

Canadian Export Project to Nepal

Nutra-Fix© Probiotics and Barley Sprout Fodder

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Section 1- Product information

ABOUT THE COMPANY

Nutra-Fix©, a company created by Roland Poirier, is located in Chesterville, Ontario. It is the owner, Roland Poirier, that designed their unique barley sprout fodder wheel, supplying both organic and large-scale farms in Canada and in the United States (Nutra-Fix Probiotics, n.d.). Nutra-Fix probiotics also offers several probiotics and supplements for various uses: livestock, hay and silage, soil, lawns and gardens, lakes and ponds, and humans. For any questions or to contact the company, either by phone, e-mail, or mail, please refer to the list below.

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PRODUCT DESCRIPTION

This export project is a two-phase project that targets two products from the Nutra-Fix Company in order to better fulfill the needs of Nepalese dairy farmers. The first phase is the

livestock probiotics, offering an immediate solution to many issues of the Nepalese livestock industry. The second phase is the barley sprout fodder wheel©, which is more of a long-term solution to these issues, further discussed in Part 2 of this report.

Probiotics

Nutra-Fix offers a variety of livestock supplements including *Fermentation Product for Livestock*©, *Lactobacillus Acidophilus Fermentation Product*©, and *Nutra-Fix Pro-Blend*©. Although all products can possibly be useful to Nepalese farmers, the *Fermentation Supplement for Livestock* (CFIA Registration No. 982789) would be the most beneficial livestock supplement to export to Nepal. The daily recommended quantity for dairy cows is 57 g/day, but the product can also be used as a feed supplement for beef cattle, horses, swine, sheep, goats, and poultry (Nutra-Fix Probiotics, n.d.).



Picture courtesy of Jenna James, Drentex Jerseys

Health/Nutritional Information

Probiotics, live micro-organisms, and yeast were proven to have not only nutritional benefits, but also improve health (Anadón, Rosa Martínez-Larrañaga, Aranzky Martínez, 2006). The main nutritional and health benefits to be known are reduced toxic substances resulting from metabolic reactions, and an increased immunity (Anadón, Rosa Martínez-Larrañaga, Aranzky Martínez, 2006). Moreover, many users have reported a subsequent increase in milk production when using the *Fermentation Supplement for Livestock*© (Nutra-Fix Probiotics, n.d.). The exact nutritional contents are as listed below.

GUARANTEED ANALYSIS:
 Crude Protein, minimum 12.0%
 Equivalent Crude Protein from
 Non-Protein Nitrogen, maximum 0.0%
 Crude Fibre, maximum 9.0%
 Moisture, maximum 10.0%
 Calcium, minimum 38.8%

<http://www.nutra-fix.com/livestock.html>

Probiotics can also reduce the incidence of ruminal acidosis, a serious disease in dairy cattle caused by an excessive consumption of carbohydrates, lowering the pH of the rumen (Chiquette, 2009). Live yeast found in probiotics stabilizes the pH by encouraging the use of lactic acids by the bacteria in the rumen (Chiquette, 2009).

Gut health is greatly improved through the use of probiotics. *Aspergillus oryzae*, ingredient contained in the *Fermentation Supplement for Livestock*, is an enzyme that improves the rate and efficiency at which bacteria degrade plant cell wall, an important step in the metabolic pathway of ruminants (Chiquette, 2009).

Fodder



The barley sprout fodder is a wheel system composed of 32 racks, each containing 3 trays (Nutra-Fix Probiotics, n.d.). Each tray requires 6 to 7.5 pounds of barley seeds, added to trays once the mature sprouts are harvested (Nutra-Fix Probiotics, n.d.). 60 to 75 pounds of fresh barley sprouts are produced per tray per day, which corresponds to a total of 700 to 800 pounds (Nutra-Fix Probiotics, n.d.). An average of 25 to 50 pounds of barley sprouts is the recommended daily quantity per cow, the fodder could therefore supply feed for up to 30 cows

(Nutra- Fix Probiotics, n.d.). The fodder wheel dimensions are 11’ 8’ high by 12’ deep by 16’ wide.

