Exporting Triticale seed to Nepal

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PART 1: PRODUCT INFORMATION

Triticale Seed description and production:

Triticale is a hybrid between wheat and rye (Eudes, 2015). Triticale is not a genetically modified; in fact; it is made by conventional breeding methods (Chapman, Salmon, Dyson, & Blackley, 2005) Triticale production zones overlap in the extremist area of the wheat and rye (Salmon, D.F., Mergoum, M, Gomez Macpherson, 2004). Possible production areas are the same as wheat (Salmon, D.F., Mergoum, M, Gomez Macpherson, 2004). There are two different types of triticale seed: Spring and winter triticale (Guedes-Pinto, Darvey, & Carnide, 2012). Spring triticale is usually grown for the grain production (Salmon, D.F., Mergoum, M, Gomez Macpherson, 2004). This seed can be produced in an environment which there are long growing seasons and sufficient amount of moisture (Nation Research Council, 2002). Also, spring triticale has a high drought tolerance which makes it possible for triticale seed to be grown in the areas with lower moisture level and rainfall (Chapman et al., 2005). Therefore, spring triticale seed can be produced in the following areas (Salmon, D.F., Mergoum, M, Gomez Macpherson, 2004)

- High-latitude (45° or higher) area, such as Russia, Northern China and Northern Great Plain of North America, where spring triticale is planted in early spring (Salmon, D.F., Mergoum, M, Gomez Macpherson, 2004).
- Lower to middle latitude (between 45° and 30°) area, for instance, Mediterranean, the southern part of South America, India, Pakistan and parts of China where there is sufficient amount of moisture that is available from natural resources and irrigation. These areas also have mild winter which cause the sowing of the crop to happen in winter (Salmon, D.F., Mergoum, M, Gomez Macpherson, 2004).

- Low-latitude (lower than 30° N and 30° S) areas, such as Ethiopia, Zambia, Kenya and central and northern parts of South America where there are abundant rainfall and the crop is rainfed, the sowing happens in early spring and summer in the upland areas (greater than 1500 m) (Salmon, D.F., Mergoum, M, Gomez Macpherson, 2004).

From the production perspective, winter and spring triticale have a lot of similarities. The winter triticale requires long period of low temperature (four to eight weeks). The temperature should be above the freezing point but below 9° C to meet vernalization requirement and also to have a sufficient cold tolerance. Thus, winter triticale seed can be grown in the following areas (Salmon, D.F., Mergoum, M, Gomez Macpherson, 2004):

- Planting in the fall in high-latitude where there is cold climate that fulfil the vernalization and hardening process (Salmon, D.F., Mergoum, M, Gomez Macpherson, 2004). Also, there should be sufficient amount of snow that can cover the crop for its survival against harsh temperatures (Salmon, D.F., Mergoum, M, Gomez Macpherson, 2004). The areas such as northern Europe, Russia, Northern China, eastern North America and Northern Great Plains can fulfil the requirements (Salmon, D.F., Mergoum, M, Gomez Macpherson, 2004).
- Planting in the autumn in middle to high latitude where there is a cold climate for the vernalization to occur but does not have the extreme winter hardiness (Salmon, D.F., Mergoum, M, Gomez Macpherson, 2004). Areas with these requirements are Turkey, Islamic Republic of Iran. central China, United States of America and Eastern and Western Europe (Salmon, D.F., Mergoum, M, Gomez Macpherson, 2004).

In areas that high PH, heat, salinity, drought and low input are common triticale seed offers additional uses for human and animals (Salmon, D.F., Mergoum, M, Gomez Macpherson, 2004). However, in the areas where there is a high input and great amount of rainfall, triticale can be used for forage and grazing (Nation Research Council, 2002; Salmon, D.F., Mergoum, M, Gomez Macpherson, 2004).

