

Exporting Sunflower Seeds to Nepal to Increase Soil Zinc Levels

Maeghan Brennan

Part 1- Product Information

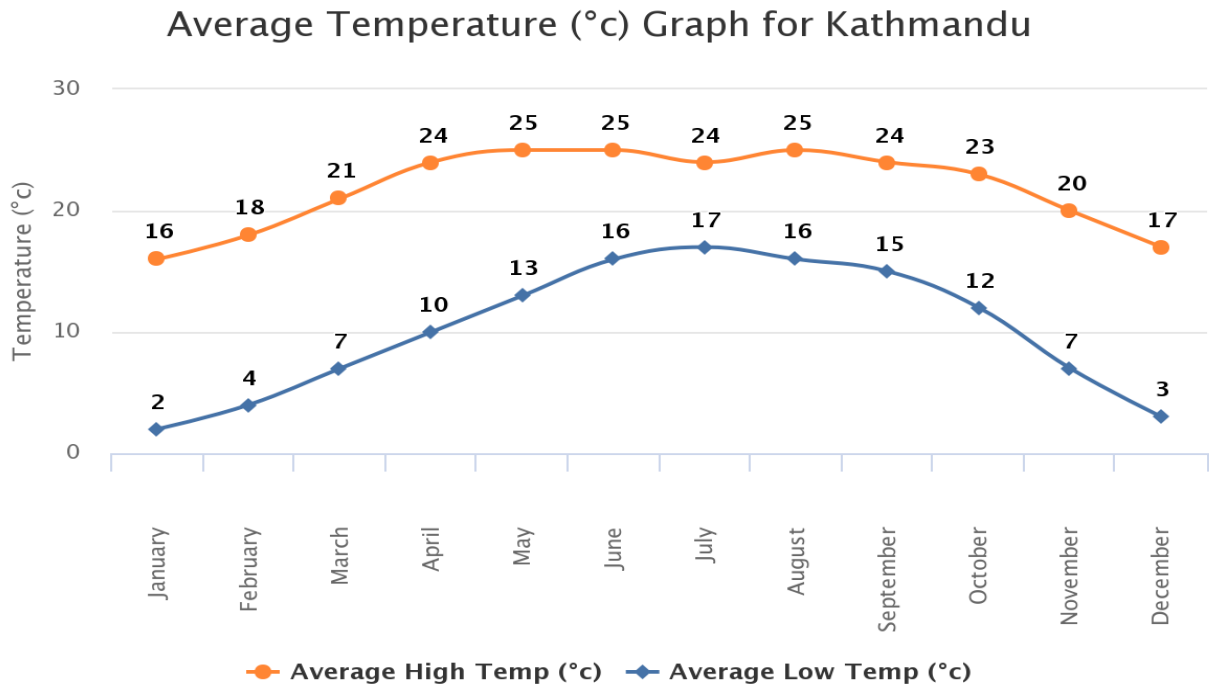
Product description: Sunflowers are a hardy crop capable of growing in sandy-clay loam soils, at a pH of 6-7.5 (OMAFRA, 2009). Sunflowers belong to the family of *Asteraceae*, in the genus *Helianthus* (Miller and Mazurak, 1958). Sunflowers can be used to increase soil zinc levels in Nepal because the shoots and leaves contain a concentration of zinc of approximately 69 parts per million, which can be incorporated into the soil at the end of the growing season, from decomposition of microorganisms, heat, and other chemical components of the soil (Alloway, 2008). Sunflowers also have a very deep tap root, approximately 5-7 feet deep, that can utilize and pull up nutrients in the soil that other crops cannot, increasing the plants resilience to drought and other harsh climatic conditions (Alloway, 2008). Almost half of the worlds soils are deficient in zinc, and the people in Nepal can benefit from planting sunflowers as a cover crop because it will increase soil zinc levels (Fageria, 2012), thus providing increased yields and profit to Nepalese farmers.



