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# Breeding Objectives Formulation for Dairy Goats Towards Improved Production and Reproductive Efficiency in Intensive Production Systems

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**Abstract**
The study was conducted to formulate breeding objectives for dairy goats raised under a pure confinement system, through analyzing various selection criteria such as productive performance, reproductive efficiency, milk quality, herd inventory, selection practices and economic aspects. With the data gathered, results showed that there were four specific breeding objectives ranked and prioritized, namely weight traits, milk yield, precocity, and genetic improvement giving emphasis on milk quality. Birth and weaning weights with an average mean of 2.71 kilograms (kgs) and 14.39 kgs, and an average breeding weight of 67.47 kgs were the phenotypic variables identified for weight traits. Result shows that milk production averaged at 1.87 L per day. Milk quality was also recommended with a composition of 3.51% protein, 3.89% milk fat, and 4.23 somatic cell score. In terms of precocity, the recommended specific breeding objectives were first kidding and kidding interval, that shortens generation intervals and improve the overall productivity of does promoting herd efficiency. Results also emphasized genetic integrity and improvement as the selection criteria responsible for enhancing reproductive efficiency and increasing productivity, thus promoting higher market demand and long-term profitability and sustainability.

**Keywords:** breeding objectives, selection criteria, weight traits, milk yield, precocity

## 1. Introduction

For the past two decades, the continuous importation of exotic goat breeds has been undertaken. This importation program of the government was primarily to augment the demand for goat products and improve the genetic constitution of native goat populations locally by infusing genes from exotic breeds of desirable traits to the indigenous population [1]. However, despite this move, the program in improving the breeds of the local goat population seemed slower, as well as behind that of other goat producing countries. Likewise, one of the major constraints being identified why goat industry has not reached its full potential is the low source of improved breeder stocks [2], which could be attributed to the lack of organized selection methods and strategies, mating systems, cost-efficient breeding programs [2,3,4], and the lack of identified breeding goal and objectives as basis for selection indexes development [5].

With the ultimate goal of developing selection indexes, identifying breeding objectives with corresponding selection criteria is vital to enhancing the general performance of goat population, as well as increasing

the profit margin of goat raisers and enthusiasts [6,7,8]. On the other hand, goat milk proteins and fats have gained popularity over the years due to its unique nutritional and functional properties [7,8]. Goat has a unique distinction when it comes to comparing its milk quality to cows, since their milk has a more complex amino acids level (i.e., tryphtophan and cysteine), while other composition remains constant. It has potential uses for treatment of diseases, such as autoimmune diseases, allergies, and other immune disorders [8]. With the need of the country to increase milk goat production with well-known potential benefits in medicine, agriculture and fashion industry, and to avail the demands on milk and other products, constructing cost-efficient and doable breeding goals/objectives to provide a sustainable breeding program with different economically important milk traits is indeed a significant contribution that eventually increase milk production and improve the goat industry. Unlike other animal industry, there is not enough research conducted that supports the formulation of breeding objectives and selection criteria [9,10,11]. Similarly, there are no studies locally regarding the use of selection criteria in attaining farmers' breeding objectives.

Hence, the study aims to document the farm profiles of selected commercial dairy goat farms in terms of years in farming, organizational membership, goat population inventory, selection practices, and variability of production expenses and revenues, the preferences of commercial dairy goat farms in selecting breeder bucks and does, and factors influences the attainment of their breeding objectives; and to determine and formulate breeding objectives and corresponding selection criteria are employed by commercial dairy goat farms under an intensive production system.

## 2. Methodology

### Research Design

The breeding objectives of intensively managed goats in Central Luzon, Philippines were identified using the descriptive–analytical research design with cross-sectional and retrospective methods. The approach combined farmers' participatory methods, own-flock ranking and actual farm record analysis (from January 1, 2011 to May 19, 2025) to formulate breeding objectives which is evidence and science-based within the preference and production perspective of the farm breeders, managers and owners.

### Research Locale

The study was conducted at the two highest dairy goat population density, purposively selected dairy goat farms in Luzon, Philippines practicing intensive production system with a goat herds of at least 25 does. All information provided by the farm owner, farm breeder and/or farm manager from January 1, 2011 to May 19, 2025 was encoded, tabulated, analyzed and summarized and were used as data for the construction of breeding objectives for goats raised under intensive production system because they were directly responsible for herd management and breeding decision-making.

The data were gathered from the actual owner and/or farm manager through formal interview and actual farm visitation regarding the production of goats in Luzon, Philippines from March to May 2025 in two highest dairy goat population density selected commercial (25-doe level and above) dairy goat farms practicing intensive type of production system (i.e., cut-and-carry system, implementing 70-80% roughage and 20-30% formulated/commercial dairy concentrate).

### Research Instrument

Data on farmer's participatory approach was analyzed using descriptive statistics such as PROC MEANS and PROC FREQ while data on own-flock ranking with relative weights were further analyzed using Wilcoxon rank-sum test (SAS version 9.1.3) to determine the effect of different factors on identifying

objectives and selection criteria for dairy goats raised under intensive production system.

