Environment and Natural Resources Trust Fund
2018 Request for Proposals (RFP)

Project Title: **ENRTF ID: 083-B**

Incentivizing Oilseed Cash Covercrops for Water Quality Improvement

Category: B. Water Resources

Total Project Budget: $ 1,320,000

Proposed Project Time Period for the Funding Requested: 3 years, July 2018 to June 2021

Summary:

Through a market-based approach, this project will protect water resources by increasing the marketability and adoption of oilseed cash cover crops into annual row crop agricultural production systems across Minnesota.

Name: M. Scott Wells

Sponsoring Organization: U of MN

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Web Address

Location

Region: Northwest, Southwest

County Name: Becker, Chippewa, Clay, Grant, Kandiyohi, Kittson, Mahnomen, Marshall, McLeod, Meeker, Norman, Otter Tail, Polk, Pope, Redwood, Renville, Sibley, Stearns, Stevens, Swift, Traverse, Wilkin, Yellow Medicine

City / Township:

Alternate Text for Visual:

The map details sugar beet county level acreage (left) and Minnesota Pollution Control Agency nitrogen concentrations in Minnesota surface waters (right).

_____ Funding Priorities	_____ Multiple Benefits	_____ Outcomes	_____ Knowledge Base
_____ Extent of Impact	_____ Innovation	_____ Scientific/Tech Basis	_____ Urgency
_____ Capacity Readiness	_____ Leverage	_____ TOTAL	_____%

I. PROJECT STATEMENT

This project aims to protect, conserve and sustain Minnesota water resources by expanding oilseed cover crop production through increased awareness, value and demand for pennycress and camelina products. Cover crops are essential for protecting ground and surface water quality by preventing nutrient leaching and runoff. In Minnesota, cover crops can reduce nitrate loss by over 60%. Nutrient leaching not only necessitates replenishing the soil with nutrients, but also adds to the burdensome cost of remediating ground and surface water. Despite numerous ecological and environmental benefits, cover crops are not implemented broadly in MN, mostly due to the perception they are too expensive to plant and have little harvestable value. When the value barrier is removed, adoption is greatly enhanced. For example, through the Cash for Cover Crop program, 80% of Maryland farmers use cover crops to protect the Chesapeake Bay. The project team posits that we can overcome adoption barriers in MN through the development of new "cash cover crops" that not only complement current agricultural production systems but also provide profitability and market diversity. This project will develop pennycress and camelina as the winter annual cash cover crops of choice in Minnesota. Using a market system approach, we will integrate pennycress and Camelina into traditional agriculture production systems throughout Central and West Central MN to protect and improve water resources. We will push demand for adopting pennycress and camelina as cash cover crops by researching and developing a portfolio of commercially valuable food, feed, nutrition, and bio-based products.

II. PROJECT ACTIVITIES AND OUTCOMES

Activity 1: Develop test and bring to market viable new products derived from pennycress and camelina to increase market demand and spur producer adoption of oilseed cover crops. Budget: $170,000

The objective is to establish new and viable supply chains from farm to market for pennycress and camelina by identifying and fostering markets for camelina and pennycress oil in food, bioproducts and biodiesel sectors.

1. Researchers will develop a detailed analysis of oil from various germlines to evaluate application in food, cosmetics, biofuel and bioproducts industries.
2. Plant residue from pennycress and camelina will be tested for cellulosic sugars that can be extracted for conversion into high-value bioplastics and nutraceutical application.
3. Development and management of pilot-scale projects with private businesses where the economic advantages of oilseeds will be tested and demonstrated.
4. Education and outreach to the business sector will involve 3 – 6 AURI Innovation Network program forums, as well as one-on-one networking and meetings.

Outcome	Completion Date
1. Identification of the market sectors (food, fuel, bioproducts, etc) for oil from camelina and pennycress and a strategy for market penetration	June 2019
2. Optimized process to extract sugars from the residue of camelina and pennycress crops for conversion into high-value bioplastics and nutraceuticals	June 2020
3. Establish supply chain logistics by working with farmers, commodity groups and co-ops to produce and process camelina and pennycress crops	June 2021
4. Build industry awareness and stimulate demand through ongoing communication, presentations and networking with potential and targeted downstream supply chain partners (crushers, processors, distributors, etc).	June 2021

Activity 2: Characterize water quality protection afforded by pennycress and camelina Budget: $180,000

The objective of this set of activities is to implement field-scale experiments examining the utility of cash cover crops to protect soil, sequester nutrients and enhance water quality in Minnesota's agroecosystems. For comparisons, the entirety of each field will be sown with (a) pennycress, (b) camelina, or (c) traditional winter-fallowed corn/soybean. All chemical analyses will be performed in-house at the Soils Research Lab, which has well-equipped labs and experienced staff.