Picture reference: <http://inminutes.com/wp-content/uploads/2015/06/Six-Health-Benefits-Of-Sunflower-Seeds-2-500x330.jpg>

Health information: Sunflower seeds are an excellent source of vitamin E and B-1 (Rudrappa, 2009). Though they are small, they are mighty and provide high levels of protein which help to improve bone density, as well as, provide healthy monounsaturated and polyunsaturated fats, that lower blood pressure and the risk of cardiovascular disease (Engel, 2012). Sunflower seeds also contain folate, niacin and iron that are anticarcinogenic and help to reduce the risk of cancer (Engel, 2012). A nationally conducted study was done in December 1997 that determined Nepal people's micronutrient status. The study discovered that there is a high percentage of women and female children that have iron deficiency (Tulane University, 1997-1998). Since sunflowers are a great source of iron, it would be a successful and affordable solution to iron deficiency for Nepalese people.

Growing sunflowers: When planting, sunflowers should be placed at a depth of 3-5 cm and with a row width of 60-90 cm (OMAFRA, 2009). Sunflowers are a hardy crop capable of growing in sand clay loam soils, at a pH of 6-7.5 (OMAFRA, 2009). Sunflowers can grow to approximately 6 feet, allowing for large biomass accumulations at the end of the growing season (Alloway, 2008). Sunflower seeds can be planted by hand, by a corn planter or by a grain drill, and are ready to harvest when the seeds are hard and dry, at approximately 120 days (OMAFRA, 2009). Sunflowers will begin to germinate at temperatures of 6 °C, but temperatures of 16 °C to 26 °C are optimal for continued growth (Alloway, 2008). In Nepal, the average temperature in January is 9 °C, and in July the average temperature is 20.5 °C (World Weather, 2016). Given this information sunflowers can be planted at any time of the year in Nepal, without getting in the way of Nepalese farmers planting their food crops such as maize, beans and rice. Once the seeds are harvested, the shoots and leaves of the plants can be returned to the earth by tilling them under and allowing them to decompose and release zinc and other nutrients to the soil.



This image shows the average temperatures in Kathmandu from 2000 to 2012.

Picture reference: https://www.worldweatheronline.com/v2/weather-averages.aspx?locid=1774062&root_id=1773563&wc=local_weather&map=~kathmandu-weather-averages/np.aspx

Supplier: The Cottage Country Gardener is a Canadian run family business that specializes in growing and distributing certified organic sunflower seeds to gardeners and farmers. The business has four employees and it located in Newtonville, Ontario. The organic seeds have no altered genetics so farmers are able to re-plant the harvested seeds year after year (Cottage Country Gardener, 2016). To buy a package of the organic sunflower seeds it will cost Nepalese farmers ten Canadian dollars, which is equivalent to eight hundred and one Nepalese rupee's (Cottage Country Gardener, 2016; The Money Converter, 2016). Each package contains approximately six hundred seeds (Cottage Country Gardener, 2016). For further information, the

Cottage Country Gardener can be contacted at 905-786-2388, or at heirlooms@cottagegardener.com.

Benefits to Canada: Canada will benefit from trade with Nepal because the sunflowers are being exported from a Canadian company, thus increasing economic activity in Canada. It will benefit the Cottage Country Gardener company because it will increase profit, due to selling to a larger number of customers. This may lead to land expansion and increased jobs from the new work load. It may also encourage other Canadian business to help international countries, and thus may lead to more international agricultural programs. As well, with the increased interest in sunflower seeds, more research may go into developing different varieties of sunflowers for diverse climatic conditions globally.

Part 2 – Export Potential to Nepal

Introduction to Nepal: Nepal is a landlocked country located between China and India, and is home to eight of the world's fourteen largest mountains (Chapagain, 2016). The country of Nepal is unique as it has a variety of land uses. There are three agro-ecological regions in Nepal based on altitude, as well as, crop and livestock production systems (SAK Nepal, 2016). The terai produces large quantities of small grains, while the hills and mountains are popular for fruits, vegetables and livestock (Chapagain, 2016). Agriculture employs sixty eight percent of the population and contributes to thirty four percent gross domestic product each year to the country's economy (US AID, 2016). Agriculture in Nepal is dependent upon the warm seasons to grow food crops, therefore, farming leads to a widespread of unemployment during the cooler seasons (US AID, 2016).



