Field Days Feature Local Energy

Rick Exner

The new PFI Bioenergy and Diversity project hosted three field days in late summer 2008. The focus of this article is a biodiesel field day that was hosted on August 30 by Plainfield farmers Gary Laydon and Pat Mennenga and their neighbor Berl Biekert.

Kim Odden, an instructor at Wisconsin Indianhead Technical College, demonstrated his mobile oilseed press and presented budgets for producing oil from different seeds and turning it into biodiesel. These budgets help illustrate whether biodiesel is a viable option for farmers and which crops demonstrate the most potential. Pressing oil is the next stage for on-farm biodiesel, since used fry oil is now in short supply in many communities.

Table 1. Oil Production per Acre by Crop.†

Crop	lbs oil/acre	US gal/acre
corn (maize)	129	18
oats	163	23
cotton	244	35
soybean	335	48
linseed (flax)	359	51
hazelnuts	362	51
pumpkin seed	401	57
safflower	585	83
sunflowers	714	102
peanuts	795	113
canola	893	127
olives	910	129
jojoba	1,365	194
coconut	2,018	287
oil palm	4,465	635

† Extracted from a table published by Azure Biodiesel Co., Sully, Iowa 50251.

Oilseed crops differ greatly in the amount of oil produced per acre (see Table 1). An oilseed sunflower crop, for example, contains twice as much oil per acre as soybeans. On the other hand, the sunflower meal byproduct is too high in fiber to make good swine feed. But soybean and cottonseed oils make biodiesels with high gel points. Gel point is the temperature fuel stops behaving as a liquid and turns into a gel in your tank.

Odden's approach values a crop's oil and its meal at Chicago Board of Trade prices (Table 2). He includes the market price of the oil as an opportunity cost in the budget for on-farm oil production (Table 3). This is a conservative approach; a farmer might prefer to substitute his/her own cost of production, but some value should be placed on oilseeds that instead of being sold are pressed on the farm. Odden's approach does put all crops on a standard basis. The other assumption Odden's calculations make is that a farmer pressing oilseeds will find a buyer or an on-farm use for the meal at market rates.

Gary Laydon watches as Kim Odden feeds the dual-expeller press, capable of 50 gallons in 24 hours.

Table 2. Aug. '08 market prices and yields of crops and their oil and meal components.

Crop		Meal		Oil	
Sunflower	$.26/lb, $520/T	1,280 lb @ $.15/lb	$192	720 lb @ $.455/lb	$328
Soybean	$.215/lb, $430/T	1,740 lb @ $.18/lb	$313	260 lb @ $.45/lb	$117

When producing biodiesel from the extracted seed oil, methanol and lye (sodium hydroxide) or potassium hydroxide is added to separate the fuel from the glycerin. The biodiesel is sometimes "washed" to clean out first the methanol, and then the remaining water. Table 4 is Kim Odden's budget for fuel production.

Table 3. Aug. '08 cost per lb and gallon of oil extraction from seed.

Oil @ Table 2 price/lb, e.g., soybean @ $.45	$.45
Extraction Labor/lb oil	$.02
Electricity/lb oil	$.01
Depreciation/lb oil	$.02
Repairs/lb oil	$.02
Total Cost, soybean	$.52/lb, $4.06/gal
Total Cost, canola	$.39/lb, $3.04/gal
Total Cost, sunflower	$.525/lb, $4.10/gal

The tables show a difference between the economics for canola oil and that for soybean and sunflower. When the workshop took place, canola oil was trading at a much lower price than the other two oils. In 2008, the corn ethanol market pushed up prices for corn and soybean oils, but canola was less affected. By December 2008, the overall economy had softened corn and soy prices, reversing the relative advantage of canola as a biodiesel feedstock (Table

Table 4. Cost per gallon of biodiesel fuel production from extracted oil, August and December 2008.

	August '08	December '08
Oil, e.g., soybean	$4.06	$3.12
Labor	$.10	$.10
Electricity	$.05	$.05
Lye †	$.02	$.02
Methanol †	$.56	$.56
Total Cost, soybean	$4.79	$3.85
Total Cost, canola	$3.77	$4.75
Total Cost, sunflower	$4.83	$3.89
Farm-delivered Diesel	$4.10	$1.80

† Northeast Iowa prices

4). Petroleum prices plunged as well, temporarily erasing any cost advantage of biodiesel derived from oilseeds.

