

Department of Agriculture, Trade and Consumer Protection
Division of Marketing
Agricultural Development & Diversification Program (ADD)

1998 Grant Project Final Report

Contract Number: 13061

Grant Project Title: Vegetable Oil Lubricant Development

Project Beginning Date: July 1, 1998 Project End Date: December 30, 1999

Amount of Funding Awarded: \$50,000

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**Final Report for the
Period July 1, 1998 to December 30, 1999
Contract Number 13061
Vegetable Oil Lubricant Industrial Development
Agricultural Development and Diversification Grant Program
Wisconsin Department of Agriculture Trade and Consumer Protection
by the
Wisconsin Business Innovation Corporation**

The following final progress report addresses the scope of services as defined in the contract, (contract number 13061) between the WDATCP and the Wisconsin Business Innovation Corporation. The final report also addresses the program content for a final report as outlined in the contract

The overall intent of the project was to begin the development of an industrial lubricant industry in Wisconsin based on vegetable (bio) oils. While research and industry experience demonstrates that a number of varieties of vegetable oils have a role to play in bio industrial lubricants, this project focused primarily on canola oil and to a lesser degree on sunflower oil. Through this project the Wisconsin Business Innovation Corporation was able to identify review and evaluate a number of different sources of technology to fortifying bio oils into industrial lubricants. It was found that a number of European companies have been successful in developing and commercializing bio lubricants based on canola oil. Additionally, through this project, and after considerable analysis, The Wisconsin Business Innovation Corporation was able to develop an agreement to gain exclusive access to more than forty bio lubricant formulations from Tessel, GmbH of Stuttgart Germany.

Work undertaken

1. Field Trials of Canola Cultivars

This work continued twelve years of cultivar field trials by the University of Wisconsin, Agronomy Department. The work was conducted at three University Agricultural Experiment Stations. See Appendix A for a summary of the field trials evaluating yield and other production results.

2. Product Development and Processing

Governor Tommy Thomson helped negotiate and sign a technology transfer agreement between Tessel GmbH and IBG Montforts, GmbH and the Wisconsin Business Innovation Corporation in October 1998 in Stuttgart Germany. The agreement provides the Wisconsin Business Innovation Corporation with exclusive rights to Tessel's proprietary additives for more than forty different industrial lubricant applications made from canola oil. IBO Montforts is the manufacturer of the "cold press" equipment which is used to extrude oil from plant material and provides ongoing technical advice on the use of the technology.

Starting in the fall of 1998, about 60,000 lbs. of canola seed was harvested from approximately 100 acres of planted canola. The seed was cleaned and processed into a "cold press" base oil. About, 2,200 gallons were produced using a press leased from Colorado River Valley Farms. Several hundred gallons of sunflower oil were also produced from sunflower seed purchased on the open market. The canola harvest had less than the average yield for canola and was due to a number of factors, including the following:

- Unusually warm growing season and late planting time
- Loss of yield due to use of a combine harvester that shattered hulls during harvesting
- Spoilage due to improper drying of seeds
- Canola seed that had lower than average oil content possibly due to weather or the varieties grown

The first industrial lubricant product produced from the base canola oil was a chainsaw "bar and chain" oil. The canola oil was blended with Tessel additive to produce a chainsaw "Bar and Chain" oil. Approximately 80 gallons

were processed and bottled. The product was introduced at a Loggers Conference in April at Hayward at which there were 400 loggers and wood industry representatives in attendance. Free samples were provided and a survey conducted to gather market research information.

Since the initial product samples were, produced, approximately another 200 gallons of chainsaw oil have been produced as of September 30, 1999.

Specifications for bar and chain oil

The specifications for Tessol's Chainsaw "Bar and Chain" oil have been converted to English. Working through the Tunap Group of Wolfrathausen Germany, the oil was tested for lubricity characteristics and compared to a petroleum based product. The test measuring method was through a "oscillation, friction and wear tester". Compared to the petroleum based "bar and chain" oil, the bio based oil has a significantly lower coefficient of friction and eliminates wear by a factor of more than five.

A special formulation of "bar and chain oil was prepared using a combination of canola, soybean and sunflower oil. This special blend was tested by the Tunap Group and was found to be a highly effective blend. Badger Oil intends to use this blend for many of its industrial lubricant formulations, since it will create markets for crops which farmers can grow in rotation,

Product labeling A research effort was undertaken to develop a brand name for the bio lubricants. More than 100 ideas for possible names were generated. Six of the best names were tested in a survey of loggers and a small group of individuals who are knowledgeable about industrial lubricants. After the survey and testing, the brand name ***Grease Lightning BioLube*** was selected. Labels have been prepared for various sized containers.