Picture reference: <http://www.tibetdiscovery.com/assets/images/destination-map/kathmandu/nepal-map.gif>

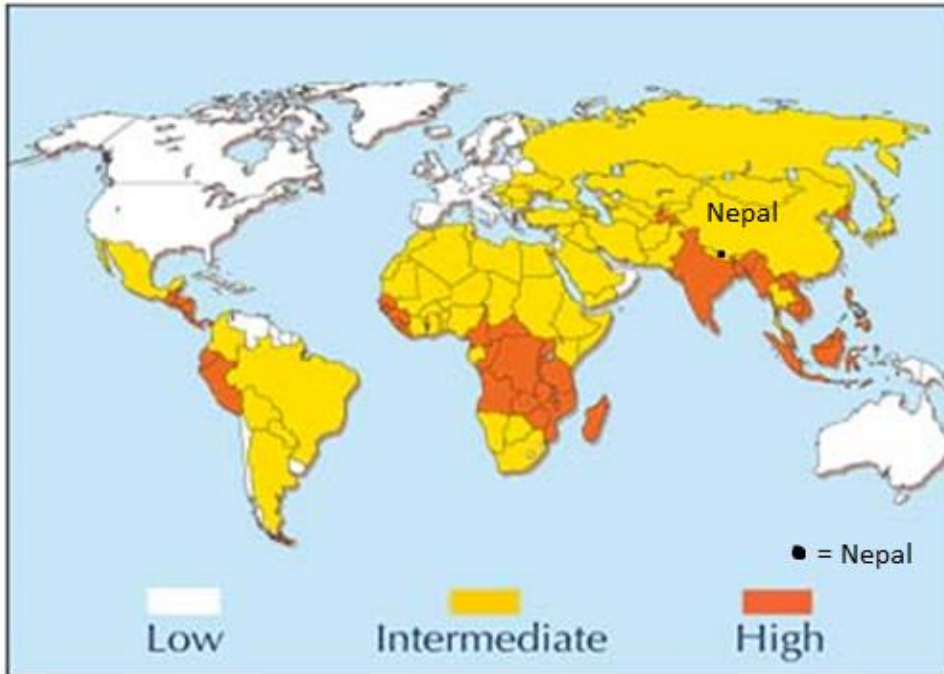
Nepal is a developing country with twenty-eight million people, and one million people living in the capital, Kathmandu (Dixit, 2013). Technology in Nepal is not advanced like in many other parts of the world, such as North America. Nepalese farmers take advantage of the landscape geographic's to plant crops and to produce livestock. Nepal is rich in water resources, many rivers flow from high mountains, down through the hills and out to the terai, providing Nepal citizens with fresh drinking water, and providing farmers with irrigation for crops (State of water resources, 2016). Though Nepal is rich in water resources, soil productivity is limited by soil zinc deficiency and other micro and macro nutrient restrictions (SAK Nepal, 2016).

River Basin	Estimated catchment area in Nepal(km ²) #	Average discharge (m ³ /s)	Annual discharge (km ³ /year)
Rivers originating at Himalayas			
Koshi	27,863	1409	45
Gandaki/Narayani	31,464	1600	50
Karnali	41,058	1397	44
Mahakali	5,188	573	18
Rivers originating at Middle Mountains and Hills	17,000	461	14.5
Rivers originating at Siwalik zone	23,150	1682	53
Total	145,723	7122	224.5

The above picture represents the amount of available water from river basins in Nepal.

