

# Innovation Grants

Since 2016, Minnesota Corn has offered Innovation Grants to farmers and researchers to explore practices that benefit air and water quality and study ideas to make corn farming more efficient and profitable.

Learn more about Minnesota Corn's Innovation Grant program, and how you can apply for a grant, at [mncorn.org](http://mncorn.org).



## Effects of procyanidins on corn growth and nitrous oxide reduction (Year 2)

**Principal investigator:** Chejen Hsiao, postdoctoral scientist, UMN Department of Soil, Water, and Climate

**Overview:** This project is studying whether the naturally occurring compound procyanidin can effectively limit the ability of soil microbes to convert nitrates into nitrous oxide and nitrogen dioxide, a process known as denitrification. While nitrogen dioxide is harmless, nitrous oxide is a long-lived greenhouse gas. In 2024, the researchers will test their lab-created procyanidin product in indoor growing chambers and evaluate its effectiveness at reducing nitrous oxide emissions and its impact on corn growth.

## Evaluation of variable-rate nitrogen in corn fields receiving manure (Year 2)

**Principal investigator:** Peter Anthony, farmer, Nicollet County

**Overview:** This project is studying how manure and cover crops affect the need for commercial nitrogen fertilizer in corn fields. Anthony will apply various rates of nitrogen in fields with manure application and/or cover crops to determine the optimal nitrogen rate. The results of the project will provide important guidelines for precision nitrogen management of corn in fields with manure application and/or cover crops in Minnesota.

## On-farm evaluation of variable rate sulfur application (Year 3)

**Principal investigator:** Kirk Stueve, farmer, Traverse County

**Overview:** The project is evaluating the potential benefits of variable-rate sulfur application in corn fields. Stueve will apply the nutrient at five different rates and assess different soil and agronomic properties. The project could provide important guidelines for precision sulfur management in Minnesota.

## Azospirillum brasilense inoculation to enhance corn nitrogen uptake (Year 3)

**Principal investigator:** Paulo Pagliari, assistant professor and nutrient management specialist, UMN Extension

**Overview:** This project studies the ability of the bacterium Azospirillum brasilense to supply corn plants with nitrogen. In 2024, the researchers will test Azospirillum brasilense strains isolated from Minnesota soils in corn plots supplied with nitrogen at five different rates. Minnesota Corn is providing two grants for the project—one for trials in Becker and another for the trials in Lamberton.

## Hands-on learning for future ag professionals: impacts of fertility (Ongoing)

**Principal investigator:** Adam Alford, Southwest Minnesota State University (SMSU)

**Overview:** This project supports a series of research plots for students at SMSU. In 2024, Alford will plant corn in the plots, utilizing a different nitrogen rate in each. He and his students will evaluate how the different nitrogen rates affect the corn crop.

## Wilkin SWCD soil health demonstration site (Year 4)

**Principal investigator:** Vance Johnson, farmer, Wilkin County

**Overview:** This project compares the impacts of cover crops, conservation tillage, and extended crop rotations on soil health in northwestern Minnesota. Johnson hopes to help farmers better understand the effects of implementing these practices, both in terms of economics and soil health.

## Effects of cover crops in a five-year crop rotation (Year 4)

**Principal investigator:** Mikayla Tabert, farmer, Red Lake County

**Overview:** This project studies the long-term impacts of integrating cover crops on a field with a corn-soybean-wheat-sunflower crop rotation. During corn and soybean years, Tabert interseeded a cover crop mix early in the growing season. The goal of the project is to demonstrate the lasting economic and soil health benefits of integrating cover crops into a rotation.

## Manure vs commercial fertilizer vs 1/2 rate nitrogen/manure corn plot (Year 4)

**Principal investigator:** Blair Hoseth, farmer, Mahnomon County

**Overview:** This project studies how the use of beef manure and/or commercial nitrogen fertilizer affects yield, profit, and soil health. In 2024, Hoseth will utilize one plot with manure, one plot with manure and urea, and a third plot with urea only.

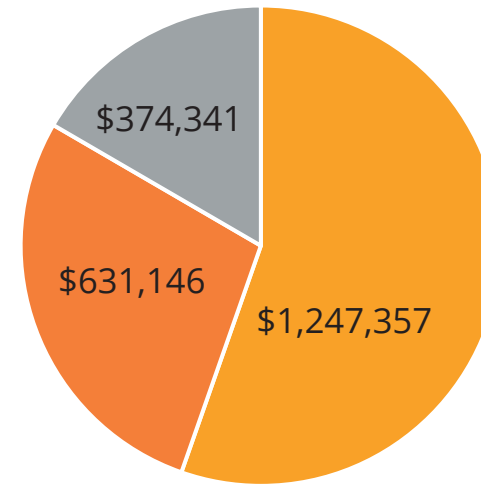
## Evaluating alternative strategies to side-dressing urea in corn (Year 4)

**Principal investigator:** Les Anderson, farmer, Goodhue County

**Overview:** Anderson will compare the effectiveness of side-dressing nitrogen to using a pre-plant nitrogen application along with a nitrogen stabilizer and the nitrogen-fixing microbial product Pivot Bio Proven 40. He'll use a 160-pound nitrogen rate in the side-dressed plots. On one of the pre-plant plots, he'll use a 120-pound nitrogen rate, and he'll use a 160-pound rate on the other.