1. Instrumenting drainage outlets of three small concave-shaped fields in Stevens Co. with weirs and hydrologic equipment

for measuring and sampling water and sediment discharge comparing runoff volumes and chemistry. Water and sediment discharges will be analyzed for nitrate and phosphate.

2. Independently evaluate drainage water, flow rate and sample analysis of water emanating from three tile-drained fields in Stevens Co. sown with (a) pennycress, (b) camelina, and (c) traditional winter-fallowed corn/soybean.

Outcome	Completion Date
1. Seasonal and annual reductions in N and P in runoff water (surface water) attributable to pennycress and winter camelina compared to traditional winter-fallowed cropland.	June 2021
2. Seasonal and annual reductions in N and P in groundwater (tile drainage) attributable to pennycress and winter camelina compared to traditional winter-fallowed cropland.	June 2021

Activity 3: Partner with Central and West Central Minnesota farmers and UMN Extension to educate and demonstrate the water protection services provided by integrating pennycress and camelina into traditional annual cropping systems. Budget: $320,000

Pennycress and camelina production following autumn harvest will be evaluated on three Central and West Central MN working Minnesota farms per year where their cropping system represent more than 3 million acres of MN farmer land. Participating farmers will:

1. Develop enterprise budget via tracking economic inputs throughout production and harvest of the oilseed and will receive contracted compensation for the harvested crop.
2. Enhance adoption through grower engagement via the development of educational curriculums and field demonstrations outlining the wellhead and watershed protection services pennycress and camelina offer.
3. Disseminate research findings through the combination of two-farm tours, 15 winter grower meetings, one summer field event, and series of web-based educational publications shared through leading Minnesota agricultural organizations with more than 4300 subscribers.

Outcome	Completion Date
1. Develop enterprise budgets and cost benefit analysis for pennycress and camelina production.	June 2021
2. Host public education events, (on-farm tours. workshops and a summer field day) on the 3 farm sites to share research, agronomic production practices, cost benefit analysis and market information with farmers, buyers, distributors and other partners in the supply chain.	June 2021
3. Partner with agricultural leaders, including Minnesota Farmers Union (MFU), Sustainable Farming Association (SFA), UMN Extension and the Regional Sustainable Development Partnership (RSDP), to share research and cost benefit analysis with farmers. Communication includes presentations at state conferences and grower meetings, webinars,and website publications.	June 2021

III. PROJECT STRATEGY

A. Project Team/Partners University of Minnesota: Program Director; Activities 1-3. Agricultural Utilization Research Institute Activity 1

B. Project Impact and Long-Term Strategy: The outcomes associated with each activity will increase the adoption of camelina and pennycress cash crops into corn, soybean and sugar beet cropping systems. The increased adoption will provide greatly needed wellhead and watershed protection across MN.

C. Timeline Requirements: The three activities outlined in this proposal are designed to meet all outcomes in three years.

