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Research Article

Farmer Characteristics and Knowledge of Reproductive Management Practice in Traditional Dairy Goat Farming at Simpay Tampomas Farmers Group, Sumedang, West Java Indonesia

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Abstract | Dairy goat production efficiency can be achieved through adequate reproductive performance and appropriate breeding practice. This study aims to explore farmers' profiles, behaviours, and existing knowledge about reproductive management practices in traditional dairy goat farming. The study were carried out among Simpay Tampomas Farmers Group in Sumedang, West Java, Indonesia. The sample population consisted of thirty participants and the reproductive performance of 96 goats was investigated. Sociodemographic characteristics and reproductive knowledge of breeding were collected through questionnaires, interviews, and direct observation of the farms. The majority of members of Simpay Tampomas Farmers Group were males aged 41-59 years, who graduated from elementary school and had more than 10 years of experience in dairy goat farming. Furthermore, 75% of them had adequate literacy about the signs of heat, length of pregnancy, signs of delivery, and weaning of lamb. The results showed that less than 50% of farmers lacked awareness about the length of heat and the signs of early pregnancy. The majority of the participants immediately carried out mating of the estrus dairy goat and more than 75% treated the pregnant animal and prepared a proper place for delivery. A small proportion of <25% managed and weaned the kids. Farmers mated their goats in the first estrous cycle, leading to an early first delivery age of approximately 12 months. Farmers in Simpay Tampomas Farmers Group generally had adequate knowledge of reproductive physiology but little experience in managing dairy farming goats, leading to suboptimal reproductive performance.

Keywords | Dairy goat, Reproductive management, Breeding practice, Reproductive performance

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INTRODUCTION

Sustainable dairy goat farming has been effectively developed in Indonesia, Malaysia, and Thailand through collaborative efforts with plant-based agro-industries (Miller and Lu, 2019). In Indonesia, dairy goats have gained significant recognition and popularity among rural smallholders. Furthermore, these animals are typically raised in quantities of 3-10 heads per household on plots of land measuring less than 0.3 hectares or by landless farmers (Cyrilla et al., 2016). According to previous reports, dairy goats can be used as savings to obtain cash during emergencies, a source of income for smallholders, and a protein source, particularly in poor rural households (Oluwatayo and Oluwatayo, 2012). Despite the small-scale production of these animals, their significance is often underestimated both in terms of impact on the community and contribution to the economy.

The population of dairy goats in Indonesia is estimated to be approximately 17.9 million head in 2012, with distribution spanning the entire country (Sutama, 2015). Furthermore, the majority were found in specific areas, including Java and Madura (57%), Sumatera (22.4%), Sulawesi (8.9%), Bali and Nusa Tenggara (7.9%), Maluku and Papua (2.3%), and Kalimantan (2.2%) (Sutama, 2015). The dominant species in Indonesia was the Etawah Crossbred, which was obtained by breeding native Kacang goats with Jamnapari bucks from India, during the Dutch colonization period. Although this species is often raised for meat supply, there has been a sudden surge in the demand for goat milk in Indonesia within the last 15 years (Astuti and Sudarman, 2012). Traditional farmers rear Etawah crossbred using an intensive rearing method due to its suitability for smallholders and landless farmers (Christopher et al., 2020).

The sustainability and success of dairy goat farming are determined by the interaction between natural animals, the environment, and farmers who manage them for specific purposes. Farmers play a significant role in managing farming systems to reach optimum productivity. Furthermore, the characteristics of farmers, prerequisite knowledge about reproductive traits, and reproductive management practice are crucial factors in improving the product's quality (Shahudin et al., 2018). Lack of literacy and expertise in managing proper dairy goat-rearing practices can cause inefficient production and poor reproductive performance (Peacock, 2008). According to previous studies, reproductive performance is determined using several variables, including the age of the first mating, the age of the first kidding, the days open, and the kidding interval (Widayati et al., 2010). The evaluation of this parameter in a local and adapted breed of goat can provide important information on its potential using local resources. A good performance often leads to high reproductive efficiency and increased dairy goat farming productivity.

