

Assessment of the Possible Exportation of Yellow Mustard Seeds to Nepal

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Part 1-

Introduction of Product:

The yellow/ white mustard seed belongs to the *Brassica* family and is also known as *Brassica Sinapis alba*. It is a cool season crop and is most productive in a short growing season. The yellow/white mustard seed is a relative of the canola plant but is more resistant and tolerant to drought, heat and frost, which makes it ideal for Nepal's colder climates (Agriculture and Agri-foods Canada 2015). This paper will critically analyze the benefits and realistic costs of exporting yellow mustard seeds grown and processed in Canada to the country of Nepal.

Description of How/Where Product is Grown:

Brassica Sinapis alba is primarily grown in Canada's prairie provinces such as Alberta and Saskatchewan ("Canadian Mustard Seed," 2013). 70% of the production of yellow mustard seed plants primarily occurs in Saskatchewan (Katepa-Mupondwa, Raney, & Rakow, 2005, p. 382). The mustard plants, from which the seeds are obtained, are grown under rain-fed conditions or by the use of irrigation. Farmers usually incorporate mustard plants in their crop rotation practices along with a variety of cereal crops (McKenzie & Carcamo, 2010). Yellow mustard seed plants require approximately 80 to 85 days to fully mature in their ideal temperature conditions. These plants prefer to be grown in on fertile, well-drained loamy soils (Oplinger et al., 2015).

The Impact of Product on Canada:

The importation and exportation of yellow mustard seed and the other variants of mustard seeds has remained at a relatively steady pace throughout the last couple of years as seen in

figure 1. As a result, the yellow mustard seed is a stable product in Canada and is capable of generating a decent amount of income for the producers who are responsible for its production and the means to process the product.

