RESEARCH DIRECTORY 2016

MinnesotaCorn GROWERS ASSOCIATION

MinnesotaCorn RESEARCH & PROMOTION COUNCIL

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This publication provides an overview of research projects jointly funded by the Minnesota Corn Growers Association (MCGA) and the Minnesota Corn Research & Promotion Council (MCR&PC) through the Minnesota corn check-off. Included in this research portfolio are projects that promote the success of Minnesota corn farmers, their families, and Minnesota's rural economy. The corn check-off, self-funded by corn farmers themselves, supports research that investigates the development of value-added products, the management of corn inputs, topics related to ethanol use, the evaluation of genetic traits, and the relationship between agricultural management practices and water quality.

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Moving Corn Northward: Identification of High Quality Corn Under Cold Stress (2011)

University/Company: North Dakota State University
Principle Investigator: Marcelo Carena

The purpose of this project is to expand corn to cooler seasons and increase the profitability of northern Minnesota farmers. A long-term solution for improving profitability in this vast region is to develop cold tolerant high quality products for the sustainable corn production in central and northern Minnesota. For that purpose, this project will utilize unique corn products and methods developed in joint historical successful efforts between North Dakota and Minnesota. Thousands of lines and hybrids will be screened in marginal regions under severe controlled cold stress short-season environments aiming at fast cold tolerance short-season genetic improvement. Elite tropical and temperate corn adapted to North Dakota will be screened and only a few will survive each season for hybrid testing.

Risk and Management of Goss's Wilt of Corn (2013)

University/Company: University of Minnesota
Principle Investigator: Dean Malvick

Although corn producers in Minnesota have historically had few significant problems with leaf diseases, this has changed recently with the emergence of Goss's leaf blight and wilt. Goss's wilt is now known to be widespread in cornfields across the state and, thus, more inoculum is available than ever to increase the risk of this disease, which can greatly reduce yields.

Management of Goss's wilt is based on genetic resistance, although crop rotation and tillage may also be important. However, these practices have not prevented yield loss in all fields, and there is a paucity of information available upon which to improve and tailor management practices for Minnesota for the short and long term.

This research will look to determine if there is pathogenic variability in the populations of the Goss's wilt pathogen that threatens durability of resistant hybrids. It will also endeavor to determine which factors influence survival and spread of the Goss's wilt pathogen in a field and area.

Maximizing Soil Warming and Health Under Different Tillage Practices in a Corn-Soybean Rotation (2014)

University/Company: University of Minnesota
Principle Investigator: Jodi DeJong-Hughes

This is a multi-state effort involving Minnesota and North Dakota corn and soybean growers. This study is based on the following producer questions: What are the benefits of using chisel plow, vertical tillage and strip till on clay and/or loamy soils; how do I manage residue in each type of tillage system; can I achieve the same yields under all three types of tillage; and how does my choice in tillage practice affect the bottom line of my farming operation? This study is designed to answer these questions and others over the span of four years. All the work will be completed using full-sized equipment to get an accurate representation of each tillage practice and allow producers to visualize the implementation of each practice on their own farm.

Planting Date Effects on Corn Yield (2014)

University/Company: University of Minnesota
Principle Investigator: Tom Hoverstad

Minnesota farmers oftentimes face the possibility of not being able to plant corn until after the optimum planting date due to wet soil conditions in the spring. Current yield by planting date tables are based on data obtained a decade ago. Consequently, there are questions as to the validity of this data given advances in corn genetics over time. As corn acreage in northern Minnesota increases, this information becomes even more critical given new corn genetics. The objective of this study is to provide Minnesota corn growers with up-to-date information about corn yield losses associated with late planting.

Moving Corn North: Developing the Next Generation of Early Maturing Products (2014)

University/Company: North Dakota State University
Principle Investigator: Marcelo Carena

This project addresses northern corn productivity and profitability as well as value-added market opportunities by breeding the next generation of short-season corn products. This project is innovative as it focuses on the invention of new products and the generation of new cost/effective methodologies for breeders and farmers. Growing productive shorter-season corn solves most of the agronomic problems facing Minnesota corn farmers. Still, the market offers slower-drying hybrids that are not stable to northern Minnesota environmental conditions. This research will be essential to influence the corn industry to invest in central and northern Minnesota, independent from commodity price.

This research will look to adapt tropical genes to short-season environments and may have large implications to industry and farmers in the long run. The objective is to advance corn to an earlier maturity at an average rate of 2-3 days per year by development of new germplasm carrying genes not identified in multi-million genome sequence projects.

Improving Corn Grain Yield Through Grain Yield Component Traits (2015)

University/Company: University of Minnesota
Principle Investigator: Candice Hirsch

Grain yield in corn has improved constantly over the past century due to many factors including improved genetics, the advent of hybrid seed production, changes in agronomic practices, and implementation of biotechnology. In 2012, Minnesota corn growers produced corn on nearly 9 million acres statewide, and harvested approximately 1.4 billion bushels of grain. While dramatic improvements have been made, the ceiling for grain yield has not been reached.

Understanding the genetic basis of corn grain yield and yield component traits, such as seed size, is important for making continued progress in corn grain yield potential. Some mutants that effect overall seed and/or endosperm development have been identified in corn; however, the genetic basis of seed size variation and other yield component traits is still largely unknown. Our aim is to understand the genetic basis of corn grain yield by characterizing the genetic basis of grain yield component traits and determining the relationship of those traits with grain yield. It is anticipated that results from this project will be used by corn breeders to develop higher yielding hybrids that are also more stable across environments.

Impact of Cover Crop Strategies on Productivity of Corn (2016)

University/Company: University of Minnesota
Principle Investigator: Axel Garcia Y Garcia

The dominant crops in Minnesota are corn and soybeans; together, they are responsible for more than 80% of the $9.25 billion value of the state's field and miscellaneous crops in 2014 (USDA-NASS, 2015).

As part of the Midwest, the state is within one of the most intense agricultural areas in the world. Corn and soybeans, the main crops, are typically grown in rotation using conventional cropping practices, including high external inputs. The practice is under scrutiny due to issues with soil erosion and nutrient losses, such as nitrogen in the form of nitrate (NO_3) polluting water resources.

Cover crops integrated into current cropping practices have been promoted as an affordable and environmentally friendly option for crop production. Intuitively, cover crops will use water and nutrients and may influence weed, insect and pathogen populations, but the strategy is expected to result in a more efficient use of resources while maintaining or improving productivity and enhancing the quality of the environment. The goal of this proposal is to assess the impact of cover crop strategies on the productivity of corn grown under different environments and production practices.

Development of Biobased Class B Fire Retardant (2012)

University/Company: Agricultural Utilization Research Institute
Principle Investigator: Liana Palaikis

This project will develop and scale-up for manufacture agricultural component-based, next generation Class B and/or Class A/B firefighting concentrate compatible with on-truck liquid delivery systems. Class B fires involve flammable liquids, gases, solvents, oil, gasoline, paint, lacquers, tars and other synthetic or oil-based products. There is a need for improved Class B products that are safer for the environment and exhibit improved stability when applied to a fire for greater product efficacy.

