

Increasing Agricultural Sustainability in Nepal through the Import of
Field Peas from Canada

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Section One:

Field peas (*Pisum sativum L.*) are a legume pulse crop that is grown in many regions (Saskatchewan Ministry of Agriculture, n.d.). They are an excellent source of livestock feed with the leaves and stems being fed as hay and the peas being fed as a grain ration. Since they are a cool season crop they are fairly hardy and are able to withstand small amounts of cold, heat and drought stress (Saskatchewan Ministry of Agriculture, n.d.; Pavek, 2012). Additionally, they are an annual vine usually planted in the early spring (Pavek, 2012). As a vine, the pea plant has the ability to climb if given the means.

Cultivation:

There are several steps required to ensure the best possible yield from a crop. The first step is to determine when it is the best time to plant. Field peas prefer well drained soil that is not excessively packed. (Saskatchewan Ministry of Agriculture, n.d.). If there are a considerable number of large stones in the field, they should be removed so they do not hinder growth (Saskatchewan Ministry of Agriculture, n.d.). Once the average temperature of the soil is around five degrees Celsius, the seeds can be safely planted and can withstand a slight frost if it occurs (Saskatchewan Ministry of Agriculture, n.d.). However, just before planting a fungicide and inoculants should be applied to help avoid disease and improve nitrogen fixing of the pea plant (Saskatchewan Ministry of Agriculture, n.d.). A common inoculate used is the rhizobium bacteria which promotes the formation of nodules on the pea root and aids in nitrogen fixation (Saskatchewan Ministry of Agriculture, n.d.).

Fertilization is not always necessary but it does improve the overall quality of the plant. In order to develop extensive root systems and better seedlings, field peas require phosphorus (Saskatchewan Ministry of Agriculture, n.d.). This is also important for nitrogen fixing and should be applied at a maximum rate of 17 kg/ha with a 2.5 cm spread and 15-18 cm between rows (Saskatchewan Ministry of Agriculture, n.d.). In order to improve yields and overall crop performance, fertilizer application should be considered.

A major problem in many agricultural productions is the control of weeds. Field peas are not very competitive against weeds and therefore need some help (Saskatchewan Ministry of Agriculture, n.d.). There are many methods that can be used to prevent weeds, including chemical and mechanical control. One method is crop rotation which works well with field peas when a competitive cereal crop is planted the year prior to the peas (AAFC, 2008). With the cereal crop, the weeds cannot establish themselves as well resulting in fewer weeds the following year. Similarly, if the field peas are planted early enough and at a reasonable density they will stand a better chance of crowding out weeds (Saskatchewan Ministry of Agriculture, n.d.). Glyphosate can be sprayed before the weeds emerge as a burn-off treatment and can also be sprayed before harvested if the peas are not being used as seed (Saskatchewan Ministry of Agriculture, n.d.). For mechanical weed control there is rod-weeding, tillage, and harrowing. Rod-weeding can be done shortly after planting and after tillage to control the growth of weeds (Saskatchewan Ministry of Agriculture, n.d.). Before planting, tillage can be performed to encourage the growth of weeds which will be removed during rod-weeding (Saskatchewan Ministry of Agriculture, n.d.). Finally, harrowing can be done just before the peas emerge to

control any new weeds (Saskatchewan Ministry of Agriculture, n.d.). The control of weeds is also important for improved crop production and quality.

Another major concern with crops is insect pests which damage the plants and result in a poor yield. Many of the pests that target field peas are not severe enough to cause any significant loss (Saskatchewan Ministry of Agriculture, n.d.). The pea aphid is a long, green insect that weakens the stem by feeding on the sap (Saskatchewan Ministry of Agriculture, n.d.). These aphids are also hosts for viruses that can be transmitted to the plant and cause further damage (Saskatchewan Ministry of Agriculture, n.d.). However, insecticide should only be applied if there are more than ten aphids per plant and after flowering (Saskatchewan Ministry of Agriculture, n.d.). Pea weevils can also cause serious damage through the destruction of leaves and the larvae that feed on the root nodules (Saskatchewan Ministry of Agriculture, n.d.). In order to protect crops, fields should be monitored to ensure that insect pests do not become a serious problem.

