



Environment and Natural Resources Trust Fund (ENRTF)

M.L. 2020 ENRTF Work Plan (Main Document)

Today's Date: February 26, 2020

Date of Next Status Update Report: April 1, 2021

Date of Work Plan Approval:

Project Completion Date: December 31, 2023

Does this submission include an amendment request? No

PROJECT TITLE: Implementing hemp crop rotation to improve water quality

Project Manager: Keith Olander

Organization: Central Lakes College

College, Department, or Division: Ag & Energy Center

Mailing Address: 1830 Airport Road

City, State, Zip Code: Staples, MN, 56479

Project Manager Direct Telephone Number: 218-894-5163

Email Address: keith.olander@clc.edu

Web Address: <http://www.clcmn.edu/ag-energy-center/>

Location:

Region: Central, Metro, Southwest

Counties: Carver, Redwood, Stevens, Todd, Wadena

City/Township: Staples, Morris, Waconia, Lambertton

Total Project Budget: \$700,000

Amount Spent: \$0

Balance: \$700,000

Legal Citation: M.L. 2020, Chp. xx, Sec. xx, Subd. xx

Appropriation Language:

PROJECT STATEMENT:

Establishing industrial hemp (*Cannabis sativa*) as an oilseed grain crop has potential to improve surface and ground water quality and restore soil integrity within the conventional crop rotation systems that are major environmental concern in Minnesota. Deep rooted hemp has the potential to scavenge, prevent runoff and reduce leaching of agricultural nutrient inputs, especially nitrogen, while further contributing organic matter to the soil horizon. We will experimentally test the effectiveness of hemp grain crops to scavenge excess nitrogen and prevent leaching in crop rotation systems. In parallel, we will demonstrate on a production scale how the incorporation of hemp grain into conventional crop rotation systems can achieve desired water quality and soil health outcomes. Finally, we will communicate the viable economic potential of hemp oilseed/grain cropping as discovered, refined and facilitated by market pathway and supply-chain development analyses. Communication of study results and best practices through field days, farm demonstrations, and presentations will support adoption of hemp crops to achieve water quality, soil improvement and other environmental benefits in Minnesota.

II. OVERALL PROJECT STATUS UPDATES:

First Update April 1, 2021

Second Update November 1, 2021

Third Update April 1, 2022

Fourth Update November 1, 2022

Fifth Update April 1, 2023

Sixth Update November 1, 2023

Final Report between December 31, 2023 and February15, 2024

III. PROJECT ACTIVITIES AND OUTCOMES:

ACTIVITY 1 Title: *Corn vs. hemp comparison of nitrogen movement & corn-soybean-hemp integration*

Description: Changes to the 2014 and 2018 federal Farm Bills have piqued the interest of growers in adding industrial hemp to their crop rotations. Unlike corn, hemp produces a robust tap root that has the potential to recover nitrate leached deep into the soil profile before it enters the water table. This three-year experiment will use experimental blocks sited at four locations to quantify nitrate in leachate collected under experimental hemp plots and corn plots and thereby assess the potential for hemp to mitigate nitrate contamination of water resources if included in typical crop rotations. We will also conduct production scale trials at two locations to demonstrate the integration of hemp into conventional corn-soybean rotations and to assess leaching and scavenging of nitrogen.

ACTIVITY 1 ENRTF BUDGET: \$424,000

Outcome	Completion Date
1. Investigate the potential of hemp to mitigate groundwater nitrate contamination.	
a) Compare hemp and corn crops following a previous crop of corn at four locations for percent nitrate in leachate collected under experimental plots at several sampling periods during the growing season.	April 1, 2022

b) Compare hemp and corn crops following a previous crop of corn at four locations for the quantity of N leached under experimental plots during the entire growing season.	April 1, 2022
c) Compare hemp and corn crops following a previous crop of corn or hemp at four locations for percent nitrate in leachate collected under experimental plots at several sampling periods during the growing season.	April 1, 2023
d) Compare hemp and corn crops following a previous crop of corn or hemp at four locations for the quantity of N leached under experimental plots during the entire growing season.	April 1, 2023
e) For each year and location, mean nitrate percentage and quantity of nitrate leached under corn and under hemp will be plotted by sampling date along with rainfall and irrigation data to allow preliminary exploration of differences in and timing of nitrate leaching during the growing season.	April 1, 2022 and April 1, 2023
2. Demonstrate benefits of nitrate recovery from hemp in production-scale demonstration rotation to farmers.	
a) For each year and crop within the production-scale rotation, record and summarize the economic impact of adding hemp to a traditional corn-soybean rotation.	December 31, 2021 December 31, 2022 December 31, 2023
b) For each year within the production-scale rotation, record and summarize logistical considerations that need to be accounted for when growing and harvesting hemp in both a grain and/or fiber production system.	December 31, 2021 December 31, 2022 December 31, 2023
c) Provide a best management guide to hemp production economics and logistics based on a) and b).	December 31, 2023