In 2008, first market effects of corn ethanol and then the overall economy made biodiesel less advantageous. However, Kim Odden notes that in 2007 the Red River Valley of Minnesota was without diesel fuel for five days during harvest season. If you are concerned about buffering your farm from supply shocks and price spikes, biodiesel may be something to move on now rather than later.

Kim Odden is happy to respond to questions about biodiesel. He can be reached at (715) 764-5557, kodden@chibardun.net.

Supplemental Information

Table 5. Typical setup costs to press oil and produce biodiesel fuel.

2-screw press	$16,500
3-phase converter	$1,200
electrical work	$500
2 augers	$1,000
press stand	$300
overhead bin	$25
3 settling tanks	$500
fittings, tubes	$25
Extraction Total	$20,050
Fuel-making equipment	
Fuelmeister™ processor	$3,000

This configuration could press and process 10,000 to 30,000 gallons/year.

Tables 6-8 (on following pages). Feed Analysis of Canola, Soybean, and Sunflower Meal.

UW Soil & Forage Analysis Laboratory
8396 Yellowstone Drive
Marshfield, WI 54449
Phone 715-387-2523 Fax 715-387-1723

COOPERATIVE EXTENSION
University of Wisconsin-Extension
University of Wisconsin-Madison
Soils Department, Madison, WI

Kim Odden
P.O. Box 232
Cameron, WI 54822

Account: 557634
Date received: 3/10/2006
Date processed: 3/16/2006
Client: Kim Odden

Results also available on-line at http://uwlab.soils.wisc.edu/reports
lab number: 5636 access code: trd8

Grain/Commodity Report

Report Number: *5636* ***Lab Number:*** *1354* ***Sample Description:*** *Pellets*
Material: *Other Forage*

Item	*Abbreviation*	*Unit*	*Result*	*Method*[1]
Dry Matter	DM	% as fed	92.60	WC
Moisture		% as fed	7.40	C
Protein Fractions				
Crude Protein	CP	% of DM	36.90	WC
Fiber Fractions				
Acid Detergent Fiber	ADF	% of DM		NA
Neutral Detergent Fiber	aNDF	% of DM	16.49	WC
Lignin (Acid Detergent)	ADL	% of DM		NA
Carbohydrates and Fats				
Non Fiber Carbohydrate	NFC	% of DM	23.92	C
Fat		% of DM	14.09	WC
Energy Calculations: 2001 NRC				
Total Digestible Nutrients, 1X	TDN	% of DM	87.98	C
Net Energy, Lactation, 3X	Nel	Mcals/lb	0.92	C
Net Energy, Maintenance	NEm	Mcals/lb	1.09	C
Net Energy, Gain	NEg	Mcals/lb	0.77	C
Metabolizable Energy	ME	Mcals/lb	1.57	C

Macro Minerals				
Phosphorus	P	1.02	% of DM	WC
Calcium	Ca	0.60	% of DM	WC
Potassium	K	1.37	% of DM	WC
Magnesium	Mg	0.24	% of DM	WC
Sodium	Na		% of DM	NR
Chloride	Cl		% of DM	NR
Sulfur	S		% of DM	NR

Micro Minerals				
Iron	Fe		ppm	NR
Manganese	Mn		ppm	NR
Zinc	Zn		ppm	NR
Copper	Cu		ppm	NR
Ash		8.60	% of DM	WC

[1] WC = wet chemistry
NIR = near infrared spectroscopy
NR = not requested
NA = not available
C = calculated
T = tabular value

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UW Soil & Forage Analysis Laboratory
8396 Yellowstone Drive
Marshfield, WI 54449
Phone 715-387-2523 Fax 715-387-1723

COOPERATIVE EXTENSION
University of Wisconsin-Extension
University of Wisconsin-Madison
Soils Department, Madison, WI

Kim Odden
PO Box 232
Cameron, WI 54822

Account: 557634
Date received: 2/27/2007
Date processed: 3/9/2007

Results also available on-line at http://uwlab.soils.wisc.edu/reports
lab number: 403 access code: ccgr