2018 Detailed Project Budget

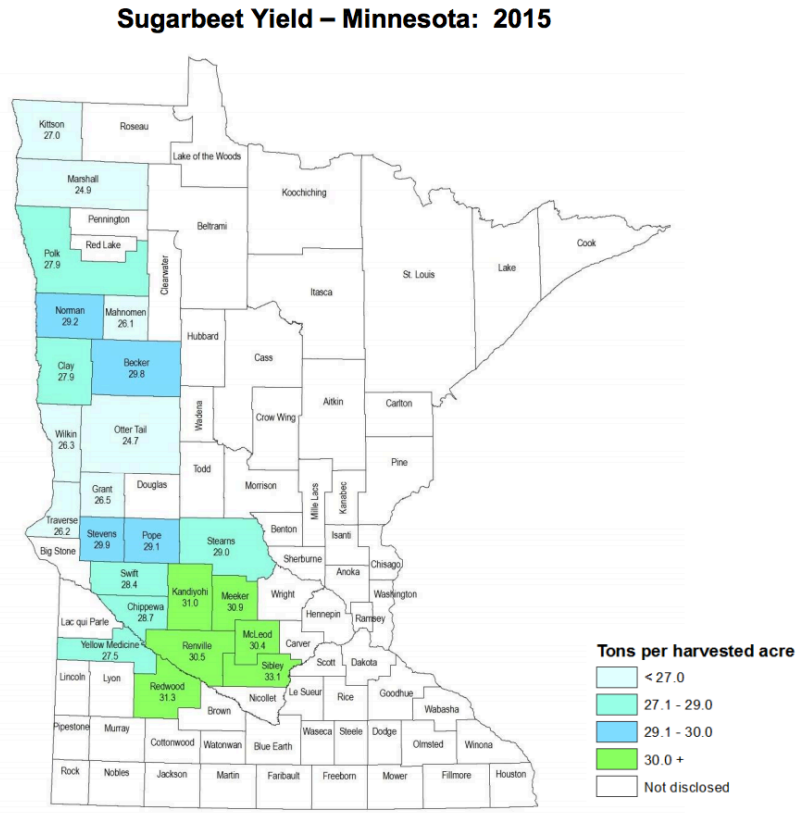
Project Title: Oilseed cash cover crops for water quality protection