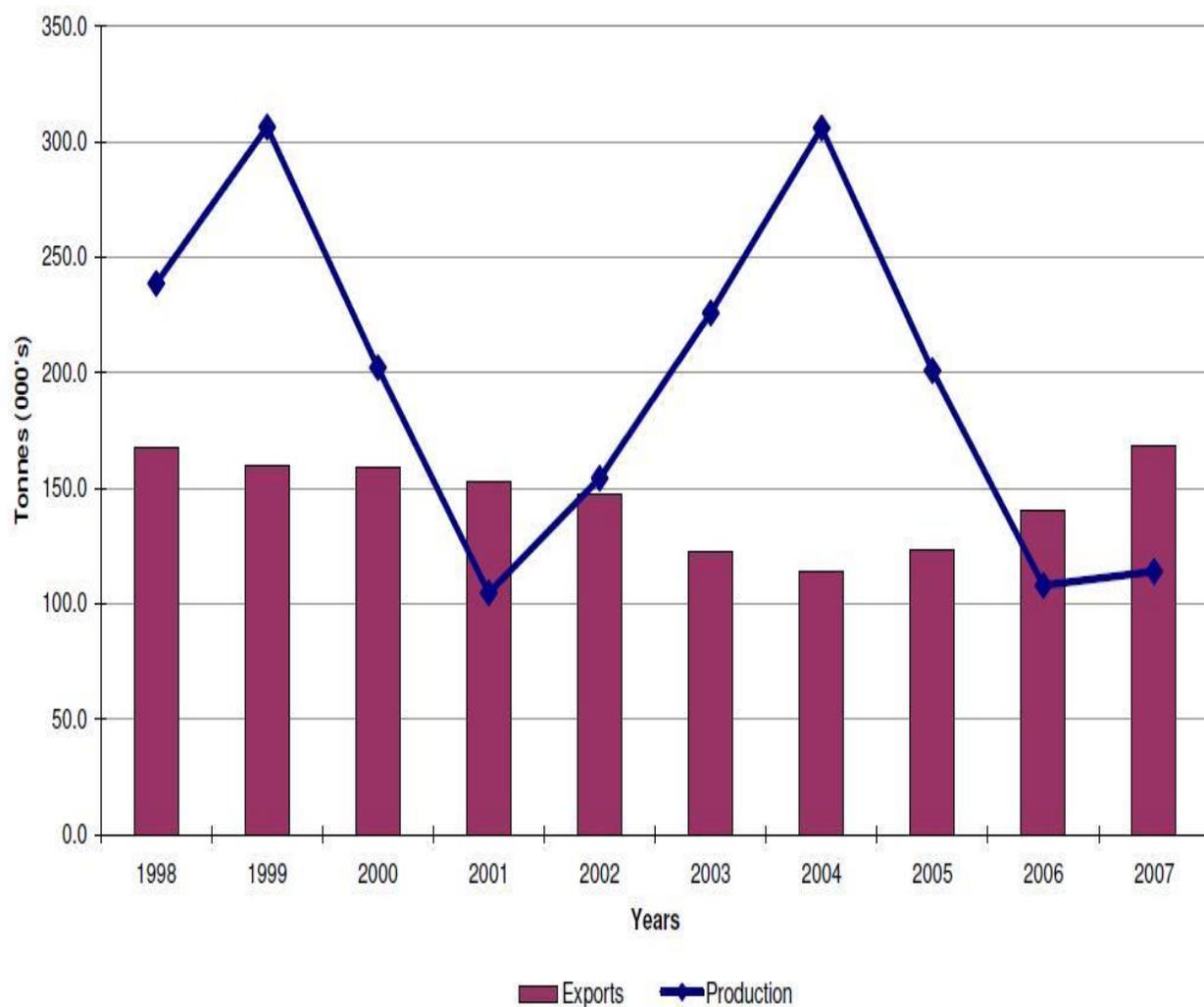


Figure 1: Canadian exportation and production of mustard seeds in the year span of 1998 to 2007, retrieved from: <http://www.agr.gc.ca/eng/industry-markets-and-trade/statistics-and-market-information/by-product-sector/crops/pulses-and-special-crops-canadian-industry/mustard-seed/mustard-seed-statistics/?id=1174504635719>

There have been some fluctuations over a span of some years in regards to the amount of mustard plants seeded and harvested.

Table 1: Statistics for the production of mustard seed in Canada from 2013-2016, retrieved from: <http://www.agr.gc.ca/eng/industry-markets-and-trade/statistics-and-market-information/by-product-sector/crops/crops-market-information-canadian-industry/canada-outlook-for-principal-field-crops/canada-outlook-for-principal-field-crops-september-24-2015/?id=1444823469089>

Mustard Seed [a]: September 24, 2015

	2013-2014	2014-2015[f]	2015-2016[f]
Area seeded (kha)	148	202	132
Area harvested (kha)	146	195	121
Yield (t/ha)	1.06	1.01	0.90
Production (kt)	155	198	109
Imports (kt) [b]	2	1	0
Total supply (kt)	193	209	144
Exports (kt) [b]	138	126	110
Total domestic use (kt) [c]	45	48	29
Carry-out stocks (kt)	10	35	5
Stocks-to-use ratio (%)	5	20	4
Average price (\$/t) [d]	775	700	785-815

[a] August-July crop year.

[b] Imports and exports exclude products.

[c] Total domestic use = Food and industrial use + Feed waste and dockage + Seed use + Loss in handling. Total domestic use is calculated residually.

[d] Producer price, Free-on-board (FOB) plant, average over all types, grades and markets.

kha: kilohectares

t/ha: tonnes per hectare

kt: kilotonnes

\$/t: dollars per tonne

f: forecast, Agriculture and Agri-Food Canada, September 24, 2015

Source: Statistics Canada and industry consultations.

As seen in table 1, the amount of land used to plant the mustard seeds have decreased by a fair in the time span between the years 2015 to 2016. Although there has been a decrease in the

production and yield for the mustard seeds, the demand for the exportation of these seeds to Nepal may influence the producers to consider putting a greater emphasis on this product.