**Data Gathering Procedure**

The collection of data in this study was derived from two sources, namely primary and secondary sources. This is to obtain the inclusive understanding of various key points such as breeding practices, selection criteria, and herd performance of the goat farms. Under the primary data collection, the researcher crafted a structured questionnaire highlighting the provision of farm demographics, flock features, breeding objectives, selection criteria, and economic considerations of goat farms. Face-to-face interview was selected as the mode of information gathering in order to ensure accurate responses and also to enable follow-up questions for further clarifications and extensive research.

The mode of data gathering was through participatory approach, wherein the farm owner and manager provided their decision-making process on breed selection. In terms of ranking the performance and economic value of does, the own-flock ranking method was done. This is to identify the best, second-best, third-best, and most inferior doe in the flock. This method provided practical insight into farmers' valuation of individual animals for breeding purposes.

Additionally, secondary data were collected to validate the primary data and to provide historical records of herd performance and economic output. The data specifically included the farm inventories, individual animal records covering production, reproduction, and milk yield, population records, as well as financial documents, such as production costs and revenue statements. The period of the data collected were from the timeline between January 1, 2011 to May 19, 2025, since this contributes largely in cross-checking farmers' responses and assessment of the actual herd performance over time. Data gathered were then combined and cross-checked to ensure reliability and accuracy. Inconsistencies in the data gathered were clarified through follow-up discussions with the concerned farm owner/manager.

There were also ethical considerations observed throughout the entire conduct of the data gathering. This included informing respondents on the purpose of the study, acquiring their consent, and confirming that all information disclosed and all materials provided were treated with utmost confidentiality.

**Ethical Considerations**

The researcher provided a request letter to the farm owners/manager on the conduct of the interview, specifying the date and the disclosure of data collected. Participation of farm owners and/or managers was voluntary. Prior to data collection, the objectives of the study were clearly explained to respondents, and confidentiality of farm-specific information was assured. Data were used solely for research purposes.

**Statistical Treatments of Data**

Identification of breeding objectives were derived through farmers' participatory approach and ranking the breeder buck/doe using the gathered data that are adopted from Gizaw (2016), Mirkena (2010), Gizaw *et al.,* (2010), and Tabbaaa and Al-Atiyat (2009).

Participatory approach was conducted using structured questionnaire to investigate the breeding objectives and selection criteria adopted by breeders/farm owners and/or farm manager particularly for goats raised under intensive production system and to determine the factors that affects the breeders'/farmers' decisions.

Selected commercial goat farm owners and/or farm managers were visited for identification of the breeding objective traits and the relative importance with respect to its production environments and the factors affecting the breed choice of farmers and breeding strategies to be proposed for use in the breeding programs. Likewise, farm owners were asked to select, with reasons, the first best, second best, third best, and the most inferior does from their own flock to identify the purpose of raising goats, traits affecting

consumers' preference and traits considered important in improving the performance of goats. Moreover, relative weights were assigned on the answer of the majority. Therefore, averages of relative weights were finally ranked and compared using Wilcoxon rank-sum test.

In addition, the inventory or population records, individual animal records (production, reproduction and milk production record), and the cashflow-inflow record were requested to determine the performance of the raising goats under intensive production system.

Given the results of the breeders'/farmers' interview and the actual farm data gathered breeding goals/objectives were developed for goats raised under intensive production system.

## 3. Results and Discussion

### Commercial Dairy Goat Farm Profile

The farm profile collected from the commercial dairy goat farms in Central Luzon, Philippines are characterized and presented in the study by including years in farming, membership to goat organizations, starting and existing goat population inventory, selection practices, and the variability of production expenses and revenues.

Farm owners and/or managers of the surveyed commercial dairy goat farms are all members of both FGASPAPI and ADGA thus, indicating full participation in recognized national and international breeder organizations. FGASPAPI was associated with a longer year in farming at 37 years, likely reflecting local industry involvement and accumulate practical knowledge. On the other hand, ADGA showed shorter duration at 22 years, suggesting more recent engagement with international breed registration and genetic improvement programs. The high level of organization affiliation reflects the farmers' commitment to reaching the farms' potential for breed purity, record keeping, and continuous improvement in commercial goat production under intensive systems.

**Table 1. Membership to Goat Organizations and Years in Dairy Goat (*Capra hircus* Linn.) Farming under Intensive Production System in Central Luzon, Philippines**

| Organization | Percentage | Years in Farming |
|---|---|---|
| Federation of Goats and Sheep Producers Associations of the Philippines (FGASPAPI) | 100% | 37 |
| American Dairy Goat Association (ADGA) | 100% | 22 |

### Population Inventory

Findings revealed the total herd population inventory of commercial dairy goat farms in Luzon as of May 19, 2025, with the total of 1,483 heads which was composed of five main breeds - Saanen, Anglo-Nubian, Alpine, LaMancha, and Boer/Kalahari (Table 2). The total population was dominated substantially by the breeder does with 308 heads and kids with a total of 216 doe kids and 263 buck kids. The farms showed significant expansion of herds and have maintained a consistent flow of replacement stocks for future breeding and production purposes, as emphasized by the presence of 184 doelings, 145 bucklings, 189 growing does, and 166 growing bucks.

