



Environment and Natural Resources Trust Fund

2021 Request for Proposal

General Information

Proposal ID: 2021-285

Proposal Title: Developing Cover Crop Systems for Sugarbeet Production

Project Manager Information

Name: Anna Cates

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

Office Telephone: (612) 625-3135

Email: catesa@umn.edu

Project Basic Information

Project Summary: Evaluate effective ways to protect soil from erosion in sugarbeet production, with the long-term goal of slowing soil degradation, nutrient loss, and water quality.

Funds Requested: \$331,000

Proposed Project Completion: 2023-12-31

LCCMR Funding Category: Water Resources (B)

Project Location

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

Region(s): NW, Central,

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

Region(s): NW, Central,

When will the work impact occur?

During the Project and In the Future

Narrative

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

Wind erosion in western MN averages 3-8 tons/acre per year. A cover crop planted the fall before sugarbeets should protect the soil as well as protect sugarbeet seedlings. No research has been done to evaluate erosion protection due to fall vs spring-seeded cover crops before sugarbeets. It is critical to quantify nutrient losses from sugarbeet fields in this region in order to meet Minnesota's Nutrient Reduction Strategy targets for the Red River Valley (10% in phosphorous and 13% in nitrogen by 2025). Researchers have noted that a high-residue fall cover crop suppressed weeds, which is of critical importance as growers struggle with increasing herbicide resistance in weed populations. In addition, fall-planted cereal rye reduces soil nitrate, which increases sugarbeet quality and reduces potential for nitrate leaching to ground and surface water.

Erosion is an even more difficult problem following sugarbeets in rotation. Sugarbeets are destructively harvested late in the fall, leaving soil exposed to fall, winter, and spring erosion. However, seeding cover crops which survive sugarbeet harvest has the potential to increase fall residue cover of the soil which would slow wind and water speeds, reducing erosion, potentially suppressing weeds.

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.

- In West-Central Minnesota, interseeding cover crops with strip-tilled corn prior to sugarbeets could reduce spring soil loss and save farmers time and money.
- In Northwest Minnesota, late-summer harvest of winter wheat provides an excellent window for establishment of pre-beet cover crops.
- In both regions, interseeding cover crops into standing beets will reduce fall erosion.

Successful fall cover crops reduce soil, phosphorous and nitrogen losses during the fallow period, an opportunity for savings on fertilizer costs while improving water quality. In addition, a robust pre-beet cover crop could suppress competitive herbicide-resistant weeds, which are spreading throughout the state. In order to mitigate risk for farmers adopting these new practices, our research will evaluate different planting and termination timings and methods and develop initial recommendations. We will establish large-scale on-farm trials and plot-scale trials to evaluate regionally-specific systems for sugarbeet yield and quality, troubleshoot agronomic best practices, and measure soil health metrics, wind erosion, surface runoff, and associated nutrient loss. Growers are duly wary of adopting new practices without a clear understanding of the benefits and risks, so this groundwork is necessary for workshops, technical assistance, and promotion of sustainable sugarbeet production in Minnesota.

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?

This data will be used to promote adoption of cover cropping in sugarbeets to reduce erosion by wind and water, which enhance nutrient delivery to Minnesota's surface water. As sugarbeets are grown in rotation with other crops, other relevant agricultural conservation practices will be discussed at field days and in publications, using this research as leverage to promote soil and water conservation in the West-central and NW regions of Minnesota.

Activities and Milestones

Activity 1: Central Minnesota: Integrating cover crops in strip-till corn-sugarbeet crop rotations

Activity Budget: \$110,333

Activity Description:

We will evaluate four treatments for soil protection and agronomic best practices: (1) pre-beet cover (rye and Austrian winter pea) interseeded between strip-tilled corn rows at ~R6, (2) post-beet cover sewn after beet harvest, (3) nurse crops sewn at beet planting, and (4) no cover crops. Growers with the Southern Minnesota Beet Sugar Cooperative have agreed to host large on-farm trial plots, and SMBSC has agreed to support the logistics of research including beet yield and quality sampling. We will use dust collectors to quantify soil and nutrients lost to wind erosion and measure soil health metrics (biologically active soil C and N). Yields of beets, corn, and wheat will be evaluated using farmers' combine or weigh wagon data, and a subsample of beets and wheat will be taken from each plot to evaluate quality. Cover crop and weed success will be quantified by harvesting biomass and photographing ground cover. Field days will be held each year to address grower concerns and share best management practices developed.

