Export of CDC Baler oat seeds to be introduced and grown as fodder in the hill regions of Nepal

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Part 1: Product Information

Product Description

CDC Baler oats is an oat variety grown primarily for silage or fodder purposes. A certified seed released by FP Genetics, CDC Baler is engineered to have exceptional forage yield and standability. The mature plant can reach heights of 99cm, which is taller than other varieties released by FP Genetics. This height, combined with the exceptionally wide flag leaf and thick stem, translates into a high biomass yield. (FP Genetics, n.d.)

CDC Baler has a late maturity, although the maturity can be reduced through the addition of fertilizers. Conversely, poor weather conditions can increase the time to maturity (Leuke, 2014a). Oats are a C3 plant, so are adapted to function best in a more temperate climate (Bareja, 2013). In this respect, cooler weather patterns do not have a highly negative impact on growth. CDC Baler has very good resistance to smut but poor drought tolerance (FP Genetics, n.d.). Their growth will be largely impacted by the amount of moisture available during growth. Nutrients and green leaf colour are maintained far into the growing season, lending to a higher quality forage when harvested (Trawin Seeds, 2014). This variety has high energy protein, essential for feed quality (Ibid, 2014). While the concentrate yield of CDC Baler is noticeably lower than milling oat varieties, CDC Baler offsets this through its high forage yield (Leuke, 2014a).

Machinery and Labour Requirements

CDC Baler would require little machinery for cultivation and growth in Nepal. It would be adapted into the regular cropping system and would utilize the same machinery as other cereal crops, so farmers would not have the added expense of machinery specialized for oat cultivation. Machinery needed for proper growth include a plough to prepare the soil and a sickle or scythe for harvest (Pariyar, 2004). The oats, as they are being grown for fodder, would not be threshed but would be harvested on a cut-and-carry system (Leegwater & Schiere, 1999). This system operates with little machinery and

considerable labour. When ready, the forage is cut with a scythe or sickle and laid out to dry, then carried back to the farm for storage or feeding.

Labour required for fodder oat cultivation is similar to that of other cereal crops. The soil needs to be cultivated, the seed sown, and the crop harvested. Labour inputs would increase depending on the number of fodder cuts taken from the crop. However, the growth of a fodder crop on-farm has the potential for less labour requirements gathering feed from other sources such as native growing vegetation. The fodder crop would be grown in fields close to home, resulting in a shorter distance to bring the forage back to the farm as opposed to bringing in forages obtained from randomly located native vegetation.

Description of Growth and Harvest

The land would first be ploughed to integrate any crop residues from the previous crop and to expunge unwanted weeds (Pariyar, 2004). Manure would be applied to the soil to act as fertilizer, and a second cultivation would incorporate the manure into the soil and prepare the seedbed (Ibid, 2004). The oat seed would be broadcast onto the prepared soil at a rate of 100-120 kg/Ha (Pariyar, Shrestha & Paudyal, 2013). Traditional sowing techniques would be used; there is no machinery required for the actual sowing of the seed. Planting would occur in the fall season immediately after the harvest of the previous crop, and harvest would begin approximately 60 days after planting (Pariyar, 2004). The number of cuttings is dependent on the rate of growth of the crop and the fodder needs of the farmer. The farmer would cut the crop with a sickle or scythe. Some fodder could be fed immediately to the animals, and the remaining crop would be dried and carried back to the farm to be stored and fed as needed to the animals. Additional harvests would occur as the oat crop matures (Ibid, 2004). The final harvest would occur in the spring to give way to the growth of the next crop in the cropping system (Pariyar, Shrestha & Paudyal, 2013). As Pariyar, Shrestha and Paudyal (2013) show in Annex VIII, a

time line for the planting and cultivation of oats begins in Poush and ends in Baisak, essentially covering the winter growing period from November to April.

Inputs Required

The growth of fodder oats is a relatively low-input system. Because oats fit into the farmer's regular cropping system, little changes need to be made to accommodate the growth of this new crop. If oats already exist as part of the regular cropping system, CDC Baler seeds can easily replace the existing obsolete variety. Material inputs include a plough and manure, both of which are readily available products on the farm (Pariyar, 2004). Consequently, there are no additional inputs involved with CDC Baler oat cultivation in respect to the cultivation of other cereal crops with the exception of the seed. If a farmer chooses he can add other forms of fertilizer to the crop to increase its yield and growth rate, but this input is not necessary for the successful production of the oat crop. Inputs of water are also an option if the farmer wishes to irrigate or has access to irrigation systems, but the successful growth of the crop is not dependent on irrigation. Rainwater is sufficient for crop growth.