IV. TOTAL ENRTF REQUEST BUDGET 3 years

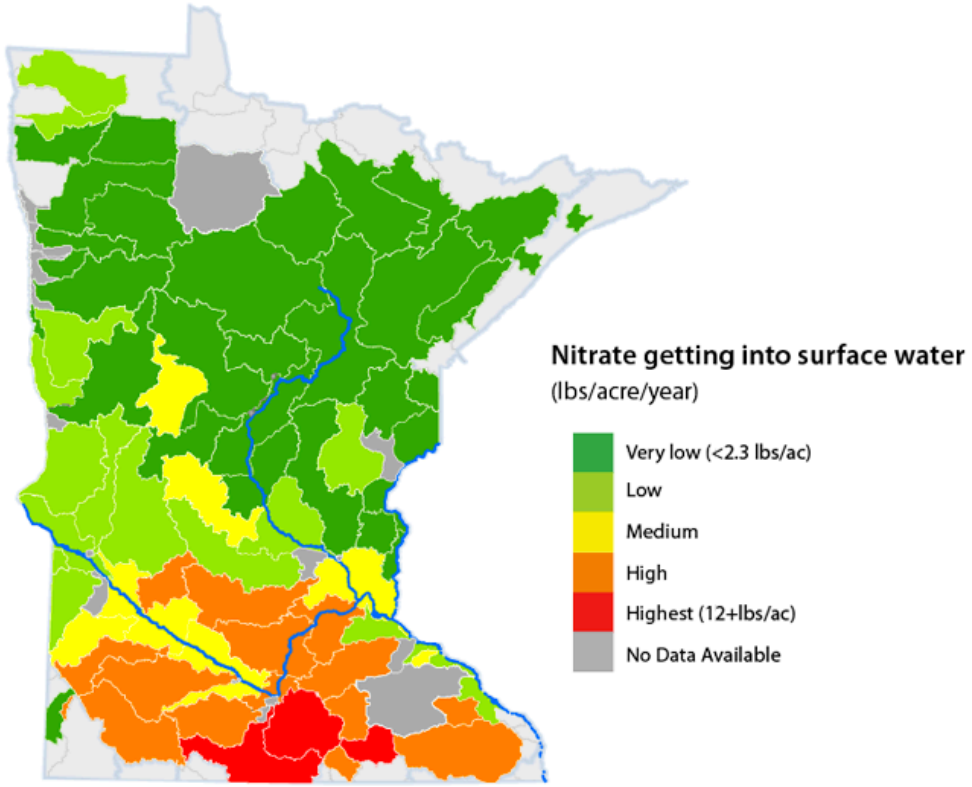
BUDGET ITEM	AMOUNT
Personnel:	
M. Scott Wells, Assistant Professor, Program Director (66.5% salary, 33.5% benefits). Pro 11% FTE year 1, 22% FTE year 2 and 3	$ 84,343
Connie Carlson - Extension Outreach and Supply Chain Expert (72.8% salary, 27.2% benefits) will develop supply chain networks, work closely with AURI, and UMN for outreach and education. 50% FTE years 1-3.	$ 103,673
Alex Hard - Research Scientist (72.8% salary, 27.2% benefits), deployment and management of research efforts. Collect, process, and assist in data analysis. 60% FTE years 1 - 3.	$ 96,240
Research Associate (Research 6), data monitoring, analysis, and maintaining research (87.6% salary, 21.4% benefits); 100% FTE for each of 3 years	$ 121,400
Student Laborers (100% salary, 0% benefits); 25% FTE years 1-3	$ 30,000
Sub Contract: AURI: Research Scientist - Project technical team (72.8% salary, 27.2% benefits) (comprising of Process Engineer, Organic and analytical scientist and Food Scientist) will work on assessing the oil and biomass composition, develop process for the conversion of oil into biodiesel and food-based applications as well as for extracting sugars and high-value nutraceuticals from the crop residue. 30% FTE years 1 - 3.	$ 51,480
Sub Contract: AURI: Research Scientist - The Innovation and Commercialization (72.8% salary, 27.2% benefits) team will focus on business development opportunities through exploration, development and management of pilot scale projects with private businesses to commercialize new products and technologies. The Commercialization team will devote time equivalent to 40% FTE years 1-3.	$ 68,640
Sub Contract: AURI:Research Scientist - The Outreach and Communications (72.8% salary, 27.2% benefits) teams will organize 3-6 Innovation Network Program forums over the course of the grant period to further awareness, knowledge sharing and action planning related to innovative opportunities in camelina-based food, feed and fuel applications and products, markets and technologies 10% FTE years 1 - 3	$ 17,160
Professional/Technical/Service Contracts:	
Equipment/Tools/Supplies:	
Sub Contract - AURI Analytical equipment (Refurbished Gas Chromatograph with Mass Spectrometer) for the detection and quantification of high-value compounds, oil analysis and biodiesel assessment; associated supplies	$ 13,170
Field agronomic supplies, seeds, bags, tags, fertilizer, field stakes, and tractor fuel	$ 9,344
Weirs runoff catchment and installation	$ 8,000
Field tiles and installation to assess percolation	$ 10,000
Flow gauages and Auto-samplers for weirs and titles	$ 8,000
Water, soil, and tissue sample ananlysis lab supplies	$ 7,000
Acquisition (Fee Title or Permanent Easements):	$ -
Travel:	
Travel to field sites for deployment, maintenance, and data collection. Travel from St. Paul to Morris project team meetings. Overnight lodging, meals, and incidentals.	$ 19,000
Sub Contract: AURI: Travel by the technical team to collect samples and conferences, to partner labs = $3,400; Travel by Innovation and Commercialization Team to private businesses and investors across the state = $12,750; Travel by the Outreach and Communications team to Forums, host prominent speakers = $3,400	$ 19,550
Additional Budget Items:	
Short-term rents and lease for land on-farm demonstration, education, and outreach events	$ 3,000
TOTAL ENVIRONMENT AND NATURAL RESOURCES TRUST FUND $ REQUEST =	$ 670,000

V. OTHER FUNDS *(This entire section must be filled out. Do not delete rows. Indicate "N/A" if row is not applicable.)*

SOURCE OF FUNDS	AMOUNT	Status
Other Non-State $ To Be Applied To Project During Project Period:	$ -	*NA*
Other State $ To Be Applied To Project During Project Period:	$ -	*NA*
In-kind Services To Be Applied To Project During Project Period:		
Activity direction by F. Forcella & R. Gesch (65% salary, 35% benefits), 20% FTE for each of 3 yrs	$ 120,000	*Secured*
Technical support by J. Eklund & J. Boots (65% salary, 35% benefits), 20% FTE for each of 3 yrs	$ 66,000	*Secured*
Past and Current ENRTF Appropriation:	$ -	*NA*
Other Funding History:	$ -	



USDA – NASS. https://www.nass.usda.gov/Statistics_by_State/Minnesota/Publications/County_Estimates/2016/MN_CtyEst_Sugarbeets_14-15.pdf



Minnesota map showing pounds per acre per year of Nitrate getting into surface water

