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BIODIESEL

World production and usage of biodiesel is increasing sharply because of growing environmental concerns, uncertainty over the security of crude oil supplies, a global surplus of oilseeds and various subsidies and favourable government policies resulting from the rising price of mineral based fuels. Biodiesel consumption in the European Union (EU)-25 and the United States (US) has increased significantly and is expected to grow in Canada. However, further growth of the world biodiesel sector is expected to be constrained by a shortage of high oil bearing oilseeds and by a surplus of protein meal and glycerin. To meet the expected growth in demand for biodiesel, and to maintain its current markets, Canada will have to expand its production of canola and soybeans and raise the oil content of canola. This expansion of production can be achieved through higher yields and by a tightening of the crop rotation. This issue of the *Bi-weekly Bulletin* examines some of the issues surrounding the expansion of the biodiesel market.

OVERVIEW

Biodiesel is defined as a diesel equivalent, processed fuel, derived from biological sources of which the most common are tallow, yellow grease or vegetable oils. The source feedstock for biodiesel varies by region. In North America, the most common source of biodiesel is currently soybean oil or yellow grease and tallow, while in the EU it is rapeseed oil. In Asia, research is being conducted into making biodiesel out of palm oil.

Biodiesel was first produced in 1853 by scientists E. Duffy and J. Patrick, many years prior to the first functioning diesel engine. In 1893, Rudolf Diesel operated his first engine on peanut oil which, while strictly not a biodiesel, was a vegetable oil. In remembrance of this event August 10 has been declared as International Biodiesel Day.

Modern day interest in biodiesel production started with farm co-operatives in the 1980s in Austria. In 1991, the first industrial-scale plant opened in Aschach with a capacity in excess of 10,000 cubic meters a year. Throughout the 1990s, plants were opened in many European countries and by 1998, 21 countries were identified with commercial biodiesel projects.

The recent growth in the biodiesel sector has been supported by rising crude oil prices. In the late 1990s, the average world price of crude oil ranged around US$20 per barrel (/bbl), in 2004 dollars. Prices then increased sharply due to increased demand from rapid economic growth in Asia, low US inventories, cutbacks in output in the Oil Producing and Exporting Countries and by disruptions in production in Venezuela, Iraq and the US following the hurricane Katrina. Prices peaked, post-Katrina, at US$75/bbl on the New York Mercantile Exchange and are currently around $US60 a barrel.

SITUATION

EU: The World Leader in Biodiesel Production

The EU-25 is the world's leader in the biodiesel sector. Its biodiesel industry has expanded fourfold since the mid-1990s and annual production for 2005 was slightly over 3.2 million tonnes (Mt) (3.6 billion litres), compared to 1.9 Mt for 2004. Numerous large scale biodiesel plants and crushing facilities have been constructed in Germany, France and the Netherlands. The construction of these plants has increased intra-EU trade in rapeseed and rapeoil. More plants are expected to be built in the near future.

This growth in biodiesel production is supported by growing environmental concerns, which include the high level of automotive emissions of carbon monoxide hydrocarbons and particulates. Biodiesel is seen as a partial solution as tests demonstrate that switching to biodiesel and installing a catalytic converter can reduce emissions of carbon monoxide by 53%, of hydrocarbons by 81% and particulates from high sulfur diesel by 81%.

The growth of the EU-25 biodiesel sector is also supported by a host of regulatory reforms. In 1992, reforms to the Common Agricultural Policy were introduced in an attempt to reduce the large surpluses of butter and wine a situation that had become politically unacceptable. One of these reforms included the formation of set-aside land which was allowed to grow only non-food crops. By 2000, about 1 million hectares (Mha) of set aside land was dedicated to growing biofuel crops, of which about 700,000 ha were sown to rapeseed.

In the EU-25 about 80% of the biodiesel is produced from rapeseed oil. As a result, the demand for biodiesel has become a major factor influencing the rapeseed and rapeseed oil markets. Regulatory standards for biofuel in the EU-25 limit the use of soyoil to a 20-25% blend as measured by an Iodine value.