Issues Concerning Crop Production in the Hills

Several issues arise concerning the growth of CDC Baler in the hill regions because of the climate and elevation difficulties of these regions. Hill agriculture is accomplished through terraced farming, so field sizes are extremely small. The sloping topography makes the soil prone to surface wash, and the winter months which cover the oat growing season are typically cool and dry (Shrestha, Wake, Mayewski & Dibb, 1999). However, CDC Baler would still grow successfully in these conditions. As previously mentioned, oats are a C3 crop so growth is optimized in temperate conditions such as those in the hill regions (Bareja, 2013). Oats have a fibrous root system and would be effective at holding the soil particles together, reducing the rate of soil surface wash (Hannaway & Larson, 2004). Small field

sizes offer no drawbacks to oat production because labour requirements remain stable regardless of field size.

The average land holding size of resource-poor Nepalese farmers, such as those found in the hills, is 0.4ha (Pariyar, 2006). This land supplies food for the farmer's family and his livestock. An increase in land used for livestock feed production will result in a decrease in the amount of land available for the cultivation of human food. Nepalese farmers are unable to grow large amounts of livestock feed, hence the appeal of a sedentary system of animal production. If CDC Baler oat seeds were exported to Nepal, there could be some difficulty in persuading farmers to grow the crop. However, because it can be integrated into an existing crop production system and has an extremely high forage yield, the farmer is able to benefit by either adding CDC Baler to his forage production system or using CDC Baler seeds as opposed to his obsolete existing seed variety.

Because of the variable topography, roads are non-existent in the hills, making it quite difficult for a farmer to reach the nearest market (UNWFP & FAO, 2007). This poses a particular problem in marketing and transporting the new CDC oat seed to the farms in the hill regions. Likewise, the price of this new seed will impact the financial viability of the farming operation, in that more money is being expended on seed inputs than if a farmer retained seed from the previous year's crop to plant the following year. The increased outputs in the form of volume of fodder produced effectively counter the cost of production. The farmer has increased inputs, but outputs more than compensate for cost of production.

Cost

The cost of CDC Baler seed is relatively inexpensive. A 40lb bag of seed costs $9.40 CAD (Leuke, 2014b). The 2013 GNI per capita for Nepalese was $730, so the price of the seed is within an affordable range (World Bank Group, 2014). It has already been established that the average land

holding size of farmers in the hill regions is 0.4ha, and average area planted to oats will be assumed 0.05ha (Pariyar, 2004). Seeding rates for oats are 100-120kg/ha (Pariyar, Shrestha & Paudyal, 2013). From this data the average cost of seed for the farmer for one year is calculated to be $3.10, seeded at a rate of 120kg/ha. However, this cost does not factor in the cost of transportation, so cost for the farmer will be higher to account for the shipping of the seed from Canada to Nepal.

Nutritional Information

CDC Baler oats have many nutritional values which make it an exemplary fodder crop to livestock in the hill regions of Nepal. A table from the book 'Nutrient Contents of Fodder Tree, Shrubs and Climbers in Nepal' illustrates the nutritional averages for fodder tree, shrubs and climbers in Nepal, and an excerpt from this table illustrates the nutrient content of *Avena sativa*, shown in Table 1 (Upreti & Shrestha, 2006). While this nutritional composition is standard for all oat varieties, CDC Baler also has an exceptionally high biomass yield (FP Genetics, n.d.). Despite supplying similar nutrients as other oat varieties, CDC has a higher value as a fodder crop because of the amount of forage it produces. In addition, oat straw is more palatable than the straw of wheat or barley and can be used in the diets of all livestock (Pariyar, 2004). Because it serves such a broad spectrum of livestock, oat fodder can be used in any livestock application, increasing its market opportunity.