Corn Protein Plastics for Agricultural Products (2013)

University/Company: Iowa State University
Principle Investigator: David Grewell

This project will identify certain chemical and physical treatments from corn proteins that will be selected according to various attributes including mechanical strength, temperature stability and processability that will produce a zein-polylactic acid (zein-PLA) product that can replace petroleum-based plastics and will be friendly to the environment.

Adequacy of Manure Produced by Feedlot Cattle Housed Under Various Facility Types (2013)

University/Company: University of Minnesota
Principle Investigator: Alfredo DiCostanzo

This study proposes to test if the type of manure management system is a factor in determining the nutrient value of manure. The project will focus on manure sampling and testing, manure spreader calibrations, and the economics of different manure management systems.

Mitigating HCL Emissions from the Gasification of Corn Cobs Using Low Cost Fuel Additives: A Pilot Study (2014)

University/Company: University of Minnesota, Morris
Principle Investigator: James Barbour

The objective of this project is to test the efficacy of three potential hydrochloric acid (HCL) mitigation agents (lime, kaolin and dolomite) at laboratory scale as a pilot project to guide the design of a full-scale test. The Minnesota Legislature has enacted a major Energy Future Bill that requires the study of biomass fuels, especially agricultural biomass, to displace a large amount of fossil fuels. Mitigation of HCL from corn cobs during gasification/combustion will increase the viability of corn cobs as a fuel and increase the potential marketability of this valuable corn residue.

Financial and Beef Quality Implications of Corn Crop Harvest Options for Cattle Feeders (2014)

University/Company: University of Minnesota
Principle Investigator: Alfredo DiCostanzo

This project will aid in evaluating shredlage (whole-plant shredded silage), earlage, high-moisture corn and rolled corn as options for most return per acre of corn planted when fed to cattle. By determining the corn crop harvest that maximizes beef yield per acre, additional corn acres would become available on cattle feeding operations when corn grain prices increase to meet demand for corn grain. Finding corn crop harvest options that sustain the beef industry financially will permit a continued thriving market for corn.

Enhancing the Feeding Value of Corn Residues to Improve Beef Cattle Production (2014)

University/Company: University of Minnesota & University of Illinois
Principle Investigators: Allen Bridges, Ryan Cox and Tara Felix

The focus of this research is to determine the most cost-effective approach for enhancing feed value of poor quality roughages (corn residue); development of alternative grazing approaches for backgrounding; evaluating cattle performance on alternative feeds during the backgrounding period; and residual effects of roughage inclusion and source in backgrounding diets on feedlot performance and carcass quality.

Converting Condensed Distillers Solubles (CDS) to Slow Release Fertilizers and Adsorbents for Phosphorous (2014)

University/Company: University of Minnesota
Principle Investigator: Kenneth Valentas

It has been reported that a magnesium oxide-biochar nanocomposite will adsorb phosphorous and nitrates from aqueous medium. This has significant implications for reducing phosphate and nitrate runoff from agricultural operations and also for functioning as a slow release fertilizer for controlled phosphorous application. These nanocomposite were made by dry pyrolysis from biomass such as sugar beet tailings, tomato leaves and the like.

Utilizing biomass such as beet tailings or tomato leaves is problematic since energy must be provided to dry the biomass for dry pyrolysis to form the biochar, and handling and transport of such materials are, at best, difficult and expensive with microbial action likely to degrade and alter the material prior to processing.

For wet biomass, such as condensed distiller's solubles (CDS), Hydrothermal Carbonization (HTC) is the preferred technology for producing a char from the standpoints of efficacy and simplicity of the process and the favorable energetics. The resulting magnesium-hydrochar is expected to exhibit functional advantages compared to a biochar product. Furthermore, CDS is readily accessible at all corn ethanol plants. We propose utilizing HTC technology to convert CDS to a hydrochar that will be processed in various ways to yield three value-added products.

Food Grade DDG for Human Consumption–Value Enhancement of a Corn Co-Product (2015)

University/Company: South Dakota State University
Principle Investigator: Padmanaban Krishnan

The purpose of this study is commercial development of Food Grade Distillers Grains. New food grade ethanol plants have come on-line in recent years and are a significant development since there is now an even greater need for new markets and new applications for a co-product of ethanol production. The goal of the research is to use part of the stream in ethanol plants for the production of wholesome dried distillers grains (DDG) that meet the specifications of a food ingredient. This research proposes to develop a set of specifications to serve as a standard.

The research also will determine the minimum inputs to processing DDG while maintaining minimal cost. Minimal treatment inputs administered to DDG streams at the ethanol plant are key to an inexpensive but high-value food grade DDG. Laboratory investigation will lead to optimization of the corn substrate used for fermentation.

Value-Added Materials from Corn Stover (2016)

University/Company: University of Minnesota
Principle Investigator: Marc Hillmyer

Our overall goal in this project is the utilization of abundant and readily available organic chemicals derived from corn stover for the preparation of new polymeric materials through the discovery of novel chemical transformations. Polymerization of reactive monomers to produce materials having versatile properties and applications is the backbone of the polymer and plastics industry. The discovery of unique polymerizable monomers and of new methods for polymerization using corn-derived chemicals will lead to novel materials having unique and useful properties.

Through the efforts in this proposed research project, we aim to expand bio-based opportunities by conversion of the highly functional molecules that can be derived directly from abundant corn-based biomass into materials with high potential value. Through new efficient transformations, our team will significantly advance the existing knowledge in the area of selective and high-yielding chemical transformations of low-cost and abundant functional molecules into higher-value polymeric materials.

Intermediate Ethanol Blends in Small Engines (2009)

University/Company: Minnesota State University-Mankato
Principle Investigators: Bruce Jones and Gary Mead

In order to increase the ethanol content of gasoline to blends higher than 10% for non-flexible fueled vehicles a waiver must be obtained by the U.S. Environmental Protection Agency (EPA). In the 1970s when the waiver was granted for E10, the EPA did not require small engines be included in the process. Therefore, no testing was done on small engines. Today the EPA regulates approximately 900 combinations of engine and components with small non-road engines (SNRE). Millions of SNREs are sold each year in the form of leaf blowers and string trimmers, lawn mowers, snow blowers, generators and small tractors. The study evaluates the performance of small 2-stroke cycle and 4-stroke cycle engines using intermediate ethanol blends.

Seasonal Storage Issues of Intermediate Ethanol Blended Fuels (2012)

University/Company: Minnesota State University-Mankato
Principle Investigators: Bruce Jones and Gary Mead

The purpose of this study is to determine the effects of storing gasoline including E10, E15 and E20 on the fuel systems of 2-stroke and 4-stroke small engines found on power equipment. The test is designed to closely mimic how consumers store their power equipment over summer and winter. Unlike automobiles which tend to be used frequently and year-round, small engines use is often seasonal and infrequent, which allows fuel to remain in them for extended periods of time, which can lead to starting and operational issues. Most small engines are carbureted and have no method to automatically compensate for fuel-related issues. The study will investigate both material compatibility and performance issues such as starting, hot start/restart, idle and wide open throttle stability.

