Assessment of the Export Potential of Canadian Oilseed Presses to Nepal

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Monday 2:30 PM

AGR1110

Monday, November 24, 2014

This paper was prepared to evaluate the potential benefits of and obstacles to exporting oilseed presses from Canada to Nepal. These advantages and disadvantages are outlined in detail within two major sections. Specifically, a thorough description of the oilseed press itself is followed by a clear investigation of its prospective benefits for Nepal. An analysis of possible local and global competitors is provided after these two sections. Lastly, the data outlined in this report is culminated in a summary and list of recommendations. These are aimed at enhancing the opportunities related to the export of Canadian oilseed presses to Nepal. These opportunities have a great potential to be applicable to other developing nations as well.

Part I: Information pertaining to Canadian oilseed presses and oilseed presses in general

i) Oilseed press designs

Breaking it down to its simplest formulation, the process that oilseed presses carry out appears to be and is quite simple. Oilseed presses essentially extrude or 'press' vegetable oil from oil-bearing seeds, which include soybean, sunflower, peanut, safflower, canola, sesame, niger, castor bean, linseed, mustard, coconut, olive, and oil palm (FAO, 2010a). The simplicity of this procedure is shadowed by the diversity of oilseed press designs that perform it. As seen in Table 1, oilseed press designs can be placed into the three major classes of traditional, manual, and mechanical presses (Axtell & Fairman, 1992).

Traditional presses include ghanis, water extraction systems, and other methods (Axtell & Fairman, 1992). Aside from the ghani, these designs are generally low yielding and particularly labour intensive (Axtell & Fairman, 1992; Head et al., 1995). Moreover, all the traditional forms mentioned operate on a batch system. This entails that only a given amount of oilseed can be processed at a given time and, when the oil has been extracted, the pressed oilseed must be cleaned out of the machine (Herkes, Grubinger, Schumacher, & Thompson, 2012).

Table 1: Advantages and drawbacks of various oilseed press designs

Oilseed Press Design		Description	Advantages	Disadvantages
Traditional	Ghani	Ghanis originated (Kurki, Bachmann, & Hill, 2008) and are still used widely (Head et al., 1995) on the Indian subcontinent. They essentially consists of a large mortar and pestle (Axtell & Fairman, 1992; Head et al., 1995; Swetman, 2008). Motors or bullocks are utilized to rotate the pestle within the mortar (Axtell & Fairman, 1992; Head et al., 1995). Some motor-powered ghanis possess a rotating mortar and stationary pestle (Axtell & Fairman, 1995). The pestle forces out oil and allows it to run out of a small hole in the base of the mortar (Axtell & Fairman, 1992; Head et al., 1995; Swetman, 2008). When a sufficient amount of oil is extracted, the meal is removed and a new batch of oilseed is added (Head et al., 1995).	-No preliminary grinding of oilseed is required (Head et al., 1995) -Decent yield of high-quality oil (Head et al., 1995) -Low operating costs and can be manufactured locally (Head et al., 1995)	-Within 3 to 4 hours, a bullock operating a ghani becomes tired and must be replaced by another (Head et al. 1995; Swetman, 2008). -Manual models are slow and require a skilled operator for optimum oil extraction (Swetman, 2008).
	Water Extraction	Ground (Axtell & Fairman, 1992; Head et al., 1992) oilseed is boiled for several hours and oil is skimmed off the surface. The oil is then heated to remove any water that persists (Axtell & Fairman, 1992; Head et al., 1995).	-Equipment is readily available, uncomplicated procedure (Head et al., 1995) -Final heating removes water and improves shelf life of oil (Axtell & Fairman, 1992)	-Low yielding (Axtell & Fairman, 1992; Head et al., 1995) -Laborious process (Head et al., 1995) -Long boiling sessions consume substantial quantities of fuel (Head et al., 1995) -Oil-water emulsions can form and these cause for issues in removing traces of moisture in the final process (Axtell & Fairman, 1992).
	Other	There are various methods of extraction including wedges, levers, heavy stones, and twisted ropes (Axtell & Fairman, 1992; Head et al., 1995).	-Simple machines, easy to access equipment	-Low yielding, small capacity, physically demanding (Axtell & Fairman, 1992; Head et al., 1995)

Oilseed Press Design		Description	Advantages	Disadvantages
Manual	Cage Press	A press plate or piston is forced through a vertical perforated cylinder (Axtell & Fairman, 1992; Head et al., 1995) via a threaded rod, large scissor levers, or a hydraulic cylinder (Head et al., 1995).	-Maximum pressure can be maintained for a short period of time, allowing for the small amount of remaining oil to be squeezed out. (Herkes et al., 2012) -Simple to use	-Like the traditional designs, cage presses operate on a batch system (Head et al., 1995). Only a set amount of oilseed can be pressed at once and the press must be cleaned out after each batch (Herkes et al., 2012). -When using a hydraulic cylinder for applying pressure, care must be taken so that hydraulic fluid does not leak into the product (Axtell & Fairman, 1992; Head et al., 1995; UNIDO, 1985).
	Ram Press	The ram press consists of a piston that is manually forced through a horizontal perforated cylinder via a lever (Axtell & Fairman, 1992; Hyman, 1992; Head et al., 1995; Swetman, 2008). Upon the piston's return stroke, more seed automatically falls into the compression chamber, which is otherwise closed off by the piston (Hyman, 1992; Head et al., 1995; Swetman, 2008). A hole at the end of the chamber provides an exit for pressed material and can be adjusted to regulate the pressure exerted (Axtell & Fairman, 1992; Hyman, 1992; Head et al., 1995; Swetman, 2008).	-The gap at the end of the cage and the piston's ability to act as its own valve allow for continuous operation (Hyman, 1992; Head et al. 1995, Swetman, 2008). -Smaller models can be operated with ease by women (Head et al., 1995). -Buckets, screens, plastic sheets, and containers are the only extra equipment required (Hyman, 1992). -The design allows for increased 'shearing' action (Axtell & Fairman, 1992; Hyman, 1992), which contributes the breakdown of material and extraction of oil. -Much higher efficiency with some materials as compared to cage presses (Axtell & Fairman, 1992). -High pressures* of 190 (Head et al., 1995) to 200 kg/cm^2 (Hyman, 1992) are attained. This is similar to the 170 kg/cm^2 pressures applied by small expellers and is greater than the maximum 125 kg/cm^2 applied by cage presses (Head et al., 1995). -Can be effectively manufactured and repaired locally (Hyman, 1992) -Unlike for cage presses, the seed coats of soft-shelled seeds do not have to be removed (Hyman, 1992).	-Attempting to press particularly hard seeds causes for decreased oil yield and may result in the press being damaged (Hyman, 1992).