Picture reference: <http://www.wepa-db.net/policies/state/nepal/state.htm>

Soils in Nepal are highly effected by soil zinc deficiency (SAK Nepal, 2016). Zinc is an essential micronutrient found in soil that is responsible for driving metabolic reactions in crops such as chlorophyll formation, protein synthesis, and gene expression (Alloway, 2008). Zinc deficiency is prominent is plants when young leaves start to yellow in between the veins and the leaf tips become discolored and die (Viets et al., 1954). As well, the leaves may take on a unique banded appearance and stop growing vertically (Viets et al., 1954). A vast majority of soils in Nepal are suffering from zinc deficiency, thus limiting productivity of crop yields, increasing hunger, and decreasing the profits to farmers.



This image is showing the different levels of zinc deficiency around the world.

Picture reference:

http://www.mosaicco.com/sustainability/report/2009/_images/zinc_deficiency_risk_map.jpg

Target market for organic sunflower seeds: Since the country of Nepal is so highly effected by soil zinc deficiency, the target is small and larger farmers in Nepal. Persuading small and large farmers to plant the organic sunflower seeds will produce increased soil zinc levels on a large scale, rather than only targeting small farmers and gardeners.

Transportation: Transportation to Nepal is very difficult because it is a landlocked country with only one reliable road from India to Kathmandu (Chapagain, 2016). Therefore, travel by air from Toronto to Nepal will be the most logical form of transportation. NEX is an international shipping company that will ship products less than one hundred and fifty pounds around the world, at a cost of fifty Canadian dollars per pound (NEX Worldwide Express, 2016). NEX provides two types of shipping services to Nepal, priority express, which takes 2-3 business days, and economy service, which takes 4-10 business days (NEX Worldwide Express, 2016).

Seeds will be shipped from the Cottage Country Gardener to Toronto Pearson Airport, to Ohio airport in the United States of America, to Kathmandu International Airport in Nepal, and then to local markets in Nepal for distribution.

Nepalese retailers: NFC Seed Co. Pvt. Ltd and Nepal Agro Sales and Services are two seed distributors in Nepal that could sell the sunflower seeds to Nepal farmers (SeedQuest, 2016). As well, the organic sunflower seeds can be distributed at local markets.

Who may the sunflowers hurt: Some local grocers over time may be hurt by the growth of the sunflower seed market in Nepal if it occurs on a large scale. This is because there will be a flood of sunflower seeds on the market and this will create a reduced demand. This will happen if Nepalese farmers are producing and selling their own sunflower seeds to neighbors and other urban citizens.

Storage: Once seeds are harvested they must be stored in a cool and dry area, in a covered container. For proper storage, the seeds should contain approximately seven percent moisture or less to reduce the risk of mold and mildew (*Saving your seeds for a long life*, 2016). If seeds are harvested at higher moisture content they should be dried immediately. Drying seeds is easily done in a conventional grain drier for people in North America, but for Nepalese farmers it can be done by placing seeds on a shelf over a cooking fire or by placing the seeds out in direct sunlight until dry. Sunflower seeds can be stored for approximately one year if kept in dark, cool conditions (*Saving your seeds for a long life*, 2016). This time frame is perfect for the re-planting of the organic sunflower seeds each year.

Cost analysis: There are pro's and con's to shipping sunflower seeds to Nepal when accounting for cost. **Cons:** the cost to purchase and ship the sunflower seeds is quite high. One

package of sunflower seeds cost ten Canadian dollars and contains approximately six hundred seeds (Cottage Country Gardener, 2016). For the average Nepal farmer who owns 0.7 hectares of land approximately thirty-five thousand seeds can be planted (OMAFRA, 2016). Doing a cost analysis, it will cost approximately six hundred and eighty Canadian dollars or fifty-four thousand nine hundred and twenty-three Nepal rupees. Nepalese farmers make an average of two dollars per day, and have an average annual income of seven hundred and thirty dollars. Therefore, planting the organic sunflower seeds would consume ninety three percent of the average Nepalese income, making it very expensive for a single farmer to peruse on his own.

