

Promoting Canadian Agrifoods Export to Nepal

Canadian sunflower seeds for oil

Juultje Blom

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TA Fawn Turner

Product information

The common sunflower (*Helianthus annuus L.*) is one of the few crops that has its roots in North America (Hu, Seiler & Kole, 2010). The name sunflower comes from its distinct feature of turning towards the sun. Its most important use is as oil, which is also the most economic valuable form of sunflower. Furthermore, as Hu et al. (2010) point out it is the fifth most important oilseed crop, performing well in temperate zones. The first part of this report will focus on the characteristics of sunflowers, cultivation, nutritional information, machinery and costs involved and market opportunity.

Cultivation

Helianthus annuus is an annual crop that can adapt to various types of soil and has a short growing season, but depends highly on nitrogen fertilizer (FAO, 2010). It has two distinct phenological stages: the vegetative and reproductive stage (Hu et al., 2010, Alberio et al., 2015). Certain stages within the vegetative stage are crucial for yield, these include the development of the cotyledons and the number of leaves (Alberio et al., 2015). A period of 70 days is required for the plant to start flowering after sowing (Grompone, 2011). After 130 days the seeds are ripe and available to harvest 10 days later (Grompone, 2011). Dry and sunny climates are optimal for the sunflower, but can tolerate a temperature range of 8 to 34 degrees C (Grompone, 2011). Sunflowers are very drought tolerant, and their roots can get as deep as 3 meters to reach for water (Alberio et al., 2015).

Sunflowers are planted preferably in rows, to practice optimal weed control (University of Kentucky, 2014). They should be rotated with other crops every 3 to 4 years. Although commercial sunflowers do not need pollination by insects, bees have been proven to be effective in increasing yields by their pollination (University of Kentucky, 2014).

Furthermore, sunflowers need the following macronutrients: N, P, K, Ca, Mg, S and the following micronutrients: Fe, Mn, Zn, Cu, B, Cl, Mo (Alberio et al., 2015). The soil affects the ability of the plant to uptake water and minerals. Nitrogen is particularly important in the phase before the plant starts flowering. Per hectare, 150 kg of fertilizer is needed for a yield of 3 ton per hectare (FAO, 2011). Potassium is of importance as well as phosphorous, but the latter in smaller amounts. Boron is the micronutrient most often limiting for sunflowers (Alberio et al., 2015)

Weed control at the beginning of the season is important although sunflowers are competitive against most weeds (University of Kentucky, 2014). Insects pose a bigger threat to crop yield, causing diseases such as downy mildew, Sclerotinia white mold, rust and Verticillium wilt. Birds become a threat to the sunflower when the seeds have developed (University of Kentucky, 2014).

Nutritional information

Sunflower seeds are rich in dietary fibre and iron (FAO, 2010). The seeds of the sunflower for oil production have a black seed coat and have an oil content between 38-50%. Hybrid varieties have been developed through breeding, that have different oil compositions (Gunstone, 2011). Sunflower seeds for confectionary uses are lower in oil percentage and have a larger seed coat with white stripes (FAO, 2011). Sunflower oil can come in different shapes and forms (Grompone, 2011). It is used as margarine, shortening, frying oil, salad oil, cooking oil, and used for processing other products such as mayonnaise (Grompone, 2011).

Sunflower oil is considered a premium oil because it is highly unsaturated and contains linoleic fatty acid concentration which is an essential acid, and not synthesized by humans (Dorrel & Vick, 1997). There are three different types of sunflower oil: regular, mid-

oleic and high-oleic and thus are distinguished by their oleic content (Grompone, 2011). The latter two types have been developed through hybrid breeding (Grompone, 2011).

Regular sunflower oil contains per 100 grams: 884 calories, 100 grams fat of which 10.3 grams saturated, 65.7 grams polyunsaturated and 19.5 grams monounsaturated (USDA, n.d.). It contains per 100 grams 274% of the daily recommendation of Vitamin E. It is high in polyunsaturated fats and Vitamin E compared to other cooking oils (USDA, n.d.)