Oilseed Press Design		Description	Advantages	Disadvantages
Powered	Expeller	Oil expellers are composed of a rotating worm within a horizontal cylinder that gradually increases the pressure on the oilseed within (Axtell & Fairman, 1992; Kurki et al., 2008; Head et al., 1995). Like for the ram press, an adjustable choke at the end of the cylinder can adjust the pressure that is applied (Axtell & Fairman, 1992; Kurki, Bachmann, & Hill, 2008; Head et al., 1995).	-Continuous operation (Axtell & Fairman, 1992; Herkes, et al. 2012; Head et al., 1995) -Predominant power-driven oilseed press design in the world (Herkes et al. 2012) -Models that process anything from a few kg/hr to tons/hour are available (Axtell & Fairman, 1992). -Friction within the cylinder generates heat that improves oil yield (Kurki et al., 2008). -Small and medium-sized powered expellers exert high pressures on the raw product.* These pressures are 170 and 540 kg/cm^2 respectively (Head et al., 1995). Note: Very small models are often manual. For example, 5 kg/hr manual expellers are available from Piteba in The Netherlands (Piteba, n.d.).	-Electricity or fossil fuels are required to drive larger models. -Motorized expellers produce lower-quality oil as compared to cold-press systems (Hyman, 1992). -The rings, choke, and the end of the worm wear down quickly (Head et al., 1995; UNIDO, 1985). Ready access to parts and skilled labour is a requirement (Head et al., 1995; UNIDO, 1985).
*Pressure is a good indicator of pressing efficiency for oilseed presses (Head et al., 1995).				

Despite these setbacks, traditional oilseed presses are basic in their design and are composed of easily obtainable or easy-to-manufacture equipment (Head et al., 1995).

As for manual presses, cage style and ram presses are the general layouts (Axtell & Fairman, 1992). While cage presses operate on a tedious batch system (Head et al., 1995), the operation of ram presses is continuous (Hyman, 1992; Head et al. 1995). The latter point about the ram press design is joined by multiple other advantages that are listed in Table 1. These advantages are especially attractive for developing nations.

The final major class of oilseed presses, the powered presses, is dominated by the expeller. These presses also exhibit continuous operation (Axtell & Fairman, 1992; Herkes, et al. 2012; Head et al., 1995). Furthermore, they are available in a great range of sizes that can process anywhere from a few kilograms per hour to multiple tons per hour (Axtell & Fairman, 1992). These and other positive attributes (Table 1) are countered by how powered expellers require electricity or fossil fuels and how their components can wear quickly (Head et al., 1995).

ii) Nutritional value of products

No matter the design, the same end products are obtained from the operation of an oilseed press. After the oil is removed from the oilseed, an oilseed meal or cake remains (Kurki et al., 2008). This valuable by-product is especially rich in protein (Lardy, 2008; Oregon State University, 2004b). Table 2 contains quantified data gathered by Lardy (2008) that effectively displays this fact. Aside from safflower and sunflower meal (Lardy, 2008), most oilseed meals contain around 40 % crude protein (Lardy, 2008; Oregon State University, 2004b). Although this allows most oilseed meals to be readily applied as a protein supplements for ruminants such as cattle (Lardy, 2008), the truth that many of these meals have undesirable amino-acid ratios or show poorer digestibility limits their use in swine and poultry diets (Lardy, 2008).

An exception to this trend is soybean meal. It possesses an excellent amino-acid profile (Bajjalieh, 2003; Cromwell, 1999; Dale 1996; Lardy, 2008; Oregon State University, 2004b), a low fibre content (Lardy, 2008; Oregon State University, 2004b), high digestibility (Cromwell, 1999; Lardy, 2008; Oregon State University, 2004b), and high crude protein levels ranging from 44 to 50 % (Bajjalieh, 2003; Cromwell, 1999; Dale 1996; Lardy, 2008; Oregon State University, 2004b). These advantages, including soybean meal's high lysine content of 6.5 % (Cromwell, 1999), make it a very appropriate protein supplement in poultry and swine as well as ruminant diets (Cromwell, 1999; Dale, 1996; Lardy, 2008; University of Oregon, 2004b). In fact, soybean meal accounts for 63 % of the protein feed sources that are utilized globally (Cromwell, 1999). This surpasses the canola meal, which is also nutritionally adept for feeding to poultry and swine (Dale, 1996; Lardy, 2008; University of Oregon, 2004b), by a full 51 % (Cromwell, 1996).

In addition to the meal, the oil that is procured from oilseed presses also possesses great nutritive benefits. Oils are naturally energy-dense materials (Health Canada, 2000; Oregon State

Table 2: Nutrient composition of various oilseed meals resulting from solvent or mechanical extraction (Lardy, 2008)

Table 6. Nutrient composition of various oilseed meals resulting from solvent or mechanical extraction.