Activity Milestones:

Description	Completion Date
Interseed cover into R6 corn, evaluate fall ground cover and soil erosion (2021 and 2022)	2022-11-30
Evaluate spring cover, spring erosion, and plant sugarbeets (2022 and 2023)	2023-05-31
Field days to disseminate results (2022 and 2023)	2023-08-31
Evaluate sugarbeet yield and quality (2022 and 2023)	2023-11-30

Activity 2: Northwest Minnesota: Integrating cover crops in wheat-sugarbeet rotations

Activity Budget: \$220,667

Activity Description:

We will evaluate four treatments for soil protection and agronomic best practices: 1) pre-beet cover sewn after wheat; 2) post-beet cover interseeded before beet harvest; 3) no cover beets. Growers with American Crystal Sugar have agreed to host large on-farm trial plots, and ACS has agreed to support the logistics of research including beet yield and quality sampling. We will use dust collectors to quantify soil and nutrients lost to wind erosion and measure soil health metrics (biologically active soil C and N). Yields of beets, corn, and wheat will be evaluated using farmers' combine or weigh wagon data, and a subsample of beets and wheat will be taken from each plot to evaluate quality. Cover crop and weed success will be quantified by harvesting biomass and photographing ground cover. Field days will be held each year to address grower concerns and share best management practices developed.

In addition, a small-plot study at Crookston NWROC will evaluate the same treatments, and be split to evaluate 2-5 different cover crop species for pre-beet and post-beet windows. Evaluation of soil and environmental indicators will proceed as in on-farm plots.

Activity Milestones:

Description	Completion Date
Establish cover crops following wheat harvest (2021 and 2022)	2022-09-30
Evaluate spring cover, spring erosion, and plant sugarbeets (2022 and 2023)	2023-05-31
Field days to disseminate results (2022 and 2023)	2023-08-31
Evaluate sugarbeet yield and quality (2022 and 2023)	2023-11-30

Project Partners and Collaborators

Name	Organization	Role	Receiving Funds
Heidi Reitmeier	UMN, NW Research and Outreach Center	Technician to collect field data and analyze water quality samples.	Yes
Graduate research assistant	UMN	Collect and analyze field data including water quality and soil health metrics.	Yes
Leah Grim	UMN	Help to collect and analyze samples for soil health indicators.	Yes
David Mettler	Southern Minnesota Beet Sugar Cooperative	Mettler helped identify cooperators and will coordinate harvest data collection including yield and beet quality.	No
Todd Cymbalak	American Crystal Sugar	Cymbalak identified NW MN growers, and will coordinate plot data collection including sugarbeet yield and quality metrics.	No
Dr. Thomas Peters	North Dakota State University and University of Minnesota	Extension Sugarbeet Agronomist, will lead weed pressure evaluation.	No
Dorian Gatchell	MN Ag Services	Farmer contact and field work support in central MN work.	Yes
Jodi DeJong-Hughes	University of Minnesota Extension	Regional Extension Educator in Crops and Soils, lead on Central MN work.	Yes
Dr. Lindsay Pease	NW Research and Outreach Center	Assistant Professor and Extension Specialist of Nutrient and Water Management, Department of Soil, Water, and Climate, UMN, Crookston, MN. Lead on Crookston site management, surface runoff measurements, graduate student co-advisor.	Yes

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 project addresses basic questions of cover crop management for sugarbeets; however, we expect to refine these systems. All personnel will disseminate these results through field days on farms, at the NWROC Crop and Soils Field Day, UMN-Extension website, two peer-reviewed research publications, at winter beet Grower’s Seminars and ACS’s “Way to Grow” series. Federal, cost-share is available to individual growers for cover cropping. Commodity crop organizations including the Sugarbeet Research and Education Board, MN Wheat, MN Soybean Growers Association, and MN Corn Growers Association fund cover crop research which may be used to address questions raised here.