Development of a Port-Injected Hydrous Ethanol System for Diesel Engines (2013)

University/Company: University of Minnesota
Principle Investigator: William Northrop

The purpose of this project is to develop a novel and effective system for operating a diesel engine in a dual fuel mode with hydrous ethanol as the primary fuel. The project seeks to prove the hypothesis that using timed injection of denatured 160 proof hydrous ethanol near the intake port as opposed to continuous fumigation in the intake plumbing will allow higher ethanol energy fraction (EEF) levels than are possible with currently marketed systems, while reducing emissions and improving engine fuel efficiency. Objectives include developing a hydrous ethanol port-injection system that will be applicable for a range of aftermarket applications and engine types. By developing a stand-alone ethanol fuel injection system, we envision no modification of the existing engine control unit (ECU). In other applications like reactivity controlled compression ignition (RCCI), the stock ECU is replaced or reprogrammed to further increase engine efficiency, a scenario that could be possible in collaboration with an industrial engine manufacturer.

Enhancement of Corn-Based Fuel for Recreational Engines and Vehicles (2014)

University/Company: Michigan Technical University
Principle Investigator: Scott Miers

E15 is replacing E10 at fuel stations, which means snowmobiles and other recreational vehicles will be required to operate on fuel for which they have not been calibrated. This project will determine if changes to the engine calibration unit (ECU) can minimize any negative engine effects while taking advantage of improved fuel properties to reduce emissions and potentially increase performance. Steady-state engine dynamometer testing will be used to evaluate the effect of E20 with the stock engine calibration on emissions, combustion and performance. Engine sensors may be identified (exhaust, fuel, etc.) that could be incorporated zinto the control system for in-field, real-time calibration changes.

Quantifying Energy Savings Gained through Production of Hydrous Ethanol from Corn (2014)

University/Company: University of Minnesota
Principle Investigator: William Northrop

This project represents an expansion of current work at the University of Minnesota in evaluating and developing technology that will allow the expanded use of hydrous ethanol in diesel engines. Early research has proven that up to 150 proof hydrous can be used in a dual fuel mode to reduce soot and NO_x emissions below regulated standards without complex after treatment systems and without reduction in engine fuel efficiency. This project combines this ongoing research with previous experience in lifecycle energy analyses to further motivate the expanded use of hydrous ethanol. The proposed work fills a critical knowledge gap by definitively proving that optimization of plant processes to produce hydrous ethanol will improve the economics and renewability of fuel-ethanol production.

Direct estimations of energy savings possible by converting an existing plant to hydrous ethanol production will provide additional motivation for expanded uses of the fuel. If hydrous ethanol can be used as a diesel replacement, for example, blend wall restrictions on ethanol fuel sales can be overcome. The goal of this research is to quantify the energy use from thermodynamically optimized hydrous and anhydrous ethanol refineries using the modeling software Aspen Plus and additional analysis.

Enhancement of Corn-based Fuel for Recreational Engines and Vehicles (2014)

University/Company: Michigan Technical University
Principle Investigator: Scott Miers

E15 is replacing E10 at fuel stations, which means snowmobiles and other recreational vehicles will be required to operate on a fuel for which they have not been calibrated. When E15 fuel is used in a snowmobile that was calibrated for E0, exhaust system temperature and NO_x emissions increase, carbon monoxide and 1,3 butadiene emissions decrease, cold-start performance degrades, and fuel consumption increases.

This project will determine if changes to the engine calibration can minimize the negative impacts of E20 while taking advantage of improved fuel properties to reduce emissions and potentially increase performance. Steady-state engine dynamometer testing will be used to evaluate the effect of E20 with the stock engine calibration on emissions, combustion, and performance. Additional engine testing to conduct a limited recalibration of the engine calibration unit (ECU) to minimize the negative effects of E20 will then be conducted.

The final component of the project will be to identify sensors (exhaust, fuel, etc.) that could be incorporated into the control system for in-field, real-time calibration changes. This would permit the engine calibration to be changed at each fuel fill-up, maximizing performance and minimizing emissions.

Expanded Small Engines Ethanol Storage Study (2014)

University/Company: Minnesota State University-Mankato
Principle Investigator: Gary Mead

This study will determine the effects of E10, E15 and E20 on the fuel systems of small engines found on handheld and non-handheld power equipment. It will investigate both material compatibility and performance issues. This study is an expansion of the small engines storage study conducted at Minnesota State University-Mankato from 2012 to 2014.

During that first storage study, it was discovered that ethanol blended fuels did have some effects on certain types of carburetors. The expanded study will investigate additives to mitigate the negative effects seen on low-cost diaphragm carburetors and will continue the investigation on float type carburetors. Both 2-stroke and 4- stroke engines will be tested. The test is designed to closely mimic how consumers treat their power equipment. Sixty-four engines will be required to ensure a large enough sample. This will be broken down into 32 handheld 2-stroke pieces of equipment, 8 per the 4 fuels, and 32 non-handheld 4-stroke pieces of equipment (8 per fuel).

Each piece of equipment will be assigned to a specific fuel and performance measurements will be made. Then the equipment will be stored for six months with the fuel tanks half full of fuel. After the six-month storage period, the equipment will be started and the same performance measurements will be taken again. Next, the equipment will be stored for another six-month period and then performance measurements will be taken again. Finally, the fuel systems will be disassembled to check for material compatibility issues.

Advancing Corn Ethanol in an Era of Low Oil Prices (2015)

University/Company: DeFour Group LLC
Principle Investigator: Dean Drake

Corn ethanol is under attack by a combination of oil interests concerned about losing market share and some environmental groups trying to protect favored technologies like electric vehicles from cost beneficial biofuels. "Renewables Now!" is a new narrative focusing on this country's commitment to reduce greenhouse gas emissions 26% - 28% from 2005 levels by 2025. Only those renewable fuels and efficiency technologies currently invented and proven could be employed to achieve these reductions in such a short timeframe. Only proven biofuels like corn ethanol can increase the greenhouse gas emissions from the transportation sector between now and 2025. In addition, any rollback of corn ethanol between now and then will create greenhouse gas emission increases that must be offset if the U.S. is to achieve its targets. Under "Renewables Now!" our team will conduct the air quality and economic analysis to support this narrative and provide a comprehensive report to state and national corn growers describing our findings.

Hydrous Ethanol Reforming for Reducing NO_x Emissions from Diesel Engines (2016)

University/Company: University of Minnesota
Principle Investigator: William Northrop

The University of Minnesota (UMN) has demonstrated a dual-fuel hydrous ethanol injection system for use on existing diesel engines that can replace up to 40% diesel fuel use by energy with ethanol. We have also demonstrated that 180 proof hydrous ethanol production can save 10% in plant natural gas usage and reduce net plant water use up to 6%.

