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Application of Artificial Insemination (AI) as a Breeding Method for Dairy Goat Herd Build-Up in Region 3, Philippines

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Abstract

One of the constraints in the development of dairy industry in the country is the limited number of dairy animals of which only 14% are goats providing only 1% of the total volume of local milk production. Meanwhile, increasing dairy goat population is hindered by the lack or the high price of dairy breeder animals that can be used in improving our local stocks. To spur the population of goats with genetic potential for dairying among goat farms in Region 3, Philippines, artificial insemination (AI) was applied in this project. Within the implementation period, a total of 50 participants were trained on AI in goats. They served as AI service providers in their respective and nearby municipalities. Meanwhile, a total of 4 seminars on goat raising was conducted at the different municipalities to promote the use of AI in goat breeding and upgrading which were participated by a total of 166 goat raisers. A total of 346 inseminations were reported by the trained technicians. Based on the total number of inseminations monitored, the observed conception rate was 60.29% ranging from 37.50% in Bulacan to 100% in Zambales. Of the total number of kiddings recorded, the percent of singletons, twins, and triplets observed were 46.38%, 44.93%, and 8.69%, respectively, giving an average kidding size of 1.17. A total of 106 kids were born with 61.32% (65 kids) males and 38.68% (41 kids) females with an overall male to female ratio of 1.59:1. Majority (73.58%) of the total kids born were of upgraded Anglo-Nubian bloodline. Meanwhile, of the five commercial farms visited, the Soliman Goat Farm in Tarlac was selected as the location for the establishment of the farm-based goat semen processing laboratory. Moreover, the owner and the farm staff involved in operating the laboratory had already undergone training on semen collection, processing, and evaluation.

Key Words: artificial insemination, breeding method, dairy goat, herd build-up

Introduction

Goats are considered one of the world's living assets in animal production as it plays an important role in the lives of many communities in the world. Goats are valued in developed countries mainly for milk, fiber, and meat, while in developing countries these animals are valued mainly for meat followed by milk, fiber, and skin (Solaiman, 2010). "Poor man's cow" is also a common description to goats as it provides essential benefits to households like meat, milk, and income similar to that of the cow but with little capital investment. In the Philippines, goat meat or "chevon" is the main product derived from goats as this meat is well known in the preparation of many Filipino delicacies commonly served during special occasions.

In terms of goat population in the Philippines, Region 3 or Central Luzon ranked fifth in the backyard level with 7.83% or 283,044 hd, while in the commercial level, the region ranked first contributing 20.96% or 13,423 hd out of the total inventory of goats in the country (Bureau of Agricultural Statistics [BAS], 2013). Compared to the slaughter goat industry, goat dairying is considered a sunrise industry as its development is constrained by the limited number of dairy goats in the country. According to the National Dairy Authority (NDA) (2013), the total inventory of dairy animals (cattle, carabao, and goat) as of September 2013 was only 44,909 hd, and only 14% (6,379 hd) of this are goats. With its small population, dairy goats had a very minimal contribution to the local milk production of only 1% or 255 thousand liters out of 18,448 thousand liters total milk produced (BAS, 2013). Meanwhile, dairy goats in the region are commonly found in the commercial farms mainly because backyard raisers are financially constrained to support higher feed costs of dairy animals as well as expensive breeder goats with dairy bloodline.

As a breeding method, artificial insemination (AI) has the ability to maximize the use of superior sires which has been considered as its greatest advantage (Parkinson & Morrel, 2019) which could give the raisers the opportunity to have access on utilizing superior genetics in their farm breeding program, especially at the small-hold backyard level where the service of a live buck may not be readily available. In 2009, the use of AI as a breeding tool for goats was introduced in the rural areas of Region 2 which resulted to significant improvement in the growth performance of slaughter goats (Nayga, 2011). As AI through its delivery system was proven to be instrumental in the improvement of the genetic make-up of the slaughter goats in Region 2 through upgrading scheme using fresh extended (chilled) and frozen semen, this was also applied in other regions. In Region 3, AI was initially institutionalized through the implementation of the project village-based roll-out of AI delivery system (AI DS) in Region 3, under the National Science and Technology Program on Slaughter Goats, attaining a conception rate of 70% (Celestino et al., 2016). Hence, the same technology was also adapted utilizing frozen semen from donor bucks of dairy breeds such as Saanen, Anglo Nubian, Toggenburg, and Alpine aiming at increasing the number of goats with dairy bloodlines which can be used as breeder base in developing dairy goat herd in the region.

Materials and Methods

Coordination Activity with the Collaborating Agencies

The project implementation was coordinated with the different concerned agencies which served as collaborators. Frozen goat semen in straws used in the study were acquired from the semen processing laboratory of Nueva Ecija Stock Farm (NESF) in Gen. Tinio, Nueva Ecija while the liquid nitrogen (LN2) used in the maintenance of the frozen semen was acquired from the Philippine Carabao Center at Central Luzon State University (PCC at CLSU). Meanwhile, PCC at CLSU also provided the list of technicians who participated in the training on artificial insemination in goat that included Local Government Unit AI technician (LGUBAIT) and Village-Based AI technician (VBAIT) who have already

been involved in providing AI services for large ruminants (buffalo and cattle). Further, the study implementation was also coordinated with the Department of Agriculture Regional Field Office in Region 3 (DA RFO3) which facilitated the linking of goat AI in the Unified National AI Program (UNAIP) through its regional and provincial AI coordinators (RAIC and PAIC) and various Municipal Agriculture Officers (MAO). Municipalities included in the piloting were selected based on the density of goats and the presence of large ruminant AI practitioners.

