Exporting Liquid Nitrogen Tanks to Nepal

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Introduction

Artificial insemination is used throughout the Canadian dairy system to breed cows. Artificial insemination has helped Canadian farmers improve the genetics of their farm since 1934 (Snyder, 1984). Artificial insemination is an economical and simple method of introducing dairy genetics and breeding cows (Vishwanath, 2003). There are many different products that are necessary to make a successful dairy operation. Liquid nitrogen tanks are an important part of an artificial insemination system and were first produced for the exact cause of storing semen (Foote, 2002). For Nepal to improve the existing dairy genetics system and to start using artificial insemination on a larger scale it will need liquid nitrogen tanks. In this detailed report a proposed export potential of liquid nitrogen tanks from Canada to Nepal is outlined. Exporting liquid nitrogen and dairy semen will also be included on the report.

Product Information

A well run artificial insemination system requires many inputs including liquid nitrogen to freeze and keep the integrity of semen. The main product discussed in this report, liquid nitrogen tanks, is used to freeze semen and keep it usable for insemination (Foote, 2002). Semen is stored in small 0.5mL straws and frozen before it is extracted from the liquid nitrogen, warmed up and used to inseminate the animal.

The Canadian cryogenics company Cole-Parmer sells liquid nitrogen tanks. One of their many products is the XT20 a liquid nitrogen dewar. It is a more cost efficient tank and is most suitable for exporting to Nepal. The XT20 holds up to 20.7L of liquid nitrogen and can store up to 1500 0.5 mL (1/2cc) straws. The XT20 is designed with 6 separate holding containers and makes for easy removal and storage of semen samples (see Fig. 1). The XT20 liquid nitrogen tanks are listed at a price of $2,322CND (Cole-Palmer, 2016). With the capacity to hold lots of liquid nitrogen, semen samples and remain affordable the XT20 is one of the best options for Nepalese farmers to consider when introducing artificial insemination practices to their farms.

The XT20 is produced by the American company Taylor-Wharton Cryogenics. Taylor Wharton has many other products they manufacture that could be good options for Nepalese farmers. However, many of these products are not available through Cole-Parmer and therefore would not provide any export potential to Canada.

Nepal Overview

Nepal is a small country located between northern India and southwest China in south central Asia. Nepal is a small nation with an area of about 150 000 square kilometres (Government of Nepal, 2014). However, with a population of nearly 27 million (Government of Nepal, 2014) Nepal is quite densely populated at approximately 180 people per square kilometre.

Agriculture is a very prominent part of Nepal's economy. Agriculture in Nepal accounts for 68% of the labour force (International Labour Organization, 2016). Agriculture also makes up for a large part of Nepal's exports and more than a third of the gross domestic product at 33.7% (World Bank, 2014). Animal agriculture more specifically accounts for 12.8% of the national gross domestic product and 31.5% of the agricultural GDP (Sharma, 1997). Agriculture also shows a large potential for growth in Nepal as the country struggles to produce enough food to sustain itself and an unemployment rate of approximately 42% (USAID, 2016).

Nepal is composed of three geographical regions; mountain, hill and Terai. The Himalayan mountains in the north are infertile, undeveloped and does not have any sustained agriculture. Most of the animal agriculture in Nepal is in the hills region (Pariyar, 2005). The full distribution of cattle can be seen in Table 1. This would also mean that the largest potential for starting an artificial insemination program between farms and the best place to ship liquid nitrogen tanks to.

Benefits to Nepal

Nepal would have a great opportunity to benefit from improved dairy genetics. Nepal struggles to produce milk at a productive rate. Comparatively to Canada, Nepal has over one million dairy cows (MOAC, 2014) and Canada has about sixty thousand less just under one million dairy cows (Canadian Dairy Commission, 2016). This is relatively similar levels but when you consider the production levels you can see a large difference. The main dairy cattle breeds in Nepal are the indigenous Nepali and many cross breeds of Nepali cattle including Holstein/Nepali, Brown Swiss/Nepali and most commonly Jersey/Nepali crosses. The Nepali Government to recommends

