



Environment and Natural Resources Trust Fund

M.L. 2024 Approved Work Plan

General Information

ID Number: 2024-247

Staff Lead: Noah Fribley

Date this document submitted to LCCMR: June 6, 2024

Project Title: Harnessing Cover Crops and Roots for Sustainable Cropping

Project Budget: \$375,000

Project Manager Information

Name: Axel Garcia y Garcia

Organization: U of MN - College of Food, Agricultural and Natural Resource Sciences

Office Telephone: (507) 752-7372

Email: axel@umn.edu

Web Address: <https://cfans.umn.edu/>

Project Reporting

Date Work Plan Approved by LCCMR: June 20, 2024

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

Project Completion: June 30, 2027

Final Report Due Date: August 14, 2027

Legal Information

Legal Citation: M.L. 2024, Chp. 83, Sec. 2, Subd. 03y

Appropriation Language: \$375,000 the second year is from the trust fund to the Board of Regents of the University of Minnesota to determine carbon sequestration, nitrogen credit potential, water use, and performance of cover crops in corn-soybean and corn-soybean-wheat rotations in southern Minnesota.

Appropriation End Date: June 30, 2027

Narrative

Project Summary: This project proposes to increase the adoption of cover cropping in southwest Minnesota to address issues of loss of diversity and environmental degradation. By generating important information on cover crops,

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

The proposed project aims to promote sustainable crop production practices in southwest Minnesota by increasing the adoption of cover cropping. Current crop production practices have led to a loss of diversity and environmental degradation. Cover cropping is a diversification practice that has been shown to enhance yield and quality of the environment. However, its adoption is low in the state due to short growing seasons. There is still a knowledge gap in basic information such as timing for planting and termination, C and N use and credit, biomass contribution of roots, and water use at multiple locations. This project aims to fill this knowledge gap by generating much-needed information on cover cropping in southern MN, targeting major crops and cover crop types. The objectives of the project are to determine the C sequestration and N credit potential of cover crops as well as characterize their water use and evaluate performance across multiple locations in southwestern Minnesota. Our approach combines existing and new knowledge to design strategies that increase crop diversity and improve soil health. This approach promises value for both stakeholders and policymakers.

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

We propose to conduct applied field research on cover cropping in the corn-soybean and corn-soybean-wheat rotation practices to complement existing results. Research results and ancillary data will be coupled to crop models to synthesize current cover cropping knowledge for conditions in the state. Our approach of research and ancillary data coupled with crop models to synthesize current knowledge will allow extending findings beyond research sites. This strategy will further support the development of applied, ready-to-use information to help cover crop decision-making in corn-soybean and corn-soybean-wheat rotation practices in southern MN.

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?

Key measurable outcomes include:

- a. Quantification of potential C sequestration and storage increase in the soils
- b. Quantification of potential N credit and estimates of quantifiable provision of N to main crops, and insights into a potential reduction of synthetic N fertilizer use
- c. Water use estimates and effects on productivity of main crops
- d. Productivity metrics for cover crop and main crop performance
- e. While not directly measured, results will show the contribution of cover cropping to a reduction in GHG emissions. This will serve as a benchmark for sustainable crop production, offering benefits to society, especially rural communities.

Project Location

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

Statewide

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

Region(s): SW

When will the work impact occur?

During the Project and In the Future

Activities and Milestones

Activity 1: Carbon sequestration and N credit potential of cover crops

Activity Budget: \$180,000

Activity Description:

Field trials will be conducted at different locations throughout the state to represent different gradients of precipitation and soil conditions. The UMN Long-term Agricultural Research Network will be used as the platform to conduct the experiments. Cereal rye, red clover or equivalent legume, and winter camelina will be planted in the corn-soybean and corn-soybean-wheat rotations. Soil samples will be collected at the beginning, before seeding cover crops, and end of the study. Cover crops will be seeded immediately after harvest of main crops. Samples for above- and below-ground biomass will be collected at frost establishment in the fall and at termination in the spring. Biomass samples will be processed for dry biomass and then prepared for carbon and nitrogen concentration.