English Name	**Scientific Name**	**Mt./h (DM)**	**Description**	**DM %**	**OM %**	**T. Ash %**	**CP %**	**EE %**	**NDF**	**ADF**	**ADL**	**Ca %**	**P %**
Oat grass	*Avena sativa*	3-5	Mean	15.74	89.13	10.87	11.65	3.35	57.37	44.12	8.43	0.46	0.34
			Std	2.86	2.99	2.99	3.35	0.64	7.40	7.19	3.06	0.17	0.09
			Max	19.70	96.81	16.10	17.22	3.80	70.26	57.39	14.18	0.83	0.56
			Min	11.37	83.90	3.19	5.69	2.90	44.77	33.71	4.45	0.18	0.20
			N	10	24	24	24	2	19	19	19	20	20

Table 1: Nutrient content of A*vena sativa*

Patent Constraints

FP Genetics is the only licensed distributor of CDC Baler oat seeds (Sk MOA, 2011). Farmers growing

this variety are allowed to keep the seed for their own use and cannot sell it to other farmers for seed (Leuke, 2014b). The purpose of introducing CDC Baler seed is for growth as a fodder crop in Nepal, so the seed produced by the crop will be fed with the forage, not sold.

Market Opportunity

The market opportunity of CDC Baler oats is high in the hill regions of Nepal. There is a definite need to increase crop production for farmers in these areas because of the impact to livestock production and its resulting impact on the general level of income for farmers in these areas.

A census conducted in 1991-92 concluded that 60% of people in the hills were living below the poverty line (Nepali et al., 2010). Shrestha (1992) indicates that farmers in the hills primarily raise cattle and goats but the development of this livestock industry is hindered by the unavailability of forages for animal consumption (Pariyar, 2004). The demand for green fodder necessary for a productive livestock enterprise exceeds the supply and this deficit is most apparent in the hill regions (Upreti & Shrestha, 2006). As Pariyar (2004) established, oats are an acceptable form of forage to all livestock. This being, CDC Baler can be grown by all farmers in the hill regions who are involved in raising livestock, whether for personal or commercial production, and can supply farmers with the fodder necessary to fill demand.

It must be noted that many Nepalese farmers save seed from the previous year's crop to plant the following year (Private seed enterprise development, 2005). This has the potential to hinder the market opportunity of CDC Baler in respect to cost of production. It is less costly for the farmer to save seed from his previous crop, but the genetic advancement of CDC Baler needs to be considered. CDC Baler seeds, compared to seeds saved from a previous oat crop, carry more hybrid vigour, have less potential for disease and will produce a higher yield. If farmers in the hill regions were given the opportunity to grow CDC Baler their farming operation would become more sustainable.

Benefits to Canada

The most obvious benefit to Canada regarding the export of CDC Baler oat seeds to Nepal is the impact it would have on the Canadian economy. There would be an economic boost for FP Genetics, the company supplying the seeds, and for Dennis Leuke, the seed grower/producer, because of the expanding consumer market. Because the seed produced for export to Nepal would be grown as part of an existing seed production operation, there would be no large start-up costs associated to increased production for Canadian growers. Depending on the market for CDC Baler in Nepal, Canadian production areas would expand and contribute to income stability for the growers. The market expansion increases the assurance that the product will remain in demand, consequently strengthening the retail potential of the seed. FP Genetics would become a more international company and would have expansive marketing possibilities as shipment of the seed would increase awareness of the company as different countries and people were exposed to the seed through its shipping route.

Environmental Sustainability

Canada, being a primary producer of oats on a global level, has experienced an increase in the production of oats throughout the last two decades (Sk MOA, 2011). Extrapolating from this and taking into account the importance of cereal crops in the future sustainability of the planet, oat production should continue to rise in the coming years. CDC Baler alone accounted for 2945 acres of production in Canada in 2014 (Canadian Grain Commission, 2014).

The environmental sustainability of oat cropping practices is largely dependent on the cropping practices of the grower. A paper prepared by Thiessen Martens, Entz and Wonneck (2013) highlights some precedents of environmental sustainability in relation to crop production. By critically evaluating the questions related to sustainability issues, farmers are able to assess their current practices and

possibly implement new practices or adjust existing systems to improve sustainability. Regardless, oat production will continue in Canada, so availability of CDC Baler is ensured.

Recent statistics by the Canadian Grain Commission (2014) show that CDC Baler is also produced in Alberta and Manitoba, though to a lesser extent. If the Saskatchewan grower has insufficient production or leaves the agricultural business, Canadian-grown CDC Baler oat seeds would still be available to export from Canada to Nepal.