The demand for rapeseed has encouraged the expansion of rapeseed area. This increase, together with favourable weather and growing conditions, has led to record rapeseed harvests in 2004-2005 and 2005-2006. However, demand for rapeseed

BIODIESEL: COMMON CONVERSION FACTORS

Biodiesel	1 litre weighs 0.880 kilograms
Canola Oil	1 litre weighs 0.917 kilograms
Canola	1 tonne yields 0.42 tonne of canola oil
Diesel Fuel	1 litre weighs 0.85 kilograms

Note: Conversion factors may vary by source.
Source : SIMetric.Co.Uk, AAFC

US: BIODIESEL PRODUCTION BY SOURCE CROP

Feed Stock	Litres per hectare
Soybeans	375
Canola/Rapeseed	1,000
Mustard	1,300
Jatropha	1,590
Palm Oil	5,800
Algae	95,000

Source: United States Department of Energy

exceeded production, leading to an increase in imports of rapeseed and rapeseed oil and a decline in exports.

Because of continued low crush margins for soybeans relative to rapeseed, crushers in northern Europe are increasingly focusing on rapeseed crushing. In southern Europe, there is a rising interest in crushing soybeans, which can be produced domestically.

Biodiesel production in the EU-25 has recently been given fresh impetus by regulations specifying minimum target quantities of biofuels in the Commission's action plan. According to the plan, the market share of biofuels should increase from 2.0% in 2005 to 5.75% in 2010. To date, these are targets rather than minimum requirements.

US: Rapid Expansion of Biodiesel Capacity

The production of biodiesel in the US tripled in 2005 to 91 million gallons (Mgal) or 364 million litres (ML) from 25 Mgal in 2004. This was spurred on in large part by the Blenders Credit provision in the Energy Bill which provided a subsidy of US$1 per gallon to support the production of biodiesel from vegetable oil and $0.50/gal for tallow biodiesel. Currently, the US has about 80 biodiesel plants either in operation, under construction or on the drawing boards. Announcements to begin the construction of new plants are occurring almost daily.

US interest in biodiesel was originally stimulated by the *Clean Air Act* of 1990, combined with regulations requiring reduced sulphur content in diesel fuel and reduced diesel exhaust emissions. The *Energy Policy Act* of 1992 established a goal of replacing 10% of motor fuels with non-petroleum alternatives by 2000 and increasing to 30% by the year 2010. By 1995, 10% of all federal vehicles were to be using alternative fuels to set an example for the private automotive and fuel industries.

Currently, much research is ongoing into finding suitable crops and improving oil yields for making biodiesel. Using current yields, vast amounts of land and fresh water would be needed to produce enough biodiesel to completely replace fossil fuels.

Recently a Marlborough New Zealand company announced that it had commercially produced bio-diesel from specialized algae grown in a local sewage pond. Previous research by the Office of Fuels Development in the US Department of Energy on an Aquatic Species Program had produced biodiesel from specialized algae varieties, some of which contained in excess of 50% oil. The studies determined that theoretically the US could meet its entire 141 billion gallon (Ggal), in diesel-equivalent, fuel requirements from algae grown on a land (pond) area of about 4.0 Mha in a high sunshine area such as the Sonora Desert. By contrast, producing biodiesel from soybeans or canola would require 200% or 66% of the US cropped area, respectively.

Canada: Starting to Expand Biodiesel Production

Canadian production of biodiesel is slowly coming on stream with annual production estimated to reach 95 ML in 2006-2007. In Montreal, biodiesel is being produced from yellow grease and tallow. In Oakville, Ontario, a small scale pilot plant is expected to begin operation, employing a breakthrough technique that significantly lowers the cost of production. In Nova Scotia, fish oil is being burned in diesel engines although some quality problems have been detected. To-date, most of biodiesel manufactured in Canada has been exported to the US.