The breeder doe with a total inventory of 308 heads and breeder bucks at a lower quantity of 12 heads may indicate that the lower ratio of bucks suggests that they were kept and managed to practice artificial insemination or controlled pen-mating type of reproduction (Oregon State University Extension Service, 2018).

Population inventory showed that Saanen (568 heads) is the preferred breeds, followed by Anglo-Nubian (390 heads) and Boer/Kalahari (319 heads), with LaMancha (104 heads) and Alpine (102 heads) as the least recorded inventory in the goat farms. The data likely suggests that these farms preferred the Saanen breed which is linked to their ability to produce high milk yield [15,16]. According to Bondoc *et al.* (2018) Kholif *et al.* (2020), Anglo-nubians showed high adaptability to intensive production system and their milk content was characterized by higher butterfat content, thus it was considered as the second highest population preferred by the goat farms. On the other hand, since goats were also raised for meat purposes, Boer/Kalahari was considered, since according to the Department of Agriculture Philippines (2022) and the Australian Center for International Agricultural Research (2012), this breed was primarily raised for its dual-purpose ability (for meat and milk production). Alpine and LaMancha being the least preferred goat breeds could be attributed to the lack of accredited breeder farms that sources these types of breeds.

**Table 2. Population Inventory (May 19, 2025) of Commercial Dairy Goat (*Capra hircus* Linn.) Farms under Intensive Production System in Central Luzon, Philippines**

| Physiological stage | Breed | | | | | TOTAL |
|---|---|---|---|---|---|---|
| | Saanen | Anglo-nubian | Alpine | LaMancha | Boer/ Kalahari | |
| Breeder doe | 135 | 96 | 12 | 19 | 46 | **308** |
| Breeder buck | 5 | 3 | 1 | 1 | 2 | **12** |
| Doeling | 62 | 42 | 23 | 22 | 35 | **184** |
| Buckling | 55 | 44 | 6 | 9 | 31 | **145** |
| Growing doe | 95 | 37 | 18 | 14 | 25 | **189** |
| Growing buck | 55 | 42 | 11 | 14 | 44 | **166** |
| Doe kid | 68 | 54 | 14 | 12 | 68 | **216** |
| Buck kid | 93 | 72 | 17 | 13 | 68 | **263** |
| **TOTAL** | **568** | **390** | **102** | **104** | **319** | **1483** |

***Legend:*** *Growing doe (weaned to 6 months); Growing buck (weaned to 6 months); Doe kid (0-3 months); Buck kid (0-3 months)*

Since the overall comparison of the data revolved around the high yielding dairy goat breeds, it is concluded that the dairy goat farms are focused on the production output. However, challenges may arise since the ratio of buck kid is higher than that of doe kid (263:216), particularly on the management aspect, marketing, or the utilization of surplus bucks [4]. With the identified challenges, dairy farms should be cautious on undertaking their breeding programs, culling, and genetic management as this will be vital in sustaining herd productivity and profitability in the long term.

**Performance of Commercial Dairy Goat Raisers in Central Luzon, Philippines**

The phenotypic variability collected from the commercial dairy goat farms for the various traits includes BWT, WWT, Weight at breeding, MP, LL, AFK, KI, %MPROT, %MFAT, and SCS are presented in Table 3. Evaluating the magnitude of variation in these traits is crucial for understanding population performance and identifying potential traits for selection and improvement.

**Table 3. Production Performance of Commercial Dairy Goat (*Capra hircus* Linn.) Farms under Intensive Production System in Central Luzon, Philippines**

| TRAITS | N | MEAN | SD | Range |
|---|---|---|---|---|
| Birth weight (kg) | 3,432 | 2.71 | 0.55 | 2.15 – 3.90 |
| Weaning weight (kg) | 3,432 | 14.59 | 1.42 | 12.50 – 25.00 |
| Weight at breeding (kg) | 1,871 | 67.74 | 4.13 | 55.00 – 72.00 |
| Milk production (L/day) | 1,871 | 1.87 | 0.28 | 1.36 – 3.00 |
| Lactation length (days) | 1,871 | 251.56 | 5.94 | 230.00 – 273.00 |
| Age at first kidding (months) | 903 | 16.77 | 0.41 | 15.00 – 17.50 |
| Kidding interval (days) | 1,871 | 301.57 | 9.57 | 260.00 – 324.00 |
| Percentage milk protein (%) | 1,871 | 3.51 | 0.45 | 3.00 – 4.30 |
| Percentage milk fat (%) | 1,871 | 3.89 | 0.38 | 3.20 – 5.00 |
| Somatic cell score (cells/mL)* | 1,871 | 4.23 | 1.01 | 2.60 – 7.30 |

**analyzed as food (milk) sample and health condition of the animals were not accounted.*

**Production Traits**

Results (Table 3) showed the data structure of goat traits specifically production, reproductive, and quality traits raised under pure confinement production system. Analysis revealed that birth weight has the highest mean of 2.71 ± 0.55 kg. This exhibits uniformity in terms of prenatal growth and may be influenced by several factors such as nutrition and the management practices of the goat farm [19]. Moreover, Mavrogenis and Constantinou (2004) discussed that the variability of the BWT is relatively low thus, its incorporation as trait to be improve in the goat breeding programs could effectively reduce the perinatal mortality and postnatal growth disparities.

