Promoting Canadian Agri-food Exports to Nepal: Canola Seeds

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PART 1

Product description:

Canola is an offspring from a variety of rapeseed from the *Brassica* species. This specific species was bred to have low levels of both erucic acid and glucosinolates in the seed portion of the plant (Bell, 1981). The canola plant's seeds are small and black, with approximately 44% oil content- double the oil concentration of soybeans (appendix, figure 1) (CCC, 2014). The oil from the canola seed is considered to be the world's healthiest vegetable oil due to its richness in two essential fatty acids, and low levels of saturated fats (Bell, 1981). Although canola is namely extracted for its oil, a high protein meal is also produced (CCC, 2014). This high protein meal is used as a livestock feed supplement for cattle, poultry and swine. Canola is now considered one of Canada's most valuable crops: contributing $19.3 billion per year to the Canadian economy- including over $2.8 billion from canola exports (CCC, 2014). Approximately 9 million tonnes of canola seeds are produced each year in Canada, and the *Canola Council of Canada* expects an increase to 15 million tonnes by 2015 (CCC, 2014).

There are many varieties of canola that are available for commercial production. The variety chosen for export is CANTERRA 1990. This is a superior hybrid seed that has been shown to consistently have a higher yield than its leading competitors (appendix, table 1)(CS, 2014). This seed is resistant to blackleg and fusarium wilt and is suitable to all growing zones (CS, 2014).

Where Product is Grown:

Predominately, Canadian canola production is concentrated in Alberta, Saskatchewan and Manitoba; although a sizable amount of crop is grown in Ontario,

Quebec and British Columbia (appendix, figure 2) (SC, 2009). As most of the growing regions are centered around western Canada; it is there where most economic benefits are found (CCC, 2014).

Labor Required and Cost:

Similar to other cereal crops, canola production has associated costs that are dependent on specific factors for each field. In order to calculate a cost for growing canola, various prices need to be considered. Per acre, a bag of canola is around $54.63 in Manitoba (GOM, 2014). With added average costs of fertilizer, herbicide, fungicide, insecticides, fuel and machinery operation, an average total operating cost per acre of canola would be $248.32 (GOM, 2014). Added to this cost would be fixed costs; such as , land investment, machinery depreciation, machinery investment and storage costs which average around $105.03 (GOM, 2014). A third added cost would be the labor involved in harvesting and maintaining a healthy crop. The total amount of operating, fixed and labor costs is around $388.90 for the average acre of canola (GOM, 2014). Although these numbers are for the average production costs in Manitoba, similar costs can be expected in Alberta and Saskatchewan.

Health and Nutritional Information:

There are two products produced from the processing of canola seeds. The first, and most valuable of the two is canola oil. Canola oil has the lowest saturated fat level of all vegetable oils. It is rich in two fatty acids that are essential in our diet: Alpha-Linolenic acid- omega-3 fatty acid and Linoleic acid- omega-6 fatty acid. Alpha-Linolenic acid has been shown to protect against heart attacks and strokes by helping to lower bad cholesterol (CCC, 2014). Linoleic acid- omega-6 fatty acid- is important for

growth and development of infants (CCC, 2014). One serving of canola oil each day delivers about a quarter of the daily requirements of vitamin E – an antioxidant that protects your body's fats and proteins from free radical damage (CCC, 2014). Vitamin E also may help reduce heart disease risk, cancer and memory loss (CCC, 2014)

Canola meal is the by-product of processing the seeds for oil. It is one of the most widely used protein sources for animal feed (CCC, 2014). It is palatable and non-toxic with low levels of glucosinolates and an excellent amino acid profile (appendix, table 2).

As canola is one of the grains defined in the Canada Grain Regulations, the Canadian Grain Commission maintains quality standards for canola (GC, 2013); therefore it can be said with accuracy that minimum crude protein guarantee for Canadian canola meal is 36% (CCC, 2014). Similar to many vegetable protein sources, canola meal has high levels of methionine acid and cysteine. When introduced into lactating dairy cows diets, canola meal has been shown to increase mean milk production by 1.0 kg per day, when compared to diets containing cottonseed meal or soybean meal (CCC, 2014).

