Farmer Rancher Grant Program

Final Report

I. PROJECT IDENTIFICATION
 Name: Chris Ellis
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 Phone: 608-323-7146
 Website:
 Project Title: Small Scale On-Farm Biodiesel Production Utilizing By-Product as On-Farm Feed Supply
 Project Number: FNC07-697
 Project Duration: 3+ Years
 Date of Report: February, 2012

PROJECT BACKGROUND
Family owned and operated farm with 2 generations involved. Diversified farm with about 125 dairy cows, 100 steers, 800 acres cropland owned and 300 rented crop acres. Most of the crops are corn, corn silage, soybeans, hay, and canola. We also do some custom harvest work and manage our forest according to a state certified forestry plan.

Buffalo County, where we live has very productive land, but very steep hillsides (50 percent of our cropland has slopes greater than 12 percent). Our farm follows a NRCS approved conservation plan, maintains waterways and erosion control structures, follows a nutrient management plan that utilizes the manure produced on farm, implemented stream bank improvement projects and follows a forestry management plan.

PROJECT DESCRIPTION
Goals: The project will test the following solutions:
- What soybean varieties produce the most oil and protein per acre on our farms through on-farm field size variety trials?
- Are sunflowers or other oilseed crops a viable option on our farms and in our environment through small, field size plantings?
- What is the quality of biodiesel that we can produce using different oilseeds though the use of our current equipment purchased in 2007 and installed by February, 2008? Will test using the ASTM fuel standards.
- Is the quality of by-products suitable for feeding dairy cows and/or beef steers? Quality will be determined through the use of tests by University of Wisconsin-Madison. The palatability of the by-product will be determined through feeding our cattle.
- Determine soils that are best suited for rotations that include soybeans or other oilseed crops, through cooperation with local NRCS office staff.
- Is field to fuel biodiesel production economically feasible on our farms? Breakeven cost budgets and

actual budgets will be developed using our farm information.

PROCESS
Farm Scale biodiesel equipment was purchased following recommendations from the Iowa State Biodiesel Center. Stainless steel construction, heat provided through a boiler using raw vegetable oil, and a system for reclaiming methanol were all part of the system. Equipment was purchased through other funding sources.

We wanted to try several types of oil for both the ease of processing, quality of biodiesel, and the overall economics of production. Soybeans, canola, and sunflowers were chosen. These were produced on the grant cooperators' farms and all processed at our site. We have a long history of successful soybean production and very limited experience on sunflowers and canola, but we wanted to experiment with them because of their high oil content.

We also wanted to determine quality of biodiesel without the addition of water to the system (for washing the final product). Adding water to the system had two issues we wanted to avoid. First, we try to avoid water and moisture in diesel fuel for engine maintenance. Secondly, washing with water generates a waste product that would need to be addressed.

PEOPLE
Chris Ellis – Ellis Enterprises; W326 County Road CC, Independence, WI 54747. Farm with wife Karen, sons Dustin (recently completed diesel mechanics school), and Drew and daughter Danielle. Chris is enrolled in the Western Wisconsin Technical College farm production program and serves on the Buffalo County Farm Bureau Board of Directors. Chris and Karen have served as the Buffalo/Trempealeau Counties Farm Safety Day coordinators for 10 years. Chris was the project manager.

Dustin Ellis, Farmer: refine oil into biodiesel and collect samples, conduct workshops and tours. Dustin was also the person who worked with biodiesel experts nationally to improve the quality of the final product.

Joe Bragger – Bragger Family Farm, W89 Pape Valley Road X, Independence, WI. Own and operate a diversified farm with 700 acres cropped, 220 dairy cows, 125 steers and contract pullet growers. Bragger Family Farm was the first Discovery Farm participant in cooperation with UW-Madison. Joe also serves as president of the Wisconsin Soybean Association Board and is the current president of the Buffalo County Farm Bureau Board of Directors. Joe planted canola to evaluate as a biodiesel crop on marginal farmland.

Matt Danzinger – DS Farms, W1528 County Road E, Alma, WI 54610. DS Farms crop 1,100 acres of alfalfa, corn and soybeans and milk 500 dairy cows. Matt graduated from UW-River Falls with a Dairy Science Degree. DS Farms is very interested in alternative energy sources and currently has a wind test tower on their farm. Matt serves on the Buffalo County Farm Bureau Board of Directors and is the Young Farmer Chair. Matt grew sunflower variety plots that were evaluated for oil content and profitability.

Mike Schesslor, Farmer: Assist with oilseed variety plot. Mike grew sunflowers to evaluate for oil content and profitability.

Carl Duley; Buffalo County Extension Ag Agent; 407 South 2nd Street, Alma, WI 54610. 608-685-6256 – will assist with the economic analysis using farm data and with development of fact sheets, workshops and field days.