Several reports have shown that there is still limited information on the profile of traditional crossbred Etawah farmers and their ability to manage the reproductive performance of herds. Therefore, a role model is required to provide an understanding of their characteristics and capacity for practicing reproductive management in the traditional dairy goat farming system. Simpay Tampomas Farmers Group consists of individuals who rear crossbreed Etawah dairy goats in traditional farming methods, with a population of approximately 168 heads in 2019. Group raises these animals as a source of income in addition to agricultural goods production. The majority of the members are farmers who have successfully used livestock rearing to rehabilitate unproductive landscapes at a sand mining in Cibeureum Wetan, Sumedang, West Java, Indonesia. Therefore, this study aims to explore profiles, farmers' behaviours, and existing knowledge of reproductive management practices in traditional dairy goat farming. The results are expected to help stakeholders in the development of small-holder dairy goat farming mainly in West Java, Indonesia. Furthermore, subsequent information about the socio-culture and level of farmer knowledge about reproductive physiology, as well as how their approach to farming management system will help the government and private sector in formulating policies and strategies for developing smallholder of dairy goat farming productivity.

MATERIALS AND METHODS

Data collection and analysis

This study was carried out using survey methods in Cimalaka District, Sumedang Regency, West Java, Indonesia.

The participants selected consisted of 30 individuals in the "Simpay Tampomas" farmers group who met the requirements. Each farmer had been breeding Etawah cross-bread dairy goats for at least three years. Data were obtained by completing designed questionnaires and face-to-face interviews. The following determinants were recorded, namely (1) the pastoralist socio-economic characteristics, such as gender, age, education, and experience in goat-keeping; (2) the extent of reproductive physiology knowledge of Etawah crossbreed; (3) pastoralist psychomotor abilities to elaborate breeding practice comprehension in reproductive management (4) Etawah cross breed reproductive performance. Reproductive performance was calculated using age at first mating, age at first kidding, days open or DO (interval after kidding and subsequent pregnancy), and kidding interval. Farmers estimated each reproductive performance measurement

based on information on reproductive events in flocks during the year. The procedures were approved by the Padjadjaran University Ethical Committee Board with reference No. 957/UN6.C.10/PN/2017.

Data analysis

The data were analyzed using descriptive statistics and expressed as percentages and mean (SEM) and descriptive analysis.

RESULTS AND DISCUSSION

The general characteristics of the Simpay Tampomas Farmers Group are presented in Table 1. Gender, age categories, educational status, and experience in rearing Etawah cross-bred dairy goats were measured in this study. The majority of the participants were males aged 41-59 years. Furthermore, most of them had completed elementary school as their formal education (70%) and less than 10% completed junior or senior high school. In terms of goat farming experience, a total of 73% had performed more than ten years of breeding practice.

Table 1: The characteristics of simpay tampomas farmers group.

Parameters	Number (n)	Percentage (%)
Gender		
Female	3	10
Male	27	90
Total	30	100
Ages (years)		
20-40 years	3	10
41-59 years	19	63.3
>65 years	8	26.7
Total	30	100
Level of formal education		
Uneducated	4	13.3
Elementary school	24	70
Junior high school	3	10
Senior high school	2	6.67
Total	30	100
Experience as goat dairy farmer (years)		
0-5 years	2	6.7
6-10 years	6	20
>10 years	22	73.3
Total	30	100

Gender, age categories, educational status, and experience in rearing Ettawah cross-bred dairy goats.

The insight of farmers in terms of does' fertility attributes and fertile period was assessed. The perception of the participants regarding the initial oestrus phase up to parturition and re-breeding signs was evaluated individually. Table 2 shows Simpay Tampomas farmer's level of knowledge and awareness on does' reproductive physiology trait. According to the data, the majority of farmers had extensive knowledge of the oestrus sign, pregnancy duration, parturition signs, and weaning period (all variables >75%). Meanwhile, 57-64% of them had less understanding of the early signs of does' pregnancy, kidding intervals, and the appearance of initial oestrus after delivery. A total of 43% could recognize the duration of the estrous cycle and 63% were able to identify the first oestrus cycle after parturition.