Crop Settlement:

Similar to other cereal crops triticale seed should be planted in a firm seedbed near moisture (Nation Research Council, 2002; Salmon, D.F., Mergoum, M, Gomez Macpherson, 2004). Even though, triticale seed has a big seed and tough embryo it has been observed that in the colder climate the development of this seed becomes slower (Salmon, D.F., Mergoum, M, Gomez Macpherson, 2004). This might be explained by the fact that the seed is growing the roots before having a top growth (Salmon, D.F., Mergoum, M, Gomez Macpherson, 2004). Since triticale has a bigger seed than wheat therefore it can planted deeper in the soil which helps the product to have more moisture and better development at the beginning of the season (Salmon, D.F., Mergoum, M, Gomez Macpherson, 2004). This property is useful for drought-prone areas (Salmon, D.F., Mergoum, M, Gomez Macpherson, 2004). Seed equipment has to be prepared for this crop in specific, since the seed might be 10 to 20% bigger than wheat's seed (Salmon, D.F., Mergoum, M, Gomez Macpherson, 2004). Seed placement is very important for winter triticale specially if it is going to be planted in high latitudes or in medium latitudes (Salmon, D.F., Mergoum, M, Gomez Macpherson, 2004). The winter triticale can handle the winter hardiness better than winter wheat if it is planted in early autumn and shallow soils (maximum depth of 2.45 cm) (Salmon, D.F., Mergoum, M, Gomez Macpherson, 2004). Since winter triticale takes longer time to develop their maximum cold tolerance therefore if this seed is planted deeply in

soil it will cause the seed to not have a robust crown which is crucial for its winter survival (Salmon, D.F., Mergoum, M, Gomez Macpherson, 2004)

Fertilization and pest control:

Triticale seed has a very extensive root system which can maximize the use of nutrient even in the soils that fertility is poor (Salmon, Mergoum, & Gomez Macpherson, 2004) . Use of the fertilizers depends on the soil and climate of the area; Triticale seed uses same cultural practices as its parental species which is wheat and rye (Salmon, Mergoum, & Gomez Macpherson, 2004). In the northern Morocco where it is very hot, and the precipitation is very low, it was seen that triticale seed had a higher yield and bigger increments when phosphorus and nitrogen were used as inputs (Mergoum, Ryan and Shroyer, 1992). As a general trend, crops that are new to the environment do not have to compete with the weeds which is the case for triticale (Schoofs and Entz, 2000). There are not that many if not any pesticide or herbicide recommended for triticale (Salmon, Mergoum, & Gomez Macpherson, 2004). Most of the herbicide and pesticide that is being used for triticale seed comes from wheat and rye. However, it has been seen that the resistance of triticale seed is lower to some herbicide cocktails that is usually used for wheat (Deryche and Latre, 1998).

Harvest and storage:

Due to the large seed and embryo size of triticale crop harvesting becomes really critical, if the machinery that is being used to harvest the crop is not set to the right option it will damage the embryo of the crop which makes the crop vulnerable to to the pests and it all makes the storage harder. For avoiding the pest during the storage period, the storage area has to have great ventilation and it also has to be dry so that it can decrease the damages that can be caused by the

remaining moisture in the crop. Ideal harvest moisture is around 14% and less. A moisture level lower than 13.5% is highly ideal due to the fact that the insects and moulds are not active in that moisture level (Chapman et al., 2005). Another approach other than lowering the moisture content is by lowering the temperature to a specific limit (Chapman et al., 2005). For instance, the temperature lower than 8 ^{O}C for insect prevention, 3 ^{O}C for exclusion of moulds and -8 ^{O}C for mites suppress (Chapman et al., 2005).

Nutritional Information:

Most chemical properties of the triticale seed are closer to wheat than rye (Pena, 2004). This can be explained by the fact that triticale has received two genomes from wheat and just one genome from rye (Pena, 2004). One of the properties that triticale has and it is closer to rye than wheat is the free sugar content (Pena, 2004). The free sugar content is higher in triticale than wheat (Pena, 2004). One of the interesting properties of triticale seed is its high protein value, in specific its high lysine content which is main limiting amino acid in the most cereal crops (Kies and Fox, 1970; Villegas, McDonald and Gilles, 1970). Triticale's protein value is between 10.0 to 16.0 percent, and its NaCl soluble protein is higher than wheat (Pena, 2004) (Table 1). The gluten content and quality vary depend on the genetics of the crop; However, the highest gluten content in triticale is 20 to 30 percent lower than wheat (Pena, 2004) (Table 1)