Common Use of Product:

Mustard seeds are a common product in salads, food flavorings and are a major component of a specific type and flavor of mustard. The most common use of the yellow mustard seeds is a condiment, which involves crushing the seeds into a paste (Aluko & McIntosh, 2004, p. 679). Another use for the seeds would be as a source of protein. After the mustard seeds undergo a process to extract their oil, a residual meal remains. This residual meal is very high in protein, accounting for approximately 30- 48 % of the dry weight of the residue (Aluko & McIntosh, 2004, p. 679). This residual meal could be incorporated into a variety of meals in order to increase the protein content. A major benefit of the use of yellow mustard seeds could arise from the form of biodiesel, a fuel made from biological sources such as animal fat and vegetable oils (Ciubota-Rosie et al., 2013, p. 83). This alternative source of fuel would be beneficial because of its biodegradable and non-toxic nature along with the low emission rates associated with this product (Ciubota-Rosie et al., 2013, p. 83).

Environmental Sustainability of Product:

Mustard seed plants prove to be a beneficial product based on their effects on the overall quality of the soil in which they planted. By incorporating the mustard residue from the post harvest direct seeded cropping system on the fields will help protect the surface soil from wind, water and erosion. Mustard plants also inhibit the growth of certain weeds by interrupting their initial germination and also act as protection against diseases in other crops that are in close

proximity (H, P, & Carcamo, 2010). As seen by the numerous benefits, mustard plants would aid in decreasing the amount of energy needed to transport, plant and maintain the many crops planted in prairie provinces of Canada.

Benefits to Canada (Canadian Farmers):

There are many benefits that would arise for Canada from the exportation of yellow mustard to Nepal. One such benefit would be the increase of jobs for many farmers and producers of this crop. In previous years, the export of mustard seeds decreased by a significant amount. Despite this decrease, the exportation of mustard seeds has been predicted to increase, thus giving farmers more opportunities in this sector (Canada and Agri-Food, 2015). It has been predicted that the production and demand for brown and oriental mustard seed will decrease while the yellow mustard seed will remain less affected.

