

IDENTIFICATION MAINTENANCE SYSTEM OF GOAT IN BOMBANA REGENCY

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DOI: <https://doi.org/10.70210/amrj.v4i3.252>

Abstract

An optimal goat-rearing system from birth is essential for producing goats with high production and productivity potential that can replace animals that are no longer reproductively productive, either as breeding females or breeding males. Proper goat management, including birth management, rearing systems, and disease prevention and control, plays a significant role in determining the success of goat farming. This study aimed to investigate goat-rearing systems in Bombana Regency. The research was conducted over a one-month period, from March 28 to April 30, 2019. At the regency level, the research locations were determined using a stratified sampling method by classifying the goat populations across 22 districts into three categories: high, medium, and low. One district was then randomly selected from each category. At the district level, locations were selected using purposive sampling by identifying villages with the largest goat populations within each selected district. Three villages in each district were selected for respondent recruitment. The variables examined in this study included: (1) goat-rearing management, covering breeding stock selection, reproduction and breeding, feeding systems, housing, and disease prevention and control; (2) rearing systems, classified into extensive or traditional, semi-intensive, and intensive systems; (3) herd size; and (4) livestock marketing. The data were analyzed descriptively. The results indicated that goat farming in Bombana Regency was predominantly managed under a semi-intensive system (70.51%), followed by an intensive system (17.95%). However, some farmers continued to use extensive or traditional rearing systems (11.54%).

Keywords: *identification, handling system, goat*

Introduction

Southeast Sulawesi Province is one of the regions in eastern Indonesia with considerable potential for developing ruminant livestock, particularly goats. This potential is supported by abundant natural resources, which have not yet been fully utilized or optimally managed. The province has a total land area of approximately 3,148,000 hectares, comprising both developed and underutilized areas. In 2014, the goat population in Southeast Sulawesi reached 133,201 head (BPS Sultra, 2019).

Bombana Regency is one of the regencies in Southeast Sulawesi Province with a relatively large goat population. In 2014, the goat population in Bombana Regency reached 14,332 head. The goats raised by farmers in the regency are predominantly Kacang goats, an indigenous Indonesian goat breed. The distribution of the goat population varies across different areas within the regency. These variations are

attributed to differences in topography, climatic conditions, and the sociocultural characteristics of each area (BPS Bombana Regency, 2019).

One of the livestock species widely raised by the community in Bombana Regency is the goat, a small ruminant that provides substantial benefits to humans. In addition to producing meat and milk to meet the demand for animal protein, goats offer several advantages in terms of husbandry, as their management is relatively simple compared with that of other livestock species. Furthermore, goat farming generally requires a relatively modest initial investment, making it an accessible livelihood option for smallholder farmers (Abadi et al., 2023).

The goat breed commonly found in Bombana Regency is the Kacang goat, an indigenous Indonesian breed characterized by a relatively smaller body weight than other goat breeds. Kacang goats have several advantages, including their ability to adapt easily to local environmental conditions and their relatively good reproductive performance. These characteristics have encouraged many community members to engage in goat farming as a means of improving household income (Melati et al., 2022; Tjahyani et al., 2020).

Goat farmers in Bombana Regency primarily adopt a semi-intensive rearing system, while a smaller proportion use extensive or intensive systems. The extensive system allows goats to roam freely and forage for their own food. In the semi-intensive system, goats are allowed to graze or forage during the day and are kept in housing at night. In contrast, the intensive system involves keeping goats in housing continuously, with their daily activities and management entirely controlled by humans. These rearing systems present several challenges for goat farmers, particularly in terms of livestock performance and productivity. In addition to the rearing system, proper goat husbandry management is also essential for improving farm productivity. This management includes breeding stock selection, reproduction and breeding, feeding practices, housing, and disease prevention and control (Aku et al., 2022).

