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Utah's On-Farm Mobile Oil Seed Press and Biodiesel Processor

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Mobile biofuel plant at USU

By Kim Burgess
staff writer

A mobile biofuel plant rolled onto Utah State University's campus Saturday as part of the annual Bioneers Conference.

The Central Utah Biodiesel (CUB) Project parked a trailer containing its equipment to show off their efforts at the three-day sustainability event.

"This is a pretty nice set-up," said Matt Dawson, a graduate student in secondary education who was attending the conference.

Dawson admired the two large white tanks in the trailer and the many tubes and wires connecting them. A mysterious gauge included buttons like "Inject Methoxide."

Dawson commenting that the machinery looked more sophisticated than a friend's biodiesel efforts using two old water heaters in place of tanks.

"It's great they have this here," Dawson continued. "Anything to get the word out."

Getting the word out was precisely the purpose of dragging the trailer to USU from Sevier County, according to Doug Wendel, one of the program's coordinators and a Snow College engineering professor.

Wendel also explained that the trailer is a working fuel plant, not ju[illegible]eks, Wendel said.

Energy facts

- America uses 25 percent of the world's energy.
- China and Japan have the next highest usage at 7 percent each.
- The U.S. uses more energy than the five next highest users combined.

Source: Sridhar Viamajala of USU's Sustainable Energy Research Center.

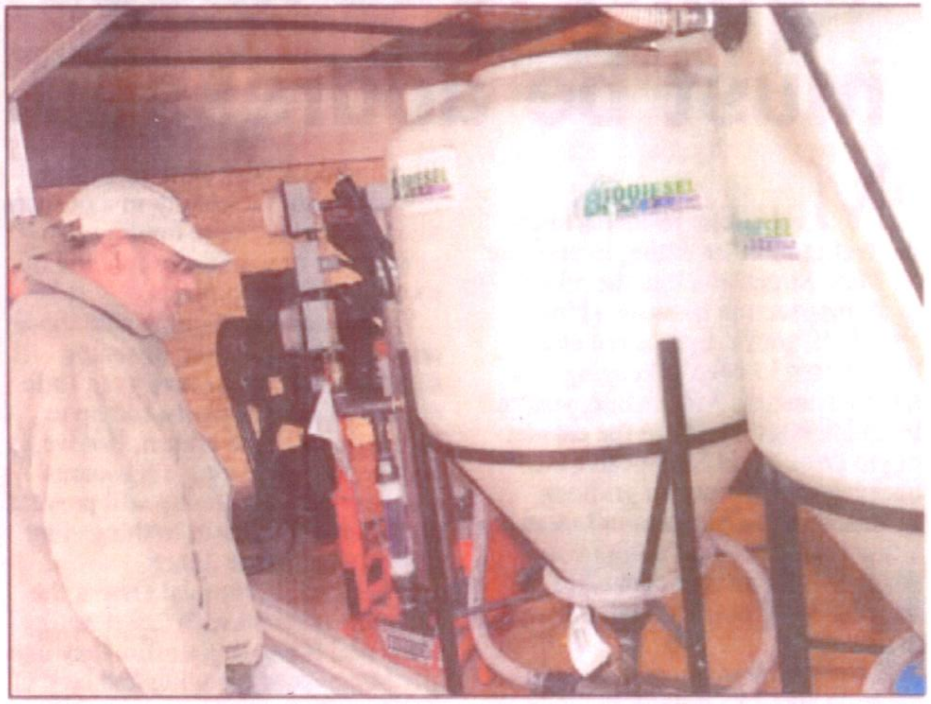
A group of 15 to 20 central Utah farmers are using the trailer to make biodiesel in their own backyards.

Each has allocated part of his land to growing plants that can be made into the fuel — spring canola, safflower, sunflower or camelina.

After the crop is harvested, the trailer is driven to the farmer's land to complete the biodiesel processing.

The effort began three years ago and is a partnership between USU's Sevier County Extension and Snow College in Ephraim. Seven researchers from the two institutions make up the CUB team. Grant funding came from the Utah Department of Agriculture and Food.

So far, small batches of biodiesel have been made, but a larger amount will be produced in the next few



Eli Lucero/Herald Journal

Bob Laine looks over a machine that makes biodiesel that was on display on the USU campus Saturday.

The goal is to provide enough fuel for each farmer to run his tractors and other farm machinery.

In addition, the team is looking into creative uses for the byproducts of biodiesel manufacturing.