Table 1. Protein solubility in 0.5M NaCl and gluten protein content of wheat, triticale and rye flours (Pena, 2004)

Flour	NaCl-soluble (%)	NaCl-insoluble (%)	Gluten protein in flour protein (%)	Difference (%)
Wheat	17.7	78.2	78.5	-0.3
Triticale (S)	32.4	65.6	50.5	15.1
Triticale (C)	32.5	64.2	46.4	17.8
Rye	36.7	63.0	-	-

Triticale has a higher fiber content than wheat and rye; however, the vitamin and the amino acid content of triticale is on the same level as wheat and rye (Chapman et al., 2005)(Figure 1). Triticale has higher digestibility for both animals and humans compare to other Canadian cereals (Chapman et al., 2005). It also has a comparable or even higher energy source for all classes of animals if it is being used as a feed (Chapman et al., 2005).

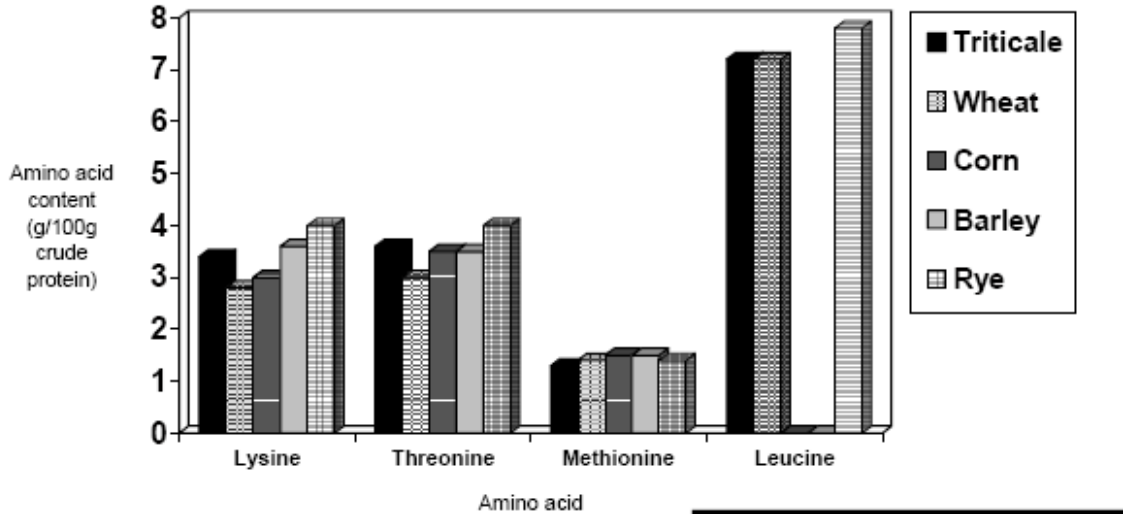

Figure 1. Amino acid content (g/100g crude protein) of triticale and other grains (Chapman et al., 2005).

Marketing Opportunity:

Comparing triticale seed to other cereal crops show that triticale has a higher yield of forage and grain for lower number of production inputs (Fohner & Hernandez Sierra, 2004). However, as it was mentioned before triticale seed is a new crop compared to wheat and only having some additional benefits to other cereal crops would not open up any market opportunities (Fohner & Hernandez Sierra, 2004). Therefore, there is niche market for triticale seed, and the reason why is that this crop has to compete with crops like wheat, rye and many more to get a bigger market (Fohner & Hernandez Sierra, 2004). The process of getting into a larger market is very difficult since other cereal crops meet the farmers need (Fohner & Hernandez Sierra, 2004). For example, for some farmers triticale seed is used as a bundle of nutrient for livestock animals, but there is similar feed for livestock that can replace the use of triticale as a feed which will decrease the demand for that specific crop (Fohner & Hernandez Sierra, 2004). One of the ways that this crop can become more prevalent in the marketplace is by educating the society about the benefits that are a bit more specific about this crop such as its higher resistance to pests and drought, its higher input uptake such as nitrogen and phosphorous and etcetera (Fohner & Hernandez Sierra, 2004). One of the important thing that has to be considered about the marketing of the triticale seed is the area that the product is being marketed (Fohner & Hernandez Sierra, 2004). For instance, there are different challenges facing the market in developed countries versus the ones that developing countries have (Fohner & Hernandez Sierra, 2004). These difference can affect the times of surplus and shortage of any specific crop that competes with triticale seed (Fohner & Hernandez Sierra, 2004)

