Temiskaming Oilseed Industry Evaluation and Action Plan: A Feasibility Study

Prepared for
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EXECUTIVE SUMMARY

Grain and oilseed production in the Temiskaming region has expanded due to a number of factors. Oilseed production ranges from 8,000 to 10,000 tonnes in the Temiskaming region, and can be as high as 15,000 tonnes when the Verner and Temiscamique areas are considered.

Currently, all of the canola (at least 6,000 tonnes) and all of the soybeans (at least 2,000 tonnes) are shipped into southern Ontario for processing. Soymeal and canola meal are shipped back into Temiskaming to be used by the livestock industry, predominately the dairy industry. In Temiskaming, the dairy industry uses between an estimated 4,500 tonnes and 5,750 tonnes of protein meal reach year.

The Temiskaming Grain Growers Association commissioned this study to determine whether it is feasible to process oilseeds in the region. Processing can include roasting (or micronizing) of soybeans and mechanical extrusion of canola and soybeans to separate the oil from the meal. The saving on freight suggests that processing could be a viable proposition, as the average freight bill is $25/tonne on either hauling in meal or shipping out oilseeds.

One of the issues identified is whether soybeans will become a regular cash crop in the region. The 2000 crop year can be considered abnormal due to the extremely early frost. If so, soybean acreage can be expected to expand, as long as its returns are attractive relative to cereal grains.

Roasted soybeans have high by-pass proteins values and are well suited to the dairy business. Roasting soybeans incurs an up-front capital charge of at least $500,000 when it is part of an existing grain business, and when 2,750 tonnes of soybeans are roasted in the region, the operation will break even. Micronizing of soybeans is also feasible, but a gross margin of $70/tonne of raw beans is required to break even. The key question for roasting and micronizing is whether this volume of soybeans will be available in the region each year, and whether the dairy and feed industry will utilize this volume of roasted beans in their feed rations.

Existing small scale crushers and roasters of soybeans indicate that volume is required to achieve economies of scale, that a reasonable margin is required to provide the value added service, and the need to find a market for the oil that reflects edible oil values. Suggested volumes of around 20,000 tonnes well exceed the volume of meal required in the region, as well as the supply of oilseeds currently grown in the region. The changing nature of the edible oil market in the south has dried up outlets for crude oil, and as a result a market needs to be developed for the oil. Values for oil will likely reflect uses in feed formulations. One small-scale refinery in Michigan should be in operation in late 2001, and possibly one in southern Ontario in early 2002 will provide an outlet for crude oil based on edible values.

When a mechanical crush plant is part of an existing grain business, then an up-front capital cost of at least $1.5 million can be expected. This cost is over $2 million when crushing is contemplated as a standalone business. The crush margins for soybeans are very attractive in Temiskaming, with margins of $75 to $90/tonne very attainable. These margins, however, require more soybeans (4,500 tonnes) than are currently grown in the region. Crushing canola using extrusion technology is currently not that viable due to 10 to 11% of the higher value oil left in the meal, and the low values of edible oils today. Margins are negative unless an edible value can be obtained for the oil, and a premium is received for the canola meal over regular meal due to by-pass protein properties. Canola is typically crushed for the oil, not the meal due to the higher oil content and the lower protein profile in the meal.

A mechanical crusher must capture a $70 to $75/tonne gross margin (of oilseed) to breakeven if the crusher were to supply all of the meal required in the region (comparable to 6,500 tonnes of canola and soybeans). This is hard to achieve with the margins that can be realized for a 40:60 soybean/canola ratio of crush. Viability is possible if some used equipment is purchased and 9,000 tonnes of canola and soybeans grown in the region are crushed and the surplus meal is shipped into eastern Ontario and Quebec markets (with a by-pass premium). This may be difficult to achieve, since pricing is based on the crusher paying the same purchase price as larger growers receive when they ship directly to Hamilton.

The viability of an oilseed extrusion plant depends on whether soybeans are a viable crop in the region, on whether sufficient volumes of soybeans can be attracted into the crush plant, and whether the crush plant can access oil market that reflect an edible oil value, versus a feed market value. In such a plant, today's economics indicate that soybeans would subsidize the crushing of canola.

These facts and perspectives are provide to enhance the discussion on oilseed processing in the region and to assist the Temiskaming Grain Growers Association in assessing the attractiveness of encouraging investment into oilseed processing in the Temiskaming region.

1.0 Introduction

Grain and oilseed production in the Temiskaming region has expanded due to a number of factors including;

- Demand for grain from the local livestock region,
- Development and diversification of the local agricultural economy,
- Development and introduction of shorter growing-day grain and oilseed varieties, and
- A general increase in the number of growing days and heat units in the region[1].

Major grain and oilseed production in the Temiskaming region is reported in Table 1.1, and shows the growing importance of oilseeds - canola and soybeans[2].

Table 1.1 Temiskaming Grain & Oilseed Production, Current & Expected Acreages

Crop	Acreage
Barley	17,000 to 20,000
Oats	3,000 to 4,500
Wheat	4,500
Soybeans	3,000 to 8,000
Canola	5,000 to 8,000
Flax and solin (linola)	300

Source: Various sources

Locally produced grains can be used directly by the feed industry, or by farmers for on-farm feed use in the region. Any excess grain, or food grain grains are shipped out of the region to markets in southern Ontario. This does not occur with canola and soybeans, where they remain in the region to fulfill protein requirements. Even if the region is short of protein, locally produced oilseeds must be shipped out of the region to be processed for use by the feed industry. For example, soybeans must be either roasted or crushed to transform the oilseed into a product suitable for livestock consumption. Similarly, with canola, the oil and meal should be separated prior to using the protein in animal feeds. By shipping oilseeds out of the region, and shipping protein sources back into the region, a unique opportunity exists to process local oilseeds in the region.

The Temiskaming Grain Growers Association is interested in adding more economic activity in the Temiskaming region and commissioned **JRG Consulting Group** to conduct a feasibility analysis and evaluation of adding value added oilseed processing in the Temiskaming region.

[1] There is a difference of opinion as to whether there is an increase in the number of growing days. Some argue that there is a long-term trend increase in growing days, while others argue that the last few years have illustrated more variability around a constant mean.

[2] OMAFRA does not provide production statistics for most grains and oilseeds in the region. The 1996 Census did not report acreage for some of the crops, as well.

The objectives guiding this project are: (1) to *evaluate the feasibility of adding value locally to Temiskaming's ever increasing soy and canola acreage, and (2) to evaluate the potential to create jobs in secondary food processing (in the Temiskaming region)*

The approach used is to first address the feasibility of primary processing of oilseeds, which includes operation of a roaster and/or a mechanical crushing operation. After this feasibility is explored, then the synergies and inter-related feasibility of secondary processing operation are addressed.

Roasting and micronizing of soybeans is very different from mechanical extrusion where the oil and the meal are separated. With roasted soybeans the whole product is fed to livestock, while with extrusion the protein meal is separated from the oil. The meal is fed to livestock, while the oil must be marketed into other value streams. In some cases part of the separated oil is added back to the meal to provide more energy to the feed ration. If not, a market for the separated oil must be developed. This will become evident in the following feasibility analysis.

This report is organized in the following manner. Section 2.0 …

2.0 Oilseed Supply and Disposition in the Region

The supply and disposition of oilseeds in the Temiskaming region are addressed in this section. Since the Temiskaming region can easily access grain from Temiscamique, Quebec and from the Verner area (north west of Lake Nippissing, the production from these areas is also considered in the feasibility analysis.

2.1 Canola and Soybean Acreage

Close to 10,000 acres in Temiskaming were planted to either canola or soybeans in 2000, with potentially up to 17,000 acres in the wider region when Verner and Temiscamique are considered (see Table 2.1).

Table 2.1 Estimated Canola and Soybean Acreage in the Region, 2000

Region	**Canola**	**Soybeans**
	acres	*acres*
Temiskaming, Ontario	7,000 to 8,500 - 5,100 in 2006	2,500 to 3,000 2300 - 2005
Verner, Ontario	400 to 500	400 to 500
Temiscamique, Quebec	1,300 to 2,000	800 to 2,500
Total	*8,700 to 11,000*	*3,700 to 6,000*

Source: Compiled based on information provided by a number of growers and dealers

Northern Ont -> total 2006 - 6,900

Canola has been grown in the region for a number of years and is a proven crop in the region. Canola is a cool season crop, and is ideally suited to the Temiskaming region[3]. Estimated 2000 canola acreage is significantly above 1996 Census data (see Table 2.2).

Some producers in the Temiskaming region have grown soybeans for the last five years. The crop has not fully proven itself in the region due to the shorter growing season, and the occurrence of early September frosts, as occurred in 2000[4]. Notwithstanding, some stakeholders believe that 8,000 acres can be grown in Temiskaming.

Table 2.2 Canola and Soybean Acreage in the Region, Census 1996

Region	**Canola**	**Soybeans**
	acres	*acres*
Temiskaming, Ontario	4,229	0
Nipissing & Sudbury	0	0
Temiscamique, Quebec		
Total		

Source: 1996 Census of Agriculture

[3] In 1992, which was a cool year (CHU of 2205 in New Liskeard, canola yields were the highest recorded at the New Liskeard Research station.

[4] A killing frost occurred on September 5th , 2 weeks ahead of normal, not allowing for complete seed development.

With acceptable prices and expectations of continued growing conditions acceptable to soybeans, both soybean and canola acreage can be expected to increase in the near future. Factors supporting the growth of acreage include:

- Round Up Ready canola and soybean varieties are available making both canola and soybeans an excellent rotation crop to clean up the fields,
- Continued expansion in cash crop production as the dairy sector continues to consolidate,
- New land brought into crop production through improvements such as tiling, and
- For soybeans, crop insurance coverage extended to soybeans.

Some of the short-term factors affecting the acreage of canola and soybeans include;

- the per acre return for canola and soybeans relative to wheat and barley (barley prices are supported by the preliminary CVD on corn imported into western Canada), and
- the low price of vegetable oil, which has a larger impact on canola than soybeans due to canola's higher oil content.

For canola another negative short-term factor is the price of nitrogen, and canola's large nitrogen requirement.

2.2 Canola and Soybean Yields and Production

Research data exists for canola and soybean yields in the New Liskeard region. Table 2.3 provides some statistics on the research station yields over the last 10 years.

Table 2.3 New Liskeard Research Station Canola and Soybean Yields

Item	Canola	Soybeans
	Tonnes/acre	Tonnes/acre
Range over 10 years	0.86 to 1.88	0.51 to 1.63
Average	1.25	1.36
Median	1.25	1.20
Estimated average farm yield	0.85	0.85

Source: Derived from data provided by New Liskeard Research Station

The 10-year average of soybean yields based on New Liskeard research station results is 50 bu/acre (or 1.36 tonnes per acre), with a range from a low of 0.51t/acre in 1992 to a high of 1.63 t/acre in 1999. The median yield over this period is 1.2 tonnes per acre. Actual farm yields do not approach research data yields, and using a 70% factor, the estimated farm yield is .85 tonnes per acre based on the median research yield.

Similarly, for canola the research yields range from a low of 0.86 tonnes/acre in 1995 to a high of 1.88 tonnes./acre in 1992. The average and median yields are 1.25 tonnes, resulting in an estimated farm yield of 0.85 tonnes per acre. Some growers suggest using a 0.75 to 0.8 tonnes per yield to represent average farm yields. A yield of 0.85 is used for purposes of this report.

For purposes of this report a yield of 0.90 tonnes per acre is used, implying that on average, the region should be able to generate around 2,700 tonnes of soybeans in

Temiskaming and between 3,780 tonnes and 6,300 tonnes for the broader region, based on current acreage estimates.

The length of the growing season has a large impact on soybean yields, and this is based in a large part on the first killing frost in the fall. Table 2.4 is provided to show the frost incidence reported by the New Liskeard Research Station for New Liskeard and Verner. The data shows that the September 5th frost in 2000 was 2 weeks ahead of normal, thereby not allowing the soybean seed to fully mature in September. The data shows that Verner's first day with a frost below 2°C is less variable than in New Liskeard, and that the September 5th 2000 frost is much earlier than normal.