3. Market Introduction

The chain saw bar and chain oil was introduced and featured at a logger conference in April. This sector of the market is price sensitive. Petroleum based bar and chain oil is available in quantity at a price of about \$2.50 per gallon. Most bar and chain oils are recycled motor oils. The initial estimated wholesale price for the bio lubricant is \$6.00 per gallon. Consequently, the commercial loggers market is not an initial target for the bio lubricant. It was learned, however, that some large landowners such as paper companies are becoming increasingly concerned about the amount of oil being spilled into the environment by large tree processors which use chain saws. Some of the commercial processors use two gallons or more per hour.

A special formulation of a bar and chain oil for the large high speed tree processors used in the logging industry was developed and tested during the summer of 1999 by Tessol. Initial test results were very favorable indicating a much lower incidence of chain breakage compared to the petroleum based products.

Distribution and marketing of the oil to date consists of the following:

- Schroeder Log Home Supply - This is the largest distributor of tools and materials for log home builders with three warehouse locations nationally. This company has indicated good interest in carrying the ***Grease Lightning Biolube***, chainsaw bar and chain oil based on its biodegradability and "non staining" nature of the oil. They will feature it in the winter catalog. The log home market is now estimated at 5 to 8% of the total home construction market. Some initial product has been supplied to large builder in Montana.
- Electric Utilities - The oil is being sold to three electric utilities for use in right of way work. Minnesota Power, Wisconsin Public Service and Eau Claire Electric Cooperative.
- US Forest Service - The Superior National Forest has begun using the oil and used it extensively in the clean up of storm damage in the Boundary Waters Canoe Area in the summer of 1999.
- Contact has also been made with the US Department of the Interior and the National Park Service. Badger Oil products are being considered in a special demonstration of bio products in the National Park system.

Based on the market research to date, the following are targeted niches within the chainsaw "bar and chain" market

- National Park Service Federal Forests and other park systems
- Log home builders and crafters
- Electric Utilities
- Large paper company landowners, Meade Paper
- OEM Chainsaw manufacturers Stihl, Oregon Chainsaw, Homelight
- Distributors of environmentally friendly products

4. Organizational Development

After study of several different incorporation models, Badger Oil was incorporated as a Wisconsin C Corporation on June 8, 1999. It was felt this form provided the most flexibility while being attractive to investors. The initial incorporators are the Wisconsin Business Innovation Corporation and E. Peter Matthies.

During the spring of 1999, two Komet presses were purchased and installed in the Spooner Enterprise Center to enable Badger Oil to have the capacity to process about 700 tons per year.

5. Other Opportunities for Value Added Products

Badger Oil has successfully processed a significant number of different plant oils. The following is a list of oils which were cold pressed from plant seeds:

- Cranberry oil
- Plum oil
- Raspberry oil
- Saw Palmetto oil
- Safflower oil
- Sunflower oil
- Soybean oil
- Chestnut oil
- Hemp oil
- Meadow Foam oil
- Grape oil
- Pumpkin oil

In the spring of 1998, another attempt was made to grow Meadow Foam. Meadow Foam oil has applications in industrial lubricants, cosmetics and bio plastics. A small test plot was seeded and the plants grew to maturity, providing encouragement for attempting a larger test plot in 2,000. Virtually all of the above oils have significant potential to add value to Wisconsin's agricultural crops.

During the project period, Badger Oil designed and built a "toaster" for preheating the seeds. Toasting the oil enhances the flavor for food grade products and in some cases apparently enhances some of the properties for industrial lubricants. Preheating the seeds is critical for some plant varieties for optimum extraction of the oil. The design for the toaster is unique and offers another point of differentiation for Badger Oil's products.

Summary of Some Key Indicators

Number of Jobs Created	2 full time 2 part time
Capital Investment	
Equipment	\$47,000
Working Capital	\$110,000
Incl. product development and marketing	
Total	\$157,000

Badger Oil Company

1400 South River Street
Spooner, WI 54801
Phone: 715-635-2197
Fax: 715-635-7262

Introduction to Badger Oil Company

Badger Oil Company is a new company having been formed in 1998 to produce high quality - high valued oils and meals from plant materials. The company employs "cold press technology" to produce extra virgin unrefined oils and meals for diversified food, industrial lubricants, fuels, and other non- food products.

In the fall of 1998, Badger Oil began development of a two-ton per day pilot plant located in the Spooner Enterprise Center. The current plant consists of two KOMET presses (built by IBG Montforts GmbH of Germany), seed cleaning equipment, an inline process toaster used in treating some of the seeds for certain applications, and various material handling and storage equipment. Plans for 2000 include doubling the company's process capacity.