Already, a Snow College art professor is planning to use empty seed husks to make artisan paper. The husks could also be fed to turkeys and cows. The change in diet would lead to more Omega 3 fatty acids in animal's meat.

The second byproduct, glycerin, can be used in cosmetics.

It's all part of a change in attitude, a switch toward leaving a smaller footprint on the Earth, Wendel said.

See BIOFUEL on A12

CENTRAL UTAH Biodiesel
UtahState University COOPERATIVE EXTENSION
SNOW COLLEGE

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Biofuels Personal Journey

- Low interest (2005)
- Flood of requests and rebuttals
- Need for nonbiased research-based information
- Possible Opportunities and need for technology and creativity
- Global Climate Change

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Why Biodiesel?

- Easy substitution
- Diesel is a farm fuel
- Processing can be small scale
- Lower Water Use in processing than Ethanol - Ethanol 4 :1 Diesel 1:1 (water:fuel ratio)
- Oil seeds are energy dense and versatile

Alternative Crops

- Camelina
- Canola (Spring and Fall)
- Safflower (Spring and Fall)
- Sunflower (oil and confectionary)
- Flax
- Several others proposed (soy, sesame, castor, mustards, jatropha, crambe, guar, hemp, lupine, other ?)

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Biodiesel Production

- Biological fat + Lye + Alcohol = Biodiesel and Glycerin
- Separate off Glycerin
- Wash with water
- Separate water and dry
- B-100 Biodiesel

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6.5g
AMY +
HEAT

Central Utah Bio-diesel Project

- Farmers and Citizens
- Snow College Chemistry
- Emery Co. Economic Development
- Piute Co. Economic Development
- USU Extension