One of the major challenges in goat farming is low productivity, which is often attributed to the poor quality of breeding stock and feed, as well as inadequate husbandry practices. The availability of sufficient forage is a key factor in determining livestock productivity. Although many farmers have made efforts to improve husbandry management and feed quality, these improvements have not always been accompanied by corresponding efforts to enhance the quality of breeding stock. Improving breeding stock quality is closely associated with genetic quality, which plays an important role in determining the productive performance of goats (Sukoco et al., 2022).

Method

This study was conducted over a one-month period, from March to April 2019, in Bombana Regency, Southeast Sulawesi Province, Indonesia. The study covered three districts: Lantari Jaya, Mata Oleo, and Rumbia. The study population consisted of farmers who raised goats. The research sample comprised goat farmers from the three selected districts, representing areas with high, moderate, and low goat populations, respectively: Mata Oleo District had the highest goat population, Lantari Jaya District had a moderate population, and Rumbia District had the lowest population. Respondents were required to have at least two years of experience in goat farming. Three villages were selected from each district as research sites, and ten goat farmers were sampled from each village. When the number of eligible farmers in a village was fewer than ten,

a census method was applied. The data collected consisted of primary and secondary data.

At the regency level, a stratified sampling method was used to classify the goat populations across the 22 districts into three categories: high, moderate, and low. One district was then randomly selected from each category. At the district level, purposive sampling was used to select villages with the largest goat populations within each selected district. Three villages from each district were chosen for respondent recruitment.

The population strata were determined by calculating the range of the goat population, obtained by subtracting the lowest goat population (PR) from the highest goat population (PT), resulting in the population range (K). This range was then divided by three to determine the stratum interval ($\frac{1}{3}$ K). The population strata were classified as follows: (1) low population: from PR to PR + $\frac{1}{3}$ K; (2) medium population: from PR + $\frac{1}{3}$ K + 1 to PR + $\frac{2}{3}$ K; and (3) high population: from PR + $\frac{2}{3}$ K + 1 to PR + K (Sani, 2008). Based on these calculations, the following population strata were obtained:

$$\begin{aligned}\text{Low population range} &= \text{PR s.d (PR + 1/3 K)} \\ &= 13 \text{ s.d (13 + 1/3 x 396)} \\ &= 13 \text{ s.d (13 + 132)} \\ &= 13 \text{ s.d 145}\end{aligned}$$

The number of goats in each district classified as having a low population ranged from 13 to 145 head.

$$\begin{aligned}\text{Medium Population Range} &= (\text{PR + 1/3 K + 1}) \text{ s.d (PR + 2/3 K)} \\ &= (13 + 1/3 \times 396 + 1) \text{ s.d (13 + 2/3 \times 396)} \\ &= (13 + 132 + 1) \text{ s.d. (13 + 264)} \\ &= 146 \text{ s.d. 277}\end{aligned}$$

The number of goats in each district classified as having a medium population ranged from 146 to 277 head.

$$\begin{aligned}\text{High Population Range} &= (\text{PR + 2/3 K + 1}) \text{ s.d. (PR + K)} \\ &= (13 + 2/3 \times 396 + 1) \text{ s.d. (13 + 396)} \\ &= (13 + 264 + 1) \text{ s.d. 409} \\ &= 278 \text{ s.d. 409}\end{aligned}$$

The number of goats in each district classified as having a high population ranged from 278 to 409 head. Furthermore, data related to goat-rearing systems were tabulated and analyzed descriptively.

Result and Discussion

A. Respondent Characteristics

1. Age

Age is one of the factors influencing farmers' work capacity and thinking patterns when determining the type and management practices of livestock farming and other business activities. Novarista et al. (2020) classified age into three categories: individuals under 15 years of age are considered non-productive, those aged 15–54 years are classified as

being of productive age, and those over 55 years are categorized as being of less productive age. The age classification of respondents in the study area is presented in Table 1.