The "cold press" process is unique, as most oils exit the presses at temperatures of less than 75°F, compared to 200°F to 300°F for conventional compression or screw type presses. Unlike other extrusion and solvent processes, the end product oils and meals retain their natural character and are unaltered by heat or solvents. Not only are the pure, unaltered oils better for food products since they retain the vitamins and antioxidants, but the high concentrations of those components help preserve the shelf life of non-food products. Badger has the capability to produce oil from a wide variety of seeds including caraway, cranberry, grape, hemp, plum, pumpkin, raspberry, saw palmetto and walnut, as well as many others. These oils are used for food, pharmaceutical, nutraceutical and cosmetic applications.

Badger Oil has developed a strategic and exclusive relationship with two German companies: IBG Montforts, GmbH for the presses and Tessol, GmbH for technology to fortify the base oils from plant materials into a variety of industrial lubricant end products and a natural plant oil diesel fuel. The Tessol agreement includes not only the exclusive rights to import and market the different additives, but also to manufacture the products in the US and Canada.

With technical support from Tessol, Badger Oil has developed a unique blend of base oil using canola, sunflower and soy oil. Not only does the blend contribute to the quality of the end products, but it is also helpful from an agricultural production standpoint, since it creates markets for crops which can be grown in rotation. The first - products to be introduced, using the brand name Grease Lightning BioLube are a bio bicycle chain oil, bio chainsaw bar and chain lubricant and a bio tree harvester oil. Independent testing has proven these products perform significantly better than their petroleum counterparts while protecting the environment. During 2000, Badger Oil intends to add to its portfolio the test marketing of a two-cycle motor oil, an outboard motor oil, a forming oil, and a vacuum pump oil.

A proprietary form of a natural-plant diesel fuel called TESSOL NADI (Natural Plant Diesel Fuel), using a blend of three plants oils which are cold pressed, is being demonstrated during the summer of 1999 and future years in a Caterpillar 35 Challenger farm tractor. The test is scheduled to last through the year 2001. Based on initial observation, the TESSOL NADI product achieves a higher horsepower output, quieter operation and better internal engine lubricity than petroleum based diesel.

Badger Oil was organized by the Wisconsin Business Innovation Corporation and is an outgrowth of several years of investigation and research into bio industrial lubricants by a consortium of interests involving the Wisconsin Department of Agriculture, Trade and Consumer Protection Agency, University of Wisconsin Agronomy Department and Center for Cooperatives. E. Peter Matthies is its first operating officer. He has extensive experience in producing a wide variety of plant oils for both food and non food products.



Wisconsin Business Innovation Corporation

a technology-based enterprise network

To: Erwin Sholts 
Michael Bandli

From: Mark Mueller

Date: January 20, 2000

Attached is the 1998 Spring Canola Variety Test Results, University of Wisconsin Agronomy Department. Please include the report with the final Report by the Wisconsin Business Innovation Corporation, Contract Number 13061, Vegetable Oil Lubricant Industrial Development.

1998 WISCONSIN SPRING CANOLA VARIETY TESTS

T.C. Osborn & R.D. Vogelzang
Agronomy Department
Univ. of Wisconsin - Madison
Madison, WI 53706
(608) 262-2330

	Locations		
	Arlington	Hancock	Sturgeon Bay
Soil Type:	Plano silt loam	Plainfield sand	Longrie silt loam
Row spacing:	6"	6"	6"
Planting Date(s):	4/28/98	4/30/98	4/27/98
Cooperator:	S. Kraak	J. Breuer	R. Weidman

Companies providing seeds:

AgrEvo (Plant Genetic Systems) Interstate Payco Seed Co.
104-111 Research Drive Box 338
Saskatoon, SK Canada S7N3R2 West Fargo, ND 58078

Limagrain Canada Seeds, Inc. Pioneer HiBred Int'l, Inc.
4-411 Downey Rd. 720 S. 48th St.
Saskatoon, SK Canada S7N 4L8 Grand Forks, ND 58201

Croplan Genetics
P.O. Box 1291
Minot, ND 58702

Additional funding provided by:

Wisconsin Dept. of Agriculture, Trade and Consumer Protection, through the Wisconsin
North Central Canola Council Research Program