Table 2.4 Incidence of Frost at New Liskeard and Verner, 1990 to 2000

Year	New Liskeard	Verner
	(First fall frost < -2°C)	(First fall frost < -2°C)
1990	Sept 17	Sept 18
1991	Sept 21	Sept 25
1992	Sept 30	Sept 23
1993	Sept 19	Sept 19
1994	Oct 3	Oct 2
1995	Sept 20	Sept 15
1996	Oct 10	Sept 24
1997	Sept 24	Sept 24
1998	> Sept 30	Sept 23
1999	Oct 3	Sept 22
2000	Sept 5	Sept 24

Source: Data provided by New Liskeard Research Station

Using the average yields for canola and soybeans, the range in canola and soybean production in Temiskaming and in the surrounding region is reported in Table 2.5. Temiskaming, itself can expect to produce 6,0oo to 7,500 tonnes of canola and 2,100 to 2,500 tonnes of soybeans. Total oilseed production in the region can increase to between 7,400 tonnes and 9,700 tonnes of canola and between 3,000 and 5,000 tonnes of soybeans. Where these oilseeds are currently used is discussed in the next section.

Table 2.5 Estimated Canola and Soybean Production in the Region

Region	*Canola*	*Soybeans*
	tonnes	*tonnes*
Temiskaming, Ontario	6,000 to 7,500	2,100 to 2,500
Verner, Ontario	300 to 500	300 to 500
Temiscamique, Quebec	1,100 to 1,700	600 to 2,000
Total	*7,400 to 9,700*	*3,000 to 5,000*

Source: Compiled based on information provided by a number of growers and dealers

2.3 Disposition of Canola and Soybeans

Soybeans and canola must be shipped out of the region for processing. The major markets for these oilseeds includes:

- Sale to CanAmera in Hamilton for solvent extraction of the oil from the meal,
- Sale to ADM in Windsor for solvent extraction of the oil from the meal, and
- Shipment to roasters and micronizes in southern Ontario for roasting and return to Temiskaming for feeding to livestock.

Table 2.6 illustrates the destination of the canola and soybeans grown in the broader Temiskaming region. The shipments are based on the mid-point volume used in Table 2.5. The majority of the oilseeds are shipped to Hamilton for processing by CanAmera. If CanAmera is full, or has logistical issues, or if a backhaul is available out of western Ontario, then soybeans and canola are shipped to ADM in Windsor. Other shipments include sales to niche market buyers and custom roasting.

Table 2.6 Estimated Shipments of Canola and Soybeans out of the Region

Region	Canola	Soybeans
	tonnes	tonnes
CanAmera (Bungee)	8,000	3,000
ADM	400	500
Other	100	500
Total	*8,500*	*4,000*

Source: Estimates based on information compiled from shippers and carriers

- Tem Ag Center – Terry Philips
- Normie Koch
- Kevin Runnalls.

Parrish + Heimbecker – major grain handlers company.

3.0 Oilseed Product Markets and Use in the Region

Is the feed industry a growth industry (More hogs, more TMR and complete feeds), a declining industry (fewer dairy farms), or a stable industry.

3.1 Protein Meals Used by Feed Manufacturers

Representatives of the feed industry have estimated the feed market in the Temiskaming and Verner area to be approximately 15,000 to 18,000 tonnes of manufactured feed. An estimate of feed and protein requirements can also be based on livestock population.

The livestock industry in the Temiskaming region is mostly dairy and cattle. On July 1, 1999, the total cattle[5] population for Temiskaming was 40,300 head, representing 32% of the cattle population in Northern Ontario and 1.9% of the Ontario total. The region had 7,000 dairy cows, 3,500 dairy heifers, 12,000 beef cows, 1,600 beef heifers, 3,700 slaughter steers and heifers, and 12,000 calves (beef and dairy under a year). The dairy industry, and milking cows in particular, can be used to represent the major use of feed and protein supplements. A dairy cow consumes on average 3.3 tonnes of feed a year, suggesting the feed demand in Temiskaming is 23,000 tonnes.

Feed manufacturers estimate that livestock feeds and supplements used in Temiskaming, Verner, and Quebec account for around 4,500 tonnes soymeal and canola meal. Most of the meal is soymeal (over 70%) and not all of the meal is manufactured as feed in the region – some of the meal is shipped into the region as prepared feeds (e.g., by Masterfeeds, Shurgain, and by Land O'Lakes).

Soymeal and canola meal (as sources of protein) usually accounts for 25% of the ration[6], therefore, the demand for soymeal and canola meal would be approximately 5,750 tonnes based on 7,000 dairy cows in Temiskaming. This volume suggests an average milking cow consumes 825 kilograms of protein supplements a year, and just over 2 kilograms a day.

This demand for protein can be provided by a number of sources, including soymeal, soymeal from mechanical extruders with by-pass proteins, canola meal, roasted soybeans, micronized soybeans, corn gluten meal, fish meal, etc. Soymeal is typically the protein source used, unless canola meal is favourably priced given its protein content.

Some feed manufacturers suggest that canola meal can only be 10 to 15% of a dairy cow feed ration, which suggests that the total demand for canola meal in the region is 2,500 tonnes to 3,500 tonnes. Others suggest that canola meal can be 20 to 25% of a dairy feed ration. The reaming protein requirement would likely come from soymeal and/or roasted soybeans..

[5] There is no comparable data for hogs or poultry for the Temiskaming region.
[6] Many dairy rations suggest a 25% inclusion rate for soymeal. Other species (e.g., poultry and swine can have an inclusion rate ranging from 15% to 40% in a complete feed.

The feed industry in the region has used soymeal from mechanical crushers. Representatives of the feed industry in southern Ontario indicated that they would pay a $25 premium for soymeal from mechanical extractors over hexane-extracted soymeal due to by-pass protein properties and due to improved palatability. (in another section).

The soybean meal used in the Temiskaming region is sourced from southern Ontario – either CanAmera, ADM, or from the mechanical soybean extruders operating in southern Ontario. Canola meal can be sourced from ADM or CanAmera in southern Ontario or from the crush plant in Altona, Manitoba.

3.2 Soy Proteins Used by Food Manufacturers

Meatless Gourmet

Soyflour and the texturized soy proteins (TSP) are sourced from …

3.3 Vegetable Oils Used in the Region

Potential future uses

4.0 Oilseed Product Prices in the Region

In this section, the pricing of oilseed products in the Temiskaming region and the importance of freight costs is considered.

4.1 Transportation Costs on Oilseeds and Their Products

Oilseed crops are shipped out of the region, and oilseed products (e.g., soymeal) are shipped into the region. Prices are established based on these product flows. Canola and soybean seed prices in any part of the region are the Hamilton and/or Windsor prices minus a basis charge. The basis includes freight and elevator handling charges (if not direct from on-farm storage). Freight costs from the Temiskaming region vary between $18/tonne and $30/tonne depending if the southbound shipment is the forward (primary) haul, or the back-haul. Freight cost from the Verner area range from $12 to $22/tonne based on whether the load is a back haul movement, or whether the trip is one way.

If the main haul is into the north from the south, then back-haul rates of $20 to $22 per tonne can apply fro canola and soybeans shipped to Hamilton. However, if the carrier's primary haul is to the south, then the applicable rate is $25 to $28/tonne.

For canola meal and soymeal the landed cost is based on the selling price at Hamilton and/or Windsor plus the freight charge to move product up to the feed manufacturing region. Thus if the soymeal moves up to Temiskaming on a back-haul, when soymeal is $18 to $24 per tonne above Hamilton prices, and $12 to $20/tonne above Hamilton in Verner. Some canola meal is shipped into the region from Altona, Winnipeg by truck. The associated freight cost for western canola meal is approximately $50/tonne[7].

An average freight cost of $25/tonne will be used for this analysis for the Temiskaming region, and $20/tonne for the Verner area. It should be noted that id fuel prices remain at current levels, that these rates may increase by 5% to 10%.

4.2 Prices Are Directly Related to Chicago and Winnipeg Futures

Oilseed prices are directly related to Chicago and Winnipeg futures market prices. In the case of soybeans, the price paid by the major crushers in southern Ontario is at a basis to the Chicago bean futures. On December 20th , for example, January soybean prices closed at $(US) 5.08 per bushel, which is equivalent to $284.08 per tonne in Canadian funds. On that day both Windsor and Hamilton were buying within $1/tonne of the nearby Chicago futures. In Temiskaming, the soybean price can be calculated with a basis for freight and handling based on shipments to Hamilton.

In the case of canola, the crusher's purchase price is based on the Winnipeg futures price for canola seed. For example, in late December canola was being purchased in Hamilton

[7] Western canola meal with $50/t freight can compete with southern Ontario canola meal with around $20/t freight due to western canola meal being valued sometimes at $25/tonne under Hamilton. (Other times of the year, the product can be priced on a comparable value.

at $6.00/tonne over the January Winnipeg futures price. A basis to Winnipeg in Temiskaming can be calculated for canola, whether as a sale to a grain dealer, or as a fob price ready to be shipped to CanAmera or Windsor. With freight to Hamilton at $25/tonne, the Temiskaming basis for fob grain is $19/tonne under the Winnipeg futures. The basis will be larger for deliveries to a grain dealer in the Temiskaming region, to include handling charges.

Soymeal prices in Temiskaming are based on soymeal prices in southern Ontario plus freight into Temiskaming. Southern Ontario soymeal prices are based on the supply and demand of soymeal, with soymeal prices at or above Chicago soymeal futures prices if soymeal demand exceeds the supply, such as when some US imports are required into parts of eastern Canada. On December 18, 2000 the Hamilton selling price for soymeal was $20/tonne over Chicago (in Canadian funds and adjusted to a metric tonne). Therefore, a basis to nearby Chicago soybean futures prices can be established for the Temiskaming region, for example $40/tonne over Chicago – reflecting $20 of freight and $20 for the Hamilton basis. Canola meal trades at a discount to soymeal, with canola meal valued at 59% to 60% of soymeal prices.

5.0 Perspective Gleaned From Other Oilseed Processors

A number of cold press – mechanical extruders – have crushed soybeans (and canola) in eastern Canada and the northern United States. Representatives of a number of these businesses were contacted to obtain their perspective on the key issues affecting their operation. A few of the crushers have left the business, or stopped crushing, and the successful operations appear to be integrated into feed operations or have dome an excellent job of marketing both the oil and the meal. As well, companies in the business of roasting and micronizing soybeans were also interviewed. These businesses are also in the business of manufacturing feed or handling grain.

This section may be considered confidential and not released for broader circulation

5.1 Helin Oils

Helin Oils is a soybean crusher (using mechanical extrusion) that exited the business in 2000. When in operation the business was crushing 12 to 14 hours per day over a 5-day week. The volume of crush was driven by sales and the need to maintain a 200 tonne inventory of soymeal. Helin Oils was able to position its soymeal as a premium soymeal, and branded it as Mora meal[8].

The reasons for exiting the business are varied, including tight margins, a changing market for crude (not degummed soy oil) and consistency issues. Key issues to manage based on this company's experience is:

- the need to have a proper equipment maintenance schedule and invest in equipment upgrades, etc, and
- the market for the premium soymeal is limited to the dairy market and requires a concerted marketing and customer service effort.

5.2 Natures Milling

Natures Milling started processing soybeans in 1998 and stopped crushing in early in early 2000. The business stopped crushing due to the dissolution of the business partnership, and poor operating margins at the time of dissolution. The business may be re-established by one of the partners, or the equipment may be for sale.

The business had two extruders that were capable of processing 40 tonnes of soybeans in a day. From a technology point of view, the important operational parameters include, synchronizing the drying and heating with extruding capacity and rate of flow, the need to dehull soybeans for poultry and swine rations, the need to pre-heat beans for crushing, the wear and tear of ancillary equipment (augers, bearings, etc based on continuous use), and the high utility costs for running the operations. The business was able to sell some soymeal as a premium meal to some dairy producers. The oil returns were poor due to the oil not being degummed, and the only oil market was based on trucking oil into the Ohio

[8] Feed manufacturers in the study region have used Mora meal in their dairy rations.

and Illinois market[9]. The difficulty with this business was that it was not integrated with either a feed business or an oil market – resulting in the poor margins realized for crushing soybeans, which left some higher valued oil in the meal (at 6 to 8% oil content in the meal).

