Evaluating the Benefits of Exporting Canadian Poultry Aspirator Kits to Nepal.

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Artificial Insemination

Historically, artificial insemination has acted as a valuable tool for many farmers in North America and Western Europe, and is now being developed in South America, Africa, and many areas of Asia (Blesbois et al., 2006). The success of artificial insemination (AI) in commercial turkey production, and its subsequent advances in optimizing efficiency illustrates the necessity of further AI development in poultry (Blesbois et al., 2006). Artificial insemination requires a process of semen collection, dilution, storage, and deposition in the female tract (Parker, Karaca, Yeatman, Frank, & McDaniel, 2002). Depending on the production system, farmers may choose to only use artificial insemination techniques or to use a mix of artificial insemination and natural breeding practices (Chowdhury et al., n.d.). As broilers become more productive (increased body weight) floor breeding (natural breeding) becomes more difficult and poses a greater threat of the hen being harmed in the process (Chowdhury et al., n.d.). Aspirator kits are used to collect and deposit the semen into the hen using the syringes and plastic tubes supplied (Donoghue & Wishart, 2000). Collected semen can be stored at refrigerated temperatures for up to 24h while maintaining comparable viability to fresh semen (Donoghue & Wishart, 2000). Other artificial insemination livestock industries such as cattle utilize glycerol to freeze semen. This technology is not effective in poultry due to the differing structural characteristics of the sperm (Donoghue & Wishart, 2000). Diluents are commonly used to aid in storing semen, acting as a means to extend viability periods. Primarily utilizing fresh semen samples limits the number of hens that can be inseminated with a given sample (Donoghue & Wishart, 2000). Typically hens are

inseminated at the beginning of an egg production cycle for optimal fertility, this cycle can be induced by increased lighting stimuli (Donoghue & Wishart, 2000).

Product Information:

Aspirators have become a popular tool for commercial poultry and reproduction (Donoghue & Wishart, 2000). Due to reasons such as age or physique the poultry may be unable to breed or unlikely to be selected as a mate (Donoghue & Wishart, 2000). Increasing the variability in breeding allows for improved disease resistance or tolerance (Stear, Bishop, Mallard, & Raadsma, 2001). Additionally, using an aspirator for breeding reduces the instance of contact transmitted infections or disease (Fournié *et al.*, n.d.). Utilizing artificial insemination technology permits the introduction of new varieties into an indigenous population. Resulting in hybrid varieties with characteristics such as improved feed to weight gain ratios and increased egg production. The kits typically include a 6 or 12 ml plastic syringe, and various plastic tubes that connect to the top of the syringe, aiding in dispensing and collecting semen ("Aspirators | ITSI," n.d.).

Benefits to Canada

Exporting this product would benefit aspirator suppliers such as Insemination Techniques and Supplies Incorporated. Based in Princeton, Ontario, ITSI supplies artificial insemination equipment for various livestock industries including equine, swine, poultry, bovine, goats, and rabbits. For the purpose of poultry insemination, this company supplies individually packaged, disposable aspirator kits

Figure 1: Aspirator Kit (ITSI, n.d.).

("Aspirators | ITSI," n.d.). Since it is composed primarily out of plastic, this product would be relatively easy and inexpensive to produce. Subsequently, aspirators are already widely used in Canada making it an easily accessible product (Donoghue & Wishart, 2000). Although the website for this company does not provide employment statistics, it can be assumed that the effects would spread to other areas such as plastic manufacturing and international transportation companies.

Contact Information	Toll Free: 1-800-692-ITSI (4874) Tel: (519) 458-4856 • Fax: (519) 458-8224
Location	415 – 3rd concession Rd., Princeton, Ontario, Canada N0J 1V0
Product Information	12 ml aspirator kit P2-7100 6 ml aspirator kit P2-7101 Additional syringes code P6-6606 or P6-6612