Benefits Canada:

The triticale seed is relatively new compared to other cereal crops and Canada in specific has "lagged in adopting this crop" (Chapman et al., 2005) which causes fewer farmers to know about the pros and cons of this seed. Figure 2 demonstrates the world triticale acreage in 2001 and according to that Canada has very low acreage compare to other countries (Chapman et al., 2005).

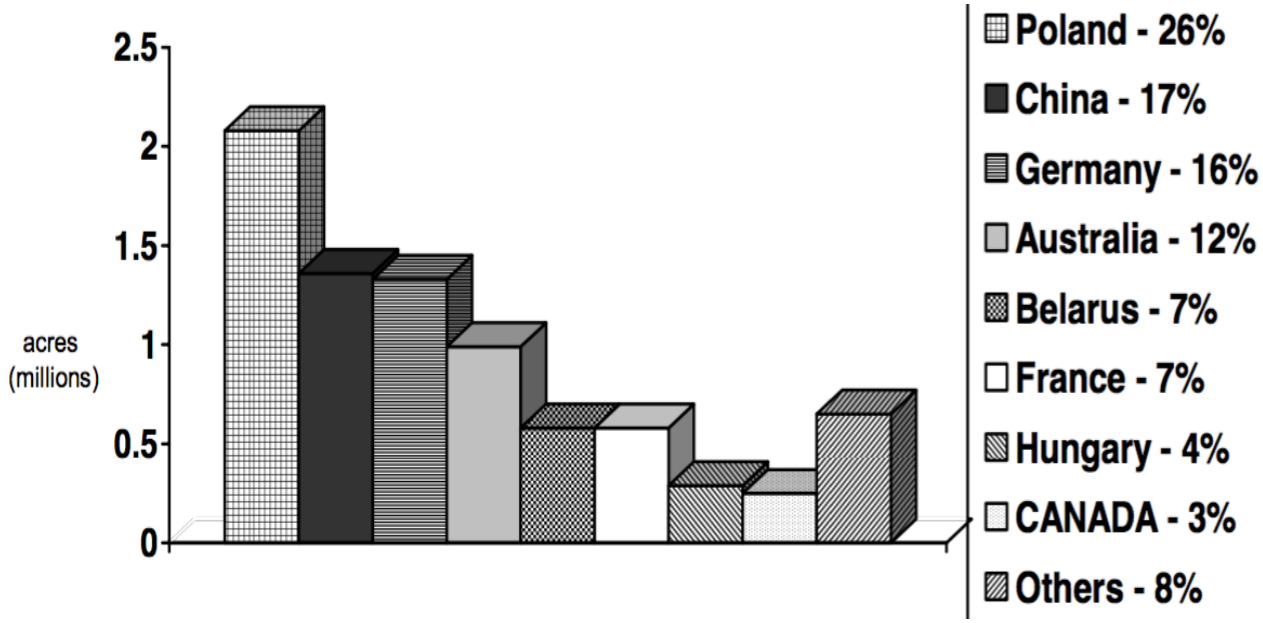

Figure 2. World triticale acreage (millions), 2001 (Chapman et al., 2005).

Exporting this product will help the Canadian farmers to become more familiar with this product. If this product becomes mainstream, it might cut some costs for the farmers since it has a higher yield and need lower protection compare to other grain and cereal crops(Chapman et al., 2005; Salmon, D.F., Mergoum, M, Gomez Macpherson, 2004). Since this crop does not have big marketing opportunities, there are not many companies that are willing to sell this crop. However, Girodat seed Ltd is one of the companies that sells this product. This company is family oriented which makes it hard for them to compete with giants such as John Deere, but by

exporting this seed there can be a major help for the company to expand which ultimately will increase the employment rate and GDP of Canada.