Activity Milestones:

Description	Approximate Completion Date
Determine C, N, and C:N ratio of cover crops residue in fall	December 31, 2024
Determine C, N, and C:N ratio of cover crops residue in spring	July 31, 2025
Determine C, N, and C:N ratio of cover crops residue in fall	December 31, 2025
Determine C, N, and C:N ratio of cover crops residue in spring	July 31, 2026
Determine C, N, and C:N ratio of cover crops residue in fall	December 31, 2026
Determine C sequestration and N credit potential of cover crops and crop systems.	June 30, 2027

Activity 2: Characterize the water use of cover crops

Activity Budget: \$70,000

Activity Description:

Activity Description:

Field trials established for C and N will be used for this purpose. Soil moisture under cover cropping will be monitored to a 4-foot depth at each location. Weather data from automated weather stations will be collected at each experimental site. Soil moisture and weather information will be used to run a field water balance and quantify the amount of water used by cover crops, from planting to termination. In turn, that information will be used to determine the effect of cover crop water use on major crops.

Activity Milestones:

Description	Approximate Completion Date
Determine the fall water use of cover crops	December 31, 2024
Determine the spring water use of cover crops	July 31, 2025
Determine the fall water use of cover crops	December 31, 2025
Determine the spring water use of cover crops	July 31, 2026
Determine the fall water use of cover crops	December 31, 2026
Characterize the soil-water dynamics in crop rotations with cover crops	June 30, 2027

Activity 3: Evaluate cover crop performance at multiple locations in southwest Minnesota

Activity Budget: \$125,000

Activity Description:

In this project, field and existing research results will be used to synthesize cover crop performance in southern MN. The platform of the Decision Support System for Agrotechnology Transfer (DSSAT; www.dssat.net), including the Crop Environment Resource Synthesis maize and wheat (CERES-Maize and -Wheat) and CROPGROW-Canola and –soybean models, will be used. DSSAT encompasses several process-based crop models that predict growth, development, and yield as a function of local weather, soil conditions, crop management scenarios, and genetic information. Input data to run DSSAT include daily weather, soil properties, specific-crop information, and agronomic management. This project will integrate knowledge of above- and below-ground biomass of crops for high-efficiency cropping systems.

Activity Milestones:

Description	Approximate Completion Date
Calibration of models	December 31, 2025
Crop models validation	June 30, 2026
Model cover crop C and N contribution and water use	June 30, 2027
Model the effect of long-term cover cropping in corn-soybean and corn-soybean-wheat rotations	June 30, 2027

Project Partners and Collaborators

Name	Organization	Role	Receiving Funds
Gregg Johnson	University of Minnesota	Research collaborator	Yes
Liz Stahl	University of Minnesota	Extension collaborator	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.

Results will be disseminated through both extension and scientific initiatives. Our extension program aims to prepare varied outreach activities and materials, fostering connections with both farmers and policymakers. Our activities will intentionally promote cover crops as a way to make cropping systems more diverse, highlighting C sequestration potential, N credit, and soil-water dynamics as related to benefits to Minnesota’s natural resources. In partnership with Extension educators, we will create online content for the MN Crop News Blog (www.blog-crop-news.extension.umn.edu), which serves over 1,600 subscribers linked to the U of MN Extension Cover Crop website. Our dissemination approach includes press releases on our field days, contributions to regional and local newsletters, radio segments, podcasts, and presentations at local and regional meetings. Upon request, curated data will be shared as appropriate. Beyond the project’s completion, we intend to publish fact sheets on the Midwest Cover Crop Council website (www.midwestcovercrops.org) and share our results at professional meetings. The culmination of our research will be synthesized in a peer-reviewed article that may include a permanent link to data shared in a data repository.

In the growing seasons of 2025 and 2026, field days will be organized at each LTARN node. These events will not only allow farmer participants to share their insights but also showcase in-field demonstrations and interactive hands-on activities. Additionally, and whenever possible, we will present at existing extension events, such as the ROC field days and various state conferences.

All our communication and outreach efforts will acknowledge the ENRTF funding. In public displays, exhibits, and digital content, the ENRTF logo will be displayed to ensure visibility. In written communications, the following text will be included: “Funding for this project was provided by the Minnesota Environment and Natural Resources Trust Fund as recommended by the Legislative-Citizen Commission on Minnesota Resources (LCCMR).” For verbal acknowledgments, the statement, “Funding provided by the Minnesota Environment and Natural Resources Trust Fund,” will be used. We will mention and tag ENRTF in social media posts and online materials related to the project

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 work be funded?