Machinery, labour and other inputs

If oil will be produced by the farmer there is machinery and labor required. The seeds of the sunflower must be crushed in order to be able to extract oil from the seeds (Le Clef & Kemper, 2015). The hard press method, primarily used before the 1940s in the US, is able to abstract 25% of the oil. The prepress solvent extraction method can get 40% of the oil and is the major technique used to crush seeds globally (Le Clef & Kemper, 2015).

Depending on which technique is used, cost varies from US\$1,000 for a hard press machine to US\$200,000 for a prepress solvent extraction machine (numbers are an indication from Alibaba.com, 2015a). FAO (2011) mentions a capital investment of between US\$22,000

Costs	USD/ha
Output	664
Variable costs:	
seed	178
fertilizer	91
sprays (*)	62
Total variable costs	331
Gross margin per ha	333

Figure 1. Costs and margins when yield are 2 tons per hectare and price is USD 332 per ton (Nix, 2008 in FAO, 2011)

and US\$33,000 for such an

oilseed pressing plant. Labour required per acre is according to the University of Kentucky (2014) two hours for production and one hour for harvesting. Other costs are purchasing the seeds and investing in land preparation (University of Kentucky, 2014), storage facilities and main equipment (FAO, 2011). Figure 1 provides an overview of the costs and the margin according to the FAO (2011).

Land preparation often includes tillage to control and prevent pest diseases. However, this practice is associated with certain negative effects such as top soil and water loss (University of Nebraska, n.d.). No-till agriculture is proven to benefit the soil composition and to be more profitable. Herbicides might not be necessary as sunflowers are naturally competitive against weeds (University of Kentucky, 2014). The application of nitrogen fertilizer is important for growth in sunflowers, but too much fertilizer can cause oil loss in the seeds (National Sunflower Association Canada, 2012). Five lbs of nitrogen for ten lbs of yield goal is the recommended guideline (National Sunflower Association Canada, 2012).

Market opportunity

To become a profitable sunflower seed farmer, there needs to be demand from a large population. Nevertheless, as mentioned before, sunflower oil is considered a premium oil (Dorrel & Vick, 1997) and should therefore easily become economically valuable and create a margin for the farmer.

The FAO (2011) mentioned in its 'agribusiness handbook' on sunflowers that the demand is likely to grow. This is due to the demand from food processors for oils free from trans-fat. Food manufacturers are interested in oils that are healthier for the heart and are high-oleic in its acid (Roseboro, 2014). Lower levels in saturated fat are also highly appreciated. Furthermore, it is unlikely that the sunflower industry will start producing genetically modified varieties of sunflower oil seeds. This is interesting for food processors, companies and consumers who demand non-GMO food (Roseboro, 2014).

Export potential to Nepal

The second part of the report will explore the opportunity to export Canadian sunflower seeds for oil production, for cultivation in Nepal. Nepal is a low income country with a population in 2014 of 28.17 million. Together responsible for a GDP of US\$19.64 billion (The World Bank, 2014). The share of agriculture in Nepal's GDP has been around 40% over the last 20 years (The world Bank, 2012). Rice, maize, wheat, potatoes and soybean oil represent the top 5 commodities produced in Nepal (FAOSTAT, 2011). The list is followed by milk, millet, pulses, vegetables and oil crops (FAOSTAT, 2011). The currency is the Nepalese Rupee, where 1 CAD represents 79,83 NPR (as of November 25th, 2015).

Nepal is a landlocked country situated between India and China. Geographically, the country can be divided in 3 major regions: the Terai region, the hill region and the mountain regions.

Environmental circumstances

As Hu et al. (2010) point out, there is potential of the sunflower to expand to other geographical areas: any region that did not previously grow sunflowers and has somewhat fertile land in temperate to arid/hot climates, sunflowers are able to outcompete other crops and become a premium oil crop (Hu et al., 2010). Sharma (2001) identified sunflower oilseed as a possible crop for diversification of agriculture in Nepal. The environmental circumstances are in the advantage of Nepal as sunflowers can be grown in the Terai or hill region. Rainfall ranges in Nepal from 300 mm to 3500 mm (Semple, Hicks, Lozare, & Castermans, 1988). The rain season is from June to September and most of the annual precipitation (80%) occurs within that timeframe. The dry period is from October to May (Semple et al., 1988).