The primary motivations for developing a viable hydrous ethanol dual-fuel system are to expand the market for ethanol to diesel-powered applications and to reduce pollutant emissions from diesel engines. One key market driver for dual fuel systems is to use them as an alternative to add-on catalytic after-treatment systems for off-highway engines meeting the California Air Resources Board (CARB) Diesel Risk Reduction Plan verification levels for in-use engines. However, based on our evaluation of existing aftermarket dual-fuel systems including our own, injecting ethanol into the intake of a diesel engine does not reduce nitrogen oxide emissions (NO_x) compared to diesel only operation. This is due to chemistry in the engine cylinder that enhances conversion of NO to NO_2 from excess ethanol in fuel-lean areas.

The primary goal of this project is to develop an aftermarket hydrous ethanol reforming system that would meet CARB in-use standards for both particulate matter (PM) and NO_x, an achievement that has not been achieved by any dual-fuel ethanol systems to date.

Benefits from Mid-level Ethanol Blend Fuels Using Government Computer Models (2016)

University/Company: DeFour Group LLC
Principle Investigator: Dean Drake

Currently, the market for corn ethanol is less than 15 billion gallons a year. A mid-level (20% - 30% ethanol) gasoline blend with the octane rating of today's premium, if widely available, would allow automakers to increase the efficiency of future engines and reduce the cost of compliance with future fuel economy and greenhouse gas regulations. This, in turn, would expand the market for fuel ethanol and potentially lead to an increase in the amount of corn ethanol that can be used in gasoline.

Ensuring this new fuel becomes widely available will require government action similar to what was done in the 1970s to get unleaded gasoline on the market. Efforts are underway to convince the Environmental Protection Agency (EPA) to take such action at its mid-term review of the 2017 – 2025 fuel economy standards. This will require an analysis of the costs and benefits of the new fuel and new engines robust enough to withstand severe criticism. The best way to accomplish this is to perform the cost-benefit analysis on the same computer models used by the government.

This project looks at the two computer models used by the government (EPA's OMEGA model and the National Highway Traffic Safety Administration's (NHTSA's) VOLPE model) to determine which best meets our needs. The best model will be downloaded by Air Improvement Resource (AIR). AIR will then add the capability to model the costs and benefits of the new fuel under various scenarios.

Adding Value to Ethanol Production Byproduct (Distillers Grain) through Production of Biochar and Bio-Oil (2010)

University/Company: United States Department of Agriculture-Agricultural Research Service & University of Minnesota
Principle Investigators: Kurt Spokas, Roger Ruan and Robert Morrison

The goal of this project is to increase the value of distillers grain by sequestering carbon and producing additional renewable energy resources (bio-oil and syngas) through microwave-assisted pyrolysis. This project provides an optimized process for capturing additional bio-energy while producing a potential soil improvement agent. This project examined the potential increase in soil fertility and carbon storage of the biochar produced. The potential long-term outcomes of this research are the development and promotion of on-farm energy production using microwave-assisted pyrolysis and distillers grain as a feedstock, as well as improving the sustainability of corn production through returning carbon to the field.

Impact of Feeding Diets Containing Reduced-Oil Distillers Dried Grains with Solubles on Growth Performance and Pork Fat Quality of Growing-Finishing Pigs (2013)

University/Company: University of Minnesota
Principle Investigator: Gerald Shurson

This project includes three experiments. The first experiment will determine the impact of feeding pigs formulated diets containing 40% reduced oil-dried distillers grains with solubles (oil-DDGS). The second experiment will determine the impact of formulating diets with two sources of reduced oil-DDGS. The third experiment will be used to determine the impact of feeding diets containing wheat midds and reduced oil-DDGS. The results will be determined by growth performance and carcass characteristics.

Evaluation of Growth Performance, Nutrient Utilization, Metabolic Profile, and Onset of Puberty in Dairy Heifers Fed Reduced-Fat Distillers Dried Grains in Replacement of Forage in Limit-Fed Rations (2013)

University/Company: South Dakota State University
Principle Investigator: Jill Anderson

The research will be used to determine how energy and protein from reduced-fat distillers grains is utilized in replacement of energy and protein from forage in limit-feeding scenarios for dairy heifers and the effects on growth, metabolic profile and onset of puberty.

Milk Composition and Cheese Quality: Investigating the Impact of DDGS (2013)

University/Company: Iowa State University
Principle Investigators: Stephanie Clark and Donald Beitz

The proposed research will investigate the impact of dried distillers grains with solubles (DDGS) on milk composition and cheese production. In addition to gaining insight into the chemical and microbiological mechanisms, solutions to this industry problem will be investigated.

Reduced-Fat Distillers Grains in Finishing Dairy Steer Diets (2013)

University/Company: University of Minnesota
Principle Investigator: Ryan Cox

U.S. feedlots have relied on supplementing their feeder cattle supply by utilizing steers and naturally sterile (Freemartin) heifers derived from the 9 million dairy cows in the U.S. In any given year, approximately 4 million dairy calves are funneled to feedlots and finished at 1,300 to 1,400 lbs. to supply the U.S. with lean, highly marbled, and tender beef cuts and ground beef. As the supply of beef-sourced feeder cattle suffers from a declining beef cow inventory, or even as future efforts to re-populate the U.S. beef herd will reduce the number of heifers finished in feedlots, the importance of adequate feeding and management recommendations for cattle feeders to start, grow and finish dairy steers is needed.

Final Validation of Reduced-oil DDGS Energy Prediction Equations for Swine and Widespread Industry Implementation (2014)

University/Company: University of Minnesota
Principle Investigator: Gerald Shurson

The overall objective of this research project is to validate equations for prediction of the concentration of metabolizable energy among sources of reduced oil distillers dried grains with solubles (RO-DDGS). These well validated prediction equations will be available and can be utilized to accurately formulate diets for swine when including RO-DDGS. Availability of accurate formulation and diets will minimize current resistance among swine nutritionists when making a purchasing decision of RO-DDGS.

Evaluation of Long-Term Reproduction and Lactation Performance of Dairy Heifers Fed Increasing Dietary Concentrations of Reduced-Fat Distillers Dried Grains in Replacement of Forage During Pubertal Development (2014)

University/Company: South Dakota State University
Principle Investigator: Jill Anderson

This project is an expansion of existing research that is evaluating growth performance, rumen fermentation, total tract digestion, metabolic profile, and onset of puberty of dairy heifers fed three increasing inclusion levels of reduced-fat dried distillers grains (RF-DDGS) in replacement of forage.

In this expansion, another 12 heifers will be added to the original 36 in the experiment, to increase the statistical strength of the study for collection of long-term data. All heifers will finish the study and cease to be fed the treatment diets at approximately 11 months of age, which is also predicted to be approximately 1 month post-puberty. Post-trial, all the heifers will be returned to the general herd at the South Dakota State University Dairy Research and Training Facility, managed under normal farm protocols, and fed common herd diets. Data will be collected on reproductive performance, such as number of AI services, age at conception, and predicted calving age. Frame size and body weights at approximately 3 weeks prior to predicted calving date and within 48 hours post-parturition will be measured. During the first 100 days of lactation, daily milk weights and milk composition will be monitored to evaluate lactation performance. If it can be demonstrated that long-term reproductive and lactation performance is maintained or enhanced with high levels of RF-DDGS in the growing heifer diet, it will give dairy producers and nutritionists increased confidence in the co-product and its utilization increased.

