farmers invest in their future



Each year, as part of its mission to promote opportunities for corn farmers while enhancing quality of life, Minnesota Corn invests corn check-off funds in research aimed at improving on-farm practices and identifying new markets for the state's corn crop.

"When we're reviewing these projects, the question of 'what's the deliverable to the farm?' is always top of mind. Nobody ever loses sight that this is check-off money from the broader Minnesota corn community, and we take that responsibility really seriously when we're allocating the funds."

— Jocelyn Schlichting,
Benton County

In 2022, Minnesota Corn is investing over \$2 million in research projects covering everything from efforts to develop and improve corn-based polymers and plastics, to a field trial that evaluates the effectiveness of an enzyme at preventing corn bacterial diseases. Nine projects are new; the other nine have been funded previously.

Like in past years, the 2022 project-selection process was primarily led by the Minnesota Corn Discovery & Development (D&D) Team. The team includes members of the Minnesota Corn Research & Promotion Council (MCR&PC) and the

Minnesota Corn Growers Association (MCGA) board of directors.

Team members evaluated projects based on their novelty, how well they addressed Minnesota Corn's research priorities, and the value they will provide to Minnesota corn farmers.

The following provides a rundown of the projects Minnesota Corn is funding in 2022. Throughout the year, visit mncorn.org/research to read progress reports from these projects, as well as summaries of research projects funded in previous years.

Education

Supporting nutrient-management, water-quality education for corn farmers

Project lead: University of Minnesota Extension

Project overview: This project supports an Extension Educator position dedicated to these topics. The position is currently held by soil scientist Brad Carlson.

Helping corn farmers make the best nitrogen-management decisions

Project lead: Brad Carlson, University of Minnesota Extension

Project overview: This project supports the University of Minnesota Extension Nitrogen Smart Program. The program provides education on how nitrogen behaves in the environment, with the goal of helping

farmers make nutrient-management decisions that are best for their farms.



Expanded uses for corn

Developing corn-based polymers and bioplastics

Project lead: Marc Hillmyer, Center for Sustainable Polymers (CSP), University of Minnesota

Project overview: The project aims to improve existing corn-based plastics and to develop new corn-based materials. It consists of seven different research projects within CSP. Minnesota Corn has funded the slate of projects since 2019.



***Indicates newly funded project**



***Laying the groundwork for CO2 capture in ethanol plants**

Project lead: Will Northrop, University of Minnesota

Project overview: The project will work to determine the energy and cost benefits of converting carbon dioxide emitted at ethanol plants into methanol and the synthetic fuel e-gasoline. Specifically, the research will focus on determining the energy requirements, capital costs and financial benefits of installing a CO2-to-fuel system.

***Analyzing the prospects of hydrogen derived from ethanol**

Project lead: Luca Zullo, AURI

Project overview: Hydrogen has a variety of industrial uses, including as a component of sustainable aviation fuel, fuel cells and renewable diesel fuel. This project will assess the economic viability of ethanol-derived hydrogen and the technical capabilities needed for its production.

***Evaluating the toxigenicity of aromatics in gasoline**

Project lead: Shujun Liu and Leena Hilakivi-Clarke, The Hormel Institute, University of Minnesota/Steffen Mueller, Energy Resources Center, University of Illinois Chicago

Project overview: This research is exploring how the aromatic compounds added to fuel to boost octane, such as xylene and toluene, affect chemicals in the body that control gene expression. It will specifically study DNA and gene expression changes in animals and cell cultures that are exposed to aromatics found in gasoline.

***Assessing the potential of food-grade DDGs**

Project lead: Jason Robinson, Agricultural Utilization Research Institute (AURI)

Project overview: This project will assess the practicality of converting dried distillers grains (DDGs), a byproduct of ethanol production used as animal feed, into a human food ingredient. The research is also looking to assess the potential market for food-grade DDGs.



Production stewardship

Helping farmers address water-quality issues

Project lead: Warren Formo, Minnesota Agricultural Water Resource Center (MAWRC)

Project overview: This grant provides funding to MAWRC, a research and education organization dedicated to increasing awareness of water-related issues within the agricultural community.

Determining how nitrogen-fertilizer rates affect yield, environment

Project lead: Fabian Fernandez, University of Minnesota

Project overview: Fernandez is exploring how the application of nitrogen fertilizer at various rates affects grain yield, nitrate-leaching rates, nitrous oxide emissions and ammonia volatilization. The research is being conducted on tile-drain plots at the University of Minnesota Southwest Research and Outreach Center in Lamberton.