MEDIUM-TERM OUTLOOK

EU Growth to Increase Imports of Canola/Rapeseed

Over the medium-term, the EU-25 is expected to consume about 9.3 Mt of biodiesel a year of which it will be able to produce 4.2 Mt. This growth in biodiesel usage is mostly based on rapeseed and is expected to lead to a regional shortage and increased imports mainly from the Former Soviet Union countries where production is expected to expand to serve the new market. Imports from Canada, however, are not likely to rise because of regulations surrounding imports of genetically modified organisms. EU imports of canola oil are also projected to rise and a large segment of this growth is expected to be captured by Canada. As a result of the high rapeseed oil prices, EU-25 food sector is expected to switch to using increased amounts of sunflower seed oil. Sunflower seed oil was one of the most expensive oils in the EU while rapeseed oil used to be one of the cheapest. However, because of the rising biodiesel demand, rapeseed oil is commanding a premium to sunflower seed oil. As a result of this price difference and because of its high quality, imports of sunflower seed oil are also expected to increase.

US: Upcoming Protein Glut

The biodiesel sector is expected to grow less rapidly in the US than in the EU-25 and Canada, as the US concentrates more on ethanol production. Total installed biodiesel capacity is expected to reach 632 Mgal or about 2.09 Mt by 2007.

BIOFUEL TAX REDUCTIONS AND TARGETS FOR MARKET SHARE IN KEY COUNTRIES

	Tax Reduction for biofuels	Target for biofuels volumes/market share
Canada	Federal excise tax exemption of 10¢/L of ethanol blended with petrol and 4¢/L for biodiesel. Additional fiscal incentives in several provinces.	Canada has a target of 5% renewable content in transportation fuels such as ethanol and biodiesel by 2010.
Brazil	The total of value-added tax, fuel tax and other taxes on ethanol is only about half that applied to petrol.	Obligation to blend between 20% and 25% ethanol with fossil petrol depending on the situation on the alcohol market.
US	Federal tax credit of US$0.52/gal of pure ethanol; Blenders Tax Credit of US$1.00/gal or CAN$0.31/L; Additional fiscal incentive in several States.	Renewable fuels standard mandates the use of 7.5 Ggal (28.4 GL) of biofuels by 2012.
EU	Varying level of tax reductions in different EU Member States (between 0 and 100%)	Indicative targets for the share of renewable fuels in the transport fuel market of 2% by end 2005 and 5.75% by end 2010.
Australia	Full excise tax exemption for both fuel ethanol and biodiesel (AUS$0.38/L) i.e., 1.75% of total petrol consumption at current level.	National target of 350 ML of biofuels by 2010.

Source: Canadian Renewable Fuels Association

Most of the expected growth in biodiesel production in the US will be based on soybeans which contain 18% oil and 82% meal. Based on the current and announced biodiesel plant capacity, the feedstock demand is estimated at about 2.15 Mt of vegoils and fats, equivalent to 20% of total US vegoil use for 2004-2005.

A sharp increase in soybean crush, to satisfy the growing biodiesel demand over the medium-term, is expected to result in a glut of soymeal. Combined with expanded production of DDGs as a co-product of expanded ethanol production, the US is expected to face a major surplus of protein meals which is expected to lead to sharply lower prices.

The growth in US biodiesel output is also expected to result in surplus supplies of glycerin. Glycerin is produced as a byproduct of the refining process that turns vegetable oil into biodiesel and accounts for about 10% of the total output. Historically, glycerin was considered a high value product but prices are expected to fall sharply over the medium term as the biodiesel sector expands. Prices are expected to decline to as low as US$0.05 per pound (lb) for low quality glycerin compared to the historical highs of US$0.50-1.50/lb achieved for high quality glycerin. Current annual production of glycerin in the US is about 300 million pounds (Mlb) per year which is expected to rise to about 450 Mlb, assuming the US produces a relatively modest 200 Mgal (800 ML) of biodiesel a year.

Canadian Biodiesel Production Expected to Rise

Over the medium-term, biodiesel production in Canada is tentatively projected to rise to 0.30 to 0.40 billion litres to support the anticipated mandate of 5% biofuel content. Studies on the cost of production suggest that yellow grease and tallow are the least cost feedstock for biodiesel production in Canada, followed by soyoil. Canola oil is the most expensive.