DDGS Feeding Modifies Milk Composition: Investigating Impact on Cheese Quality (2015)

University/Company: Iowa State University
Principle Investigators: Stephanie Clark and Donald Beitz

Clostridium tyrobutyricum are spore-forming and butyric acid-lactate-fermenting bacteria that release large amounts of gas upon fermentation of lactose. Late blowing in cheese is unacceptable to consumers and it reduces the economic value of cheese. Appearance of splits and cracks is due to unwanted gas production during the ripening of Swiss cheese. Dairy farmers suspect feeding DDGS might be a reason for such defects in cheese. With ethanol production being a major industry in the Midwest, utilization of DDGS in animal feeding is inevitable and generally economical. Consequently, it is of high priority to farmers in the Midwest that we investigate the effects of DDGS inclusion in the diet of dairy cows on quality markers of milk as they relate to cheese production.

The research was designed to investigate the impact of lactose, sulfate and thiosulfate on quality of Baby Swiss cheese. Additionally, because of the industrial shift from a full-fat dried distillers grains (FF-DDGS) to reduced-fat dried distillers grains (RF-DDGS), we will investigate the effect of feeding two types of reduced-fat DDGS that contain two different concentrations of fat (3-4% and 8%) on feed efficiency and usability of milk for Swiss cheese production. It is expected that high concentrations of lactose, sulfate and thiosulfate in milk impair the growth and metabolism of the specific microorganisms responsible for high quality Baby Swiss cheese.

Whole Corn Grain Meal Inclusion in Commercial Shrimp Feeds (2016)

University/Company: Ralco Nutrition
Principle Investigator: Jonathan Holt

The world farm production of shrimp in 2014 was 9.02 billion lbs. The estimated world consumption of feed consumed by shrimp farms was 16 - 20 billion lbs. in 2014. Wheat grain and/or by-products (e.g. wheat middlings) levels typically average around 30% of shrimp feeds. Thus, approximately 4.8 billion to 6 billion lbs. of wheat grain and/or by-products were consumed by commercial shrimp feeds in 2014. The world's shrimp farm production is increasing by over 7%/year with the prediction to reach the size of chicken production in the future.

A major reason why corn grain is not being used in shrimp feeds instead of wheat grain and/or by-products is the contamination level of aflatoxin in corn in the world, particularly the sub-tropical and tropical regions. Considering the very small incidence of aflatoxin in Minnesota corn, plus the demonstration that corn could replace wheat grain and/or by-products in feeds with no reduction of shrimp farm production/acre, indicates that a potential new market for Minnesota corn can be established.

Nutritional Improvement of Corn Ethanol Co-products via Yeast Engineering (2016)

University/Company: University of Minnesota
Principle Investigator: Bo Hu

Co-products generated from corn ethanol bio-refining, for instance, Distiller's Dried Grains with Solubles (DDGS), are very attractive in animal feeds as partial replacement of some more expensive and traditional feeding materials for energy (corn), protein (soybean meal), and phosphorus (mono- or di-calcium phosphate). However, variability in nutrient content and digestibility, especially the lower digestibility of most amino acids compared to corn and soybean meal, has been observed, and extra undigested nutrients are then excreted to the manure, causing environmental concerns.

The project will focus on improving the nutritional value of corn ethanol coproducts by increasing the level of several key amino acids, such as lysine, tryptophan and arginine. This will be accomplished by genetic engineering of the yeast *Saccharomyces cerevisiae* to accumulate a higher content of key amino acids in the cell biomass during the ethanol fermentation, thereby increasing these amino acids in the final co-products. Improving the nutritional amino acid balance of such ethanol coproducts would minimize the cost associated with nutrient supplements and decrease the discharge of nitrogen to the environment.

Corn ethanol co-products are serving significant roles in the global feed market and they have become a more important revenue source for the ethanol industry. The proposed project will improve the utilization of co-products with more nutritionally balanced components and will benefit the animal feed industry and corn growers.

Request for Funding of a Master's Level Graduate Student for Study in Nutrient Management Area of Corn Production (2011)

University/Company: University of Minnesota
Principle Investigators: Daniel Kaiser and John Lamb

As new technologies and issues emerge in agriculture, there is a need for qualified individuals with advanced degrees. This especially includes individuals with experience studying how nutrient management in corn interacts with issues such as water quality. The proposal requests funding for training a master's level student in the area of nutrient management. This student will work on a research project not only focused on fertilizer management but the effect on water quality.

Carbon, Nitrogen, Phosphorus and Sulfur Interactions Effects on Soil Biochemical Processes and Corn Grain Yield (2012)

University/Company: University of Minnesota
Principle Investigators: Paulo Pagliari and Jeffrey Strock

This research was developed to try to understand whether corn grain yields can be increased to levels beyond the state average of high yielding sites (200 bushel/per acre). There has been no research documenting the effects of different carbon management systems combined with several nitrogen, phosphorus and sulfur application rates on the rate of mineralization of plant nutrients and how this process could affect corn grain yield. The proposed study aims at understanding what factors are controlling nutrient availability at isolated locations where yield potential exceeds high-yielding site averages.

Corn Response to Nitrogen and Starter Fertilizer Using a Modified Strip Trial Design (2012)

University/Company: University of Minnesota
Principle Investigator: Daniel Kaiser

Traditional field research involves small plot experiments replicated three to four times within a field on a uniform area. However, with ever increasing adoption of variable rate controllers, there is increased interest in research focusing on within field variation to crop nutrients. This project will evaluate corn response to nitrogen fertilizer across a variable landscape. It will determine if multi-spectral imaging can be used to predict nitrogen response at different times of the growing season. The project studies how landscape position may effect nitrogen use efficiency of corn. It evaluates variable rate application of starter fertilizer on corn response early in the season and the effect on yield across fields. Lastly, it assesses fertilizer rate control of new application controllers in larger trials within farmers' fields.

Nutrient Management Specialist for Agronomic Cropping Systems (2012)

University/Company: University of Minnesota
Principle Investigator: Carl Rosen

Minnesota Corn Growers partnered with the University of Minnesota to hire a nutrient management specialist to provide leadership for programs dealing with environmental issues related to nutrient management of corn cropping systems. Research and educational activities for this position will emphasize the linkages between nitrogen management, water quality and economic impacts. This is a greatly needed position that will help to provide continuity and support for nutrient management programs.

Nitrogen Fertilizer Management for Rain-Fed Corn in Minnesota if Spring Application is the Only Option (2013)

University/Company: University of Minnesota
Principle Investigator: John Lamb

The project will investigate the ability of spring and post-planting options for nitrogen fertilizer application for corn in Minnesota.

Corn Response to Nitrogen and Starter Fertilizer Using a Modified Strip Trial Design (2013)

University/Company: University of Minnesota
Principle Investigator: Daniel Kaiser

Farmers typically use starter in a liquid form to increase plant growth early in the season with the intentions of increasing yields. In western Minnesota, corn growers may use starter as a way to apply nutrients in a band on calcareous soils, which have the potential to tie up nutrients. Band applications are typically thought to be superior in these cases.