Project Manager and Organization Qualifications

Project Manager Name: Anna Cates

Job Title: Assistant Professor and Extension Specialist, Department of Soil, Water, and Climate

Provide description of the project manager’s qualifications to manage the proposed project.

Dr. Anna M. Cates, Project PI, Assistant Professor and Extension Specialist, Minnesota Office for Soil Health and Department of Soil, Water, and Climate. The Minnesota Office for Soil Health (MOSH, <https://www.wrc.umn.edu/mosh>),

of which Dr. Cates is the principal member, was founded in 2018 to address water quality in Minnesota's agricultural lands by focusing attention on soil stewardship. Dr. Cates is involved with technical training for local government personnel including Soil and Water Conservation Districts and NRCS staff to increase support for farmers in implementing conservation practices across the state. The MOSH is putting together a Minnesota Cover Crop Guide which will compile research on cover crops in the state to make recommendations and identify research needs in this burgeoning area. Dr. Cates has experience managing budgets and personnel in both academic and private settings. She has published in peer-reviewed journals on cover crops and crop management impacts on soil organic matter pools and soil structure.

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

Organization Description:

UMN-CFANS is Minnesota's flagship educational institution, with vast expertise for carrying out and promoting research in applied settings. Within CFANS, the Department of Soil, Water, and Climate has a long history of collaboration with greater Minnesota to address agricultural challenges.

Budget Summary

Category / Name	Subcategory or Type	Description	Purpose	Gen. Ineligible	% Benefits	# FTE	Classified Staff?	\$ Amount
Personnel								
Professional and Admin		PI			26.7%	0.03		\$2,796
Professional and Admin		Scientific Leadership			26.7%	0.13		\$14,438
Professional and Admin		Scientific and Field Leadership			32.6%	0.07		\$8,485
Graduate Student		Data collection and analysis			46.6%	1.25		\$125,598
Researcher		Lab and field technical support			24.1%	0.75		\$35,799
Researcher		Lab and field technical support			24.1%	0.38		\$20,248
Undergraduate researcher		Lab and field work			0%	1.05		\$31,980
							Sub Total	\$239,344
Contracts and Services								
MN Agricultural Services, Dorian Gatchell	Professional or Technical Service Contract	Soil sampling, erosion monitoring, yield sampling at \$25/hour for 60 hours/year for 2 years. Gatchell has MS in Agronomy, owns soil sampling equipment, works closely with farmers, and has years of experience with research protocols.				0.05		\$3,000
Soil sample analysis	Professional or Technical Service Contract	\$20/sample *101 plots * 2 years, for analysis of standard nutrients or soil biological activity.				-		\$4,040
Water sample analysis	Professional or Technical Service Contract	At Crookston NWROC plots only, collect runoff samples approximately monthly to represent key points during the growing season (e.g. pre/post planting, pre/post cover crop interseeding). 9 samples/year * \$5/sample * 20 plots * 2 years				-		\$1,800
							Sub Total	\$8,840
Equipment, Tools, and Supplies								

	Tools and Supplies	Field supplies for 101 plots, \$900/year 1 and \$650/year 2	Field flags to mark plots, soil sampling bags, maintenance and repair of soil samplers,					\$1,550
	Tools and Supplies	Dust collectors, 40 too be manufactured at \$250/each, 20 in West-central MN and 20 in NW MN.	To measure wind erosion on selected on-farm plots, collecting sediment for analysis of total organic matter, pest presence, and nutrients.					\$10,000
	Tools and Supplies	Cover crop seed, Pre-beet cover: Winter rye (.24/lb * 60 lb/ac) and peas (.65/lb * 10 lb/ac) *20 ac/farm, * 6 farms * 2 years Post-beet cover: Winter rye (.24/lb * 60 lb/ac) and rapeseed (1.2/lb * 5 lb/ac) *20 ac/farm, * 6 farms * 2 years	This seed should be sufficient to supply all farmers with uniform seed supplies to apply treatments.					\$9,912
	Tools and Supplies	Farmer stipend, \$1100/site * 6 sites * 2 years	To compensate farmers for use of their land and their participation in the project.					\$13,200
	Tools and Supplies	Equipment rental: To strip-till plots, \$800/site/year @ 2 sites/year and interested covers, \$800/year at 2 sites/year (not all farmers require this)	Farmers who are experimenting with these practices must hire proper equipment to apply field treatments.					\$6,400
	Tools and Supplies	6 sprinkle infiltrometers, \$1450 apiece, plus \$150 golf hole cutter for installation	To measure infiltration and runoff at all plots, allowing collection of water samples for nutrient analysis, and showing the resiliency of soil structure to rainfall.					\$8,850
	Tools and Supplies	In-house soil analysis, \$30/sample * 101 plots * 2 years	Samples will be analyzed for biological activity, structure and organic matter					\$6,060
							Sub Total	\$55,972
Capital Expenditures								
							Sub Total	-
Acquisitions and Stewardship								
							Sub Total	-
Travel In Minnesota								
	Miles/ Meals/ Lodging	Approximately 65 trips/year of varying lengths, \$0.575/mile, plus lodging (\$1000) and meals (\$700)	Travel sampling, project team meetings, and field days will mostly consist of day trips, except for St.					\$20,544