Dry matter basis

	DM, %	CP, %	Fat, %	TDN,%	NEm, Mcal/lb	NEg, Mcal/lb	ADF,%	Ca,%	P,%
Camelina meal, mechanical extraction	91.5	36.5	14.1	88.6	0.97	0.64	19.2	0.38	0.77
Canola meal, mechanical extraction	90	41	7.4	76	0.8	0.52	16	0.6	0.94
Canola meal, mechanical extraction, On-farm press	92.6	36.9	14.1	88	1.09	0.77	NG	0.6	1.02
Canola meal, solvent extraction	90	43.6	1.2	69	0.73	0.45	18	0.67	1
Mustard meal, mechanical extraction	93	34.5	5.5	73	0.76	0.48	NG	NG	NG
Safflower meal, mechanical extraction	91.9	23.5	7.2	56.1	0.55	0.25	NG	0.26	0.66
Safflower meal, solvent extraction	92	25.4	1.1	57	0.55	0.29	41	0.37	0.81
Soybean meal, mechanical extraction	90.7	46.7	5.2	84.9	0.94	0.62	NG	0.31	0.65
Soybean meal, solvent extraction	89	49	1.2	84	0.94	0.64	NG	0.33	0.71
Sunflower meal, mechanical extraction, On-farm press	93.1	23.6	19	90.5	1.13	0.8	NG	0.43	0.79
Sunflower meal, solvent extraction	90	38.9	1	64	0.65	0.35	28	0.39	1.06

Abbreviations: DM = Dry Matter; TDN = Total Digestible Nutrients; NEm = Net Energy for Maintenance; NEg = Net Energy for Gain; CP = Crude Protein; ADF = Acid Detergent Fiber; Ca = Calcium; P = Phosphorus; NG = Not Given.

Nutrient content of oilseeds and oilseed meals vary. Producers should have samples analyzed by a laboratory to ensure the most accurate data for each particular feed.

University 2004a) that constitute about 25 % of the total caloric intake of the typical individual

(Zambiazi, Przybylki, Zambiazi, & Mendonca, 2007). Particularly, vegetable oils are composed mainly of unsaturated fats (EUFIC, 2014; Indiana University 2014; Zambiazi et al., 2007), which include the essential omega-3 and -6 polyunsaturated fatty acids (Health Canada, 2000). Animal-based fats, in contrast, contain saturated fats (EUFIC, 2014; Indiana University, 2014), which are linked to cardiovascular disease (Health Canada, 2000; Oregon State University 2004a). Figure 1 effectively displays this dichotomy as well as the fatty acid profile of various fats and oils.

As seen in Figure 1, different oilseed species possess unique fatty acid profiles. This same principle applies to the oil contents of various oilseeds as well. For example, while canola

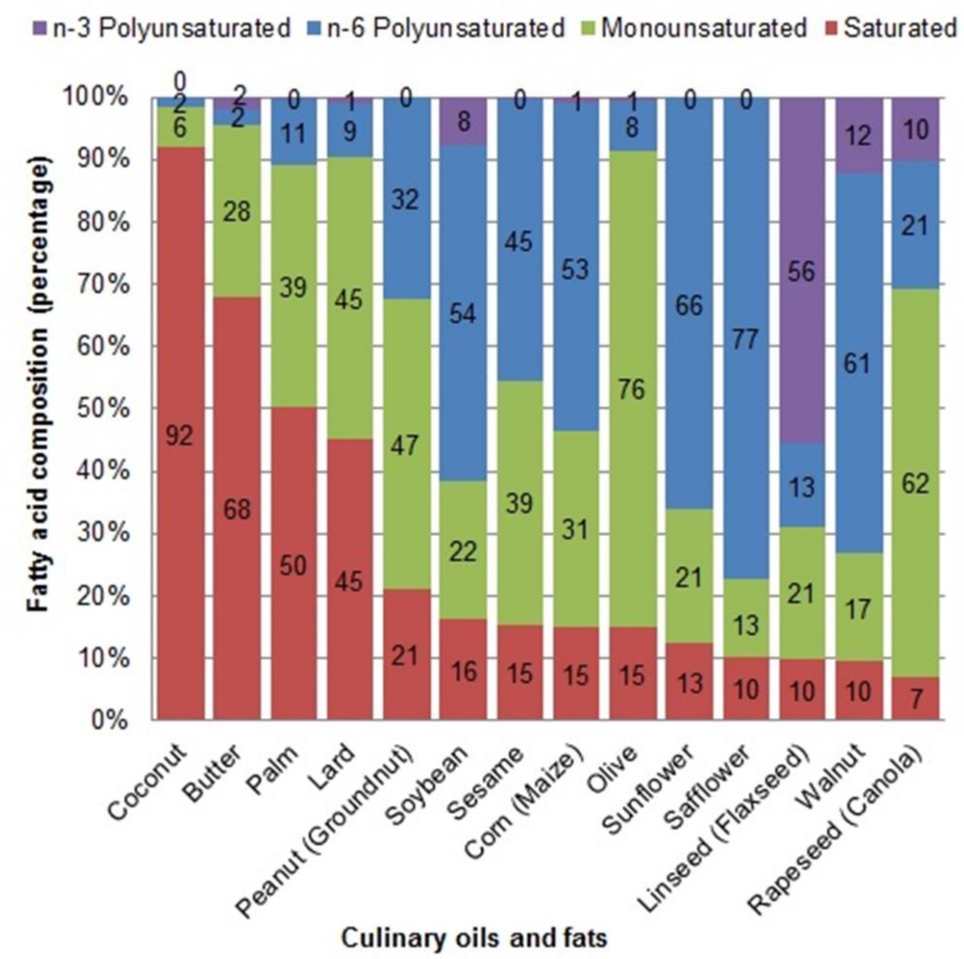

Figure 1: Fatty acid profiles of vegetable oils and fats
Plant or vegetable oils consist largely of unsaturated fatty acids (EUFIC, 2014).