Health/Nutritional Information

The fodder was proven to have many positive repercussions on the health of dairy cattle. Amongst the most important: increased oxygen in the circulatory system, reduced incidence of acidosis, and increased milk production (Nutra-Fix Probiotics, n.d.). The uniquely engineered seeds, *NutraFX Clean Sprout*, minimize the incidence of mold that often is one of the major issues in sprout fodder systems (Nutra-Fix Probiotics, n.d.) Because barley sprouts contain a high amount of conjugated linoleic acid (CLA), they also present many other health benefits, including reduced odds of cancer, and an increased immune system (Bhattacharya, Banu, Rahman, Causey, Fernandes et al., 2006).

As described by the tables in Figure 1. and Figure 2., barley sprouts have a higher protein and vitamin content in comparison to other types of feed, including hay and grain (Benson, Burrichter, 2009).

Feed	Total Digestible Nutrients (TDN)	Protein	Energy MJME/kg DM)
Barley Sprouts	78.4	16.7	11.8
Rye Grass Hay	68	10.4	10.3
Alfalfa Hay	60	18	9
Barley Grain	84	13.5	12.7

Source: Review of Hydroponic Fodder Production for Beef Cattle, Meat and Livestock Australia Limited 2003

Figure 1. Nutrient analysis of different types of feed

VITAMIN	BARLEY GRAIN	BARLEY SPROUTS
VITAMIN E	7.4	62.4
BETA-CAROTENE	4.1	42.7
BIOTIN	0.16	1.15
FREE FOLIC ACID	0.12	1.05

Source: Cuddeford (1989).

Figure 2. Vitamin analysis from a 6-day grass samples

BENEFITS TO CANADA

Because Nutra-Fix is a rather small-scale local company, exporting their products to Nepal would support the company’s local economy and ensure employment to the local

employees. The exportation of the livestock probiotics and barley sprout fodders would benefit and support Canada's economy, as the Canada based company employs and creates work for Canadians. There is also a possibility to create new employment, for instance, sales representatives and consultants, possibly working from Nepal, for Nutra-Fix Probiotics in order to ensure the good running of the project. Furthermore, the resources used to build the fodder would originate from other Canadian industries.

REQUIREMENTS

Probiotics

Costs

Nothing requires to be built in order to use the probiotics. The only cost associated to the product is the cost of the 20kg bag, which is sold at the price of \$183/bag (Nutra-Fix Probiotics, n.d.).

Inputs

The *Fermentation Supplement for Livestock* is composed of various yeasts and fermentation products, as listed below (Nutra-Fix Probiotics, n.d.).

- Yeast brewers dehydrated
- Yeast culture dehydrated
- Lactobacillus acidophilus fermentation product dehydrated
- Aspergillus oryzae fermentation solubles dehydrated
- Aspergillus niger fermentation solubles dehydrated
- Bacillus subtilis fermentation solubles dehydrated

Location/Storage

There are no complex storage requirements for the probiotics. It only requires to be stored in a fresh and dry area to maintain freshness of the product for up to 10 months (Nutra-Fix Probiotics, n.d.). This is an important advantage to the exportation process of the product as it minimizes greatly the logistics required during handling and shipping.

Fodder

Costs

The fodder is a rather complex and expensive structure to export. The cost of producing such a fodder is \$25,000(Nutra-Fix Probiotics). Included in this price are the required materials to build the wheel, listed below, in *Inputs*.

As mentioned previously, a particular type of seeds, *NutraFX Clean Sprout*, need to be used with the fodder wheel system in order to eliminate the risk of developing mold. These quality seeds can be purchased for the price of \$24 per litre.

Inputs

The materials included in the fodder wheel building unit are as listed below (Nutra-Fix Probiotics, n.d.):

- 1-1/4 horsepower motor
- 1-speed driver and worm gear
- 4-9 foot wheels
- 8-poly spokes/wheel

In order to ensure optimal functioning of the barley sprout fodder wheel, in-floor radiant heat, wall and ceiling insulation, ventilation system and waste water drainage are also required (Nutra-Fix Probiotics, n.d.).

