

Potential Canadian Export Idea: Kale Seeds

Elissa DeBoer

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Part I: Product Information

Product Description

Kale is what one may call a fad, and one that has certainly exploded in the Western world, yet this vegetable is more than deserving. Until recent years, kale was a little known vegetable, having been overshadowed by spinach, Brussels sprouts, and other dark green vegetables. Now the beautiful and fascinating kale plant is getting its time in the limelight, a place in which it should stay. Historically, kale has been grown and cultivated for approximately 2000 years, however, in the Middle Ages, kale was replaced in popularity by cabbage (Vectis Road Allotments, 2015). Continually, kale has been, and continues to be, important in colder regions of the world, due to its remarkable frost resistance and strength. It comes in a variety of colours and leaf types, and each variety of plant has different qualities associated with it. Some of the varieties include Dwarf Curled Scotch, Nagoya Mixed Kale, Red Russian, Winterbore and Redbore, among many others (Ontario Seed Company 2015).



Figure 1: Varieties of Kale

(Source:https://www.google.ca/search?q=varieties+of+kale&source=lnms&tbm=isch&sa=X&ved=0ahUKEwj_wP7B9rjJAhXPth4KHdYHDnYQ_AUIBygB&biw=1525&bih=709&dpr=0.9#imgrc=Raf2kL3WBSQKxM%3A)

The appearance of kale varies greatly, with each variety being distinctive from any other variety. The range in colours and leaf shapes and types show that kale is a very diverse crop, with each of the different types suitable for different growing, harvesting and cooking preparation. Yet the consistency lies in the nutritional value of kale, which will be discussed later in this paper. Kale is usually harvested 70-95 days after planting from seed, and 55-75 days if the kale was planted as seedling that had been grown, most likely indoors, prior to the planting date (Rutherford-Fortunati, 2012). If preferred, the entire head of kale can be cut off, about 2 inches above the soil and approximately 1-2 weeks later, new leaves will begin to sprout. (Rutherford-Fortunati, 2012).

Inputs Needed

As with all living things, plant or animal, certain inputs are needed to grow kale. Firstly, the soil needed for growing kale is not exhaustingly specific, rather, it is quite adaptable. Kale prefers well drained soil with organic matter, and varying degrees of fertility (Drost & Johnson, 2010). The organic matter needed for the growth of kale could be sourced with ease, as there is an abundance of livestock in Nepal, therefore a large amount of manure. Currently, there are 8.8 million goats, 7.2 million cows, 4.8 million buffaloes and 801 371 sheep in Nepal. All of these animals are producing large amounts of manure every day, and this manure is rich in nutrients that are needed for plant growth, such as nitrogen. Manure is an organic fertilizer that can be referred to as “green fertilizer” (Igbal, Khan, Hassan, Raza, Amjal, 2012). The total K and N content in soil can be measured in a variety of ways, some of which being hydrometer, ammonium electrode, and Quantofix- N- Volumeter (Van Hessel, Reeves, Thompson, 1999). Using manure as fertilizer would be more than ideal for the farmers of Nepal, as it is a no cost solution to the problem of fertilizer use and availability. Secondly, the kale plants need

hydration, but their water source can be provided by natural rainfall, as kale is a very hardy plants and can survive through a small bout of water deprivation. This is an undeniable advantage of this crop, as it would not cause any strain on the water resources of a single family or farm. Thirdly, the plant's desire for sunlight can vary, depending on the season. It is advised that if you have planted kale during the periods of the year in which the sun is the least strong, for example, wintertime, then the kale plants should be grown in such a place that they have full sun, or as close to it as possible (Rutherford-Fortunati, 2012). That is not to say that the kale plant needs full sun, which could potentially cause problems for planting, rather that if you are growing an adaptive plant in a variety of different agro ecological zones, that sunlight needs fall into a category in which there is room for experimentation with sunlight exposure, yet that there is basic need for a certain amount of sunlight. In one study conducted, the experimental kale plants were grown in two separate classifications of seasons. One season section was Spring/Summer, the other Summer/Winter, and the results showed that the kale grew exceptionally well in the Spring/Summer section, as it had a higher concentration of the measured macronutrients, yet, the kale grew very well in the Summer/Winter section, and resulted in a much higher concentration of crude protein in the leaves (Rosa & Heaney, 1996). It was stated that in the Spring/Summer season section, there was a larger overall amount of hours of sunlight compared to the Summer/Winter season section (Rosa & Heaney, 1996). Finally, the temperature at which to grow the kale must be considered. Kale can successfully grow and thrive in a wide range of temperatures, however, optimal temperatures have been discovered. This optimal temperature range is between approximately 20 and 25 degrees Celsius (Ligor & Buszewki, 2012).