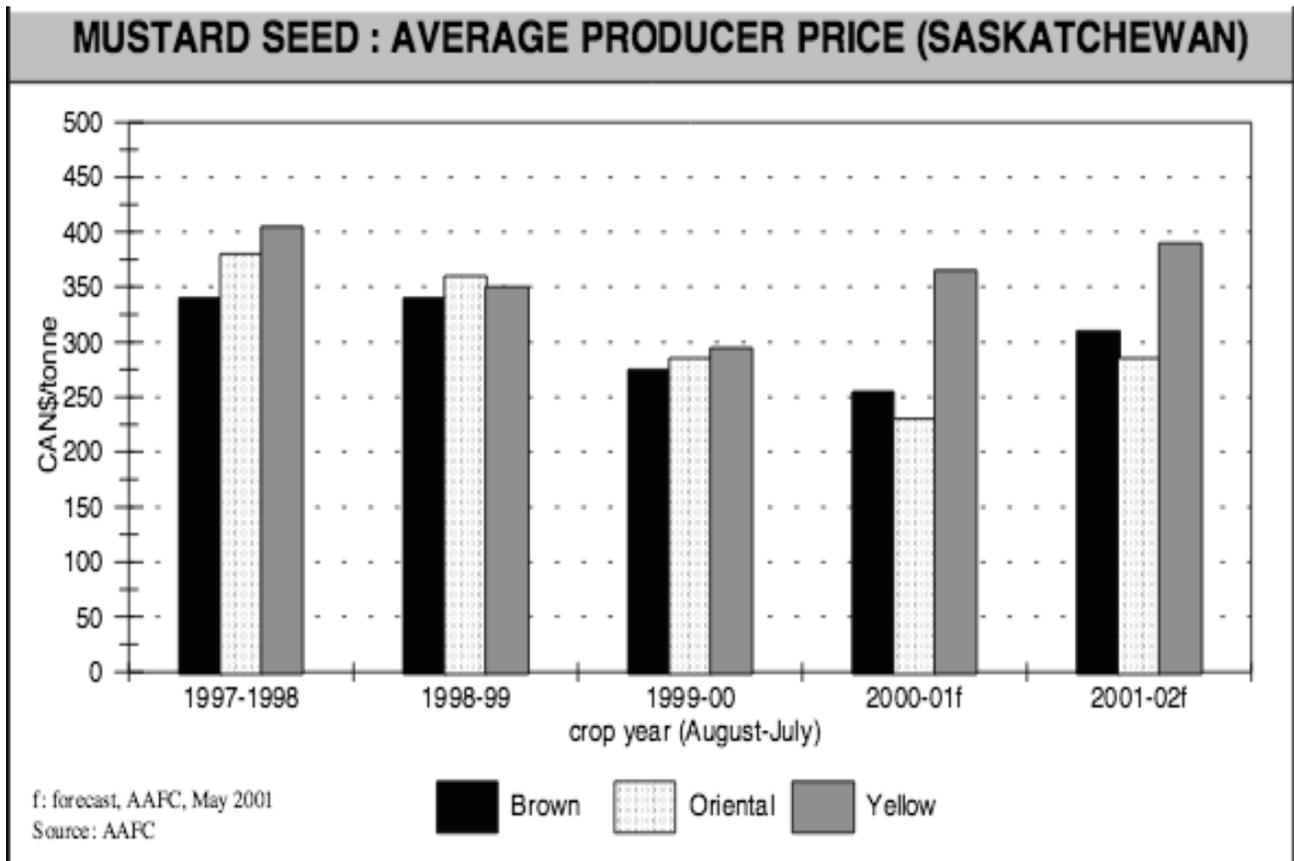


Figure 2: The average producer price for the three most common types of mustard seeds in the year span of 1997-2002. Retrieved from: <http://publications.gc.ca/collections/Collection/A27-18-14-8E.pdf>

As seen in figure 2, the prices for the yellow mustard seeds have remained at relatively steady rate throughout span of 1997 to 2002. This indicates that the yellow mustard seed is a reliable product for Canada to continue investing in and also the most rewarding in regards to the money obtained from selling this seed type.

Since the yellow mustard seed is such a vital product in Canada, the Canadian Grain Commission created quality standards for these mustard seeds. These seeds are also protected by security, which enables farmers and producers to make a claim against buyers who do not make a payment ("Canadian Mustard Seed," 2013). There are numerous companies who are licensed under the Canadian Grain Commission and thus have the means to get compensation through the Payment Protection Program if anything goes wrong with the delivery made to the dealer (Government of Canada, 2014). As seen, the yellow mustard seed sector enables many people to establish a stable means of generating money with certainty that they will be given the amount they deserve from the dealers and companies that acquire their products.

Part 2-

Introduction to Nepal:

Nepal is a small country located in South Asia, specifically in the Himalayan Mountain range. Nepal is located between India, which is to the south, east and west of the country and China, which is to the north. Nepal is approximately 147, 181 square kilometers and is entirely landlocked with no access to any major body of water (Country, 2005, p. 5). Nepal consists of three major geographical regions, the Tarai region, the Hill region and the Himalayan region.

The Tarai region is located in the south of the country and is the main area for agriculture and contains the highest density of Nepal's population. The Tarai region is the warmest area in Nepal with a temperature range of 5 ° C to 47 ° C (Country, 2005, p. 6). The Hill region is located in the north of Nepal. This region consists of mainly hills, valleys, flat lands and mountains. The climate in the Hill region ranges from 0 ° C to 28 ° C (Country, 2005, p. 6). The Himalayan region of Nepal is found in the North of the country and consists of large mountains, including Mount Everest. The temperature range in the Himalayan region ranges from below 0 ° C to 16 ° C (Country, 2005, p. 6).

Nepal is considered as a relatively poor country and has a population of approximately 23 million people. In regards to economic sectors in Nepal, agriculture is by far the largest and most prominent. For many years, agriculture has employed a majority of Nepal's population and provided approximately half of the gross domestic product (GDP) (Country, 2005, p. 11). Even though agriculture plays such an important part in the economy and the lives of the Nepalese people, this sector has also experienced a significant decline due to low agricultural growth rates and high population growth rates (Country, 2005, p. 11). These low agricultural growth rates arose from the fact that Nepal has a very limited means of acquiring new and advanced agricultural technologies (Country, 2005, p. 11).

Transportation Logistics-

The mustard seeds will be harvested in the Canadian Prairie Provinces and processed and cleaned at Petracek's Seed Farms LTD, which is located in Saskatchewan ("Petracek's Seed Farms Ltd," n.d.). Table 2 offers the numerous methods in contacting the Petracek's Seed Farms Ltd.