Table 1. Age Classification of Farmer Respondents in Bombana Regency

Age (Years)	Amount (people)	Percentage (%)
15 – 45	72	92,30
> 55	6	7,70
Amount	78	100

Based on the data presented in Table 1, 7.70% of the respondents in the study area were over 55 years of age. In terms of age characteristics, the majority of farmers in Bombana Regency (92.30%) were within the productive age group, indicating that they generally had the potential to work effectively and manage their livestock enterprises. These findings suggest that the respondents remained physically and mentally capable of developing their farming businesses. In other words, most of the goat farmers were still within the productive age range for carrying out their occupations and managing their livestock enterprises. This finding is consistent with Zahida et al. (2021), who stated that age is one of the factors influencing an individual's work productivity. Age classifications generally distinguish between productive and non-productive age groups, with individuals of productive age tending to demonstrate higher work productivity than those outside the productive age range.

2. Attainment of Education

Educational attainment, particularly formal education, influences an individual's ability to think critically and make informed decisions, especially when determining appropriate actions and strategies to improve their standard of living (Hidayat & Solaeman, 2019). The educational levels of the farmer respondents in this study are presented in Table 2.

Table 2. Educational Levels of Respondents in Bombana Regency

Educational Attainment	Amount (people)	Percentage (%)
SD	28	35,89
SMP	27	34,61
SMA	23	29,48
Amount	78	100

Based on the data presented in Table 2, the largest proportion of respondents had completed primary school (35.89%), followed by those who had completed junior high school (34.61%), while the remaining respondents had completed senior high school (29.48%). These findings suggest that the educational attainment of goat farmers in the study area was relatively low, which may indicate limited access to or opportunities for formal education. Consequently, farmers may rely more heavily on practical, day-to-day experience, which could influence their ability to acquire and apply new knowledge and

information. This finding is consistent with Hanif and Kusumastuti (2024), who stated that low levels of education among workers can hinder their ability to absorb new information. Furthermore, the educational attainment of farmers is an important indicator of human resource quality in the study area. Higher levels of education are generally associated with greater work productivity (Lainawa & Lenzun, 2022).

According to Maora and Sumarno (2018), education is considered not only a means of improving expertise and skills but also a way to foster positive attitudes and enhance human resource knowledge, ultimately contributing to increased productivity

3. Type of Work

In general, goat farming in Bombana Regency is predominantly managed under a semi-intensive system, while a smaller proportion of farmers adopt intensive and extensive systems. Goat farming is generally conducted as a supplementary livelihood on a relatively small scale, using simple technologies that contribute to low productivity (Siamsa et al., 2023). In addition to goat farming, the residents of Bombana Regency engage in various other occupations. The distribution of respondents by occupation is presented in Table 3.

Table 3. Types of Occupation of Respondents in Bombana Regency

Type og Work	Amount (people)	Percentage (%)
Farmer	38	48,71
Trader	15	19,23
Fisherman	14	17,94
Entrepreneur	11	14,10
Amount	78	100

Based on the research findings presented in Table 3, farmers in the study area engaged in a variety of occupations in addition to goat farming. The respondents' primary occupations were farming (48.71%), trading (19.23%), fishing (17.94%), and self-employment (14.10%). These findings indicate that goat farming was generally not the respondents' primary occupation, as most of them worked as farmers. This suggests that goat farming is still considered a supplementary livelihood, with goats serving as a form of savings that can be sold to meet urgent financial needs and provide additional household income (Sudrajat et al., 2024).

4. Livestock Farming Experience

Livestock farming experience plays an important role in promoting the development and improvement of livestock enterprises (Alam et al., 2023). This experience enables farmers to acquire practical knowledge and skills through their involvement in goat farming over time. The goat farming experience of respondents in the study area is presented in Table 4.

Table 4. Goat Farming Experience of Respondents in Bombana Regency

Livestock Farming Experience (year)	Amount (people)	Percentage (%)
0 – 5	26	33,33
6 - 10	52	66,66
> 10	-	-
Amount	78	100

Based on the findings presented in Table 4, the majority of respondents in the study area had 6–10 years of goat farming experience, accounting for 66.66% of the respondents. This indicates that goat farmers in the study area had a relatively adequate level of experience, which may positively influence the development of goat farming enterprises in Bombana Regency. The findings further show that most farmers fell into the moderately experienced category. This is consistent with Zahidah et al. (2021), who classified goat farming experience of 5 years or less as limited experience, 6–10 years as moderate experience, and more than 10 years as extensive experience in goat farming.