# Minnesota Corn Research Program

## 2024 Allocations



■ Production and Environmental Stewardship ■ Education and Outreach ■ New Uses

## 2020-24 Allocations

Year	Funds Allocated
2020	\$2,352,645
2021	\$2,000,767
2022	\$2,237,740
2023	\$2,112,697
2024	\$2,252,844
<b>Total</b>	<b>\$10,956,693</b>

## Listen to the Minnesota Corn Podcast!

Learn more about Minnesota Corn's research projects with host Mark Dorenkamp, a reporter for Brownfield Ag News.

[mncorn.org/minnesota-corn-podcast](http://mncorn.org/minnesota-corn-podcast)

Questions about Minnesota Corn's research program? Contact Research Director Maciej Kazula, Ph.D., at [mkazula@mncorn.org](mailto:mkazula@mncorn.org).

**About the cover:** Dr. Satu Häkkinen, a former postdoctoral scientist at the University of Minnesota's Hillmyer Research Group, conducts lab work.



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# Driving innovation through research



Minnesota Corn Research Brochure, 2024



**MinnesotaCorn**

# Farmers invest in their future



A manure spreader runs through an alfalfa field.

To increase the profitability, productivity, and sustainability of corn production, the Minnesota Corn Research & Promotion Council (MCR&PC) invests corn check-off funds in research focused on production stewardship and new uses for corn and corn coproducts. The council works closely with the Minnesota Corn Growers Association (MCGA) Board of Directors when making research funding decisions.

“Comprehensive, professional research conducted on working corn farms is crucial to increasing the sustainability, productivity, efficiency, and profitability of corn production and developing new uses for corn to drive market demand. Through the corn check-off, Minnesota Corn is proud to fund this important work on farms and in labs across the state. We appreciate the hard work and dedication of check-off-funded researchers and look forward to seeing the results of their efforts.”



— Nick Peterson, chair, Minnesota Corn Discovery & Development Team

In February, the council finalized its 2024 research investments. Thirty-four projects covering everything from nutrient management to corn-based plastics and located in farm fields and labs across Minnesota will receive a combined \$2.2 million in funding this year. Eleven of the projects are new, and 23 were funded previously.

Like in past years, Minnesota Corn solicited research proposals from farmers and university-level researchers. Farmers could apply for grants to conduct on-farm trials known as Innovation Grants, while professional researchers could apply for funding for more complex projects. Proposals were vetted by Minnesota Corn’s Discovery & Development Team, which includes grower-leaders from the MCR&PC and MCGA board.

Following are brief overviews of the projects in Minnesota Corn’s 2024 research portfolio. Learn more about them at [mncorn.org/research](https://mncorn.org/research).

## Education and outreach

### Nitrogen Smart and Advanced Nitrogen Smart (Ongoing)

**Principal investigator:** Brad Carlson, University of Minnesota (UMN) water resources extension educator

**Overview:** Nitrogen Smart is an education program that provides growers and agriculture professionals with the latest information on the nitrogen cycle, nitrogen management, nitrogen loss pathways, nitrogen sources, and more. University of Minnesota Extension developed the program in partnership with Minnesota Corn. It provides information through online video courses and in-person meetings.

In 2024, funding from Minnesota Corn will support the production of a new online Nitrogen Smart course focused on how growers can reduce nitrate loss to water. Additionally, it will support the production of a new series of podcasts and short videos focused on nitrogen management topics and allow Extension to hold in-person Nitrogen Smart classes. Minnesota Corn is providing separate grants for each of the respective efforts.

### University of Minnesota Extension water quality education (Ongoing)

**Overview:** This project funds a half-time water-quality Extension educator. In 2024, the Extension educator will continue educating Minnesota corn growers on the latest water quality research through presentations, articles, and online resources.