Market Opportunity:

Canada is the second largest producer of canola in the world (Reece et al 2014); canola alone contributes $19.3 billion to the Canadian economy each year (CCC 2014). Canada exports 90% of the canola produced, making the access to global markets incredibly important to the industries success (CCC, 2014). The canola market in Canada is an open market, meaning that the grower sells directly to the buyer or grain handling and exporting company (CCC, 2014). Exporting seeds to Nepal will allow Cargill Limited and Prince Rupert port access to more of the Asian market. In order for the success of the canola industry to continue The Canola Market Access Plan –designed by

a joint effort of both the Canola Council of Canada and the Government of Canada- suggests that maintaining and growing market access is critical (CCC, 2014). As only 7 countries are recipients of the majority of exported canola seeds and oil, canola has the potential to expand its market into other counties.

Although today, there is no shortage of a buyer for the amount of canola produced, going forward in coming years, market access will be critical to the canola market (Cargill Limited, Personal Communication, November, 4, 2014).

Benefits to Canada:

The canola industry provides jobs and economic growth to communities across the country because of international market opportunities. Exporting canola seeds to Nepal will create a new market for canola. As the price of canola fluctuates depending on the market, exact profit cannot be calculated. The average canola seed price on November 20, 2014 was $544.69 per tonne of canola (CCC, 2014). In a higher margin scenario (price up 5% and yield up 10%), farmers could see a net profit of $25.75 per acre (GOM, 2014). In a lower marginal scenario (prince down 10% and yield down 5%), farmers could see a potential net profit of around $80.51 per acre (GOM, 2014). Canadian canola farmers will not be the only ones to benefit from a higher demand for canola. The first company to benefit from a new market is *Canterra Seeds*. Increasing seed sales for their variety CANTERRA 1990 will boost average profit margins for this company. Secondly, *Cargill limited* (the company used to export canola seeds) may be able to create new and unique job opportunities for Canadians. The new export market of Nepal will also allow the port of Prince Rupert- of which Cargill is an active share holder- to create quality jobs and economic opportunities in Prince Rupert and close

communities in British Columbia. By improving and expanding Asian markets, the port will allow economic prosperity from where the canola is grown- Saskatchewan, Manitoba and Alberta (PRPA, 2014). For canola imported to Nepal, the customs duty is 1% (Department of Customs, Nepal, Personal Communication, November 14, 2014). This will allow maximum profit for Canada.

Environmental Sustainability of Growing Canola in Canada:

Improving production efficiency is a key way to reduce the ecological footprint of canola production. Due to advances though the Canadian canola research and the adaption of Canadian farmers to those strategies, growing canola is becoming more efficient (CCC,2014). Between 1986 and 2006, a model based estimate of the carbon footprint of canola production in the Canadian Prairies showed that the green house gases emission intensities decreased by 65% due to higher yields (Shrestha B.M, et al. 2013). Although canola production has become more efficient, the prairies have still seen an increase of 13% in green house gas emissions, due to the doubling of canola production (Shrestha B.M, et al. 2013). In the future, it is aspired that new technology and new varieties of canola will lower this threshold.

There are a number of sustainability projects underway funded by the Canola Council of Canada to increase grower sustainability with minimal impacts to the environment. One to name is the consistent and environmentally sound canola production project. The objective of this project is to determine the best management practices for consistent and environmentally sound production of high quality canola from the oil and meal markets. A second project underway is exploring the ecological impact of canola-

inclusive cropping systems in western Canada. The objective of this project is to identify weed species associated with production and determine if shifts in species abundance and community have occurred over time in farmer's fields (CCC, 2014).

PART 2

Nepal

Nepal is a small landlocked country in South Asia, located between the People's Republic of China and the Republic of India (appendix, figure 3) (ATNC, 2014). There are approximately 29.33 million people in Nepal with over 16% of the total population undernourished (FAO, 2014). The climate regions and topography of Nepal vary greatly because of the dramatic range in elevation. Nepal is classified into 3 main geographical regions; the lowland plains, the hill region and the mountain region. Because of the varying elevations Agriculture in Nepal is dictated by altitude (ATNC, 2014).

Transportation Logistics:

The canola harvested by the Canadian farmer will enter the commercial system in the form of a grain and oil seed elevator (Cargill Limited, Personal Communication November, 4, 2014). From the elevators, the canola seeds will be shipped by CN rail from Manitoba, Saskatchewan and Alberta directly to Prince Rupert Grain Port (Cargill Limited, Personal Communication November, 4, 2014). The port of Prince Rupert is North America's closest port to the Asian market by up to 3 days (PRPA, 2013). From the port, the canola seeds will be put on a vessel, first to India, and then trucked or railed into Nepal (Cargill Limited, Personal Communication November, 4, 2014).