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Part 2: Export Potential to Nepal

Nepalese Agriculture

Nepal is a landlocked country in South Asia, located between India and China. The Nepalese hill regions extend from approximately 700-2000 meters, and the primary agricultural focus is subsistence farming and the raising of livestock (Nepali et al., 2010). The climate and topographical variances in Nepalese hill agriculture offer a unique situation for farmers growing crops. The biggest issue is the implementation of terraced farming. Temperatures in the hill regions are cooler than in the lower regions of Nepal. Precipitation measures 27.5-230 cm, but only 20% of this occurs during the winter months, essentially making it a dry period (Ibid, 2010). Because of the sloping topography, soil is prone to surface wash (Shrestha, Wake, Mayewski & Dibb, 1999). Road access is extremely poor in the hills because of the variable terrain, so market access is limited for farmers living in these areas (UNWFP & FAO, 2007).

Transportation Logistics

Transportation of the seed from Canada to Nepal is available by either boat or air. However, because seed should not be exposed to moisture, air transport would be a safer selection (Egbert, 2011).
Boat transport is likely to be less expensive, but the viability of the seed would be at risk. In addition, Nepal is a land-locked country and has only dry ports, so the seed would not be able to be delivered directly to Nepal. Shipping would need to occur via to Kolkata, India, a major port, and from there transported to Biratnagar or Birgunj, both large dry hubs in Nepal which are connected to Kolkata by rail (UNWFP & FAO, 2007).
If the seed was shipped by air it would have a much more direct route. The seed would be shipped from the nearest Canadian international airport to Kathmandu International Airport. Kathmandu, being the capital of Nepal, would have the most developed transport system so distribution of the seed from Kathmandu to other market locations in Nepal would be ensured.

The Mahendra highway runs along Nepal and is integral in the transport system of Nepal (Ibid, 2007). The seed would be transported along the Mahendra highway in trucks, which would stop at different markets located along the highway (see Figure 1, Annex). Farmers in the hill regions would be responsible for accessing these markets, purchasing the seed and transporting the seed back to their farm. This system is quite problematic because of the poor market access to farmers in the hill regions. Farmers in these areas face difficult terrain and unestablished roads, so it could take hours to get to the market (Maltsoglou & Taniguchi, 2004). An additional issue to this system is communication. There is no way for farmers to know the seed has arrived at their nearest market without physically going to the market to check. This has the potential to waste a farmer's time if he travels to the market and the seed has not arrived.

Cost Analysis

It has already been established that the average cost for the seed, per farmer, would be $3.10. The cost of transportation will increase this price, depending on the mode of transportation used to ship the seed from Canada to Nepal.

An independent quote from A1 Freight Forwarding estimates a shipping cost of CAD $1841.00 for 25 bags of seed to be shipped by air from Edmonton International Airport to Kathmandu International Airport, as shown in Figure 2. This would bring the total price of one bag of seed to CAD $83.04. The cost for the farmer, purchasing enough seed to cover 0.05ha, would be $27.40.

There would be additional costs for shipping the seed from Saskatchewan (where it is grown) to the Edmonton Airport, and from Kathmandu to different markets in Nepal.

Storage Issues from Post-Harvest to Market

It is vital that the seed remain dry after harvest. Exposure to moisture long before planting will reduce

the vitality of the seeds by instigating premature fertilization or the growth of molds, which would destroy the seed.

Needs and Benefits to Nepal

A report by the Government of Nepal et al (2013) indicates that the import of hybrid seeds occurs as a response to the demand of new and improved seed varieties. Canada can invest in this market by exporting CDC Baler oat seeds to Nepal.

There is a definite need for fodder in Nepal, specifically to farmers in the hill regions, and Canada can help fulfil this need by exporting a fodder seed. Data included in a paper by Upreti and Shrestha (2006) illustrates a negative feed balance available for farmers in the hill regions, shown in Table 2, and Table 3 illustrates the deficiency of green fodder available in Nepal.

Table 2: Feed balance (10^3 DM)

Description	**Mountain**	**Hills**	**Terai**	**Total**
Feed required	930	4985	2949	8864
Feed available	1056	2228	3040	6324
Feed balance	126 (+)	2757 (-)	91 (+)	2540 (-)
% Deficit/surplus	113 (+)	55 (-)	103 (+)	29 (-)

Source: Upreti & Shrestha, 2006

Table 3: Feed balances in terms of dry matter (DM)

Item	**Total m.mt DM**	**Feed Category (m.mt DM)**		
		Straw	**Green Fodder**	**Concentrate**
Feed demand	26.9	9.1	15.1	2.7
Feed available	18.6	10.7	6.9	0.9
Balance	-8.3	1.6	-8.2	-1.8
Percentage	-30.8	17.6	-54	-66.7

