# Exporting Artificial Insemination Kits to Nepal

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In Nepal, agriculture is embedded in their lifestyle. Nepal has a total area of 147 187 squared kilometres and a total population of 31 551 305 people. Of the total population, 81% are engaged with agricultural activities and 66% of whom are directly involved with agriculture. Nepal is located between India in the East, South and West and China in the North (FAO, 2015). Nepal can be divided into 3 ecological regions known as the Himalayan, Hill and Terai regions. The Himalayan region covers 35% of the total area. It is home to the highest peak of Mount Everest and is covered in snow throughout the year. The Hill region located throughout the middle section of Nepal covers 42% of the total area and includes hills, valleys, and lakes. The Terai region covers 23% of the total area and contains dense forest area (FAO, 2015). Nepal is home to 75 districts and the capital city is Kathmandu. It is clear that Nepal's population is large relative to its total area. In 2014, the GDP (gross domestic product) per capita was $2400 US dollars, agricultural accounting for 38% of the total GDP. One quarter of the population is living below the poverty live (CIA, 2015). Evidently, Nepal is developing country.

To add to the challenges the people of Nepal encounter daily, on April 25th, 2015, an earthquake struck Nepal with a magnitude of 7.8. Aftershocks of a 7.3 magnitude struck Nepal on May 12th. This was the worst earthquake Nepal faced within the last 80 years. The earthquake trigged avalanches and landslides in the mountains and hills and left thousands dead, injured, hungry and homeless (FAO 2015). Seeds, food grains, agricultural tools and machinery were

buried and destroyed especially in the 40 districts that were struck. With this devastating natural disaster, Nepal must find ways to improve their major source of income.

Livestock consumes nearly a third of Nepal's agriculture domestic products. Dairy is important for growing agricultural industry contributing two thirds of the livestock sector which is dominated by small farmers. Milking processing began in the early 1950's (Pradhan, 2000). Livestock is an important source of income for the Nepalese. Products made from livestock can be sold for cash met through milk, yoghurt, cheese, ghee, egg and live animals (FAO, 2015). Each ecological region consists of different animals. In the Himalayas, Yak or Chauri (breed of cow) and goats are dominate. In the Hills, cows, sheep, goats and poultry are dominate. In the Terai, buffalos, cows, goats and poultry are dominate. Major sources of farm power the Nepalese use come from human and animal labour (FAO, 2015). Nepal has relatively larger herd sizes compared to the other South Asian countries but have low milk yields, poor quality of animal health care and breeding services (Singh and Pundir, [date unknown]).

Farming in Nepal

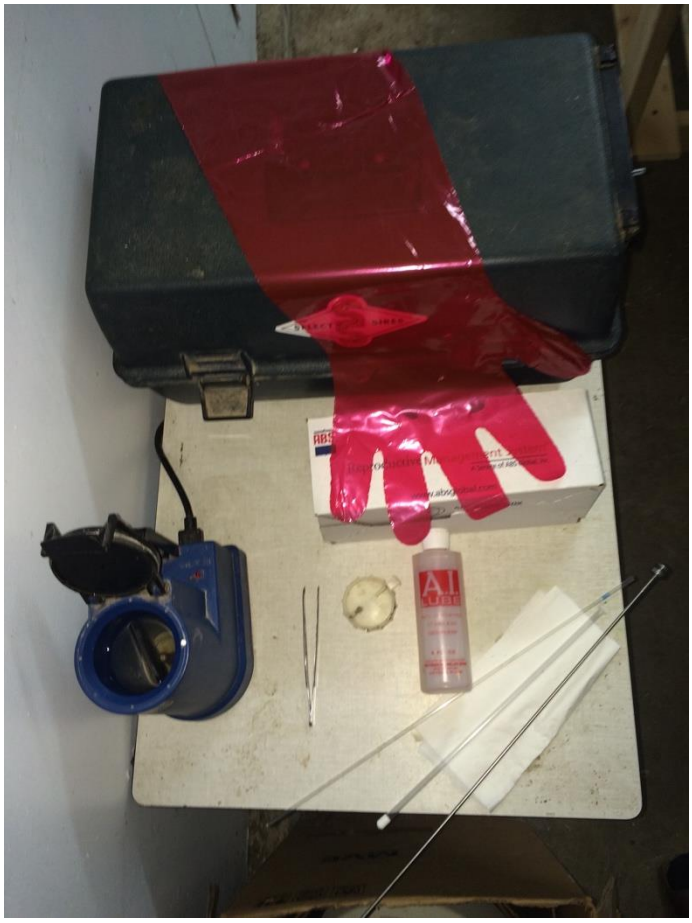
The dairy industry and farming is a growing sector in Nepal (Pradhan, 2000). There are several factors involved as to why there is high cost for milk production. The dairy sector is dominated by non-commercial, small-scale farmers. The average herd size per family is 3.8 cattle/buffalo (Joshi and Bahadur, [date unknown]). Nepal is a net importer which allows free entry of milk into the country. This leads to a more competitive price of milk that Nepalese