Environmental Sustainability:

Spring and winter triticale both can be used for forage and grain (Chapman et al., 2005). That said if the seed is been grown for the forage the quality of its grain will be lower for other uses (Chapman et al., 2005). The spring and winter triticale can be used as rotation crops to extend the forage season (Chapman et al., 2005). Because of that spring and winter triticale seed is predominantly used for the forage in western Canada (Chapman et al., 2005). The triticale seed is an excellent disease breaker for other crops that is usually used in the area as well.(Chapman et al., 2005). Triticale also has a higher uptake for common fertilizers such as nitrogen and phosphorus (Fohner & Hernandez Sierra, 2004). Considering that these two fertilizers pollute the environment as a runoff, provides additional evidence to why triticale seed is more environmentally sustainable than other cereal crops (Lauzon, 2015). They can also reduce the erosion of the soil because of their extensive root system (Salmon, Mergoum, & Gomez Macpherson, 2004) and the fact that using them as a rotation crop would not let the soil to stay bare between two planting seasons (Lauzon, 2015). All these properties of triticale are very useful for Nepal in specific since one of their major challenges is the soil degradation (Chapagain, 2015). The plant can be cultivated on the hillside where there are steep slopes and high erosion potential. Also the fact that triticale does not have to compete with weed for nutrient (Schoofs and Entz, 2000) cuts a lot of costs for the Nepalese farmer.

PART 2: Export Potential to Nepal

Introduction to Nepal:

Nepal is small country located in southern Asia between India and China (CIA, 2015; FAO,2015). Nepal has a population of 31,551,305 million people (CIA, 2015) and has a total area of 147,181 Km^2(CIA, 2015; FAO,2015). Nepal is a landlocked country, and it is divided into three different ecological zones, Tarai or flat river plain that is located in the south of Nepal, hill region which situated in the central portion of the country and the mountain zones which are located in the north of the country (CIA, 2015). Agriculture is a very important source of income in Nepal (The World Bank, 2015). In fact, one-third of the GDP comes from agricultural activities. Also, agriculture has the largest employment sector in Nepal (The World Bank, 2015). The total cultivable land in Nepal is 3.1 million hectares (FAO,2015) which from this 3.1 million hectare 28.8% of the land is used for agriculture (CIA, 2015) (Table 2). Following table contains more in depth break down of different uses of the land in Nepal (FAO,2015).

Table 2. Land use statistics (FAO,2015).

Category	Area (000 ha)
Agricultural land cultivated	3091
Agricultural land uncultivated	1030
Forest land	4268
Shrub land	1560
Grass and pasture land	1766
Water	383
Others	2620
Total	14718

There are a few challenges that Nepal faces as a country which can also affect the process of exporting triticale to Nepal. The challenges are poor infrastructure, difficult regulatory environment, instability of the financial sector, Poverty and literacy rate (The World Bank, 2015).

Triticale Seed Provider:

As it was mentioned in the pervious section triticale seed is relatively new therefore there are not many companies that can provide this seed. However, Girodat Seed Ltd. is a company that can provide seed for the project. The company was established in 1988, and they are specialized in selling certified cereal seeds such as barley, triticale, chickpeas, peas, lentils and variety of wheat. The company is located in Shaunavon, Saskatchewan and it is a family oriented company. One of the advantages that this company has is their connection with the larger corporation which can fulfill their shortage at any period of time.

Transportation Logistics:

The most economical way of exporting the triticale seeds to Nepal is by sea. The reason is that numerous products can be loaded into the ship, and it is cheaper than alternative transportation options. However, transportation overseas is not the only transportation method that is required to export the seeds; we also need road transportation since Nepal is landlocked. The shipping cost of $1,000,000 worth of Triticale seed in a 45 ft. container from Vancouver, Canada to Chittagong, Bangladesh is between $2,846.37 - $3,145.99 (Freight Calculator, 2015). For the 40 ft. container it is between $2,587.61 - $2,859.99 and for 20 ft. container is between $1,733.70 - $1,916.19 (Freight Calculator, 2015). The cost of truck transportation between

Chittagong, Bangladesh and Kathmandu, Nepal ranges from $2,875.98 to $5,403.81 for the 20 ft. container (Freight Calculator, 2015).