Storage Issues post Harvest to Market:

After harvest, canola should be cooled for up to six weeks because of high respiration rates and moisture. There is a potential risk of spoilage due to storage issues in Nepal. Spoilage in canola seeds happens when the initial temperature ranges from 10°C to 50°C and moisture content is from 12% to 7% (appendix, figure 4) (CGC, 2013). The moisture content and temperature of a bulk stock of canola may need monitors and an aeration system so that moisture content and temperature can be monitored (CGC, 2013). It is recommended that for long-term storage, canola should be at 8% to 9% moisture and below 20°C (CGC, 2013). In order to prevent mold and disease in the seed in Nepal, grain bins with have to be established by the government.

Cost Analysis to Achieve Profit:

The average price for canola seeds in Canadian dollars is $544.69 per tonne (CCC, 2014). The canola seeds exported will be shipped by the tonne to Nepal. Specific transportation costs for the canola seeds to travel to Nepal is unknown (Cargill Limited, Personal Communication November, 4, 2014). It is known that the more inland a product must travel the more significantly the costs will increase: this is especially prevalent in Asia. As Nepal is a land locked nation, and is not bordered by any body of water, another mode of transportation inland will add a significant amount to the cost of the import (Cargill Limited, Personal Communication November, 4, 2014).

Technology Needed:

In order to process canola seeds, a means of extraction is needed. Poor rural farmers commonly extract mustard oil using traditional oil mills. Because both mustard and canola are from the Brassica species, similar crushing methods can be used. The

traditional mills in place in Nepal will be used to process the canola seeds (appendix, figure 5). The traditional mills work by applying low pressure on the seeds to initiate the cracking process (Shrestha D.S., et al. 1996). The cracked seed comes out of the grinder because of rolling and action created by a disc grinder. The seeds are then taken in a frying pan and heated to about 60°C (Shrestha D.S., et al. 1996). The seeds are then taken into a leather bag and placed between two compression beams of the oil mill (Shrestha D,S., et al. 1996). The beams apply pressure on the seeds to extract the oil. After maximum pressure is applied to the seed bag, the seeds are kept in the compressed condition for around half an hour to extract the most amount of oil possible (Shrestha D.S., et al. 1996). These traditional mills are not as efficient as newer technology to extract seed: as much as 30% of the total oil content can remain in the oil meal (Shrestha D.S., et al. 1996). As the market grows for canola oil, the Nepalese government will be able to invest in new infrastructure and technology to increase efficiency of extraction and produce higher quality oil.

Needs and Benefits to Nepal:

Agriculture is the largest sector of economy in Nepal; therefore, undoubtedly the Nepalese population relies heavily on agriculture as their main livelihood (Ratnakar, et al. 2005). In order to expand Nepal's export destinations, new products must diversify its export profile (Ratnakar, et al. 2005). The processing of imported canola seeds will do exactly that. Not only canola oil, but also canola meal will create new trade opportunities with different countries.

Mustard seed is a very important crop in Nepal; as a result, it accounts for the majority of the oil consumed there (Mirshra, et al. 2010). Various problems with oil

seed crops from soil and weather result in a low yield of seeds. A main challenge is a decline in soil fertility caused by a continuous adaptation of the same cropping system (Mirshra, et al. 2010). Mustard is being grown in nutrient lacking soil, when it is an energy rich crop. Some of the cropping systems used in Nepal remove 400 to 900kg of nutrients per hectare (Mirshra, et al. 2010). This persistent nutrient loss poses a huge threat to oil seed production in Nepal. Importing oil seeds will create a constant supply for vegetable oil production.

A second challenge Nepal faces is the high degree of variation in climate. With the effects of rising temperatures, erratic rainfall patterns and irregular monsoon seasons, a large part of the agriculture sector of Nepal- which depends largely on weather and climate conditions- may be effected (Manandhar, et al. 2010). Although Nepal does not contribute significantly to global warming, because of its underdevelopment Nepal is quite sensitive to the effects climate change has on weather patterns. This change is also increasingly affecting the livelihood of Nepalese farmers who are defenseless because of economic reasons (Manandhar, et al. 2010). A study from the *Canadian Journal of Plant Science*, found that an increased frequency of hot days during critical stages of plant development resulted in lower yields for *Brassicaceae* vegetables (Warland, et al. 2009). Evidence clearly suggests that increased temperatures are not beneficial for *Brassica* crop production. Although Canada isn't impervious to climate change, Canada has access to more resources for nutrients and research into development of new strains of oil seeds that will withstand the changing climate. With Canada's resources, oilseed production in Nepal will not be ridden with the problem of low yields.