Table 2: The contact information for Petracek's Seed Farms Ltd, retrieved from:
http://members-new.sasktrade.com/members_detail.php?q=1000528

Owner	Ted Petracek
Telephone	306-745-3829
Adress	P.O. Box 410 Churchbridge, Saskatchewan S0A 0M0
Email	psf@sasktel.net

Another alternative company that could be involved in the packaging and processing of the mustard seed is Western Grain and Processing Division located in North Battleford, Saskatchewan. A larger company known as Toepfer International, which is located in Hamburg, Germany, owns Western Grain and Processing Division (Toepfer International Western Grain & Processing Division, 2012). The contact information is located below in table 3.

Table 3: Contact information for Western Grain and Processing Division, retrieved from:
<http://www.westerngrain.com/products.html>

Address	Hw. 4 North at Hamlin Rd Box 1149 North Battleford, SK, Canada S9A 3K2
Phone	(306) 445-4022
Fax	(306) 445-4033

After the seeds have been processed and cleaned they will be shipped to the Toronto airport via CN rail or by truck. The seeds will then be flown to Nepal's main international airport located in Kathmandu. The seeds will be flown to Nepal rather than shipped to ensure the overall freshness and quality of the seeds. The mustard seeds will then be transported to their designated areas by trucks, which will travel on Nepal's safer roads to reach the customers (Country, 2005, p. 16).

Shipment of Product-

Yellow mustard seeds produced in Canada will be shipped to Nepal in either bulk or in containers (Canada and Agri-Food, 2015). Western Grain and Processing Division export mustard seeds in bulk in sizes ranging from 100 lb. bags, 45 Kg bags, 50 lb. bags, 25 Kg bags and 20 Kg bags with prices around for \$ 0.90/lb. for mustard seeds Division (Toepfer International Western Grain & Processing Division, 2012). The mustard seeds will be transported in the bags from the international airport to smallholders in the villages of the Hill farming system. The mustard seeds will flourish in that region in Nepal because the farmers have experience with crops such as rice, wheat, maize and millet, which require a similar temperature range as yellow mustard seeds (Krishna & August, 2010, p. 4).

Overview of the Product in Nepal-

In order to make it easier to understand and visualize the exact way in which the yellow mustard seeds will be transported to Nepal, a flowchart was created.



Figure 3: A flowchart depicting the series of events involved in the exportation of yellow mustard seed to Nepal.

Needs and Benefits to Nepal-

A major problem in Nepal is the severe amount of deficiencies in the population. Table 4 outlines the most prevalent deficiencies found in Nepal.

Table 4: Major deficiency disorders in Nepal, retrieved from:

