BRINGING

RESEARCH TO FARMERS

Nebraska CornBoard

2024 Research Report

2024 ANNUAL RESEARCH REPORT

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Your Investment, Your Impact: Research and Innovation from Nebraska Corn

We are proud to introduce the first annual Nebraska Corn Research Report, a comprehensive resource that highlights our work and partnerships. As part of our strategic plan, the Nebraska Corn Research and Stewardship committee proposed that we continue to elevate our research and innovation efforts in new and impactful ways. This report showcases the various research projects we've partnered on as an organization, from single-year initiatives to multi-year endeavors and the results that have come from them.

Nebraska Corn is intentional about maintaining a research portfolio that covers several key topic areas important to Nebraska's corn farmers and industry partners. The committee's growing interest is in the biotechnology/industrial uses space. These research programs tend to carry a higher degree of both risk and reward. New use programs help to create new demand while furthering the bioeconomy. We're committed to exploring new uses for corn and driving demand for Nebraska-grown corn and value-added corn products.

As a farmer, you know that every dollar counts. That's why we're committed to using your checkoff dollars wisely, with a focus on delivering the best possible return on investment for your future. The research we're doing today will impact not just our farms, but the next generation of farmers as well.

So, take a look through these, as they are invested by farmers for farmers. We can't wait to hear what you think.

Dan Nerud

Nebraska Corn Board District 1

Nebraska Corn Research Committee Co-Chair

A New Year, New Ideas and a Continued Commitment to Nebraska Farmers

As a member of the Nebraska Corn Growers Association, you are receiving the first issue of what we plan to be a valuable way of communicating checkoff-funded research outcomes to producers. With my background as a former university professor, turned farmer, this is extremely exciting for me to see the report come together, be a part of the research process and witness this information get into farmers' hands.

The Nebraska Corn Board has partnered on research projects with several organizations, including the University of Nebraska-Lincoln, Nebraska commodity organizations and the National Corn Growers Association. These projects vary in scope and include biotechnology/industrial use, livestock, nutrient management, production efficiency, pest management and outreach/education. Each project is carefully selected to align with our organizational goals and strategic plan, which is shared by both the Nebraska Corn Board and the Nebraska Corn Growers Association.

Those sitting on the research committee include corn farmers from both the Nebraska Corn Board and Nebraska Corn Growers Association, in addition to representatives from local corn grower associations. We believe it's essential to have diverse voices and perspectives from all corners of Nebraska, ensuring that our programs meet the unique needs of farmers like you. From the western panhandle to the eastern side of the state, the needs and knowledge gaps are different.

As you dig into this report, you'll discover a range of programs that may seem similar at first glance but are actually quite diverse in their objectives. Our research committee and the Nebraska Corn team have worked tirelessly to ensure that every program we fund and partner on is of high quality, practical and focused on delivering value to farmers like you and me. We're committed to transparency and accountability in our research and programming efforts. We believe that it's essential to invest in initiatives that benefit Nebraska farmers and contribute to the long-term viability of our industry.

We hope you find this newsletter informative and valuable. If you have questions or would like to get involved in our research efforts, please don't hesitate to reach out. Together, we can drive innovation and progress in Nebraska's corn industry.

Jason Lewis

Nebraska Corn Growers Association State Representative

Nebraska Corn Research Committee Co-Chair

Biodegradable Plastics Production from Ethanol Byproducts

RESEARCH TEAM | Dr. Yaşar Demirel, Dr. Rajib Saha (UNL), Dr. Mark R. Wilkins (KSU)
FUNDING AWARDED | $94,340

PROJECT DURATION
July 2022–August 2024

Research Conducted

This project focused on the production of biodegradable plastics, specifically polyhydroxyalkanoates (PHAs), from corn ethanol byproducts: corn kernel fiber (CKF) and distillers corn oil (DCO). PHAs are natural, biodegradable polyesters produced by microorganisms (Figs. 1 and 2). They hold promise as replacements for petroleum-based plastics in applications such as automotive components and medical devices. This study explored the innovative use of CKF and DCO as combined feedstocks to address the high production costs of PHAs, which are primarily driven by feedstock expenses. The research incorporated experimental optimization, process modeling and economic feasibility studies to evaluate the potential integration of PHA bioplastic production in Nebraska's corn ethanol plants.

Impact

This area of study demonstrates the potential for corn ethanol byproducts to be repurposed into higher-value materials like PHAs. Being biodegradable, PHAs offer an alternative to traditional plastics, addressing the ecological concerns associated with petroleum-based plastics. This approach could diversify revenue streams for ethanol producers and increase the economic value of corn. This project sought to expand upon previous work on PHA production from corn kernel fiber to include distillers corn oil as a feedstock.

Findings and Recommendations

While this research identified Nebraska's ethanol plants as potential hubs for bioplastic production, the research team concluded that the proposed bioprocess, under current conditions, is not commercially viable due to low yields and high operational costs. The estimated capital cost for an annual 135 metric tonnes of bioplastics plant was $173.3 million, with a discounted payback period of more than 20 years under current conditions. To address the challenges and improve the feasibility of bioplastic production, the research team recommends: a) further development of microbial strains capable of tolerating high fatty acid concentrations and efficiently converting diverse feedstocks into PHAs, b) increased process intensification such as continuous feeding strategies and fed-batch fermentation exploration to increase yields, and c) implementing strategies to reduce water and energy consumption such as water recycling and energy recovery systems. While immediate commercialization remains challenging, this research helps the industry move toward advancements in microbial engineering and bioreactor design that could pave the way for scalable, cost-effective bioplastic production in the future.

Future Objectives

Future research will focus on optimizing microbial strains to tolerate higher concentrations of DCO. This could involve synthetic biology. Further investigation is also needed to improve process intensification, possibly by exploring continuous fermentation processes with economic bioreactor configurations. Other areas for future research include cost optimization of downstream processing, comprehensive economic and market analysis, detailed life cycle assessment, and engaging policymakers to discuss incentives and regulations for the development and adoption of bioplastics.

Figure 1. Some pictures of the research process: (a) microorganism propagation for fermentation experiments, (b) biosafety cabinet preparation for corn oil fermentation and (c) recovered cell pellet before PHA extraction.

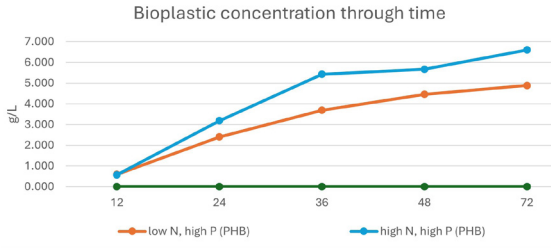

Figure 2. Full factorial experiment with two levels of nitrogen and phosphorus, Higher amounts of phosphate have produced better yields.

Sustainable Manufacturing of High-Quality Carbon Fiber from Corn Kernel Fibers

RESEARCH TEAM | Dr. Bai Cui (UNL), Dr. Mark Wilkins (KSU)
FUNDING AWARDED | $77,656

PROJECT DURATION
July 2022–December 2024

Research Conducted

This project explores the potential of corn kernel fiber (CKF), a low-cost, renewable co-product of corn processing, as a raw material for carbon fiber (CF) production. The overarching goal is to determine whether corn-based carbon fiber can compete economically and technically with traditional petroleum-based CF, while also identifying potential risks and opportunities for commercialization. Research questions guiding the project included assessing market potential, defining product requirements, conducting technical and commercial evaluations, and identifying intellectual property and regulatory challenges.

Impact

This project has the potential to make a significant impact on the carbon fiber industry by reducing production costs and providing a sustainable alternative to petroleum-based precursors. Carbon fiber is highly valued for its exceptional strength-to-weight ratio, making it a key component in high-value applications like aerospace, automotive and renewable energy. Corn-based carbon fiber has the potential to reduce production costs by using sustainable, renewable raw materials, which could expand its applications and increase demand.