First Update April 1, 2021

Second Update November 1, 2021

Third Update April 1, 2022

Fourth Update November 1, 2022

Fifth Update April 1, 2023

Sixth Update November 1, 2023

Final Report between December 31, 2023 and February 31, 2024

ACTIVITY 2 Title: *Economic impact with business development for industrial hemp in Minnesota*

Description: Ameliorating the impact of agriculture on water quality requires economically viable alternatives to current crop rotation systems. We will gather information on crop yield and economic data to deliver economic benefits that are aligned with environmental quality in connection with Activity 3. This activity will examine the economics of adding industrial hemp to a conventional crop rotation, supply chain and identify the market potential for feed, food, fuel, and fiber from industrial hemp. Due to public safety concerns as well as market volatility, we will not investigate the economics of cannabidiol (CBD) production in hemp.

ACTIVITY 2 ENRTF BUDGET: \$166,000

Outcome	Completion Date
---------	-----------------

1. Produce environmental benefits and provide advice for a profitable production of industrial hemp in corn-soybean rotation.	June 30, 2023
2. Communicate economic findings on implementing industrial hemp in a corn-soybean rotation. a) Present economic findings of industrial hemp in a corn-soy rotation at field days.	September 30, 2023
3. Identify and relay market opportunities for industrial hemp by reviewing supply chain availability.	December 31, 2023
a) Provide summary of market potential and supply chains in Minnesota from discussions with industry representatives. Present findings at hemp field days.	November 1, 2021
b) Provide summary of market potential and supply chains in Minnesota from discussions with industry representatives. Present findings at hemp field days.	November 1, 2022
c) Provide summary of market potential and supply chains in Minnesota from discussions with industry representatives. Present findings at hemp field days.	November 1, 2023
d) Discuss market opportunities and supply chain findings of industrial hemp for feed, food, fuel, and fiber in Minnesota.	December 31, 2023

First Update April 1, 2021

Second Update November 1, 2021

Third Update April 1, 2022

Fourth Update November 1, 2022

Fifth Update April 1, 2023

Sixth Update November 1, 2023

Final Report between December 31, 2023 and February 15, 2024

ACTIVITY 3 Title: *Education and outreach on growing hemp in a conventional cropping systems*

Description: We will host annual field days and demonstrations to showcase the production of industrial hemp in a rotation to farmers, government officials, local businesses, educators, and students. This activity will showcase a farmer with industrial hemp as part of a corn and soy crop rotation. We will also communicate the results obtained from Activities 1 and 2 so farmers can be informed on requirements to implement hemp in a rotation, economic considerations, market availability, and water quality improvement.

ACTIVITY 3 ENRTF BUDGET: \$110,000

Outcome	Completion Date
1. Educate stakeholders, citizens and students about growing industrial hemp.	October 31, 2023
a) Organize and host a hemp field day to assist in education and awareness of growing industrial hemp in a crop rotation.	September 30, 2021

b) Organize and host a hemp field day to assist in education and awareness of growing industrial hemp in a crop rotation.	September 30, 2022
c) Organize and host a hemp field day to assist in education and awareness of growing industrial hemp in a crop rotation.	September 30, 2023
2. Demonstrate the variable markets of industrial hemp from a cropping rotation.	October 31, 2023
a) Discuss the variable markets in Minnesota of industrial hemp during field day	August 30, 2021
b) Discuss the variable markets in Minnesota of industrial hemp during field day.	August 30, 2022
c) Discuss the variable markets in Minnesota of industrial hemp during field day.	August 30, 2023

First Update April 1, 2021

Second Update November 1, 2021

Third Update April 1, 2022

Fourth Update November 1, 2022

Fifth Update April 1, 2023

Sixth Update November 1, 2023

Final Report between December 31, 2023 and February 15, 2024

IV. DISSEMINATION:

Description:

Communication of study results and best practices through field days, farm demonstrations, and presentations will support adoption of hemp crops 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](#).