We will partner with the UMN Extension Programs, specifically from the project’s PI and collaborator, Liz Stahl. Our findings will inform sustainable practices during annual Cover Crop and SWROC field days, reaching over 300 stakeholders in southwest MN. The Cover Crop Field Day aims to evolve into a regional knowledge hub, hosting workshops based on our findings. For sustained funding, the PIs actively seek grants from federal, state, and industry bodies. We expect success metrics from this project will benefit our chances for securing financial support.

Budget Summary

Category / Name	Subcategory or Type	Description	Purpose	Gen. Ineligible	% Benefits	# FTE	Classified Staff?	\$ Amount
Personnel								
Two research technicians		Support field data collection at three locations			32%	2		\$100,000
Summer helpers		Support research technicians with data collection			8.3%	2		\$36,000
Research Assistant		Oversee field trials and synthesize results			24.1%	4		\$115,000
Researcher		Oversee the completion of the project, summer salary			36.8%	8		\$75,000
							Sub Total	\$326,000
Contracts and Services								
Minnesota Valley Testing Laboratories, Inc. (MVTL)	Professional or Technical Service Contract	Fees for lab analysis of plant and soil samples.				0		\$21,000
University of Minnesota	Professional or Technical Service Contract	Land use (research plot fees)				-		\$2,800
							Sub Total	\$23,800
Equipment, Tools, and Supplies								
	Equipment	1 Pr2/6 probe and accessories	Probe to monitor soil moisture					\$4,700
							Sub Total	\$4,700
Capital Expenditures								
							Sub Total	-

Acquisitions and Stewardship								
							Sub Total	-
Travel In Minnesota								
	Miles/ Meals/ Lodging	From and to research sites located in Grand Rapids, Lamberton, and Waseca and to CFANS in St. Paul. This averages 11 trips/year, each at \$650. Trips include 1 to three people. Trips to Grand Rapids and Saint Paul include lodging and meals. Average yearly miles was estimated at 2200.	Establish field experiments, data collection, meet with grad student in St. Paul, and present results as required by LCCMR					\$14,500
							Sub Total	\$14,500
Travel Outside Minnesota								
							Sub Total	-
Printing and Publication								
	Printing	Bulletins summarizing findings	For extension and outreach purposes					\$2,500
	Publication	A scientific paper	Cost of publication of scientific findings					\$3,500
							Sub Total	\$6,000
Other Expenses								
		N/A	N/A					-
							Sub Total	-
							Grand Total	\$375,000

Classified Staff or Generally Ineligible Expenses

Category/Name	Subcategory or Type	Description	Justification Ineligible Expense or Classified Staff Request
---------------	---------------------	-------------	--

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: [aa409f93-db6.pdf](#)

Alternate Text for Visual Component

Letter authorizing proposal submission...

Supplemental Attachments

Capital Project Questionnaire, Budget Supplements, Support Letter, Photos, Media, Other

Title	File
UMN letter of endorsement	92f19711-a6e.pdf
Research Addendum revised 2024-247_Final	b129252d-cab.pdf

Difference between Proposal and Work Plan

Describe changes from Proposal to Work Plan Stage

The major change involves extending the project's conclusion to 2027. This extension ensures data collection from two full growing seasons (2025 and 2026). By doing so, the project benefits from a more robust dataset, reducing vulnerability to weather-related risks, enhancing our prospects for publication, and allowing time for the study's modeling component and the student's completion of her/his program. Consequently, the budget has been revised to reflect third-year expenses. Nonetheless, the total funding sought remains unchanged from the initial proposal. Additionally, we've made minor edits in the document to enhance clarity in certain sections.

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?

Yes, I agree to the UMN Policy.

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

Yes

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

Yes

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

No

Does your project include original, hypothesis-driven research?

Yes

Does the organization have a fiscal agent for this project?

No

Does your project include the pre-design, design, construction, or renovation of a building, trail, campground, or other fixed capital asset costing \$10,000 or more or large-scale stream or wetland restoration?

No

Do you propose using an appropriation from the Environment and Natural Resources Trust Fund to conduct a project that provides children's services (as defined in Minnesota Statutes section 299C.61 Subd.7 as "the provision of care, treatment, education, training, instruction, or recreation to children")?

No