



Environment and Natural Resources Trust Fund

M.L. 2021 Approved Work Plan

General Information

ID Number: 2021-384

Staff Lead: Michael Varien

Date this document submitted to LCCMR: July 21, 2021

Project Title: Long-Term Nitrate Mitigation By Maintaining Profitable Kernza Production

Project Budget: \$485,000

Project Manager Information

Name: Dennis Fuchs

Organization: Stearns County Soil and Water Conservation District

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Project Reporting

Date Work Plan Approved by LCCMR: July 20, 2021

Reporting Schedule: December 1 / June 1 of each year.

Project Completion: June 30, 2024

Final Report Due Date: August 14, 2024

Legal Information

Legal Citation: M.L. 2021, First Special Session, Chp. 6, Art. 6, Sec. 2, Subd. 04i

Appropriation Language: \$485,000 the first year is from the trust fund to the commissioner of natural resources for an agreement with the Stearns County Soil and Water Conservation District to evaluate the effectiveness of aging Kernza stands on water quality and to continue to develop a sustainable supply chain with a focus on post-harvest processing of Kernza for water protection and local economies.

Appropriation End Date: June 30, 2024

Narrative

Project Summary: Long-term nitrate mitigation by maintaining profitable Kernza production will evaluate the effectiveness of aging Kernza stands on water quality. Continue to develop a sustainable supply chain, focusing on post-harvest processing.

Describe the opportunity or problem your proposal seeks to address. Include any relevant background information.

Nitrate leaching from crop fields to groundwater pollutes natural habitats and threatens human health. A new perennial grain crop called Kernza® can reduce nitrate leaching and provide other ecosystem services such as carbon sequestration, wildlife habitat, and soil conservation, all while keeping farmland in production. However, Kernza grain yields decline in the 3rd year, reducing profitability. This project will continue monitoring existing LCCMR Kernza plantings and determine how yields can be maintained while still preventing nitrate leaching.

This opportunity is critical for two reasons: 1) It is very rare to be able to monitor water quality in a novel crop like Kernza for more than three years, and this project would provide the first long-term dataset of its kind in the world. 2) Markets and supply chains for Kernza are emerging in Minnesota faster than anywhere in the USA, thus our state is poised to show our country how a perennial crop that protects drinking water can also improve the agricultural economy. This project would both contribute to and take advantage of the emerging Kernza market.

What is your proposed solution to the problem or opportunity discussed above? i.e. What are you seeking funding to do? You will be asked to expand on this in Activities and Milestones.

The State of Minnesota has a rare and valuable opportunity to enhance the protection of drinking water and the environment for citizens. A previous LCCMR grant (details below) successfully established and instrumented three Kernza fields – one in a replicated experiment in Pope County and two in large-scale research and demonstration fields in Stearns County – both areas with elevated groundwater nitrate levels. It has also developed Kernza product specifications and processing procedures to ensure that grain harvested from these fields can be safely and economically incorporated into various food and beverage products to stimulate local economies. The previous project is set to end on June 30, 2022 (extension requested), and this project would extend monitoring and commercialization activities for years 2021 – 2024.

Specifically, this project will measure nitrate leaching below aging Kernza stands (years 3-5), test different methods of stimulating grain yields in aging stands, and determine the effects of those methods on water quality. This project will also continue to research and develop sustainable supply chains with an emphasis on post-harvest handling and processing optimization for various food and non-food products. Results will be disseminated to a wide range of stakeholders through extensive outreach events and networks.

What are the specific project outcomes as they relate to the public purpose of protection, conservation, preservation, and enhancement of the state's natural resources?

Minnesota's current agriculture is dominated by annual crops like corn and soybean that grow during the summer, leaving land bare and brown for much of the year. Without active plant root systems to hold soil in place and absorb water, fields are much more vulnerable to wind and water erosion, and nutrient leaching; both major contributors to non-point source pollution. By adding perennial, like Kernza, improvements to water quality, such as drinking water, can be achieved because these crops are active during most of the year, including the fall, winter and spring when summer annual crops are absent.

Project Location

What is the best scale for describing where your work will take place?

Region(s): Central

What is the best scale to describe the area impacted by your work?