farmers have to compete with (Pradhan, 2000). Nepal can reduce their production costs of milk by improving management systems through better feeding, health care, and breeding of their animals. The annual milk consumption per person per capita is 49 kg/year. This is considerably low compared to other South Asian countries (Pradhan, 2000). A factor that influences a low milk consumption per person is the quantity of milk purchased per household. On average, about 1.03 L of milk is consumed per day in a household. Of the three regions, the Hills has a respectably consumption rate of 1.10 L milk a day whereas the Terai region only consumes 0.09 L/day. Buffalo and cattle products contribute the most to Nepal's GDP (Joshi and Bahadur, [date unknown]). Cattle is primarily dominate in the Eastern Hills and buffalo is primarily dominate in the Western Hills. In the Eastern Hills, the average livestock size is approximately 3.4 livestock/household and the number of dairy cattle did not exceed two. The upper and lower Hills both have an average of 2.5 dairy livestock/household but the total average of livestock differes. The upper-hills total average livestock is approximately 5.4/household whereas the lower-Hills averages approximately 4.7 livestock/household (Sharma and Banskota, 2002). The total population of cattle is 7 million head but only 12% of cattle produce milk (Sharma and Banskota, 2002). The percentage of cows being milked is low due the exposal of cattle is difficult (Sharma and Banskota, 2002) and 81.3% of Nepalese follow Hindu religious practices (CIA, 2015). One of the Hindu practices the Nepalese follow is referring to bulls (male cattle) as the holy animal.

Product Information

Natural breeding services and artificial insemination are both used in Nepal (Wilson, 1997). Artificial insemination (AI) is the process of collecting sperm cells from a cow and manually depositing the cells into the reproduction tract of the female cow (FAO, 2015). The AI kit contains equipment that allows for proper disposal of the semen in the straw (ABS Global, 2008). The average AI kit includes sheaths, covers, spiral syringe, latex gloves, lubricant (along with a portable plastic bottle), stainless steel tweezers, and clippers (Figure 1). Kits also include a cito thaw thermos which increases the price (B. Poulin, personal communication, 2015). There is clear advantages and minimal disadvantages to artificial insemination. AI is the most successful and cost effective technology used in reproduction. It improves the rate of sires and bulls can be intensely selected to a farmers desired needs (Lohuis, 1995). Farmers being able to diversify their herds can benefit Nepal

**Figure 1: Equipment in an artificial insemination kit**




Source: (Teselink, 2015).

tremendously (Pradhan, 2000). AI enhances genetic processes, controls diseases and increases safety around the farm by eliminating bulls. The one outstanding disadvantage towards using AI kits is the farmer would need to check for the cows estrus cycle (heat) within the herd (Goodman, 2013). In 1975, 50% of dairy cattle were breed artificially in Canada continued to grow (Figure 2). AI has a major impact on the rates of genetic process (Van Doormaal and Kistemaker, 2003).