Given limited supplies of yellow grease and tallow, the successful expansion of the biodiesel sector in Canada is dependent on secure supplies of canola and soybeans, the alternative market for niche trait canola and soybeans, and the prices for *co-products.* It is assumed that major growth in biodiesel production in Canada involves using canola and soybeans for feedstock. For both oilseeds, producer returns will have to be significantly above that of wheat in western Canada, and corn in eastern Canada, to convince farmers to grow a stable supply of oilseeds to satisfy the growing demand from the biofuel sector.

Some studies forecast that Canadian canola production will rise by 6% by 2010 to support this growth.

Canada: Factors affecting future growth

In Canada, over the past 5-10 years a number of companies have invested in specialty-trait canolas, such as "high-oleic, low-lin" varieties, suitable for "trans-fat free" margarines, salad oils and baking products. With a growing nutritional awareness, consumer demand for zero trans-fat products is expected to expand, creating a premium market for these special trait canolas. It is estimated that up to one-third of the canola area in Canada may end up being seeded to "niche" canola varieties which are expected to be too expensive for biodiesel production.

The expansion of the biodiesel sector will also increase the supply and depress prices of co-products such as protein meals and glycerine. Given the tight margins in producing biodiesel, the profitability will be highly sensitive to these prices. With the concurrent expansion in ethanol production, North American protein meal prices are expected to decline due to surplus stocks of DDG with solubles, along with the rising stocks of canola meal. Canola meal prices are forecast to decline to the point where the surplus volumes are expected to be exported.

WORLD

DIESEL CONSUMPTION (EXAMPLE)

	2004 -2005	2005 -2006e	2006 -2007f
	……..million tonnes per year……		
World Petroleum Diesel Usage	934	940 \1	950 \1
Transportation Petroleum Diesel Usage (60%) \2	561	564	570
Potential Biodiesel Usage :			
B2\3	11.2	11.3	11.4
B5\4	28.1	28.2	28.5

BIODIESEL PRODUCTION (select countries)

	……million tonnes per year……		
Canada	0.000	0.023	0.086
US \5	0.088	0.264	0.792
EU-25 \6	1.933	3.184	n/a
Total	**2.021**	**3.471**	**n/a**

VEGETABLE OIL PRODUCTION

	……..……million tonnes……		
Palm	33.9	35.5	37.6
Soybean	32.5	34.3	35.3
Canola/Rapeseed	15.7	17.2	17.9
Other	29.1	30.2	30.5
Total	**111.2**	**117.2**	**121.2**

\1 AAFC (for illustrative purposes)
\2 60% of World Petroleum Diesel Usage
\3 2% Biodiesel; \4 5% Biodiesel
\5 US National Biodiesel Board;
\6 European Biodiesel Board
e: estimate; f: forecast, USDA – October 2006
Source: USDA, AAFC

CANADA

DIESEL USAGE

calendar year	2004	2005	2006
	...million litres per year...		
Total	**25,153**	**26,289**	**26,500**
For transport	17,570	18,090	18,190
B2 Mandate \1	351	362	364

BIODIESEL PRODUCTION

crop year \2	2004 -2005	2005 -2006e	2006 -2007f
	……million litres…..……		
Canola Oil	0	0	0
Soybean Oil	0	0	0
Tallow and Yellow Grease	0	0.02	0.08

CANOLA OIL AND SOYBEAN OIL SUPPLY AND DISPOSITION

crop year \2	2004 -2005	2005 -2006e	2006 -2007f
	…….million tonnes…..……		
Carry-In Stocks	0.04	0.04	0.04
Production	1.52	1.75	1.82
Imports	0.17	0.13	0.13
Total Supply	**1.73**	**1.92**	**1.99**
Domestic Consumption	0.71	0.76	0.76
Exports	0.98	1.12	1.19
Total Usage	**1.69**	**1.88**	**1.95**
Carry-Out Stocks	0.04	0.04	0.04

OILSEED PRODUCTION

crop year \2	2004 -2005	2005 -2006e	2006 -2007f
	…….million tonnes…..……		
Canola	7.73	9.66	8.49
Soybeans	3.05	3.16	3.29

\1 potential demand for biodiesel based on 2%
\2 Canola: Aug.-Jul.; Soybean: Oct.-Sep.
e: estimate; f: forecast – AAFC, October 2006
Source: Statistics Canada

The Canola Council of Canada forecasts that Canadian canola production would have to increase to about 14 Mt annually to meet the demand of canola for food and for B5 biodiesel. This rise in demand could be accomplished through an increase in seeded area, higher oil yields and higher plant yields.