### MAWRC/Discovery Farms research and education program (Ongoing)

**Principal investigator:** Warren Formo, executive director, Minnesota Agricultural Water Resources Center (MAWRC)

**Overview:** MARWC is a research and education organization aimed at helping growers and agriculture organizations address water quality issues. The center operates the Discovery Farms Minnesota program, which collects on-farm surface runoff and tile drainage data, and it hosts conferences to help growers learn about nutrient management and conservation practices. In 2024, MAWRC will continue operating a controlled drainage research and demonstration project at Farmamerica in Waseca. The project is evaluating the extent to which holding back tile drainage through a control structure limits tile flow and nitrogen losses.

### Survey efforts for corn insect pests in Minnesota in 2024 (Ongoing)

**Principal investigator:** Fei Yang, corn entomologist, UMN Extension

**Overview:** This project is a long-term effort to better understand trends when it comes to key corn insect pests. During the 2024 growing season, the researchers will use traps to monitor the prevalence of pests such as European corn borer, black cutworm, and corn earworm, and in the fall, they’ll survey fields for European corn borer larvae. The goal of the project is to improve pest forecasting and fine-tune integrated pest management practices.

## New uses

### Engineering degradability into corn-based plastics (Year 1)

**Principal investigator:** Thomas Hoyer, professor, UMN College of Science and Engineering

**Overview:** This project aims to develop a new strategy to create more easily degradable versions of PLA plastic and other biodegradable polyesters. Although PLA is compostable, that operation needs to be conducted in an industrial high-temperature composting facility to proceed at a viable rate, and the material does not degrade readily in the environment.

### Direct conversion of corn-derived carbohydrates to ether-based clean fuels (Year 1)

**Principal investigator:** Paul Dauenhauer, professor, UMN College of Science and Engineering

**Overview:** This study aims to assess the potential of a chemical process to convert corn to dimethyl-ether. The process utilizes a catalyst to break apart the carbon-carbon bonds of corn-derived carbohydrates, ultimately yielding methanol which can be readily dehydrated to dimethyl ether. Research will evaluate two general strategies for catalyst design and evaluate the economics of the corn-to-dimethyl-ether production process.

### Modeling production of SAF from corn ethanol and CO2 (Year 1)

**Principal investigator:** William Northrop, professor, UMN College of Science and Engineering

**Overview:** This research will explore the potential for large-scale projects to combine captured carbon dioxide emitted from ethanol production to produce sustainable aviation fuel (SAF). Northrop will collaborate with the Chippewa Valley Ethanol Company plant in Benson to determine energy and cost benefits of generating SAF through waste carbon dioxide and ethanol.

## Production and environmental stewardship

### Are increasing maximum return-to-nitrogen values related to nitrogen source? (Year 1)

**Principal investigator:** Fabian Fernandez, nutrient management specialist, UMN Extension

**Overview:** This project will study why corn farmers have needed more nitrogen to achieve higher yields in recent years than expected, based on past trial data. Researchers will also study how various nitrogen fertilizer sources fare when applied in the fall.

### Tracking nitrogen mineralization in Northwest Minnesota soils (Year 1)

**Principal investigator:** Lindsay Pease, nutrient and water management specialist, UMN Extension

**Overview:** This project will study how soil texture, soil moisture, and nitrogen rate affect nitrogen availability and grain production. The researchers will plant corn plots at the University of Minnesota Northwest Research and Outreach Center in Crookston and use different rates of nitrogen for each

plot. For each plot, they’ll evaluate soil nitrogen availability, soil temperature, soil moisture, corn yield, and other production metrics.

### Evaluating nitrogen credits to corn following manured and non-manured alfalfa (Year 1)

**Principal investigator:** Melissa Wilson, manure management and water quality specialist, UMN Extension

**Overview:** This project will evaluate how manure and/or commercial fertilizer application affect nitrogen fixation in alfalfa fields. The researchers will determine how corn fares on the alfalfa plots in following years.

### Efficacy of insecticide seed treatments in corn for managing corn rootworm complex (Year 1)

**Principal investigator:** Fei Yang

**Overview:** The researchers will study the effectiveness of the various rates of insecticides in seed treatments at plots in Rosemount and Lamberton. They’ll also evaluate how the presence of Bt technology affects rootworm management.

### Developing biocontrol against corn pathogens (Year 1)

**Principal investigator:** Devanshi Khokhani, assistant professor, UMN Department of Plant Pathology

**Overview:** This project will study the effectiveness of seven different bacteria species at combating the pathogen pythium ultimum, which causes damping off and root rot disease in corn. The researchers hope to identify the compounds among the seven bacteria species that are responsible for combating pythium ultimum.

### High-throughput gene platform for validating resistance against fusarium in corn (Year 1)

**Principal investigator:** Josiah Mutuku, group leader, 2Blades

**Overview:** The project will fund work by the nonprofit biotech organization 2Blades to engineer corn varieties that are resistant to the soil fungi fusarium, which can cause stalk and ear rot and mycotoxins. 2Blades has identified genes responsible for encoding proteins that control fusarium and reduce mycotoxin accumulation. The organization eventually hopes to transfer these genes into corn.