For corn growers, the development of corn-based carbon fiber presents an opportunity to create a new, value-added product that could enhance the processing margins of corn facilities. However, challenges remain. The carbon fiber market is currently small, and the high price of the material limits its adoption. Additionally, other lignin-based raw materials could prove more cost effective or higher quality than corn kernel fiber, posing competitive risks.

Findings and Recommendations

The project has identified several strengths and weaknesses. Strengths include the renewable nature of corn kernel fiber and the potential for cost competitiveness if production costs decrease. Weaknesses include the lack of defined economics for the production process, the high capital costs required for scaling up and the limited current market size for carbon fiber. The research team has been collaborating with Georgia Tech to conduct electrochemical property measurements of carbon fiber samples derived from CKF. Preliminary test results show that these carbon fibers have a higher specific capacity (~240 mAh/g) compared to traditional petroleum-based carbon fiber anodes (~194 mAh/g). This suggests that corn kernel fiber-based CFs could be a viable alternative for lithium-ion battery applications. Several key questions remain unanswered, including the cost of production, target selling price and competitive assessments relative to existing technologies. The team recommends further research and development to optimize the manufacturing process and improve the performance of corn kernel fiber-based CFs.

Future Objectives

The next steps in the project involve addressing the critical gaps identified in the research phase. Future objectives include conducting economic feasibility studies, optimizing production techniques and further testing the scalability of the technology. By addressing these objectives, the project seeks to position corn-based carbon fiber as a viable, sustainable alternative in a growing market, adding value to the corn industry while reducing reliance on fossil fuels. Additionally, the team is applying for external funding from the U.S. Department of Agriculture and the Department of Energy to further support this research direction. The long-term goal is to commercialize the production of corn kernel fiber-based CFs, providing a sustainable and cost-effective alternative to traditional CF production methods.

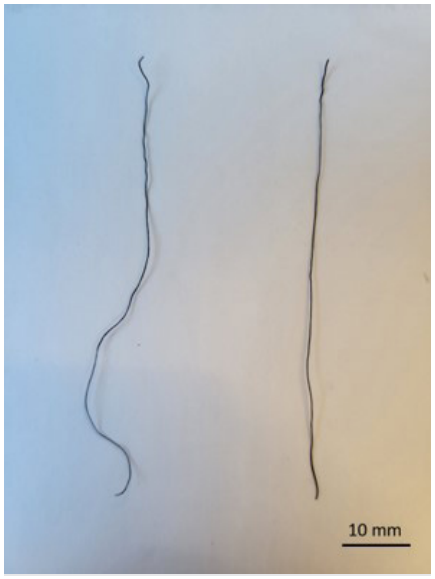

Figure 1. Image of a single strand of carbon fiber derived from corn kernel fibers

Radicle Corn Challenge

RESEARCH TEAM | Chris Bengtson (Iowa Corn), Radicle Insights
FUNDING AWARDED | $25,000

PROJECT DURATION
June 2024-October 2024

Program Conducted

The Radicle Corn Value Chain Challenge, launched in 2024, is a strategic initiative to address the growing need for new markets and uses for corn. The program is managed by the Iowa Corn Promotion Board and Radicle, a global leader in agricultural innovation challenges. Additionally, the challenge is supported by nine state corn organizations (Iowa, Nebraska, South Dakota, Illinois, Kentucky, Kansas, Ohio, Michigan and Colorado). With a budget of $2.3 million, the challenge awards or invests $1 million to the first-place winner and $500,000 to the second-place winner, along with $500,000 allocated for a landscape report and challenge implementation. The contest process includes identifying and evaluating four to six finalists, conducting due diligence and selecting winners through a panel of judges. Winners are supported by Radicle subsequently for three years as they further their objectives.

Impact

The Radicle Corn Value Chain Challenge has the potential to transform the corn industry by identifying and commercializing innovative technologies and products that create new markets for corn. Past Radicle-led events have demonstrated that early-stage startups benefit greatly from strategic and operational support. Winners have a high success rate in raising follow-on capital, highlighting the value of Radicle's mentorship and resources. The challenge's collaboration with state corn organizations exemplifies a successful model for pooling resources to address shared industry challenges.

Outcomes

The Radicle Corn Value Chain Challenge attracted more than 130 applications by April 2024, with a "Shark Tank"-style pitch day held fall 2024 to determine the winning technologies or solutions. Radicle's experience indicates that 64% of applicants are typically international and 86% early-stage startups, ensuring access to cutting-edge ideas and technologies. The program's structure ensures a rigorous evaluation process, including due diligence and final selection by a panel of expert judges. Additionally, the challenge seeks to strengthen partnerships between state corn organizations, universities and commercial entities to ensure scalability and long-term success for the innovations developed.

Future Objectives

Radicle will guide the winners through the investment process, provide strategic advice and connect them with potential investors and commercial partners. By supporting breakthrough ideas, the challenge aims to create sustainable, high-value markets for corn, ensuring economic stability for producers. Expanding the program to include additional winners or a larger prize pool could further enhance its impact. By leveraging Radicle's expertise and resources, the program aims to position corn as a vital and versatile resource for diverse industries, reducing reliance on fossil fuels and traditional markets while creating new economic opportunities for farmers.

Using Corn Starch and Corn Oil to Manufacture High-Capacity Lithium-Ion Batteries

RESEARCH TEAM | Dr. Li Tan, Jayden Palik (UNL)
FUNDING AWARDED | $90,000

PROJECT DURATION
July 2023–June 2024

Research Conducted

The primary goal of this project was to create a carbon material using corn starch and corn oil for application in sodium-ion batteries. This project resulted in a new development strategy for creating battery materials using agricultural-derived products. The creation of this battery material; i.e., formless carbon powders, begins with mixing water, corn starch and corn oil to create an oil-in-water Pickering emulsion or mixture. This emulsion then undergoes several high temperature heat treatments including hydrothermal carbonization. The resulting carbons show variation in composition and battery performance. Preliminary measurements suggested great energy storage from these agro-derived battery materials. This project focuses on optimizing this material specifically for sodium-ion battery anodes utilizing a variety of electrochemical tests, allowing for a scalable and cost-effective manufacturing method.

Impact

The project has led to the development of a novel synthesis strategy for battery materials derived from corn products, marking a significant advancement in the field of sustainable battery technology. By manipulating various parameters, researchers can control the structure and composition of the carbon, which is essential for enhancing battery performance. The ability to produce hollow carbon spheres and other structures offers potential benefits in sodium storage capabilities, contributing to the advancement of high-performance sodium-ion batteries. This rapidly growing market is expected to be valued at $2.13 billion by 2030.

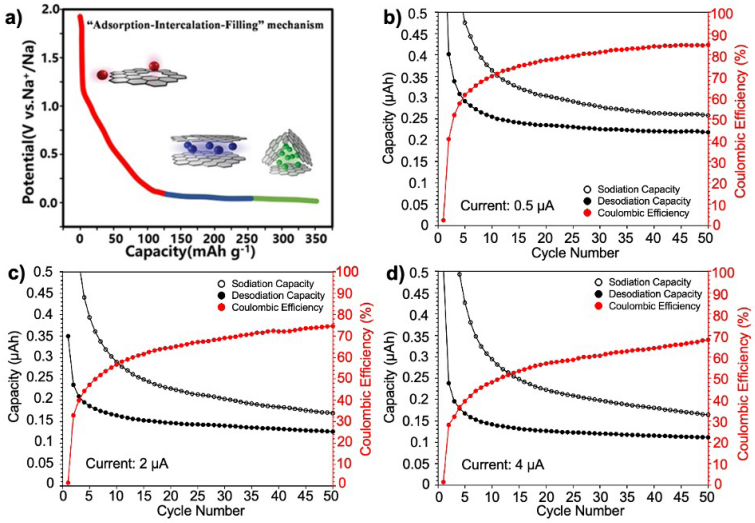

Figure 1. Results from the study showing: a) storage capacity changes based on environmental condition and b-d) capacity change after multiple cycles under varied levels of current.