Environmental benefits

It is important that when producing sunflowers, there is a rotation pattern every three to four years (University of Kentucky, 2014). Sunflowers can make for a good rotation crop themselves too: their long roots dig deeper in the soil for water and nutrients than most other plants can (National Sunflower Association Canada, 2012). Parts of these resources in the soil that is located on the surface is then left for the next crops (National Sunflower Association Canada, 2012).

Furthermore, sunflowers can be an excellent, energy rich feedstuff for livestock (National Sunflower Association Canada, n.d.). Adding whole sunflower seeds to the diet of dairy cows can increase milk production with 3 to 5% (National Sunflower Association Canada, n.d. a). As the production of sunflowers is likely to be an expensive process for Nepalese farmers, feeding cows whole sunflower seeds might not be the best option. The by-product of sunflower oil is sunflower meal, which can also be fed to livestock. Most research in this area has been done around the aspects of sunflower meal for poultry feed (Rad & Keshavarz, 1976; Senkoylu & Dale, 1999).

Harvest and storage

Sunflowers are ready for harvest when the back of the flower turns from green to yellow and when the head is brown to black (National Sunflower Association, n.d. b) Waiting too long for the seeds too dry on the plant can cause yield losses, it is better to harvest the seeds and then dry them out (National Sunflower Association, n.d. b). In Nepal, sun drying is the most common method for drying crops and is therefore dependent on the temperature and season (Semple et al., 1988). Wooven mats of rice straw are used to dry cereals such as rice, wheat and maize (Semple et al., 1988).

Cleaning and drying the seeds before storing is important (University of Kentucky, 2014). Timber and bamboo are often used but methods of storage differ per crop (Semple et al., 1988). Storage pests are mainly insects, rodents and birds, causing a loss ranging from 5.92% to 7.3% depending on the crop type.

Opportunity for oil production

Although 15 years ago sunflower was mentioned as a potential new oil crop for Nepal (Sharma, 2001), very little information is available on the crop in Nepal. This leads to the conclusion that sunflower is currently grown in Nepal. The initial costs of growing sunflowers for oil production are high, thus not likely to be attractive for many farmers in Nepal. The highest costs are in the extraction of oil and the purchase of an oil pressing machine.

However, there are some solutions to this issue. First, cold press machines can be used that have already been used by the Nepali population for other oil crops such as mustard. Cold press oils have a longer shelf life than prepress solvent extraction machines (Hyman, 1992). A second option is to transport the sunflower seeds to a larger facility where they process the seeds into oil. This will then be a different actor in the value chain.

Thirdly, the ram press might be an opportunity for farmers. This press was discussed in an article that focussed on the introduction of this sustainable technology in Tanzania (Hyman, 1992). This press was designed for sunflower seeds and for production in villages on small scale. Benefits of the press include its portability, easy maintenance, inexpensiveness and the little additional material needed for the process of extracting oil. Precondition for using this machine is planting soft shelled varieties of sunflowers (Hyman, 1992).

Benefits to Canada

Through exporting Canadian varieties of sunflowers, employment in Canada is likely to occur in the process of breeding, selecting and exporting the best Canadian sunflowers that are suitable for the conditions in Nepal. An option for breeding could be to perform research in Nepal to the best performing types of sunflowers.

One example of a company that is in the business of exporting sunflower seeds for oil is Paterson Grain, located in Winnipeg, Manitoba. A second example is Nuseed, which has its head office in the United States but offices in Canada and offers Canadian varieties of sunflowers. The contact information of the two companies can be found in Table 1.

Table 1: Contact information companies selling sunflower seeds for planting

Company	Contact Information	Reference
Paterson Grain	Head office: Manitoba (204) 956-2090 info@patersongrain.com or infocanmexoilseed@patersongrain.com	Paterson Grain (2015)
Nuseed	Sunflower Headquarters: Minnesota 218-643-2410	Nuseed (2015)

The companies are both in the business of exporting seeds, thus this would be beneficial when starting up the export to Nepal. However, neither of the two would provide a price for the seeds. Furthermore, it was difficult to get in touch with them so this might be an obstacle in the process.