Benefits to Nepal:

As it was mentioned in the previous sections triticale seed has:

- Higher yield than other cereal crops
- Better uptake of fertilizer such as nitrogen and phosphorous.
- More environmentally sustainable than alternative cereal crops.
- High drought tolerance
- Cheaper to maintain compare to wheat
- Great cover crop
- Dual use for forage and grain
- High nutrition value

Higher yield will help Nepalese farmers to maximize their production. This is really important point since most of the agricultural lands are around 0.7 hectares (Chapagain, 2015). Triticale seed has a high uptake of fertilizer such as nitrogen and phosphorus (Mergoum, Ryan and Shroyer, 1992) which makes it critical because Nepalese farmer can cut more costs and have better profitability. Due to the fact that nitrogen and phosphorus can be absorbed by triticale better than other cereal crops it helps their resources to stay clean and usable since there will be a

very low runoff from those fertilizers. This crop has a high drought tolerance (Chapman et al., 2005) which makes it cheaper and easier to maintain since there is less water needed for the crop which makes it more affordable for their budget and climate. This crop can reduce the erosion potential as well (Salmon, Mergoum, & Gomez Macpherson, 2004) which protects more cultivable land from losing its soil nutrient and etcetera. Different uses of this product can further help Nepalese farmer to maximize their use from this product for both forage and grain (Chapman et al., 2005). Finally, the nutritional value which is really important for Nepalese citizens because they do not necessarily have the best diet. In fact, 60% of children in Nepal die because of malnutrition issues (UNICEF, 2015; World Health Organization, 2012). Triticale has a high lysine, sugar content and protein value which makes it more nutritious while it has same use as it parental species (Kies and Fox, 1970; Villegas, McDonald and Gilles, 1970). Triticale seed can be used for both milling and baking, and It can also be for baking different types of breads such as leavened, flat and dense.

Triticale as an animal feed:

Triticale grain is a good feed for the ruminants such as sheep, cattle, goats and etcetera (Myer & Lozano del Rio, 2004). The energy level of triticale's grain is comparable to other cereal crop, therefore, this seed can replace grain sorghum, maize and other cereals (Brown, 1989; Myer & Lozano del Rio, 2004). The triticale also has a higher protein value which will eliminate the need for any protein supplement in animal feed (Brown, 1989; Myer & Lozano del Rio, 2004) which will ultimately cut some costs for the Nepalese farmer. Triticale can be used for grazing as well and it has been reported that triticale herbage lasts longer than rye herbage (Varughese, Barker, Saari, & Center, 1987). Weight gained by ruminants that have been feeding on triticale seed is higher than the ones that have been fed with wheat and rye (Varughese et al.,

1987). In fact the animals that has been grazed on triticale gained 0.72 Kg daily where animals that has been grazed on wheat gained 0.69 Kg and on rye they gained 0.59 Kg (Varughese et al., 1987). This helps the farmer to grow their animals faster which then translates to having "first to market" advantage. This will help them to sell their product at the higher price and before the farmers who do not use triticale seed.

Cost analysis:

Spring triticale seed in Canada is $0.40 per pound, and winter triticale is $0.27 per pound (Green Cover Seed, 2015). There are 16,000 seeds per pound for winter triticale and for spring triticale there are 15,000 seeds per pound (Green Cover Seed, 2015). Every package of triticale is approximately going to be around 0.5 Kg, which is roughly 1 pound. For filling up a 45 ft. container there can be 68,000 packages of triticale seed. The transportation will cost around $3,000. Also, there is a 5% tax in Nepal for agricultural imports (Government of Nepal, 2015). The sum of all of these costs will end up to be approximately $24 for each package that can be sold to the farmers. The price can decrease with the size of the container. For instance, for the 20ft container the final price for the farmer will be around $12. These seeds can be distributed between the seed companies that provide Nepalese farmers with the seed. If the farmers can not afford to buy this product, there can be a community share. This makes it cheaper for farmers to buy the product and after a period of time that they made a profit out of this product they can buy it individually. These costs can also be reduced when it is ordered in high numbers by authorities.