Statewide

When will the work impact occur?

During the Project and In the Future

Activities and Milestones

Activity 1: Identify stand renovation methods to increase nitrate leaching mitigation and grain yield in ageing Kernza stands.

Activity Budget: \$270,000

Activity Description:

Continue monitoring existing Kernza research plots as they age at the Rosholt Research Farm using lysimeters and soil water sensors to measure water quality and nitrate leaching in years 3-5. Tasks include collecting soil water samples from lysimeters every two weeks during three growing seasons, 2021, 2022 and 2023, analyzing nitrate concentration in all soil water samples, measuring soil moisture at various depths every three weeks, applying irrigation to half of the plots, monitoring soil conditions, and measuring biomass and grain yields annually. Field work will be completed by Pope SWCD in coordination with researchers from University of Minnesota.

We will impose two yield renovation treatments in year four (year two of this project) to established Kernza stands managed with and without irrigation at the Rosholt Research Farm. The two renovation treatments will include one organic option using strip tillage and one conventional option using herbicides. Both treatments will strive to terminate 8" wide strips while maintaining 24" wide rows of Kernza. Based on preliminary data, the tillage treatments will be imposed in the fall and the herbicide treatments will be imposed in the spring. These treatments will be applied as a split-plot factor to the existing experiment at Rosholt.

Activity Milestones:

Description	Completion Date
Impose renovation treatments to four-year-old Kernza stands	September 30, 2022
Report first-year grain yield responses to renovation treatments	December 31, 2023
Recommend practices to enhance mitigation of nitrate leaching and Kernza yields in ageing stands	June 30, 2024
Report changes in nitrate leaching and yields beneath Kernza over a 5-year production system.	June 30, 2024

Activity 2: Support local grower adoption of Kernza production through outreach and networking

Activity Budget: \$55,000

Activity Description:

Technical and financial (incentive payment) support will be provided to growers in the Cold Spring watershed to plant additional Kernza acreage to provide perennial cover in sensitive drinking water source management areas (DWSMAs) in the region with the intent to prevent nitrate leaching to groundwater and bolster local economies. The incentive payment (similar to cover crop incentive payments) will hopefully encourage farmers to plant an additional 100 acres Kernza in the DWSMA. Results from activities 1 and 3 will be disseminated to various stakeholders including growers, concerned citizens, agencies, non-profits, businesses, and others working to protect Minnesota drinking water. A special session on Kernza production and water quality will be held at the annual Rosholt summer field day, which attracted 100 participants in 2019. Dissemination and outreach will also occur through other activities supported by Pope and Stearns County SWCDs, including events focused on drinking water quality.

Activity Milestones:

Description	Completion Date
Coordinate Annual Rosholt Field Day to share information on Kernza study and opportunities	September 30, 2022
Coordinate Annual Rosholt Field Day to share information on Kernza study and opportunities	September 30, 2023
Share information developed during project through events, publications, and other outreach activities.	June 30, 2024

Support growers by providing technical assistance and incentives for Kernza production	June 30, 2024
Coordinate project activities	June 30, 2024

Activity 3: Build sustainable supply chains, enhance utilization, and assess storage and handling techniques for Kernza

Activity Budget: \$160,000

Activity Description:

Work on this activity will support the development of sustainable supply chains for Kernza® through technical assistance, commercialization, and stakeholder engagement. Technical work is focused on the evaluation of post-harvest handling, cleaning, drying, and storage of Kernza®. Tests will be conducted to evaluate the effectiveness of different grain drying technologies. We will select conditions and technologies that will result in minimal grain damage from harvest while maximizing yield and quality. We will also assess the optimal harvest and storage conditions (moisture, drying temperature, duration) to enable effective on-farm storage of Kernza® grain, providing recommended technologies and process operating conditions. Supply chain development efforts will be aimed at expanding uses and markets for Kernza®, with a special focus on the advancement of ecosystems services models that will provide additional economic returns to growers and increase market viability. AURI staff will also work with Minnesota businesses on pilot projects to test and demonstrate market-ready Kernza® food and non-food products. AURI's outreach component will include organizing an annual field day and inclusion of Kernza®-related programming at annual AURI "Fields of Innovation" events to further awareness, knowledge-sharing, and action planning and build stronger commercialization and supply chain networks for Kernza®.