Training of Technicians on Goat AI

Technicians of the different municipalities included in the study implementation undergone a two-day training on AI in goats held at the CLSU Small Ruminant Center, Sciency City of Muñoz, Nueva Ecija, Philippines. Two (2) batches of trainings were conducted which were attended by a total of 50 participants coming from the different provinces in the region, namely Aurora (8), Bataan (1), Bulacan (12), Nueva Ecija (5), Pampanga (3), Tarlac (7), and Zambales (12). Topics discussed during the lecture session were a review on basic anatomy and physiology of the goat reproductive system, breeds of goats, application and technique of intracervical AI as a breeding method, and principles on semen collection, evaluation and processing. Practical exercises were also done on breed identification, estrus detection and the actual AI of in heat does. Instruments being used in goat AI such as vaginal speculum and head light and supplies such as lubricant, vitamins ADE, dewormer and disposable syringes were given to each participant after the completion of the training. Moreover, 0.5ml straws of frozen semen from Saanen, Anglo Nubian, Toggenburg, and Boer were also distributed to the participants at the end of the training to be used in their AI activities using the same insemination catheter that they were using in inseminating large ruminants. Meanwhile, semen straws were acquired from the Nueva Ecija Stock Farm (NESF) semen processing laboratory in Gen. Tinio, Nueva Ecija, Philippines as per the conventional freezing protocol standardized in the said laboratory.

Provision of AI Service and the Insemination Technique Applied

Within the municipalities covered by the project, AI service to farmers with does that were in natural estrus was provided by the trained technicians. Due to the risk of inducing abortion among pregnant female goats, trained technicians refrained from using prostaglandin F2 alpha (dinoprost tromethamine) and performed AI only in does that were in natural estrus. Does that were in estrus as reported by the raiser were evaluated by the technician prior to insemination. Does that were in apparently healthy condition and observable signs of estrus such as tail flagging, bleating, serous vaginal discharge, and open cervix (as observed by the technician through the use of vaginal speculum with proper lubrication while the does were under proper restraint) were considered qualified for cervical insemination. Thawing of frozen semen straws was done in a 37–38˚C water bath for 15 seconds prior to loading in an insemination gun/catheter, which was followed by subsequent deposition in the cervix of the recipient doe. Based on the farmer's observations, does that had been observed to manifest estrus in the morning were inseminated in the late afternoon, while those that started to manifest estrus in the afternoon were inseminated early in the morning the following day. A second AI was performed approximately 12 h later such that does inseminated in the early morning were reinseminated in the late afternoon on the same day, while those that were inseminated in the late afternoon were reinseminated in the early morning of the following day. Meanwhile, does that did not qualify based on the technician's assessment and were not inseminated were administered with dewormer (albedazole 11.25% suspension, 1ml per 10kg body weight, oral) and vitamin ADE (1ml per doe, intramuscular) in preparation for future insemination.

Capacity Building of Goat Semen Processor

The raiser who owns the farm where the farm-based semen processing laboratory was set up attended a training on semen processing covering the aspects of semen collection, processing, and

evaluation as well as AI technique. The training was initially conducted at the Cagayan Valley Small Ruminant Research Center (CVSRRC) in Isabela State University (ISU), Echague, Isabela where the project lead agency's semen processing facility was located. To further enhance the learning experience, on-site training on semen collection, evaluation, and processing was also held at the farm where the farm-based semen processing laboratory was established. Semen collection was done using artificial vagina, while semen collected was evaluated based on volume, color, consistency, mass activity, and concentration. Meanwhile, the vertical freezing technique learned during the training was applied in processing the semen samples.

Data Gathering and Analysis

Insemination record forms were distributed to each of the trained goat AI service providers. The name of the technician, date of AI, name of raiser, identification of the doe (ear tag number and breed), and semen straw identification (buck identification and breed), farm address, the remarks regarding the insemination made resulted to pregnancy or not, and expected kidding date were the information included on the record. In addition, kidding records were also distributed on which the technicians recorded the date of kidding, type of birth (singleton, twins, triplets, etc.), and description of offspring such as breed and sex. Success of AI was evaluated based on the conception rate which was computed as percentage of the total number of does confirmed pregnant out of the total number of does inseminated. Meanwhile, conception was confirmed based on actual term kidding or abortion to ensure the accuracy of pregnancy detection. Furthermore, other parameters such as average kidding size and male to female ratio were also calculated.