***Evaluating fortified DDGs diets in weanling pigs**

Project lead: Hans Stein, University of Illinois

Project overview: This research will test how weanling pigs fed high-protein corn co-products, such as DDGs, respond when their diets are supplemented with the amino acids isoleucine, tryptophan and valine. Specifically, it will evaluate how fast these pigs grow compared to pigs fed a control diet of corn and soybean meal, and how the experimental diets affect the pigs' health.

***Identifying the fatty acid profiles of corn inbred lines and hybrids**

Project lead: Candice Hirsch, University of Minnesota

Project overview: This research will identify differences in the composition of oil and fat among different corn inbred lines and commercial hybrids.



Evaluating how an enzyme prevents bacterial infections in corn

Project lead: Mikael Elias, University of Minnesota

Project overview: This research will explore why the enzyme lactonase inhibits the capacity of the bacteria *Clavibacter michiganensis* subsp. *nebraskensis* (Cmn) to cause Goss's wilt disease in corn, as a small-scale field experiment has discovered. Additionally, it will replicate the study on several mid-sized fields and evaluate whether lactonase inhibits the capacity of the bacteria *Xanthomonas vasicola* to cause bacterial leaf streak.



Determining conservation-practice effectiveness on a watershed scale

Project lead: Gary Feyereisen, USDA Agricultural Research Service

Project overview: This project aims to evaluate how the implementation of conservation practices on all cropland in a small watershed in southern Minnesota affects nutrient losses via runoff and tile drainage.

Evaluating the prevalence of corn pests, diseases in Minnesota

Project lead: Anthony Hanson, University of Minnesota

Project overview: This research aims to continue efforts to identify where corn insect pests and diseases are prevalent in Minnesota. It includes expanding trap networks and on-farm surveys of insects and diseases.



*Mitigating nitrogen losses during spring freeze/thaw

Project lead: Tim Griffis, University of Minnesota

Project overview: This project is exploring how freeze-thaw cycles, the frequency of which are increasing, affect nitrogen losses on cropland.

*Determining how nitrogen, irrigation rates affect leeching, yield

Project lead: Vasudha Sharma, University of Minnesota

Project overview: This project is studying how irrigating and applying nitrogen fertilizer at variable rates in different parts of a field, depending on soil-data measurements, compares to irrigating and applying nitrogen fertilizer at uniform rates.

*Studying nutrient management in northwestern Minnesota

Project lead: Lindsay Pease, University of Minnesota

Project overview: This research will measure how monoammonium phosphate and diammonium phosphate fertilizers applied in northwestern Minnesota affect yield, nutrient losses, and soil nitrogen, phosphorus and carbon availability during a two-year corn-soybean rotation. It will also evaluate how application of these fertilizers affects the aforementioned factors when applied annually versus once in the two-year cycle.



*Assessing how corn responds to nitrogen at different potassium-fertilization rates

Project lead: Dan Kaiser, University of Minnesota

Project overview: This project will evaluate how different rates of nitrogen- and potassium-fertilizer application affect fixed nitrogen and potassium in soil.

Innovation Grants

Since 2016, Minnesota Corn has offered Innovation Grants to farmers and researchers. These grants support projects aimed at developing new uses for corn; exploring farming practices that enhance air and water quality;

studying ideas that might make corn farming more profitable and efficient, and more.

In 2022, Minnesota Corn is funding 11 Innovation Grant projects. Four are new, and seven have been funded previously. Find results of previous projects at mncorn.org/research.

** Indicates newly funded project*

* Helping students understand how nitrogen rates affect corn yields, canopy growth

Project lead: Adam Alford, Southwest Minnesota State University (SMSU)

Project overview: This project will include growing corn using six different nitrogen-fertilizer-application rates on a plot donated to SMSU. Students will use the plot as an educational tool to learn about the various aspects of corn growth and development. Additionally, a field day will be held to summarize the results of the experiment for local farmers.

Determining how a microbial product affects nitrogen levels in corn

Project lead: Allan Dose, farmer, Sibley County

Project overview: This research will explore whether application of Pivot Bio PROVEN® 40, a microbial product that converts atmospheric nitrogen into ammonia, increases corn nitrogen levels.

Comparing the effects of commercial fertilizer vs beef manure

Project lead: Blair Hoseth, farmer, Mahanomen County

Project overview: The project will compare corn yields when a commercial fertilizer is applied versus when beef manure is applied.

Improving soil microbial mineralization using a "Living Carbon" soil amendment

Project lead: Gary Prescher, farmer, Faribault County

Project overview: This project is studying whether the application of a "Living Carbon" composted manure on corn and soybean fields affects soil-fertility metrics and yield.

Studying the impact of cover crops on cropland

Project lead: Mikayla Tabert, farmer, Red Lake County

Project overview: This project continues efforts to quantify the impacts on soil health and economic factors when cover crops are integrated into a crop rotation.