A more prominent concern is diseases, which are more prevalent, and can result in significant economic loss. Field peas can be affected by many diseases which greatly reduce their yields (Saskatchewan Ministry of Agriculture, n.d.). The most concerning disease is *Mycosphaerella* blight which causes the lower leaves to develop purplish-black spots (Saskatchewan Ministry of Agriculture, n.d.). If the season is wet the disease is more likely to occur and is usually in the form of airborne spores (Saskatchewan Ministry of Agriculture, n.d.). Although most new pea varieties are resistant to Powdery Mildew it can still be a problem (Saskatchewan Ministry of Agriculture, n.d.). It occurs during a warm and dry season and

causes white powdery areas to form first on the leaves and stem and then eventually the entire plant (Saskatchewan Ministry of Agriculture, n.d.). Finally, there are two kinds of rot that can occur, Sclerotinia rot and Root rot (Saskatchewan Ministry of Agriculture, n.d.). The former is more vigorous and is capable of living for up to 3-5 years with no registered fungicidal treatment (Saskatchewan Ministry of Agriculture, n.d.). The latter is prevented through the treatment of the seed and causes damage to the roots of the plant (Saskatchewan Ministry of Agriculture, n.d.). Overall, it is important to be vigilant in regards to monitoring your crop so no economic loss is experienced. It also prevents the diseases and pests from becoming a serious problem and affecting other crops as well.

Harvesting peas is similar to many other crops except it does require a little more care. Peas that are harvested for feed do not need to be at the same standards as those for the food market (Saskatchewan Ministry of Agriculture, n.d.). The crop can be either swathed or combined depending on the stage of maturity, but both machine headers need to have vine lifters (Saskatchewan Ministry of Agriculture, n.d.). The best time of day to harvest the peas is when it is humid as it lessens the chance of the pods cracking (Saskatchewan Ministry of Agriculture, n.d.). Following the harvest of the peas the residue can be used as hay or straw (Saskatchewan Ministry of Agriculture, n.d.). Following good harvest practices ensures that waste of seed does not occur.

Storage of peas is important to prevent spoilage and needs to be completed properly to avoid heating. They are typically stored in silos or bins with a temperature at or below fifteen degrees Celsius and sixteen percent moisture (Saskatchewan Ministry of Agriculture, n.d.). If a

heater is needed for further drying then the maximum temperature that can be reached while still remaining safe is forty-five degrees Celsius (Saskatchewan Ministry of Agriculture, n.d.). Proper care is necessary to ensure that heating does not occur which could start a fire and destroy the crop and property. If all of the above mentioned steps are followed a reasonable to excellent crop yield should be expected, permitting that the weather is also favourable.

Nutrition Information:

Field peas are a nutritious source of livestock feed with high amounts of energy and protein (Anderson *et al.* 2007). Starch is the main source of energy available from the peas which contributes to animal wellbeing (Vander Pal *et al.* 2008). The peas can be ground into a grain and integrated into the feed ration as a mix with other grains (Anderson *et al.* 2007). After the peas have been harvested the remainder of the plant can be used as hay which is a reliable feed source in the winter when other food is scarce (Hayashi *et al.* 2007). Refer to Table 1 for a summary of the important nutrient contents of field peas.

Nutrient	Field Pea
Digestible Nutrients, %	87
Crude Protein,%	25.3
Calcium,%	0.15
Phosphorus,%	0.44

Table 1: Nutrients in field peas (Anderson *et al.* 2007).

Canadian Companies:

There are several companies in Canada that sell and process field pea seeds with the major growing regions being Alberta, Saskatchewan and Manitoba (Pulse Canada, n.d.). The first company is DL Seeds located in Morden, Manitoba where they develop peas that are sold at FP Genetics (DL Seeds, n.d.). Trawin Seeds, a company located in Melfort, Saskatchewan produces high quality seed which is sold throughout Canada and United States (Trawin Seeds, 2012). They currently have 9 full-time employees and hire close to 30 seasonal workers throughout the year (Trawin Seeds, 2012). A third company is Columbia Seed Co. Ltd. located in Vauxhall, Alberta who exports seed for propagation and peas for human consumption (Columbia Seed, 2014). They also have a processing facility that prepares the product for shipment in bags ranging from 25kg to 1000kg (Columbia Seed, n.d.). They currently have 9 people on staff (Klempnauer, 2014). Columbia seed sells their seeds at different prices depending on the quality of the seed. High quality seed is sold for \$40/25kg and lower quality is sold for \$15/25kg (Klempnauer, 2014). A buyer can also purchase seed that has not been processed at \$20/25kg and \$8/25kg for high and low quality respectively (Klempnauer, 2014). For contact information on the above companies refer to Table 2. The Saskatchewan Pulse Growers website (www.saskpulse.com) is a helpful resource for information on other companies and the pulse industry in Canada.