typically exhibits an oil content of around 40-45 % (Lardy, 2008; Kurki et al. 2008; Oregon State University 2004a; Swetman, 2008; UNIDO, 1985), soybeans consist of about 20 % oil (Lardy, 2008; Oregon State University, 2004a). Despite these specifics, it is important to note that the amount of oil extracted depends on the efficiency of the extraction process (Lardy, 2008). Decreased oil yield is detrimental in the perspective of oil production, yet is beneficial for livestock producers since the leftover cake's nutritive value is augmented (Lardy, 2008).

iii) Oil extraction process

The actual extruding of vegetable oil from oilseeds by oilseed presses is preceded and followed by several other activities. The first step in the procedure is to have clean, dry seed. Removing material such as rocks, soil, chaff, leaves, sand, dust, and other foreign particles augments pressing efficiency, reduces wear, and decreases the chances of damage being done to the press (Kurki et al., 2008; Lardy, 2008) Drying seed to around 10 % prevents the press from being clogged (Kurki et al, 2008) and also prevents the spread of mould during storage (Hyman, 1992; Kurki et al., 2008; UNIDO, 1985).

For seeds with hard seed coats such as sunflowers or groundnuts (Swetman, 2008; UNIDO, 1985), dehusking or decortication is required (Axtell & Fairman, 1992; Swetman, 2008; UNIDO, 1985). This removal of the seed coats improves productivity and reduces bulk (Swetman, 2008; UNIDO, 1985). In addition to decortication, preliminary milling for some oilseeds such as groundnuts is needed (Swetman, 2008; UNIDO, 1985).

Before the oilseed can be pressed, scorching or heating of the seed may also have to be conducted (Axtell & Fairman, 1992; Swetman, 2008). An example of this is how soybeans must be roasted to deactivate trypsin inhibitors (Lardy, 2008; N. Leja, personal communication, October 2, 2014; Oregon State University, 2004a) that are anti-nutritional for swine and poultry

(Lardy, 2008; N. Leja, personal communication, October 2, 2014). In general, warming seed before processing increases oil yield (Kurki et al., 2008). Although the best seed temperature for pressing is 38-71 ºC (Kurki et al., 2008), it is known that warming sunflower seed in the sun for just a half hour raises oil yields by 25 % (Hyman, 1992).

All of this leads up to that actual pressing of the oilseed, which is followed by more procedures that involve processing the oil. Clarification removes small contaminants and impurities in the oil by letting the oil sit for a period, which allows the particles to settle (Kurki et al., 2008; Swetman, 2008; UNIDO, 1985). Further clarification can be done by heating the oil or filtering it through a fine cloth (Kurki et al., 2008; Swetman, 2008; UNIDO, 1985). Clarification extends the shelf-life of the oil from days to months (Swetman, 2008; UNIDO, 1985).

Degumming, bleaching, neutralization, and deodorizing are all processes that follow clarification (Axtell & Fairman, 1992; Kurki et al., 2008; Swetman, 2008). These procedures are often not applicable to developing nations due to their complexity (UNIDO, 1985) and the fact that the flavours of unrefined oils are well accepted in these areas (Axtell & Fairman, 1992; Swetman, 2008). Whether these processes are applied or not, the oil must be stored in some way. Storage containers should be filled with oil to the top, completely clean, air and water tight, and opaque (Kurki et al., 2008; Swetman, 2008; UNIDO, 1985). Moreover, oil should be stored in a cool area away from light (Kurki et al., 2008; Swetman, 2008; UNIDO, 1985).

iv) Equipment/Inputs Required

From the above information regarding oil extraction and oil presses, a list of inputs and requirements for operating one such oil press can be devised. The composition of the exact list is dependent on the oilseed being processed, the quality-requirements, and the size of the set-up (Swetman, 2008). Seed bags, a well-ventilated indoor space, pallets to raise the seed above the ground, and a seed cleaner or sieve would be required for the proper storage of the oilseed. Pre-extraction equipment such as a mill, a decorticator, and a roaster may also be needed (Swetman, 2008). Post-extraction equipment would include air and water tight, opaque containers for storing the oil (Swetman, 2008). It is important to note that much of this equipment may not even be required. The previously-mentioned fact about warming sunflower seeds in the sun (Hyman, 1992) is a good example of a replacement of the roaster. Moreover, the seed used in this example could be pressed without being decorticated (Hyman, 1992).

Other possible inputs include a ready source of electricity for electrically-powered presses, easy access to parts and repair services, tools, and labour. If an oilseed press owner had some form of storage facilities and multiple harvests of oilseed crops throughout the growing season, an employee could be hired on a full-time, year-round basis. In the case of Nepal, the average wage in 2008 was, assuming a forty hour work week (ILO, 2010), about 32 Nepalese Rupees per hour (ILO, 2010). This is the equivalent of about 0.36 cents Canadian per hour.

v) Manufacturers/Suppliers in Canada

There is only a handful of manufacturers and suppliers of oilseed presses in Ontario. In fact, Energrow Ltd. from Listowel, Ontario, is the sole manufacturer of oilseed presses in Canada (N. Leja, personal communication, October 2, 2014). It manufactures oil expellers with capacity for 600 to 2400 kilograms of oilseed per twenty-four hours (Energrow, 2014). In addition to Energrow, Golburn Valley Oilmill Inc. from Tisdale, Saskatchewan, distributes German-built Komet presses that can process 24 to 2400 kilograms of oilseed per twenty-four hours (Golburn Valley Oilmill Inc., 2013). Lastly, Golden Green Sustainable Resources Ltd. from Truro, Nova Scotia, markets German-built Anton-Fries oilseed presses that can process between 290 and 720 kg of product per 24 hours (Golden Green Sustainable Resources Ltd., 2012). The specifics of the models these companies offer are provided in Table 3.