Activity Milestones:

Description	Completion Date
Identify and evaluate methods for post-harvest handling, cleaning, drying, and storage of Kernza®.	September 30, 2023
Provide technical assistance to Minnesota businesses developing Kernza®-based products and processing capacity	December 31, 2023
Disseminate information developed during project through events, publications, and other outreach activities.	June 30, 2024
Support grower profitability and sustainability through ecosystem services markets and continued supply chain development.	June 30, 2024

Project Partners and Collaborators

Name	Organization	Role	Receiving Funds
Michael Stutelberg	Agricultural Utilization Research Institute	Lead supply chain activities	Yes
Holly Kovarik	Pope County Soil and Water Conservation District	Manage Rosholt research plots	Yes
Margaret Wagner	Minnesota Department of Agriculture	Oversee deliverables on water quality	No
Jacob Jungers	University of Minnesota	Lead Kernza research	Yes

Dissemination

Describe your plans for dissemination, presentation, documentation, or sharing of data, results, samples, physical collections, and other products and how they will follow ENRTF Acknowledgement Requirements and Guidelines.

Research results will be summarized and presented in the LCCMR final report document. Communication of study results and best practices through field days, events, publications, and presentations will also be employed during the project to support adoption of Kernza to achieve water quality, soil improvement and other environmental benefits in Minnesota.

The Minnesota Environment and Natural Resources Trust Fund (ENRTF) will be acknowledged through use of the trust fund logo or attribution language on project print and electronic media, publications, signage, and other communications per the ENRTF Acknowledgement Guidelines.

Long-Term Implementation and Funding

Describe how the results will be implemented and how any ongoing effort will be funded. If not already addressed as part of the project, how will findings, results, and products developed be implemented after project completion? If additional work is needed, how will this be funded?

This work is part of the Forever Green Initiative, a coordinated effort to develop the next generation of perennial crops to protect Minnesota's environmental resources. Clean Water Funds allocated to the Forever Green Initiative are used for the basic research needed to develop new crops. LCCMR funds are crucial for studying the environmental aspects of these new crops and supporting field-scale deployment of new crops – which we have demonstrated from previous LCCMR appropriations below. LCCMR funds help Minnesota citizens realize the environmental and economic benefits of new Forever Green crops. Related projects are supported by federal grants and industry.

Other ENRTF Appropriations Awarded in the Last Six Years

Name	Appropriation	Amount Awarded
Accelerating Perennial Crop Production to Prevent Nitrate Leaching	M.L. 2019, First Special Session, Chp. 4, Art. 2, Sec. 2, Subd. 04k	\$440,000

Budget Summary

Category / Name	Subcategory or Type	Description	Purpose	Gen. Ineligible	% Benefits	# FTE	Classified Staff?	\$ Amount
Personnel								
Grants Administration Coordinator		Coordinate grant reports and budgets			30%	0.09		\$12,000
Project Coordinator		Coordinate project			30%	0.06		\$7,000
							Sub Total	\$19,000
Contracts and Services								
University of Minnesota	Sub award	(Activity 1) Identify stand renovation methods to increase nitrate leaching mitigation and grain yield in aging Kernza stands. Personnel = \$166,578; Sampling equipment, lab analysis = \$46,248; Research rental fee = \$1,500; Travel = \$5,674 (numbers rounded to approximate value)				6		\$220,000
Ag Utilization Research Institute (AURI)	Sub award	(Activity 3) Build sustainable supply chains, enhance utilization, and assess storage and handling techniques for Kernza; and support local grower adoption of Kernza production through outreach and networking. Personnel = \$128,000 Supplies = \$7,000 Contracts = \$16,500 Field Days = \$3000 Travel = \$5500 (Approximate values due to rounding)				1.5		\$160,000
Pope County SWCD	Sub award	(Activity 1 & 2) Implement field work on research plots at Rosholt Research Farm and assist with networking and outreach to farmers.				1.38		\$61,000
							Sub Total	\$441,000
Equipment, Tools, and Supplies								