Grain/Commodity Report

Report Number: *403* ***Lab Number:*** *1296* ***Sample Description:*** *Extruded Soybeans*
Material: *Other Feed/Byproduct*

Item	*Abbreviation*	*Unit*	*Result*	*Method*[1]
Dry Matter	DM	% as fed	93.90	WC
Moisture		% as fed	6.10	C
Protein Fractions				
Crude Protein	CP	% of DM	39.08	WC
Fiber Fractions				
Acid Detergent Fiber	ADF	% of DM		NA
Neutral Detergent Fiber	aNDF	% of DM	8.60	WC
Lignin (Acid Detergent)	ADL	% of DM		NA
Carbohydrates and Fats				
Non Fiber Carbohydrate	NFC	% of DM	31.20	C
Fat		% of DM	14.84	WC
Energy Calculations: 2001 NRC				
Total Digestible Nutrients, 1X	TDN	% of DM	94.64	C
Net Energy, Lactation, 3X	Nel	Mcals/lb	1.00	C
Net Energy, Maintenance	NEm	Mcals/lb	1.20	C
Net Energy, Gain	NEg	Mcals/lb	0.85	C
Metabolizable Energy	ME	Mcals/lb	1.71	C

Macro Minerals				
Phosphorus	P	0.61	% of DM	WC
Calcium	Ca	0.21	% of DM	WC
Potassium	K	1.47	% of DM	WC
Magnesium	Mg	0.20	% of DM	WC
Sodium	Na		% of DM	NR
Chloride	Cl		% of DM	NR
Sulfur	S		% of DM	NR

Micro Minerals				
Iron	Fe		ppm	NR
Manganese	Mn		ppm	NR
Zinc	Zn		ppm	NR
Copper	Cu		ppm	NR
Ash		6.28	% of DM	WC

[1] WC = wet chemistry
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T = tabular value

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Canola Meal Feed Analysis	Soybean Meal Feed Analysis

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8396 Yellowstone Drive
Marshfield, WI 54449
Phone 715-387-2523 Fax 715-387-1723

COOPERATIVE EXTENSION
University of Wisconsin-Extension
University of Wisconsin-Madison
Soils Department, Madison, WI

Sunflower Meal Feed Analysis

Account: 555901
Date received: 9/1/2006
Date processed: 9/8/2006

Results also available on-line at http://uwlab.soils.wisc.edu/reports
lab number: 8446 access code: 943f

Grain/Commodity Report

Report Number: *8446* ***Lab Number:*** *7346* ***Sample Description:*** *Sunflower Meal*
Material: *Other Feed/Byproduct*

Item	Abbreviation	Unit	Result	Method[1]
Dry Matter	DM	% as fed	93.07	WC
Moisture		% as fed	6.93	C
Protein Fractions				
Crude Protein	CP	% of DM	23.64	WC
Fiber Fractions				
Acid Detergent Fiber	ADF	% of DM		NA
Neutral Detergent Fiber	aNDF	% of DM	30.57	WC
Lignin (Acid Detergent)	ADL	% of DM		NA
Carbohydrates and Fats				
Non Fiber Carbohydrate	NFC	% of DM	20.51	C
Fat		% of DM	19.04	WC
Energy Calculations: 2001 NRC				
Total Digestible Nutrients, 1X	TDN	% of DM	90.51	C
Net Energy, Lactation, 3X	Nel	Mcals/lb	0.95	C
Net Energy, Maintenance	NEm	Mcals/lb	1.13	C
Net Energy, Gain	NEg	Mcals/lb	0.80	C
Metabolizable Energy	ME	Mcals/lb	1.62	C

Macro Minerals

Phosphorus	P	0.79	% of DM	WC
Calcium	Ca	0.43	% of DM	WC
Potassium	K	1.59	% of DM	WC
Magnesium	Mg	0.52	% of DM	WC
Sodium	Na		% of DM	NR
Chloride	Cl		% of DM	NR
Sulfur	S		% of DM	NR

Micro Minerals

Iron	Fe		ppm	NR
Manganese	Mn		ppm	NR
Zinc	Zn		ppm	NR
Copper	Cu		ppm	NR
Ash		6.24	% of DM	WC

[1] WC = wet chemistry
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