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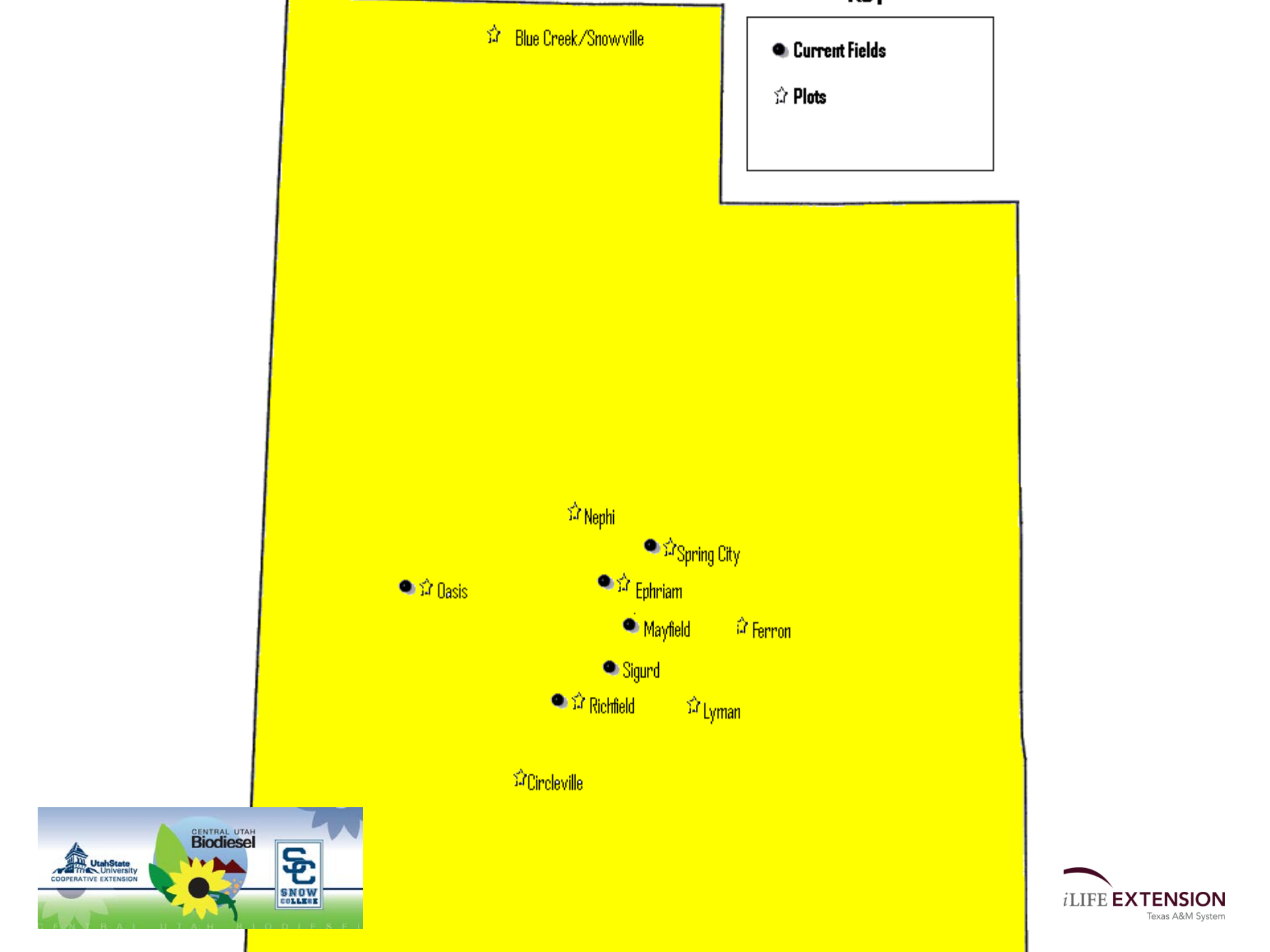
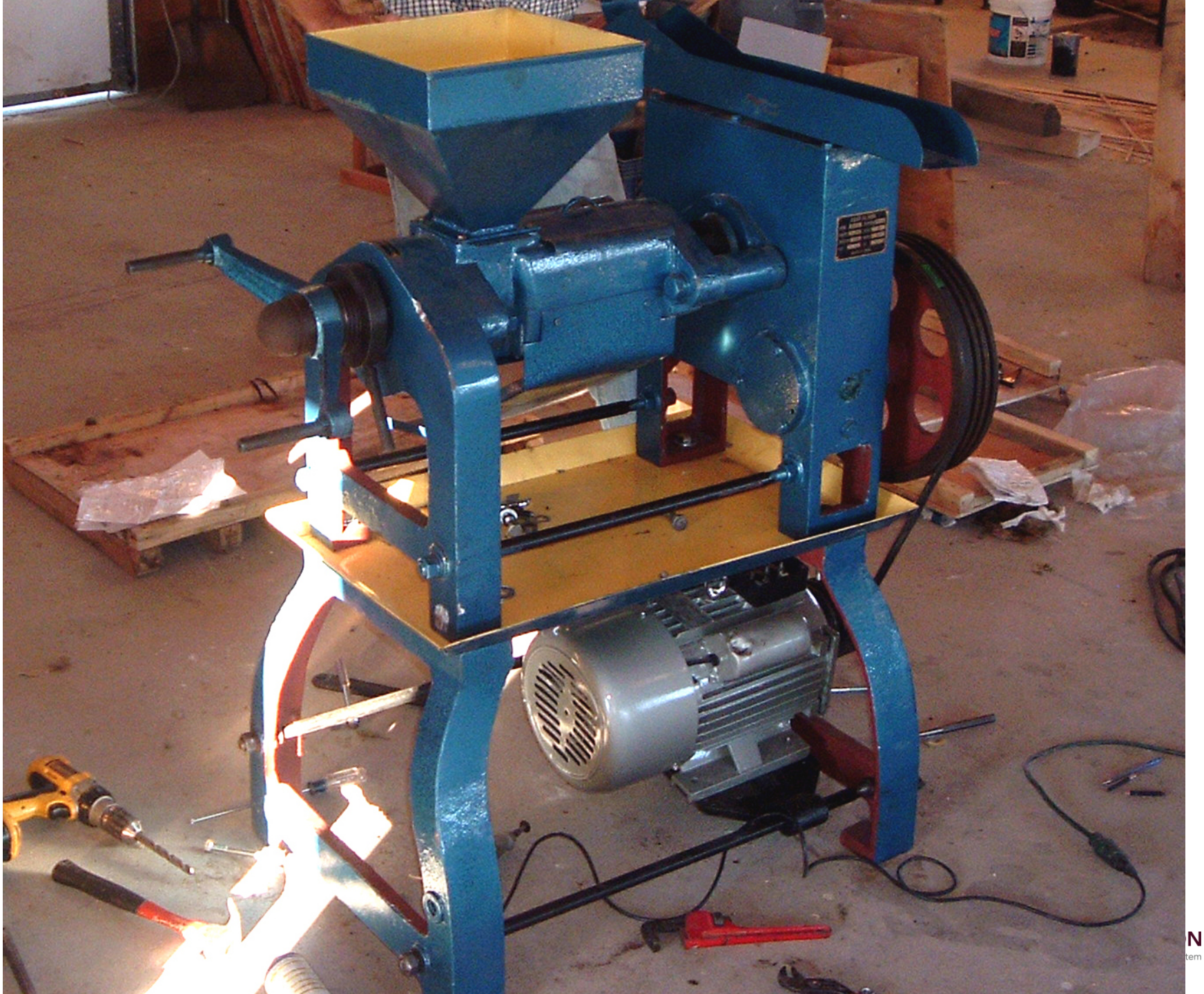


