Environment and Natural Resources Trust Fund
2011-2012 Request for Proposals (RFP)

LCCMR ID: 150-F3+4

Project Title: Alternative Biofuel Crops to Conserve Water and Soil

Category: F3+4. Renewable Energy

Total Project Budget: $ $344,180

Proposed Project Time Period for the Funding Requested: 2 yrs, July 2011 - June 2013

Other Non-State Funds: $ 0

Summary:

Determine life-cycle impacts of alternative biofuel crops relative to corn ethanol. Alternative crops use less water and fertilizers, provide better cover to erodible agricultural land, and could be more profitable

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Sponsoring Organization: Central Lakes College

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Web Address

Location

Region: Central

Ecological Section: No. Minnesota Drift and Lake Plains (212N), Minnesota and NE Iowa Morainal (222M)

County Name: Becker, Beltrami, Benton, Cass, Crow Wing, Douglas, Hubbard, Isanti, Itasca, Lake of the Woods, Morrison, Otter Tail, Sherburne, Stearns, Todd, Wadena

City / Township: Staples/ Thomas

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

2011-2012 MAIN PROPOSAL

PROJECT TITLE: Alternative Biofuel Crops to Conserve Water and Soil

I. PROJECT STATEMENT

1) Corn ethanol production requires intensive water and fertilizer inputs and has low profit margins in the central sand plains of Minnesota. Emerging evidence suggest alternative annual crops (sweet sorghum, pennycress and camelina) require significantly less water and fertilization and could produce more energy and profit per acre than corn. These alternative crops can deal with immediate concerns for soil and water conservation as biofuel technology advances for perennial crops. Our study will integrate:

- **Profitability—** Energy yields and profitability will be measured from crop establishment to fuel production. Because the focus is on marginal lands, alternative biofuel crops will complement and diversify farm income.
- **Water Conservation—** Expansion of alternative biofuel crops in the central sand plains could reduce landscape level water consumption and impacts on water quality. We will quantify life cycle impacts on water for each biofuel crop.
- **Erosion Prevention—** Biofuel crops (camelina and pennycress) emerge early in the spring and provide cover to agricultural soils when they are most vulnerable to wind erosion. A short growing season for biofuel crops allows for summer establishment of a cover crop to replenish soil nutrients and minimize erosion. We will test erosion prevention and soil improvement in biofuel-cover crop systems.
- **Demonstration and Outreach—** We will host field days and classes to demonstrate management practices and yields associated with energy-efficient biofuel crops. Education will focus on increasing farmer expertise and demonstrating environmental and economic benefits of alternative biofuel crops.

2) This research will support a community-based initiative to expand alternative biofuel crops and increase sustainability of the biofuel industry in the central sand plains. We will leverage the university, federal and state agencies, private industry and local producers in an integrated effort to revitalize rural economies and protect marginal, erodible lands. At the core of this project is the Energy and Agricultural Center of Central Lake College in Wadena County, Minnesota. The Energy Center is well connected to regional producers, agriculture, and bioenergy facilities.

II. DESCRIPTION OF PROJECT ACTIVITIES

Activity 1: Profitability and Natural Resource Conservation **Budget:** $344,180

We will quantify ethanol yields in sweet sorghum (versus corn) and biodiesel yield in camelina and penny cress. Sweet sorghum (10 varieties), corn, camelina, and penny cress will be established in 0.2 acres plots in each of four production fields (4 replications per field, 208 total experimental units). We will also establish 5 acre commercial plots of each alternative biofuel crop. A winter wheat-legume cover crop will be planted after harvest in camelina and penny cress to protect against erosion and improve fertility.

We will use new fuel processing methods to convert sweet sorghum juice into ethanol and the oil from the oilseeds into biodiesel. To determine net energy yields we will record all production inputs (fertilizer, irrigation, pesticides, harvest, transport and fuel processing) for each biofuel crop. We will quantify environmental costs: nutrient leaching, soil erosion, and water requirements. We will perform a life cycle analysis of biofuel net energy yields, greenhouse gases emissions and profitability.

Outcome	Completion Date
Quantify net energy yields and profitability of biofuel crops (two annual crops).	December 1, 2012
Perform analysis of life cycle impacts on water and soil conservation of biofuel crops (two annual crops).	December 1, 2012
Communicate relevance to Minnesota biofuels through peer-reviewed journals, websites and field days.	December 1, 2012

III. PROJECT STRATEGY

A. Project Team/Partners

Robert Schafer, Director-Central Lakes College Ag & Energy Center
The Energy Center will be supplying project management, equipment, labor, financial accounting with MNSCU system, field days and publicity.