Considerations:

In order to understand the benefits of exporting Canadian grown canola to Nepal, there are a few unknowns that need to be taken into consideration. It is to be considered that exporting canola seeds to Nepal may not be beneficial to the countries population in entirety. Nepalese farmers' that grow mustard seed may suffer with the addition of more oil seeds to be processed. It should be researched quantitatively the possible negative side effects an abundance of oil seeds will have on subsistence farmers. Another point that needs to be taken into consideration is the road network in Nepal. Nepal's rugged terrain prevents road access to a substantial part of Nepal (TWB, 2009). With 15 out of 75 district headquarters not connected by road, significant problems could arrive for the shipment of the canola seeds from India into Nepal (TWB, 2009). In conclusion, more research will need to be done in order to assess the benefits and problems associated with exporting canola seeds to Nepal.

Appendix:

Figure 1: Canola Seeds
(http://www.canolacouncil.org/media/image-gallery/seed,-oil-meal/)

Company	Variety	Yield (bu/ac)	% of competitor	# of sites
CANTERRA SEEDS vs. Dekalb	CANTERRA 1990	56.37	102%	32
	74-54 RR	55.29		
	CANTERRA 1990	54.77	101%	35
	74-44 BL	54.39		
	CANTERRA 1990	57.02	104%	23
	73-75 RR	54.60		
CANTERRA SEEDS vs. Dupont	CANTERRA 1990	56.92	105%	15
	D3153	53.91		
CANTERRA SEEDS vs. Invigor	CANTERRA 1990	56.54	104%	14
	L130	54.28		
	CANTERRA 1990	53.59	103%	7
	L120	52.15		
	CANTERRA 1990	59.25	103%	8
	5440	57.33		
CANTERRA SEEDS vs. Brett Young	CANTERRA 1990	55.11	102%	16
	6060	54.01		
CANTERRA SEEDS vs. Pioneer Hybrid	CANTERRA 1990	56.16	106%	12
	45H29	52.99		
	CANTERRA 1990	55.32	103%	14
	45H31	53.86		
	CANTERRA 1990	55.81	104%	15
	45S54	53.86		

Table 1: Summary of CANTERRA 1990 results across Western Canada
(http://www.canterra.com/home/performance_data/)

Figure 2: Canola growing regions in Canada and the United States (http://www.canolacouncil.org/media/image-gallery/canola-growing-region-map/)

Amino Acid	Average % (36% CP basis)	Proportion as % of CP
Alanine	1.57	4.36
Arginine	2.08	5.78
Aspartate + asparagine	2.61	7.25
Cystine	0.86	2.39
Glutamate + glutamine	6.53	18.14
Glycine	1.77	4.92
Histidine	1.12	3.11
Isoleucine	1.56	4.33
Leucine	2.54	7.06
Lysine	2.00	5.56
Methionine	0.74	2.06
Methionine + cystine	1.60	4.44
Phenylalanine	1.38	3.83
Proline	2.15	5.97
Serine	1.44	4.00
Threonine	1.58	4.39
Tryptophan	0.48**	1.33**
Tyrosine	1.16**	3.22**
Valine	1.97	5.47

Table 2: Amino Acid Composition of Canola Meal (http://www.canolacouncil.org/oil-and-meal/canola-meal/nutrient-composition-of-canola-meal/protein-and-amino-acids/)

		N	P_2O_5	K_2O	S
Spring wheat	Uptake [1]	76 - 93	29 - 35	65 - 80	8 – 10
2690 kg / ha (40 bu / ac)	Removal [2]	54 - 66	21 - 26	16 - 19	4 - 5
Barley	Uptake	100 - 122	40 - 49	96 - 117	12 - 14
4300 kg / ha (80 bu / ac)	Removal	70 - 85	30 - 37	23 - 28	6 - 8
Oats	Uptake	96 - 117	36 - 45	131 - 160	12 - 14
3584 kg / ha (100 bu / ac)	Removal	55 - 68	23 - 28	17 - 20	4 - 5
Flax	Uptake	64 - 78	18 - 22	39 - 48	12 - 15
1492 kg / ha (24 bu / ac)	Removal	46 - 56	14 - 17	13 - 16	5 - 6
Canola	Uptake	100 - 123	46 - 57	73 - 89	17 - 21
1960 kg / ha (35 bu / ac)	Removal	61 - 74	33 - 40	16 - 20	10 - 12