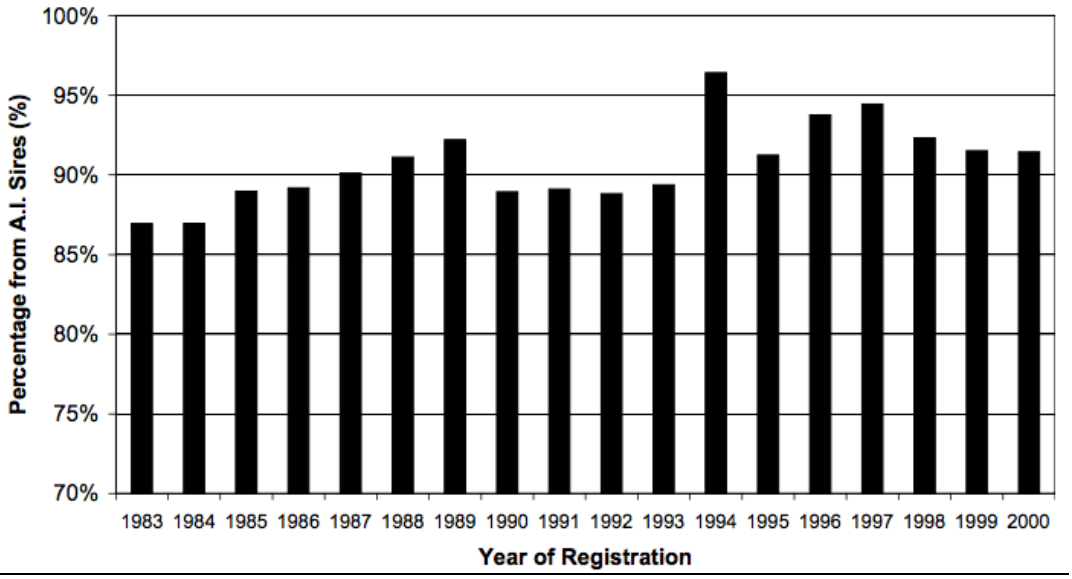



**Figure 2: Evolution in the percentage of Canadian cattle bred through artificial insemination sires** (Van Doormaal and Kistemaker, 2003)**.**

Effects of Artificial Insemination

Dairy farmers get frustrated when their herd is inefficient in reproduction. Management of the cows, milk systems, feed, housing, insemination and care for the animals are all components that affect efficient reproduction. There are several factors that limit a cows'

efficiency in reproduction which include body conditions, dry matter intake, detection of heat and embryonic survival. Cow comfort is critical in achieving efficient reproduction (Stevenson, 2001). Minimizing standing time for milking and maximizing time for estrus to occur along with feed intake will increase efficient in reproduction. For proper rumination and efficient milk synthesis to occur it is critical for cattle obtain to maximum number of hours for resting (Stevenson, 2001).

Breeds of Cattle in Nepal

AI services for cattle have been widened in 45 districts (FAO, 2015). Jung Bahadur Rana, former Prime Minister of Nepal, implemented importation of European cattle for the United Kingdom in 1917 (Pradhan, 2000) The most common breeds, Jersey and Holstein-Frisians are imported from India. (Wilson, 1997). Nepal imports mainly from India but Jersey, Holstein-Frisians, Brown Swiss and Ayrshire breeds are all imported from India or New Zealand (Pradhan, 2000). Milking animals are mainly located in the Hills containing 58% of the country's total milking population. The most dominate specie to be found in Nepal is the Zebu's (*Bos indicus*). Majority of the Hills consist of the milking animals, therefore having variation in breeds (Sharma and Banskota, 2002). Brown Swiss breeds are mainly located in the mid-upper Hills. Jersey and Holstein are located in the mid-Hills. Haryana and Sahiwal breeds are mainly located in the Terai region. Table 1 examines the main development stages in dairy farming (Pradhan, 2000).