Likewise, data showed that the weaning weight trait (WWT) was 14.59 ± 1.42 kg (range 12.50–25.00 kg). These values are likely more variable unlike birth weight. This may be due to differences in postnatal environment and nutrition. Concomitantly, Dereje (2015) reported that native breeds in Eutopia have varied weaning weight due to milk availability, dam parity, and post-weaning feed management. For the breeding weight of 67.74 ± 4.13 kg (range 55.00–72.00 kg), results showed that goats reached optimal physiological maturity for reproduction which is comparable to the normal and recommended standards for dairy goat breeds raised under intensive production system [22].

Milk production has an average mean of 1.87 ± 0.28 L/day with a range of 1.36–3.00 L/day. This may indicate that the milk yield was consistent with the dairy goats raised under intensive production system. It was indicated in the findings of Rodríguez-Hernández *et al*. (2022), that the result was similar to the dairy herds raised under Mediterranean confinement systems and had obtained a daily milk yield of 1.5 and 2.8 L. The derived standard deviation (SD), which was lower than the mean, suggests that the lactational output is consistent, and may be a result of a uniform dietary intake and genetic stability of the goats. The average mean of the lactation length (LL) was 251.56 ± 5.94 days, consistent with the average number of days under intensive production system (240-260 days) as reported by Goetsch *et al.* (2011). In terms of milk yield, longer lactation period may be advantageous since higher production may be achieved. However, this may have negative impact on the reproductive cycle, since longer lactation may hinder pregnancy of does.

**Reproductive Traits**

Results showed that age at first kidding (AFK) has an average mean of 16.77 ± 0.41 months, this means

that the dairy goats raised under pure confinement production system had matured at an ideal age and is well-managed for reproduction. It is comparable to the reported findings of Silva *et al*. (2017) with a range of 15-17 months. The kidding interval (KI) derived has an average mean of 301.57 ± 9.57 days. This may indicate that the reproductive cycle of the goats raised under intensive production system has a slightly greater interval as compared to the ideal cycle which is 365 days. The marginal interval may be due to the longer conception rate and prolonged postpartum anestrus brought about by poor nutrition and various factors such as daylength, climate, temperature, and feed availability [23].

**Milk Composition and Udder Health Indicators**

The average mean of milk protein content (%MPROT) as shown in Table 3 was 3.51 ± 0.45%, while the percentage milk fat's (%MFAT) mean averaged at 3.89 ± 0.38%. These values passed the standard range for dairy goats raised in tropical conditions as documented by Park *et al.* (2007) and Dereje (2015). The composition of these actual traits was influenced by the genetic background, feed conversion efficiency, and lactation cycle. Additionally, Goetsch *et al*. (2011) reported that the milk quality is notably of high quality since the nutritional intake of the dairy goats are controlled under intensive production system.

The average mean of the somatic cell score (SCS) of dairy goats was 4.23 ± 1.01 (range 2.60–7.30), This result indicates that the udder health of the dairy goats raised under intensive production system was generally acceptable. However, some animals may exhibit a higher SCS and may be diagnosed with mastitis or udder health issues [26]. These inconsistencies in SCS may be due to several factors such as the age/reproductive history, milk hygiene, and the type of immunity the animal acquired [22]. Overall, even though there is non-uniformity on the SCS, the entirety of the herd was considered apparently healthy which may be attributed to the good hygienic practices and proper udder health management.

**Production Expenses**

Production expenses were a vital investment requirement for the maintenance and expansion of the goat farms raised under intensive production system. Findings show that the highest cost accumulated was for the acquisition of breeder stocks, doelings at ₱33,129.06 per head and was followed by bucklings at ₱22,541.73, specifically the ones that were acquired from accredited breeder farms with breeder certificates (Table 4). The price difference of these from the breeders without certificates (₱18,893.22 for buckling and ₱25,761.91 for doeling) was quite significant, thus indicating that the traceability of lineage and genetic quality through valid documents was preferred and is critical for herd improvement [6,16,17]. Moreover, Abbasi & Savar (2015) and Layola (2020) reported that the proper documentation of the animals' lineage, breed, and genetic quality can improve the value of the breeder stocks, thus sustaining long-term productivity in goats.

The results also showed that the highest recurring/operating costs, aside from animal acquisition, were fixed costs (i.e., housing, electricity, and water). The total amount was at ₱12,903.25 per head per year. This was supported by the study conducted by Oregon State University Extension Service (2018), wherein they stated the demand for infrastructures was vital especially for the intensive production system type of raising goats. This was to ensure animal health, productivity and welfare. Another important production expenses were labor costs at ₱1,955.65/head/year, this is significant in dairy goat production as it needs skilled manpower for the maintenance of the area, feeding, health monitoring and recording [4,18].