							Sub Total	-
Capital Expenditures								
							Sub Total	-
Acquisitions and Stewardship								
							Sub Total	-
Travel In Minnesota								
							Sub Total	-
Travel Outside Minnesota								
							Sub Total	-
Printing and Publication								
							Sub Total	-
Other Expenses								
		Incentive payment to farmers to grow 100 additional acres of Kernza in Cold Spring's DWSMA.	(Activity 2) Incentives will help with goal of additional acres of Kernza in DWSMA, improving drinking water quality.	X				\$25,000
							Sub Total	\$25,000
							Grand Total	\$485,000

Classified Staff or Generally Ineligible Expenses

Category/Name	Subcategory or Type	Description	Justification Ineligible Expense or Classified Staff Request
Other Expenses		Incentive payment to farmers to grow 100 additional acres of Kernza in Cold Spring's DWSMA.	All farmers in the Cold Spring DWSMA with row-crop production fields 10 acres or greater in size would be contacted. A sign-up deadline would be established. If more that 100 acres, fields would be scored and ranked. Approved farmers would be required to have Kernza in production for 3 years.

Non ENRTF Funds

Category	Specific Source	Use	Status	Amount
State				
			State Sub Total	-
Non-State				
			Non State Sub Total	-
			Funds Total	-

Attachments

Required Attachments

Visual Component

File: [c7e938ef-01a.pdf](#)

Alternate Text for Visual Component

As Kernza stands age, they produce fewer seeds but more plants. Preventing yield decline with inter-row cultivation or herbicide - but does this affect nitrate leaching?...

Board Resolution or Letter

Title	File
Stearns SWCD Letter	41a9b446-66e.pdf

Optional Attachments

Support Letter or Other

Title	File
Background check	40978ad5-33d.pdf

Media Links

Title	Link
Rosholt Research Farm	https://popeswcd.org/program/rosholt-research-farm/
University of Minnesota Forever Green	https://www.forevergreen.umn.edu/crops-systems/perennial-grains-oilseeds-pulses/kernza

Difference between Proposal and Work Plan

Describe changes from Proposal to Work Plan Stage

Reduced budget for all activities by 15%. Activity 1: removed research activity on farm production fields. Research will be focused at Rosholt Research Farm. For activity 2 & 3 reallocated work load to meet reduced budget.

7/12/2021

Added "Other Expenses" Budget Item for incentive payment to farmers to grow Kernza in Cold Spring's DWSMA of \$25,000. Activity 2 goal is to encourage farmers to grow additional 100 acres of Kernza in the City of Cold Spring's DWSMA an incentive payment is necessary for this Activity to be successful. Currently there is no established market for Kernza and it will be the farmers' responsibility find a market for the harvested crop. Also, the current market is quite favorable for commodity crops (corn and soybeans) making it more difficult for farmers to take on the risk of growing a new crop with limited markets and proven grower success.

To keep the proposal at the current funded level and to include a budget for incentives the project partners agreed to following reductions:

Activity 1. UMN reduced total budget \$5000 from \$225,000 to \$220,000 (sampling equipment, lab supplies budget reduced \$5000 from \$51,248 to \$46,248)

Activity 2. Pope SWCD reduced personnel budget \$10,000 from \$71,000 to \$61,000.

Activity 3. AURI reduced total budget \$10,000 from \$170,000 to \$160,000 (personnel from \$134,000 to \$128,000; supplies from \$9000 to \$7000, and travel from \$7500 to \$5500)

Also a portion of the Pope SWCD budget (\$61,000) was split between Activity 1 (\$50,000) and Activity 2 (\$11,000) to more accurately reflect contributions.

These budget modifications will not impact the overall goal of the project. Total budget remains at \$485,000.

Additional Acknowledgements and Conditions:

The following are acknowledgements and conditions beyond those already included in the above workplan:

Do you understand and acknowledge the ENRTF repayment requirements if the use of capital equipment changes?

N/A

Do you agree travel expenses must follow the "Commissioner's Plan" promulgated by the Commissioner of Management of Budget or, for University of Minnesota projects, the University of Minnesota plan?