Trade, permits, Canada-Nepal relations

Canada and Nepal have both been benefitting from bilateral agreements since 1965 (Government of Canada, 2013). The relationship shifted from an aid focus towards Nepal to a two-way trade and investment focus. A lot of trade is organized through India (Government of Canada, 2013).

Seeds exported from Canada are inspected by the Canadian Food Inspection Agency for quality standards and labelling (Canadian Food Inspection Agency, 2015a). As mentioned earlier, seed multiplication abroad is an option to breed sunflower varieties that are most suitable for Nepal. In this case, a Multiplication Agreement must be permitted to ensure inspection and certification (Canadian Food Inspection Agency, 2015b).

For the import of seeds to Nepal, import permits are required according to the “Plant Protection Act 1972 and the Plant Protection Rules 1975” (SME Toolkit Nepal, n.d.). The import permit should be requested at the Plant Quarantine, which costs 10 NPR. Furthermore, Nepal requires a phytosanitary certification, and more regulations around importing can be found on the website of SME Toolkit Nepal (n.d.).

Transport

Transportation is a viable part of the process of exporting Canadian sunflower seeds for planting to Nepal. It will be needed in the first place to bring the Canadian seeds to Nepal. This involves ships from Canada to South Asia and from there trucks through South Asia to the destination in Nepal. Truck Freight, associated with Paterson Grain, facilitates the transport from Canada to any port (Paterson Grain, n.d.). Paterson Grain has facilities in Vancouver to serve Asia and the Pacific. They are a shareholder of the Alliance Grain Terminal that is located at the port of Vancouver (Paterson Grain, n.d.). The product would then be shipped to Calcutta in India. From there, trains or trucks provide the transport from

Calcutta to Katmandu in Nepal. Because of the fact that additional costs of processing sunflower seeds into oil are high, it is unlikely that a farmer in Nepal will be able to produce oil from the beginning of the process. Therefore, transportation to an oil producing facility is needed as well, most likely by truck. The price of transport however will be a constraining factor.

Competition

Competition in sunflower oilseed production comes from a few big countries producing a large amount of sunflower seeds: the Russian Federation, Ukraine, U.S. and Argentine (FAO, 2010). In terms of usage, sunflower oil will compete with mustard oil which is a favourite in Nepal because of its taste. Other popular oilseed crops are rapeseed, linseed and groundnut (Nepal Agricultural Research Council, 1996). Then, there is also competition from other countries providing sunflower seeds for planting, from which it is likely to be more inexpensive to import these to Nepal. Mainland China in particular offers a wide variety of seeds for planting, and is likely to be a more attractive option.

Conclusion & Recommendations

Helianthus annuus is crop with potential for cultivation in Nepal. It is currently not grown there but it might have positive benefits to agriculture in Nepal. Produced to oil, sunflower seeds can be a valuable crop. It can be beneficial to the human diet as it is rich in Vitamin E and polyunsaturated fats. The by-product of sunflower oil production is sunflower meal, which can be used for livestock feed. This would make an economic and sustainable way of using the yield. Furthermore, with its long roots it makes an excellent crop for crop rotation, digging deeper for nutrients and water often not available to other plants. There is

one Canadian company in the business of selling sunflower oilseeds for planting, which has transport links to Asia.

Producing sunflowers from scratch seems to be an expensive industry to get in. Limiting factors are the price of transport and the competition from other countries. However there are several options. The ram press is an inexpensive but good functioning oil press which can be introduced to Nepalese farmers along with the sunflowers. Furthermore, oil presses for common oilseeds in Nepal can be used (sometimes after slight alteration) for pressing sunflower seeds.

The recommendations for future research in this area are to analyze the costs of growing sunflowers in Nepal and if this is deemed to be worth it. Furthermore, it would be necessary to find out whether sunflower oil would actually be used by Nepalese consumers. Otherwise, the seeds or produced oil would need to be exported to other countries. Although sunflower is a premium oil crop and quite valuable, this is not the intention of the project. Finally, it should be investigated if there are options to make this a suitable (cash) crop for subsistence farmers, or if it is only suitable to produce this if there is a large enough capital.

Resources

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