CANADA: FEEDSTOCK REQUIREMENTS TO MEET RENEWABLE FUEL TARGET

		Scenario 1	Scenario 2		Scenario 1	Scenario 2
	Annual Consumption[\1]	5% Biofuel Component	2% biodiesel >5% ethanol	Feedstock	5% Biofuel Feedstock Requirement[\2]	Adjusted Feedstock Requirement[\3]
	billion litres			million tonnes		
Diesel	18	0.9	0.36	Canola	1.71	0.56
				Soybeans	0.09	0.03
				Sub-total	**1.80**	**0.59**
Gasoline	44	2.2	2.74	Corn	3.67	4.57
				Wheat	1.84	2.29
				Sub-total	**5.51**	**6.86**
Total	**62**	**3.1**	**3.1**	**Total**	**7.31**	**7.45**

[\1] forecast by AAFC based on NRCan data; [\2] adjusted for biodiesel produced from animal fat
[\3] adjusted for for 2% versus 5% biodiesel content and biodiesel produced from animal fat
Source: AAFC

The area seeded to canola could be increased through a tightening of crop rotations to one in three years in the provinces of Manitoba and Alberta and two out of five years in Saskatchewan. The area seeded to canola could also expand in the dry growing regions of southern Saskatchewan and Alberta with the release and adoption of more drought tolerant, brassica juncea based canola varieties.

The oil content of canola could be raised by 2%, to about 44% from the current 42%. Under the current grading regulations, producers are paid on yield, not on the oil content of the canola. A switch to paying for oil content will introduce incentives to increase oil content, leading farmers to select higher oil yielding varieties and to adopt different agronomic practices.

The increase in canola production can be supported by an anticipated annual growth of 2% in yields over the medium-term, as growers continue to adopt the new, higher yielding hybrid varieties. The best performing hybrid varieties currently under development out-yielded the check varieties by 28 to 32% in the Prairie Canola Variety Testing Program trials. Consequently, in a follow up survey of canola breeders, they remained confident that canola yields will continue to rise at the current pace. With the advances in hybrid breeding and in agronomic practices, canola has the genetic potential to yield over 4 tonnes per hectare (t/ha) versus 1.83 t/ha in 2005-06, according to the Canola Council of Canada.

World Biodiesel Growth to Support Canola Prices

If Canada, the EU and the US all strive to expand their biodiesel sectors, the impact on oilseed production and prices would be significant. This increased demand for vegetable oil may increase soyoil prices by up to 15%, according to some studies. However, soybean oil is a joint product with soymeal. The extra soymeal produced would have to be sold into a market already supplied by growing stocks of dried distiller's grains (DDG) with solubles. Consequently soymeal prices are forecast to decrease by up to 10%, resulting in a 0.1% decrease in soybean prices overall.

On the other hand, canola prices are forecast to rise by about 10%, resulting in a shift in seeded areas into canola out of cereals, assuming a slight rise in wheat, corn and barley prices.

CANADA: RENEWABLE FUELS STRATEGY

The federal government is working with the provinces to develop an integrated national renewable fuels strategy and to fulfill the government's commitment to achieve 5% average renewable content in Canadian transportation fuel by 2010. Ministers responsible for renewable fuels met in May and agreed to move forward to develop a nation renewable fuels strategy. The renewable fuels strategy for Canada will include both biodiesel and ethanol.

An announcement of $10 million, for this fiscal year, in support of The Biofuels Opportunities for Producers Initiative was made by the Minister of Agriculture and Agri-Food Canada to help agriculture producers develop sound business proposals as well as undertake feasibility or other studies to support the creation and expansion of the biofuel production capacity. On September 20, 2006, $5 million in funding was released in support of the initiative. The government is also supporting biofuels opportunities through a one-time $1 million addition to the existing Co-operative Development Initiative. This funding will provide support to individuals, groups and communities wishing to develop co-operatives as a way to take advantage of opportunities associated with biofuels and other value-added activities.

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