<u>Method of Contact</u>	DL Seeds	Trawin Seeds	Columbia Seed Co. Ltd.
Telephone	1-204-331-2361	306-752-4060	1-403-654-2158 or 1-877-577-2158

Mail	DL Seeds PO Box 2499 Morden, Alberta, Canada. R6M 1C2	Trawin Farms Ltd. Box 267 Melfort, Saskatchewan, Canada. S0E 1A0	Columbia Seed Co. Ltd., Box 80 Vauxhall, Alberta, Canada, T0K 2K0
E-mail	Leah Beattie: Office Manager: Leah.Beattie@dlseeds.ca Kevin McCallum: General Manager: Kevin.McCallum@dlseeds.ca	infor@trawinseeds.ca	Joerg Klempnauer: Sales: joerg@columbiaseed.ca Petra Klempnauer: Administration: petra@columbiaseed.ca

Table 2: Contact Information for Canadian Companies

Benefits to Canada:

There are many benefits that could be experienced by Canada if a new trade agreement were created with Nepal. Countries that export have been proven to be more productive than countries that do not due to global competition (Baldwin and Gu, 2004). This competition promotes incentive to increase efficiency within the company (Baldwin and Gu, 2004). This would most likely have a greater effect on smaller companies who are not as prominent on the global market. With an increase in production there would be a need for more employees to meet the high demand (Greenaway and Kneller, 2004). With an increase in demand for the peas there would probably need to be a higher acreage planted. This would hopefully benefit the agricultural industry through the increase in production. Established farmers could enter a

new crop into rotation, hopefully resulting in more income. This could also open doors for people who are looking to become involved in farming but could not enter the market in the past.

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Section Two:

Introduction to Nepal:

Agriculture is the main source of income for many people in underdeveloped countries, but does not provide enough to reduce poverty. In Nepal, agriculture accounts for 80% of the population's means of living with 60% of the people not being able to supply enough food for themselves (NARC, 2010). There are three main geographical regions in Nepal, each with varying levels of productivity (NARC, 2010). The first and most fertile area is the Terai which is a low-lying area with fertile soil (NARC, 2010). Of the total land area 41% of it is used to grow crops such as rice, wheat, and maize (NARC, 2010). The second region is the Hill area where both crop production and livestock keeping is predominate (NARC, 2010). In this area 20% of the land is in production and maize is the primary crop (NARC, 2010). The least productive area of Nepal is the Himalayan region where the temperature and topography of the land make it difficult to cultivate (NARC, 2010). Only 5% of the land is utilized for crops and their main agricultural production system is livestock (NARC, 2010). Food and agricultural security are major problems for Nepal and could be improved through the aid of other countries.

Export Proposal:

A new agricultural import in Nepal could potentially have several advantages for the people and the country. In the Terai, field peas are grown by farmers but the peas enter the food market and the stem and leaves remain in the field (Hayashi et al. 2007). Since field peas are vines, the farmers could grow them along terrace walls and other areas where they would climb. With the average farm size being only 0.8 ha farmers need to find more ways to

maximize their land use (NARC, 2010). Allowing peas to grow among other crops and in areas not normally used, the farmers could potentially increase their production. The soil and other crops, such as rice and maize, would benefit due to Field peas ability to fix nitrogen. It has been shown that they can provide between 130-150kg N/ha to the soil (Frame, n.d.). Therefore, if more seed became available and the Nepalese were educated about the many benefits of growing field peas, there could be more demand for the product.