Table 3: Oilseed press manufacturers and models from Canada*

Company	Model	Cost	Basic Information
Energrow Inc.	Single (Figure 2) or Double ES3750B Expeller Press	$ 30 000 for single system (additional $ 3000 for oil filter) (N. Leja, personal communication, October 2, 2014)	-Tool kit, 2-year warranty on moving and electrical parts provided -80 L soybean oil per 24 hours and 250 L canola oil per 24 hours (double screw system has doubled output) -Can be picked up with pallet forks -Easy-to-use touch screen, programmable settings -Can be operated without supervision (N. Leja, personal communication, October 2, 2014) -Single screw expeller can process 600-1200 kg of raw product per 24 hours. A double-screw expeller can process 1200-2400 kg. -Requires 240 V/50 A electrical connection (2x for double model) -300 and 400 kg weight for single and double system respectively -10-30 % extraction rate by weight for both models
Golburn Valley Oilmill Inc.**	Komet S120F Expeller Press	$ 31 300	-Can process anywhere from 1200 to 2400 kg of material per 24 hours of operation -440 kg weight -7.5 kW electrical motor
	Komet CA 59 1-H Expeller Press	$ 2 300	-Can process 24 to 72 kg of material per 24 hours -30 kg weight -Manual operation
Golden-Green Sustainable Resources Ltd.	Anton-Fries P240R Expeller Press	Information not recovered	-Can process 290-720 kg of material per 24 hours -34-38 % extraction rate by weight -Tested and compatible with an extremely wide range of oilseeds -88 kg weight, 240 V electric motor (Anton-Fries, n.d.)
Contact Information: Energrow Inc. 510 Rocher Road Listowel, Ontario. Canada,N4W 0B2 Phone: 1-844-363-7476 Website: http://www.energrow.ca/ Golburn Valley Oilmill Inc. 1 Golburn Road West R.M. Tisdale NO. 427 Saskatchewan S0E 1T0 Golden-Green Sustainable Resources Ltd. 421 Little Dyke Rd. NS, BOM 1LO Canada Email: info@golden-green.ca Jocelyn Harris (Manager) Phone: 1-855-408-4100 Website: http://www.golden-green.ca/			

Canada Email: golburn.valley.oilmill.inc@gmail.com Phone: 1-800-913-3693 Website: http://oilpressequipment.com/	
*Unless otherwise noted, the information in this table is from (Energrow, 2014; Golburn Valley Oilmill Inc., 2013; Golden-Green Sustainable Resources Ltd., 2012) for the respective companies. **Golburn distributes 5 Komet expeller presses. The models presented are at the top and bottom of the lineup in regards to capacity.	

Figure 2: Energrow Inc.'s single screw ES3750B expeller (Energrow, 2014)

vi) Benefits for Canada for Exporting Oilseed Presses

Today, the direct impact of exporting Canadian-manufactured or distributed oilseed presses to Nepal would be fairly small. Energrow Inc., for example, employs a total of four people at its main branch in Listowel, Ontario (N. Leja, personal communication, October 2, 2014). Golden-Green Sustainable Resources Ltd., moreover, is just a single-dealer, family-run business (Golden Green Sustainable Resources Ltd., 2012). Despite this, a much greater indirect impact would be noted. Specifically, the sale of Energrow's products supports local machine shops in Ontario; a control-panel manufacturer in Quebec; and dealers in Ontario, Quebec, and Alberta. (N. Leja, personal communication, October 2, 2014). Considering that Energrow sports a sustainable business with the sale of just 20 to 30 machines annually (N. Leja, personal communication, October 2, 2014), the sale of only a handful more units would have a substantial impact on the company's operations. Additionally, the export of Canadian oil presses would have a positive impact on the trucking industry, even if only a few dozen extra hauls are made. Finally, if more companies begin producing their own oilseed press models in Canada as a result of marketing opportunities in Nepal, then Canadian farmers will benefit by having a greater range of oilseed press models from which to choose.

vii) Environmental Aspects of Production in Canada

The manufacturing of oilseed presses in Canada is quite environmentally responsible. All of the designing, programming, and assembly of oil presses is done in-house at Energrow Inc. (N. Leja, personal communication, October 2, 2014). All of the metal parts are sourced from local machine shops and the control panels are sourced from Quebec (N. Leja, personal communication, October 2, 2014). Furthermore, used parts are refurbished and reused wherever possible and the design of Energrow's presses lends itself to electrical efficiency (Energrow, 2014). A final point is that Energrow utilizes vegetable oil produced from its expellers to power all of its company vehicles (Energrow, 2014). Consequently, oil press manufacturing in Canada is an environmentally sustainable enterprise.

viii) Market Opportunity of Canadian Oilseed Presses in Nepal

There are multiple potential markets for Canadian oilseed presses in Nepal. One possible outlet is through the dairy cooperatives in Nepal. There are 36 District Milk Producers' Cooperative Unions that exist to augment the growth and development of the dairy industry in Nepal (FAO, 2010b). These larger organizations may have enough funds to purchase Canadian oilseed presses that are otherwise too costly for small-holders. In addition, these larger organizations would have more connections to facilitate the optimum application of these oilseed presses. A potential starting goal for this opportunity would be to sell one large oilseed press, such as an Energrow single screw expeller, to each of these cooperatives.

If a cheaper, smaller, manually-operated oilseed press was developed in Canada, the market opportunity would be much greater. Considering that over three-quarters of the 3.8 million farms in Nepal are less than 1 hectare in size (Central Bureau of Statistics, 2013), a small, easy-to-utilize ram or cage press would be very applicable. Thousands of units can potentially be sold in these circumstances.