The major drawback to starter fertilizer is the cost per pound of nutrient is typically greater than forms used for broadcast application, so the cost of its use is more problematic. Research work in Iowa has shown that the use of starter with broadcast fertilizer would likely not increase profitability. However, this work did not focus on soils or landscapes with areas where phosphorus fixation may be a problem. Strip trials may be beneficial to determine if starter is needed in some fields and if so, what the optimum rate is.

Since starter fertilizer is prevalent in Minnesota, we need to provide corn growers with information as the appropriate rate of application for their particular soils. If starter is not required, a corn producer could save money to invest in other management that may provide a better return on investment. This study will focus on rates of 10-34-0 applied in-furrow with the planter when fertilizer phosphorus (P) is and is not applied.

Mineralization Potential of Agricultural Soils and Canopy Sensing Technologies to Predict Corn Nitrogen Needs after Fertilization in Minnesota (2014)

University/Company: University of Minnesota
Principal Investigator: Fabián G. Fernández

This project will provide needed information to help fine-tune current fertilizer nitrogen (N) rate guidelines based on mineralization potential of different soils. In addition, this project will benefit farmers as they will know from this study whether or not in-season N applications are beneficial to supply N to the crop and under what conditions relative to more traditional practices.

Climate Change Impacts on Minnesota Corn Production and Environmental Consequences (2016)

University/Company: University of Minnesota
Principle Investigator: Tim Griffis

With past support from the Minnesota Corn Research and Promotion Council, we have significantly advanced the development of the University of Minnesota Mesocosm Facility (http://biometeorology.umn.edu/). This facility is now allowing us to probe how climate and management decisions impact corn productivity and some of the critical environmental side effects of food production.

As of November 2, 2015, 7 of 12 mesocosms are fully functional and being used in trials. The other 5 mesocosms are being brought online following operational testing and are expected to be used in trials before the end of December 2015. Updates regarding the mesocosm facility and experimental trials can be obtained at the above website.

Despite numerous challenges in building and testing each mesocosm, our research continues to advance this facility. We are poised to conduct more collaborative investigations that explore processes ranging from the microbe to whole plant canopy scales. Our proposed research will begin to develop an ensemble of plausible climate change simulations that represent the next 50 years to assess impacts on corn productivity, and examine the impact of timing nitrogen fertilizer applications to match crop demand.

University of Minnesota Extension Water Quality, Nutrient Management, and Agricultural Drainage Education (2010)

University/Company: University of Minnesota Extension
Principle Investigator: Michael Schmitt

This project supports an area of emphasis within the University of Minnesota Extension for an Extension Educator (Soil-Water and Nutrient Management emphasis). This position's main objective is to focus on issues pertaining to water quality/nutrient management. Sub-objectives relate to: 1) drainage planning and design for water management; 2) incorporating information relating drainage management to soil nutrient management; and 3) incorporating relevant issues in tillage and manure management to provide additional value and information to corn growers.

This benefits corn farmers by providing research-based information to assist them with making management decisions relating to issues on agricultural drainage and water quality.

Optimizing Nitrogen Use Efficiency and Minimizing Nitrification-Induced N Leaching and Gaseous Losses with Post-Plant Fertilizer Applications: Field and Lab Studies (2011)

University/Company: United States Department of Agriculture-Agricultural Research Service
Principle Investigator: Rodney Venterea

This project will evaluate the effects of co-application of urease and nitrification inhibitors (UI/NIs) with split applications of post-plant fertilizer applications compared to single pre-plant nitrogen application and split applications without co-application of UI/NIs on yields and nitrate leaching. This project will also improve the fundamental understanding of the short-term biochemical processes driving nitrogen (N) losses following addition of N fertilizers.

Matching Conservation Drainage Practices with Nitrogen Application Rates and Sources for Minnesota (2011)

University/Company: University of Minnesota
Principle Investigator: Gary Sands

The overall goal of the proposed project is to improve profitability and environmental impact on drained agricultural lands through conservation drainage approaches and different application rates and sources of fertilizer. Building on an existing Minnesota Corn Growers project, this project will involve the creation of drainage design tables for southern Minnesota (for seven benchmark soils and three locations) based on the principle of maximizing net return on investment and conserving water and nutrients in the field, using both alternative drainage practices and different nitrogen application rates and sources. The design tables will be offered to drainage practitioners in multiple formats, and will be available at the Drainage Outlet website, www.drainageoutlet.umn.edu.

Role of Depressions and Wetlands on Water Retention and Surface Flows in Blue Earth County, Minnesota (2011)

University/Company: University of Minnesota
Principle Investigator: Satish Gupta

There is a pervasive belief that drainage of agricultural lands has drastically increased flows in the river of the Minnesota River Basin, which in turn has increased river bank sloughing and thus higher sediment loads. However, research has yet to establish if this is true and what volume of water the landscape can hold if it were not drained.

Using Light Detection and Ranging (LiDAR) elevation data, this research will quantify the potential volume of water that landscape depressions in Blue Earth County could hold provided there was no drainage and the excess water that may reach rivers at several precipitation probabilities. This research will establish a maximum baseline surface water retention capacity of Blue Earth County and consequently river flow reductions at various precipitation probabilities provided the depressions had not been drained.

Balancing Production Gains against Environmental Impacts of Nitrogen Fertilizer Management Practices (2012)

University/Company: United States Department of Agriculture-Agricultural Research Service
Principle Investigator: Rodney Venterea

Corn producers in Minnesota and agricultural producers in general are facing two pressures which are on a collision course with each other: the pressure to increase crop yields to meet growing demand, and the pressure to lessen the environmental footprint of production. This project aims to address this issue by simultaneously measuring the effects of nitrogen management on yields, potential soil nitrate leaching, and nitrous oxide emissions.

Identification of Erosion Mechanisms and Volume Loss for River Banks and Ravines (2012)

University/Company: University of Minnesota
Principle Investigator: Satish Gupta

River banks are the primary source of sediment to sediment-impaired waterways in the Greater Blue Earth River Basin (GBERB). Yet, little is known about the mechanisms driving the failure of these banks. This research will attempt to identify the degree to which shallow groundwater impacts the stability of river banks along waterways in the GBERB.

Agricultural Production and the Hydrologic Cycle in the Upper Midwest (2013)

University/Company: University of Minnesota
Principle Investigator: Tim Griffis

The aim of this research is to gain a better understanding of how agriculture fits within the regional water cycle in the Upper Midwest. This project will use a combination of measurements made at field and regional scales, and meso-scale meteorology-land surface modeling to determine agriculture's contribution to regional evapotranspiraton (ET), and how changing management to increase water storage coupled with supplemental irrigation can enhance productivity and affect regional hydrology.