N/A

Does your project have potential for royalties, copyrights, patents, or sale of products and assets?

No

Do you understand and acknowledge IP and revenue-return and sharing requirements in 116P.10?

N/A

Do you wish to request reinvestment of any revenues into your project instead of returning revenue to the ENRTF?

N/A

Does your project include original, hypothesis-driven research?

Yes

Does the organization have a fiscal agent for this project?

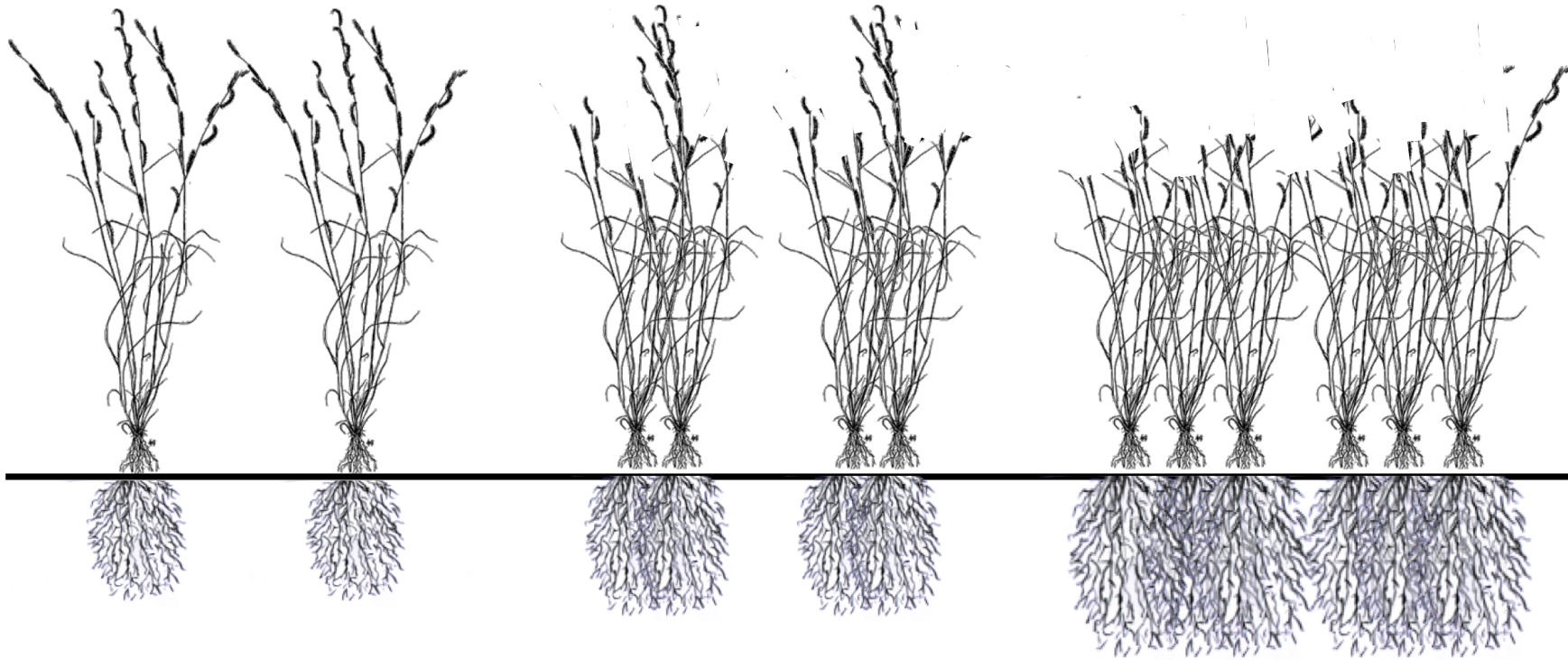
No

As Kernza stands age, they produce
fewer seeds but **more** plants

Year 1

Year 2

Year 3



Inter-row
cultivation

Inter-row
herbicide

Preventing yield decline with inter-row cultivation
or herbicide – but does this affect nitrate leaching?

Title: Long-term nitrate mitigation by maintaining profitable Kernza production
Project Lead: Dennis Fuchs