Since the peas would not be planted in a large area similar to other crops, there would not be a need for a large quantity of seed. It is estimated that there is between 2700-4500 seeds in a 1kg package (Frame, n.d.). This amount of seed would probably be enough for the average farm. However, not every farmer has the space to plant the seed and not every area is suitable for growing it. It would have to be determined how many farmers would actually be interested in the crop before determining the amount needed. Currently, the prices for field peas are \$9.30-\$9.50 CDN/bushel for number 1 peas and \$8.50-\$9.50 CDN/bushel for number 2 peas (Statpub, 2014). There is approximately 27.2 kg in 1 bushel which would be enough seed to supply many farmers (Rayglen Commodities Inc, 2014). At this price it would probably be more beneficial for a village or a couple villages to buy the seed together as a shared product. Overall, field peas are reasonably affordable for the farmers of Nepal if they all share in the cost for a unit of seed.

Benefits to Various Livestock:

There are several advantages for the dairy industry in Nepal if peas became a major feed source. Since 1997, the industry has increased 30% with buffalo accounting for 66% of the

country's milk yield (Hayashi *et al*, 2007). As a result, many farmers depend on this industry for income. Rice straw, which has a very poor nutrient value, accounts for most of the livestock's feed with little benefit to the animal (Hayashi *et al*, 2007). In the winter there is generally a shortage of food due to the loss of pasture and as a result milk yields decline (Hayashi *et al*, 2007). Compared to rice straw, field pea hay would greatly improve the milk quality produced by the buffalo (Refer to Table 3 for nutrient comparison of rice straw and field peas) (Hayashi *et al*, 2007). Specifically, it would help to increase the quantity of fat in the milk which is needed by the Nepalese as a source of energy (Hayashi *et al*, 2007). Overall, better quality milk could help improve the livelihood of the Nepalese over time.

Nutrient	Field Pea	Rice Straw
Digestible Nutrients, %	87	45-50
Crude Protein,%	25.3	3-5
Calcium,%	0.15	0.25-0.55
Phosphorus,%	0.44	0.02-0.55

Table 3: Comparison of nutrients in field peas and rice straw (Anderson *et al*. 2007; Jackson, 2014)

Additionally, it could be used to feed sheep and goats in Nepal. Due to the high source of protein field peas are good substitutes in finishing diets at an inclusion rate of 450g/kg or lower (Loe *et al*. 2004). Tests have shown that lambs that were fed a diet consisting of field peas had higher fat deposits than those that were not (Loe *et al*. 2004). This results from the high energy content of the field peas (Loe *et al*. 2004). With diets consisting of higher protein and energy, sheep and lambs would become better milk producers providing another means of

income. Moreover, they would have better meat quality and could potentially become a more valuable source of food for the Nepalese.

Chickens are another animal that could perform better on a field pea diet. Chickens can be fed the field peas in either raw (whole) or ground form and have been shown to increase the meat quality of the bird (Dotas *et al.* 2014). The quantity of peas fed to the chickens has to be changed as the chickens become older due to the possibility of poor performance (Dotas *et al.* 2014). This results from anti-nutritional factors (ANF) which inhibit the absorption of nutrients in the gastrointestinal tract (Dotas *et al.* 2014). To prevent this from happening, the chickens should not be fed more than 480g/kg of peas at any time (Dotas *et al.* 2014). With higher quality feed the chickens will grow better resulting in an increase of meat available on the bird. This would hopefully create a greater food source and income for the people.

Environmental Benefits:

Environmentally, field peas are also beneficial due to their ability to fix nitrogen. Poor crop yields in Nepal have been linked to the absence of fertilizer use due to lack of availability and cost (NARC, 2010). Nitrogen fixation helps to improve the quality of the soil through higher levels of organic matter and provides nitrogen for future crops (McCauley *et al.* 2012). Additionally, it hinders pests by disturbing their natural cycle and lowers energy inputs through lower fertilizer requirements (McCauley *et al.* 2012). Field peas could potentially improve the soil of Nepal and help increase the yield of other crops.

Nepalese Companies:

Farmers in Nepal rarely buy seed due to a lack of money, but instead reuse seed from the previous year (Khanal, 2014). As a result, there are not very many companies in Nepal that sell seed since there is not a great demand for it. However, there are a few companies and government agencies that could be contacted about this export idea. The Agricultural Inputs Company Ltd. is located in Kathmandu where they currently look into procuring fertilizer for farmers (AICL, 2008). In the past they were involved in all aspects of agriculture including selling seeds (AICL, 2008). Even though it may not be economically viable for the company in the beginning to purchase the seed it could benefit the company in the future when the product becomes more widely used. Since they were once in the business of selling seeds they hopefully have the knowledge regarding marketing and distributing of seed that the same principles could be applied to field peas.