| Year | Number of dairy animals brought into Nepal | Origin |
|---|---|---|
| 1953 | Red Sindhi cows: 20<br>Bulls: 2 | Pakistan |
| 1957 | Brown Swiss cows: 8<br>Bulls: 2 | American Heifer Project |
| 1958 | Jersey Bulls: 2 | N/A |
| 1960 | Starting of artificial insemination in Kathmandu Vallley | Kathmandu |
| 1965 | Jersey cows: 13<br>Bulls: 2 | N/A |
| 1967 | Murrah buffalo (male): 1<br>Female: 40 | India |
| 1971 | Murrah buffalo: 11 | India |

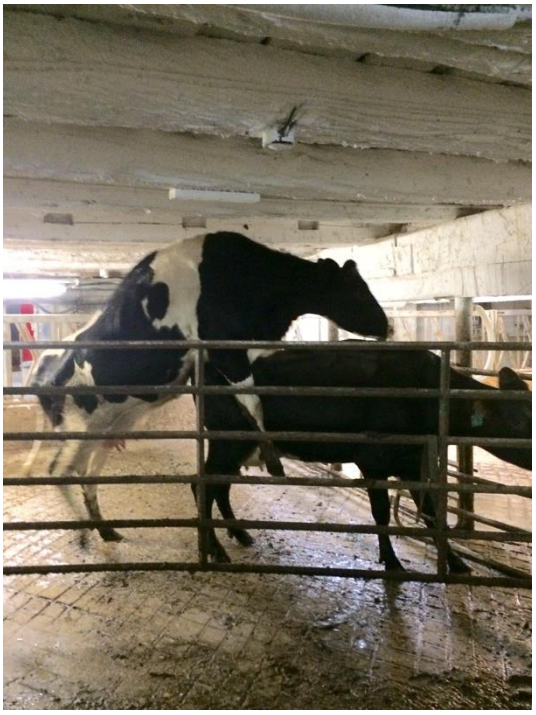
**Table 1: Stages involved in the development of dairy farming in Nepal** (Pradhan, 2000)

As seen in Table 1, the use of AI began in the 1960's. The Department of Agriculture implement programs which resulted in improved cattle breeds by a natural breeding service and by artificial insemination (Sharma and Banskota, 2002).

Inputs Required

In dairy cattle, heat detection is a major component involved with the success of reproduction. The most reliable sign of heat detection would be standing to be mounted (Stevenson, 2001). Standing to be mounted is a result when a cow undergoes a series of hormonal changes which is stimulated by estrogen and inhibited by progesterone (Stevenson, 2001). Figure 3 is an example of standing to be mounted. A bull or a cow will jump onto the cow that is showing signs of heat (Perry, 2004).

**Figure 3: The bottom cow is being mounted and is showing signs of heat**



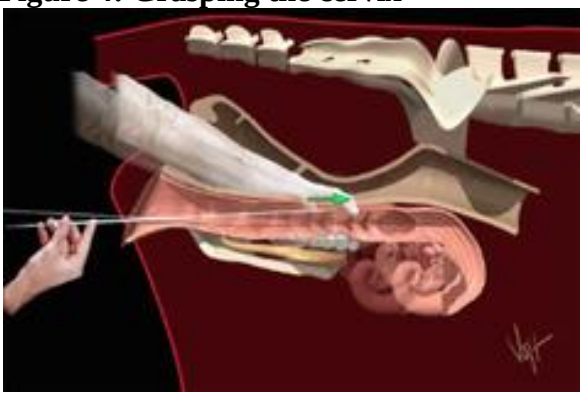
Source: (Teselink, 2015)

The floor type that a herd is standing on is critical in the process of detecting for heat. If the cow feels unsteady or unbalanced, it will not display the visible sexual behaviours when in heat. A dirt floor is more preferred than concrete when the cows are ready to mount (Stevenson, 2001). Cows that have poor hoof qualities typically mount less but a solid dirt floor can eliminate some of the problems regarding their feet. Secondary signs of heat involve behavioural changes other than sexual interactions (Stevenson, 2001). Cows in heat will rest their chin on the rump of a cow and/or sniff/lick the genital region of a cow. Another sign of heat is increased activity within the herd. The cow will spend more time walking and interacting with cows rather than spending time resting. Another physical sign a cow shows when in heat is a clear thin discharge from the vulva. Once heat is detected, ovulation occurs 24-32 hours after. Within the range of 24-32 hours (Stevenson, 2001), the artificial insemination process can begin.