Findings and Recommendations

To control the structure of the carbon, the amount of corn starch in the emulsion can be altered along with the oil to water ratio. It was found that hollow carbon spheres around 500 nanometers in diameter could be acquired when using an amount of corn starch equal to 10% weight of the total mass of the emulsion and using a 40:60 oil to water ratio. It was also found that hydrothermal carbonization at 270° C for 24 hours followed by a heat treatment under nitrogen at 1100° C for two hours was adequate for conversion to carbon for use in metal-ion batteries. Figure 1a shows the storage capacity of unstructured carbons as conditions change. The red region represents the holding of metal ions onto the carbon surface, the blue region represents the insertion of ions between the graphitic layers, and the green region represents the ions filling into nanopores inside the carbon. In the case of the blue and green regions, there is a greater charge per voltage applied in these configurations.

Figures 1b-d show a key finding, where the batteries do not show long-term cyclability, meaning irreversible capacity loss, a behavior that is often downplayed by other research conducted in this field. The irreversible capacity loss causes short battery cycle life and this stems from lack of stability. Figure 1b also shows that operating at a low electrical current (.5) offers greater efficiency (red line) compared to the higher currents (2 and 4, respectively) for Figure 1c and Figure 1d. Further research is needed to investigate the formation and degradation mechanism of the nanometer-thin layer, where the carbon and metal ions meet.

Future Objectives

Looking ahead, the project team aims to secure additional funding from sources such as the National Science Foundation and the Department of Energy to continue research. Future objectives include continued exploration of the capacity loss issue as well as investigating energy storage capacity under long-term or low temperature storage conditions.

Vinyl Acetate Monomer (VAM) Derived from Corn Feedstocks

RESEARCH TEAM | Dr. Alex Buck, PMP (Iowa Corn), AVN Corporation
FUNDING AWARDED | $75,000

PROJECT DURATION
September 2024–August 2027

Research Conducted

Vinyl acetate monomer (VAM) serves as a building block for various types of plastics, adhesives and everyday products like yoga mats or flip-flops. This project aims to develop a novel process for converting corn-based feedstock into vinyl acetate monomer (VAM), a precursor for various polymers. This venture is coordinated by Iowa Corn with additional funding support from Nebraska Corn, Michigan Corn, Kentucky Corn, Wisconsin Corn, North Dakota Corn and South Dakota Corn. As of November 2024, the project has successfully completed five out of five milestones in its first year, including screening more than 30 catalysts and filing six provisional patents.

Impact

The successful commercialization of this VAM production process is anticipated to increase demand for corn, benefiting corn farmers economically. With a global production of around 18.5 billion pounds of VAM annually, the project is positioned to tap into this growing market, which is expected to expand by approximately **22 million bushels-per-year equivalents**. The project represents a significant step toward reducing reliance on fossil fuels by utilizing corn as a chemical feedstock.

Findings and Recommendations

The project has achieved notable progress, with the Technology Readiness Level (TRL) improving from TRL 3 to TRL 5 (9 being the highest). This indicates substantial advancements in process modeling, simulation and kinetic definitions. The operational strategy of running parts of the project in parallel rather than in series has facilitated a broader scope of work and faster resolution of uncertainties.

Future Objectives

Future goals include expanding the continuous reactor, engaging with commercial partners and producing polymer-grade VAM. Overall, the project is expected to generate valuable research and development outcomes that will aid in the commercialization of the technology.

Contractor

AVN

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Creation, Validation and Implementation of a Universal "Green/Sustainable" Index for Beef

RESEARCH TEAM | Dr. Elliott Dennis, Dr. Mike Boehm, Greg Ibach, Dr. Galen Erickson, Dr. Jay Parsons, Dr. Dick Perrin, Dr. Lilyan Fulginiti, Dr. Andrea Watson, Dr. Emie Yiannaka (UNL)

PROJECT DURATION
July 2022–June 2025

FUNDING AWARDED | $50,000

Research Conducted

This project is co-supported by the Nebraska Soybean Board, Nebraska Farm Bureau, Nebraska Ethanol Board and the Nebraska Beef Council. The overall goal is to develop, validate and implement a sustainability index for beef, which will serve as a score to measure the environmental feasibility, social responsibility and economic viability of beef production. The research team has set several objectives, including comparing existing indices relevant to beef production, creating a new universal "green" index, developing a validation system for this index throughout the beef supply chain and assessing consumer perceptions regarding the sustainability attributes of beef products. The validation system for the index will be developed in collaboration with a third-party auditing firm, which will conduct evaluations post-project to ensure practical implementation. By achieving these goals, the project seeks to establish a standardized evaluation method for Nebraska beef products that can be applied both domestically and internationally, potentially becoming the leading index for responsible beef production.

Impact

This initiative aims to define and quantify responsible production practices in the beef industry in an unbiased and verifiable manner. Nebraska is a prime example of a circular bioeconomy. The development of an evaluation system that measures that heightened efficiency can support producers and ranchers who choose to explore emerging marketplaces. This index is designed to recognize and promote sustainable beef production practices in Nebraska, feedstock production included. The implementation of an index tool for beef could bring enhanced reputation and market differentiation for Nebraska-based beef products, attracting industry investment and expanding consumer audiences.

Findings and Recommendations

The research team has taken a comprehensive approach to developing the sustainability index. The research team has gathered more than 250 existing indices currently used by various corporations and commodities worldwide. This data will help identify relevant factors for inclusion in the new index while analyzing the strengths and weaknesses of existing systems. Ongoing efforts include determining the most relevant factors for beef production, assessing the availability of data to quantify these factors and gathering models to compute index scores. A life cycle assessment focusing on water, energy and greenhouse gas emissions from beef systems is being developed, incorporating improved pasture greenhouse gas measurements and data from Nebraska's production systems. Additionally, the project is enhancing the Integrated Farm System Model (IFSM), a USDA-ARS web tool, and exploring various formulations for the index.

Future Objectives

Next steps include assessing agricultural practices across crop, integrated and livestock systems to evaluate their greenhouse gas management capabilities. Comparisons will be made between U.S. and Nebraska production systems and global food production systems to provide meaningful insights into sustainability measurement. The project also aims to establish accurate sustainable food package labeling to demonstrate value to consumers and retailers. The "green" index will be tested among 2,100 domestic consumers using differing information and labeling strategies, allowing for real-world evaluations of consumer valuations for environmentally certified beef products. The outcomes will inform better labeling designs that effectively communicate the environmental and sustainability benefits to consumers. By positively influencing consumer demand for Nebraska and U.S. beef, the initiative seeks to create demand through both direct premiums and indirect market access, ultimately enhancing the economic viability of beef producers.

Impact of Constant Versus Variable Inclusions of Modified Distillers Grains Plus Solubles on Feedlot Cattle Performance and Carcass Characteristics

RESEARCH TEAM | Dr. Galen Erickson, Dr. James MacDonald (UNL)
FUNDING AWARDED | $67,718

PROJECT DURATION
July 2023-June 2024

Research Conducted

This research aims to evaluate the effects of "constant" versus "variable" inclusions of modified distillers grains plus solubles (MDGS) in the diets of finishing feedlot cattle. The study assessed how varying the dietary inclusion of MDGS impacted cattle performance, carcass characteristics and feed efficiency. The experiment utilized 400 crossbred beef steers, blocked by initial body weight into heavy, medium and light categories, and fed for an average of 191 days. Five treatment groups were studied: a) constant MDGS inclusion at 10% or 25% of diet dry matter (DM), b) variable MDGS inclusion averaging 10% (ranging 0-20%) or 25% (ranging 15-35%) of diet DM, and c) a control group with 0% MDGS. Performance metrics such as dry matter intake (DMI), average daily gain (ADG), final body weight and carcass traits were measured, with carcass data collected at a commercial abattoir. Statistical analysis was performed to determine the effects of MDGS inclusion levels and variability on animal performance.

