

**Environment and Natural Resources Trust Fund
2012-2013 Request for Proposals (RFP)**

Project Title:

ENRTF ID: 031-B

Beneficial Use Determination for Corn Cob Ash Fertilizer

Topic Area: B. Forestry/Agriculture/Minerals

Total Project Budget: \$ 636,000

Proposed Project Time Period for the Funding Requested: 3 yrs, July 2013 - June 2016

Other Non-State Funds: \$ 0

Summary:

Collect, report data to support Beneficial Use Determination for corn cob ash as efficacious and safe natural fertilizer for corn. Conduct production scale field studies, greenhouse studies, and laboratory analyses.

Name: James Barbour

Sponsoring Organization: U of MN - Morris

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Location

Region: Central

County Name: Statewide

City / Township:

<input type="checkbox"/> Funding Priorities	<input type="checkbox"/> Multiple Benefits	<input type="checkbox"/> Outcomes	<input type="checkbox"/> Knowledge Base
<input type="checkbox"/> Extent of Impact	<input type="checkbox"/> Innovation	<input type="checkbox"/> Scientific/Tech Basis	<input type="checkbox"/> Urgency
<input type="checkbox"/> Capacity Readiness	<input type="checkbox"/> Leverage	<input type="checkbox"/> Employment	<input type="checkbox"/> TOTAL _____%

Project Title: Use of Corn Cob Ash for Phosphorus & Potassium Fertilization in Corn: A Production Scale Comparison with Commercial Fertilizer

Project Statement: Ash from the gasification/combustion of agricultural residues is a potentially marketable byproduct for land application. In Minnesota, the use of biomass-derived ash (except wood ash) as fertilizer can be done only through a process called Case-Specific Beneficial Use Determination (CSBUD). This project will provide much-needed data to support a general Beneficial Use Determination for corn cob ash. The data will be shared with MPCA. An experiment done at the U of M Southern Research and Outreach Center in 2008¹ showed that biomass ash from two different sources when applied at the same phosphorus rate produced corn grain yields that were not significantly different from a commercial fertilizer. This project will focus specifically on corn cob ash from the UMM biomass-fired heat and power plant.

The goal of this project is to show that corn cob ash can be used as an efficacious and safe natural source of P and K in corn. The outcomes of this project include (1) data on which to base a Beneficial Use Determination; (2) a potential new fertilizer option for farmers in the Midwest; (3) ash as a lower-cost alternative to mined or synthetic fertilizer; (4) Undergraduate Research Opportunities for two students; and (5) employment for a lab technician, graduate student, and the PI. The likelihood of long-term cheap natural gas is forcing generators of biomass energy to find value-added products and markets. Having a market for the ash would be a boon to the industry, encouraging future development that will provide new jobs in rural Minnesota and keep local energy expenditures in the local economy.

I. Description of project activities

Activity 1: Data for Beneficial Use Determination

Budget: \$255,000

(A) Three year field study on four field sites in West Central Minnesota. Each field site will have 9 strip plots of about 3 acres each, being treated with no P/K fertilizer, P/ K commercial fertilizer, or corn cob ash at the same rate of P or K, depending on which is shown by soil testing to be limiting. (B) Greenhouse study using ash and commercial fertilizer on multiple soil types representative of Minnesota soils. (C) Travel to Twin Cities to meet with colleagues/collaborators to review data.

Outcome:	Completion Date
1. Demonstrated efficacy and safety of corn cob ash fertilizer	Q3 2016
2. Data shared with MPCA	Q4 2016

Activity 2: Sampling and Lab Analyses

Budget: \$277,000

Soil samples will be taken from all plots preplanting and postharvest each year and analyzed for P, K, and pH at the USDA-Agricultural Research Service (ARS) laboratory in Morris. Plant samples will be taken

¹ Vetsch, J. 2010. Utilizing ash as a nutrient source for corn: 2009 final report. Univ. of Minnesota, AURI, and Minnesota Corn Growers Assoc.

and grain yield will be measured at harvest, and grain samples will be analyzed for P and K. Analyses will be done at the ARS Lab in Morris.

Outcome:	Completion Date
1. Data corroborate the efficacy and safety of corn cob ash fertilizer	Q3 2016
2. Data shared with MPCA	Q4 2016

Activity 3: Data Analysis and Reporting

Budget: \$104,000

Write journal articles, submit for publication. Write final report and submit to LCCMR, MPCA.

Outcome	Completion Date
1. Dissemination of results	Q2 2017
2. MPCA acts on Beneficial Use Determination for corn cob ash	Q2 2017

III. Project Strategy

A. Project team/partners (Note: All are receiving funding from ENRTF)

- Dr. James Barbour, University of MN, Morris; Role: PI, Project Manager
- Dr. Jane Johnson, USDA-ARS, Morris; Role: Soil Scientist, Analytical Laboratory Supervisor
- Mr. Kevin Lundberg, Landowner; Role: All agronomic activities
- Dr. Kurt Spokas, USDA-ARS; Role: Soil Scientist, Ash/Char expert, direct greenhouse studies
- Dr. Peter Wyckoff, UMM, Undergraduate Student Research Advisor

B. Timeline Requirements

The project will begin July 1, 2013 and conclude on June 30, 2017. We are requesting the additional year to allow for completing the third full growing season.