**Table 4. Sources of Production Expenses in Commercial Dairy Goat (*Capra hircus* Linn.) Farms under Intensive Production System in Central Luzon, Philippines**

| Source of production expenses | Unit | Mean Value |
|---|---|---|
| Buckling (8-12 months) with breeder certificate | Php/head | 22,541.73 |
| Doeling (8-12 months) with breeder certificate | Php/head | 33,129.06 |
| Buckling (8-12 months) without breeder certificate | Php/head | 18,893.22 |
| Doeling (8-12 months) without breeder certificate | Php/head | 25.761.91 |
| Feed cost | Php/head/year | 1,715.22 |
| Forage cost | Php/head/year | 1,089.74 |
| Labor cost | Php/head/year | 1,955.65 |
| Veterinary drugs and biologics | Php/head/year | 45.23 |
| Fixed cost (housing, electric, water bill) | Php/head/year | 12,903.25 |

The most essential component of dairy goat production was for the acquisition of feeds (₱1,715.22/head/year) and forage (₱1,089.74/head/year). This is because this component contributes largely for the nutritional demand of dairy goats in order to increase reproduction and milk yield [15,28]. In addition, Department of Agriculture (2022) stated that several factors were also considered in achieving the nutritional demand of the goats such as feed efficiency and appropriate feed formulation, most particularly under intensive production system wherein feeds and forage are mostly controlled.

In terms of animal health services, veterinary drugs and biologics contributed the lowest cost for goat production at ₱45.23/head/year. This may suggest that the provision of her health programs was effective, since there was minimal reported occurrence of diseases that may require the acquisition of the said biologics.

In general, a high initial investment is necessary for dairy goat production, particularly for the acquisition of breeder stocks, as this will be the basis for the productivity of the farm. Likewise, the recurring expenses for housing, labor, and feeding were reasonable and may highlight long-term involvement in the industry, though, strategic cost management should be implemented in order to ensure profitability and sustainability [15,16,17].

**Production Revenues**

Findings (Table 5) show that the highest source of revenue was for the sale of breeder stocks. Doelings with breeder certificate contributed the highest income at ₱33,129.06 per head followed by the sale of bucklings with breeder certificate at ₱22,541.73. On the other hand, sale of doelings and bucklings without breeder certificates was a bit lower compared to the ones with certificates, offered at ₱25,761.91 and ₱18,893.22 per head, respectively. This highlighted the importance of record keeping and the ease of backtracking the breed purity of the animal, as this increases the its value [16, 17].

The sale of growing bucks and does, with an average mean of ₱15,529.41 and ₱20,323.53/head, also contributed to the revenue of the dairy goat farming. Sale of culled bucks and does were also considered and have an average mean of ₱235.87/kg, this promotes sustainability, since removed animals from the herd still adds income which can serve as revolving funds for future acquisition of breeder stocks [4,18].

Other that the sale of live animals, one contributor for the revenue of goat production is the selling of animal by-products and crops, mainly forage seedling (₱5.50/seedling), grass cuttings (₱290.00/sack), goat manure (₱60.00/sack), acacia pods (₱25.00/sack), and silage (₱5.23/kg). The integration of these products contributes to the farm efficiency, since wastes and surpluses can be utilized [18].

The most distinct and profitable source of income from dairy goat production in Central Luzon was the sale of value-added dairy products such as fresh milk sold at ₱150.00/L and flavored variants such as chocolate milk reached ₱175.00/L, goat ice cream priced at ₱185.00 per 250 g pack, goat white cheese at ₱160.00 per 100 g, and pastillas de leche at ₱120.00 per 250 g. These highlights the increase demand for such products, since these were source of nutrients essential for growth and development [4, 15, 28].

**Table 5. Sources of Production Revenues in Commercial Dairy Goat (*Capra hircus* Linn.) Farms under Intensive Production System in Central Luzon, Philippines**

| Source of production expenses | Unit | Mean Value |
|---|---|---|
| Buckling (8-12 months) with breeder certificate | Php/head | 22,541.73 |
| Doeling (8-12 months) with breeder certificate | Php/head | 33,129.06 |
| Buckling (8-12 months) without breeder certificate | Php/head | 18,893.22 |
| Doeling (8-12 months) without breeder certificate | Php/head | 25.761.91 |
| Growing buck (6 months) | Php/head | 15,529.41 |
| Growing doe (6 months) | Php/head | 20,323.53 |
| Culled buck/doe | Php/kg | 235.87 |
| Forage seedlings | Php/seedling | 5.50 |
| Grass cutting | Php/sack | 290.00 |
| Goat manure | Php/sack | 60.00 |
| Acacia pods | Php/sack | 25.00 |
| Silage (corn stalk/corn husk) | Php/kg | 5.23 |
| Fresh milk | Php/L | 150.00 |
| Choco milk | Php/L | 175.00 |
| Ice cream | Php/250g | 185.00 |
| *Pastillas de leche* | Php/250g | 120.00 |
| Goat white cheese | Php/100g | 160.00 |

The data showed that farms were oriented toward product development to maximize market opportunities, and not relying on the sale of live animals. Studies [17, 28] have shown that the inclusion of these value-added products have increased the farmers' income significantly while promoting an alternative source of milk that Filipinos patronize.