Pros: planting organic sunflower seeds is a relatively cheap solution to soil zinc deficiency, due to its ability to be re-planted year after year. Purchasing the sunflower seeds is a high upfront cost, but if the seeds are collected from harvest each year and stored correctly, they can be re-planted the following year at no cost to the farmer.

Cost Analysis Breakdown:

- 35 000 seeds per 0.7 ha / 600 seeds per package = 58.33 or 59 packages of sunflower seeds will be needed
- 59 packages x \$10/package = \$590.00 Canadian dollars
- 1 package weights 0.03125 lbs (0.5 oz) x 59 packages = 1.84 lbs
- To ship 1 lbs is cost \$50 Canadian x 1.84 lbs of package weight = \$92.19 shipping cost
- Total cost to Nepalese farmers = \$682.19 to plant 0.7 ha

Benefits to Nepal: The economic and environmental benefits to Nepal from planting organic sunflower seeds are increased soil zinc levels. Soil zinc deficiency is a major problem in Nepal that limits the growth and success of crop yields (SAK Nepal, 2016). Increasing soil zinc levels will increase crop yields and therefore profit to farmers. The sunflower seeds exported by the Cottage Country Gardener are organic, and have no altered genetics, so they can be planted year after year (Cottage Country Gardener, 2016). This is beneficial because Nepalese farmers can

become self-sustainable in growing sunflower seeds, and potentially begin to sell harvested seeds to neighboring farmers, or countries.

Not only will planting sunflower seeds improve soil zinc levels, but it may provide additional job opportunities for Nepalese farmers. The harvested seeds can be sold on the market as an edible protein source as an alternative to meat. Sunflower seeds have a longer shelf life than meat and are more easily stored. As well, sunflower seeds are high in vitamin E, iron and vitamin B-1, that promote healthy bone growth and development, and reduced the risk of cancer and cardiovascular diseases (Engel, 2012). The benefits provided will be increased nutrition and quality of life among Nepalese citizens. After harvest, Nepalese farmers can also use some of the remaining shoot and leaves as a forage for livestock, this may reduce the area required to graze, and increase the number of livestock the farmers own.

A potential partnership may arise between Nepal and India. India, a neighboring country, is a net importer of edible sunflower oil (Mordor Intelligence, 2016). India relies on the imports of sunflower seeds to produce sunflower oil (Mordor Intelligence, 2016). Nepal could sell some of the harvested sunflower seeds to India and generate a profit. Nepal may also decide to create a niche market by hiring women and children to directly produce the sunflower oil. The sunflower oil produced by the women and children could then be directly sold to India. This would create more jobs and give a profit to women and children.

Global competition: Sunflowers are the fourth most important oilseed crop in the world (Mordor Intelligence, 2016). The production of sunflower seeds contributes to nine percent of the world's oilseed output (USDA, 2016). During 2015 and 2016, the global sunflower production was 39.4 million metric tons and is predicted to increase into 2017 (Mordor Intelligence, 2016).

Seventy percent of the world's sunflower production is produced by Russia, Ukraine, the European Union and Argentina (USDA, 2016).

Future studies: Future studies on the interest of Nepalese farmers growing organic sunflower seeds must be further investigated to determine the overall effectiveness of improving soil zinc levels in Nepal. If farmers are not willing to buy and grow the organic sunflower seeds, then the exporting idea is a bust. However, further research and money should be devoted to education programs. These education programs would demonstrate to the subsistence farmers in Nepal the benefits of growing the organic sunflower seeds, as they produce no harmful chemicals and do not degrade the environment in any way.

Part 3 – Conclusion

In conclusion, I believe that exporting the organic sunflower seeds, sold by the Cottage Country Gardener, is a good idea. I believe this because the seeds will benefit the Nepalese farmers from increased soil zinc levels, thus providing more sustainable crops with higher yields and more income to the farmers. This will provide more food for the population and reduce hunger. With less stress on food security and nutrition in Nepal, priorities may switch to education and developing new technologies. Canada will benefit from increased profit and jobs due to selling to a larger volume of customers. As well, more money may be put into research education and international agricultural programs to create relationships with developing countries. Overall the additional benefits from the harvested sunflower crop in Nepal will make up for the initial cost of the production system.