Impact

MDGS, a byproduct of ethanol production, serves as a valuable feed ingredient for cattle due to its nutritional composition and economic benefits when priced lower than corn. This study provides critical insights into the use of MDGS in feedlot cattle diets, which is highly relevant for Nebraska, where ethanol byproducts are abundant. This research is valuable for feedlot operators, especially those facing supply chain disruptions or fluctuating MDGS availability. It highlights the economic and nutritional implications of feeding MDGS at variable rates, emphasizing the importance of consistency in achieving optimal cattle performance. The findings may influence feedlot management strategies, particularly in optimizing feed formulations to balance cost, supply reliability and cattle performance. By understanding the trade-offs of variable versus consistent MDGS inclusion, feedlot operators can make informed decisions to enhance profitability and efficiency.

Findings and Recommendations

Consistent inclusion of MDGS, particularly at higher levels (25%), showed significant improvements in cattle performance, including increased dry matter intake, average daily gain and carcass weight. However, when MDGS inclusion varied weekly, the performance benefits were less pronounced, particularly at the higher inclusion level. While the study found no statistically significant negative effects of variability, it demonstrated that consistent MDGS inclusion maximized the benefits of the feed ingredient. Feedlot operators should aim for consistent MDGS inclusion in diets, particularly at higher levels (25%), to maximize performance benefits. If supply disruptions necessitate variable MDGS inclusion, operators should anticipate slightly diminished performance improvements, particularly at higher inclusion levels.

The cost-effectiveness of MDGS inclusion should be evaluated relative to corn prices, as higher MDGS levels yield better performance outcomes. Additional studies are needed to explore strategies for mitigating the performance decline associated with variable MDGS inclusion, such as optimizing diet formulations or using alternative feed ingredients during supply shortages.

Future Objectives

Although this specific project is considered complete, additional research is planned to further investigate the effects of variable versus constant inclusions of distillers grains in feedlot cattle diets. The Nebraska Corn Board has awarded funding for a new project at the ENREEC, Eastern Nebraska Research, Extension and Education Center, set to take place in 2024-2025. This study will evaluate five dietary strategies for finishing cattle, focusing on carcass weight and characteristics. The research aims to produce valuable insights that can influence feeding practices and cattle industry standards. Preliminary steps for disseminating results include publishing findings in the 2025 Nebraska Beef Report, related journals and student theses, as well as presenting at conferences.

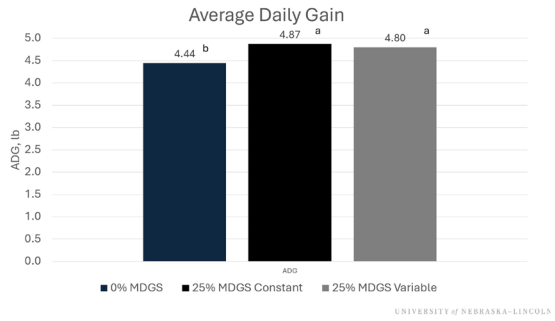


Figure 1. Results of the study showing average daily gain of the following treatments: no inclusion of MDGS, 25% constant inclusion of MDGS and varied inclusion of MDGS.

Interseeding Cover Crops into Early Vegetative Stage Corn to Increase Sustainability and Grazing Potential in Corn Systems

RESEARCH TEAM | Dr. Mary Drewnoski, Dr. Darren Redfearn, Dr. Jay Parsons, Dr. Chris Proctor, Jenny Rees, Laura Thompson, Dr. James MacDonald, Dr. Caro Cordova (UNL)

PROJECT DURATION
July 2022–June 2024

FUNDING AWARDED | $66,534

Research Conducted

A collaborative team of researchers and extension professionals sought to explore the logistical and economic feasibility of interseeding cover crops into early vegetative-stage corn to improve soil health, grazing potential and sustainability in corn systems. Conducted at the ENREEC, Eastern Nebraska Research, Extension and Education Center, from 2022 to 2024, the study aimed to determine whether cover crops such as annual ryegrass, red clover and collards could be successfully established without negatively impacting corn yields. The project also sought to evaluate the economic and ecological benefits of using these cover crops as forage for grazing cattle.

Impact

This project highlights the potential benefits of integrating cover crops into corn systems, such as improving soil health and increasing plant diversity, and providing forage for cattle. However, environmental stressors, particularly drought in 2023 and grasshopper predation in 2024, prevented the successful establishment of the interseeded cover crops. These challenges underscored the importance of reliable irrigation and effective pest management strategies. While the setbacks limited the ability to collect meaningful data on soil health, cattle performance and economic impacts, the research provided valuable insights into the conditions necessary for successful cover crop integration.

Findings and Recommendations

The study revealed that successful establishment of interseeded cover crops in corn systems is highly dependent on environmental conditions. In 2023, drought conditions caused rapid seedling loss despite initial rainfall supporting germination. Similarly, in 2024, grasshopper damage led to complete defoliation of the cover crops within a week, preventing further assessments. These results suggest that irrigation is critical for ensuring the establishment and growth of cover crops, particularly in dry conditions. Additionally, pest management strategies, such as scouting and timely insecticide applications, are necessary to protect the cover crops from damage and ensure full-season growth. While the grasshoppers preferred feeding on the cover crops over the corn, their impact on the cover crop stand highlighted the need for proactive pest control measures.

Future Objectives

Looking ahead, the project team plans to refine their approach to interseeding cover crops. Future objectives include exploring improved strategies for cover crop establishment under variable environmental conditions and investigating pest management techniques to mitigate grasshopper damage. The lessons learned from this project provide a foundation for future research and practical applications, contributing to the advancement of sustainable practices for Nebraska's corn and cattle producers.

Images of cover crop growing between rows of corn.

Improving UNL Nitrogen Algorithm with the 4Rs Nitrogen Management

RESEARCH TEAM | Dr. Javed Iqbal, Dr. Joe Luck, Dr. Bijesh Maharjan, Dr. Chris Proctor (UNL)
FUNDING AWARDED | $84,095

PROJECT DURATION
July 2022–June 2025

Research Conducted

The "4Rs" nutrient stewardship approach—right source, right place, right time and right rate—aims to enhance crop production, profitability and sustainability in agriculture. This project focuses on refining nitrogen (N) fertilization practices in Nebraska by investigating the effects of four N sources (anhydrous ammonia, UAN, ESN and Urea), two placement methods (broadcast and injected) and two timing options (pre-plant and split application) on corn yield and nitrogen losses below the root zone. Field trials were conducted at two sites with contrasting soil types. Data collection and analysis focused on corn yield, N use efficiency, soil N retention and N losses (N2O emissions, NO3 leaching and NH3 volatilization).