Jim Eckberg, Research Fellow – University of MN. Ecologist – Minnesota Native Landscapes
Lead scientist, technical writing, protocols and supervisory services.

Michelle Johnson, Technician – Central Lakes College Ag & Energy Center
Establish experimental plots and treatments, data collection

Ron Nelson, Farm Manager – Central Lakes College Ag & Energy Center
Equipment operation, plot management

Central Minnesota Irrigators Corporation – Member landowners
Members can provide land for demonstration plots; Information dissemination through local and state wide irrigator newsletters; Funding for members demonstration plots.

Dr.John Moncrief, Professor, (Soil, Water and Climate) – University of MN
Consulting on soil fertility, nutrient leaching and water quality issues.

Tom Smude, Entrepreneur of an Oilseed pressing business – Pierz MN.
Will press Camelina and Penny Cress seed to extract the oil.

Dr. Greg Mowry, University of St. Thomas School of Engineering: EE, ME.
Provide portable McGyan Biodiesel plant and consulting on Biodiesel production.

SarTec Corporation – Anoka, Mn
Provider of Penny Cress seed and McGyan Biodiesel technology

Abdullah A. Jaradat – Research Leader. USDA-ARS Morris MN
Provide consulting and technical assistance for all aspects of Sweet Sorghum production.

McClune Industries/Sor-Cane Harvester – Reynolds, GA
Provide Sweet Sorghum harvesting equipment

B. Timeline Requirements

Spring 2011— Establish large-scale trials of sweet sorghum, camelina, pennycress and corn.
Summer-winter 2011— Maintain experimental treatments, collect data, conduct field demonstrations, and provide annual report.
Spring 2012— Establish second trials of sweet sorghum, camelina, pennycress and corn.
Summer-winter 2012— Maintain experimental treatments, collect data, conduct field demonstrations, and provide final report.

C. Long-Term Strategy and Future Funding Needs

In 2009, a NexGen grant was obtained to conduct preliminary studies on camelina and perennial grass crops. The funding requested here is essential to expand these studies and address gaps in our knowledge of alternative biofuel crops.

2011-2012 Detailed Project Budget

IV. TOTAL TRUST FUND REQUEST BUDGET — Three years

BUDGET ITEM	Grant	
Personnel:		
Robert Schafer, Project Manager Annual Salary $56,523 plus fringe $24,916 = - $81,439 x .20 FT = $16,287.80 x 3 years	$ 48,863	
Michelle Johnson, Research Technician Annual Salary $27,266 plus fringe $19,463 x .20FT = $9,345.80 x 3 years	28,037	
Ron Nelson, Farm Manager - Equipment Operator Annual Salary $27,266 plus fringe $19670 x .20FT = $9,387.20 x 3 years	28,162	
Contractual / Professional Services:		
Jim Eckberg, Research Fellow / Ecologist - will oversee the project consultation, research protocols and publications and professional writing	$ 82,250	
Dr. John Moncrief, Fertility, Soils and Water Consulting	10,000	
Central MN Irrigators, Inc. Members, land rent for large scale 50 acre plots	7,500	
Tom Smude, Oilseed Press, oil extraction from Camelina and Penny Cress	10,000	
SarTec, Inc. MCGYAN technology for biodiesel production	15,000	
McClune Industries, rent for sweet sorghum harvesting equipment	10,000	
Dr. Tim Smith, Life Cycle Analysis	6,000	
Dr. Greg Mowry - Consultation and use of Portable MCGYAN Biodiesel plant	30,000	
Equipment/Tools/Supplies:		
Seed, Fertilizer, Herbicides	$ 9,000	
Tillage, planting, spraying, fertilization, harvesting equipment	10,000	
Fuel Conversion costs, sweet sorghum ethanol, Camelina Biodiesel	18,000	
Travel:		
Ag Center Travel for Project Manager, Research Technician and Equipment Operator between off site plots for project purposes. Anticipated number of sites 12 x 24 mile average RT x (Once per week x 24 weeks) = 6,912 miles annually x .50/mile	$ 10,368	
Additional Budget Items:		
5 Field Days annually (3yr total of 15 Field Days) will include Tours, educational seminars for farmers, educators, industry and Gov't Agencies estimated cost per event including guest speakers, facilities and set-up = $200/event	$ 3,000	
Materials and publication of newsletters (4 issues per year)	3,000	
Repair and Maintenance of equipment and general farm supplies $5,000 per year	15,000	
TOTAL ENVIRONMENT & NATURAL RESOURCES TRUST FUND $ REQUEST	**$**	**344,180**