Health and Nutritional Information

Similar to all leafy, dark green coloured vegetables, kale is considered to be extremely healthy, for a multitude of reasons. Kale has high concentrations of Vitamins A, K, and C, as well as lutein, zeaxanthin, calcium, and beta carotene (Ligor & Buszewski, 2012). In comparison, kale has higher antioxidant activity than spinach, garlic, broccoli and Brussels sprouts (Ligor & Buszewski, 2012). The vegetable is truly a remarkable one. In a study conducted by Ligor and Buszewski (2012) in Krakow, Poland, the concentrations of lutein in two varieties of kale were evaluated, and the several sets of experimental plants were grown, all under different conditions and real life stressors. The results showed that both varieties had large amounts of lutein, as was seen through the weight measurement of milligrams of lutein per gram of leaf. Specifically, the Redbore F1 kale was measured at 2.04 ± 0.15 mg/g, and the Winterbore F1 kale was measured at 1.10 ± 0.09 mg/g (Ligor & Buszewski, 2012). Lutein is extremely important for the function of the body, specifically the health of the eyes. It can be found in the retina of the eye, where it acts as a filter from blue and UV light in the everyday environment (American Optometric Association, 2015). Lutein is a strong antioxidant, assists in the protection of eyes and skin, reduces risk of skin cancer, and has a protective role from Age-related Macular Degeneration and the development of cataracts (Chew et al. 2013). Therefore, regular consumption of kale would be very beneficial for any human diet.

Foods with lutein and zeaxanthin		
FOOD	SERVING	mg
Kale (<i>cooked</i>)	1 cup	23.8
Spinach (<i>cooked</i>)	1 cup	20.4
Collards (<i>cooked</i>)	1 cup	14.6
Turnip greens (<i>cooked</i>)	1 cup	12.2
Spinach (<i>raw</i>)	1 cup	3.8
Corn (<i>can or cooked</i>)	1 cup	2.2
Green peas (<i>canned</i>)	1 cup	2.2
Broccoli (<i>cooked</i>)	1 cup	1.6
Romaine lettuce (<i>raw</i>)	1 cup	1.3
Green beans (<i>cooked</i>)	1 cup	0.8
Eggs	2 (<i>large</i>)	0.3
Orange	1 (<i>medium</i>)	0.2

Figure 2: Lutein and Zeaxanthin Content in Common Vegetables

(Source: <http://www.aoa.org/patients-and-public/caring-for-your-vision/diet-and-nutrition/lutein?sso=y>)

Also, kale increases the absorption of nutrients that are not present in the kale itself, but are included in a meal eaten with kale alongside (Bohn, Davidsson, Walczyk & Hurrell, 2004). Specifically, as kale is relatively low in oxalate, it allows a higher absorption of magnesium in a meal (Bohn et al.). Kale also assists with the absorption of Vitamin K, as was seen by a study conducted by Novotny, Kurilich, Britz, Baer & Clevidence, (2010) in which seven healthy study subjects ingested a 400g serving of kale, after which a blood sample was taken from each subject, and analyzed. The findings were such that the absorption of Vitamin K is high, because a significant amount was found in the blood samples taken, thus kale is excellent for absorption of Vitamin K (Novotny et al.). Another nutrient that kale is abundant in is calcium. When measuring the quantitative amounts of calcium in three common plants (wheat, spinach and kale)

it was seen that wheat contained $0.3 \pm 0.1\%$, spinach contained $26.4 \pm 5.2\%$, and kale contained $76.3 \pm 1.2\%$ of organism calcium bioavailability (Benway & Weaver, 1993).

Product Sourcing

The kale seeds proposed for shipment to Nepal will be sourced from the Ontario Seed Company, based in Waterloo, Ontario. The seeds that have been selected for export are the Red Russian kale seeds. These seeds are available in 1 kg bags, priced at \$49.10, and the product code number of the seed is 1703. (Ontario Seed Company, 2015). This company can be reached at 519-886-0557 or emailed at seeds@oscseeds.com (OSC, 2015). There are several different varieties of kale seeds available from the Ontario Seed Company, as well as other Canadian companies, however, the Red Russian variety was chosen for its excellent cold weather and frost hardiness.