**Selection Criteria for Breeder Doe**

A total of 12 criteria were ranked by the goat raisers in selecting breeder doe, where 1 as the most considered trait and 12 as the least preferred trait prior to breeding (Table 9). There was various selection criteria determined on the commercial farms in Central Luzon, and they were mostly directed on productivity, reproductive performance, and functional traits. Findings on the selection criteria for breeder doe showed that milk production ranks first with an average mean of 1.53±0.71, while breed purity ranks second (2.18±0.73). This reflects farmers' preference in maintaining desirable genetic lines with respect to high kid survival and weaning rates [5, 6, 17].

Age was also considered as one of the emerging criteria (4.06±1.00) and ranked fourth for the list of preferences. This suggests that farmers select does that were reaching their optimal reproductive age, hence its longevity in the herd [27]. The moderately important traits were milk quality and birth type,

ranked fifth and sixth, respectively. The preferred criteria emphasizes that farmers are oriented toward producing nutritionally high-quality milk and prolific does that promotes herd expansion [28].

**Table 6. Selection Criteria for Breeder Doe Based on the Preferences of Commercial Dairy Goat (*Capra hircus* Linn.) Farms under Intensive Production System in Central Luzon, Philippines**

| Selection criteria for breeder doe | Mean ±SEM | Rank |
|---|---|---|
| Breed Purity/Source | 2.18±0.73 | 2 |
| Strong legs | 11.88±0.10 | 12 |
| Milk Quality | 4.82±0.49 | 5 |
| Body Score | 8.35±0.34 | 8 |
| Milk Production | 1.53±0.71 | 1 |
| Kid sex | 10.76±0.23 | 11 |
| Birth type (single, twin, triplet) | 5.00±0.42 | 6 |
| Mothering ability (% weaned) | 3.65±0.61 | 3 |
| Kidding interval | 8.76±0.22 | 9 |
| Kid weight at birth | 6.65±0.19 | 7 |
| Udder size | 9.71±0.19 | 10 |
| Age | 4.06±1.00 | 4 |

***Legend:*** *1 as the most preferred selection criteria and 12 as the least preferred selection criteria.*

Results showed that the least preferred traits were kid weight at birth (rank 7) and body score (rank 8), reiterating that traits related to producing high milk yield were more prioritized as compared to growth and body condition [16]. Some of the least preferred traits showed were kidding interval (rank 9), suggesting that farms were unbothered by the longevity or the extension of reproductive cycles as long as the milk yield remains high. Udder size (rank 10) and kid sex (rank 11) were uncontrollable recurring traits and therefore irrelevant in doe selection. Likewise, strong legs (rank 12) may be assumed less preferred, since less movement is likely to happen under intensive production system [18].

**Selection Criteria for Breeder Buck**

Results (Table 7) show the criteria preferred, emphasized around genetic quality and reproductive potential. Breed purity ranked first and was considered the most important traits for selecting breeder bucks, since this proves that the animal was sourced from established and verified genetic lines and will improve the quality of the herd [16, 17]. Milk production of relatives (full/half-sib records) ranked second with an acquired average mean of 2.18±0.73. This may be attributed to the crucial role of the bucks in passing desirable dairy traits to future herds [5, 28].

The physical and health condition of the bucks were necessary for mating and reproduction. Thus, Table 10 showed that body score (rank 3) and age (rank 4) was valued as an indicator for breeding efficiency and longevity [27]. These traits were responsible for sustaining the physiological soundness and active reproductive roles of the bucks. Testicle circumference (rank 5) was also added as this may be an indicator for the fertility potential of the sperm [5, 18].

The least preferred selection criteria were birth type (rank 6), milk quality (rank 7), sperm quality (rank 8), and strong legs (rank 9). Low ranking for birth type may imply that even though multiple births were significant, it was not critical in selecting sires as compared to genetic and physical traits. Sperm quality (rank 8) is less like preferred by farmers since they heavily rely on natural mating systems where the

genetic constitution of the goat is assumed adequate, unless problems arise [27]. Strong legs were ranked last since mobility is not ideal for animals raised under intensive confinement as compared to pasture-based systems [18].