the Jersey as the best breed for small farm milk enterprises (Shrestha, 1989). It is used for upgrading the production levels of local breeds. Because Jerseys have a smaller body size they are easier to maintain, reach sexual maturity earlier, and their high milk butterfat make them an adaptable and logical choice for cross-breeding with local Nepali breeds (Clinch, 1991). Milk productions for Nepali cattle average around 1.8 litres per day. Nepali crosses average in a range from around 5.3 litres per day to 6.5 litres per day, standards that still fall far short of Canadian dairy production standards. Table 5 shows production levels for the Nepali breed as well as its cross breeds. When you compare it to the milk production averages of Canadian cows that are not cross bred with the Nepali breed they the Canadian averages are up to five times greater. Canadian Holstein cows average approximately 33.6 litres per day compared to the mere 6.5 litres of milk per day of the Holstein/Nepali cross (CDIC, 2016). The Jersey/Nepali cross averages 6.3 litres per day of milk much less compared to the 22 litres per day average of Canadian Jerseys (CDIC, 2016). Taking this into consideration Nepal could benefit greatly from Canadian dairy genetics. Breeding Nepali cows for several generations with Canadian genetics could seriously improve the production level and the overall genetics of the Nepali cattle. This could improve the Nepali dairy industry greatly.

Benefit to Canada

Canada would benefit very little from the exportation of liquid nitrogen tanks to Nepal. To start, the liquid nitrogen tanks are not manufactured in Canada so there is no potential to increase production levels and create new jobs. Canada also would not benefit much economically from the liquid nitrogen tanks for the same reason. If Taylor-Wharton Cryogenics could start manufacturing liquid nitrogen tanks in Canada than this export plan would become much more logical for Canada.

The benefits that Canada could receive from the trading would be an increased partnership with Nepal and the potential to increase trading with the country. This could help Canada in a long time if Nepal started trading their own dairy genetics and Canada was looking to expand their genetics. Canada could also start exporting more products related to the liquid nitrogen tanks and sending Canadian dairy semen to Nepal. If Canada included sending frozen semen in the marketing strategy it would bring an opportunity for the Canadian dairy industry to widen its genetics but also widen it’s reaches and research. A Canadian company Semex could increase its

reach to start producing even more semen meaning a lower overall cost for Canadian farmers, expanded genetics through the involvement of even more Canadian dairy test bulls as well as a larger staffing leading to economic growth for the Canadian agriculture sector. Beyond shipping semen Canada could benefit from sending breeding kits, semen straws, liquid nitrogen and other materials that would all be necessary to help Nepalese farmers start and maintain their breeding programs.

Although there are many avenues that could lead to the potential growth to the Canadian economy, and dairy sector from related products to liquid nitrogen tanks, the nitrogen tanks themselves do not show a large export value for Canada.

Business Plan

To ship liquid nitrogen tanks to Nepal there are a few companies that must be involved in the business plan. The first company would be Cole-Parmer a Canadian company that sells cryogenic tanks for artificial insemination. Cole-Parmer would be the distribution company for the liquid nitrogen tanks and could sell the liquid nitrogen tanks internationally to Nepal. The cost of an XT20 is $2032.22CND or approximately 162,560 NPR. The next company that would be helpful in the exportation of liquid nitrogen tanks is UPS. United Postal Service has the best rates for exporting larger products like liquid nitrogen tanks to Nepal. If the tanks were shipped in bulk on a freight carrier boat the cost would work out to approximately $825CND for a single liquid nitrogen tank. That would cost the Nepalese farmer an extra 66,000 NPR. The combined cost of shipping and the product works out to around 228,560 NPR.

To make the whole business transaction more viable for both Canada and Nepal an extra consideration would be to include Canadian bull semen to sell to the Nepalese farmers to help improve their dairy cattle productivity.

Competition

Nepal has started researching the benefits of artificial insemination in both their national agricultural research council as well as some private larger operations in the country (NARC, 2016).

Conclusions

In a complete overview, it is not realistic for Canada to export liquid nitrogen tanks to Nepal or Nepalese farmers to purchase liquid nitrogen tanks from Canada. Canada would not benefit very much from the trade relation of just liquid nitrogen tanks as the tanks are not produced in Canada and Canada would only act as a shipping and trading dock between Nepal and the United States where they are produced. This export idea could benefit both countries much more if other items were included in the trade.