Figure 3: Red Russian Kale

(Source:https://www.google.ca/search?q=red+russian+kale&source=lnms&tbm=isch&sa=X&ved=0ahUKEwiP1e2eprvJAhUDoD4KHUb2Dw0Q_AUIBygB&biw=1525&bih=709&dpr=0.9#imgrc=p5RJ0oKger0XsM%3A)

Potential Benefits to Canada

If this product were to be exported to Nepal, there would undeniably be benefits to Canada. Firstly, using a local Ontario company for the seed source would be a benefit, as there would be an increase in labour needed for the shipment of the product, and therefore more employment spaces to be filled. Specific labourers would be needed, as in those with forklift licenses to move the skids with the bags of seeds in wrapping upon them. Further, the farm that the seeds are sourced from for the Ontario Seed Company would have an increase in kale seeds production, thus allowing the farm to thrive and possibly expand.

Part II: Export Potential to Nepal

Nepal as a Nation

Nepal is home to approximately 31 million people, and covers an area of 147 181 km² (British Broadcasting Channel, 2015). The life expectancy at birth is 67/70 years (World Health Organization, 2015).

Table 1: Area of agro-ecological zones

Agro-ecological zone	Area (km ²)	Percentage
Mountain	51 817	35
Hills	61 345	42
Terai	34 019	23
Total	147 181	100

(Source: <http://www.fao.org/ag/AGP/AGPC/doc/Counprof/Nepal/nepal.htm#agro>)

Each of these agro-ecological zones have distinct and unique characteristics. The mountain region has a climate that ranges from warm temperate to alpine, and its primary focus is on livestock grazing, as the soil is nutritionally poor, and the people who live here are prone to a nomadic style of living (Food and Agriculture Organization, 2015). The hills region has a climate that ranges from subtropical to warm temperate, and the agricultural focus is on crops, primarily cereal crops (FAO, 2015). The terai region has the warmest climate of all the regions, and is composed of fertile lowlands, in which many crops are grown, and livestock raised (FAO, 2015).

Transportation Logistics

As kale seeds are relatively light for shipping, especially when compared to other products that are shipped, such as machinery and cars. Thus there are more options for shipping this product. Regardless of the overseas route, the seeds must be picked up by truck from the distribution warehouse in Waterloo, Ontario. The 1 kg bags would be placed on pallet skids, and wrapped in a saran-wrap like substance for security during transport. From there, the skids could go to one of two places; Pearson Airport in Toronto for air transport, or Toronto Harbour for freight shipping. Upon arrival in Veraval, Gujarat, a seaport in India, the seeds would then be transferred to trucks for shipping to Nepal.



Figure 4: Major Seaports in India

(Source: https://www.google.ca/search?q=seaports+in+india&biw=1525&bih=709&source=lnms&tbm=isch&sa=X&sqi=2&ved=0ahUKEwiT75b0wLvJAhUBNT4KHQglBccQ_AUIBygC&dpr=0.9#imgrc=Uk17We220YQUJM%3A)

Required Import/Export Documentation

One of the barriers to exporting seed is the regulations to export put in place by the Canadian Food Inspection Agency (CFIA). If these seeds were to be shipped, it would be under the voluntary Authorized Exporter Program (AEP) (Canadian Food Inspection Agency, 2015). This program allows private persons to be authorized to sample, tag and export certain amounts

of seed. Varietal Certificates are issued for every seed lot to be exported through the AEP. (CFIA, 2015). The CFIA has the national authority to investigate any and all seed lots to be exported. (CFIA, 2015).

Benefits to Nepal

The benefits of importing kale seed to Nepal are many. To begin, kale is a highly nutritious vegetable, and the people of Nepal are known to be nutritionally deficient (Horak, Markl & Lama, 2015). The majority of children who are underweight and stunted live in Asia, particularly the southern regions of Asia (Singh, Nair, Grubestic & Connell, 2009). Childhood malnutrition leads to psychological and physical sequelae that continues through adulthood, as well as cause intergenerational effects, loss of human potential, and therefore a loss of social productivity (Singh et al.) A deficiency of Vitamin A was found responsible for one-third of developed bilateral blindness in children of preschool age (Upadhyay, Bhupendra, Pillai & Nepal 1985). To combat this, kale would be a valuable addition to the everyday diet of the Nepalese, due to its high Vitamin A content, among its other nutritional benefits.