Process of Artificial Insemination

Before breeding, equipment available in the kit will allow for successful insemination. First, the tweezers are used to obtain the semen straw from the semen storage tank. Within 10 seconds, the semen straw must be placed in the cito thaw thermos with the optimal temperature being 35-37˚C. After the straw has been in the thermos for 30-45 seconds, remove the straw from the thermos using stainless streel tweezers (ABS Global, 2008). Shake the straw to remove the water particles and to adjust the airspace. Take a clean napkin to remove any excess water. With the air bubble facing upward, use the clippers to cut the tip of the straw off for preparation of the spiral syringe (ABS Global, 2008). Preparing the spiral syringe involves several steps. First, insert the straw into the sheath as far as possible. With the spiral syringe, continue pushing the straw into the sheath until the blue top has reached the top of the sheath. Once at the top, screw the sheath onto the syringe to secure the semen straw (ABS Global, 2008). Carefully press the plunger slowly to remove any excess airspace without losing a drop of semen. Once completed, place the prepared syringe in the cover. It is critical to protect the prepared syringe from extreme temperatures so the semen is not damaged (ABS Global, 2008).

**Figure 4: Grasping the cervix**



Source: (Dejarnette and Nebel, [date unknown])

Once heat has been detected and the syringe is prepared, the cow is ready to be inseminated. Wearing the latex gloves, apply lubricant to the glove. Cup the fingers in pointed fashion and insert the left hand into the rectum of the cow. Once injected, gently

**Figure 5: Displaying the blind spots and cervix**

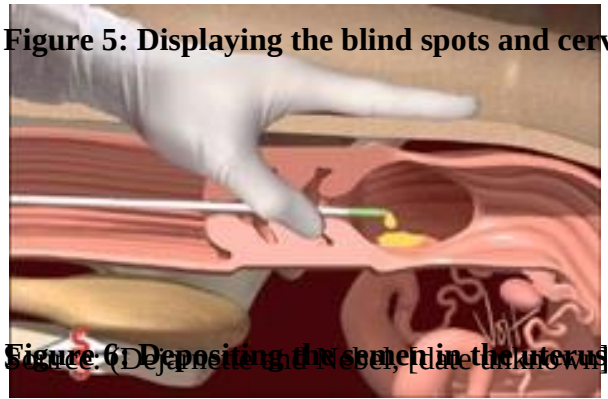
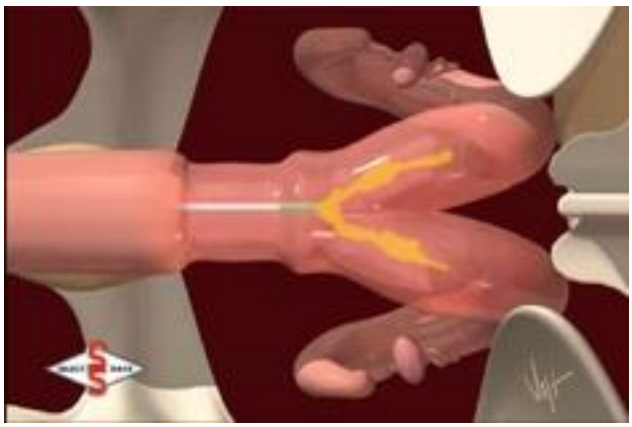