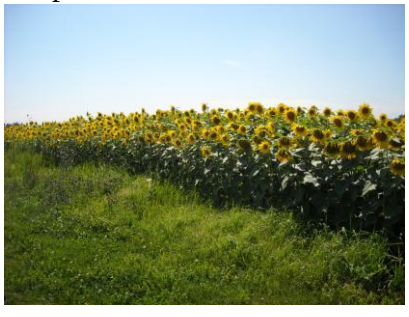
Jon Zander; Trempealeau County Extension Ag Agent; 36245 Main Street, Whitehall, WI 54773. 715-538-231, ext 376 – will assist in biodiesel production and by-product feeding information collection and with development of fact sheets, workshops and field days.

Todd Mau, District Conservationist, NRCS, 407 South 2nd Street, Alma, WI 54610. 608-685-4454 – will assist in calculating soil loss using different rotations and soil types.

RESULTS

Field trials were grown on soybeans, sunflowers, and canola in cooperation with UW-Cooperative Extension. Results looked at oil per acre, by-product production, and production cost. We determined that canola was the oilseed of choice for our system for several reasons. Soybeans have a lower oil content and with our press, oil production was limited. A larger press and by-product handling system would be needed to process soybeans even at a moderate farm scale size.

We have production issues with sunflowers in our region. Sunflowers in almost all cases grew in excess of six feet tall. The first year they were planted, they were in excess of eight feet tall and much of the production was lost to lodging. The next year, seeding rate was doubled and fertilizer was restricted to get bring the height of the sunflowers to a level that was more manageable. The height combined with excess fall rains, and migrating bird issues make sunflowers a challenge in our area. Yields were great with some varieties yielding in excess of 2500 pounds per acre.



Canola seems to be our best bet for production issues and oil production. It is very high quality oil and gels at the lowest temperature of the three oils we tried. Yields were good at averages at 2000 pounds per acre. We did not have the lodging problems that we saw with sunflowers, but did need to watch for wildlife damage to the crop. The small seed size poses some difficulties with harvesting and storage facilities, but can be handled with some preparation beforehand. Canola also does not ripen all at one time, so there will be some green seed. Once harvested, air needs to be applied to prevent heating and mold formation, or the seed needs to be processed for oil immediately.

Regardless of the crop used, we would add a centrifuge to the system to separate particulates from the oil following the press. This would reduce time for settling and reduce the number of storage tanks needed. Oil could be cleaned up before processing adding efficiencies to the processing equipment. We also added a pre-heating blanket to the oil seed press to increase the yield of oil and speed up the pressing process. Finally, we would use Potassium Chloride versus Calcium Chloride in the biodiesel refining process. We find that the Potassium mixes easier and stays in suspension better than the Calcium.

DISCUSSION

On-Farm biodiesel processing combined with feeding by-product does have potential for Wisconsin livestock farms. Soybeans would not be our oilseed because of its lower oil content and the need for a larger press and larger facilities for handling and storing the by-product.

Currently, the relatively low cost of diesel fuel combined with the high price of oil seed will not

encourage people to process oil for diesel fuel. On-farm diesel fuel is around $3.60 per gallon and biodiesel value (considering all cost) is between $3.60 and $4.50 per gallon.

The fuel does work well, but additives need to be developed for winter use because of cold temperature gelling of the fuel. The system allows us to make ASTM quality fuel.

Currently supplies of other by-product feeds (distillers grains) at very reasonable prices also makes biodiesel less profitable than a few years ago.

Wisconsin Department of Natural Resources visited and verified there were no air emission issues, water quality issues, or hazard waste issues. The only recommendation was to provide containment for any methanol that was stored on-site.

OUTREACH

Outreach was accomplished in several ways:

- Field Days – to discuss oil seed crop production and biodiesel, 4 fields days were held at plots, agronomic data was discussed, crops viewed and questions were answered about the plots. Total attendance was about 120 people.
- Visits to biodiesel processing site – 6 visits were scheduled, including:
  - Wisconsin State Energy Center, Wisconsin Department of Natural Resources, and Department of Commerce to determine what environmental risks were associated with the on-farm production of biodiesel, if any
  - Riverland Energy Cooperative managers and Board
  - Western Wisconsin UW-extension Agricultural Agents
  - Farm groups
  - Individual farm contacts
- Annual updates on the project at UW-Cooperative Extension Annual Winter Crop Update Seminars
  - Three sessions with total attendance of 240 people
- Walk-by Display at farm shows and other organization events
  - 5 events
- News Articles
  - Wisconsin Agriculturist
  - Wisconsin Corn and Soybean Digest