Costs Associated with Product and Transportation to Nepal

Since the aspirator kits are composed primarily of plastic, and considerably lightweight, shipping by air carrier would be ideal. DHL International is a shipping and courier service that could be used in exporting the aspirator kits. With service locations in Kitchener and Hamilton, DHL International is within convenient proximity to ITIS headquarters in Princeton, Ontario. The estimated costs associated with shipping a 5kg package, measuring 30cm X 20cm X 20cm is $404.40 Canadian. Although a 5kg shipment would include a substantial quantity of aspirator kits, the shipping cost would significantly increase the marginal cost of supplying the product ("DHL Express |

Shipping, Tracking and Courier Delivery Services," 2016). This increase in marginal cost would give rise to a notably higher retail price. Since this product is plastic and individually packaged it will be easier to transport. There are no import restrictions in Nepal on plastics ("WTO | Nepal - Member information," 2016). Once reaching Nepal the product can be stored in warehouses or shops while being distributed since it does not expire and has no necessary storage requirements. This product would not be exceedingly beneficial to commercial production since it requires manual input, and can only operate for a single use. The time and labour required to apply this product in a large-scale setting would not be efficient from a productivity perspective. Given that the targeted consumers are small-scale poultry farmers the product should be distributed primarily in rural areas through smaller village shops. Large retail stores are located in more major cities such as Kathmandu, which are quite a long journey from many rural villages. Since roads to some smaller villages tend to be inaccessible for larger vehicles, boxes of the kits could be transported via motorbikes.

Export Potential to Nepal

Nepal is a relatively small country with a population of 28.51 million people (The World Bank, 2015). A geographically diverse country, Nepal is composed of mountainous, hill, and terri regions (Devkota & Upadhyay, n.d.). The hills area comprises the majority of land employed in livestock pasture and crop production. While the terri region is primarily used for grain production since it is flat and relatively dry (Devkota & Upadhyay, n.d.)Currently, the agriculture industry represents around one-third of Nepal's gross domestic income, and provides work for roughly three-quarters of the population

(The World Bank, 2015). Economic growth has declined considerably after the devastating earthquake in 2015; one of the main factors inhibiting growth is infrastructure (World Bank, 2015).

Throughout the world, poultry products such as meat and eggs represent an important source of dietary protein (Chowdhury *et al.* 2014). Despite the recent surge of commercial poultry farming in Asia, the majority of meat and eggs are derived from smallholder farms under a traditional scavenging system (Chowdhury *et al.* 2014). Poultry represents an essential meat source in Nepal since cattle and pigs are not widely consumed as meat sources due to religious reasons. Thus, the poultry industry provides opportunity for both commercial and small-scale farmers to earn a fairly reliable income. According to Chowdhury *et al.*, 90 percent of poultry breeds located in various developing nations within Asia are indigenous (2014). Typically, these indigenous breeds are less productive than those found in temperate regions (Chowdhury *et al.* 2014). Introducing high-yielding exotic varieties through methods such as artificial insemination allows for increased production in semi-intensive systems (). Utilizing AI technologies to incorporate high yielding exotic breeds with indigenous breeds would increase the market value a small-scale farmer would receive for their chickens. In India, the production of broilers under a system of artificial insemination is more cost effective when compared to natural mating systems (Chowdhury *et al.* 2014). This is due to various factors such as the low cost of labour, the reduced number of males required, and the hybrid vigour obtained from crossbreeding.

Artificial insemination practices such as using an aspirator for breeding act to improve the genetic variability and overall health of the flock (Donoghue & Wishart, 2000). This could prove to be especially beneficial in Nepal since they have experienced outbreaks of Highly Pathogenic Avian Influenza (HPAI), which have been traced back to the practices of the poultry industry (Fournié et al., n.d.). Having genetic variability within flocks would allow them to more effectively adapt to a changing environment and factors such as disease. Additionally, the use of aspirators would allow the farmers to gain more money for their chickens since they would be unharmed from breeding. The implementation of aspirators in poultry breeding would primarily benefit small-scale set ups, since commercial production systems would require a mechanized aspirator as opposed to the manual one being proposed.