			Paul-based personnel to spend nights in Crookston for harvest and field days, and Crookston-based personnel to spend nights in St. Paul for meetings.					
							Sub Total	\$20,544
Travel Outside Minnesota								
	Conference Registration Miles/ Meals/ Lodging	2 trips at \$1500/trip	PI or graduate student will present results and national or regional meetings devoted to soil health, agronomy, and/or water quality	X				\$3,000
							Sub Total	\$3,000
Printing and Publication								
	Printing	Research reports and field day handouts, \$150/year 2 and \$150/year 3	Growers still appreciate paper copies of research results, which will be mailed to participating growers, and summarized for the field day audience					\$300
	Publication	2 peer-reviewed publications, \$250/each	To communicate project results to the scientific community					\$500
							Sub Total	\$800
Other Expenses								
		\$500/field day for 5 field days (Year 2: 2, Year 3: 3)	Field day logistics, i.e. food, porta-potty rental, tent rental, will cover the cost of hosting on-farm events					\$2,500
							Sub Total	\$2,500
							Grand Total	\$331,000

Classified Staff or Generally Ineligible Expenses

Category/Name	Subcategory or Type	Description	Justification Ineligible Expense or Classified Staff Request
Travel Outside Minnesota	Conference Registration Miles/Meals/Lodging	2 trips at \$1500/trip	Minnesota is a major player in the beet-growing industry, which holds regional meetings to share best practices. In order to reach all top Minnesota personnel as well as a relevant wider audience, project personnel should be prepared to present their results at these national and regional meetings. This legitimizes the project in the wider industry and amplifies our impact on water quality and soil conservation.

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: [87560803-874.pdf](#)

Alternate Text for Visual Component

Cover crops provide ground protection and take up nutrients when summer cash crops are not growing. Without cover crops, erosion transports N and P to waterways and leaves degraded soil.

Administrative Use

Does your project include restoration or acquisition of land rights?

No

Does your project have patent, royalties, or revenue potential?

No

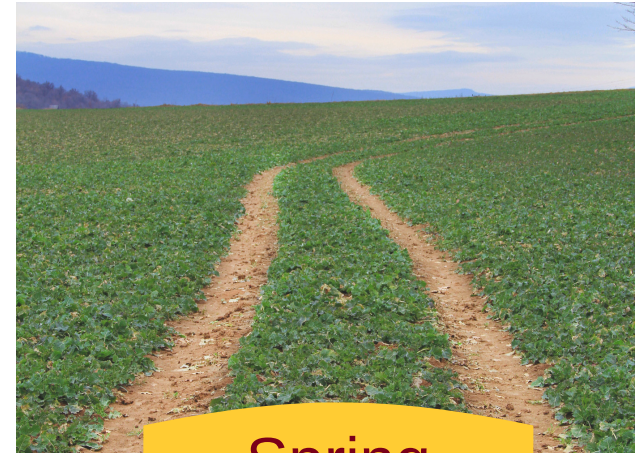
Does your project include research?

Yes

Does the organization have a fiscal agent for this project?

Yes, Sponsored Projects Administration

Cover crops hold soil in place, retain N and P, and add organic matter to the soil.



Without cover crops, erosion transports N and P to waterways and leaves degraded soil.