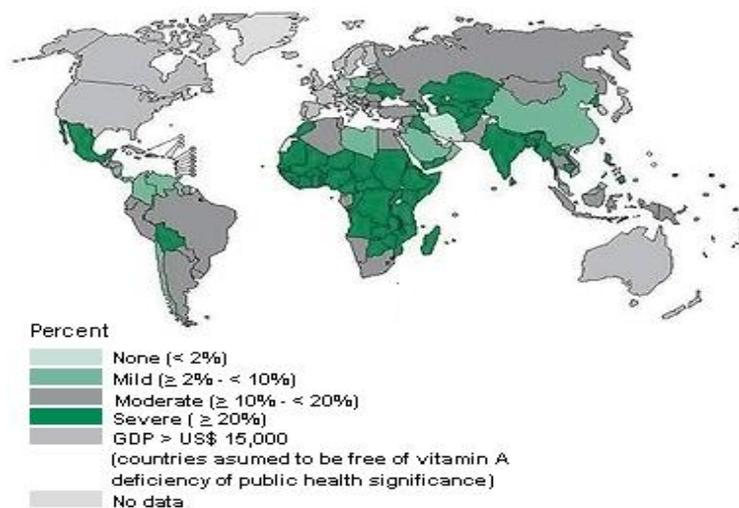


Figure 5: Vitamin A Deficiency Worldwide

(Source:https://www.google.ca/search?q=varieties+of+kale&source=lnms&tbm=isch&sa=X&ved=0ahUKEwj_wP7B9rjJAhXPth4KHdYHDnYQ_AUIBygB&biw=1525&bih=709&dpr=0.9#tbm=isch&q=vitamin+a+deficiency&imgc=DtG4rXB58IE1VM%3A)

Malnutrition is undeniably deeply rooted in poverty (Singh et al. 2009). Without the monetary means to provide food for one's family, there is insufficient food in the home, and if this trend continues, it can lead to malnutrition of the members of the family. As stated by Andersen (2007) "Hidden hunger –malnutrition due to a lack of micronutrients- is a major threat to human health in Nepal." Kale could be integral in combating malnutrition in developing countries such as Nepal, because it is so nutritionally diverse and beneficial. Also, kale is traditionally prepared in conjunction with other vegetables, resulting in a filling and balanced meal. As the majority of Nepalese people are either Hindu or Buddhist, they eat little or no meat, so a variety of plant proteins are needed for the Nepalese to maintain health (World Health Organization, 2015). The kale seeds that have been proposed for shipment to Nepal can be purchased in small packages from the 1 kg packages, for the purpose of the Nepalese growing personal vegetable gardens to care for their own family's nutritional needs. Therefore, if this product were to be shipped to Nepal, the 1 kg bags could be purchased by a local seed store for further distribution in smaller packages, or the 1 kg bag could be purchased by a village or a cooperative to be used in either personal gardens, or personal use, or in a small scale farming operation.

Storage of Crop

After harvest, the kale leaves do not last as long as tubers or other durable crops, however, kale leaves have a greater longevity compared to other leafy greens (Hagan, Borge, Solhaug & Bengtsson, 2009). For best keep of kale post-harvest, the leaves are to be kept at

about 1°C, and can remain there for approximately 3 weeks (Hagan et al.) However, access to refrigerator units in Nepal is limited, so this procedure is unlikely to apply to the majority of the populace. Alternatively, the kale leaves can be harvested as needed during the time that the kale is ready for use, and all leftover kale can be cut off, 1 to 2 inches above the soil, and new leaves will grow (Rutherford-Fortunati, 2012). The leftover kale previously mentioned could be cooked en masse, and stored for later use, or be fed to livestock, if the excess cannot be suitably kept for human consumption.

Regional and Global Competition

There is high competition for kale seeds in the Southern Asian area. Varieties of kale seed are available from Vietnam and China, and at a good price. The kale seeds available for purchase at Alibaba.com are not of the same quality of the seeds available from the Ontario Seed Company, but undeniable benefits are the greatly reduced transportation costs, as Nepal and China are neighbouring countries (Office of the Prime Minister and Council of Ministers, 2015). Also, there would be a greater ease of transport over borders, as the shipping of seed would not have occurred over both land and ocean, rather it would be a relatively short overland shipping route.