**Figure 6: Depositing the semen in the uterus**

Source: (Dejarnette and Nebel, [date unknown])

wipe the vulva with a paper towel to remove any excess manure or debris (Dejarnette and Nebel, [date unknown]). Insert the syringe at a 30˚ upward angle. Once inserted, grasp the cervix and gentle move it forward to straighten vaginal folds (Figure 4). The cervix typically contains 3-4 annular rings or folds. In Figure 5, the blind spots that are outlined in white are sometimes mistaken for the entrance to the cervix (Dejarnette and Nebel, [date unknown]). If the syringe is in a blind spot, gently pull back and try again. Once the syringe is placed in the cervix, slowly deposit the semen into the uterus (Figure 6). Good distribution of the semen enters both uterine horns (Figure 7) which allows for a greater chance of the cow becoming pregnant (Stevenson, 2001). The sperm being deposited in both uterine horns increases the chance of the egg and sperm cells fertilizing (Stevenson, 2001). The life span of frozen semen once placed in the reproduction tract of the cow is less than 48 hours. Once insemination takes place, there are two sources regarding pregnancy failure: fertilization rate and embryonic death. Fertilization rate are procedures that fail to unionize a viable sperm and viable egg. Failure to recognize pregnancy, normal embryonic development, or normal maintenance of pregnancy are all factors that can cause embryonic death (Stevenson, 2001).

**Figure 7: good distribution of the semen in both uterine horns**



Source: (Dejarnette and Nebel, [date unknown])

Increasing Rate of Reproduction

Cows can show signs of heat at any points in the day. When a cow shows heat in the morning, conception rates are much greater if the cow is bred the same day. If heat is detected in the afternoon, there is a much lower conception rate if the cow was bred the next morning

(Stevenson, 2001). Inseminating cows at a certain period of time allows ovulation to occur when there is a substantial amount of motile sperm available in the oviduct. The timing of successful insemination will maximize fertilization rates in the farmers herd. Generally, the sperm needs 6-10 hours to reach the lower portion of the oviduct (Stevenson, 2001). There is always a chance of failed reproduction. The technician breeding the cow must properly place the semen in the uterus. If failed to do so, the semen goes to waste and must wait until the next heat cycle for the cow. Ideally, when using AI, cows must be clear of any sickness (Stevenson, 2001). In 2007, Nepal had a 60% mastitis rate. This high rate of mastitis can affect the benefits of the product (Yadav and Devkota, 2011). Body conditions before the dry period are essential. The cows must obtain a certain body weight which allows better performance in their next lactation. It is more energy efficient for cows to gain weight during their lactation period than it is during their dry period if they are too thin. Heat stress effects a cow in multiple ways. Heat causes low milk yields and during AI period, heat stress reduces the uterine flow which is essential is successful AI (Stevenson, 2001).

Market Opportunity

Exporting artificial insemination kits to Nepal is an excellent market opportunity for Semex. Semex, located in Guelph, Ontario, distributes kits to dairy farmers world-wide. Semex has 110 different distributors located in 80 different countries. Table 2 shows the distributors located close to Nepal.

| Country | Location | Contact Information |
|---|---|---|
| China | Semex (Shanghai) Co. Ltd<br>114 room 516 Yunchaun Road,<br>Baoshan District<br>Shanghai, China<br>201906 | Tel: 021-60719585<br>Fax: 60719586-810<br>E-mail: jzhang@semex.ca<br>Website: www.semexchina.com |
| Bangladesh | Semex Alliance BD Ltd<br>Mr. Dhirendra Nath Das | Tel: +880 29117468<br>Fax: +880 29126337 |

| | | |
|---|---|---|
| | 17/1 Monipuripara, 3rd Floor<br>Sangshad Avenue<br>Tejgaon Dhaka-1215 Bangladesh | Moblie: +881 1730711555<br>E-mail: gentech@dhaka.net |

**Table 2: Semex distributors located close to Nepal**

It is more ecologically sustainable for Nepal to import the AI kit from one of the countries listed in Table 2. Canada would still benefit from this importation since Semex is a Canadian company even though it is not directly coming from Canada. In Canada, the average AI kit sells for $178 CAN but there are different variations in kits desired for the farmers needs (B. Poulin, personal communications, 2015). From China or Bangladesh, aircraft, train, or roadways are available to transport the AI kits. If transported by air, the shipment will be delivered to Kathmandu and distributed locally (FAO, 2015).