5.3 Jackson Seed Services

Jackson Seed Services operates a mechanical crusher using Insta-Pro technology, with 40 tonne per day capacity. The business is based on finding a market for split and cull soybeans that are a by-product of the seed cleaning and food grade soybean business. A business rationale was to get more value for these off-grade soybeans than could be achieved by sending them to the crush market. As a result, the equipment does not always process soybeans. Due to the changing market for crude, not degummed soy oil, the company is storing crude soy oil, and is investing in some oil processing equipment. The equipment will include a degummer.

The experience with this company outlines the importance of marketing the oil, and the fact that a market does not exist for crude, non degummed oil.

5.4 Tri- County Proteins

Tri-County Proteins is owned by three partners, with one of them having an interest in a feed mill – Rooney Feeds. The company started processing soybeans in late 1998 and is now processing 330 tonnes of soybeans each week, based on operating 24 hours per day over a 5-day week. (This is equivalent to 2.75 tonnes per hour of crushing). This company has been able to establish a price premium ($20 to $25 per tonne) for their extruded soymeal for local sales into the dairy industry. The major meal sales are to two feed companies with some sales as far east as north west of Toronto to capture the meal premiums in dairy rations. Currently, the soy oil is returning just over $200/tonne. The equipment is based on French expellers and Anderson expanders.

Key issues that were identified include:

- Need to have scale economies, with at least 20,000 to 25,000 tonnes of processing per year,
- The business needs to return at least $50/tonne margins,
- Provide a consistent quality meal for the dairy industry,
- Develop a market for the oil,
- Be prepared to spend funds on equipment repair and maintenance due to the wear and tear of beans on the equipment (suggested to ensure the equipment is stainless steel),
- Drying beans to around 6% moisture prior to processing is important, and
- Utilities costs can be high.

[9] This market for cruse, not degummed oil has disappeared, with AC Humko only buying selected cruse , not degummed soy oil, for lecithin extraction in their Champagne Illinois facility. Columbus Ohio no longer purchases crude soy oil.

5.5 UniCoop (Co-op Federee)

Unicoop started crushing soybeans (and canola) in March 2000 and they crush 200 tonnes per day (8.3 tonnes per hour using 3 presses). The business was started to supply soymeal to the related feed business. The soymeal is valued around $20/tonne over regular soymeal and $5 to $8/tonne over regular soymeal for hogs and poultry. The equipment is designed to switch over to canola after a 4 hour switch period, but the majority of the crush is soybeans. The overall capital costs for the 200 tonnes per day operation was $ 8 million, with $3 million in equipment and the remaining cost for ancillary equipment and buildings, etc.

The issue of concern to the business is the oil market, with the business not degumming oil. As a result the oil is used in animal feeds and is mixed with rendered fats for export product. The crude oil return is currently $280/tonne, or 13 cents per pound. The business is investing in degumming equipment to expand the market for oil.

5.6 Cold Springs Farm

Cold Springs Farm is one of the largest mechanical crusher of soybeans in Ontario. They crush close to 120 tonnes of soybeans per day, with the soy meal used by their feed manufacturing operations (for turkey and hogs). The perspectives offered for this concept of processing oilseeds in Temiskaming are based on their soybean experience and include:

- The facility should be integrated with an existing feed company, to allow for coordination of meal output with the feed manufacturers requirements,
- Soybeans should only be crushed when the feed mill required meal, implying that all soybeans and canola in the region may not be required by the crush plant,
- Feeds should be palletized for improved feeding efficiency,
- A market for the oil is needed, and one market is to add the oils to animal feeds, including barley and wheat based diets, either at the mill or at the farm,
- The crush plant should provide a higher farm gate return for the oilseed than the opportunity of shipping it to Hamilton

5.7 Thumb Oilseed Producers' Co-operative (Michigan)

This closed producer co-operative started operations in 1999 and started operations for $(US) 2.2 million – buildings, processing equipment and ancillary equipment. The have three Insta-Pro extruders (2500) and can process 127 tonnes per day. They operate the plant 24 hours a day for 5 or 6 days a week. They produced 27,000 tonnes in the first year of operation. The business is around 120 kilometers north west of Sarnia, Ontario.

Due to the loss in markets for crude, not degummed oil, the co-operative is investing another $(US) 1.4 million for refining the oil into a BDR (bleached deodorized and refined) soy oil. The capacity of the refinery is 30 tonnes per day of oil, which means that they 42% excess capacity. The refinery will be in operation in June 2001. They are interested in obtaining crude oil from operations such as the one proposed for Temiskaming.

Critical factors for the business include:

- Having cheap energy, they have subsidized electricity at 5.5 cents per KWH, as electricity is about 20% of their operating costs,
- Finding markets for the oil and the meal,
- The cost to running the plant is $(US) 33 per short tonne, or $(Cdn) 55/metric tonne
- Locating the plant on rail provides more options for marketing and sourcing product.

5.8 Roasting – Blythe Brae Farms Ltd.

There are a few roasters in southern Ontario in dairy country, as well as in dairy country in Quebec where soybeans are grown. Blythe Brae farms have been roasting soybeans for a number of years for feed manufacturers, and local dairy and hog producers. From the owners perspective roasting is an economical way to process soybeans for feeding to livestock. Issues raised include:

- Roasting for dairy cattle requires proper heat control and seepage (holding a temperature for 30 minutes or more) to provide for the proper PDI and by-pass proteins (seepage tanks are stainless steel to allow for proper clean-up, etc.)
- Roasted soybeans do not directly compete with soymeal, and pricing is based more on the value of soybeans versus soymeal
- The margin for roasting soybeans is $25 to $30/tonne on the raw soybean
- There is around 8 to 10% shrink with roasting – 4 to 6% on weight loss due to lower moisture content, and the rest is due to handling shrink, etc. – this needs to be factored into the pricing and/or margin required,
- Soybeans should be cleaned prior to roasting to prevent fire/flares and to have a cleaner looking product after roasting,
- The roaster should be configured to allow for gravity flow from the surge bin to the roaster to the seepage tanks, to the cooling equipment through to the storage/shipment area,
- Wear and tear on the legs and augers can be expected,
- The roasting operation should be part of an existing grain complex or feed mill to minimize capital costs in legs, bins, weigh scales, etc. and to provide full service to customers

5.9 Feasibility Considerations

- McCains uses the model where a local market is developed by shipping product into the region before they invest in a processing facility to supply the market
- Production capacity should exceed the local supply to offset production variability,
- Long term viability can not be based on importing raw materials and shipping out finished products
- Local markets for the products
- If more protein is manufactured than required in the region, the protein price will fall to an export floor price, and if importing raw materials, then viability is doubtful
- Pricing of soymeal when opportunity cost is based on shipments out of the region
- Ensuring most acreage moves through the crush plant
- AC Humko in Champagne Illinois is no longer buying crude oil as they signed a long-term contract with ADM – therefore other markets need to be found.
- Niche markets for oil and the by-pass protein meals, etc.

6.0 Soybean Roasting and Feasibility

The Temiskaming region is capable of producing soybeans, with soybean acreage ranging from 2,500 to 3,000 acres for Temiskaming, with a total acreage of up to 6,000 acres when the Verner and Quebec regions are considered. Based on average yields of soybeans (0.85 tonnes/acre), the feasibility analysis is based on the 3,000 tonnes of soybeans available in the region that could be roasted (or micronized)[10]. In an average year the Temiskaming region is able to produce this amount of soybeans, before considering some additional supplies from nearby regions.

In southern Ontario there are at least three to four soybean roasting operations, and at least four soybean micronizing operations in Ontario and Quebec combined.

6.1 Roasted Soybeans

Soybeans, when roasted, can be used as directly as an animal feed. Unprocessed soybeans contain compounds that have a negative impact on nutritional value. These compounds, called soybean trypsin inhibitors (STI), are enzymes that prevent the absorption of protein in the gut, rendering the soybean to have a low protein quality. Therefore, STIs must be inactivated if soybean products are to be used as human food. Soybean trypsin inhibitors are inactivated through a combination of heat and pH. Urease is an enzyme present in soybeans that when heated loses activity at a similar rate to the STIs. Therefore, the urease value may be used to determine the whether the soybeans have undergone sufficient heating.

Roasting of soybeans is a low cost way to process the soybean into a high-protein product for animal feed rations. Roasting improves feed efficiency, inactivates trypsin inhibitors, decreases urease activity, and provides more accessible proteins.

By-pass proteins are also referred to as Rumen Undegradable Protein (RUP), and are part of the protein that is not digested in the rumen. Properly roasted soybeans have over 50% RUP's, compared to around 30% in solvent extracted soymeal[11] Research studies have shown that this post-rumen protein increase milk production in dairy cattle.

Roasted soybeans do not compete directly with soymeal as roasted soybeans have a much higher RUP value, while soymeal protein is highly degradeable (RUP of less than 30%). Roasted soybeans, therefore competes more with bloodmeal, fishmeal and corn gluten meal, which have less protein degradation. In dairy rations, nutritionists suggest that between 35 and 45% of the protein should be by-pass protein (or RUP). Up to 20% of a dairy grain ration can be roasted soybeans, resulting in around 2kg/day of roasted soybean intake for a lactating cow. If all 7,000 dairy cows in the region were on a roasted soybeans diet, then up to 4,500 tonnes of roasted soybeans could be consumed in a year.

[10] In many places the term roasted can be interchanged for the term micronized soybeans. The differences in the two terms will become evident later in this section.

[11] Regular soymeal with low RUP's is often referred to as degradeable protein in the feed business.

One potential negative with roasted soybeans is the level of saturated fat in the product and the potential impact that it can have on the presence of oxidized milk. Oxidized milk has surfaced in the region, and some attribute roasted soybeans to this phenomena through the level of unsaturated fats. This fact can affect the demand for roasted soybeans, or it may suggest a maximum daily feed intake of roasted soybeans.

6.2 Roasting of Soybeans

The process of roasting starts with weighing and receiving of soybeans, storage of soybeans, cleaning of soybeans, conditioning, storage in a surge bin, which is metered into the roaster, after roasting the roasted beans are feed into a steeping bin (usually an conical bin) and metered out into a cooling area, and then either stored or shipped to a customer.

Roasting involves the following steps:
1. receiving
2. cleaning
3. conditioning and/or steeping with moisture
4. roasting
5. further conditioning and/or steeping (holding temperature)
6. cooling
7. flaking or milling
8. storage or shipping

Steeping or conditioning the soybeans before roasting is to have the proper moisture level prior to roasting, which is usually above 13% moisture. This does not occur with all roasting operations.

In many applications roasting does not only involve the heating of the soybeans to 250° to 300° F, but also includes the proper conditioning after the actual roasting process. Particularly for dairy cattle, the roasted soybean should be steeped (held at the high temperature in a stainless steel holding tank) for 30 minutes to an hour, and then cooled. The amount of crude protein in a roasted and steeped soybean is over 42%, and has a PDI (Protein Dispersibility Index) of between 9 and 11%, with a urease activity of 0.02, which is optimal for hogs.

Steeping after roasting, it is argued, increases the amount of by-pass protein for dairy cattle[12]. Some operators claim that by roasting the soybeans to higher temperature (another 10°F, or more) that the steeping process is not required, and the same PDI and by-pass properties are realized as by steeping.

This roasting process requires the same infrastructure that exists at grain elevators, or at feed mills. This raises the question of whether the roaster should be a greenfield operation, or whether it should be an extension of an existing business that has much of the existing infrastructure required to roast soybeans. Successful roasting operations are

[12] Mechanical extrusion of soybeans also increases the number of by-pass proteins due to the heat exerted during extrusion.

usually operated by very large farms (livestock and/or grain) with the existing infrastructure, or by grain elevators, and feed manufacturers. This will be a consideration when capital costs and breakeven volumes are considered.