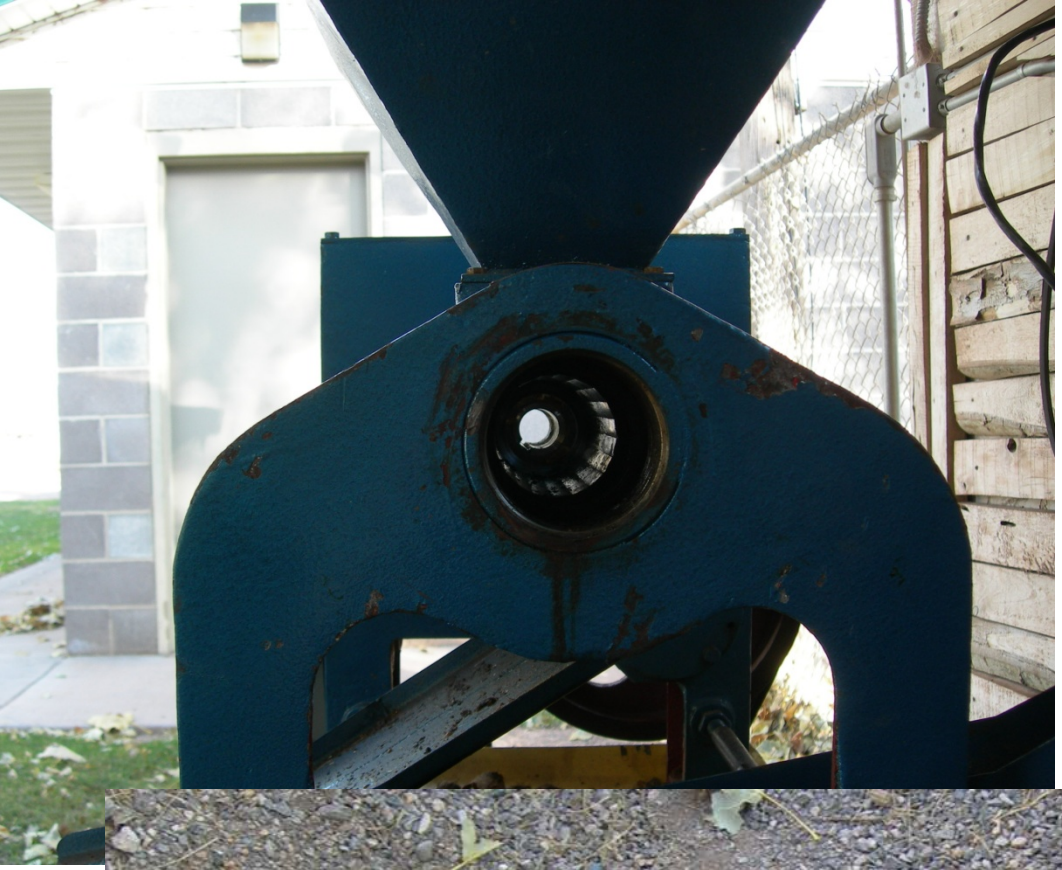
Project Goals

- Applied Research
- Extension and Education
- Local and Rural Energy Independence
- Distributed Energy
- Trial Equipment


WINTERSTEIGER
classic


Camelina
6 lbs/acre






Central Utah
Biodiesel
SNOW
SEVIER CO. EXTENSION
Utah State
UNIVERSITY

Mobile Oil Press and Biodiesel Processor

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INTRODUCTION

The Central Utah Biodiesel project was established in 2005 as a multidisciplinary partnership with USU Extension, Snow College, and local farmers and citizens. Support for the project has come from a number of farmers, citizens, government agencies, and industry. The goal was to provide an energy hedge or renewable alternative for agriculture and rural economies. Applied research, education, and demonstration activities have been conducted to establish agronomic practices and production benchmarks, fuel conversion processes, the economic opportunities of biodiesel and other value added products and by products, and to identify other synergistic opportunities.

SEEDS TO FUEL

The equipment in this trailer, a seed press and reactor tanks; can produce diesel fuel from seeds grown in Central Utah (Figure 1). Seeds include: sunflower, safflower, canola, and camelina.