Location/Storage

The fodder requires a sufficient area, at least 12' by 16', that is stable enough to support the structure (Nutra-Fix Probiotics, n.d.). A similar project was executed in Kenya, where the cows could eat barley sprouts directly from the fodder. The purpose of this modification is to gather all the livestock, collect their manure and use it as fertilizer for crops (Nutra-Fix Probiotics, n.d.). This could possibly be done in Nepal, and the fodder would therefore need to be located in an area that can be accessed by the cows. The fodder system also requires to be located in proximity to a water source and needs a way to dispose or make use of the waste water.

CHALLENGES AND RECOMMENDATIONS

The exportation of probiotics presents very little challenges. Due to the size and dimensions of the bags, the manufacturer can easily package 50 onto a pallet, making overseas transportation efficient and fairly simple (details further discussed in Part 2-Export Potential to Nepal, Transport) (Borealis AG, n.d.).

The product may seem somewhat expensive, retailed at \$183 per 25kg bag. However, because only a very little quantity is required, 57 g/cow/day, this corresponds to \$1.90/cow/day (Nutra-Fix Probiotics, n.d.). When considering the health benefits resulting from the use of the product, this is a rather adequate cost.

Exporting barley sprout fodder wheel would be a very beneficial product to export to Nepal, but also presents many challenges.

One of the main issues with the barley sprout fodder wheel is the lack of power sources in remote Nepalese rural areas. Although the fodder wheel is operated by a motor, a source of electricity would still be required, for the in-floor radiant heat for instance. This issue could be

solved by the installation of solar panels on the structure, but this would also represent additional costs.

Another important issue associated with the use of the barley sprout fodder wheel is determining an appropriate location for stability, water sourcing and disposal of waste water. A stable surface is not as much of an issue in the terrain region than in the hills, but in both cases, a level surface of at least 12' by 16' is necessary. If this is not available, a cement pad might have to be built, which, once again, would lead to additional fees. Moreover, although the Nutra-Fix fodder wheel requires less water than a typical system, it still needs to be located in proximity to a water source. This issue could possibly be solved by using a portable gravitational water system, such as presented in Melinda Drummond's export project (AGR*1110*0104).

Although both the probiotics and barley sprout fodder wheel are products that can be very useful to Nepalese farmers, and can be transported with little to some difficulties, the cost of these products remains an issue. In order to spread the costs, maximize the use, and share the benefits of *Fermentation Supplement for Livestock* and barley sprout fodder wheel, they should be retailed to dairy cooperatives rather than individual farmers. Organizations such as Ceci and Samarth (details further discussed in Part 2-Export Potential to Nepal, Marketing), are ideal starting points and contacts to achieve this goal.

COMPETITION

Company	Country of origin	Product	Price range	Website
Organic Biotech Private Limited	India	Probiotics	\$1-20/kg(up to \$500 for 25kg bag)	https://www.alibaba.com/product-detail/Dairy-Cattle-Feed-probiotics_175306444.html
Life Products	United States	Probiotics	n/a	http://www.lifeproductsinc.com/probiotics.php
Bovamine	Denmark	Probiotics	n/a	http://www.bovamine.com/dairy/
Fodder Solutions	Australia	Sprout Fodder	n/a	http://www.foddersolutions.com.au
Fodder Works	United States	Sprout Fodder	\$11,950-\$48,950	https://www.fodderworks.net/collections/systems
Henan Machinery & Equipment	China	Sprout Fodder	\$4,000-\$6,000	https://www.alibaba.com/product-detail/CE-livestock-fodder-hydroponic-system-hydroponic_60467658290.html

Figure 3. Competitive companies and their information

Organic Biotech Private Limited©'s probiotics require larger daily quantity of probiotics for a similar end result. Their probiotics are also added to water, rather than being a top coat to feed, which could be an issue, as it is difficult to ensure that each cow receives an adequate quantity. This product is also more expensive than the *Fermentation Supplement for Livestock*.

Life Products©' probiotics are a rather competitive product to Nutra-Fix's *Fermentation Supplement for Livestock*, as a similar daily quantity is required and the product is offered in various forms. However, their product's function is more specific, therefore multiple products are required in order to have the same health benefits as Nutra-Fix's probiotics.

Bovamine Dairy© is one of the most competitive products. Although there is little information about cost or daily required quantities, its efficacy is proven and supported by much scientific research. Furthermore, because the company is based in Denmark, costs associated to shipping and handling would be lower as it does not need to travel across the Atlantic.