Summary of Wisconsin Spring Canola Variety Tests, 1998

Entry	Company	1998 Yields by Station ^a			1998 All-Location Averages				
		ARL	HAN	STB	Yield	Yield	Extended Height ^b	Height Ratio ^c	Harvest
		lbs/ac			lbs/ac	bu/ac	(in)		(DAP)
CL2070	Croplan Genetics	1623.7	1327.0	2182.3	1711.0	34.2	49.9	0.740	95.2
CL2078	Croplan Genetics	1775.1	1301.8	2209.1	1762.0	35.2	48.5	0.743	95.7
CLEX57	Croplan Genetics	1167.1	1129.7	1843.9	1380.3	27.6	50.3	0.721	95.8
Cyclone	Croplan Genetics	1693.1	1399.9	2008.6	1700.5	34.0	51.1	0.690	92.8
Hudson	Croplan Genetics	1287.6	1090.1	2151.4	1509.7	30.2	45.4	0.600	90.6
Crusher	Interstate Payco	1595.5	1424.1	2159.6	1726.4	34.5	51.7	0.878	95.3
Hyla 401	Interstate Payco	2406.7	1468.4	2825.8	2233.6	44.7	41.2	0.687	91.8
Quantum	Interstate Payco	1505.2	1118.1	1852.5	1491.9	29.8	49.8	0.764	92.5
Ebony	Limagrain Canada	1800.4	1181.2	1992.0	1657.9	33.2	48.8	0.674	94.8
LG3333	Limagrain Canada	1603.0	1247.1	1922.8	1590.9	31.8	45.6	0.630	90.8
LG3430	Limagrain Canada	1377.6	1386.2	2017.0	1593.6	31.9	49.4	0.747	95.7
46A65	Pioneer International	2079.8	1463.9	2387.0	1976.9	39.5	47.8	0.692	94.2
46A74	Pioneer International	1733.4	1194.9	2042.8	1657.0	33.1	50.7	0.654	95.6
HCN-35	AgrEvo/PGS	1359.7	1369.3	1754.4	1494.5	29.9	45.8	0.594	93.6
HCN-41	AgrEvo/PGS	1652.1	1312.9	2035.8	1666.9	33.3	48.9	0.771	94.2
PHS97-457	AgrEvo/PGS	1793.9	1693.1	2386.3	1957.8	39.2	51.0	0.695	94.4
PHS97-460	AgrEvo/PGS	1841.3	1523.6	2409.0	1924.6	38.5	53.0	0.641	94.2
PHS97-482	AgrEvo/PGS	1393.7	1504.3	1881.1	1593.0	31.9	49.1	0.627	94.2
PHS97-494	AgrEvo/PGS	1628.2	1480.3	2312.3	1806.9	36.1	52.3	0.650	95.1
PHS97-504	AgrEvo/PGS	1446.4	1279.9	2133.4	1619.9	32.4	51.5	0.700	93.8
PHS97-506	AgrEvo/PGS	1381.3	1372.4	2435.6	1729.8	34.6	50.7	0.705	92.7
PHS97-513	AgrEvo/PGS	1509.4	1521.0	2119.6	1716.7	34.3	50.5	0.692	93.7
PHS97-514	AgrEvo/PGS	1509.7	1505.5	2150.6	1721.9	34.4	51.1	0.611	92.8
PHS97-515	AgrEvo/PGS	1823.2	1593.4	2363.7	1926.8	38.5	51.6	0.637	92.2
PHS97-579	AgrEvo/PGS	1711.3	1370.9	2246.6	1776.3	35.5	51.1	0.612	93.8
TRIAL MEAN		1627.9	1370.4	2152.9	1717.1	34.3	49.5	0.686	93.8
LSD(.05)		461.7	376.5	434.6	424.3	8.5	7.8	0.214	3.3
CV (%)		19.43	18.83	13.83	17.36	17.36	7.46	22.60	2.39

^a ARL=Arlington, HAN=Hancock, STB=Sturgeon Bay

^b Extended plant height and undisturbed canopy height measured just before harvest.

^c Height ratio (canopy height divided by extended height) provides an indication of lodging.

Wisconsin Spring Canola Variety Tests, 1998

Dr. T. C. Osborn
 Department of Agronomy
 University of Wisconsin-Madison
 Madison, WI 53706
 (608) 262-2330

Location: Peninsular Agric. Research Station (Sturgeon Bay, WI), field #11
 Soil Type: Longrie silt loam
 Soil Test: Mar 98
 Previous Crop: Potatoes
 Fertilizer: 500#/A 19-19-19 (4/24/98)
 Herbicide: Treflan (0.5# A.I./A; 4/24/98)
 Seed Treatment: Benlate
 Planting Date: April 27, 1998
 Seeding Rate: 6 lb/A
 Plot Size: Seven 25 ft rows, 6 in apart; replicated four times
 Insecticide: Thiodan 50WP (1#/gal, 200 gpa; 5/13/98)
 Harvest Date: August 1-12, 1998
 Harvest Method: Swath 7 rows x 20'/plot; field dry 10-12 days; combine.