References

Table 1: Cattle population by Agro-Ecozone (% in brackets)

Eco-Zones	Number of cattle
Mountain	867 700
Hill	3 285 375
Terai	2 813 361
Total	6 866 436

Source: MOAC (2004) retrieved from www.fao.org/ag/agp/agpc/doc/Counprof/Nepal/nepal.htm November 28, 2016

Table 2: Number of Cows per Province, Canada (Thousands)

	BC	**AB**	**SK**	**MB**	**ON**	**QC**	**NB**	**NS**	**PE**	**NL**	**CANADA**
2016	75.6	77.9	27.1	44.7	317.7	354.1	18.5	23.2	14.3	6.0	**959.1**
2015	74.1	77.4	26.9	43.7	316.2	353.8	18.7	23.0	14.0	6.0	**953.8**
2014	72.6	80.7	27.4	43.2	318.8	354.8	18.9	23.0	13.9	6.0	**959.3**
2013	72.9	80.8	27.6	43.3	318.6	355.4	19.1	23.0	13.9	5.9	**960.5**
2012	72.2	80.9	28.0	42.8	317.7	356.1	19.0	22.3	13.5	5.9	**958.4**
2011	74.1	81.0	28.6	42.8	319.2	359.8	19.0	22.0	13.0	6.1	**965.6**
2010	73.9	81.1	28.7	43.3	319.6	359.2	19.7	21.1	13.2	6.4	**966.2**
2009	73.8	81.2	28.8	43.8	315.3	361.6	19.2	22.4	12.8	6.7	**965.6**

2008	73.6	81.3	28.9	44.2	322.6	372.9	18.9	22.5	13.0	6.8	**984.7**
2007	72.0	81.4	29.0	44.6	326.5	383.3	19.0	22.1	13.2	6.4	**997.5**
2006	75.0	85.5	29.0	45.0	334.0	390.0	18.9	22.3	13.2	6.2	**1,019.1**
2005	78.0	83.0	31.0	44.0	344.8	399.0	19.3	22.9	13.5	5.9	**1,041.4**
2004	80.0	86.5	31.5	42.0	355.5	397.0	19.2	24.0	14.0	5.2	**1,054.9**
2003	76.0	87.0	32.0	40.5	364.0	403.0	19.3	24.2	14.7	4.8	**1,065.5**
2002	74.5	92.0	28.0	42.0	367.0	418.0	19.2	24.0	14.5	4.7	**1,083.9**

Source: Canadian Dairy Commision (2016) retrieved from http://www.cdc-ccl.gc.ca/CDC/index-eng.php?id=3801 November 29, 2016

Table 3: Milk Animals and Milk Production, 2012/2013 (Nepal)

Region	Milking Cows	Cow Milk
East Region	318 838	166 692
Central Region	254 783	133 562
Western Region	171 062	82 823
Mid-West Region	150 487	56 287
Far West Region	130 421	53 015
Nepal (Total)	1 025 591	492 379

Source MOAC (2013) retrieved from www.moad.gov.np/uploads/files/YearBook%202013.pdf November 29, 2016

Table 4: Milk Animals and Milk Production, 2013/2014 (Nepal)

Region	Milking Cows	Cow Milk
East Region	319 471	176 158
Central Region	253 729	146 562
Western Region	170 749	93 056
Mid-West Region	150 122	60 921
Far West Region	130 442	55 603
Nepal (Total)	1 024 513	532 300

Source MOAC (2014) retrieved from http://www.moad.gov.np/uploads/files/Year%20book%202014.pdf November 29, 2016

Table 5: Average milk production (305 days) of 50% cross and local Nepali cattle.

Breed	Total Milk (in litres)	Milk /day (in litres)
Holstein/Friesian × Nepali	1977	6.5
Brown Swiss × Nepali	1647	5.4
Ayrshire × Nepali	1616	5.3
Jersey × Nepali	1921	6.3
Nepali	549	1.8

Source KLDF (1979) retrieved from http://www.fao.org/docrep/004/T0706E/T0706E04.htm November 29, 2016

Table 6: Average Milk Production of Canadian Dairy Cows by Breed

Breed	Total Milk (in litres)	Milk/day (in litres)
Holstein	10 257	33.6
Brown Swiss	8 496	27.9
Ayrshire	7 842	25.7
Jersey	6 699	22.0

Source Canadian Dairy Information Centre (2016) retrieved from http://dairyinfo.gc.ca/index_e.php?s1=dff-fcil&s2=mrr-pcle&s3=mpb-plr&menupos=1.1.1 November 29, 2016

Figure 1: The XT20 and its different features.

Source L&G Cryogenics retrieved from http://www.lgcryogenics.com/xt-series.html November 29, 2016.