An Alternative source for aspirator kits is a company based in Guangxi, China called Guangxi Jiangs Animal Products Co.,Ltd. This product is an AI poultry gun, advertised as having a 1 ml capacity and the ability to inseminate approximately 40 chickens (Alibaba.com, n.d.). The current listed price ranges from 2.50 to 5.00 US dollars (Alibaba.com, n.d.). This design would allow farmers to reuse the gun mechanism, only requiring the purchase of disposable syringe attachments. Included in the purchase of the initial AI gun is 100 disposable syringes, reducing the cost of additional transportation required for the continual restock of disposable components. Due to China being in closer proximity to Nepal than Canada, shipping costs would be less significant, allowing for the product to be retailed at a reduced price.

Challenges Associated with Implementing Aspirator Kits in Nepal

Implementing this product poses various challenges concerning the requirement of a corresponding spread of knowledge and access to appropriate resources. Many farmers and families may not know how to effectively use the aspirators being supplied. A possible remedy to this issue could be training workshops or having a manual type pamphlet delivered with the aspirators. These resources would provide essential information on proper chicken handling methods, the steps involved in collecting and distributing semen, and sanitation practices. Sanitation practices are imperative to successful artificial insemination. Any contact with feces, urates or bacteria tends to result in deteriorated semen quality (Donoghue & Wishart, 2000). However, despite any training workshops or instructional manuals provided, people may be reluctant to adopt this new technology. According to Devkota and Upadhyay, modern technology adoption rates are fairly low among Nepalese farmers due to lack of extension services, and low risk taking ability of farmers (2013). Although this product is relatively affordable, it still represents a substantial investment for a small-scale Nepali farmer. Why would they want to invest a considerable amount of money into a new technology that increases both labour and time inputs, when they could just continue using natural breeding practices?

Another issue implicating the viability of implementing this product is that approximately 50 to 30 million does of sperm per week are required in order to maintain broiler fertility (Parker et al., 2002). It is feasible to maintain fertility with fewer does with the use of higher quality semen (Parker et al., 2002). But this would require testing, which is most likely not widely available to small scale farmers or cost effective.

Additionally, it has been discovered that as varieties are selected for growth traits, the fertility level of the semen doses decreases (Donoghue & Wishart, 2000). Furthermore, maintaining fertility would require large amount of aspirators to collect such a large quantity of doses on a continual basis. Due to sanitation issues in Nepal aspirator kits may only be able to be used once. This raises the cost of artificial insemination considerably, since farmers would have to buy a new kit for each dose. Consequently, an increased demand for aspirators would raise the costs associated with transportation.

Recommendation

Overall, aspirator kits possess great potential for aiding growth in Nepal's livestock production industry. The use of artificial insemination techniques could increase variability within flocks, allowing for improved disease resistance or tolerance, which would aid in controlling HPAI outbreaks that have occurred in Nepal. Additionally, utilizing artificial insemination acts to reduce the instance of contact transmitted diseases or infections. This tool would allow for the incorporation of new varieties via use of semen from exotic breeds that will increase the efficiency of the feed-gain ratio. Furthermore, since labour is relatively affordable in Nepal, the aspirator kit could prove to be quite cost effective, especially since fewer roosters would be required in the breeding process. However, shipping this product from Canada is somewhat expensive when one factors in the retail price, shipping costs, and domestic transportation costs. Since the aspirator kits supplied by ITIS are disposable, a great deal of shipments would be required to keep up with demand. From a cost-analysis perspective, obtaining the aspirators from the company Guangxi Jiangs Animal Products Co.,Ltd, located in

China, would be more efficient and practical. These aspirators are only partially, disposable, moderating the expenses to the farmer. Even if the product is supplied at a reasonable price, there is no guarantee that local farmers will adopt it. Due to the damage left by the earthquake in Nepal, farmers may have limited expendable income to use for what may be viewed as a risky investment. For this product to be successful there needs to be a corresponding spread of knowledge and access to appropriate resources. Training workshops could be implemented in communities, teaching farmers how to use aspirators and the benefits associated with them. Continual extension services would also have to be available for farmers, to ask additional questions, or locate supplementary supplies such as syringes. On the whole, aspirator kits possess great potential to further develop Nepal's poultry industry, although seeking alternative supply sources in closer proximity to Nepal is recommended.

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