Considering these three companies and the products they offer, Nutra-Fix's *Fermentation Supplement for Livestock* is a competitive product and it would be reasonable to undertake its export to Nepal.

Fodder Solutions©' fodder is very similar to the Nutra-Fix barley sprout fodder wheel, from building requirements to production rate. However, Nutra-Fix's technology differentiates

itself by the fact that the fodder wheel's operation is supported by a motor rather than solely relying on electricity, an important factor when considering Nepalese life conditions.

Fodder Works© is available in a more compact format. However, Nutra-Fix is the only company to offer a sprout fodder wheel. This unique concept differentiates itself from the other “storage unit” type sprout fodders as it allows cows to eat directly from the fodder, which as further discussed in Part 2 of this report, can help increase nutrients contained in the soil.

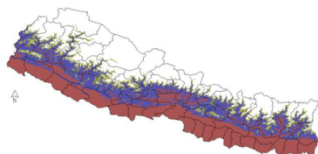
Henan Machinery & Equipment Company Limited©'s fodder, like most sprout fodders, requires 3,500L of water per day, a tremendous amount of water for a country like Nepal, where natural resources are available in very limited quantities (Alibaba.com, n.d.). Nutra-Fix barley sprout fodder wheel, although still requiring a source of water, only uses 190L of water during an entire 6 days' cycle (Nutra-Fix Probiotics, n.d.).

When comparing Nutra-Fix barley sprout fodder wheel to sprout fodders from other companies, it is obvious that it is a unique and competitive product that could certainly be a success on Nepalese farms.

Section 2- Export Potential to Nepal

INTRODUCTION TO NEPAL

Nepal, home to Mount Everest, is located in Asia, and is surrounded by India and China (BBC, 2016). This 147, 181 km² country is home to 28.46 million Nepalese citizens, a much



Source: Nepal, National Planning Commission 2010a.

Agroecological domain	Altitude range (m)	Local names for the region	Importance in terms of agricultural production
Terai and river basin	80–600	<i>Terai, Tar, Bensi, Phant, Khonch, Kachad</i>	Most important
Low hills	600–1,000	<i>TalloPahad</i>	Third most important
Middle hills	1,000–1,800	<i>Deurali, Hatiya, Madhya Pahad</i>	Second most important
High hills	1,800–2,300	<i>Lekh, Kharka</i>	Fourth most important
Mountains	>2,300	<i>Himal</i>	Least important

Source: Vaidya and Floyd 1997.

Figure 4. Map of the 3 main physiographic regions of Nepal and table of the agroecological domains in each region

denser population than Canada (EDC, n.d.). Nepal and Canada are established trade partners, with Nepal importing \$22.56 million yearly in Canadian products (EDC, n.d.). Nepal's capital, Katmandu, is located in the Central region and is one of the main cities and point of contact for potential buyers (AgTrade Nepal Canada, n.d.). The country has 3 main geographical areas: the terai, also known as the plains, the hills, or elevated flatlands, and the mountain region (Joshi, Conroy, Witcombe, 2012). Agriculture is an important industry in Nepal, representing a third of their gross domestic product (Joshi, Conroy, Witcombe, 2012). As the map and table in Figure 4. demonstrate, agriculture is mainly prominent in the terai area (Joshi Conroy, Witcombe, 2012). More than 80% of Nepal's population relies on agriculture as their main source of income, and hence improvements in the agricultural systems can improve the socio-economic status of the country as a whole (Redding, Chetri, Lamichhane, Chay, Aldinger, Ferguson, 2012).

NEPALESE DAIRY INDUSTRY

General Information

This export project focuses mainly on the terai agriculture, with some consideration for the low to mid hills as well. In this area of Nepal, dairy farming is one of the main type of agriculture (Hayashi, Thapa, Sharma, Sapkota, Kumagai, 2009). There is a population of approximately 1,187,000 heads of cattle and buffalo, and the milk production, as of 2014, was 1700073 m³ (Durbar, 2014). As described in Figure 5., the average size of herds is 3.4 cows, mainly Jersey and Holstein crosses, and their individual daily feed intake is approximately 25 kg of green grass, 5kg of crop residues and 2.24 kg of concentrate (Sharma, Banskota, n.d.).