The Government of Nepal, specifically the Department of Co-operatives could also be informed of the export potential of field peas. This department works with farmers to help establish co-operatives throughout the country so the people have access to the agricultural products they could need (GoN, 2011). In addition, they try to increase the social and economic standing of the farmers which would help alleviate the food security problem (GoN, 2011). Even though they would not buy the seed they could inform local co-operatives about the product and help them set up a market for the seeds. Similarly, they could potentially help more people have access to the product by working with other government departments.

Likewise, the Nepal Agricultural Research Council (NARC) could be helpful in promoting the product for import into to Nepal. They strive to improve poverty by increasing agricultural production through sustainability (NARC, 2007).

Problems with Transportation in Nepal:

A major problem in Nepal is the lack of safe and reliable infrastructure (Devkota *et al.* 2012). This could potentially create problems when trying to deliver seed to remote regions. With difficult terrains and monsoon rains that wash away roads, improving the transportation routes in rural Nepal is challenging (Devkota *et al.* 2012). When people need to travel somewhere to buy or sell products, the majority of them have to walk, carrying their wares on their back and shoulders (Devkota *et al.* 2012). Consequently, much time is lost with this method of travel and only necessities are purchased (Devkota *et al.* 2012). In the Kathmandu valley there is more access to transportation which could be utilized if it could handle the rough terrain (Devkota *et al.* 2012). Air transport is possible but it is not cost effective and it is only available when the weather is favourable (Devkota *et al.* 2012). Unfortunately, there are many people who may not have access to the seed. This would most likely be the Himalayan region which is more rugged than the Terai and the Mid-Hill region (NARC, 2010). As a result, it could mean that only the latter two regions would benefit from the field pea seeds.

Labour Inputs:

The overall labour required to cultivate field peas would be no greater than many of the other crops currently grown in Nepal. The farmers will be preparing the land for their other crops which will also work for field peas as well. Tractors are used if they have one or they can

rent them for the length of time needed, money permitting (Bhujel and Ghimire, 2006). Similar to rice, there would be a significant amount of manual labour required to grow field peas. Rice is harvested by hand due to limited mechanization (FAO, n.d.). Field peas would similarly have to be picked and shelled by hand. The hay could be harvested by a knife or sickle depending on the thickness of the stem (FAO, n.d.). Then the cut stems would have to be gathered and stored until it is needed as feed.

Competition for Canada:

A potential problem for Canada is competition from other countries that could produce the field pea seeds at a cheaper price. The Shanghai Greensail Biotechnology Co. Ltd located in China is an exporter of field pea seed around the world (Alibaba, 2014). They sell the seeds in packages of varying sizes ranging from 50g to 10kg (Alibaba, 2014). They also allow the customer to request a specific size if the size needed is not available (Alibaba, 2014). The price of the seed can range from \$1-\$80 US depending on the size of the bag (Alibaba, 2014). A similar company is Dharam Agro Biotech in India which sells non-hybridized seed (Alibaba, 2014). This company did not provide specific details about their product so further research would have to be done in that regards. With companies that are located in countries that share a border with Nepal it would seem more economically viable for Nepal to look to them for seed instead. In order to prevent this, Canadian companies need to compare their prices with others so that the Canadian product is chosen over the others. However, Canada does not want to lose money in this trade so research should be done to avoid this.

Recommendations and Conclusions:

There is still a considerable amount of research that needs to go into the export of field pea seeds to Nepal. The cost of transportation to get it to Nepal is unknown but since edible peas are currently imported by the country, the same method could be applied to the seed. Additionally, delivering the seeds to the Nepalese needs to be further researched due to the poor infrastructure. Tariffs on imported agricultural goods in Nepal are 14.5% but further import costs and restrictions need to be determined (Pyakuryal, 2010). The Government of Nepal's Customs webpage is currently under construction so other resources are needed. Even though the benefits of this trade would not be immediate, in the long term, field peas have the potential to increase the livelihood of the people through its improvement of animal performance and the surrounding environment.

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