Cooperator: R. Weidman, U. W.-Peninsular Ag. Research Station

Companies providing seeds:

AgrEvo (Plant Genetic Systems) Interstate Payco Seed Co.
 104-111 Research Drive Box 338
 Saskatoon, SK Canada S7N3R2 West Fargo, ND 58078

Limagrain Canada Seeds, Inc. Pioneer HiBred Int'l, Inc.
 4-411 Downey Rd. 720 S. 48th St.
 Saskatoon, SK Canada S7N 4L8 Grand Forks, ND 58201

Croplan Genetics
 P.O. Box 1291
 Minot, ND 58702

Weather Data

Month	Monthly Precip.**		Ave. Temp.	
	Normal	Normal	Normal	Normal
May	2.81	3.12	60	53
June	7.20	3.31	64	63
July	1.10	3.36	70	69
August	1.95	3.42	70	67

** In addition, irrigation supplied 0.75" (5/20/98).

Wisconsin Spring Canola Variety Tests, 1998
Sturgeon Bay, WI

Entry	Company	Yield (lbs/ac)	Extended Height (in)	Canopy Height (in)	10% Bloom (DAP)	90% Bloom (DAP)	Harvest (DAP)	1000 seeds (gm)	Seed Oil (W%)
CL2070	Croplan Genetics	2182.3	49.7	26.6	47.3	60.0	95.0	2,597	(TBD)
CL2078	Croplan Genetics	2209.1	52.2	31.5	46.8	60.0	94.0	2,516	
CLEX57	Croplan Genetics	1843.9	47.2	34.4	46.8	60.0	93.0	2,720	
Cyclone	Croplan Genetics	2008.6	50.2	21.2	45.3	57.8	88.3	2,705	
Hudson	Croplan Genetics	2151.4	47.2	11.8	40.0	58.5	88.0	2,574	
Crusher	Interstate Payco	2159.6	49.6	44.2	48.0	62.3	94.0	2,426	
Hyola 401	Interstate Payco	2825.8	44.8	19.2	40.3	57.0	89.3	2,752	
Quantum	Interstate Payco	1852.5	49.0	36.4	43.7	59.3	91.5	2,654	
Ebony	Limagrain Canada	1992.0	50.2	22.1	47.5	59.3	91.5	2,709	
LG3333	Limagrain Canada	1922.8	44.8	14.8	39.0	57.8	88.0	2,595	
LG3430	Limagrain Canada	2017.0	50.2	30.5	45.0	60.0	95.0	2,796	
46A65	Pioneer International	2387.0	53.6	21.7	41.0	60.0	90.8	2,504	
46A74	Pioneer International	2042.8	50.2	21.2	47.3	57.8	95.0	2,620	
HCN-35	AgriEvo/PGS	1754.4	46.3	13.8	45.8	59.3	88.0	2,699	
HCN-41	AgriEvo/PGS	2035.8	50.5	40.4	47.8	60.0	92.0	2,665	
PHS97-457	AgriEvo/PGS	2386.3	54.1	27.1	46.8	60.0	89.8	2,811	
PHS97-460	AgriEvo/PGS	2409.0	54.6	25.6	46.8	60.0	91.5	2,653	
PHS97-482	AgriEvo/PGS	1881.1	46.8	16.7	47.0	60.0	92.5	2,763	
PHS97-494	AgriEvo/PGS	2312.3	49.2	18.7	45.0	59.3	91.5	2,459	
PHS97-504	AgriEvo/PGS	2133.4	52.2	27.1	46.3	60.0	91.0	2,730	
PHS97-506	AgriEvo/PGS	2435.6	50.2	30.0	46.0	57.8	89.5	2,749	
PHS97-513	AgriEvo/PGS	2119.6	51.5	20.7	47.0	60.0	90.5	2,658	
PHS97-514	AgriEvo/PGS	2150.6	50.9	16.1	45.3	57.8	89.5	2,747	
PHS97-515	AgriEvo/PGS	2363.7	53.0	23.1	45.0	59.3	88.8	2,600	
PHS97-579	AgriEvo/PGS	2246.6	50.7	19.7	45.3	60.0	92.3	2,749	
TRIAL MEAN		2152.9	50.0	24.6	45.3	59.3	91.2	2,658	
LSD(.05)		434.6	5.6	13.5	1.7	1.5	2.7	0.442	
CV(%)		13.83	8.14	37.61	2.46	1.72	2.05	11.39	