One of the main goals of the Nepalese government and its dairy industry is to find products and technologies to increase milk production efficiency and food safety (Paudel, 2015)

(Adhikari, 2015). Such changes and improvements can have many positive repercussions on the quality of life of Nepalese communities.

Table 5.1: Characteristics of the main dairy production systems prevailing in the three case study areas			
	Eastern Hills	Central Hills	Western Hills
Important species	Cows	Buffalo, cows (ratio 3:1)	Buffalo, cows (ratio 4:1)
Important breeds	Jersey/ Holstein crosses	Murrah cross buffalo, Jersey cross cows	Murrah cross buffalo (50% of buffalo)
Average herd size	3.4 (<2 dairy cows)	3	4-5 (2.5 dairy animals)
Normal feed (daily, per head of dairy animal)	25 kg green grass (rainy season), 5 kg crop residues, 2.24 kg concentrate	30 kg grass in the rainy season; 12-15 kg of fodder leaves in winter; total 15-30% nutrients from concentrates	Green grass in rainy season, rice straw/ maize stovers, tree fodder leaves 1.5 kg home-made concentrate during lactation; 200- 700 kg commercial feed purchased per year
Feeding system	Stall feeding	Stall feeding	Stall feeding
Reproductive performance			
Age at first calving	28 months	3-4 years for improved buffalo, 5 years for native buffalo	4 years for local buffalo, 2.5 years for cross-bred cows, 4 years for local cows
Milk productivity	8.37 l/ day, 2660 l/ lactation	5.2 l/ day for Murrah buffalo, 3.5 l/ day for native buffalo (1590-1920 l/ lactation)	3.5 l / day for local buffalo, 4.7 l/ day for Murrah buffalo, 6.3 l/ day for crossbred cattle
Calving interval	13 months	14-15 months	NA
Lactation period	315 days	305 days	NA

Figure 5. Overview of dairy farming in the 3 main regions of Nepal
Source:Sharma, Banskota, n.d.

Needs and Challenges

The dairy sector in Nepal is facing many important ecological, social, and economical issues. One of the main concerns is the decreasing quality of food sources and increasing cost of production (FAO, United Nations, 2010).

Health and production of dairy cows depends on the farmers' knowledge of animal nutrition (Redding, Chetri, Kumar, Chay, Aldinger, Ferguson, 2012). However, in Nepal, feed protocols are inconsistent throughout the year, and as Figure 6. indicates, dairy cows are greatly affected by diseases, as a result of this issue. During the monsoon period, there is as sufficient amount of forages and pasture, but during the remaining of the year, especially in the winter, feed is a scarce resource and farmers use more concentrate than forages (Durbar, 2015) (Hayashi,

Thapa, Sharma, Sapkota, Kumagai, 2009). Their production is limited because of purchased concentrates and by-products, which represent 65 to 70% of the production cost (Durbar, 2015).

Another challenge Nepalese farmers face is the modernization of agricultural practices (Joshi, Conroy, Witcombe, 2012). Because of their low incomes, it is difficult to acquire modern technologies, which would allow them to increase their cows' milk production.

The soil quality of the land where crops and pastures are cultivated affects the nutrients contained in forages, and hence is directly linked to milk production (Redding, Chetri, Lamichhane, Chay, Aldinger, Ferguson, 2012). Improving soil fertility by using manure could therefore improve the efficiency of the Nepalese farming systems (Durbar, 2015).

Percentage of respondents ranking problem as most significant		
Water buffalo	Cattle	Goats
Deteriorating pastures: 35.9%	Deteriorating pastures: 32%	Deteriorating pastures: 24.3%
Market distribution problems: 20.8%	Market distribution problems: 4%	Market distribution problems: 5.7%
Animal disease: 41.5%	Animal disease: 64%	Disease: 24.3%
Predators: 1.9%		Malnutrition: 2.86%
		Inbreeding: 41.4%

Figure 6. Issues associated with dairy farming in Nepal
Source: Chetri, Lamichhane, Chay, Aldinger, Ferguson, 2012

75% of dairy products sold in Nepal are imported due to a lack of supply (Redding, Chetri, Lamichhane, Chay, Aldinger, Ferguson, 2012). Dairy farmers need to become more efficient in order to compete with imported products and answer to their country's demand.