Engaging Natural Resources Professionals, Drainage Contractors, and the General Public Regarding Issues Related to Agricultural Drainage and Water Quality (2013)

University/Company: University of Minnesota
Principle Investigator: Brad Carlson

Presentations and/or displays to audiences and conferences and meeting around the state concerning the activities and resources that the University of Minnesota has concerning environmental stewardship with respect to agricultural drainage and fertility management pertaining to water quality.

Effects of Time of N application and Instinct™ on Corn Production and Nitrate Losses from Tile Drainage (2013)

University/Company: University of Minnesota
Principle Investigator: Jeff Vetsch

The objective of this project is to measure the effects of Instinct™ on fall and spring-applied urea and urea/ammonium nitrate (UAN) applied at sidedress on continuous corn production, nitrogen uptake, nitrogen use efficiency, nitrate concentration and losses in tile water and residual soil nitrate.

Permanent Living Mulches for Farmable Vegetative Buffers and Waterways (2013)

University/Company: United States Department of Agriculture-Agricultural Research Service
Principle Investigator: John Baker

The objective of the research is to show that perennial living mulches can be established in sensitive locations within cropped fields and managed so that they can support continued row crop production while conferring environmental benefits.

Tracking Conservation Success (2013)

University/Company: Houston Engineering, Inc.
Principle Investigator: Brian Fischer

This project will result in an online conservation/best management practice (BMP) tracking database and web mapping application that is designed and operated to meet the needs of Minnesota's agricultural community. The applications will be developed in collaboration with the Minnesota Agricultural Water Resources Center (MAWRC) and the Wisconsin Discovery Watershed program to support the needs of their on-going initiatives while also serving Minnesota's larger agricultural community.

Enhancement of Research Capacity on Excess Water Drainage to Improve Fertilizer Nitrogen Use Efficiency for Corn Production and Environmental Protection (2014)

University/Company: University of Minnesota
Principal Investigator: Fabián G. Fernández

Nitrogen (N) is one of the most expensive inputs to farmers and one of the most difficult nutrients to manage because of all the processes that impact its availability. This project will allow the integration of many of these processes in a way not previously done to improve the predictability of how much N is needed to maximize productivity and profitability. Having research-based data can provide evidence on what is reasonably possible with best management practices for sustainable (profitable and environmentally sound) crop production.

Quantifying Hydrologic Impacts of Drainage Under Corn Production Systems in the Upper Midwest (2014)

University/Company: University of Minnesota
Principle Investigator: Jeff Strock

This research will use a combination of field research and modeling to quantify the water balances of corn production systems, with and without the presence of subsurface drainage, along a precipitation gradient from eastern South Dakota to south central Minnesota. Understanding the hydrologic response of drainage and crop water consumption at both the field and watershed scale will help corn growers be economically competitive while also informing development of tools and management approaches that can minimize their environmental impact under various climate conditions.

How is Climate Change in Minnesota Affecting the Sustainability of Corn Production? (2014)

University/Company: University of Minnesota
Principle Investigator: Tim Griffis

The goal of this project is to develop a state-of-the-art large mesocosm facility to examine how climate change will impact agricultural productivity and other environmental impacts in Minnesota. The results will provide important knowledge to Minnesota corn growers with respect to climate change adaptation. Better understanding of how current cultivars respond to changing climate will help with developing an integrated climate change adaptation plan and guide future research efforts.

Role of Structural Modifications along the Mississippi River on Sediment Transport to Lake Pepin (2014)

University/Company: University of Minnesota
Principle Investigator: Satish Gupta

The overarching goal of this research is to assess how the installation of wing dams and closing dams might have affected the downstream movement of sediments to Lake Pepin. The specific objective of this study will be to summarize information gathered from the U.S. Geological Survey and Army Corps of Engineers (USACE), various consultants the USACE has used over the years, and published literature. This study will form the basis for additional studies if it appears that wing dam and closing dams significantly reduced the river-flood plain interactions and someway contributed to an increase in sedimentation rate in Lake Pepin.

Optimizing Nitrogen Use Efficiency and Minimizing Nitrification-Induced N Leaching and Gaseous Losses with Post-Plant Fertilizer Applications: Field and Lab Studies (2014)

University/Company: University of Minnesota
Principle Investigator: Rodney Venterea

The aim of the project is to overcome some of the limitations of post-plant nitrogen (N) applications through the use of post-plant inhibitor applications, and to document the environmental and agronomic benefits of the practice. In a two-year field study, we will measure soil nitrate and nitrite concentrations, nitrous oxide (N_2O) emissions, soil temperature and moisture, grain yield and N fertilizer recovery efficiency.

In addition to testing these management practices under field conditions subject to highly variable weather effects, the lab component of the study will be used to better understand N loss processes at the molecular level. In the lab study, we will measure short-term biochemical responses to N addition including changes in pH, mineralization and nitrification rates, nitrite and nitrate concentration and N_2O production under different moisture, temperature, and carbon conditions expected for a range of field conditions representative of different periods of the growing season.

This study will compare novel combined approaches for increasing N use efficiency that, if shown to be successful, will provide Minnesota corn farmers with management options that have both agronomic and environmental benefits. A truly beneficial N management strategy is one that can reliably increase yields at the same level of N input or maintain yields at a lower rate of N input compared to a typical practice, while reducing N losses in both cases. The research also aims to improve the fundamental understanding of the short-term biochemical processes driving N losses following addition of N fertilizers that will have broader benefits over time.

Vegetative Cover Crops as a Nitrate Reduction Strategy for Tile Drainage (2016)

University/Company: University of Minnesota
Principle Investigator: Jeff Vetsch

Nitrogen (N) is an essential input for profitable corn production. Previous research (Randall and Mulla, 2001, Dinnes et al., 2002) has shown subsurface tile drainage systems deliver nitrate-N to surface waters and thereby degrade water quality. Row crop agriculture in the Midwest is under scrutiny to reduce NO_3 concentrations and loads in tile drainage. The use of cover crops and applying appropriate rates of N for corn are potential management strategies to reduce NO_3 losses in tile drainage water (Dinnes et al., 2002). The species of cover crop, establishment date and termination date could greatly affect their potential to sequester N. Cereal rye is effective at scavenging N when it's established early and not terminated until spring. Generally, Minnesota farmers who use cover crops either use cereal rye in a no-till system or seed a blend of annuals like oat, annual rye, clover and radish. These annuals are terminated by cold temperatures and/or tillage. The potential of fall/winter terminated covers to scavenge N in a corn-soybean rotation in Minnesota is not well known.

The goal of this study is to quantify the effects and interactions of cover crop management and N rate on tile water flow, NO_3-N concentration and loss in tile drainage water, corn and soybean production, N uptake and nitrogen use efficiency (NUE).

Root River Stream Bank Stabilization (2016)

University/Company: Root River Soil Water Conservation District
Principle Investigator: Dave Walter

This project complements the many other collaborative effort occurring in the larger watershed. Unfortunately, stream and near stream sediment sources are a significant contributor to chronic turbidity and habitat degradation in the Root River, yet little has been done to address this resource concern. Minnesota Department of Natural Resources (MN DNR) Fisheries and Trout Unlimited have done a great job to improve stream and habitat conditions where fisheries exist. However, the region needs a strategy that is feasible to address stream sedimentation and habitat degradation at a larger scale.