V. OTHER FUNDS

SOURCE OF FUNDS	AMOUNT	Status
Other Non-State $ Being Applied to Project During Project Period:	-	
USDA New Era Rural Technician Competitive Grant Program (RTP)	43,000	Pending
Other State $ Being Applied to Project During Project Period:	-	
Do you have any other funds that you are applying for from the state?		
In-kind Services During Project Period:	-	
Central MN Irrigators, Inc.	3,000	Secured
NRCS - Environmental Assessments of plantings on Water Quality, Soil Erosion and Widllife Habitat	2,000	Secured
Central Lakes College Ag Center land, facilities and incidental equipment	6,000	Secured
Funding History:		
Next Gen Grant - "Dedicated Energy Crop Production"	100,000	Awarded Nov '08

Alternative biofuel crops will provide cover in early spring when soils are vulnerable to intense wind erosion

Camelina is under consideration as a low-input biodiesel crop. This crop is a winter annual and therefore provides sufficient cover in the early spring to protect soil from wind erosion

Sweet Sorghum is under consideration as an ethanol crop to replace corn ethanol. It requires significantly less water and fertilizers and can produce more ethanol per acre than corn

Pennycress is under consideration as a low-input biodiesel crop. Like camelina, penny matures early which will allow farmers to establish a cover crop to protect and replenish soils in the fall

Project Manager Qualifications

Robert Schafer, Central Lakes College Ag and Energy Center, Director. Bob is a former high school Vo-Ag instructor from the Brainerd area with twenty five years of experience in the food, dairy, and livestock feeding industry and five years in the biofuels industry. He will be coordinating the Ag Center's resources allocated toward the project, the education and outreach efforts, and the activities of all participants.

Supporting activities include work as the Project Manager for a NextGen grant titled "Dedicated Energy Crop Production". Bob has established working relationships with companies like Mendel Biotechnology for cold strain Miscanthus varieties, NRCS Plant Materials Center for native perennials and woody plants, Sustainable Oils for camelina technology and seed, MCGYAN Biodiesel LLC for fuel production technology and equipment, and Circle Energy for oilseed pressing equipment.

Bob participated in starting three dry grind corn ethanol plants in five years while previously employed in the biofuels industry. He progressed from shift supervisor to production manager to plant manager with the different ethanol companies. These duties involved hiring and training the production crews, overseeing plant construction, establishing standard operating procedures for each process, optimizing production and eliminating operating costs.

Organization Description

The Ag and Energy Center is a 500 acre research and demonstration station located in the central sand plains. The sand plains are a potential epicenter for perennial biofuel crops given the wide availability of marginal, sandy land. The mission of the Ag and Energy Center is to lead the development of a community-based and sustainable biofuel industry. Current research on perennial grass suitability for biofuel is being funded through a NextGen Grant. The Ag and Energy Center is well connected to regional producers, agriculture, bioenergy facilities and the University of Minnesota.

The Ag and Energy Center is equipped with a full line of farm production equipment for tillage, seeding spraying, fertilization and harvesting. It is also equipped with Almaco plot seeding equipment, combine, forage harvester, forage drying system etc needed for accurate research and demonstration work. As a former Irrigation training center it is equipped with multiple irrigations systems, wells and ponds. An on-site biomass heated greenhouse adds plant propagation capacity and demonstration value. A 100,000 gal/yr biomass fueled ethanol plant is also located on site. The Center's office heating system is a biomass boiler able to utilize pelletized grasses.

The Center has an established array of biomass demonstration plots containing hybrid poplar, survivor false indigo, hazelnut, Miscanthus, switchgrass, big bluestem, mixed prairie, prairie cordgrass, wheatgrass and many more. Approximately twenty five acres of wasteland are planted to annual and perennial biofuel crops to test their drought tolerance, growth characteristics, nutrient requirements, economic value and environmental benefits.