C. Long-Term Strategy and Future Funding Needs

Once the Beneficial Use Determination is in place and nonwoody biomass ash becomes a commercially available alternative to volatile fertilizer markets, UM Morris will then move to set up a demonstration site to process ash into a commercially compatible alternative fertilizer. This project is on our five-year timeline and will require substantial funding from multiple sources, including commodity groups, fertilizer processors, state and federal sources. A demonstration site will eventually generate revenue from fertilizer blenders testing ash in their product, thus becoming self-supporting.

2012-2013 Detailed Project Budget

IV. TOTAL ENRTF REQUEST BUDGET 4 years

<u>BUDGET ITEM</u>	<u>AMOUNT</u>	
Personnel:	\$207,000	
James Barbour, PI, 0.75 FTE yrs 1-3; 0.20 FTE yr 4; Salary: \$106,244; Fringe: \$39,373	\$145,617	
Peter Wyckoff, Student Research Advisor, Summer Salary, \$10,456 Fringe: \$2,079	\$12,535	
Undergrad. Res. Assistants (2) - 10 hr/wk Academic year: Salary: \$16,200 Fringe: \$0	\$16,200	
Undergrad. Res. Assistants (2) - 40 hr/wk Summer: \$30,240 Fringe: \$2202	\$32,442	
Contracts:	\$420,000	
Lundberg Farms, Kevin Lundberg - Land use and agronomic operations - Mr. Lundberg is current corn cob supplier. He has the land at different locations less than 40 miles from Morris under his management and has equipment to handle the ash.	\$ 60,000	
ARS - Johnson and Spokas - includes salary for lab technician (Johnson) and graduate student (Spokas), sample processing and analysis costs, costs for greenhouse studies	\$ 360,000	
Equipment/Tools/Supplies:	\$3,000	
Sampling Equipment (soil probes, probe extensions, WhirlPak sample bags)	\$1,000	
Misc. Supplies (e.g., lubricants, field gloves, etc)	\$2,000	
Travel:	\$5,000	
Travel to field sites (avg. 60 mi. round trip, avg. 18 trips each year); Travel to Twin Cities to meet with collaborators (6 trips; 2 per year); based on vehicle charges of \$61/day and \$0.23/mile)	\$5,000	
Additional Budget Items:	\$1,000	
Ash Hauling - from UMM campus to field sites	\$1,000	
TOTAL ENVIRONMENT AND NATURAL RESOURCES TRUST FUND \$ REQUEST =	\$636,000	

V. OTHER FUNDS

<u>SOURCE OF FUNDS</u>	<u>AMOUNT</u>	<u>Status</u>
Other Non-State \$ Being Applied to Project During Project Period:	\$ 138,059	
Unrecovered indirect costs (52% of Modified Total Direct Costs)		
Other State \$ Being Applied to Project During Project Period:	\$ -	
In-kind Services During Project Period:	\$ -	
Remaining \$ from Current ENRTF Appropriation (if applicable):	N/A	
Funding History:	N/A	

Project Manager Qualifications and Organization Description

Dr. Barbour: James C. Barbour is a researcher in the Biomass Gasification Project at the University of Minnesota, Morris, and a member of the course development team for UMM's Environmental Science 1131, Renewable Energy with Biomass Gasification. He also teaches a portion of the course. He earned his PhD at the University of Georgia. While there, he studied the acclimation of photosynthesis in peanuts to shading by associated plant competitors. Jim earned his BS and MS degrees from North Carolina State University in Crop Science with an emphasis in plant physiology.

Dr. Barbour has been at UMM for four years, and currently is project coordinator for a DOE-funded grant titled "Determining optimal performance in adapting onsite electrical generation platforms to operate on producer gas from fuels of opportunity." The project is in its final years of a two-stage project. The budget totals \$1.64 million, of which \$1.05 million is funded by DOE.

University of Minnesota, Morris: UMM is a four-year Liberal Arts campus of the University of Minnesota System with an enrollment of about 1900 students. The campus has a 5.3 MW_{th} biomass gasifier/boiler producing heating, cooling, and electricity for the campus. This facility provides about 50% of the campus heating needs. The primary fuel is corn cobs. UMM has the knowledge and experience in handling and thermal conversion of corn cobs at a community scale and are especially motivated to develop data that can lead to the deregulation of corn cob ash so that the ash generated can be returned to the field as fertilizer. Lundberg Farms is UMM's current corn cob supplier and is a large-scale corn farm in West Central Minnesota. Lundberg Farms has the equipment, skill, and manpower to handle all field work described and needed for this project.