Impact

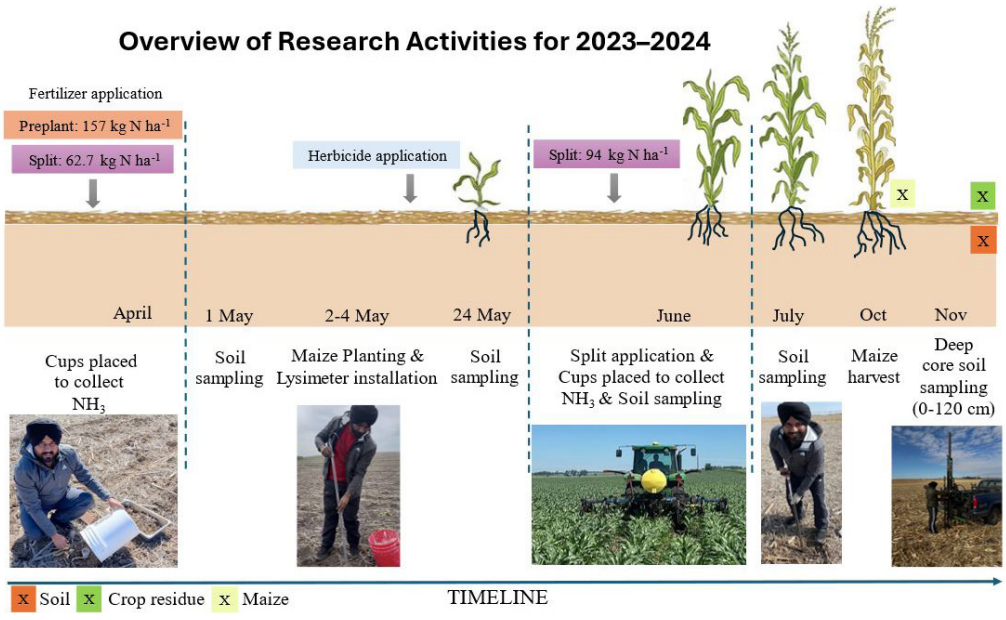
The implementation of the "4Rs" framework offers significant benefits to Nebraska's agricultural stakeholders by providing recommendations on effective nutrient management practices that enhance crop yields while minimizing nitrogen losses. This multi-year project seeks to refine and update UNL's nitrogen recommendations based on empirical data. This work has been shared at numerous events across the state including the Nebraska 4Rs Nutrient Stewardship Field Day and Crop Production Clinics. Collectively, these events have attracted more than 500 attendees, influencing management practices across **6.7 million acres** and resulting in an estimated value of knowledge gained at **$13 per acre**.

Findings and Recommendations

Preliminary results from the previous season found that UAN broadcast with split application achieved high yields on sandy soils. Notably, ammonia volatilization losses were significantly reduced when UAN was injected rather than broadcasted, with injections showing up to a 76% reduction in losses. Split applications resulted in lower nitrate concentrations in leached water compared to pre-plant applications. It is recommended that stakeholders prioritize the use of injected nitrogen sources and split applications tailored to soil type and environmental conditions. These findings emphasize that adopting the "4Rs" framework can improve nitrogen use efficiency, increase crop profitability and protect groundwater quality.

Future Objectives

Moving forward, the project will continue to assess the impact of different nitrogen fertilizer products, placements and timings on crop yield and nitrogen losses during the upcoming year (2024-2025). Specific objectives include investigating the interaction between nitrogen source and placement on nitrogen retention and losses, analyzing the economic returns of the "4Rs" and integrating research findings into UNL's nitrogen recommendation algorithm. The Nebraska Corn Board has approved additional funding to sustain this research, with plans to publish results in peer-reviewed journals and extension articles upon completion. The project also aims to extend knowledge of "4Rs" practices to corn growers, stakeholders and high school agricultural programs, further advancing sustainable nutrient management practices in Nebraska agriculture.



Wood Carbon Subsoil Amendment for Sustainable Corn Production on Sandy Irrigated Soils

RESEARCH TEAM | Dr. Daniel D. Snow, Dr. Arindam Malakar, Dr. Aaron Daigh, Dr. Daniel Miller, Xiaochen Dong (UNL)

PROJECT DURATION
July 2023–June 2025

FUNDING AWARDED | $95,506

Research Conducted

This project seeks to demonstrate the efficacy of subsoil wood carbon injection for improving groundwater quality in areas vulnerable to nitrate leaching by forming a subsoil bioreactor layer. Locally harvested woodchips were ground and injected prior to planting at or below the crop root zone on one-acre test plots. The layer of wood chips is injected using a modified subsoil plow outfitted with a variable-speed auger hopper. Field demonstrations were completed in early May 2024 on two Bazile Groundwater Management Area (BGMA) sites near Creighton, Nebraska. Soil core samples, lysimeter and greenhouse gas samples are currently being analyzed to understand the efficacy of implementation.

Impact

High groundwater nitrate is a problem affecting drinking water quality in many intensively agricultural areas across the United States, presenting substantial annual treatment or avoidance costs to public water systems and private well owners. Few, if any, cost-effective alternatives are available to producers to control nitrate losses in highly vulnerable soils. The estimated cost for injecting wood carbon is expected to be comparable to the cost for other management practices such as cover crops, and if performance is as expected, it may even improve crop yield by improving water retention and phosphorous availability. This management practice will provide a cost-effective, alterative practice for controlling nitrate leaching beneath vulnerable soils. After demonstrating the efficacy at the test plot level, this novel management practice can be scaled up with potential benefits for enhancing carbon sequestration, improving soil health through increased carbon content, phosphorous availability and water-holding capacity. This project plans to demonstrate a research-based technology and practice for both controlling nitrate leaching and sequestering carbon to help farmers increase production efficiency and profitability while safeguarding the natural resources needed for agriculture.

Figure 1. Auger shown injecting woodchips below the surface of the soil yields.

Figure 2. Additional view of auger tool in operation.

Figure 3. Ground woodchips used for the study.

Findings and Recommendations

The research team successfully implemented the wood carbon injection practice on two field sites in 2024 and monitored the sites through the growing season. Initial soil and pore water nitrate concentrations were statistically lower under soils receiving the subsoil carbon amendment. The research team modified the implementation strategy and increased the carbon injection rate, and will revisit these same fields in the spring of 2025 to monitor the benefits and longevity of this novel practice.

Future Objectives

Laboratory measurements and modeling will continue through winter 2024. Additional deep cores of the woody layer are planned for spring 2025 and will be analyzed to provide more quantitative assessments of sequestered carbon and longevity. The research team will seek to determine the optimum injection rate for nutrient control and ease of implementation. Additionally, the team will estimate the overall cost of implementation and carbon offsets that may result from using this practice.

Genomes to Fields (G2F): High Throughput and Conventional Phenotyping of Grower-Relevant Germplasm in Western and Eastern Nebraska

RESEARCH TEAM | Dr. James C. Schnable (UNL), Dr. Brandi Sigmon, Dr. Ravi Mural (SDSU)
FUNDING AWARDED | $58,267

PROJECT DURATION
Ongoing since July 2016

Research Conducted

The Genomes to Fields (G2F) initiative aims to explore the interactions between genotype variation, environmental factors and management decisions to understand yield differences across various farms and conditions. This initiative involves extensive experimentation across multiple field sites over several years, a scale that no single lab or university could manage alone. Researchers from 22 states have collaborated to generate the necessary data, focusing on maize hybrids derived from expired plant variety protection patented inbreds from major seed companies.

Impact

The Schnable Lab at the University of Nebraska-Lincoln (UNL) contributed to the G2F initiative by establishing two replicated field sites in Nebraska's eastern and western regions. This strategic placement ensures the collection of high-quality phenotypic data, which enhances predictive models for yield across diverse environments and management practices. These models could significantly reduce the number of physical locations needed for hybrid performance evaluations, thereby increasing genetic gain efficiency and benefiting Nebraska farmers in the near future. Moreover, the G2F initiative provides access to a one-of-a-kind publicly available dataset for young professionals across the nation throughout their undergraduate and graduate careers.