First Update April 1, 2021

Second Update November 1, 2021

Third Update April 1, 2022

Fourth Update November 1, 2022

Fifth Update April 1, 2023

Sixth Update November 1, 2023

Final Report between December 31, 2023 and March 15, 2024

V. ADDITIONAL BUDGET INFORMATION:

A. Personnel and Capital Expenditures

Explanation of Capital Expenditures Greater Than \$5,000:

Explanation of Use of Classified Staff:

Total Number of Full-time Equivalents (FTE) Directly Funded with this ENRTF Appropriation:

Enter Total Estimated Personnel Hours for entire duration of project: 21,528	Divide total personnel hours by 2,080 hours in 1 yr = TOTAL FTE: 10.35
--	--

Total Number of Full-time Equivalents (FTE) Estimated to Be Funded through Contracts with this ENRTF Appropriation:

Enter Total Estimated Contract Personnel Hours for entire duration of project: 2,577	Divide total contract hours by 2,080 hours in 1 yr = TOTAL FTE: 1.239
--	---

VI. PROJECT PARTNERS:

Central Lakes College (CLC) conducts production scale hemp crop demonstration and field day events at CLC (Staples) and Southwest Research and Outreach Center (ROC) (Lamberton); collaborates with local landowners, producers and regional soil and water conservation districts. University of Minnesota (UMN) conducts nitrogen scavenging/leaching/uptake experiments comparing hemp at SWROC (Lamberton), West Central ROC (Morris), CLC (Staples) and Hemp Acres (Waconia). Agricultural Utilization Research Institute (AURI) contributes to education and outreach events, conducts value-added analysis of grains and biomass, and conducts market analysis to identify market opportunities for industrial hemp.

- A. Partners outside of project manager’s organization receiving ENRTF funding
 - University of Minnesota
 - Agricultural Utilization Research Institute
- B. Partners outside of project manager’s organization NOT receiving ENRTF funding

VII. LONG-TERM- IMPLEMENTATION AND FUNDING:

The three-year span of this project coincides with the initial licensing of and expansion of commercial industrial hemp production in Minnesota as authorized under the 2018 Federal Farm Bill. Evidence-based guidance from this study on how hemp crops can mitigate water quality impacts of conventional corn-soybean agriculture by reducing excess input nitrogen runoff and leaching will help maximize environmental benefits through farmer adoption of this emerging agricultural economic opportunity.

VIII. REPORTING REQUIREMENTS:

- Project status update reports will be submitted each year of the project as noted above.
- A final report and associated products will be submitted between Dec 31, 2023 and February 15, 2024

IX. SEE ADDITIONAL WORK PLAN COMPONENTS:

- A. Budget Spreadsheet
- B. Visual Component or Map
- C. Parcel List Spreadsheet- N/A
- D. Acquisition, Easements, and Restoration Requirements- N/A
- E. Research Addendum

Attachment A: Project Budget Spreadsheet
Environment and Natural Resources Trust Fund
M.L. 2020 Budget Spreadsheet



Legal Citation:

Project Manager: Keith Olander, Central Lakes College

Project Title: Implementing hemp crop rotation to improve water quality

Organization: Central Lakes College, University of Minnesota, Agricultural Utilization Research Institute