Source: Upreti & Shrestha, 2006

As evidenced by these tables, Nepalese farmers in the hill regions need more green fodder. Because CDC Baler is grown specifically as a fodder crop, it would explicitly cater to this deficiency. CDC Baler has hybrid vigour and would have higher production values than older varieties of oat seed or

seed saved from previous years. Animals raised in the hills are underfed during the winter months, and this negatively affects the productivity of the animals in the area (Pariyar, 2004). If CDC Baler were integrated into a farmer's crop rotation system, he could grow fodder during the winter months to supplement the diet of his livestock. Production in the form of milk and meat would be increased, corresponding to the potential for commercial marketing of the products.

A more productive livestock industry benefits Nepalese by increasing dietary nutrition and household income (Aryal & Premy, 2013**)**. Livestock act as equity, so farmers are able to mitigate financial risk through the productivity of their livestock. Employment opportunities have the potential to become more inclusive, as women can become more involved with the industry by assisting with livestock production and marketing (Ibid, 2013**)**.

Companies/Buyers Involved

Contact	Contact Information	Role
FP Genetics	Rod Merryweather Office: 306-791-1045 x 234 Mobile: 306-550-7685 Email: rmerryweather@fpgenetics.ca	Chief Executive Officer
Dennis Leuke	One Oak Farms Ltd Humboldt, SK Mobile: 1-306-231-7475 Email: oakfarms@sasktel.net	Seed grower
A1 Freight Forwarding	171 Main St South Unit 6D Newmarket, ON Phone: 1-800-280-0277 Fax: 905-581-0180	Transport of seed from Canada to Nepal
National Seed Company Ltd.	Central Office: Kathmandu, Nepal Phone: 977-1-4279587 Fax: 977-1-4279587 (Bloomberg Businessweek, n.d.)	Responsible for the procurement, production, processing, storage and sale of various seeds for agricultural production (Bloomberg Businessweek, n.d.)
Seed Quality Control Centre	Nepal Phone: 00977-01-5534258 or 00977-01-5521359 Fax: 00977-01-5526276 Email: info@sqcc.gov.np (MOAD, n.d.)	Implements seed policies, acts and regulations (Government of Nepal et al., 2013)
Seed Retailers	Located throughout Nepal	Responsible for seed sales (Government of Nepal et al., 2013)

Marketing Strategy

Seed marketing in Nepal is a severely underdeveloped sector. There is a deficit of seed retailers, seed products and seed marketing strategies in the hill regions (Government of Nepal, 2013). Realistically, to get a new seed product to farmers, it would be most beneficial to go through existing seed distribution channels. If the seed were supplied to the National Seed Company Ltd, they would be most capable in distributing the seeds to different seed retailers.