Findings and Recommendations

In both 2023 and 2024, dryland/rainfed G2F trials were planted in two contrasting environments across Nebraska: the UNL Havelock Research Farm and the UNL West Central Research, Extension and Education Center. Both sites included 550 experimental plots each, with weather stations installed to record critical environmental data such as temperature, rainfall and soil moisture. Agronomically relevant growth and development traits, including ear height, plant height and flowering time, as well as plot-level grain yield, were recorded for each experimental plot. All data is uploaded to CyVerse, which consolidates G2F data from all participating states, making it publicly available to researchers. Additionally, high-throughput phenotyping methods were employed, utilizing satellite and UAV imagery collected at three growth stages to predict flowering time and grain yield remotely. A smaller high-density phenotyping experiment was also conducted at UNL's Field Phenotyping Facility, featuring a subset of 22 G2F hybrids replicated twice. This facility uses an automated Spidercam system to continuously monitor various phenotypic traits throughout the growing season. Data from the 2023 project has been submitted to the central organizers and will be part of the 2024 Genomes to Fields Yield Prediction contest, sponsored by the Iowa Corn and National Corn Growers Associations. During this reporting period, one publication

Field crew members preparing to collect samples.

detailing G2F project data was released, alongside two preprints based on G2F data from UNL.

Future Objectives

Moving forward, the G2F initiative aims to refine predictive models further and enhance the understanding of genotype-by-environment interactions. Continued collaboration among researchers across states will be essential to expand the dataset and improve the accuracy of yield predictions. The integration of advanced phenotyping technologies and data analytics will play a crucial role in achieving these objectives, ultimately supporting sustainable agricultural practices and improving crop performance under varying environmental conditions.

Nebraska On-Farm Research Network

RESEARCH TEAM | Dr. Travis Prochaska, Dr. Guillermo Balboa, Adam Leise (UNL)
FUNDING AWARDED | $66,500

PROJECT DURATION
Ongoing since July 2014

Research Conducted

The Nebraska On-Farm Research Network conducted approximately 80 on-farm research studies in collaboration with 28 members of the Nebraska Extension team during the 2023 growing season. This project focused on implementing a statewide on-farm research program to address critical farmer production, profitability and sustainability questions. The network sought to answer these questions through collaboration with growers across the state.

Impact

The project's impact extended to both crop producers and advisors, who reported significant value gained from the research. Crop producers noted a value of almost **$800,000** due to knowledge gained from the network, while advisors noted a value of nearly **$10 million**. Attendees at the annual results update meetings expressed appreciation for the opportunity to learn from other producers, access unbiased results and engage in discussions about on-farm research projects.

Findings and Recommendations

This report does not provide specific findings and recommendations from individual research studies as there are far too many to include. However, it highlights the network's dedication to addressing critical production, profitability and sustainability questions pertinent to Nebraska corn growers. The research team presented their findings and recommendations through various channels, including an annual report book, Annual Results Update meetings and CropWatch articles. Additionally, they engaged in broader knowledge dissemination through publications, guest lectures, podcast interviews and media appearances.

Future Objectives

The Nebraska On-Farm Research Network aims to continue providing growers with opportunities to use their resources to answer production-related questions and generate new discoveries. Looking forward, the network plans to continue recruitment of producers and advisors, improve digital data collection and processing, and facilitate an interactive professional development learning network for corn producers.

Adam Leise has recently accepted the role of director for the On-Farm Research Network. His vision is to continue pushing for research related to agronomic decision making, while finding the intersection where economics and crop production meet.

"Each arm has its own goals, both short and long term," Leise said. "We hope to collaborate with farmers in order to help achieve these goals, while focusing on key hot spots including production, fertility management and regenerative practices in hopes to set up our land for the next generation."

Testing Ag Performance Solutions (TAPS)

RESEARCH TEAM | Dr. Chris Proctor, Chuck Burr, Dr. Julie Peterson, Dr. Mark Burbach, Dr. Matt Stockton, Sarah Sivits, Samantha Daniels, Dr. Hope Nakabuye, Dr. Abia Katimbo (UNL), Dr. Daran Rudnick (KSU)

PROJECT DURATION
Ongoing since July 2021

FUNDING AWARDED | $52,000

Program Conducted

The TAPS program uses farm management competitions to engage agricultural producers in improving input use efficiency, profitability and environmental stewardship. The 2023 competitions focused on subsurface drip-irrigated corn, sprinkler-irrigated corn and popcorn in North Platte, Nebraska, as well as dryland and irrigated sorghum in Grant, Nebraska. The figure below shows the variability in nitrogen and irrigation decisions amongst teams in 2023, and highlights how efficient use of water and nitrogen can still result in high yields.

The 2024 competitions began in March with a kick-off event hosted at the Bayer Learning Center in Gothenburg, featuring a demonstration of John Deere's See & Spray Technology. The 2024 competition lineup included sprinkler-irrigated corn and continuous corn in North Platte, sorghum in Grant and soybeans in Mead.

Impact

The TAPS program provides a low-risk platform for producers to experiment with new and emerging technologies and management strategies before implementing them on their own farms. The program also allows researchers to conduct new research and demonstrate existing tools, methods and resources, enabling producers to benchmark their benefits and challenges against standard grower practices. By participating in the TAPS program, producers can explore new ideas, test conventional wisdom and discover improved business practices in a friendly, competitive environment.

Outcomes

More than **100** participants, including producers, agricultural education students, collegiate groups, government agencies and Natural Resources District employees, were involved in the 2023 competitions. In addition to the competitions, the TAPS program hosted webinars with six soil moisture sensor companies to help participants understand these technologies and navigate the software. For the 2024 season, the program supported **130** participants, with about 70% participating in the two corn competitions. In late June, the project team hosted a field day at the TAPS competition site in North Platte, which included both in-field and classroom sessions, as well as a networking event.

Future Objectives

Looking ahead, the program will continue at the West Central Research Extension and Education Center (WCREEC) in North Platte, and a new irrigated corn competition will be added at the Eastern Nebraska Research Extension and Education Center (ENREEC) near Mead in 2025. The TAPS program will engage approximately 75 teams in corn management competitions, focusing on achieving the highest grain yield, most efficient use of water and nitrogen, and highest profitability. New metrics like carbon intensity scores will be incorporated into evaluations. The TAPS team plans to prepare additional research papers for submission and engage the agricultural community through newsletters and workshops to further advance practices and insights within the industry.

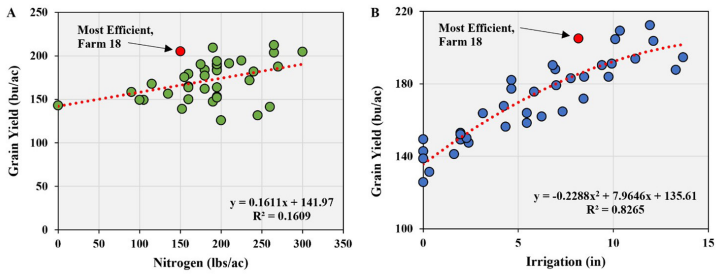


Figure 1. 2023 sprinkler corn grain yield response to seasonal total nitrogen fertilizer (A) and irrigation (B) at the WCREEC in North Platte, Neb. The most efficient farm as measured by the Water Nitrogen Intensification Performance Index (WNIPI) is denoted in red.

Figure 2. TAPS field day participants discussing soil moisture sensor technology.