Doing so would possibly represent lower cost of milk products for Nepalese citizens, who have a low income and have very little to spend on fresh products of quality.

Nepalese children have an alarmingly low literacy rate. This is in part due to weeding practices, which, all done manually, require children and women to spend many hours in the fields, when they could instead be in school, being educated (FAO/IFAD, 1997).

BENEFITS TO NEPAL

Exportation of probiotics and barley sprout fodder would solve the needs and challenges addressed in the previous section.

Nutra-Fix's *Fermentation Supplement for Livestock* is a probiotic feed supplement of quality that can help reduce health issues and diseases linked to inconsistent food supply and nutrients.

The barley sprout fodder wheel offers a forage of quality all year long, which can be used alongside forages during the monsoon period, or as a main source of feed during the rest of the year, instead of relying on concentrates. This can be seen as an investment, where the money is put towards a long lasting solution, the fodder, rather than on large quantities of concentrates that are somewhat inconsistent, unreliable, and affect milk production. Through this investment, the fodder is also a step towards the modernization of farming practices.

If cows are able to access the barley sprout fodder wheel, they could possibly feed directly from it. This would mean that they would all gather in one area, and manure could easily be collected and then used as a fertilizer to improve soil composition.

The use of probiotics and barley sprout fodder represents an increased milk production with the use of fewer resources, improving the milk production efficiency of Nepalese farmers.

This will make the Nepalese dairy products more competitive and affordable for low-income consumers of Nepal.

By adapting crops and using a barley sprout fodder wheel, the amount of time spent weeding can be decreased. Hence, children and women can allocate their time differently, for instance towards learning to read rather than weeding.

TRANSPORTATION

The products will first be shipped from Chesterville to the Port of Montreal. A1 FreightForwarding will then ship the products through ocean freight, from Montreal port to New Delhi, India for ~ \$750 per shipment (50 bags of probiotics or 1 fodder wheel) (A1 FreightForwarding, n.d.). It will then have to be transported from New Delhi to Kathmandu to be distributed to Nepalese customers, which A1 FreightForwarding also takes care of.

The probiotics bags would be rather easy to transport to the Nepalese communities, as they can easily be loaded onto trucks or such vehicles and can be loaded and unloaded by a single individual. The fodder would however require more logistics and would take a longer time to reach the communities, as the items listed previously are larger, heavier or more sensitive to environmental conditions. Nonetheless, this would however be a long-term solution to increasing the health of cows and production of Nepalese farms, hence justifying the amount that will need to be spent and the time it will take to complete the project. By making this a two phase project, the probiotics can be made available to Nepalese farmers immediately, while the logistics for shipping the fodder wheel are finalized.

MARKETING

In order to make the export of the probiotics and barley sprout fodder wheel affordable to Nepalese farmers and maximize their use, they should be marketed to the Central Dairy Co-operative Nepal (CDCAN), which englobes many small dairy cooperatives. These cooperatives were established for many reasons, including but not limited to increasing milk production, and processing and marketing the milk of the member farmers (FAO, United Nations, 2010). By marketing the products to local dairy cooperatives, all their members can contribute to covering the fees and in return they can share the products of the fodder and its benefits.

The project should be executed in collaboration with Ceci and Samarath, two similar organizations that already work with dairy cooperatives. Ceci is a not-for-profit organization aiming to reduce world poverty in developing countries, and one of their current project is working with dairy cooperatives in rural Nepalese communities (Ceci, n.d.). Samarath is a Nepal based organization, and they are focused towards reducing poverty in rural sectors (Samarath, n.d.). Among their current interventions in the dairy subdivision, they are working towards improving the access to forage and the production of milk (Samarath, n.d.).

Conclusion

The probiotics are certainly an ideal product to export to Nepal, as the 20kg bags are easy to handle and offer an immediate solution to poor dairy cattle health, mainly on the nutritional and immune function levels.

The barley sprout fodder wheel, although an extensive export project requiring much logistics, is a product that can be very useful, not only for farmers, but for entire Nepalese communities.

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