Roasting of soybeans involves a considerable amount of shrink that must be considered by the operator and by toll-manufacturing customers. Soybeans are usually around 13% moisture, and the roasted product is typically around 8 to 9% moisture. This moisture loss accounts for at least 4% to 5% shrink, with another shrink loss due to handling. Operators use a 10% factor for total shrink when roasting soybeans. Thus a tonne of roasted soybeans requires 1.1 tonnes of raw soybeans.

A roasted soybean can be safely stored for more than 6-months. Some dairy producers that use their own roasted soybeans in their feed rations will roast the soybeans in the fall as the soybeans come off of the field when the moisture of the soybean is 15 to 18% (or more). Roasting in the fall saves on any drying costs.

Once installed, the roasting equipment can be used for roasting corn, wheat, oats and barley. This suggests that there may be some synergies with a roaster being part of a feed plant, or a country elevator.

6.3 Micronizing of Soybeans

Micronizing is slightly different than roasting of soybeans because roasting involves cooking a six inch bed of soybeans from the outside based on an open heat source. Micronizing is based on using a micro-wave type of heat, with the heat applied to each individual soybean and is heated from the inside. This process results in fewer tonnes of finished product per hour (usually 1 to 2 tonnes per hour (compared to up to 15 tonnes per hour with some roasters).

The steps in micronizing are similar to roasting, except that conditioning of the soybeans prior to micronizing is crucial (for proper moisture) and the hot soybeans are flaked (through a flaker) prior to cooling.

Micronizing of soybeans involves the following steps:
1. receiving
2. cleaning
3. conditioning and/or steeping with moisture
4. micronizing
5. further conditioning and/or steeping (holding temperature)
6. flaking
7. cooling
8. storage or shipping

6.4 Equipment Requirements and Capital Costs

Soybean Roaster

The equipment cost and capital requirements depend on the size of the roaster and the capacity rating of the roaster. Manufacturers of roasters[13] provide models that can roast from 1 ton per hour to 15 tons per hour. Since roasters do not have to be run 24 hours a day to obtain processing efficiencies the size of the roaster can be determined by the volume to be roasted over a year, and the peak demand roasting requirements (for example in the fall at harvest where the roasting operation may be 16 hours per day). The capital requirements will be based on the peak capacity requirements.

A roaster that can roast around 5 tonnes per hour is selected for the analysis, based on the following considerations:

- Suppliers indicate that operators who purchased smaller equipment (1 to 2 tonnes per hour) wish they purchase larger equipment,
- Per hour operating costs can be lower due to spreading an hourly wage cost over more tonnes of soybeans,
- Efficiencies in steeping (holding the hot roasted soybean) can be gained with higher roasting capacity,
- One-half of the normal Temiskaming supply could be roasted in a 6 week period at harvest, with the roaster operating 16 hours a day during this period.
- Over a year, the Temiskaming supply of soybeans could be roasted in 50 to 60 hours per month, which allows for the use of labour on other operations, and would allow for roasting the larger region soybean crop in a high yield year in 100 hours per month, and
- The capacity allows for roasting of corn, oats, wheat and barley for livestock feed (The incremental cost will be another receiving bin for grain segregation).

The related infrastructure needs to handle this type of volume (5 tonnes per hour), and this suggests that storage bins for 3 days supply at peak harvest (160 tonnes, or 9,000 bushels) and 7 days supply during the rest of the year (105 tonnes, or 4,000 bushels). Storage capacity required for the raw soybeans is estimated at 10,000 bushels, and the storage capacity for two overhead bins of 3,000 each for the roasted soybeans. A list of the equipment and infrastructure required for a standalone operation is listed below[14]:

[13] Roasters are manufactured in the U.S. Two companies include Sweet Manufacturing in Springfield, Ohio (937) 325-1511, and Schnupp's Grain Roaster, Inc in Lebanon, PA. (717) 865-6611

[14] A roasting operation does not need to be in a building, with the roaster requiring a roof to protect it from rain and snow.

Equipment and Services Required

1. Weigh scales for up to 40 tonne loads
2. Analytical equipment – moisture etc,
3. Receiving pit and elevation to 10,000 bushel bin
4. Conveyance from storage to cleaner
5. Grain cleaner
6. Conveyance from cleaner to surge bin
7. Conical surge bin
8. Metered augering from surge bin to roaster
9. Conveyance of 300F hot soybeans to the steeping/cooling equipment (should be stainless steel)
10. Conveyance from cooling bin to a roller mill flaker (to break roasted soybeans into 5 to 8 pieces or into flakes)
11. Mill or flaker to break roasted soybeans into 5 to 8 pieces or rolled into flakes
12. Conveyance into two overhead 3,000 bushel tanks
13. Support for two overhead bins
14. Platform for roaster and steeper (they can be stacked, or they can be on the same platform)
15. Roof over area including roaster and steeper
16. Ancillary equipment, such as motors, etc
17. Installation and commissioning costs
18. Stairs and other structural equipment

Table 6.1 outlines the capital costs[15] for establishing a new greenfield, or standalone business that roasts soybeans, and the capital costs for a roaster that is an extension of an existing grain related business. For example, a greenfield operation has capital costs of just under $1 million, while a roaster that is integrated into an existing grain business has capital costs of $550,000

Soybean Micronizer

The hourly capacity of a micronizer is much less than a roaster due to the need to cook each kernel separately. A technology with a rate of low of 1.5 to 2 tonnes per hour is used for this analysis. This is also the highest capacity for a single micronizer. Micronizers are not manufactured in the UK, with Canadian distributors[16]. The costs of the micronizer including related equipment is $350,000 (before considering the needed storage bins, etc) as illustrated in Table 6.1[17]. A supplier has indicated that a used micronizer can be purchased for $200,000.

[15] Capital costs provided by the roaster manufacturers, steeping equipment by MCR Sales in London Ohio (740) 852-7890, the storage bins by John Ernewein Ltd Walkerton, Ontario (519) 881-0187, and the Millwrighting and conveyance equipment by Mitchell Mill Systems Ltd. , Newton, Ontario (519) 595-8747

[16] Bateman Equipment Corporation, Newton, Ontario (519) 595-8786 and Micronization Canada (Luc Audet) in Drummondville, Quebec (450) 677-1455 distributes the UK manufactured micronizing equipment.

[17] It should be noted that these are estimates only based on information supplied to JRG Consulting Group by equipment suppliers and by millwrights (based on information provided to them). These suppliers and JRG Consulting Group are not responsible for ensuring that these costs would be incurred. They are used for budgeting and feasibility purposes.

Table 6.1 Roasting Equipment, Related Equipment and Costs

Equipment	Roaster – Established as a New Business	Roaster – Part of Existing Grain Business	Micronizer – Part of Existing Grain Business
Weigh scales and related	$100,000		
Analytical equipment	$13,000		
Receiving pit and elevation leg	$90,000		
Grain storage for beans	$55,000		
Roof & structure over roaster	$65,000	$45,000	$45,000
Cleaning equipment & augers	$145,000	$10,000	$10,000
Conditioning equipment			
Surge bin & augers	$15,000	$15,000	$15,000
Roaster	$45,000	$45,000	
SS augering to steeping	$10,000	$10,000	
Steeping and conditioning	$50,000	$50,000	
Micronizer/steeping/flaking			$350,000
Conveying from cooler to mill	$6,000	$6,000	
Milling or flaking equipment	$75,000	$75,000	
Storage bins and augers	$50,000	$85,000	$85,000
Installation & commissioning	$215,000	$180,000	$150,000
Ancillary and other	$40,000	$30,000	$25,000
Total	***$974,000***	***$551,000***	***$680,000***

Source: Equipment costs as indicated in prior footnotes and mill systems costs based on information provided by Mitchell Mill Systems, Newton, Ontario (519) 595-8747

The difference in capital costs is significant for the three business concepts. Micronizing is more expensive than roasting. The capital costs for establishing a micronizing operation as part of an existing grain business is $680,000, while the capital cost for roasting is 81% of that level, when it is part of an existing grain operation. The costs of establishing a standalone roasting operation is almost double the costs an integrated roaster.

The cost of the steeping and cooling and equipment can be reduced by building a stainless steel bin on top of an old dryer, with the bin used to step the product and the n metered and gravity feed into the top of the old dryer, which cools the product with the dryer fans. Other costs could also be reduced, if for example, some building structure already existed, or there was other spare or used grain equipment available to be utilized.

The operating life of a roaster ranges from 25,000 to 30,000 hours. Repair and maintenance on the conveying equipment is more than on the roasting and conditioning equipment

6.5 Operating Costs

Roasting

The major operating costs for roasting soybeans are utilities and labour. One person should be monitoring the roasting equipment and process. When roasting 5 tonnes an hour, the labour costs per tonne is $4/tonne with a total per hour labour costs of

$20.00/hour. When the roasting equipment is only configured for 1.5 tonnes per hour then the per tonne labour costs is $13.33/tonne. Clearly, there are economies to size in roasting soybeans from a labour costs perspective. Labour costs are based on the assumption of the worker having non-roasting responsibilities when the roaster is not operating, or that the employment is part-time at a standalone operation.

Energy is the other major cost factor. The energy cost per tonne of raw soybeans starts at $8 using natural gas[18] and can increase to over $15/tonne based on trucked propane. For example, a portable roaster uses 21 to 25 litres of propane to roast a metric tonne of soybeans. With propane gas at close to $0.70/litre, the cost per tonne of raw soybeans range from $15.00 $17.50/tonne

Other operating costs include electricity to operate a few motors and general administrative costs.

Total operating costs (per tonne) to operate a 5 tonne per hour roaster is estimated to be $15/hour. This can vary based on the cost of energy and the volume roasted per hour.

Micronizing

The costs for labour are higher with a micronizer, when compared to a roaster. For example, at 1.5 tonnes per hour of finished product per hour, labour costs are $13/tonne. Energy costs for micronizing are usually less than for roasting soybeans. Energy costs based on natural gas are $7/tonne based on 18 cubic metres of gas and KWH of electricity per tonne. The operating costs for a micronizer are estimated to be $20/tonne.

6.6 Operating Margins

Roasting

Some custom operators in the United States charge at least $12(US)/ton for roasting. This translates into $20(Cdn)/tonne, after accounting for currency and unit adjustments. Some operators in southern Ontario charge up to $30/tonne for soybean roasting.

The operating margin is based on whether the selling price of roasted soybeans is based on the cost of soybeans, plus a fixed margin per tonne of raw soybeans. For example, when soybeans are valued at $240/tonne in the region[19], the value of roasted soybeans could be $295/tonne. The difference in the raw and roasted price of soybeans reflects the shrink (10% or $25/tonne) and the required operating margin (e.g., $30/tonne) to roast soybeans.

On January 19, 2001, when the value of raw soybeans was $240/t in Temiskaming, the value of soymeal was around $345/tonne, based on soymeal in Hamilton priced at just over $320/tonne[20]. This landed cost of soymeal can provide competitive pricing of roasted soybeans, and can allow for a higher roasting margin. An example of a higher margin can be the margins charged in southern Ontario plus a one way freight charge of $25/tonne.

[18] Based on roasting equipment requirements of 120 cubic metres per hour for 4.5 tonnes per hour of raw soybeans, and a delivered natural gas price of just under 30 cents per cubic meter.
[19] Based on January 19, 2001 Hamilton price of between $260/t and $265/tonne.
[20] The price difference of $25/tonne reflects the cost of shipping in soymeal from Hamilton.