* Evaluating variable-rate sulfur application

Project lead: Kirk Stueve, farmer, Traverse County

Project overview: This study will evaluate how different rates of sulfur-fertilizer application affect factors such as sulfur availability, organic matter and other related soil properties.

* Developing a field-scale carbon filter for tile drainage

Project lead: Nazli Yilmaz Wodzinski, Minnesota State University, Mankato

Project overview: This project will aim to design a filter that can parse nutrients out of tile drainage before they drain off the farm.

Evaluating a Pivot Bio microbial product in corn production

Project lead: Les Anderson, farmer, Goodhue County

Project overview: This project will evaluate whether Pivot Bio PROVEN® 40 can replace some of the synthetic nitrogen used in corn production.

Evaluating corn-stover-derived nanocellulose as a fertilizer control-release agent

Project lead: Lingling Liu, Iowa State University

Project overview: This study will evaluate whether corn-stover-derived nanocellulose is effective as a coating for controlled-release fertilizers.



* Studying a nitrogen-fixing microbe in corn production

Project lead: Paulo Pagliari, University of Minnesota

Project overview: This project will evaluate whether the nitrogen-fixing bacteria *Azospirillum brasilense* can positively impact corn production.

Determining how tillage practices, cover crops affect production in clay-loam soil

Project lead: Vance Johnson, farmer, Wilkin County

Project overview: This project will evaluate how no-till, strip-till and conventional tillage and cover crops affect soil properties and economic returns.

Research Q&A

As leader of the Minnesota Corn Discovery & Development (D&D) Team, Rice farmer Jocelyn Schlichting played an important role in the selection of the research projects Minnesota Corn is funding in 2022. Similarly, as the staff liaison for the D&D Team, Minnesota Corn Research Director Maciej Kazula also played an important role in the project-selection process.



Jocelyn Schlichting

Below is a brief Q&A with Schlichting and Kazula about the 2022 projects.

What are a few highlights of the 2022 projects?

Schlichting: Almost all of the Innovation Grants are focused on nitrogen-use efficiency. I think that's going to be especially relevant to people, with fertilizer prices going up so much.

Kazula: In my opinion, all of the new projects that we accepted are very innovative and things that we haven't done much of in the past.

Dan Kaiser's project, for example, is looking at interaction between potassium and nitrogen, which is something we have minimal knowledge of here in Minnesota. Tim Griffis is touching on climate change and nitrous oxide emissions, something that might really impact farming. Lindsay Pease is exploring nutrient stewardship in northwestern Minnesota.

That's something we know about in southern parts of Minnesota but less so up North, because it's a different environment.

What would you want people to know about the project-selection process?

Schlichting: When we're reviewing these projects, the question of 'what's the deliverable to the farm?' is always top of mind. Nobody ever loses sight that this is check-off money from the broader Minnesota corn community, and we take that responsibility really seriously when we're allocating the funds.

Some of the primary research projects that we fund are pretty big picture, and you're maybe not going to feel it as literally on your farm. But the innovation grants, specifically, we really analyze to make sure there is an actionable, deliverable component right on the farm.

We reanalyze these ongoing projects every year, and if somebody's not doing the deliverable component properly, then they fall off our funding list. It's absolutely front of mind for everybody on the D&D Team to make sure that the projects we're supporting are relevant and actionable at the farm.

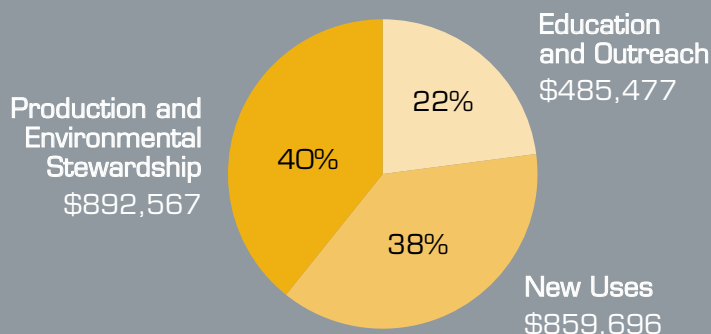
Kazula: Minnesota Corn has a long history of investing in quality research. We spend more than \$2 million annually. It's a very rigorous process, very selective. The projects that we actually fund, they have to, by default, improve the quality of life of farmers and lead to an improved impact on the environment. We have a great established relationship with the University of Minnesota, and we have a very dense research portfolio in 2022.



Maciej Kazula

Minnesota Corn research program at a glance

2022 allocations



2017-22 allocations

Year	Funds Awarded
2017	\$2,476,022
2018	\$1,776,963
2019	\$2,649,210
2020	\$2,352,645
2021	\$2,000,767
2022	\$2,237,740
Total:	\$13,493,347

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