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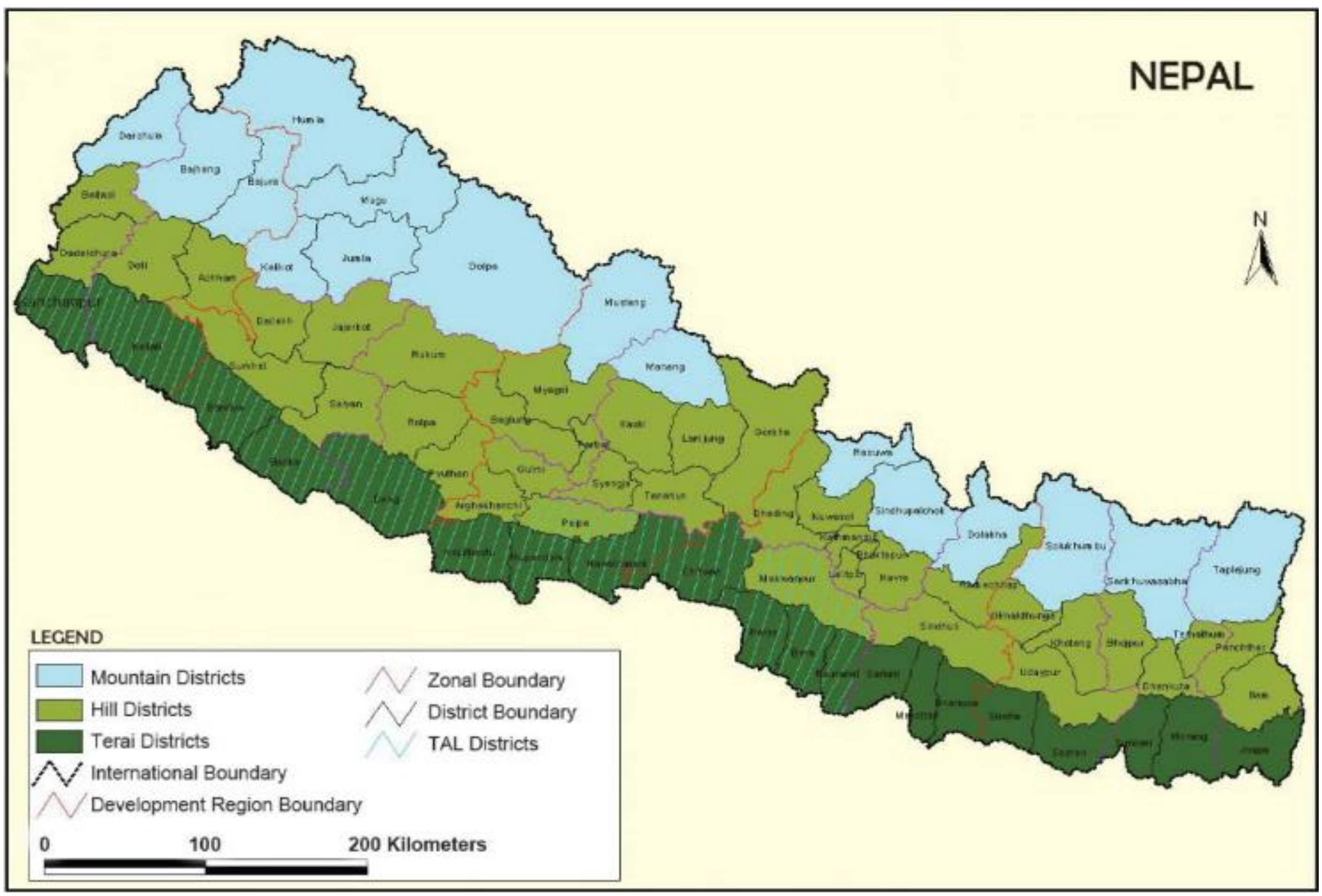
Part II: Export Potential of Canadian Oilseed Presses to Nepal

i) Introduction to Nepal

Nepal is a diverse nation that is landlocked between India and China (Central Bureau of Statistics, 2013; CIA, 2014; Nepal Tourism Board, 2012; Pariyar, 2008). Nepal as a whole encompasses about 147 000 km^2 of land (CIA, 2014; Nepal Tourism Board, 2012; Pariyar, 2008). It is comprised of three major ecological zones (Figure 3) which are known as the mountain, hill, and terai regions (CIA, 2014; Pariyar, 2008; Central Bureau of Statistics, 2013). The northern mountain region, peaking at an altitude of 8 848 m above sea level at Mount Everest (Nepal Tourism Board, 2012; Pariyar, 2008), descends into the Terai plains in the south, which possess a minimum altitude of around 60 m (Nepal Tourism Board, 2012; Pariyar, 2008).

Figure 3: Ecological zones of Nepal (Central Bureau of Statistics, 2013)

The climate ranges from cold alpine in the mountains to sub-tropical in the terai region (Pariyar,



2008).

Of the estimated 31 million people living in Nepal, about 81 % are Hindu and another 9 % are Buddhist (CIA, 2014). The population's gross national income per capita in 2012 was $ 662.50 US (UN, 2014). Another statistic is that about 80 % of the population is situated in rural areas of the nation (Central Bureau of Statistics, 2013; Shrestha, Neupane, & Adhikari, 2011). Nepal's top 5 agricultural imports by descending value are soybean oil, palm oil, maize, food preparations, and soybeans (FAOSTAT, 2013). This contrasts with the top 5 agricultural exports by value, which are nutmeg, lentils, tea, fruit juice, and macaroni (FAOSTAT, 2013).

ii) Current issues relating to the agri-food system in Nepal

Nepal is currently attempting to deal with multiple issues that involve its agri-food system. Beginning in the home setting, there is prevalent malnourishment in Nepal. Eighteen percent of the population does not receive the daily required nutrient intake (WHO, 2014). More concerning is that 29, 41, and 11 % of children under the age of five are underweight, stunted, or wasted respectively (WFP, 2014; WHO, 2014).