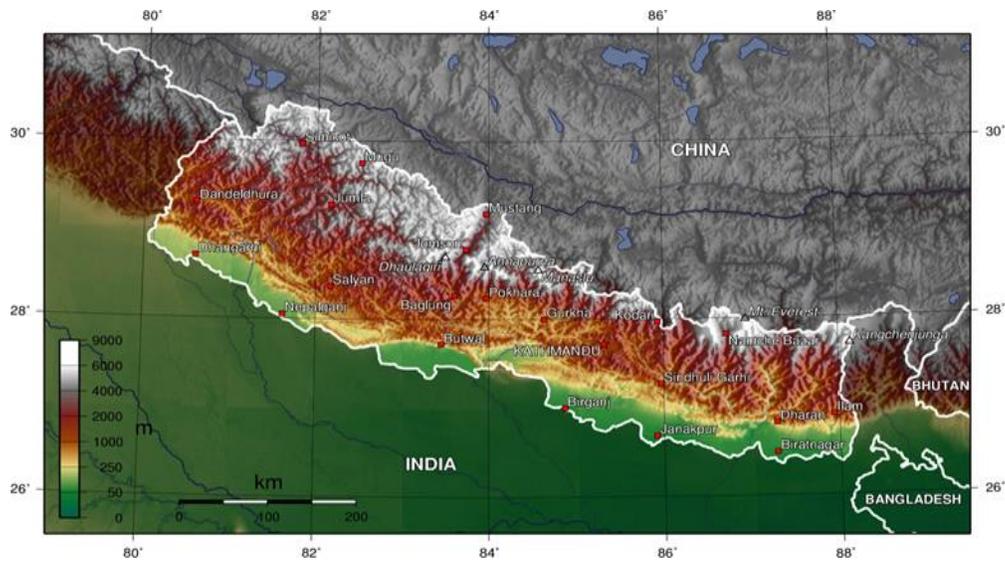


Figure 6: Geographical Map of Nepal

(Source:https://www.google.ca/search?q=nepal+geographically&biw=1525&bih=709&tbm=isch&source=lnms&sa=X&ved=0ahUKEwjhp6vEprzJAhUJdD4KHc6qC4IQ_AUICCGD&dpr=0.9#imgrc=cOXVmboYuNKmtM%3A)

Cost Analysis

The cost of shipping kale seed to Nepal must now be analyzed. Through the online shipping bid forum, Uship, the hypothetical shipment of 50 bags of kale seed, each weighing 1kg, was quoted to cost \$833.48. Further details were unable to be procured, but what is known is the shipment of seed was to be picked up at the Waterloo-based Ontario Seed Company distribution centre by truck, then subsequently delivered to the loading docks for freight, located in Toronto, and shipped to the Indian seaport of Veraval, Gujarat. The next step in this journey would be shipment by truck overland from Veraval, Gujarat, India, to Kathmandu, Nepal. The cost of international shipping would be added to the cost of the seed, elevating the price per kilogram from \$49.10 to a much higher price, with shipment costs factored in. Therefore, a

package of seeds, either the 1 kg option, or a smaller subdivided option, may be too expensive for the average Nepalese family to afford.

Future Studies needed

Future studies that would be needed to evaluate the worth of shipping kale to Nepal would be numerous. First and foremost, are many Nepalese people interested in eating kale on a regular basis? If so, would the people of Nepal prefer organic kale seed, or seed grown with the use of chemicals? Are personal gardens particularly prevalent in Nepalese society? Which regions of Nepal would be interested in growing kale?

Conclusion

At this time, it would not be advised that kale seeds be shipped to Nepal. Even though it has been made clear that kale is nutritious and beneficial as part of a regular diet, having many advantages associated with its consumption, the price of shipping, and the relatively closed market make the export of kale seeds to Nepal an unrealistic proposal. Further, the documentation required, and regulations applied to the exportation of seed from Canada are also a roadblock in the proposition of seed exportation. Moreover, to determine whether or not kale seed exportation would be feasible, a study could be conducted of a test group of Nepalese farmers to gauge interest in a crop such as kale.

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