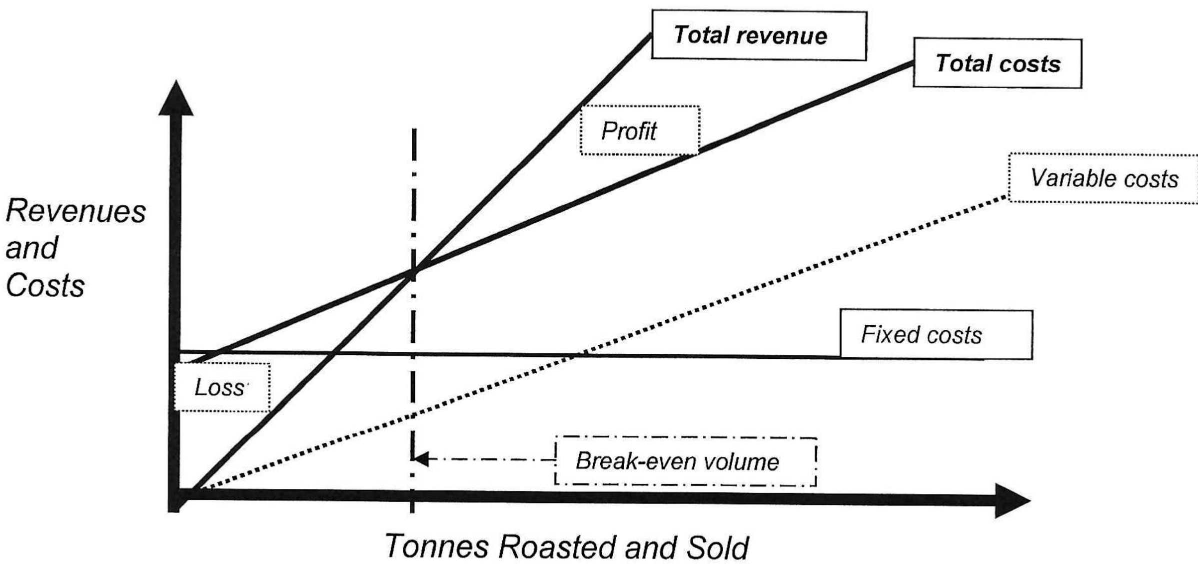
Since soymeal and roasted soybeans are not substitute products, the price of soymeal has less to do with the economics of feeding roasted soybeans; this is due to the by-pass proteins available in roasted soybeans, while soymeal proteins are highly degradable.

Micronizing
Operators in southern Ontario are charging between $40 and $50/tonne for micronizing based on the finished product. A base rate of $45/tonne of raw soybeans is used for analysis, as well as $70/tonne based on one way freight savings that can be included in the operating margin, if necessary.

6.7 Breakeven Analysis

Breakeven analysis is used to determine whether a project is feasible based on the fixed costs of operation, the variable (or operating costs) and the selling price (or gross margin in some cases). The difference between price and operating (or variable costs) is the per unit contribution of each unit of production to contribute to paying fixed costs, and subsequently a contribution to profits. This concept is illustrated in Figure 6.1.

Figure 6.1 Breakeven Analysis – Volume Roasted



Fixed annual costs of operation include a capital charge for the equipment (16% of the value to reflect depreciation and cost of capital, with payment of the capital cost over a 10 year period @10% interest), property costs (property taxes and space costs), and general management. To account for these other fixed costs, the capital charge is increase by 25% (e.g., $10,000 of additional fixed costs for an operation with a $40,000 per capital charge), for a fixed cost factor that is 20% of total capital costs. As a result the estimated annual fixed costs of operation are (as shown in Table 6.2):

- $194,000 for a standalone roasting operation,
- $110,000 for a roaster that is part of an existing grain handling operation, and
- $136,000 for a micronizer that is part of an existing grain handling operation.

Roasting

Operating costs include labour, energy, repair and maintenance, and general administration. These are estimated to be at least $15/tonne for a 5 tonne per hour roaster. With a $30/tonne gross margin on the raw soybeans, the break-even volumes based on a $15/tonne contribution margin are shown in Table 6.2 for a standalone roaster and a roaster that is part of an existing grain business.

With a $15/tonne profit contribution, a standalone roaster should process at least 13,000 tonnes of soybeans per year to realize a small operating profit. When a roaster is established at an existing grain business, the lower fixed costs allow for a break-even volume of 7,333 tonnes of soybeans roasted per year.

With a higher operating margin based on having some of the freight charge saving in the operating margin, a $40/tonne per unit contribution rate results in a breakeven volume of 4,850 tonnes for a standalone unit, and 2,750 tonnes for an integrated unit. After 2,750 tonnes are roasted does the business generate a profit. For example at 3,500 tonnes of raw soybeans roasted, the business's profit is $30,000.

Table 6.2 Soybean Roasting Break-Even Volumes

Equipment	Roaster – Established as a New Business	Roaster – Part of Existing Grain Business	Micronizer – Part of Existing Grain Business
Annual fixed costs	$194,000	$110,000	$136,000
Operating costs/tonne	$15/t	$15/t	$20/t
Gross profit margin/tonne	$30/t	$30/t	$45/t
Contribution rate/tonne	$15/t	$15/t	$25/t
Breakeven volume (tonnes)	12,900 tonnes	7,333 tonnes	5,440 tonnes
Higher contribution rate	$40/t	$40/t	$50/t
Breakeven volume (tonnes)	4,850 tonnes	2,750 tonnes	2,720 tonnes

Source: JRG Consulting Group calculations

The supply of soybeans in the region, of approximately 3,500 tonnes, and the demand for soy protein in the region (total demand of around 4,000 tonnes of soymeal) strongly suggests that the roasting operation should be configured as part of an existing grain enterprise, rather than being built as a standalone business. This saves on the capital costs of related infrastructure and allows for a breakeven volume that is consistent with soybean supply and demand for soy protein in the region.

This analysis also indicates that cost control and establishing the price of roasted soybeans (and the margin charged for roasting soybeans) is critical to the success of a roaster. This comment is in part due to the limited supply of soybeans in the region, and the limited demand in the region for soy protein (and roasted soybeans), before the price relationship changes to reflect the need to ship roasted product out of the region.

Micronizing

The annual fixed cost for a micronizer is 25 percent above the cost of using roasting equipment. With a $25/tonne contribution rate 5,440 tonnes need to be micronized each year before a profit is realized from the business. Given the demand for protein in the region and the supply of soybeans, micronizing does not appear feasible with a $45/tonne operating charge.

However, if the business can charge $70/tonne to micronize soybeans and realize a $50/tonne profit contribution rate, then 2,720 tonnes need to be processed before breakeven occurs. In this case, micronizing appears feasible given the demand for by-pass protein and the supply of soybeans (in an average year). Which technology package is chosen by the business depends on whether the expected benefits of micronizing, relative to roasting, exceed the incremental costs.

6.8 Factors Affecting Viability

A number of factors affect the viability of a soybeans roaster and include:

- the tonnes of roasted soybeans that would be directly used by livestock producers and by feed mills in the region,
- whether the roaster is part of an existing grain business or new greenfield business,
- whether the roaster is part of a feed mill or has a JV with a feed mill,
- the gross margin charged for roasting soybeans,
- whether used roasting/micronizing equipment can be purchased to lower the capital costs and annual fixed costs of operation,
- the price of soybeans in the region compared to soymeal,
- the volume roasted per hour of operation,
- the volume of soybeans in the region that can be roasted, and/or the volume of soybeans in nearby regions that can be purchased at a competitive price for roasting

These factors affecting viability are consistent with the observations provided by existing roasters and suppliers of roasting equipment.

7.0 Mechanical Crushing of Oilseeds and Feasibility

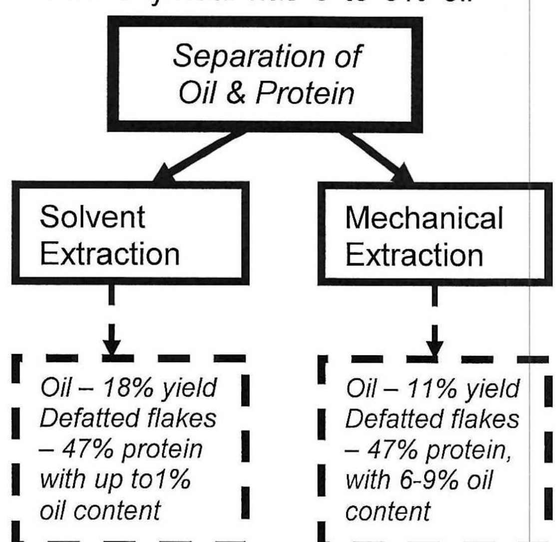
Mechanical extrusion can be used to crush canola and soybeans to separate the oil from the protein, or the meal. Oilseed production in the Temiskaming region ranges from 8,000 to 10,000 tonnes[21]. In the greater region, including Temiscamique and Verner areas, oilseed production can range from 10,400 tonnes to 14,700 tonnes. The feasibility analysis of extruding oilseeds is based on the demand for protein meals in the region and the supply that can attracted by a processing facility.

Available supply at 10,000 tonnes of oilseeds can be used for feasibility, however the local demand for protein is an estimated 5,750 tonnes in Temiskaming, prior to considering the protein demand from the Verner and Temiscamique areas. As well, the feed industry felt that local demand was likely closer to 4,500 tonnes of soy and canola meal. Meal production above these levels can result in lower margins realized on crushing based on the need to ship extra meal out of the region (and realize a lower value on the meal)[22].

Mechanical extrusion has two properties that affect the feed value of the resulting meal, one is that the soybean meal has around 6 to 9% oil[23] and the canola meal has around 8 to 11% oil left in the meal[24], and the other is that the process of extrusion produces by-pass proteins (RUP's) due to the heat generated in the extrusion process.

7.1 Mechanical Extrusion of Soybeans and Canola

Mechanical extrusion is a much different process than solvent extraction for separating the oil from the protein meal in soybeans and canola. In the case of soybeans, solvent extraction separates most of the oil from the meal, while mechanical extrusion does not. Regular soymeal has less than 1% oil content, while extruded soymeal has 6 to 9% oil content.



[21] See Table 2.5 where canola production is estimated to range from 6,000 to 7,500 tonnes and soybean production is estimated to range from 2,100 to 2,500 tonnes.
[22] This issue will be discussed in more detail later in this report.
[23] Raw soybeans are usually 18 to 22% oil, depending on the variety, implying that 65 to 67% of the oil is removed with extrusion.
[24] Canola has around 35 to 45% oil content, depending on the variety, implying that 72 to 75% of the oil is removed,

Mechanical extrusion can be considered for smaller operations as the technology exists for production volumes as low as 1 tonne per hour. In contrast, ADM and CanAmera can crush between 120 and 150 tonnes per hour, 24 hours a day.

The soymeal from mechanical extrusion has by-pass protein properties because the soybean is heated between 280°F and 300°F during the extrusion process. As a result, the resulting soymeal is not as protein degradeable as regular soymeal and has by-pass protein, with RUP's above 50%. The feed industry has been willing to pay $20 to $25/tonne premium over regular soymeal for the extruded soymeal, when the quality is consistent and predictable.

The inclusion rate for extruded soymeal in feed rations is up to 25% for cattle, 22 to 28% for turkeys and chickens, 20% for egg layers and 20 to 25% for hogs[25].

In a number of ways, extruded soymeal, if properly handled, has by-pass protein properties that are similar to roasted soybeans. Extruded soymeal can be considered a closer substitute to roasted soybeans than to regular solvent extracted soymeal.

7.2 Oilseed Crushing in Ontario

The primary use of soybeans in Ontario is crushing (processing) into soybean oil and soybean meal. In 1997/8, Ontario soybean processors crushed 1.6 million tonnes of soybeans. Soybean processors located in Ontario are illustrated in Table 7.1. ADM and CanAmera can both process canola and soybeans in their plants. These two large plants use solvent extraction to recover the oil from the fatted flakes, while the other smaller plants use mechanical expelling of the oil from the meal.