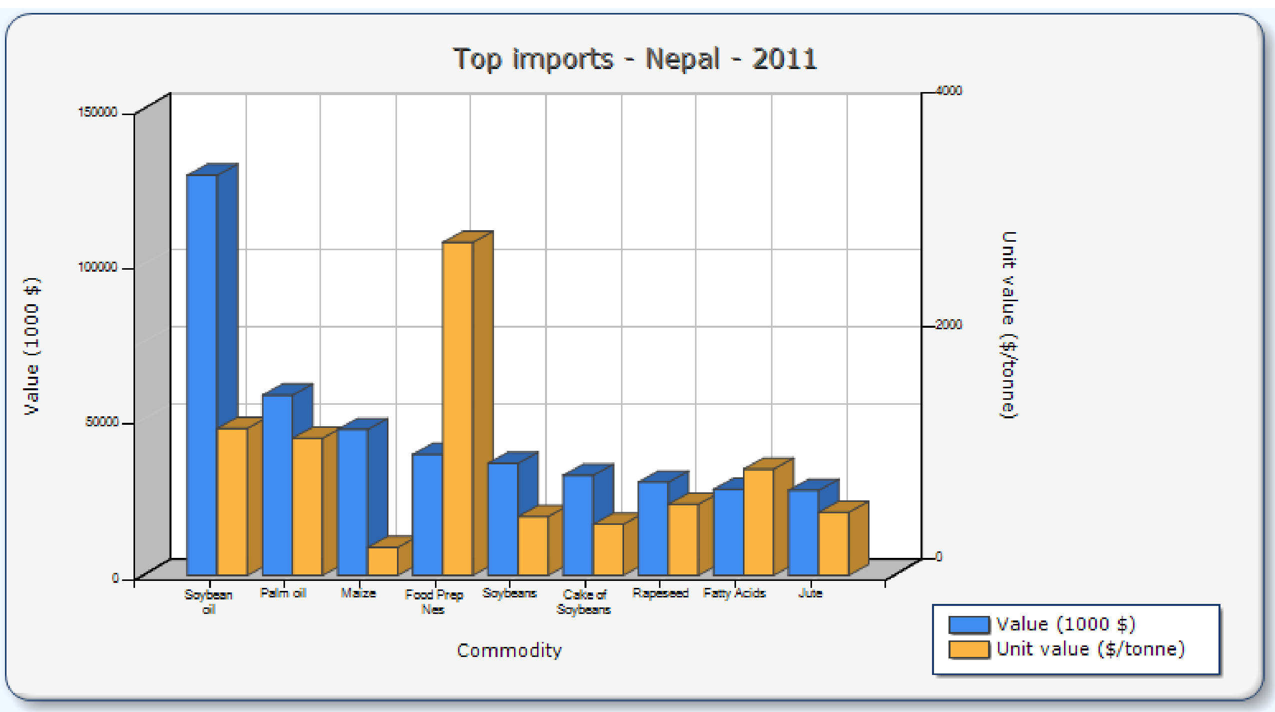
Another noteworthy fact is that about 64 % of households in Nepal utilize firewood as a cooking fuel while another 10 % use animal dung (Central Bureau of Statistics, 2014). This is worrisome since the fumes created from the burning of such solid fuels leads to inflation in the number of respiratory illness cases (Smith, Rogers, & Cowlin, 2005). Pant (2010) supports this and adds that the use of dung in particular causes for accentuated burden for rural women and children since they must produce dung cakes. Furthermore, Pant (2010) refers to how this is compounded by how a decrease in desperately-needed fertilizer occurs. The widespread use of wood as a fuel would contribute to deforestation in Nepal. Indeed, widespread deforestation has already occurred in the terai region (Pariyar, 2008).

These same forest resources are relied on heavily for livestock feed (Panday & Upreti, 2005; Pariyar, 2008) in Nepal. Increasing pressure on these and other feed resources has risen due to a large livestock population consisting of 6.9 million cattle, 3.9 million sheep, and 6.9 million goats. Furthermore, a decrease in soil health has been seen as a result of short, grain-based rotations (Pandey, Yadav, Sah, Pande, & Joshi, 2000; Shrestha et al., 2011). All of this has contributed to the land degradation that has caused for declined crop and livestock productivity (Pariyar, 2008; Joshi & Ghimire 1996).

A final issue that is evident in Nepal is the massive importation of soybeans and soybean products (Figure 4). In 2011, $ 128.8 million worth of soybean oil, $ 36.1 million worth of soybeans, and $ 32.2 million worth of soybean meal was imported into Nepal (FAOSTAT,

Figure 4: Top agri-food imports into Nepal, 2011 (FAOSTAT, 2013)

2013). At the same time, no soybean product made the top twenty list of exports (FAOSTAT,



2013). This results in a large amount of money leaving the country when it could be invested in local growers.

iii) Means by which oilseed presses can alleviate these issues

Although the issues presented above that are facing Nepal’s agri-food system are quite extensive and diverse, the characteristics of the oilseed press can confront and remedy them all to a degree. The nutrient-rich oils that are procured from oilseed presses can be effectively applied to reduce the prevalence of malnourishment, especially in young children. As for the indoor-pollution issue, burning vegetable oils produces around 0.05 kgCO2/kWh (Clark, 2013) while wood produces 0.39 kgCO2/kWh (Quaschning, 2002). This combines with the truth that the combustion of most vegetable oils is about 40 kJ/g (Gunstone, 2004) while dry wood possesses a heat of combustion of around 19 to 20 kJ/g (Francescato, Antonini, & Bergomim, 2008). Therefore, using vegetable oil as a cooking fuel in Nepal would be more effective and less dangerous.