B. Goat Rearing System in Bombana Regency

An optimal goat rearing system starting from birth is essential to produce goats with high production and productivity levels, ready to replace animals that are no longer productive—whether does or bucks (Aku et al., 2020). Goat husbandry practices—ranging from birth management and rearing systems to general management and disease prevention and control—significantly influence the success of a goat farming enterprise.

1. Seedling Source

The goat breed raised by the farmer respondents in Bombana Regency is the Kacang goat, an indigenous Indonesian breed. The breeding stock is obtained by purchasing goats from other farmers within Bombana Regency. In general, farmers purchase mature goats. For beginners with sufficient capital, it is advisable to start goat farming with goats that are ready for mating. This is because the risk of mortality is lower in breeding-age goats than in young goats (kids) (Masrah et al., 2016). The sources of goat breeding stock used by the farmer respondents in Bombana Regency are presented in Table 5.

Table 5. Sources of Goat Breeding Stock in Bombana Regency

Sueedling Source	Amount (people)	Percentage (%)
Buy	55	70,51
Gifts	13	16,66
Noisy	10	12,83
Amount	78	100

Based on interviews with respondents in the study area, the findings indicate that goat breeding stock is generally obtained by purchasing animals from local community members, receiving them as gifts from parents, or acquiring them through gaduhan, a livestock-sharing arrangement with close relatives. The data presented in Table 5 show that 70.51% of goat breeding stock in Bombana Regency was obtained through purchases, 16.66% was received as gifts from parents, and 12.83% was acquired through gaduhan arrangements. These findings indicate considerable community interest and motivation to engage in goat farming.

Farmers generally keep female goats for breeding purposes. The animals are raised and allowed to mate naturally to produce offspring that can serve as replacement breeding stock. Under the gaduhan system, close relatives provide one or more goats to family members who have established independent households. Gifts, meanwhile, are generally given by parents to their children or other family members (Aku et al., 2020).

Respondents can obtain breeding stock from nearby communities. Goat farming in the study area is generally conducted using simple management practices. Farmers select animals based on direct visual observation and basic assessments of their physical characteristics. These assessments include observing the animals' agility when searching for feed and examining the size of specific body parts (Aku et al., 2020). Farmers tend to prioritize female goats because they expect the animals to reproduce and produce offspring that can be raised as future breeding stock.

However, the selection practices applied by local farmers remain limited. When purchasing goats, farmers generally assess the animals based on their external physical appearance, particularly body size and the absence of visible physical defects. In addition to raising goats, community members also keep other livestock, including cattle, chickens, and ducks (Novarista et al., 2020).

2. Goat Feed

Feed is one of the key factors determining the success of goat farming. Feed consists of materials consumed and digested by livestock to support growth, production, and reproduction (Alnaimy et al., 2023). The types of feed provided to goats in the study area are presented in Table 6.

Table 6. Types of Feed and Goat Rearing Systems

Goat Feed	Amount (people)	Percentage (%)
Field grass and agricultural waste	9 (extensive)	11,53
Field grass, Gliricidia, and agricultural waste	55 (semi-intensive)	70,51
Agricultural waste, mangrove, banana peels, and Gliricidia	14 (intensive)	17,94
Amount	78	100

The table above shows that, under the extensive rearing system, farmers provided goats with natural pasture grasses and agricultural residues, accounting for 11.53% of respondents. Under the semi-intensive rearing system, the feed provided consisted of natural pasture grasses, gliricidia (*Gliricidia sepium*), and agricultural residues,

accounting for 70.51% of respondents. Meanwhile, under the intensive rearing system, farmers provided goats with agricultural residues, mangrove leaves, banana peels, and gliricidia, accounting for 17.94% of respondents.