Figure 2: The XT20

Source: eNasco retrieved from https://www.enasco.com/product/Z09353N/ November 29, 2016

Works Cited

Canadian Dairy Information Centre (2016). *Dairy Facts and Figures.* Government of Canada. Retrieved from http://www.dairyinfo.gc.ca/index_e.php?s1=dff-fcil November 29, 2016.

Clinch, N.J.L. (1991). *Review of breeding strategies for large ruminants in the Extension Command Area of Lumle Regional Agricultural Research Centre*. LAC Review Paper 02/91. Lumle Agricultural Centre, Kaski, Nepal.

eNasco (2016) *Taylor-Wharton Liquid Nitrogen Refrigerator - Model XT20.* Retrieved from https://www.enasco.com/product/Z09353N/ November 29, 2016.

Foote, R. H. (2002) *The history of artificial insemination: Selected notes and notables1*. J. Anim. Sci. 80:1-10. doi:10.2527/animalsci2002.80E-Suppl_21a

International Labour Organization. (2016). *The ILO in Nepal.* Kathmandu, Nepal. Retrieved November 28, 2016, from http://www.ilo.org/wcmsp5/groups/public/---asia/---ro-bangkok/---ilo-kathmandu/documents/publication/wcms_445059.pdf

L&G Cryogenics (2016). *Taylor-Wharton XT Series.* retrieved from http://www.lgcryogenics.com/xt-series.html November 29, 2016

Nepal Agricultural Research Center. (2007). *Animal Breeding Division.* Nepal Agricultural

Research Council. Retrieved from http://narc.gov.np/org/animal_breeding.php November 29, 2016.

Nepal, Ministry of Agricultural Development, Agri-Business Promotions, and Statistics Division. (2013). *Statistical information on Nepalese Agriculture*. Kathmandu: Govt. of Nepal, Ministry of Agriculture and Co-operatives, Agri-Business Promotions, and Statistcs Division. Retrieved November 29, 2016, from http://www.moad.gov.np/uploads/files/YearBook%202013.pdf

Nepal, Ministry of Agricultural Development, Agri-Business Promotions, and Statistics Division. (2014). *Statistical information on Nepalese Agriculture*. Kathmandu: Govt. of Nepal, Ministry of Agriculture and Co-operatives, Agri-Business Promotions, and Statistcs Division. Retrieved November 28, 2016, from http://www.moad.gov.np/uploads/files/Year book 2014.pdf

Pariyar, D. (2005). *Country Pasture/Forage Resource Profile* (Nepal, Nepal Agricultural Research Council, Livestock, and Fisheries Research). Nepal Agricultural Research Council.

Path, R. (n.d.). *Population Monograph of Nepal* (Nepal, Government of Nepal, Central Bureau of Statistics). Retrieved November 28, 2016, from http://cbs.gov.np/image/data/Population/Population Monograph of Nepal 2014/Population Monograph of Nepal 2014 Volume I FinalPrintReady1.pdf

Sharma, B. & Banskota, K. (1997). *Smallholder dairy farming in Nepal: Characteristics, constraints, and development opportunities.* Centre for Resources and Environmental Studies.

Shrestha, S.L. (1989). *Research needs in cattle and buffalo breeding*. In: Proceedings of the Workshop on Research Needs in Livestock Production and Animal Health in Nepal, held in Kathmandu, Nepal, January 1–7, 1989. (Eds. J.A. Yazman and K.P. Oli) pp 9–21.

Snyder, R. (1984). *Fifty years of artificial insemination in Canada 1934-1984*. Canadian Association of Animal Breeders. Print.

Taylor-Wharton. (2015). *XT Series - Worthington Industries.* Retrieved from http://worthingtonindustries.com/Products/CryoScience-Products/XT-Series

USAID. (2016, April 15). Economic Growth and Trade | Nepal | U.S. Agency for International Development. Retrieved November 28, 2016, from https://www.usaid.gov/nepal/economic-growth-and-trade

Vishwanath, R. (2003). Artificial insemination: The state of the art [Abstract]. *Theriogenology, 59*(2), 571-584. doi:10.1016/s0093-691x(02)01241-4

World Bank. (2014). Agriculture, value added (% of GDP). Retrieved November 28, 2016, from http://data.worldbank.org/indicator/NV.AGR.TOTL.ZS