Table 7.1 Soybean Crushers in Ontario

Company	Location	Daily Capacity*
ADM Agri-Industries	Windsor	3,600t
CanAmera	Hamilton	3,000t
Cold Springs Farms	Thamesford	100t
Jackson Seed Service	Dresden	40t
Sunfield Oilseeds – Underwood Bros.	Wingham	100t
Tri County Protein Corporation	Iroquois	50t

* Daily capacity of raw product
Source: AAFC, Bi-Weekly Bulletin " *Canada: Primary Processing of Grains and Oilseeds"* Vol. 10 No. 13 and JRG Consulting Group estimates

The major products for soybean crushers are soybean oil and soybean meal. Ontario crushers typically supply oil to domestic oil refiners and soybean meal to feed manufacturers. Some oil is exported, as well as some meal, with Ontario typically being a net importer of meal. See Annex III for a brief SWOT compiled on solvent based and extruded crushers.

[25] Based on information provided by Insta-Pro.

Soybean Crushers (Mechanical Extruding and Expelling)

There are four[26] smaller crushers operating in Ontario that use the mechanical expelling process, versus hexane extraction for separating the oil from the meal. Each of these companies entered the business for somewhat different reasons, but they all share some common issues (problems), which is how to generate adequate crush margins when:

- 6% to 8% of the oil is left in the soy flakes (meal) after crushing,
- buyers of crude oil will not pay a premium for oil extracted without solvents, and
- most buyers of the soy meal (which are in the feed industry) will not pay a premium for the soy meal relative to soymeal produced by solvent extraction, with less than 1% oil content. The feed industry is buying on a protein basis, notwithstanding the fact that energy is usually added to the complete feed.

For some of these crushers, the crushing operation is part of an integrated operation, such as crushing the soybeans:

- for the meal, as a major input into a livestock feed manufacturing, or livestock feeding operation, or
- to improve the net return on soybeans assembled for specialty markets, but which is off-grade due to splits, cracks, undersize, etc.
- In these operations, the crush margin may be acceptable given the integrated nature of the operation.

This industry is looking at different ways to improve crush margins, ranging from:

- crushing organic soybeans for the organic soy oil, and organic soy meal markets.
- selling some of the meal as a by-pass protein meal,
- investigating ways to extract more of the oil from the meal,
- positioning the oil in certain market segments as a natural solvent free oil,
- adding value to the oil through oil refining,
- selling into select niche markets, and
- using the soyflakes in other edible and non-edible uses, such as in the pet food industry, or milling for the edible flour market, or as a source for protein extraction.

Without alternative end-uses (or products developed) for the soy oil and/or the soymeal, where the value is realized and the crushing margin is improved, some of crushing operations have difficulty investing in financing future growth or in sustaining a viable stand-alone crushing operation.

In the United States, there are a also mechanical expellers (crushers), such as Natural Products Inc., that provide an edible product from the soy flake, that is a low fat soy flours with 6 to 8% fat in the flour. Iowa Soy Specialties along with Insta-Pro (an equipment manufacturer) are starting to provide an extruded texturized soy protein from these low fat soy flakes. This suggests that the low fat soy flakes can be used in food market. These low fat soy flakes may also be the raw material for some soy foods, such as tofu, versus starting the process with a soybean.

[26] In 1999, there were 6 of the smaller crushers operating in Ontario.

Soybean Crushers (Solvent Extraction)

Ontario's two crushers (CanAmera and ADM) that use the solvent extraction process account for over 95% of the soybeans crushed in the province, and utilize 65% of the soybean crop. These two crushers are in the business of crushing soybeans to supply crude soy oil to their respective refining operations. A major focus of the business is on the oilseed side of the soybean, since each company has considerable investments in the refining of oil into various refined soy oil products.

At the crushing stage, there is more value to the crushers in the meal, than in the crude oil, however, the refining process allows for more value creation of the oil. (In contrast, there are more earnings from the oil with canola). The two crushers have the capability to shift one of their lines to crushing canola. The decision to crush canola is based on the demands for each oil and the crush margin for soybeans and canola.

The industry is in equilibrium in Ontario, with sufficient capacity to produce the soy bean oil needed for domestic markets. Over time there has been a general shift from soy oil to canola oil in salad dressings and more recently with margarines. This has created some excess soy oil relative to soymeal. Some refined oil is exported into the US market since the soy oil and canola oil produced by these two plants is sufficient for the eastern Canadian market. However, the eastern Canadian market is short of soy meal. Around $100 million of soy meal is imported into eastern Canada for the livestock industry.

7.3 Extruding Soybeans

The process of extruding soybeans for oil and meal is relatively simple. Soybeans are first cleaned and usually pre-heated and dried (to improve oil and meal separation), and then extruded. Extrusion is a process that uses friction through having the soybean passing through a barrel (with increasing restriction) using a screw. The screw process generates heat and pressure, and then when the soy product is released from the screw barrel, the discharged product has a drop in pressure which results in expansion of the soy product. This expansion ruptures the starch cells and the structure of the cells, and vapourizes moisture. The result is a separating of the oil from the cell membranes (starch and protein).

The process used to extrude soybeans involves the following steps:

1. receiving
2. cleaning
3. pre-heating and drying (to about 9% moisture)
4. de-hulling (in some operations for poultry and hog diets)
5. extrusion (with screw presses)
6. expelling the oil from the meal (with expellers or presses)
7. cooling the meal
8. flaking or milling the meal
9. storage and/or shipment of the meal
10. storage and shipment of the crude oil

As with roasting soybeans, there is some shrink involved, both in handling and due to the loss in moisture, particularly the extracted oil. A four percent shrink factor can be considered. Some operators add some moisture back to the meal to have meal close to 11 to 13% moisture.

7.4 Extruding Canola

The same process and equipment can be used for extruding canola seed into its oil and meal components. However, for a high oil extraction rate for canola an expelling process is used prior to the extrusion screw. This requirement for canola increases the capital cost of the operation by another $100,000 to $150,000 for expellers and related equipment.

7.5 Equipment Requirements and Capital Costs

Extrusion and expelling equipment is available from Insta-Pro in the United States[27]. Capacity of the equipment ranges from 300 kg/hour to 6 tonnes per hour. Additional plant capacity can be achieved through adding more extruders. Extruders do not have to be operated 24 hours a day, and one person is required to monitor and operate the equipment while operating, whether the equipment is 1 tonne per hour or a 5 tonne per hour extruder. Much of the capital cost of the related infrastructure has less to do with the volume handled, and more to do with the equipment itself. Consequently, capital costs are assembled for equipment that will provide for the local feed market of 5,000 tonnes of meal, requiring 2,500 tonnes of soybeans and close to 4,000 tonnes of canola (one tonne of extruded canola meal requires around 1.4 tonnes of canola seed, and 1 tonne of extruded soymeal requires around 1.15 tonnes of soybeans). This suggests that 6,500 tonnes of oilseeds should be processed in a year, or 125 tonnes per week.

Based on operating 35 hours per week, equipment is required to process 3.5 to 4 tonnes per hour of operation. Insta-Pro has an extruder (Model 9600 priced at $225,000) that can process up to 3.6 tonnes per hour. If two shifts per week can be accommodated, then a pair of smaller extruders (Model 2500 priced at $76,000) can be used with each having a capacity of up to 1.35 tonnes per hour. Two of these units operating around 50 hours per week should provide the capacity needed to satisfy the local feed market.

After extrusion, expellers are required to press the oil from the meal. With one Model 9600 extruder, two expellers (model 4500 priced at $141,000) with a 1.8 to 1.9 tonne per hour capacity are required. When Model 2500 extruders are used, then three (Model 1500 valued at $70,000) expeller presses are required. Cooling the meal to ambient temperatures is desirable. Insta-Pro has a cooler (Model 3002 valued at $42,000) that can cool extruded meal up to 4.5 tonnes per hour. Some operators use fans and other equipment to cool the meal, as a way to lower costs.

Canola requires a pre-press operation prior to extrusion, thus another set of presses are required in front of the extruder for canola seed extrusion. This increases the capital costs by approximately $150,000.

[27] Other manufacturers also provide equipment, including Anderson expanders (extruders) and French expellers (presses).

The building and equipment required to operate a standalone extrusion plant are listed below.

Equipment and Services Required

1. Weigh scales for up to 40 tonne loads
2. Analytical equipment – moisture etc,
3. Receiving pit and elevation to two 10,000 bushel bins
4. Conveyance from storage to cleaner
5. Grain cleaner
6. Conveyance from cleaner to surge bin
7. Conical surge bin
8. Metered augering from surge bin to dryer/heater
9. Belt dryer/heater
10. Dehulling of beans (may not be required)
11. Metered conveyance of 9% moisture product to extruders (for soybeans) and to pre-presses (for canola)
12. Expeller presses for canola
13. Augering from canola presses to the extruders
14. Extruders (screw presses)
15. Augering from the extruders to the expeller presses
16. Expeller presses
17. Oil screening tank
18. Oil storage tanks (two tanks 37 to 40 tonnes each)
19. Meal cooler
20. Conveyance from cooling bin to a roller mill or flaker
21. Mill or flaker
22. Conveyance into two overhead 3,000 bushel tanks
23. Support for two overhead bins
24. Building to contain drying, dehulling, pre-press operation, extrusion, expelling, cooling, milling, and oil storage
25. Ancillary equipment, such as motors, pumps, etc
26. Installation and commissioning costs

The associated capital costs are illustrated in Table 7.2 for a crushing operation that is a standalone business, a crusher that is integrated into an existing grain business that operates at most one shift per week, and an integrated crusher that can operate more than one shift per week.

Table 7.2 Extrusion Equipment, Related Equipment and Costs

Equipment	Crusher – Established as a New Business - one shift -	Crusher – Part of Existing Grain Business - one shift -	Crusher – Part of Existing Grain Business - two-shifts -
Weigh scales and related	$100,000		
Analytical equipment	$13,000		
Receiving pit and elevation leg	$90,000		
Storage for soybeans & canola	$100,000		
Cleaning equipment & augers	$145,000	$10,000	$10,000
Dryer/heater	$90,000	$90,000	$90,000
Surge bin & augers	$30,000	$30,000	$30,000
Pre-presses	$282,000	$282,000	$210,000
Extruder	$225,000	$225,000	$150,000
Conveying from extruders	$13,000	$13,000	$13,000
Expeller presses	$282,000	$282,000	$210,000
Extrude meal cooler	$40,000	$40,000	$40,000
Oil screening tank	$40,000	$40,000	$40,000
Crude oil storage tanks	$40,000	$40,000	$40,000
Oil pumps and piping	$5,000	$5,000	$5,000
Surge bin and augers for meal	$20,000	$20,000	$20,000
Mill/flaker	$55,000	$55,000	$55,000
Storage bins and augers	$85,000	$85,000	$85,000
Conveying from cooler to mill	$6,000	$6,000	$6,000
Milling or flaking equipment	$75,000	$75,000	$75,000
Building	$250,000	$250,000	$250,000
Installation & commissioning	$200,000	$200,000	$200,000
Ancillary and other	$40,000	$40,000	$40,000
Total	***$2,226,000***	***$1,788,000***	***$1,569,000***

Source: Equipment costs as indicated in prior footnotes and mill systems costs based on information provided by Mitchell Mill Systems, Newton, Ontario (519) 595-8747

The capital costs for a standalone extrusion plant is estimated to be $2.2 million based on estimating the equipment required and the related costs[28]. Insta-Pro provided information to suggest that the capital costs for an extruder for the volumes considered would be in the $2.1 to $2.2 million range (based on U.S. experience). Integrating the business with an existing grain handling facility will save at least $300,000 in capital costs. When equipment is purchased based on utilizing the equipment for more than one production shift lowers the capital costs by $200,000.

[28] It should be noted that these are estimates only based on information supplied to JRG Consulting Group by equipment suppliers and by millwrights (based on information provided to them). These suppliers and JRG Consulting Group are not responsible for ensuring that these costs would be incurred. They are used for budgeting and feasibility purposes.