3. Goat Breeding System

According to Aku et al. (2020), there are two methods of livestock breeding: (1) natural mating, in which a male mates with a female either in a pen or in an open field; and (2) artificial insemination (AI), which involves introducing semen into the female reproductive tract using specialized equipment (Huda et al., 2024).

Goat breeding in Bombana Regency still relies on natural mating, using either farmers' own bucks or bucks borrowed from neighboring farmers (Shah et al., 2023). Farmers typically place the male and female goats together in the same pen for one day or longer to allow mating to occur. Artificial insemination has not yet been practiced in the study area for several reasons, including (1) farmers' limited knowledge of AI and (2) insufficient outreach and education on AI by the relevant government agencies.

Farmers in the study area also have limited knowledge of the signs of estrus in goats. They generally identify estrus by observing behavioral changes, particularly restlessness and persistent bleating. However, some farmers are unable to recognize the signs of estrus in their animals. Furthermore, farmers do not routinely examine the reproductive organs of female goats to identify physical signs of estrus (Zhao et al., 2023).

4. Housing

Housing serves as a shelter that protects goats from adverse climatic conditions, including excessive heat, rain, wind, and extreme temperatures. It also helps protect livestock from attacks by wild animals and the risk of theft. Goat housing should provide a comfortable environment for the animals by taking into account three key considerations in its design and construction: biological, technical, and economic factors (Sejian et al., 2023).



The types of goat housing found in the study area included under-house shelters, raised-floor pens, and ground-floor pens. For a more detailed overview of the types of goat housing used by farmers in Bombana Regency, the findings are presented in Table 7.

Table 7. Types of Goat Housing in Bombana Regency

Type Housing	Amount (people)	Percentage (%)
Enclosure (under-house area)	9	11,53
Dirt-floor enclosure	55	70,51
Stilted enclosure	14	17,94
Amount	78	100

Based on the research findings, most farmers in the study area already had goat housing. However, the housing structures were generally simple, with wooden walls and roofs made of sago palm leaves to protect the animals from rain and direct sunlight. Some pens had no walls, and their floors were made of either wood or compacted earth. Goats of different age groups and sexes, including kids, females, and males, were kept together in the same pen. This practice increases the risk of disease transmission among animals because separate housing facilities are not provided. Overall, the housing systems used by farmers still have several shortcomings. For example, pen dimensions are not adjusted to the number of goats kept. This situation occurs because farmers generally understand the basic function of housing as providing shelter and protection for their livestock, rather than recognizing its broader role in supporting animal health and productivity (Lima et al., 2022).

According to Danso et al. (2024), goat housing should be located in an area that is relatively higher than the surrounding land and is not damp. The site should be away from excessive noise, have access to fresh air, and be protected from strong winds. Morning sunlight should be able to enter the pen, while direct sunlight during the hottest part of the day should be limited. The housing site should also be sufficiently far from residential areas to avoid disturbing the community. In addition, it is advisable to locate pens away from drinking-water sources to prevent contamination by livestock waste. Housing should also be situated away from busy areas, such as major roads, markets, and factories, to maintain a calm environment for the animals.

Goat housing should preferably be constructed at a reasonable distance from residential areas and in locations that are not exposed to strong winds. Excessive wind exposure may contribute to health problems in goats, including weakness and digestive disturbances such as bloating (Al-Ramamneh, 2023).

5. Disease Control and Prevention

Disease prevention is considered more important than treatment in goat farming because the use of medication increases production costs and does not guarantee successful recovery. Preventive measures that can be implemented to maintain goat health include: (1) keeping housing facilities and equipment clean; (2) isolating sick goats from healthy animals and providing prompt treatment; (3) ensuring that pen floors remain dry; and (4) conducting regular health checks on the animals (Aku et al., 2020). Disease prevention and control practices for goats in the study area are presented in Table 8.