Table 3: Nutrient Uptake and Removal by field Crops (http://www.agriculture.gov.sk.ca/Default.aspx?DN=a866a31e-266f-49aa-a3db-44f31dda65ea)

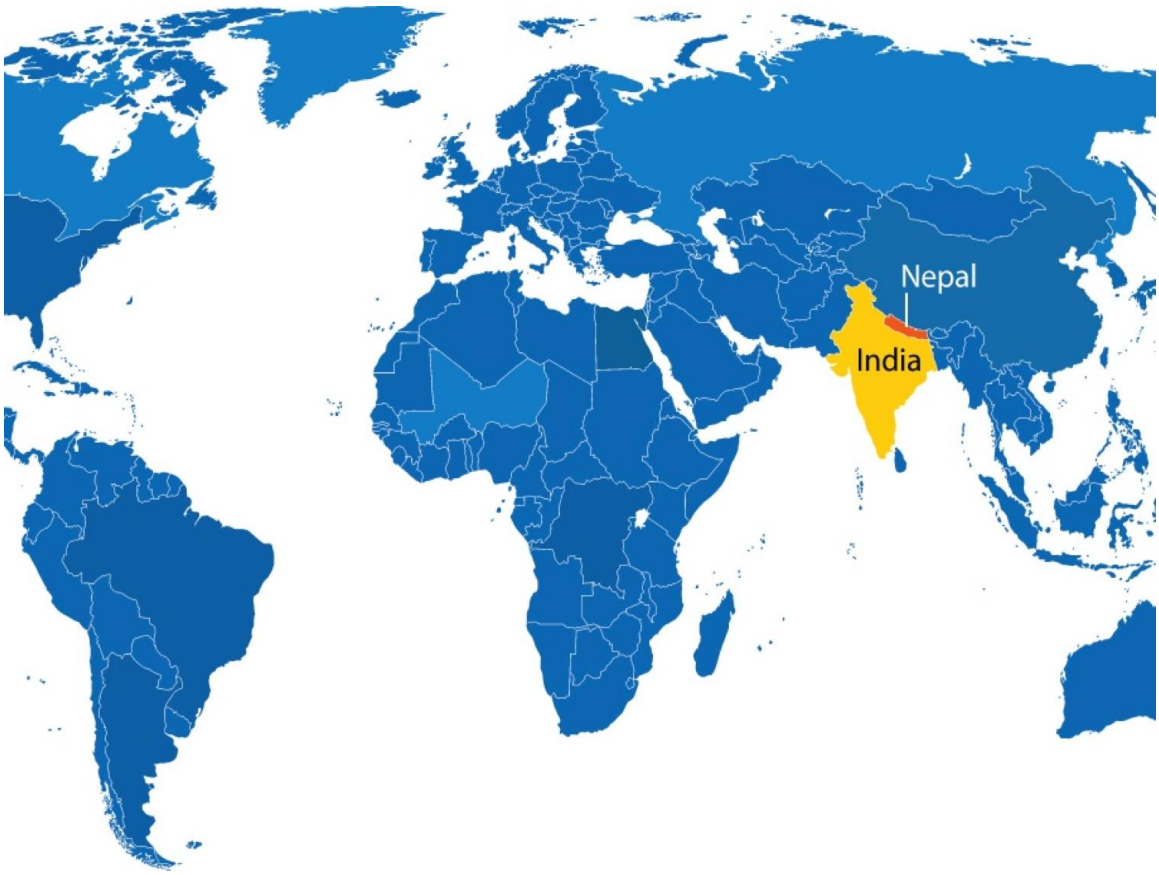

Figure 3: Nepal's location on a world map (http://www.skyscrapercity.com/showthread.php?t=1442604)