7.6 Operating Costs for Mechanical Extrusion of Oilseeds

The major operating costs for extruding product is electricity and labour. Extruding requires significant energy, with two (Model 2500 extruders) using 180 KWH of electricity and the three expellers using 78 KWH of electricity. When additional presses are required for canola, this increases by another 78 KWH. Information supplied by Insta-Pro indicated that ancillary equipment will draw another 100 KWH of electricity. Thus total energy usage is expected to be 436 KWH for canola and 358 for soybeans. Using electricity rates of 6 cents per KWH, the electricity charge is $26/hour for canola and $21.50 for soybeans. The per tonne charge corresponds to $8.60 for soybeans and $10.40 fro canola. Gas charges for the pre-heating are estimated at another $1/tonne. The electricity charge does not vary considerable on a per tonne basis when the larger equipment is used.

One operator is required to oversee, monitor, and maintain the equipment. Based on $20/hour wages and benefits, the per tonne labour costs is $5.40 for a production volume of 3.5 tonnes/hour. Likewise, a 2.5 tonne per hour production rate results in a $8/tonne of raw material labour charge.

Operators of extrusion equipment refer to the importance of repair and maintenance with both the extrusion equipment and the conveyance equipment, Insta-Pro uses $(US)2.00/ton for budgeting purposes. A repair and maintenance cost of $2.50/tonne is used here.

Per tonne operating costs at 2.5 tonnes of crushing per hour are:
- $21.90 for canola, and
- $20.10 for soybeans.

Per tonne operating costs at 3.5 tonnes of crushing per hour are:
- $19.30 for canola, and
- $17.50 for soybeans.

For analytical purposes, $21.00/hour will be used for crushing at 2.5 tonnes per hour and $18.50/tonne for crushing at 3.5 tonnes per hour.

7.8 Vegetable Oils

Mechanical crushing, as with solvent extraction, generates crude oil, which includes the gums present in the oil. The Chicago futures contract for oil is for crude oil, not degummed. However, most trading in oil is based on a degummed oil. Chicago cash oil is currently $(US) 0.13/lb, while the nearby futures is trading at $0.145/lb. These are low oil prices, with oil not trading at these levels since the late 1960's and early 1970's. In fact in 1990's oil was trading between 22 and 27 cents (US) per pound. Oil valued at 13 cents/lb in US funds translates into:
- 28.6 cents per kilogram in US funds,
- 19.8 cents per pound in Canadian funds, and
- 43.5 cents per kilogram in Canadian funds.

An issue for mechanical extruders in Ontario is to access markets that will pay this edible value for oil. For example, most of the small crushers in Ontario used to sell crude oil, with gums not removed, to AC HUMKO in the US, but they stopped buying crude oil, and are now buying refined oil from ADM. Similarly, Unilever used to buy degummed oil, but has existed the refining business.

ADM and CanAmera have indicated that they are not interested in buying crude oil, or degummed oil. This makes sense since they are in the business of crushing to supply their refineries and to sell the meal products, and want to get as much value out of the raw seed. This leaves mechanical crushers with niche markets and the animal feed market. As a result the Chicago price of $435/tonne is difficult to realize in this market environment, and can affect the economics of crushing oilseeds, particularly canola. As a result the value of unrefined oil is low, reflecting both the low values of refined oil and the need to sell crude oil into feed markets to compete with rerendered product, such as restaurant grease, as sources of energy in the animal feed markets. As noted in Section 3.0, small crushers are receiving between $200 and $280/tonne for crude oil.

Two opportunities may open up within the next year. One is fairly definite, where Thumb Oilseed Producers' Co-operative in Michigan will have a small-scale refinery operating in June of 2001, and will purchase up to 12 tonnes of oil per day to operate at full capacity. In this case the value of oil should be related to the Chicago futures minus the basis for freight and local basis. Chicago crude oil has a cash basis of 2 cents under the futures and this basis will likely exist in Michigan as well. With freight cost being closer to $70/tonne[29] (just over 3 cents per pound) into Michigan for oil. With Chicago oil at 13 cents per pound, this is equivalent to $435 per tonne at Michigan. With freight of $70 tonne and likely another $40/tonne for degumming, then the net price in Temiskaming could be $325/tonne.

The other opportunity is that a vegetable oil bottler in southern Ontario is considering an investment in a vegetable oil refinery to utilize some of the non-solvent oil available from mechanical crushers. This operation will be based on refining between 30 and 50 tonnes of oil per day. Freight rates from Temiskaming to the GTA are around $40/tonne for crude oil, and should net $355 to $360 in today's market.

The feasibility of mechanical extrusion will consider the current reality for crude oil, and the markets that may open up with the small-scale refineries.

7.9 Operating Margins - Soybeans

Existing operators of extrusion equipment speak about the need to achieve economies of scale by crushing over 20,000 tonnes a year, and the need to have adequate margins to realize a profit. The region does not have more than 20,000 tonnes of oilseeds for processing; therefore, the focus must be on the margin charged for crushing soybeans and canola. Due to the freight factor and that the basis for meal is $25/tonne above Hamilton and the basis for oilseeds is $25 below Hamilton, the crushing operation already has a

[29] Freight on oil is higher due to the lower weights that can be shipped and the longer distance relative to the GTA.

$50/tonne margin, before considering crushing margins realized in other parts of Ontario, and realizing a premium for extruded meal over regular solvent extracted meal.

Margins realized are based on the values realized for the oil and the meal, the shrink factor, and the cost of raw materials. These gross margins for crushing are illustrated in Table 7.3 for soybeans and Table 7.4 for canola. The margins in these tables are based on the assumptions that;

- After accounting for 4.5% shrink and waste, that 12% of the soybean is oil, and 83.5% is meal (this implies that the soybean was around 20% oil, leaving 8% oil in the meal,
- the crushing plant takes all of the margin and does not offer a higher return than producers could receive by shipping oilseeds south
- an average freight rate of $25 for meal into Temiskaming and for oilseeds out of Temiskaming (these rates can be much lower in both directions when they are a backhaul (e.g., $20 to ship beans to Hamilton based on a backhaul),
- that extruded soymeal can attract a $25/tonne premium over for regular soymeal in dairy rations (some operators indicate that the true value is much higher due to the by-pass proteins) – this is equivalent to $21/tonne per tonne of raw soybeans, and
- that crude oil is valued at $0.25/kg in southern Ontario, and freight to move oil into the south is $0.04/kg ($40/tonne).

Based on these assumptions, a soybean crush plant (using December 2000 and January 2001 values) would realize a $91/tonne operating margin. The same pant in southern Ontario would only realize a $50/tonne of soybean margin. The $41/tonne difference is the freight cost that is fully used by the crusher for operating margin and not passed back to oilseed producers (through higher prices) or feed manufacturers 9through lower meal prices).

In the event that crushing is feasible, then pricing could reflect some of the value back to other segments in the supply chain.

Table 7.3 Margins for Mechanically Crushing Soybeans – Taking all the Margin

Item	Yield	Volume	S. Price	S. Value	N. Price	N. Value
		kgs/tonne	$/tonne	value	$/tonne	value
Meal	83.5%	835	310.00	259	335.00	280
Oil	12.0%	120	250.00	30	210.00	25
Shrink	4.0%	40	0.00	-	0.00	-
Waste	0.5%	5	0.00	-	0.00	-
Meal premium			25.00	21	25.00	21
Total	100.0%	1,000		310		326
Soybeans		1,000	260.00	260	235.00	235
Gross margin (per tonne of soybean)				*50*		*91*

Source: JRG Consulting Group calculations

If crushing results in more soymeal than can be absorbed by the livestock industry in the Temiskaming region, then meal must be shipped out of the region. In this case, the gross margin referred to in Table 7.3 decreases to $50/tonne of raw soybeans (reflecting the reduction in soymeal values from an import replacement to an export value).

Notwithstanding these margins, it should be realized that the value of meal relative to soybeans is higher than normal (due to strong European demand for soymeal). As well, the price of oil is low and is expected to remain at this value (13 to 15 cents/lb in Chicago) due to the abundant supplies of vegetable oil around the globe.

If the crushing operation can sell crude oil to the expected refinery in Michigan and net $325/tonne versus $210, then the margin from crushing soybeans increases by $14/tonne to $105/tonne..

7.10 Historic Crush Margins

Crush margins for crushing soybeans and canola based on solvent extraction is provided in Table 7.4. This Table shows that in the first six months of 2000, a soybean crusher in Southern Ontario would be able to realize a $58/tonne of soybean gross margin. The crush margin for soybeans has varied from a low of $43/tonne to a high of $71/tonne on a semi-annual basis. In some weeks it has been over $100/tonne (in 1997) and as low as $39/tonne (in 1999). With the low prices of oil, in 2000 the crush margins are supported by meal prices being above soybean prices.

Table 7.4 Calculated Crush Margins for Solvent Extraction Crushing

Date	Soybean	Canola	Soymeal	Soy Oil	Canola meal	Soy Margin	Canola Margin
				$/tonne			
1996 - 1st	370	442	360	766	234	69	4
1996 - 2nd	369	451	362	730	235	64	-19
1997 - 1st	395	442	392	721	255	61	-2
1997 - 2nd	355	403	351	736	228	71	28
1998 - 1st	331	436	273	849	177	55	9
1998 - 2nd	298	403	240	821	156	57	18
1999 - 1st	257	367	219	633	142	43	-29
1999 - 2nd	242	302	235	533	153	51	2
2000 - 1st	268	282	275	544	179	58	42
2000 - 2nd	260	280	296	488	192	58	22

Source; JRG Consulting Group calculations based on weekly data provided by AAFC, Winnipeg
Note Margins are for solvent extractions and are based on 0.5% shrink for canola and 0.75% for soybeans; with canola meal prices valued at 65% of soybean meal prices in Ontario. Soybean prices are basis Chatham, Canola basis Winnipeg, Soymeal at Hamilton and soy oil at Chicago.

These margins in Table 7.4 for soybeans are higher than what a mechanical extruder can realize when the oil or meal does not command a premium price over solvent based extraction. This is due to the oil left in the meal, with oil value more on a per kilogram basis than meal. As well, as outlined elsewhere it is more difficult for a non-integrated crusher to realize the Chicago value of crude oil in today's market.
Inferred canola crushing margins are also provided in Table 7.4, illustrating a smaller margin, a more variable margin, and at times a negative margin. Computed margins have been as low as -$50/tonne in some weeks in 1999, and have been as high as $60/tonne

in 2000. Actual margins could be higher if canola oil is trading at a premium to soybean oil (e.g., a 4 cent a kilogram premium translates into another $16/tonne of crush margin).

The crush margins received from crushing canola by mechanical extrusion in a non-integrated plant (not part of refinery) will be lower than illustrated in table 7.4 due to two reasons;

- 11% of the oil will be left in the canola meal, which has a much lower value than soybean meal (canola oil is over 45 cents per kilogram, while canola meal is around 20 cents per kilogram.
- The edible value of the crude oil in southern Ontario may be difficult to realize in Temiskaming due to factors such as freight and end use buyers.

7.11 Operating Margins - Canola

Canola crush margins for mechanical extrusion are reported in Table 7.5. The value of canola meal and the current low value of oil result in negative crush margins for canola seed.

Table 7.5 Gross Margins for Crushing Canola – Taking all of the Margin

Item	Yield	Volume	S. Price	S. Value	N. Price	N. Value
		kgs/tonne	$/tonne	value	$/tonne	value
Meal	65.5%	655	200.00	131	225.00	147
Oil	29.0%	290	250.00	73	210.00	61
Shrink	5.0%	50	0.00	-	0.00	-
Waste	0.5%	5	0.00	-	0.00	-
Meal premium			25.00	16	25.00	16
Total	100.0%	1,000		220		225
Canola		1,000	260.00	260	235.00	235
Gross margin (per tonne of canola)				(40)		(10)

Source: JRG Consulting Group calculations

If the operation in Temiskaming were able to supply the expected refinery in Michigan (or the proposed refinery in the GTA), then a $23/tonne margin can be realized from canola crushing (see Table 7.6), which is still not a value that can sustain a crush plant. However, a general strengthening of oil prices should help improve margins.

It should be noted that a solvent-based canola crusher can extract out all of the oil, and as a result the oil in a tonne of canola has more value than the meal. As shown here, this does not occur with mechanical extraction. The technology is not designed to extract all of the higher valued oil.