Table 8. Disease Prevention and Control in Goats

Disease Managemen	Amount (people)	Percentage (%)
Treated	25	32,05
Untreated	53	67,95
Amount	78	100

Based on the data presented in Table 8, most sick goats did not receive treatment, accounting for 67.95% of cases, while 32.05% received treatment. This situation was attributed to the fact that some farmers lacked the knowledge and skills required to treat sick animals, whereas only a proportion of farmers knew how to provide treatment. The treatments administered by farmers relied primarily on traditional remedies.

The research findings and interviews with farmers indicated that the most common health problems affecting goats in the study area were scabies, eye diseases, myiasis (maggot infestation), and bloat. Farmers generally treated these conditions using traditional remedies. For example, goats affected by scabies were treated by applying a mixture of sulfur and used engine oil to the affected skin (Aku et al., 2020). When goats developed wounds that became infected and infested with maggots, farmers regularly poured a mixture of tobacco and kerosene onto the wounds two to three times a day until the wounds healed. For eye diseases, farmers applied lime juice directly to the goats' eyes. Meanwhile, cases of bloat were often fatal because farmers lacked knowledge of the appropriate treatment and emergency measures required to manage this condition.

6. Goat Rearing System in Bombana Regency

Goat-rearing systems have a significant influence on livestock production and reproductive performance (Aku et al., 2020). For a more detailed overview, the goat-rearing systems used in the study area are presented in Table 9.

Table 9. Goat-Rearing Systems in Bombana Regency

Maintenance System	Amount (people)	Percentage (%)
Exstensive	9	11,54
Semi-intensive	55	70,51
Intensive	14	17,95
Amount	78	100

Based on the research findings, goat-rearing systems in Bombana Regency are predominantly semi-intensive (70.51%), followed by intensive systems (17.95%). However, some farmers still practice extensive or traditional goat rearing (11.54%). In the study area, goats managed by the respondents are generally allowed to graze in pastures, along forest edges, and around their homes where grass is abundant. In contrast, goats raised under intensive systems are continuously housed in pens, with feed provided directly inside the pens (Aku et al., 2020).

7. Business Scale

Farm size refers to the number of goats owned and raised by a farming household (Qamara et al., 2024). Farm size is closely related to the availability of production inputs and market demand. It should be carefully planned to ensure that production levels are aligned with market demand, thereby avoiding oversupply or unmet demand. The availability of essential production inputs, such as capital, breeding stock, equipment, and production facilities, must also be taken into consideration (Ginting et al., 2024).

In the study area, goat farming is generally operated on a small, household scale, with each farmer owning approximately 1–5 goats (Paly, 2023). This small-scale operation is partly attributable to the fact that farmers raise not only goats but also other livestock, including cattle, ducks, and chickens.

8. Goat Marketing

The marketing of ruminant livestock is dynamic because prices fluctuate in response to changes in supply and demand. Prices tend to rise in the period leading up to Eid al-Adha, when demand for livestock increases. Conversely, when farmers need to sell their animals urgently to meet expenses such as school fees, ceremonial events, and other household needs, their bargaining power is often limited, resulting in lower selling prices. This weak bargaining position creates opportunities for buyers to obtain substantial profits at the expense of farmers (Ginting et al., 2024).

Based on interviews with farmers, goats in the study area are marketed directly to buyers without intermediaries, and selling prices vary considerably. The selling price of an adult male goat ranges from IDR 900,000 to IDR 3,000,000 per head, while that of an adult female goat ranges from IDR 800,000 to IDR 2,000,000 per head. Male goats generally command higher prices than female goats because they tend to have greater body weights. Prices also depend on the animals' age. Goats younger than one year are generally sold at lower prices, ranging from IDR 600,000 to IDR 900,000 per head. Farmers estimate the selling price primarily based on the animal's age and physical condition, particularly its body size and overall appearance.

Conclusion

Goat rearing systems in Bombana Regency are predominantly semi-intensive (70.51%), followed by intensive systems (17.95%). However, some farmers still practice extensive or traditional goat-rearing systems (11.54%).

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