Summary of Potential Opportunities:

Opportunities for Canada and Nepal to seize	
Canada	Nepal
Research and development in sunflower seed varieties.	Increased soil zinc levels, without the use of harmful chemicals.
Research and development in international education programs.	Increased crop yields
Forming a partnership with Nepal, and potentially other developing countries.	Reduced hunger and malnutrition.
	Job opportunities for women and children.
	Potential partnership between India and Nepal selling and distributing sunflower seeds.
	Sunflower shoots as a forage source, increases feed available to livestock, may increase number of livestock a Nepalese farmer has.

References

Alloway, B.J. (2008). *Zinc in soils and crop nutrition* (2nd.ed.). Paris, France: International Zinc Association.

Chapagain, T. (2016). *Agriculture and agri-food systems in Nepal*. Retrieved from: <https://courselink.uoguelph.ca/d21/1e/content/443268/viewContent/1445125/View>

Dixit, K. (2013). Nepal: dictated by geography. *World Policy Journal*, 30(4), 36-40.

Engel, K. (2012). Sunflower power: this tiny seed – and its various butters, flours, and oils – boast a host of health benefits. *American Health*, 74(3), 68.

Fageria, N.K. (2012). Role of soil organic matter in maintaining sustainability of cropping systems. *Communications in Soil Science and Plant Analysis*, 43(16), 2063-2113.

Miller, S.A and Mazurak, A.P. (1958). Relationships of particles and pore size to the growth of sunflowers. *Soil Science of American Journal*, 4(22), 275-278.

Mordor Intelligence. (2016). *Global sunflower seed market – growth, trends and forecast (2016-2021)*. Retrieved from: <https://www.mordorintelligence.com/industry-reports/sunflower-seeds-market>

NEX Worldwide Express. (2016). Retrieved from: <https://www.shipnex.com/default.aspx>

OMAFRA staff. (2009). *Agronomy guide for field crops*. Retrieved from: <http://www.omafra.gov.on.ca/english/crops/pub811/7other.htm#sunflower>

Rudrappa, U. (2009). *Sunflower seeds nutrition facts*. Retrieved from: <http://www.nutrition-and-you.com/sunflower-seeds.html>

SAK Nepal. (2016). Canada: Global Affairs Canada.

Saving your seeds for a long life. (2016). Retrieved from: <http://howtosaveseeds.com/store.php>

SeedQuest. (2016). *Seed dealers and exporters*. Retrieved from: <http://www.seedquest.com/seed/resellers/asiapacific/nepal.htm>

State of water resources. (2016). Retrieved from: <http://www.wepa-db.net/policies/state/nepal/state.htm>

The Cottage Country Gardener. (2016). Retrieved from: <http://www.cottagegardener.com/>

The Money Converter. (2016). *Convert Canadian dollars to Nepal rupee*. Retrieved from:
<http://themoneyconverter.com/CAD/NPR.aspx>

Tulane University. (1997-1998). *Nepal micronutrient status survey*. Retrieved from:
<http://www.tulane.edu/~internut/Countries/Nepal/nepaliron.html>

United States Department of Agriculture (USDA). (2016). *Sunflowers*. Washington, DC:
Farm Service Agency.

US AID. (2016). *Agriculture and food security*. Retrieved from:
<https://www.usaid.gov/nepal/agriculture-and-food-security>

Viets, F.G., Boawn, L.C., and Crawford, C.L. (1954). Zinc content of bean plants in relation to deficiency symptoms and yield. *Plant Physiology*, 29(1), 76-79.

World Weather. (2016). *Kathmandu monthly climate average, Nepal*. Retrieved from:
<https://www.worldweatheronline.com/v2/weather-kathmandu-weather-averages/np.aspx>