<http://www.hindawi.com/journals/isrn/2015/276469/>

Micronutrients	Deficiency prevalence	Major deficiency disorders
Iron	35% of women (15–49 years of age) and 46% of children (under five years) [36]	Iron deficiency anemia, reduced learning and work capacity, increased maternal and infant mortality, low birth weight, impaired human function at all stages of life
Iodine	22.0–27.9% [48–50] (urinary iodine <100 µg/L)	Cretinism, goiter, impaired cognitive function, increased prenatal morbidity and mortality, reduced productivity
Zinc*	87.3% in children [51]; 61.0% in pregnant women [8]	Poor pregnancy outcome, impaired growth (stunting), genetic disorders, decreased resistance to infectious diseases
Folate*	6.2% in children [52]; 12.0% in pregnant women [8]	Neural tube and other birth defects, megaloblastic anemia, heart disease, stroke, impaired cognitive function, depression
Vitamin A*	8.5% in children [52]; 7.0% in pregnant women [8]	Xerophthalmia (night blindness, Bitot's spot, corneal ulcer, keratomalacia, xerosis), increased risk of morbidity and mortality, increased risk of anemia
Vitamin D*	17.2% in children [52]; 14.0% in pregnant women [8]	Rickets, osteomalacia, osteoporosis, colorectal cancer
Vitamin E*	17.9% in children [52]; 25.0% in pregnant women [8]	Ataxia, peripheral neuropathy, muscle weakness, miscarriages, slow growth in children
Vitamin C*	Limited information	Scurvy (fatigue, hemorrhages, low resistance to infection, anemia)
Vitamin B1*	Limited information	Beriberi (cardiac and neurologic), Wernicke, and Korsakov syndromes (alcoholic confusion and paralysis)
Vitamin B2*	33.0% in pregnant women [8]	Nonspecific (fatigue, eye changes, dermatitis, brain dysfunction, impaired iron absorption)
Vitamin B3*	Limited information	Pellagra (dermatitis, diarrhea, dementia, death)
Vitamin B6*	43.1% in children [52]; 40.0% in pregnant women [8]	Dermatitis, neurological disorders, convulsions, anemia, elevated plasma homocysteine
Vitamin B12*	18.1% in children [52]; 28.0% in pregnant women [8]	Megaloblastic anemia (associated with <i>Helicobacter pylori</i> induced gastric atrophy)
Calcium*	Limited information	Decreased bone mineralization, rickets, osteoporosis
Selenium*	59.0% in children [52]	Cardiomyopathy and increased cancer and cardiovascular risk
Fluoride*	Limited information	Affects bone health including increased dental decay

*Lacking data from national survey.

As seen in table 4, the majority of the deficiencies pose as a threat to primarily young children and pregnant women. As a result, Nepal's population might experience a harsh decline if these problems are not resolved in a relatively fast and effective manner. Mustard seeds could aid in combating some of the major deficiencies in Nepal, primarily vitamin A deficiency. Vitamin A deficiency is often distinguished by its effects on the eyes, specifically a disease known as xerophthalmia, which left unattended can lead to permanent blindness. Although xerophthalmia is a serious problem, it can be cured through medications and dosages of vitamin A (Forest Restoration, 2005, p. 7). The greatest concern that should be considered is the destruction of the immune system, which alters the body's ability to resist and fight infections, possibly leading to death (Forest Restoration, 2005, p. 7). Another way in which a vitamin A deficiency can harm the body is by increasing the chance of a person becoming anemic, which is extremely harmful for pregnant women (Forest Restoration, 2005, p. 8).

Mustard seeds contain a high concentration of protein, approximately around 28 – 36 %. These seeds are also very rich in many of the essential amino acids and contain a very balanced composition of the amino acids (Damian, n.d., p. 39). Yellow mustard seeds are also very rich in a variety of compounds such as sugars and minerals, which can be seen in table 5.

Table 5: A list of the major nutrients found in yellow mustard seed. (Taken from:

<http://ndb.nal.usda.gov/ndb/foods/show/274?fg=&man=&lfacet=&count=&max=35&sort=&qlookup=yellow+mustard+seed&offset=&format=Full&new=&measureby=>)

Nutrient	unit	1 value Per 100 g	Data points	Std. Error	1 tsp 2g	1 tbsp 6.3 g
Water ^{1 2}	g	5.27	3	0.236	0.11	0.33
Energy	kcal	508	--	--	10	32
Energy	kJ	2126	--	--	43	134
Protein ^{1 2 3}	g	26.08	4	0.323	0.52	1.64
Total lipid (fat) ^{1 2 3}	g	36.24	4	1.355	0.72	2.28
Ash ^{1 2 3}	g	4.33	4	0.252	0.09	0.27
Carbohydrate, by difference	g	28.09	--	--	0.56	1.77
Fiber, total dietary ^{1 2 3}	g	12.2	4	5.482	0.2	0.8
Sugars, total ¹	g	6.79	1	--	0.14	0.43
Sucrose ¹	g	3.69	1	--	0.07	0.23
Glucose (dextrose) ¹	g	2.88	1	--	0.06	0.18
Fructose ¹	g	0.02	1	--	0.00	0.00
Lactose ¹	g	0.00	1	--	0.00	0.00
Maltose ¹	g	0.00	1	--	0.00	0.00

Galactose ¹	g	0.20	1	--	0.00	0.01
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Minerals