Global and Regional Competition

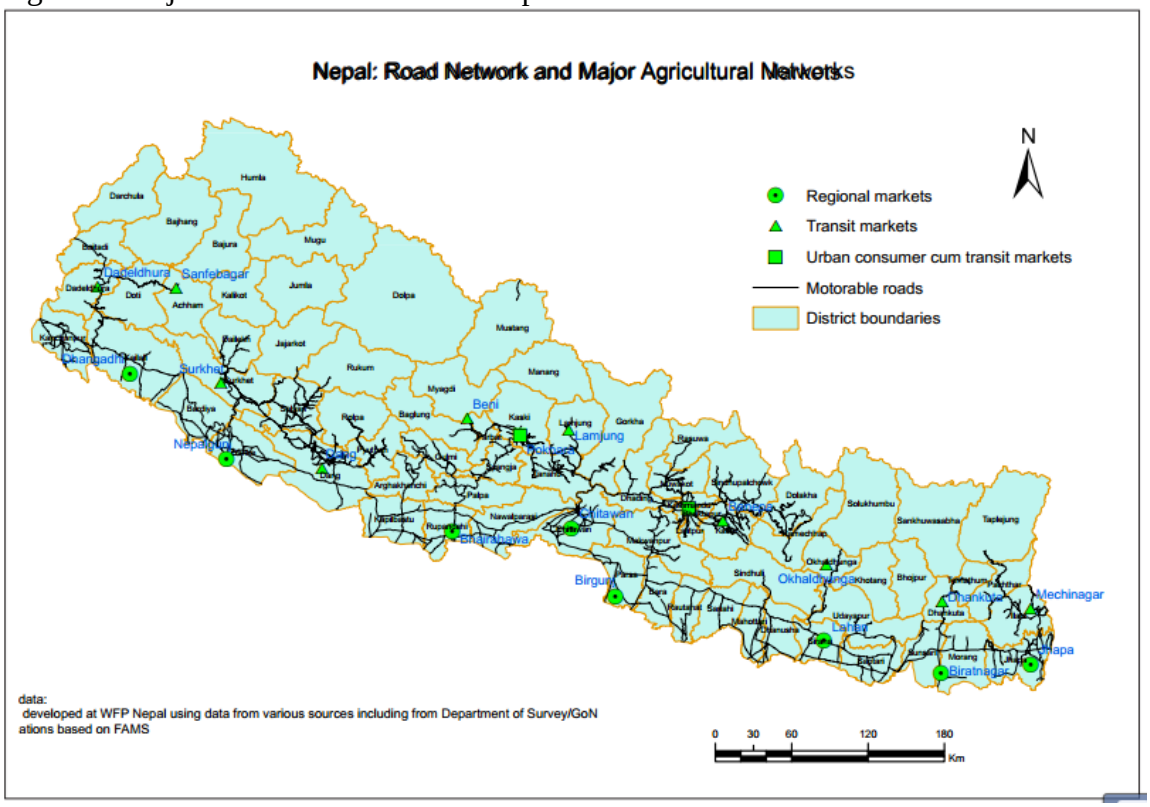
Oat seed is a common commodity throughout the world, so there is the potential for it to be less costly for a nation closer to Nepal to export the seed. In addition, Nepal may be focused on producing, developing or promoting native oat varieties. It would be much more beneficial to the Nepalese economy if they were able to support their own seed growers as opposed to buying seed internationally. CDC Haymaker is another oat variety, licenced to SeCan, which produces exceptional forage. CDC Haymaker has the potential to replace CDC Baler because it has a higher forage yield than CDC Baler (SeCan, 2013). CDC Haymaker contains CDC Baler genetics, and hence carries many of the similar strengths as CDC Baler in quality and improved grain yield over CDC Baler (Ibid, 2013). Both CDC Haymaker and CDC Baler are grown in Canada, so Canada would experience a positive boost to the economy regardless of which variety was exported.

Recommendation

Nepalese hill agriculture displays a need for the introduction of newer and better-producing fodder oat cultivars, but research in this area is limited (Pariyar, 2004). Because of the constraints on market access for farmers in the hill regions, an alternative scenario to selling the seed directly to the farmers would be for extension researchers to work with the new variety and distribute it to farmers in remote hill areas. The Nepal Agricultural Research Council specializes in agricultural research, and could perform extension work on CDC Baler and introduce it into Nepalese agriculture (Joshi, Conroy & Witcombe, 2013). Research with CDC Baler will ensure its viability in hill agriculture, and farmer risk will be mitigated because of proven yields and production data. Research may also identify possible issues with growing this particular oat variety, and determine the growing conditions where production will be maximized. It is my recommendation that CDC Baler oat seed be exported to Nepal, though to extension researchers instead of directly to the farmers.

Annex 1

Figure 1: Major roads and markets in Nepal



Source: http://www.un.org.np/sites/default/files/report/tid_188/2007-02-31-WFP-Food-and-Agricultural-Markets-in-Nepal1.pdf

Figure 2: Quote for shipping 25 bags of oat seed from Edmonton to Nepal

AIR FREIGHT

FROM: Edmonton (Our warehouse)
TO: Kathmandu - Nepal (Airport)

SHIPMENT TYPE: Commercial cargo

Type	Qty	Dimensions	Weight
Other	25	15 x 26 x 5 in	40 lb

AIR FREIGHT RATE	3.60 $ CAD / KG ALL IN
ACTUAL WEIGHT	453.00 KG
VOLUME WEIGHT	133.14 KG
CHARGEABLE WEIGHT	453.00 KG
AIR FREIGHT	1630.80
TERMINAL & SCREENING FEE	135.60
PROCESSING FEE	75.00
SURCHARGES	0.00
TOTAL:	1841.40 $ CAD

The final invoice will be based on the actual weight and dimensions from the cargo receiving terminal.

Quote includes all charges up to the cargo's arrival at the airport. Rates do not include destination charges, customs clearance, duties and taxes.
Insurance is available upon request.

Source: http://www.a1freightforwarding.com/quick-quote/

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