Conclusion:

Exporting triticale seed helps both nations in different aspects. It helps small companies to grow and compete in the bigger market and also increase the GDP by exporting the product. Due to triticale's dual use farmers do not have to spend more money on animal feed. Also, this product can deal with the harsh condition and still grow and produce grain and forage that can be used in the areas where the access to input is very expensive. Therefore, this product helps farmers to cut a tremendous amount of costs, be more efficient and have a higher profitability.

References

Aasen, A., Baig, M., Baron, V., Breland, P., Chanasyk, D., DeMulder, J…, & Wallace, T. (2005). *Triticale production and utilization manual 2005: Spring and winter triticale for grain, forage and value-added* (p. 36). Edmonton, Alberta: [Alberta Agriculture, Food and Rural Development].

Chapagain, T. (2015). *Agri-food system in Nepal.* Guelph, Ontario

Child malnutrition estimates by WHO Child Growth Standards. (2012, July 15). Retrieved November 14, 2015, from http://www.who.int/nutgrowthdb/database/countries/npl/en/

Container Specification. (n.d.). Retrieved November 23, 2015, from https://www.hapag-lloyd.com/downloads/press_and_media/publications/Brochure_Container_Specification_en.pdf

Customs Tariff 2015/2016. (2015). Retrieved October 13, 2015, from http://www.customs.gov.np/upload/documents/HS 2072_20150915105900.73(2015)

Eudes, F. (2015). *Triticale* (pp. 131-132).

Fohner, G., & Hernandez Sierra, A. (2004). Triticale marketing: Strategies for matching crop capabilities to user needs. In M. Mergoum & H. Macpherson (Eds.), *Triticale improvement and production* (pp. 59-63). Rome: Food and Agriculture Organization of the United Nations.

Guedes-Pinto, H., & Carnide, V. (1996). *Triticale today and tomorrow* (Vol. 5, pp. 91-101). Kluwer Academic.

Lauzon, J. (2015). *Water*. Guelph, Ontario.

Mergoum, M., Macpherson, H., & Salmon, D. (2004). Triticale Production and Managment. In *Triticale improvement and production* (pp. 27-32). Rome: Food and Agriculture Organization of the United Nations.

Myer, R., & Lozano del Rio, A. (2004). Triticale as animal feed. In M. Mergoum & H. Macpherson (Eds.), *Triticale improvement and production* (pp. 49-55). Rome: Food and Agriculture Organization of the United Nations.

Nepal Background. (2003, February 26). Retrieved November 25, 2015, from http://www.unicef.org/infobycountry/nepal_nepal_background.html

Nepal Home. (2015). Retrieved November 17, 2015, from http://www.worldbank.org/en/country/nepal

Pariyar, D. (n.d.). Nepal; country profiles; fao. Retrieved November 23, 2015, from http://www.fao.org/ag/AGP/AGPC/doc/Counprof/Nepal/nepal.html

Peña, R. (2004). Food uses of triticale. In M. Mergoum & H. Macpherson (Eds.), *Triticale improvement and production* (pp. 37-45). Rome: Food and Agriculture Organization of the United Nations.

Price List. (2015). Retrieved November 25, 2015, from https://greencoverseed.com/species/price-list

The World Factbook. (2015). Retrieved November 14, 2015, from https://www.cia.gov/library/publications/resources/the-world-factbook/geos/np.html

Triticale's future in the United States. (2002). In *Triticale: A promising addition to the world's cereal grains.* (pp. 74-75). Washington, D.C., Washington: National Academy Press.

Varughese, G., Barker, T., & Saari, E. (1987). *Triticale* (pp. 7-8). México, D.F.: CIMMYT.