Calcium, Ca ^{1 2 3}	mg	266	4	40.683	5	17
Iron, Fe ^{1 2 3}	mg	9.21	4	0.692	0.18	0.58
Magnesium, Mg ^{1 2 3}	mg	370	4	1.607	7	23
Phosphorus, P ^{1 2 3}	mg	828	4	27.954	17	52
Potassium, K ^{1 2 3}	mg	738	4	5.630	15	46
Sodium, Na ^{1 2 3}	mg	13	4	7.129	0	1

As seen in table 5, yellow mustard seeds contain a substantial amount of vital minerals such as iron and magnesium. As mentioned before, many children and women suffer from anemia from a lack of iron in their diet. As a result, a majority of Nepal's population is iron deficient. Anemia occurs when the red blood cells in a person's body do not function correctly. This can be seen when the red blood cells are unable to properly transport oxygen around the body. A lack of oxygen usually results in heart palpitations, fatigue, increased heartbeat, headaches, shortness of breath and an overall feeling of weakness (Susan & Holcomb, 2005, p. 53). In order to utilize the mustard seeds beneficial qualities, the Nepalese people could incorporate this product into their cuisine for spice and flavor or even use it as cooking oil.

Negative Implications to Nepal-

Although the exportation of yellow mustard seeds may benefit the Nepalese people in many ways, the product could also be detrimental. One way in which the product could be harmful is the price that it will be sold for by Canada. As mentioned previously, the prices for mustard seeds have increased over the years as result of low demand and production. This increase in cost is beneficial to Canada but may severely impact Nepal's economy thus giving the Nepalese people reason not to buy from Canada. Another reason why the product could cause problems for Nepal is the storage it requires. Mustard seeds that are kept for longer periods of time should be kept in the ideal condition of approximately less than 9 % moisture (Damian, n.d., p. 39). The farmers who purchased the product may be unable to find these ideal conditions and as result the product may spoil and not be good to plant or eventually harvest. If this scenario occurred, then the Nepalese farmers would be hesitant to purchase anymore of Canada relatively expensive yellow mustard seeds.

Competition From Other Countries:

Canada has been the top producer of mustard seeds in the world for many years but has had competition from India as well. It has been estimated that India produces approximately 2.5 million tonnes of yellow mustard seeds (Canada and Agri-Food, 2015). It can be seen that India is a major competitor for Canada and in regards to Nepal, is much closer and more convenient of a exporter. Although it seems that Nepal would benefit more from exporting from India, Canada is known for its higher quality cultivars. These cultivars have been specifically bred by Canada's top to scientists to be superior in many areas such as increase weight, lower fixed oil, higher

mucilage content (Clarke, 2011). While India may be geographically closer to Nepal, Canada has proven that its superior yellow mustard seeds are a better and more beneficial investment for Nepal.

Part 3:

Unknown Details Regarding the Exportation of Product-

As the exportation of yellow mustard seeds from Canada to Nepal has been thoroughly analyzed, it became evident that there are many unknowns that must be addressed in order to make this product a viable export idea to Nepal. One major unknown is the exact cost of transportation via the CN train in Canada, the cost of shipment of the seeds on plane and the cost associated with the transportation of the product to the smallholders in Nepal. These costs must be evaluated in order to further consider if the exportation of the seeds is feasible for Nepal. Another unknown is whether the seeds would actually thrive well in the hills region of Nepal. One way to solve this unknown is to actually run some test trials and evaluate how well the seeds grow in that area.

A major factor to consider when evaluating the possibility of the exportation of yellow mustard seed is what the farmers in Nepal will do once the product has been introduced to the country for a long period of time. The farmers would either start to grow their own seeds and process them in Nepal or they would continue to import it from Canada. Both of these options would be beneficial in some way because the Nepalese famers could become independent or Canada would continue to make money from the trade and have a stable relationship with Nepal.

Recommendations to Canada and Nepal-

After the possible exportation of yellow mustard seed has been analyzed in all areas, many conclusions have arisen. One such conclusion is that in order for this product to be a viable and beneficial export to Nepal, both Canada and Nepal must change some aspects of their government rules such as trade policies. A specific recommendation I have for Canada is to lower the prices of the yellow mustard seed, especially after the decrease in the sector. This would enable poorer countries to expand their relations and build on relationships with other countries. This would undoubtedly be difficult for Canada to accomplish but the positives outcomes of this would outweigh the cons.