Project Budget: \$700,000

Project Length and Completion Date: 3 years; Dec 31, 2023

Today's Date: February 26, 2020

ENVIRONMENT AND NATURAL RESOURCES TRUST FUND BUDGET	Budget	Amount Spent	Balance
BUDGET ITEM			
Personnel (Wages and Benefits)	\$ 502,765	\$ -	\$ 502,765
Ron Nelson, CLC farm operations manager, \$27,994, 70.4% salary/29.6% fringe, 0.15% FTE, years 1-3 (Total: 45% FTE)			
Hannah Barrett, CLC research coordinator, \$44,712, 70.4% salary/29.6% fringe, 25% FTE, years 1-3 (Total: 75% FTE)			
Todd Pollema, CLC ag technician, \$20,995, 70.4% salary/29.6% fringe, 15% FTE, years 1-3 (Total: 45% FTE)			
CLC student intern, \$23,040, 100% FTE, years 1-3, (Total: 300% FTE)			
Keith Olander, CLC center director, \$109,973, 70.4% salary/29.6% fringe, 27.67% FTE, years 1-3, (Total: 83% FTE)			
Jonathan Wenger, UMN project manager, \$90,458, 64% salary/36% fringe, 42% FTE years 1-3 (Total: 126% FTE)			
UMN nitrate experiment technical manager, \$139,577, 70.5% salary/29.5% fringe, 50% FTE year 1 + 100% FTE years 2&3 (Total: 250% FTE)			
UMN undergraduate nitrate experiment technician, \$22,880, Base wage \$14/hr. 40%-time summer (14 weeks) Year 1. 80%-time summer plus 8h/wk F&S semester Yr 2&3			
UMN graduate student, \$17,136, 83.9% salary/16.1% fringe, Full time summer (14 weeks) Year 1, Half time fall semester (14 weeks), Year 1. (FTE = 0.27 + 0.13 = 0.4)			
Technicians: water sample collection fees, \$6000, \$500 x 4 nitrogen-scavenging experiment blocks x 3 years.			
Professional/Technical/Services Contracts			
AURI Business Development team, \$51,480, Total Team effort is 15% FTE/yr at \$55/hr (\$40/hr salary & \$15/hr fringe), all years, will establish supply chain opportunities and investigate new markets with private businesses with industrial hemp products.	\$ 149,115		\$ 149,115
AURI Technical team (comprising of Process Engineer, food scientist, and analytical scientist), \$64,522, Total Team effort is 18.8% FTE/year at \$55/hr (\$40/hr salary & \$15/hr fringe), all years, will work on assessing grains for proximate analysis, nitrogen, and provide economic impact of hemp compared to other grains.			
AURI Outreach and Innovation Network, \$21,107, Total team effort is 7.5% of FTE/yr at \$55/hr (\$40/hr salary & \$15/hr fringe), all years, will organize 2 hemp field days over the grant period to assist in education and awareness of growing industrial hemp in a crop rotation. AURI program/grant manager.			
AURI: Travel by the technical team, business development team, and outreach team, \$7300. Travel from Marshall by Technical team to collect samples and field days, to partner labs, various locations (Mileage: 3 trips to Morris @~184 per trip @\$.58 per mile = \$320.16; 3 trips to Staples @ ~334 miles per trip @ \$.58 per mile= \$581.16; 3 trips to Waconia @242 miles per trip @ \$.58 per trip+ \$421.08, 3 trips to Lamberton @ 80 miles per trip @ \$.58 per mile=\$139.2; M&IE @ \$50 per day=\$600; Travel by Innovation and Commercialization Team to private businesses and investors, various MN locations (\$0.58 per mile; M&IE@ \$71 per day in Minneapolis/St. Paul)= \$3,200; Travel by the Outreach and Communications team to Field Days (Morris and Staples from various locations @ \$.58 per mile; M&IE @ \$50 per day), costs of hosting speakers =\$2,000.			
Equipment/Tools/Supplies			

Land costs: Activity 1: Six acres/yr for production-scale demonstration (\$4950) + four acres/yr for nitrogen scavenging experiment (\$3300) = 10 acres/yr x 3yrs x \$275/acre = \$8250.	\$	8,250		\$	8,250
Machinery operations: \$165/acre x 6 acres x 3 years = \$2970	\$	2,970		\$	2,970
Field day costs (material and supplies): (5 days total over 3 yrs), 700 total attendance x \$10/participant = \$7000), On-site demonstration and immersion of farmers to foster adoption of emerging practices.	\$	7,000		\$	7,000
Experiment and sample analysis material costs: \$1000: consumable plot supplies; \$1152: soil testing; \$9600: 96 soil water samplers x \$100 each; \$8700: soil water analysis lab supplies @ \$725/location/year x 4 locations x 3 years; \$2200: seed = \$600 yr 1 + \$800 yr 2 + \$800 yr 3 ; Subtotal = \$27,704.	\$	22,652		\$	22,652
Travel expenses in Minnesota					
UMN: Plot management: St. Paul to Waconia, Lamberton, Morris, Staples, St. Paul 500 mi Minivan rental \$56/day x 2 days = \$112. Hotel \$120/night. Total \$232/trip Year 1 - 2 trips = \$464 (minivan rental + hotel) Year 2 – 6 trips = \$1392 (minivan rental + hotel) year 3 - 6 trips = \$1392 (minivan rental + hotel) Presentation of results: (e.g. Annual Conference of American Society for Horticultural Science) \$2000 year 2 and \$2000 year 3 = \$4000	\$	7,248	\$	-	\$ 7,248
COLUMN TOTAL	\$	700,000	\$	-	\$ 700,000
SOURCE AND USE OF OTHER FUNDS CONTRIBUTED TO THE PROJECT					
	Status (secured or pending)	Budget	Spent	Balance	
Non-State:		\$ -	\$ -	\$ -	
State:		\$ -	\$ -	\$ -	
In kind:UMN In-kind cost share of unrecovered ICR (54% of UMN costs)	pending	\$ 167,000	\$ -	\$ 167,000	
In kind:CLC In-kind cost share of unrecovered ICR (29.4% of salary+fringe)	pending	\$ 65,000	\$ -	\$ 65,000	
Other ENRTF APPROPRIATIONS AWARDED IN THE LAST SIX YEARS	Amount legally obligated but not yet spent	Budget	Spent	Balance	
04I 076-B Farm-Ready Cover Crops for Protecting Water Quality	\$741,000	\$ 741,000	\$ -	\$ 741,000	