**Table 7. Selection Criteria for Breeder Buck Based on the Preferences of Commercial Dairy Goat (*Capra hircus* Linn.) Farms under Intensive Production System in Central Luzon, Philippines**

| Selection criteria for breeder buck | Mean ±SEM | Rank |
|---|---|---|
| Breed Purity | 1.53±0.71 | 1 |
| Birth type | 5.47±0.80 | 6 |
| Milk Quality | 6.71±0.18 | 7 |
| Body Score | 3.65±0.61 | 3 |
| Strong legs | 8.82±0.13 | 9 |
| Milk Production (full/half-sib record) | 2.18±0.73 | 2 |
| Testicle circumference | 5.00±0.42 | 5 |
| Sperm quality | 7.76±0.16 | 8 |
| Age | 3.76±0.85 | 4 |

***Legend:*** *1 as the most preferred selection criteria and 9 as the least preferred selection criteria; Birth type (i.e. twinning or being one of twins)*

Hence, commercial goat farms in Central Luzon preferred genetic integrity, productivity potential, and physical soundness in terms of selecting their breeder bucks over reproductive physiological traits such as testicle size and sperm quality. As the results suggest, the selection criteria for breeder bucks were more focused in herd productivity through genetic transmission, as influenced by careful evaluation of its ancestry and production records [5, 16].

**Factors Affecting Breeding Objectives Attainment**

There were several key factors affecting the attainment of breeding objectives in commercial dairy goat farm, as supported by the preferred traits for breeders, and were directly related to genetic quality and market demand. Table 8 shows the overall factors affecting the decision of commercial dairy goat farm raisers in the attainment of their breeding objectives, with herd breed (rank 1) emerging as the most important factor. This supports the previous results giving emphasis on the significance of genetic composition of the herds/breeder stocks in order to achieve desired production outcomes [6, 29].

The next factor determined was the market with an average mean of 1.59±0.40. This states that the breeding strategies were most likely aligned with the demand of consumers and were directed towards profitability. Studies also suggest that farmers not only put effort into improving animal performance but also respond to market trends, particularly for milk, breeder animals, and value-added dairy products [8, 30].

Farmers distinguished longevity and productivity of does and bucks based on performance as the third factor affecting their decision in attaining breeding objectives, with an average mean of 3.24. This result highlights the importance of sustaining reproductive and productive efficiency of the breeder stocks [8, 29]. Additionally, the overall doe/buck merit, which ranked fourth and has a mean of 3.65, suggests that farmers consider collective assessment of genetic potential, physiological development, and production history in guiding breeding decisions [6, 8].

**Table 8. Factors Affecting the Decision of Commercial Dairy Goat (*Capra hircus* Linn.) Farms under Intensive Production System in Central Luzon, Philippines in the Attainment of their Breeding Objectives**

| Factors affecting breeding objectives attainment | Mean ±SEM | Rank |
|---|---|---|
| Herd size | 4.88±0.15 | 5 |
| Herd breed | 1.41±0.43 | 1 |
| Market | 1.59±0.40 | 2 |
| Longevity/productivity of doe/buck based on performance | 3.24±0.24 | 3 |
| Overall doe/buck merit (overall performance) | 3.65±0.26 | 4 |

Herd size ranked lowest with an average mean of 4.88. This indicates that farmers were more directed towards the genetic quality and market demand factors. Likewise, quality is therefore more preferred than the quantity of animals, suggesting that the improvement of the herd performance is more deliberate rather than expansion [29, 30].

Findings showed that the attainment of breeding objectives in commercial dairy goat farms in Central Luzon was determined by genetic considerations and market efficiency, as well as longevity, overall doe/buck merit, and herd size as supporting factors.

**Formulation of Breeding Objectives**

The breeding objectives identified for commercial goat production in Central Luzon, Philippines reflect a balance between productivity traits and quality traits, aligning with both production efficiency and market demand. Findings (Table 9) show that the traits prioritized by raisers include breed purity, weight traits, milk production, and precocity. These objectives demonstrate that farmers strategically combine performance-based and quality-oriented selection to achieve both immediate and long-term gains [6, 30]. Among the traits, breed purity was also emphasized as one of the key selection criteria or breeding objectives, since this reflects the farmer's strong preference for genetically documented animal. Weight traits which are characterized by birth weight, weaning weight, and weight at breeding were also prioritized as supported by the actual goat records. In terms of milk production, milk yield and lactation period were the central objectives identified, while age at first kidding and kidding interval were identified as the selection criteria for precocity.

Breed purity and source, validated through memberships in organizations such as the American Dairy Goat Association (ADGA) and the Federation of Goat and Sheep Producers Association of the Philippines Inc. (FGASPAPI) emerged as a major breeding objective. This underscores raisers' emphasis on maintaining genetic integrity and securing animals with verified pedigrees to guarantee desirable traits and enhance marketability [6, 8, 17]. The use of breeder certificates and documented lineage highlights a clear trend toward formalized breeding systems in the commercial goat industry.

Under the weight traits, birth weight, weaning weight, and weight at breeding were the identified selection criteria. This breeding objective was responsible for the growth performance, survival, and the productivity of the herd [31, 32]. Increased birth weight and weaning of kids indicates stronger growth potential, thus ensuring optimal breeding weight necessary for reproductive success [16, 33]. This breeding objective, however, may require improved feed efficiency and high-quality feeds for optimal results [34].