As noted previously, the energy-dense nature of the vegetable oil would improve the nutrition intake of Nepal’s people. The same is true for oilseed meal in relation to livestock. This protein rich concentrate would reduce the pressure on local pastures and forests while increasing animal productivity. Aside from this, the strain on the land in Nepal would also be alleviated via the possible introduction of more species into common crop rotations. Oilseed presses would give local farmers the incentive to incorporate oilseeds into their crop lineup. This increased biodiversity, as Altieri (1999) notes, supports the sustainability of the agro-ecosystem and contributes to advanced soil health. Leguminous oilseeds such as soybean are of specific interest since they contribute to soil health by fixating nitrogen (Pandey et al., 2000; Shrestha et al., 2011). Moreover, if the adoption of oilseed presses leads to the increased popularity of soybeans and soybean by-products on Nepalese farms, then Nepal may be able to become more self-sufficient in regards to these products.

iv) Cost analysis to achieve profitability

The price of Canadian-manufactured or distributed oilseed presses is a major setback to their export to Nepal. A potential scenario involving the purchase of the Energrow single-screw ES3750B press can demonstrate this. A grower can sell all 80 L of soybean oil that he/she can produce in a 24 hour time frame (Energrow, 2014). If the grower sells it for twice the current commodity value of 71 500 Nepalese rupees per metric ton of soybean oil (Index Mundi, 2014), which is about 130 rupees per litre, then the grower will have to get maximum production for about 285 days just to pay off the $ 33 000 expeller and filter. This does not take into account the shipping costs of the press or the time required to process and market the oil. Even if a large cooperative purchased one of the large oilseed presses from Canada, a long-term investment strategy would have to be implemented.

vi) Transportation logistics and contacts for Canadian companies

Transportation logistics for Energrow's products from Listowel, Ontario, to its Alberta dealer already exist. The cost of this transportation is $ 800 per unit (N. Leja, personal communication, October 2, 2014). If this value is extrapolated to ship a unit to the Vancouver port, the approximate cost of shipping would be $ 1000. From there, it would be shipped on a forty-foot container to Asia, with a preference for a port such as Haldia in India. A forty-foot shipping container costs around $ 800 to ship across the Pacific (Transport Canada, 2010). The final movement of a Canadian oilseed press would occur via truck from the Indian port, across India and the India-Nepal border, and into a major center such as Kathmandu. The press could be distributed here for further shipment or picked up directly by its new owner. It should be noted that contact information for the Canadian manufacturers and distributors of oilseed presses is outlined in Table 3 in section 1.

vii) Potential competitors

There is a distinct potential for global competition to arise in the Nepalese oilseed press market. Manufacturers in Europe, China, and India are of special interest. Piteba from Europe produces a small, manual oilseed expeller (Piteba, n.d.) that could be readily adopted by farmers in a developing nation such as Nepal. Chinese companies such as Agico (2000) produce oilseed presses that are similar in capacity to Energrow's models with drastically-reduced prices of around a few thousand dollars (N. Leja, personal communication, 2014). However, Kurki et al. (2008) outlines how these presses are very poor quality. Competition from Indian companies such as Tinytech Plants (n.d.) is another possibility.

viii) Recommendations, marketing plan, and conclusion

As it currently sits, the oilseed press has great potential in the nation of Nepal. Despite this, the oilseed presses that Canadian companies distribute or manufacture are simply too expensive to allow them to be of great use to Nepal. Canadian manufacturers would be best off to develop small, simple, manual presses. Knowledge can be gained from projects in African nations such as Uganda (Republic of Uganda, 2011), Zambia (Hamazakaza, Hamusimbi, Kadimba, Kapunda, & Ndambo), and Tanzania (Hyman, 1992) where small ram presses (Figure 5) were introduced with honourable results.

No matter the type of oil press, the marketing strategies utilized in Tanzania would be optimal. Members of the project travelled from village to village, showing people the benefits, requirements, and basics of the oilseed press (Hyman, 1992). This one-on-one communication would be the most effective in delivering a message or idea to remote villagers. If this method was utilized, oilseed presses could be easily marketed to any nation that can produce oilseeds in notable quantities.

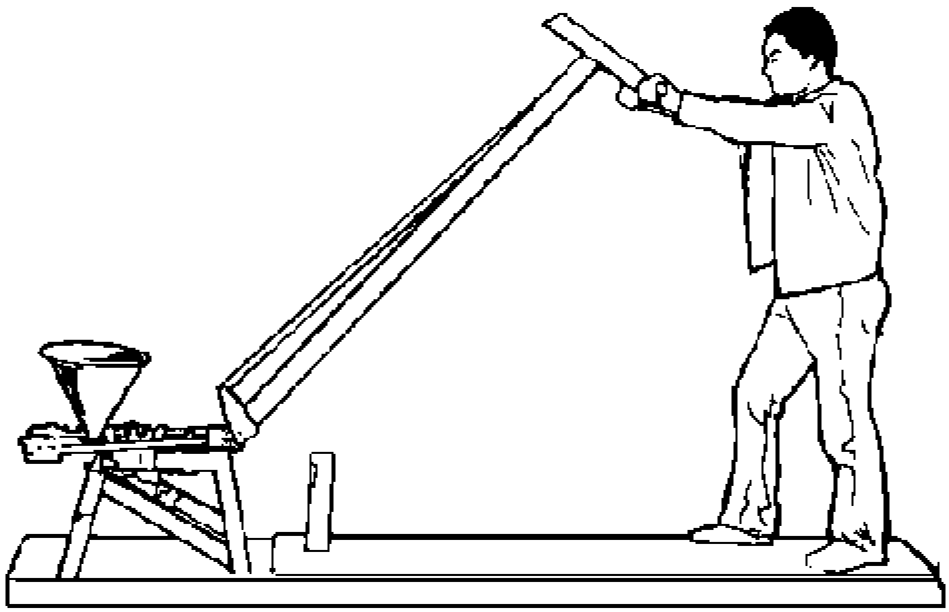


Figure 5: A small ram press (http://www.fao.org/wairdocs/x5434e/x5434e0j.htm)

Future research should be devoted to analyzing potential trade and subsidy barriers to the export of oilseed presses from Canada. Further examination of possible Nepalese, Canadian, and international loans and grants should also be conducted. The documentation required for shipping oilseed presses out of Canada and into Nepal is another aspect that must be researched. Additionally, further investigation should be done in determining how to make Canadian and Nepalese electrical equipment compatible one another. Lastly, more exact transportation costs and routes must be determined before any presses are exported.

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