### Past the learning curve: does soil health lower nitrogen requirements? (Year 1)

**Principal investigator:** Anna Cates, soil health specialist, UMN Extension

**Overview:** This project will study how soil health practices such as cover crops and minimal tillage affect a corn crop’s nitrogen needs. The researchers will work with growers who have implemented soil health practices on a short- and long-term basis as well as with growers who have not implemented the practices.



University of Minnesota researchers aim to increase the biodegradability of corn-based plastics.

### Optimizing corn-soybean rotation: Reduced tillage, varied irrigation, and cover crops (Year 1)

**Principal investigator:** Vasudha Sharma, UMN Extension

**Overview:** This project will study how conservation tillage, cover crops, and different irrigation management strategies affect crop production, soil health, and nitrogen losses in Central Minnesota. The project will start in October 2024 with the planting of a cereal rye cover crop, and the researchers hope to continue for three growing seasons.

### European corn borer resistance to transgenic Bt corn in Minnesota (Year 2)

**Principal investigator:** Fei Yang

**Overview:** This project is studying the susceptibility of European corn borer to Bt proteins and the frequency of Bt resistance among European corn borer in Minnesota. It’s also determining the genetic basis for that resistance. Results generated will provide essential data to assist growers in the management of European corn borer using Bt technologies within the state.

### Precision irrigation and nitrogen management for enhancing water-nitrogen use efficiency (Year 3)

**Principal investigator:** Vasudha Sharma

**Overview:** This project is a study of precision irrigation and nitrogen management tools, and technologies in Central Minnesota. In 2024, Sharma will conduct another set of trials comparing different combinations of variable rate nitrogen and irrigation and uniform-rate nitrogen and irrigation.

### Mitigating cold and warm season nitrogen losses (Year 3)

**Principal investigator:** Tim Griffis, professor, UMN Department of Soil, Water, and Climate

**Overview:** This project is studying how to reduce nitrogen losses from corn fields during spring freeze-thaw cycles and how warmer temperatures are affecting nitrogen losses during the growing season. Using indoor growing chambers, the researchers will evaluate whether cover crops and enhanced efficiency fertilizers reduce emissions and whether the increased prevalence of warmer temperatures affects nitrogen loss.

### Is fixed ammonium a part of nitrogen cycling in soils (Year 3)

**Principal investigator:** Dan Kaiser, soil scientist and soil/ plant nutrient management specialist, UMN Extension

**Overview:** This project will assess how corn responds to nitrogen at various levels of potassium fertilization. The project will determine how much fixed ammonium is present in soils, how fixed ammonium could be impacted by fixed potassium and vice versa, and ultimately whether fixed ammonium relates to the amount of nitrate present in the soil.

### Dialing in the most profitable and environmentally responsible nitrogen rate (Year 4)

**Principal investigator:** Fabian Fernandez

**Overview:** This study assesses the effects of various nitrogen rates on yield, economic return, nitrogen use efficiency, nitrate leaching in tile-drained fields, nitrous oxide emissions, and ammonia volatilization. Once again, the researchers will grow corn on tile-drained plots in southwestern Minnesota using different nitrogen rates. They’ll use the data to create formulas for calculating yield and nitrogen losses based on nitrogen application rates.

### Evaluating conservation practice effectiveness with a paired watershed approach (Year 6)

**Principal investigator:** Gary Feyereisen, agricultural engineer, USDA Agricultural Research Service

**Overview:** The project aims to quantify the effects of conservation practices on nitrate losses in drain tiles. For a fourth year, the researchers will monitor tile drainage outlets on adjacent southern Minnesota watersheds. Starting next year, they hope to begin implementing conservation practices such as cover crops and precision nitrogen management in one of the watersheds to get a better understanding of how the practices affect water quality.

### Hyperstable enzyme to control plant diseases (Year 7)

**Principal investigator:** Mikael Elias, associate professor, UMN College of Biological Sciences

**Overview:** This project is studying the compatibility with currently available adjuvants of an enzyme that limits the virulence of the bacteria responsible for causing Goss’ wilt. Adjuvants are additives that help water-based spray solutions penetrate their targets. Previous field studies found that the enzyme dramatically reduced Goss’ wilt when sprayed on infected corn leaves. The researchers will determine whether the enzyme can remain active in adjuvants over a season and will continue to test new products. They’ll also evaluate why the combination of the enzyme and an adjuvant resulted in increased cob weight at one site in 2023.



Professor Tim Griffis gives a tour of the University of Minnesota mesocosm facility.