Innovative Corn Rootworm Management: Corteva-UNL Collaboration

RESEARCH TEAM | Dr. Julie A. Peterson, Dr. Humberto Blanco, Dr. Tom Powers, Dr. Nicholas Cafaro la Menza (UNL)

PROJECT DURATION
July 2021–June 2024

FUNDING AWARDED | $33,856

Research Conducted

The western corn rootworm (WCR) is a major pest of continuous corn in Nebraska that has evolved resistance to multiple types of control strategies, posing a threat to the sustainability and economic viability of corn production in Nebraska. Biological control using entomopathogenic nematodes (EPNs—tiny worms that kill insects) and predatory insects can be a control strategy used alternatively or in tandem with conventional insecticides and Bt traits. This project explores the use of cover crops to promote larger populations of predatory insects and support EPNs as a method to address WCR pressure. Five on-farm sites near Madrid and Lexington were utilized for this study. Each site is an approximately 132-acre center pivot irrigated field of continuous corn. At the cover crops site, interseeded cover crops were planted at the V4 growth stage of corn. This cover crop was a mix of annual ryegrass, winter rye, rapeseed, flax, buckwheat, cowpeas and red clover. Variables measured include establishment and persistence of nematodes in the soil after application via center pivot, root feeding injury from WCR and beetle emergence, beneficial predatory insect communities, and their consumption of WCR and soil health measures. Insights were shared via a collection of peer-peer producer learning groups, field days and conferences.

Impact

This approach to WCR management can improve the stewardship of inputs (both traditional chemical insecticides and transgenic Bt traits) by studying potential biological control to minimize threats from critical insect pests, ensuring sustainability and economic viability of corn production in Nebraska. By conducting this research on real Nebraskans' farms, involving the grower-collaborators in the research process and sharing information back with them, this project aims to bring practical and adoptable pest management options to Nebraska corn growers.

Findings and Recommendations

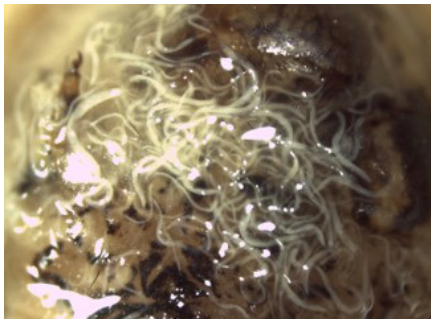
Regarding the persistence of nematodes, the highest level of nematode recovery was seen at 380 days after nematode application via center pivot. Poor or delayed establishment of nematodes led to no observed impact to rootworm populations. This could be due to poor environmental conditions during time of application, indicating that optimal conditions are a critical factor. When identifying the nematodes present as either native or applied, most present were native nematodes. Lack of persistence among applied nematodes indicates native populations could be more robust. In evaluating the influence of Bt traits, non-Bt check strips experienced higher feeding damage; however, there was a trend toward reduced feeding in areas where nematodes were applied.

Future Objectives

The project will continue analyzing data collected during the summer of 2024, including soil health measurements, and extend outreach activities into 2025. A related USDA-NIFA-funded project, led by Texas A&M, will investigate the impact of EPNs on non-target insect communities. Results from this study will be published and used to refine pest management recommendations.

Corn roots collected for analysis

Corn rootworm larvae



Entomopathogenic nematodes

Mitigating Tar Spot Disease in Nebraska Irrigated Corn

RESEARCH TEAM | Dr. Tamra Jackson-Ziems, Talon Mues (UNL)
FUNDING AWARDED | $70,592

PROJECT DURATION
July 2023-June 2025

Research Conducted

To mitigate tar spot disease in irrigated corn, this project seeks to monitor and document its movement across Nebraska. The research team is evaluating tar spot development under different irrigation conditions and the efficacy of fungicides applied through irrigation. In 2023, researchers monitored four grower fields with weather stations to collect data on precipitation, temperature, relative humidity and leaf wetness duration during irrigation events. They also studied how the height of irrigation sprinklers affects the microclimate, comparing the impact of high and low sprinkler heights on microclimate parameters during and after irrigation. Additionally, the impact of overhead pivot irrigation on tar spot incidence and severity in a field with moderate disease pressure was assessed, comparing disease levels in the rainfed corner, outer span and inner span of a pivot's application area.

Impact

In 2023, tar spot was identified in 47 counties across Nebraska, marking a significant increase in its distribution compared to the previous year. Tar spot disease poses challenges for producers and field practitioners in making crop and disease management decisions. Its recent arrival in Nebraska complicates disease identification and management, particularly in irrigated environments where the disease's favored cool and wet conditions may be more prevalent. This research aims to provide insights into the impact of irrigation practices on tar spot development, enabling growers to implement effective management strategies to mitigate the disease's impact on corn yields.

Findings and Recommendations

Initial findings from the 2023 season showed that irrigation can significantly alter the field microclimate, increasing humidity and leaf wetness duration, factors that favor tar spot development. The study also observed that irrigation events differ across pivot spans, with longer durations and greater microclimate impacts near the pivot point. Lowering sprinkler height appeared to reduce the impact on the microclimate compared to higher sprinkler heights. In a field with moderate tar spot pressure, overhead pivot irrigation increased disease incidence, with a trend of higher severity near the pivot point. To further understand these dynamics, the study recommends continued monitoring and data collection in the 2024 growing season to confirm these preliminary findings and improve disease management strategies.

Future Objectives

For the 2024 growing season, the research team expanded data collection on tar spot pressure by scouting 20+ fields across Nebraska with known disease levels. They monitored disease development in the rainfed corner, outer span and inner span, collecting weather data at randomized distances from the pivot point. The sprinkler height study was repeated with a more susceptible corn hybrid to enhance disease development. The chemigation study, which was not conducted in 2023 due to limited disease development, was implemented at the Eastern Nebraska Research, Extension and Education Center (ENREEC) and in an on-farm research trial. Researchers will continue to monitor tar spot statewide and share updates through social media and Extension programs to inform stakeholders.

Figure 1. Tar spot symptoms on corn leaf

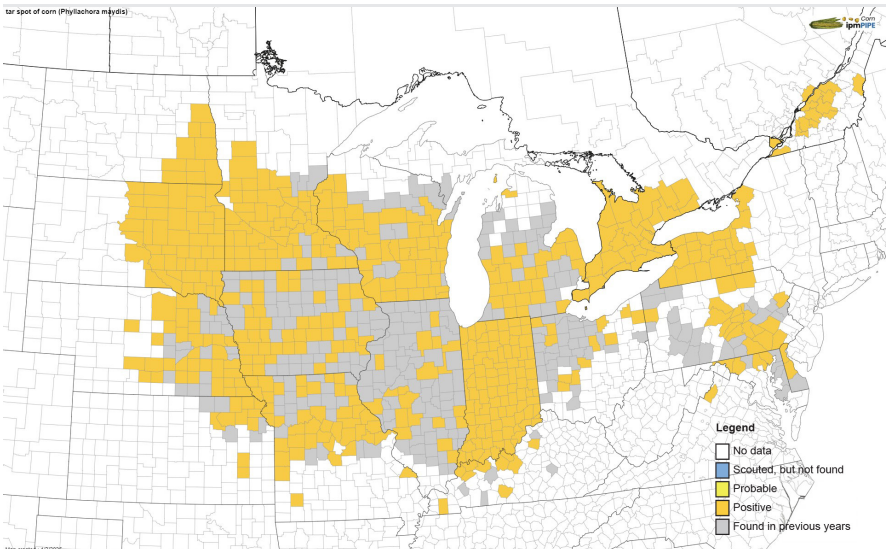


Figure 2. Distribution map of tar spot disease spread across the Midwest Cornbelt.

Understanding Crown Rot Disease in Corn

RESEARCH TEAM | Dr. Tamra Jackson-Ziems, Mukuma Chikoti, Christopher Termunde (UNL)
FUNDING AWARDED | $39,810

PROJECT DURATION
July 2023–June 2025

Research Conducted

This research project focuses on crown rot disease of corn, which has been increasing in severity over the past decade, raising concerns among producers and the agricultural industry. This study aimed to investigate the pathogens responsible for crown rot and their interactions with other pathogens, production practices and field conditions. The research team collected more than 1,000 corn samples exhibiting crown rot symptoms from nine states between 2023 and 2024. They isolated and identified various fungal pathogens from these samples. The researchers also conducted experiments to optimize inoculation and resistance screening procedures. They tested four types of inoculation procedures, including layering, concentration, toothpick and cold treatment, to evaluate their effectiveness in inducing crown rot symptoms.