This project has the added benefit of restoring regionally and globally rare bluff prairie and oak savannas by removing invasive red cedar trees. The project will monitor the effectiveness of a combination of streambank stabilization conservation projects. Process, methods and results will be shared though outreach. We will promote stream management practices that reduce sedimentation, phosphorus and nitrogen runoff to stream habitats. We will work with farmer/landowners to protect and maintain health aquatic systems or prevent further degradation from bank erosion.

INNOVATION GRANTS

To foster farmer-lead innovative solutions, the Minnesota Corn Research & Promotion Council (MCR&PC) and the Minnesota Corn Growers Association (MCGA) have created an Innovation Grant program.

The new Conservation Innovation Grant program provides an opportunity for individual farmers to test or develop an innovative or best practice related to nitrogen management, soil fertility and/or water quality. Grant recipients implement a specific practice addressing a challenge on their farm and examine how that could potentially be replicated on other farms. Innovation Grants also assist farmers who wish to showcase their ongoing nitrogen management/soil conservation practice(s) through a field day on their farm.

Grant proposals are evaluated by MCR&PC members, MCGA board members, and by members of several state agencies and the University of Minnesota.

Soil and Water Improvement through Strip-Tilling and Cover Crop Application (2016)

Grant Recipients: Brad and Darlene Nere

The objective of this project is to explore practices to reduce nitrogen loss and improve nitrogen management which, in turn, improves water quality. Cover crops will bring up underutilized nutrients from deeper in the soil profile, reduce erosion and allow better infiltration of rain water. Strip tilling will also aid in reducing soil erosion and improving water quality by leaving more residue on the soil surface during vulnerable periods during the year. The split application of nitrogen will benefit both soil and water quality and result in reduced fertilizer costs with more efficient use and less total nitrogen needed.

Integrating Side-Dressing and Interseeding for Reduced Nitrate Loss and Soil Erosion (2016)

Grant Recipient: Dan Coffman

The objective of this project is to improve soil health, reduce soil erosion and reduce nitrate loss while utilizing a side-dress nitrogen application and simultaneous inter-seeding of a cover crop. This farm has utilized conventional tillage for many years and applied nitrogen fertilizer prior to spring planting. Questions of sustainability of the current management system drive the investigation for better/newer practices. This project will integrate side-dress nitrogen during the growing season with interseeding cover crops.

How Drainage Water Management and Sub-Irrigation Impact Water Quality (2016)

Grant Recipient: Chad Davison

The soils in the Red River Valley (RRV) are generally fine textured and drain very slowly. At the same time, the RRV also receives the lowest amount of annual rainfall compared to the rest of the state. That rainfall is not distributed evenly throughout the year, with excessive moisture commonly present during spring and less precipitation later during the growing season.

The focus of this project is to monitor water quality, water table level, and yield in the proposed sub-irrigated corn field. The field will be split into three different zones. Each zone will be managed differently in respect to controlled drainage and sub-irrigation management. Soil moisture sensors placed in the field, along with rain gauges will help determine the need for sub-irrigation. Zone one will be managed as a conventional tile system that is open all year and sub-irrigation will not be used. The water table on zones two and three will be managed at different heights throughout the growing season by changing the heights of the stop logs in the control structures. Irrigation water will be pumped back into the tile of zones two and three to provide water for the corn crop based on weather data, rain gauge data, and soil moisture sensors.

By managing the water table differently in each zone, we will be able to make informed management decisions that maximize yield while maintaining a focus on improved water quality coming from the tile outlets. Throughout the growing season, water grab samples will be taken from the tile outlet of each of the three zones. The water samples will be sent to a lab to be tested for nitrate-nitrogen. Combining water flow and nitrate-nitrogen concentration data will enable the estimation of nitrate-nitrogen load loss on a per acre basis.

Interseeding Cover Crops While Applying In-Season Nitrogen (2016)

Grant Recipient: Keith Hartmann

This project will build a 12-row, 30-inch row spacing, cover crop interseeder that can apply liquid nitrogen and seed a cover crop in one pass. This will expand upon ongoing farm research using a small scale prototype interseeder that was built using commonly sourced Yetter Manufacturing strip freshener units, incorporating the seeds and a Gandy seeder. The project focus is to show farmers how they can successfully establish a cover crop in a northern climate and efficiently do that with one pass across the field during an in-season nitrogen application.

Along with the seeding, corn yield will be determined by weight to check if the interseeded cover crop has an effect on the grain yield. The corn stalk nitrate test will be utilized to check if the cover crop is competing with the corn for nitrogen. Lastly, at the end of the growing season, soil nitrate samples will be taken to measure how much nitrate the cover crop has absorbed from the soil and will be held in residue until the following season.

Demonstrating Optimal Nitrogen Rate and Timing Practices in a Corn-Soybean Rotation (2016)

Grant Recipient: Wayne Dewall

This project will engage with an existing on-farm project designed to improve understanding of the impact of agricultural practices on water quality at both the field and small watershed scale.

Current two-year edge of field monitoring indicates that an average of 51 lbs. per acre is lost from the field each year. Greatest losses are in May and June when crop nitrogen (N) requirement s are low and heavy leaching rains are most common. The proposed project will examine opportunities to reduce nitrogen application from the current rate to the suggested maximum return to nitrogen (MRTN) rate developed by the University of Minnesota. The current average nitrogen rater, the MRTN suggested rate of N, will be applied as a single application and a third treatment where 60% of the MRTN rate will be applied pre-plant and 40% split applied in season will be compared in the project.

The goal is to demonstrate that more precise N rates based on MRTN will improve farm profit potential and minimize N loss to the environment.

Field Day to Demonstrate Drainage Water Management and Sub-irrigation (2016)

Grant Recipients: Gerald and Jared Nordick

This project will consist of a field day showcasing innovative drainage systems. The field day will be open to anyone, but is intended to attract other farmers, county commissioners and county staff, watershed district managers, board members and personnel, local state senators from Minnesota and North Dakota, leaders and managers of state and federal agencies, and agricultural commodity groups.

The field day will showcase an innovative subsurface drainage system on the farm. The system is designed to manage when and how much water is being drained via controlled drainage, and to capture and store the drainage water in a storage reservoir so it can be reused and recycled through a subsurface irrigation system. A saturated buffer has also been installed in another field and will be shown during the field day. These systems help better manage water, nutrients, and crop production. Water is reused rather than being sent down the stream, and nutrients are recycled from the drainage water back to growing crops.

The project will demonstrate ongoing collaboration with several partners, including the Wilkin Soil and Water Conservation District (SWCD) and Minnesota Department of Agriculture (MDA) on monitoring impacts and effectiveness of the system.

MinnesotaCorn GROWERS ASSOCIATION

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TO LEARN MORE

For more information on projects funded by Minnesota's corn organizations, contact Paul Meints, Ph.D. at the MCGA office: pmeints@mncorn.org or 952-460-3601

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