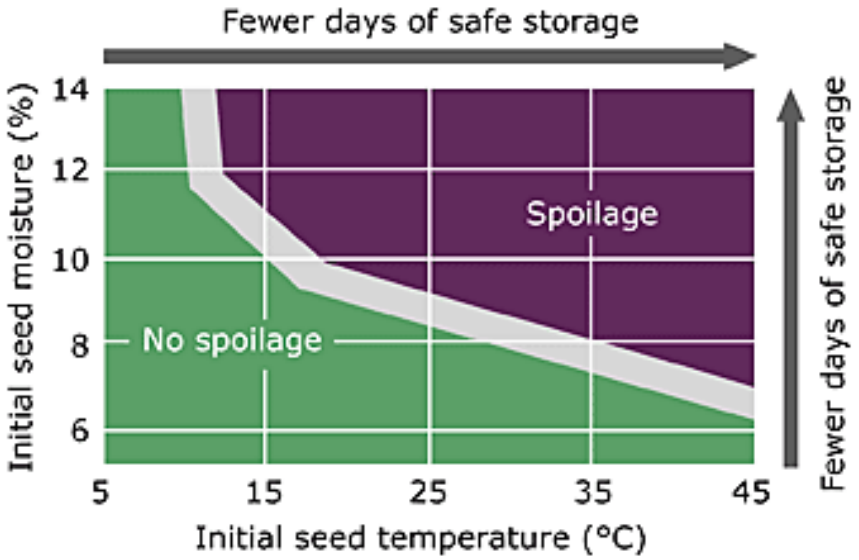

Figure 4: Safe storage chart for canola
(http://www.grainscanada.gc.ca/storage-entrepose/ssg-de-eng.htm)

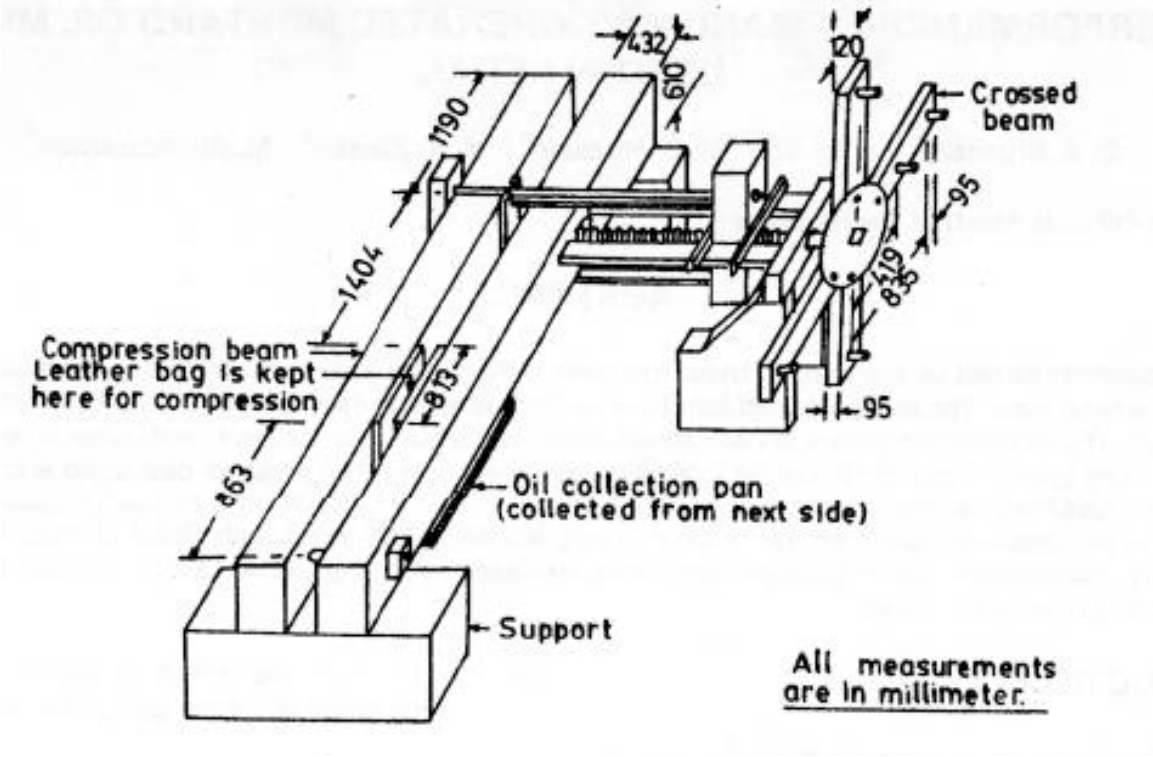

Figure 5: Manually operated mustard oil mill
(http://www.webpages.uidaho.edu/~devs/Research/Publications/Peer%20Reviewed/11%20JP_02%20Performance%20of%20manually%20operatedl%20mustard%20oil%20mill%20used%20in%20Nepal.pdf)

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