MPCA. Nitrogen in surface waters. https://www.pca.state.mn.us/featured/report-nitrogen-surface-water

M. SCOTT WELLS
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EDUCATION

Ph.D.	Crop Science	North Carolina State University, 2013
M.S.	Crop Science	North Carolina State University, 2011
B.A.	Mathematics	University of North Carolina Asheville, 2008

OVERVIEW OF RESEARCH AND EDUCATION

My applied and field ordinated research program provides research-based technologies that address the sustainable intensification of agriculture. Such technologies include cover crop interseeding into corn and soybean cropping systems, developing agronomic management of new winter oilseed relay cropping systems, evaluating optimal management strategies for alfalfa production systems, and assessing the fate of nitrogen in annual and perennial cropping systems. I also support the alfalfa and corn silage variety-testing programs. In conjunction with my research programs, I also provide statewide educational leadership for both the University of Minnesota Forage Extension Team and the Cover Crop Team.

SELECT PUBLICATIONS

Wells, M.S., Reberg-Horton, S.C., Mirsky, S., Maul, J., and Hu., S. 2016. In situ validation of fungal N translocation to cereal rye mulches under no-till soybean production -01Plant and Soil. Accepted 21 July 2016. D

Wells, M.S, Reberg-Horton, S.C., Mirsky, S.B. 2014. Cultural Strategies for Managing Weeds and Soil Moisture in Cover Crop Based No-Till Soybean Production. Weed Science. 2014;62(3):501-511.

Wells, M.S., Reberg-Horton, S.C., Grossman, J., and Smith. A.N. 2013. The Reduction of Plant-Available Nitrogen by Cover Crop Mulches and Subsequent Effects on Soybean Performance and Weed Interference. Agronomy Journal. 105:1—7.

EXAMPLES OF ON-GOING RESEARCH GRANTS

External Agency: Minnesota Department of Agriculture. Investigator Status: PI. Project Title and Dates. Increasing adoption of cover cropping systems through research-based education. 2/2016 – 6/2019. Direct Costs: $249,983

External Agency: Natural Resource Conservation Services. Investigator Status: PI. Project Title and Dates: Demonstration and regional adaptation of interseeded cover crop planting and management technologies in annual corn cropping systems in the Upper Midwest. 10/2015 – 9/2018. Direct Costs: $691,911

External Agency: National Institute of Food and Agriculture. Investigator Status: Co-PI. Project Title and Dates: A novel management approach to increase productivity, resilience, and long-term sustainability in cropping systems in the Upper Midwest. 4/2016 – 3/2018. Direct Costs: $ 2,147,839 ($168,487 to Wells)

External Agency: Minnesota Department of Agriculture. Investigator Status: PI. Project Title and Dates: Water quality enhancements in corn cropping systems through optimization of cover crop establishment technologies. 4/2014 – 6/2017. Direct Costs: $243,910

ORGANIZATION DESCRIPITIONS

University of Minnesota, Department of Agronomy and Plant Genetics

We have state of the art research laboratories, growth chambers, and greenhouse facilities. We have field equipment including small plot tractors and tillage equipment, small plot sprayers, and all equipment necessary to conduct the field research and on-farm portion of this grant. Plot research land is available at the St. Paul campus and across the 10 Research and Outreach Centers across the state. Additionally, if needed, we have considerable resources at the University Rosemont UMORE Park facility within 60 miles of the St. Paul campus including field plot preparation equipment, application equipment, and all small plot equipment necessary to conduct this research. The integrity, security, and condition of all resources are inspected and maintained to meet University regulations and standards.

USDA-ARS, North Central Soil Conservation Research Laboratory (NCSCRL).

The NCSCRL is a modern and well-equipped research unit. The research staff is supported by a computer systems specialist and an electronics engineer. All technical staff members that will be associated with this project have university degrees and the specialized training necessary for assistance with the topics to be investigated. The laboratory has a staffed in-house analytical laboratory to conduct detailed soil and plant chemical analysis, soil physical analysis and microbial analysis. Our staff also includes expert research-farm management and administrative support. Sufficient office and laboratory space are available at NCSCRL. The NCSCRL oversees its own 130-acre research farm, Swan Lake Research Farm, located approximately 10 miles north of Morris. Adjacent acreage is rented as needed.