A major recommendation I would have for Nepal would be to advertise the export of yellow mustard seeds to institutions that have the means to critically evaluate this product such as universities and government programs. If these institutions showed interest in the product, then the possibility of Canada's yellow mustard seed flourishing in Nepal would increase by a significant amount.

To conclude, the exportation of yellow mustard seed would have many benefits to the people of Nepal, whether it be a means to deal with health problems, food shortages, increase in jobs or even just fostering a relationship with an influential country.

References

- Aluko, R. E., & McIntosh, T. (2004). Electrophoretic and functional properties of mustard seed meals and protein concentrates. *Journal of the American Oil Chemists' Society*, *81*(7), 679-683. <http://dx.doi.org/10.1007/s11746-004-961-0>
- Canada and Agri-Food. (2015). *Musatrđ seed:situtation and outlook*. Retrieved December 1, 2015, from <http://publications.gc.ca/collections/Collection/A27-18-14-8E.pdf>
- Ciubota-Rosie, C., Macoveanu, M., Fernández, C., Ramos, M., Pérez, A., & Moreno, A. (2013). Sinapis alba seed as a prospective biodiesel source. *Biomass and Bioenergy*, *51*, 83-90. <http://dx.doi.org/10.1016/j.biombioe.2013.01.008>
- Clarke, S. (2011). Quality is in our nature - canadian mustard seed. Retrieved December 1, 2015, from http://publicentrale-ext.agr.gc.ca/pub_view-pub_affichage-eng.cfm?&publication_id=11538E
- Country, D. (2005). Sun. the moon and sun symbolize the eternal eyes of god, the red color represents energy in action, and the blue border signifies nepal's peaceful nature. 1. *Library of Congres*, 1-26.
- Damian, C. (n.d.). (sinapis alba l.). *Lucr?ri ?tiin?ifice - Seria Zootehnie*, *61*, 39-44.
- Forest Restoration. (2005). Getting to the roots. *Science & Society*, *69*(4), 1-76. <http://dx.doi.org/10.1521/viso.69.3.277.66519>
- Government of Canada. (2014, September 3). Financial protection for your grain deliveries. Retrieved December 1, 2015, from <http://www.grainscanada.gc.ca/producer-producteur/licence/risk-risque-eng.htm>

- H, R., P, M., & Carcamo, H. (2010, January 6). Mustard production for alberta. Retrieved December 1, 2015, from [http://www1.agric.gov.ab.ca/\\$department/deptdocs.nsf/all/agdex12947](http://www1.agric.gov.ab.ca/$department/deptdocs.nsf/all/agdex12947)
- Katepa-Mupondwa, F., Raney, J. P., & Rakow, G. (2005). Recurrent selection for increased protein content in yellow mustard (*Sinapis alba* L.). *Plant Breeding*, 124(4), 382-387. <http://dx.doi.org/10.1111/j.1439-0523.2005.01131.x>
- Krishna, B., & August, P. (2010). National issue paper on the agriculture sector (adaptaion). *UNDP*, 1-24.
- McKenzie, R. H., & Carcamo, H. (2010). Mustard production for alberta. Retrieved October 20, 2015, from [http://www1.agric.gov.ab.ca/\\$department/deptdocs.nsf/all/agdex12947](http://www1.agric.gov.ab.ca/$department/deptdocs.nsf/all/agdex12947)
- Oplinger, E. S., Oelke, E. A., Putnam, D. H., Kelling, K. A., Kaminsid, A. R., Teynor, T. M., . . . Durgan, B. R. (2015, December 1). Mustard. Retrieved December 1, 2015, from <https://hort.purdue.edu/newcrop/afcm/mustard.html>
- Susan, B., & Holcomb, S. (2005). Anemia. *Nursing*, 53.
- Toepfer International Western Grain & Processing Division. (2012). Products. Retrieved December 1, 2015, from <http://www.westerngrain.com/products.html>