Results and Discussion

There were 346 inseminations reported by the trained technicians. It was in the province of Tarlac where the number of insemination activities was the highest at 175, followed by Nueva Ecija, Bulacan, Aurora, and Zambales with 132, 27, 7, and 5 inseminations, respectively. In this study, majority of the semen utilized was of Anglo Nubian (73.99%) with 256, followed by Saanen (11.56%), Boer (10.40%), and Alpine (4.05%) with 40, 36, and 14 straws, respectively. According to Bondoc (2013) Saanen, Anglo Nubian, Alpine, and Toggenburg are the European dairy goat breeds that have long been utilized in the Philippines for crossbreeding with the local goat population. Of these breeds, however, Saanen and Alpine was introduced just recently to backyard raisers in the region for upgrading, hence farmers were still unfamiliar with the performance of this breed and they preferred Anglo Nubian more than these breeds. Meanwhile, although dairy breeds were the priority for insemination in this study, a number of farmers still preferred Boer as they already had prior familiarity to this breed during the previous study conducted by Celestino et al. (2016), wherein frozen semen from this breed was used in the inseminations which produced kids that grew faster and attained heavier slaughter weight than the native. Meanwhile, estrus synchronization through the use of prostaglandin F2a as described by Sumeldan et al. (2015) was discouraged as female goats observed in this study were initially raised by farmers in extensive system wherein goats are allowed freely in the pasture area with mature males and females combined, hence administration of such drug to synchronize estrus will result to cases of abortion if pregnant females happened to receive the drug. Instead, the farmers were advised to first separate mature males from females and observed the latter for 21 days for natural occurrence of heat.

Of the total number of inseminations reported only 136 had reports on final outcome which either resulted to full term pregnancy, abortion, or return to estrus. The outcomes of many inseminations were not observed as the does inseminated were reported disposed by the owner or due to mortalities after insemination. Of the total number of inseminations which had reports on final outcome, 54 does inseminated returned to heat, while 82 inseminations resulted to pregnancy giving conception rate of 60.29%, which is 10% lower than the conception rate obtained by Celestino et al.

(2016). This apparent difference in the conception rates, however, cannot be presumed that the previous study had superior success rate than the present study, as the former study used the non-return to estrus at 21 days post-insemination as a basis of conception and therefore possible occurrence of pseudo pregnancy or return to estrus later than 21 days were not considered. This corroborates with the findings of Kharche et al. (2013) which obtained a conception rate of 53.13% on an actual kidding basis, which was 21.87% lower than the conception rate of 75.00% on non-return to estrus basis. While 21 days is the average estrous cycle in goats, its length is highly variable with some goats having an estrous cycle of up to 39 days (Fatet et al., 2011). Meanwhile, the present conception rate observed through cervical AI using frozen-thawed semen is higher than those observed by Kharche et al. (2013), Yotov et al. (2016), and Andrabi et al. (2018) with 53.13%, 40%, and 42%, respectively. As observed by Latonio et al. (2019), farmers' knowledge of estrus is the most important factor to goat's success in AI in terms of conception rate as farmers who are more knowledgeable with the signs of estrus know better the right time for insemination. Moreover, variation in fertility between breeds and farms, between individual males used for insemination, initial semen quality and freezability, method of AI and skill of inseminator, time/stage of insemination have also been reported after AI goats (Kharche et al., 2013) as well as between natures of the occurrence of estrus of inseminated does as either natural or synchronized (Yotov et al., 2016). Moreover, fertility may also vary among goats depending on the age groups (younger or older), number of kiddings, interval from kidding to AI, and the level of milk production at the time of the hormone treatment (Arrebola et al., 2014).

Seventy-six (76) of the total pregnant does that conceived had full term kidding, while 6 had abortions. Of the term kiddings reported, only 69 had records on type of birth wherein singletons and twins almost had equal frequencies with 32 and 31, respectively; and triplets with only 6. These observed birth types resulted to an average kidding size of 1.17, interpreted as 1.17 kids born per kidding. A total of 106 kids were born composed of 61.32% (65 heads) males and 38.68% (41 heads) females. The higher number of male kids born compared to females gave an overall male to female ratio of 1.59:1 – that is for every 1 female kid born, an average of 1.59 males were born. Offspring with 50% Anglo Nubian:50% Native bloodline comprised 73.58% (78 heads) of the total kids born, followed 50% Boer:50% Native at 18.87% (20 heads), 50% Saanen or Alpine:50% Native at 5.66% (6 heads), and purebred Saanen at 2.83% (3 heads). Meanwhile, 35 female kids had bloodline of dairy breeds Anglo Nubian, Saanen, and Alpine that can be used to further increase the dairy herd inventory in the region.

Conclusion

In this study, the use of artificial insemination as a breeding method had contributed within the region a number of goat progenies with dairy bloodlines. These goats could serve as breeder base in the development of goat dairying aimed at contributing to the local milk production in the future. The use of AI served as a valuable tool in hastening the upgrading of Philippine native goats producing offspring with genetic potential for higher milk yield. Moreover, the adaption of AI has provided farmers an alternative way of breeding their stocks without the expense of buying costly breeder bucks. Meanwhile, the observed conception rate obtained in cervical AI opens opportunities for future researches aimed at determining factors that affect the pregnancy rate and so the identification of possible interventions that can be done to improve success rates in using this biotechnology.

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