Bovine Elite located in College Station, United States distributes many of their products world-wide and willing to ship to Nepal (Rugg, personal communication, 2015). Bovine Elite could be a possible competitor for Semex but the price for AI kits are much more expensive. Table 3 shows the prices Bovine Elite offers.

| Option | Prices (USD) |
|---|---|
| (1) 1 box of Latex gloves<br>1 spiral syringe,<br>1 package of sheaths,<br>cutters (clippers)<br>plastic tweezers<br>12 volt cito thaw thermos<br>8 oz. lubricant | $277.00 |
| (2) 1 box of Latex gloves<br>1 spiral syringe,<br>1 package of sheaths,<br>cutters (clippers)<br>plastic tweezers<br>120 volt cito thaw thermos<br>8 oz. lubricant | $286.00 |
| (3) 1 box of Latex gloves<br>1 spiral syringe,<br>1 package of sheaths,<br>cutters (clippers)<br>stainless steel tweezers<br>120 volt cito thaw thermos<br>1 gallon lubricant with dispenser | $321.50 |
| (4) 1 box of Latex gloves<br>1 spiral syringe,<br>1 package of sheaths,<br>cutters (clippers)<br>stainless steel tweezers<br>120 volt cito thaw thermos<br>1 gallon lubricant with dispenser | $310.50 |

**Table 3: AI options available from Bovine Elite**

Clearly, importing AI kits from the United States would not only cost more for transportation because it is a further distance but the kits themselves are more expensive.

Benefits to Canadian Farmers

Exporting AI kits from Canada to Nepal will increase Canada's economy (Farm Credit Canada, 2014). In the 1960's, AI for dairy cattle was introduced in Canada and peaked in the 1980's. Today, 75% of all the dairy cattle nationally are breed through reproductive

technologies. In Canadian dairy industry, AI is a critical component in the growing sector of genetics. Holstein yields have increased by an average of 200 kg of milk, 7.0 kg of fat and 6.3 kg of protein per year since 1980. AI processes have not only increased accuracy and intensity, but improved the rates of phenotypic and genetic processed over the years (Van Doormaal and Kistemaker, 2003). AI has allowed farmers in Canada to diversify their herds to their liking which allows them to choose from selective sires. Having the ability to choose bulls that are shown to have a high fertility rate or high muscle mass weight are two simple ways that shows how much diversification a farmer can have when using AI and AI kits (Van Doormaal and Kistemaker, 2003).

Benefits to Nepal

Diversity is a critically important for the success of Nepal. Diversity in Nepal will increase food production, maximize the productivity of agricultural land and achieve sustainable agriculture benefits to the present and future generations of Nepal (Wilson, 1997). AI genetics will improve the farmers lives, increase animal production and products and diversify a particular herd. In developing countries, AI restricts the rate of inbreeding and increases the rate of genetic improvement (van Arendonk, 2011). With the help of the AI kits, farmers can properly breed cows. AI kits will benefit the farmers that already import artificial semen. This technology allows for effective distribution of genetics and semen (van Arendonk, 2011). The use of AI and AI kits is relatively new to Nepal. In developing countries, starting a community-based breed program offers local farmers to get involved and to is easy to implement (van Arendonk, 2011). When the AI kits are successful in Nepal, Nepalese can being to import elite sires from Semex. In order for this product to be successful, the Nepalese must be patient. In Canada, AI has been proven to increase milk yields over many years. After AI peaks in Nepal, farmers will be able to

produce more milk which will allow them to participate in trade globally (Stevenson, 2001). For this to be possible, Nepal requires high volume, good quality and stability of their milk sources. Their possible export partners could be their neighbouring countries, Bangladesh and Bengal (Stevenson, 2001).

In conclusion, using AI kits will help the diversification of milk products and expand the market. Farmers can come together as one and improve the life in Nepal as a community. A business alliance or joint venture with partners from developed countries like Canada, can improve the dairy sector in developing countries. Over time there is a greater economic return in exporting artificial insemination kits (Stevenson, 2001).

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