Impact

Crown rot disease of corn has increased in cornfields for more than a decade. Often the first indication of crown rot disease is the sudden discoloration and death of a few plants to large clusters of corn plants in the weeks leading up to harvest. Unfortunately, many questions remain unanswered about crown rot disease, such as which or how many pathogens cause crown rot and are there interactions with other pathogens or production practices and field conditions contributing to development of disease? Knowing the pathogen(s) responsible for causing the disease is a first step in addressing the options to help producers avoid and minimize crown rot. Results from these experiments will provide insight into factors that can lead to crown rot and can be targeted for future disease management research.

Findings and Recommendations

The findings from the 2023 sampling efforts highlighted the diversity of fungal pathogens associated with crown rot disease, with more than 60% identified as Fusarium species. The researchers found that Fusarium species were the most prevalent pathogens associated with crown rot disease in the collected samples. While the toothpick inoculation method successfully induced crown rot symptoms, other methods primarily resulted in root rot. Recommendations include continuing to analyze field conditions and production practices that favor crown rot development, as well as further investigating the relationship between crown rot and other pathogens, including nematodes.

Figure 1. Image of crown rot development in corn

Future Objectives

The research team plans to analyze survey data from the past two years to identify production practices and field conditions that favor crown rot development. Additionally, they will continue isolating and identifying pathogens from late-season samples, complete the sequential sampling of fields with a history of crown rot to investigate sources and infection timing, and conduct further inoculation procedure experiments and develop a scale for rating crown rot symptoms in corn. Finally, the research team will evaluate the association of nematode populations with crown rot and perform community analysis of plant tissue and soil samples to investigate the role of other microbes. Following the completion of the project, the team plans to publish at least three scientific papers targeting each project objective. Additionally, they aim to build a collection of fungal isolates for further genetic studies. Preliminary findings have already been shared at various Extension and industry meetings, including the North Central Division of American Phytopathological Society (APS) in June 2024, paving the way for future discussions and potential funding opportunities.

Ag Literacy Festivals

RESEARCH TEAM | Cole Meador, Brett Kreifels (UNL)
FUNDING AWARDED | $7,500

PROJECT DURATION
Ongoing since July 2023

Program Conducted

Agriculture Literacy Festivals are held across the state educating youth about Nebraska's number one industry: agriculture. The program seeks to increase student knowledge, understanding, positive attitude and interest in the food system. As a result, youth gain a better understanding of agriculture's impact on Nebraska and become more informed consumers who can make well-informed decisions concerning agriculture issues.

Additional funding from the Midwest Dairy Association provides support for dairy producers to present and bring cattle to festivals and provide food samples. Additional supporters include AFAN, Ag in the Classroom, local and state commodity boards, local fair boards, farmers, FFA chapters, implement dealers, and Nebraska Extension faculty and staff.

Impact

In 2023-2024, 20 Ag Literacy Festivals reported educating **6,070** second, third, fourth and fifth grade students coming from 153 schools in 68 communities across Nebraska. Based on teacher evaluations (N=91), 91% indicated that they "agreed" or "strongly agreed" that their students learned more about agriculture and the food system by attending. One hundred percent indicated they would attend another Ag Literacy Festival in the future. Since the creation of Ag Literacy Festivals, 90,664 grade school students have attended.

Teacher Feedback:

"During this presentation we are actually learning about health, agriculture, how food gets from farm to table, etc. It is perfect for us."

"Opens the kids' eyes to possible careers and where their products come from."

"The students talked about this experience for many weeks following the event. They loved getting to see all the different things and learn more about animals and industries they don't know much about."

"The activities and presentations directly relate to our curriculum and standards. Kids are able to acutely participate in activities that relate to what we are learning in the classroom. Some of our students have never been to a farm so it is great for them to be able to have the opportunity to visit a farm and be able to interact with the animals and see how they impact Nebraskans."

Future Objectives

Agriculture Literacy Festivals will continue for the 2024-2025 fiscal year. Festivals began in September 2024 and will continue through spring 2025.

Innovative Youth Corn Challenge: Creating the Next Generation of Agronomists

RESEARCH TEAM | Brandy VanDeWalle, Aaron Nygren (UNL)
FUNDING AWARDED | $9,000

PROJECT DURATION
Ongoing since July 2013

Program Conducted

The Innovative Youth Corn Challenge empowers youth to take an active role in corn production. The program provides participants with the opportunity to plan, develop, implement and evaluate a plot project. Since its inception in 2012, the Innovative Youth Corn Challenge has seen 102 teams participate, with 55 teams successfully harvesting and analyzing their plot data. A total of **291** youth have been involved in the program, with three teams currently competing. The program's hands-on and in-depth approach equips youth with essential critical thinking and problem-solving skills, ensuring they are well-prepared for future roles in the agricultural industry.

Impact

Employment in the agriculture sector is growing steadily, with many new and evolving workforce roles emerging over the next decade. There is a need for the agricultural community and industry leaders to explore ways to integrate youth into the agricultural workforce. The Innovative Youth Corn Challenge has consistently inspired participants to pursue careers in agriculture, with many entering the agronomy field. For 12 years, the Innovative Youth Corn Challenge has offered youth the opportunity to work with agronomic professionals, extension educators and agricultural educators to develop essential skills for making informed, sustainable production decisions. The program has evolved over the years to maintain its relevance, introducing new opportunities while preserving its core focus. This continued innovation has attracted attention from 4-H Club leaders, FFA advisors and Extension faculty nationwide. Notably, the decision to lower the minimum participation age from 10 to eight years old has sparked interest among a new generation of eager 4-H members. A few stories of former participants, such as the 2013 participant now in a managerial role and contributing to the community, and the 2018 participant achieving historic milestones and working as an innovation agronomist, showcase the program's long-term impact. By providing experiential learning opportunities to youth, the Innovative Youth Corn Challenge is shaping the future of the agricultural industry.

Outcomes

During the 2023 growing season, five teams successfully completed their corn challenge plots. Evaluations revealed that 100% of participants either agreed or strongly agreed that the program enhanced their ability to: (1) accurately identify pests, (2) understand crop scouting procedures, (3) set up on-farm research plots, (4) determine the profitability of field practices and (5) evaluate new products or practices in the field. Two teams also completed the agricultural literacy component. The Arlington FFA and Exeter-Milligan-Friend FFA chapters created an impressive video showcasing their field project efforts. The results were shared via Nebraska Extension's CropWatch page, Nebraska Farmer magazine and social media. The Arlington FFA chapter's video alone garnered 909 views. In the 2024 growing season, five teams successfully harvested their corn plots. Additionally, two teams, consisting of 18 youth, participated in a drone field day. These teams were provided with Tello EDU drones to use in crop scouting and

to complete their agricultural literacy projects. Participants also had the chance to fly a Mavic drone, capturing pictures and videos. For the 2024 growing season, youth had access to 360-degree and time-lapse cameras for their projects. As youth advance in the agricultural literacy component, their work will be showcased on social media and Extension media. Additionally, 83% of the youth discovered new career options and expressed interest in pursuing a career in agriculture.

Future Objectives

The program team plans to include additional opportunities for participants to engage in alternative agricultural competitions including the UNL-TAPS (Testing Ag Performance Solutions) program where students will actively participate in the TAPS irrigated corn or continuous corn competitions hosted at North Platte. The program plans to increase collaborative partnerships with input providers to give students the opportunity to build relationships with agricultural professionals. Participants will also engage in a hands-on workshop to create a 360° virtual reality field trip of their plot. By the end of the virtual reality workshop, participants will be able to create and explore pre-made virtual field trips from Nebraska, Alaska and Hawaii.

Categorical/ Funding Breakdown

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