**Table 9. Breeding Objectives and Selection Criteria for Commercial Dairy Goat (*Capra hircus* Linn.) Farms under Intensive Production System in Central Luzon, Philippines**

| Breeding Objectives | Selection Criteria | Mean ± SD |
|---|---|---|
| Breed purity/Source | ADGA/FGASPAPI Membership<br>Animal breeder certificate | |
| Weight traits | Birth Weight<br>Weaning weight,<br>Weight at Breeding | 2.71 ± 0.55<br>14.59 ± 1.42<br>67.74 ± 4.13 |
| Milk Production | Milk production<br>Lactation period | 1.87 ± 0.28<br>251.56 ± 5.94 |
| Precocity | Age at first kidding<br>Kidding interval | 16.77 ± 0.41<br>301.57 ± 9.57 |
| Milk quality | Milk Protein<br>Milk Fat<br>Somatic Cell Score | 3.51 ± 0.45<br>3.89 ± 0.38<br>4.23 ± 1.01 |

***Legend:*** *ADGA – American Dairy Goat Association; FGASPAPI – Federation of Goat and Sheep Producers Association of the Philippines Incorporated.*

Milk production and lactation period were also identified as essential objectives, emphasizing the economic significance of sustained milk yield in commercial systems where dairy products constitute key revenue streams [6, 8, 15, 33]. Selection for high milk yield, combined with extended lactation, directly contributes to greater farm profitability and product diversification through value-added processing.

In addition, the age at first kidding and kidding interval, under precocity traits, were significantly identified as one of the selection criteria since it promotes shorter generational intervals and may increase does' productivity. It may also influence herd efficiency and may be a good performance indicator in the genetic progress across generations [18, 30, 35].

Aside from the recognized recorded traits, milk quality was one of the identified traits for breeding objective. Its parameters were composed of protein, fat, and somatic cell score. The emerging potential of milk quality as breeding objective may suggest that farmers were being aware of the consumer preferences for value-added dairy products and promotes product diversification in niche markets [6, 7, 8, 17, 36]. These traits may be correlated to udder health, providing an additional criterion for long-term genetic improvement [8, 35].

Nevertheless, the breeding objectives in commercial dairy goat farms in Central Luzon were more focused on production, with significant emphasis on growth, reproduction, and milk yield. Results also recognized the significance of genetic purity and emerging product quality traits. Additionally, the suggested framework ensured that the breeding strategies would address farm profitability and market demands, thus promoting dairy goat farm sustainability [6, 8, 16, 18, 33].

## 4. Conclusion

Based on the results, farm profiles of the selected commercial dairy goat farms revealed that all respondents have long years of experience in goat farming and were active members of recognized breeder organizations. Their herd inventories were composed of multiple dairy and dual-purpose breeds, with strong emphasis on maintaining replacement stocks. Selection practices were systematic and records-

based, while production expenses were primarily driven by breeder stock acquisition, feeds and infrastructure. Revenues are largely generated from sale of certified breeder animals and value-added dairy products, indicating that profitability is closely linked to both genetic quality and product diversification. In terms of the preferences of commercial dairy goat farms in selecting breeder bucks and does are largely production-oriented. Milk yield emerged as the most important selection criteria for breeder does, followed by breed purity and mothering ability. For breeder bucks, breed purity and the milk production performance of relatives were given the highest priority, emphasizing the critical genetic role of sires in herd improvement. The attainment of breeding objectives is primarily influenced by herd genetic composition and market demand, while herd size was found to be the least influential factor. This indicates that farmers prioritize genetic merit and economic responsiveness over herd expansion. Lastly, the study identified that the major breeding objectives employed by commercial dairy goat farms under intensive production system include improvement of weight-related traits, enhancement of milk production and lactation length, improvement of reproductive efficiency, and maintenance of breed purity. Corresponding selection criteria include birth weight, weaning weight, weight at breeding, milk yield, age at first kidding, kidding interval and documented pedigree through breeder certification. In addition, milk quality traits such as milk protein, milk fat, and somatic cell count were recognized as emerging breeding objectives, reflecting increasing awareness of consumer demand for high-quality dairy products and long-term sustainability of the industry.

## 5. Recommendation

Based on the detailed conclusion, the researcher recommends the prioritization of milk production and genetic quality through selection of breeder does and bucks with high milk yield, good body size, and verified breed purity should be considered by the dairy goat farmers. Moreover, maintaining access to accredited or certified goat breeder stocks sources and genetic improvement programs through membership in recognized breeder organizations should also be considered. Further, development of multi-trait selection indices incorporated by body weight, milk yield, twinning ability, pre-weaning kid survival, and reproductive efficiency which is structured to selection programs should be implemented through optimization of reproductive management through monitoring and managing key reproductive traits such as age at first kidding and kidding interval should be undertaken to improve herd turnover and milk production. The market demand and market preferences for milk yield and value-added milk products (e.g., cheese, ice cream, and *pastillas de leche*) must be associated with breeding objectives. Lastly, farmers' participation in designing the breeding objectives should be considered for ease of transition and adoption, since it would impact programs aligned with both economic and market demand that is essential for long-term success.

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