Table 7.6 Gross Margins for Crushing Canola – New Market for Canola Oil

Item	Yield	Volume	S. Price	S. Value	N. Price	N. Value
		kgs/tonne	$/tonne	value	$/tonne	value
Meal	65.5%	655	200.00	131	225.00	147
Oil	29.0%	290	365.00	106	325.00	94
Shrink	5.0%	50	0.00	-	0.00	-
Waste	0.5%	5	0.00	-	0.00	-
Meal premium			25.00	16	25.00	16
Total	100.0%	1,000		253		258
Canola		1,000	260.00	260	235.00	235
Gross margin (per tonne of canola)				*(7)*		*23*

Source: JRG Consulting Group calculations

7.12 Breakeven Analysis

The breakeven analysis for mechanical extraction is illustrated in Table 7.7. The first column reports the contribution rate of $68.50 required to breakeven crushing 6,500 tonnes of raw product. This results in a gross profit margin of $87.50/tonne for a standalone operation. This is achievable if all the product were soybeans. However, 6,500 tonnes of soybeans are not available in the region.

The second column shows the required gross profit margin for a crusher that is integrated with a grain business. This business requires a gross profit margin of $73.50/tonne to break even. When soybeans account for 2,500 tonnes and a $90/tonne gross margin and canola has 4,000 tonnes of through put, then canola must generate a margin of $63/tonne from crushing. Table 7.5 and Table 7.6 suggest that this may be difficult to achieve.

Table 7.7 Oilseed Extrusion Break-Even Volumes

Equipment	Crusher – Established as a New Business - one shift -	Crusher – Part of Existing Grain Business - one shift -	Crusher – Part of Existing Grain Business - two-shifts -
Hourly extruding rate	*3.5 tonnes/hour*	*3.5 tonnes/hour*	*2.5 tonnes/hour*
Annual fixed costs	$445,200	$357,600	$311,800
Operating costs/tonne	$18.50/t	$18.50/t	$21.00/t
Gross profit margin/tonne	$87/t	$73.50/t	$69.00/t
Contribution rate/tonne	$68.50/t	$55.00/t	$48.00/t
Breakeven volume (tonnes)	6,500 tonnes	6,500 tonnes	6,500 tonnes

Source: JRG Consulting Group calculations

The last column of Table 7.7 illustrates the breakeven gross margin required to crush 6,500 tones in the region when the plant can operate more than one shift per day. The lower capital costs associated with having less hourly capacity and more than one shift of operation results in a required $69/tonne gross margin to break even. Even if soybeans account for 50% of the crush, canola must contribute a $48/tonne margin. This appears difficult in today's market.

Canola has smaller margins in today's environment because of the low price of oil. Canola, which is an oilseed, while soybeans are a protein seed, and a negative with mechanical extrusion is that (1) the extrusion technology leaves around 11% of the higher valued oil co-product in the meal, and (2) the higher oil value is difficult to realize unless investments are made into further refining, or developing niche markets for the canola oil.

This analysis suggests that crushing soybeans is profitable if enough volume can be attracted through the plant. It does not appear that crushing canola using mechanical extrusion provides sufficient margin to justify this approach – this is likely due to canola being a true oilseed, with significantly more value from the oil than the meal when crushed using solvent extraction techniques[30].

7.13 Options for Consideration

There are some options to consider to increase the viability of mechanical extrusion, they include:

- ***Sourcing used equipment***. For example, Nature's milling may be interested in selling their equipment and if their equipment, which has a new value of $600,000 can be purchased for a used price of, for example, $200,000, then capital costs are reduced to $1.2 million (from $1.6 million). The lower capital costs results in lowering the breakeven crush margin by $11/tonne to $58/tonne (based on 6,500 tonnes of crush) – See table 7.8.

- ***Marketing the surplus meal in eastern Ontario and Quebec*** The price of meal in eastern Ontario and Quebec is $22/tonne above Hamilton values. Freight from Temiskaming to eastern Ontario and Quebec is based on back haul opportunities and is around $30/tonne. When the crusher produces more meal than required in the region, the excess can be shipped further east to avoid competing in the southern Ontario market. In this case, the value of meal switches from Hamilton plus $25/tonne to Hamilton minus $8/tonne; this reduces the margin per tonne of oilseed by $28 for soybeans and $22/t for canola. If half of the meal is shipped out of the region and must be sold at this lower value, then the average crush margin may be $60 on local sales and $35 on eastern sales, resulting in an average margin of $47.50, or gross profit contribution of $26.50. As illustrated in Table 7.8, this scenario requires 11,767 tonnes of volume to break even. All oilseeds in the broader region would have to be crushed to reach this break-even volume.

- ***Purchase used equipment and market surplus meal to the east*** Combining the above two options indicates that 9,056 tonne would have to be crushed before breakeven occurs. This option can also include situations where more of the existing

[30] With canola 40% oil and with oil valued at over $0.40 kg and the rest meal values at under $0.20/kg, the oil generates more value with solvent extraction. This is not the case with extrusion as less oil is extracted (28 to 29%) and its value is hard to realize without being part of a supply chain linked to a consumer market. The $160 oil value in a tonne of canola based on solvent extraction can decrease to under $80 based on mechanical extraction.

building and grain handling equipment from the existing grain business can be used by the crush operation. Clearly, lowering the fixed costs of operation increases the feasibility and profitability of a crush operation. The last column of table 78 illustrates the situation where annual fixed costs can be decreased to $180,000. By so doing, annual crush of 6,792 tonnes are required before the operation turns a profit, when the average gross margin is $47.50/tonne of raw material.

- ***Only canola is crushed*** If a crush facility is built and only canola is available for crushing by mechanical extrusion, then the crush business will require considerable throughput to cover the fixed costs of the business due to the lower gross margins realized. If canola can support a $40/tonne margin (in Table 7.6 the margin is $23/tonne), then based on $21/tonne operating costs[31], the business would have to crush 9,500 tonnes of canola to break even, when fixed costs are $180,000/annum.

Table 7.8 Integrated Oilseed Extrusion Options and Break-Even

Equipment	Purchase Used Equipment	Ship Surplus Meal East	Purchase Used Equipment, Ship Meal East	Purchase Used Equipment, Ship Meal East
Hourly extruding rate	*2.5 t/hour*	*2.5 t/hour*	*2.5 t/hour*	*2.5 t/hour*
Annual fixed costs	$240,000	$311,800	$240,000	$180,000
Operating costs/tonne	$21.00/t	$21.00/t	$21.00/t	$21.00/t
Gross profit margin/tonne	$58.00/t	$47.50/t	$47.50/t	$47.50/t
Contribution rate/tonne	$37.00/t	$26.50/t	$26.50/t	$26.50/t
Breakeven volume (tonnes)	6,500 tonnes	11,766 tonne	9,056 tonnes	6,792 tonnes

Source: JRG Consulting Group calculations

These options indicate that costs must be controlled, minimal volumes are required to exploit scale economies, and sufficient margin is required on each tonne crushed.

7.14 Factors Affecting Viability

- Volume of oilseeds crushed – the more the better
- Crushing soybeans appears viable, but the issue of whether the crop is a long term part of crop rotation in the region is still an issue
- Generating sufficient margin on extruding canola – analysis appears to suggest that soybeans would subsidize the canola crush
- Having low fixed costs of operation
- Realizing oil values that reflect edible uses
- Providing a benefit to local growers over what they would receive by shipping it to Hamilton for crushing
- Realizing niche markets for oil and meal, such as non-GMO oils (when linked with a small scale refinery

Many of these factors are consistent with the observations provided by operators of small scale crushing plants.

[31] Operating costs for canola are almost $2/tonne higher than soybeans, as outlined in section 7.6.

Annex I

Annex II Soy Products and Their Uses

Whole Soybean Products			
Full Fat Soy Flour Bread Candy Doughnut mix Frozen desserts Instant milk powder Pancake flour Pan grease extenders Pie crust Soy yogurt Sweet goods	**Roasted Soybeans** Candies Cookie ingredients Crackers Dietary items Soynuts Soynut butter Soy Coffee Toppings	**Seed** **Soy Sprouts** **Fresh Green Soybean** **Soy Hulls** Fibre	**Traditional Soyfoods** Miso Natto Soya sauce Soymilk Soy based desserts Tempeh Tofu Meat analogs
Soy Protein (Flour, Isolates) Products		***Soy Protein (Soy meal) Products***	
Edible Uses Alimentary pastes Anti disease agent Baby foods Bakery ingredients Beer & ale Candy/confections Cereals Diet food products Food drinks Grits Health food supplements Hypo-allergenic milk Nutraceuticals (isoflavones) Meat analogs Meat extenders Noodles Prepared mixes Sausage casings Yeast	**Technical Uses** Adhesives Analytical reagents Antibiotics Asphalt emulsions Binders – wood Building materials Cleansing agents Cosmetics Fermentation aids Films for packaging Inks Leather substitutes Paints – water based Particle board Plastics Polyesters Pharmaceuticals Pesticides Textiles	**Feed Uses** Aquaculture Bee foods Calf milk replacers Fish food Livestock feeds Poultry feeds Protein concentrates Pet foods	**Hulls** Bioremediation Dairy feed Fibre source High fibre breads Toxic spill clean-up agent
	Refined Soy Oil		***Soybean Lecithin***

Edible Uses
Coffee creamers
Cooking oils
Filled milk
Margarine
Mayonnaise
Medicinals
Pharmaceuticals
Salad dressing
Salad oils
Sandwich spreads
Shortenings
	Technical Uses
	Anti-corrosion agents
	Anti-foam agents
	Anti-static agents
	Asphalt release agents
	Buffing compounds
	Candles
	Caulking compounds
	Concrete releasers
	Core oils
	Crayons
	Disinfectants
	Dust control agents
	Electrical insulation
	Epoxies
	Hydraulic fluids
	Inks
	Linoleum backing
	Lubricants
		Technical Uses
		Metal – castings
		Oiled fabrics
		Paints
		Pesticides
		Plasticizers
		Polishes
		Protective coatings
		Putty
		Solvents
		Soap/Shampoo
		Soy diesel fuel
		Vinyl plastics
		Wall board
		Waterproof cement
			Edible Uses
			Emulsifying agents
			  Bakery
			  Candy Coatings
			  Pharmaceuticals
			Nutritional Uses
			  Dietary
			  Medical
			Technical Uses
			Anti-foam agents
			  Alcohol
			  Yeast
			Anti-splattering agents
			  Margarine
			Dispersing agents
			  Shortening
			Wetting agents
			  Calf milk replacers
			  Cosmetics
			  Paint pigments

Glycerol	***Fatty Acids***	***Sterols***	

Annex III

SWOT – Soybean Crushers (Mechanical Extruding and Expelling)

Strengths and Opportunities	Weaknesses and Threats
Strengths ➢ Serving niche and integrated markets, such as soy meal for livestock and feed manufacturing operations **Opportunities** ➢ developing markets for solvent free oils ➢ finding unique markets, and or developing products based on the 7% oil flakes (e.g., low fat soyflours, TVP, etc) ➢ using the soy flake as the raw material for traditional soy food products ➢ integrating forward into oil refining	**Weaknesses** ➢ poor crush margins ➢ some crushing facilities not operating at full capacity – due to crush margins ➢ staff with technical knowledge to develop new markets or products based on the solvent free oil and the 7% oil flakes **Threats** ➢ continuation of lower margins resulting from not extracting all of the higher value oil from the flakes, and/or not obtaining a premium for either the oil or the meal

SWOT – Soybean Crushers (Solvent Extraction)

Strengths and Opportunities	Weaknesses and Threats
Strengths ➢ Crush plants operating near or at capacity ➢ Crush operations integrated with refining capability **Opportunities** ➢ market for flakes (meal) for Ontario based protein extractors (concentrates, isolates, TVP) if Ontario is a source of non-GMO soybeans ➢ with sufficient volume in selected products, investing in soy flour capacity or TVP capability	**Weaknesses** ➢ **Threats** ➢ Reduction in Ontario based soybean production ➢ Strong demand for non-GMO beans in export markets