Figure 1. Mobile (trailer mounted) research and demonstration biodiesel processor and oil seed press. This equipment is currently available to farmers for on-farm fuel production. Funds were provided by UDAF and NRCS.

SEEDS TO OIL AND SEED MEAL

The seed press uses a screw mechanism to squeeze the oil from the seed. The oil is pushed between the edges of metal plates surrounding the turning screw and flows by gravity into a container. The solid portions of the seed are pushed out of the end of the machine and down a separate shoot (Figure 2). The oil content of sunflower, safflower, canola, and camelina ranges from approximately 33 to 40 percent. Using seeds with a 35 percent oil content would require 22 pounds of seed to produce a gallon of vegetable oil and would also yield 14 pounds of meal that can be feed to livestock.

Figure 2. Oil seed screw press separating oil (left) and seed meal or cake (right) from camelina seed. Press is belt driven by a 5hp 220v motor.

BIODIESEL BASICS

Biodiesel fuel is produced by treating a biological fat, in this case vegetable oil or waste cooking oil, with an alcohol, methanol. The reaction, readily accomplished in a kitchen using household containers or the equipment demonstrated below, can be scaled to any level of production. The biodiesel is fully functional as fuel in modern diesel engines. The reaction also produces glycerin, useful for cosmetics, fertilizer, dust control, or other household and industrial applications.

PROCESSING VEGETABLE OIL TO BIODIESEL

Vegetable oil, virgin or waste cooking should be water free and filtered or settled to remove particles. Oil, up to 50 gallons with this processor, is then added to the first reactor tank and heated to 125°F by pumping the oil through the adjacent heater (Figure 3). Methanol and lye (the catalyst) are then mixed in a separate container to make a methoxide solution (Figure 4). Methanol is added in the proportion of 1 gallon of methanol to 5 gallons of oil. The amount of catalyst varies by the titration of the feedstock oil but is usually 5-7 grams per gallon. The methoxide solution is then injected into the heated oil and the reaction runs for approximately 8 hours (Figure 4). The resulting reaction yields biodiesel on top and glycerin on the bottom in approximately the same ratio as oil to methanol. An example is shown in Figure 5a. The glycerin is drained out the bottom and the biodiesel is transferred to the second tank for washing (Figure 5b). In the second tank water is sprayed on top of the biodiesel to remove any impurities and the water and impurities settle to the bottom (Figure 5c). The water is then drained off of the bottom and biodiesel air dried, filtered, and pumped into a fuel storage tank. The equipment shown can process 50 gallons of oil from start to finish in 48 hours. If both tanks are working simultaneously the equipment could produce a 50 gallon batch in 24 hours.

Figure 3. Two pictures of the biodiesel processor with the first reaction tank and electric recirculating oil heater

Figure 4. Methoxide mixing tank (left) where methanol and lye are combined before injecting into hot oil. Biodiesel processor control panel (right).

Figure 5a,b,&c. a, An example of biodiesel on top and glycerin below in a seperatory funnel; b, the reaction tank (left) and the washing tank (right) of the biodiesel processor; c,washed biodiesel on top and wash water below in a plastic bottle.

CONCLUSIONS

This summary has been presented by the Central Utah Biodiesel Project and is focused on processing oil seeds into biodiesel. Research based information is available on growing sunflower, safflower, canola, and camelina, their agronomic benefits and additional value added products and seed meal as livestock feed including value added high Omega 3 meal is available at the USU Extension Offices in Richfield (435) 893-0470 and Ephraim (435) 283-7582 or online at http://extension.usu.edu/sevier/

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NORTH SEVIER
FFA
Home of the Wolves
MIDWAY

Demonstrations

- Experiment Station Field Days
- National Ag. Conference (Denver)
- Alternative Energy Conferences
- Bioneers Conference
- Ag. Diversification Conferences
- Schools
- County Fairs

Wheat-Safflower-Fallow

- fallow rotation yielded 364 bushels of wheat
- wheat-safflower-fallow rotation yielded 300 bushels of wheat and 4,181 lbs of safflower
- Other synergistic opportunities

Turkey Feeding Trials

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Department of Visual Art as part of this research project.
nola oilseed straw yielded consistent paper with a warm
n be used for fine art printmaking, decorative bookmaking,
rnamental applications.

king
nt

camelina canola

Acknowledgements

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- Other USU Extension participants: Jody Gale, Richfield; Dennis Worwood, Castledale; Verl Bagley, Junction. .

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