Table 2: The level of reproductive physiology knowledge of simpay tampomas farmers group.

Parameters	Number (n)	Percentage (%)
Oestrous signs		
Know	28	93.33
Unknown	2	6.67
Total	30	100.00
Oestrus length (24– 48h)		
Know	13	43.33
Unknown	17	56.67
Total	30	100.00
Initial signs of pregnancy		
Know	17	56.67
Unknown	13	43.33
Total	30	100.00
Pregnancy period		
Know	26	86.67
Unknown	4	13.33
Total	30	100.00
Signs of parturition/delivery		
Know	28	93.33
Unknown	2	6.67
Total	30	100.00
Kidding interval		
Know	19	63.33
Unknown	11	36.67
Total	30	100.00
Weaning period (3-5 months)		
Know	23	76.67
Unknown	7	23.33
Total	30	100.00
First oestrous after parturition (65-70 days)		
Know	19	63.33
Unknown	11	36.67
Total	30	100

Simpay Tampomas farmer's level of knowledge and awareness on does' reproductive physiology trait.

Table 3: Farmers' reproductive physiology knowledge in managing dairy goat farms in simpay tampomas farmers group.

Parameters	Number (n)	Percentage (%)
Mating the estrous does		
Practiced	30	100
Unpractice	0	0.00
Total	30	100
Treating the pregnant doe		
Practiced	19	63.33
Unpractice	11	36.67
Total	30	100
Preserving appropriate places for parturition		
Practiced	23	76.67
Unpractice	7	23.33
Total	30	100
Rearing offspring		
Practiced	13	43.33
Unpractice	17	56.67
Total	30	100
Weaning offspring		
Practiced	8	26.67
Unpractice	22	73.33
Total	30	100

To evaluate the capability of farmers in applying their knowledge of does' reproductive physiology in breeding practice, the routine methods in managing goat mating, breeding, and offspring handling were assessed. Furthermore, the psychomotor abilities of the participants to connect their expertise in reproductive management are presented in Table 3.

The data revealed that all Simpay Tampomas farmers group had already mated all the does in the estrous phase. The results also showed that more than half of them had also taken care of their pregnant does and prepared an appropriate place for delivery. However, they needed more supervision and guidance on the handling and weaning of the kids.

The combination of an appropriate understanding of goat reproductive physiology and daily breeding practice was depicted in reproductive performance as an indicator of productivity. Table 4 illustrates the results of the reproductive performance of the Etawah crossbreed in the Simply Tampomas farmers group.

The overall mean age at first mating was 7.06 (11.08) months, indicating that the mean age of does at first kidding was five months later, approximately 12.11 (16.63) months. Days open was defined as when the subsequent pregnancy occurred after the preceding parturition. In this study, the days open extended for a prolonged period of 103.25 (107.40) days. After delivery, the does promptly re-mated and conceived again for approximately three months following parturition, leading to a kidding interval of eight months (240.45 (310.67) days).

Table 4: Reproductive performance of Ettawa crossbreed in simpay tampomas farmers group.

No	Variable	Number of does (n)	SEM
1	Age at first mating (month)	96	7.06 ±11.08
2	Age at first kidding (month)	96	12.11±16.63
3	Days open (days)	96	103.25±107.40
4	Kidding interval(days)	96	240.45±310.67

Dairy goat production systems were a combination of agriculture and dairy goat interactions that were managed by farmers. Furthermore, farmers often determined their breeding objectives and targets, which could be influenced by the social environment where the degree of technical knowledge and production variable availability served as significant factors (Below et al., 2012). The strategic management method was commonly used in agricultural enterprises to obtain promising outcomes when applied appropriately. The application of strategic management concepts helped to design the methodology with which farmers could achieve their objectives, as well as determine the strengths, weaknesses, opportunities, and threats. The strategic management method contains stages of analysis, planning, and implementation. Accordingly, three key strategic components must be considered in agribusiness. First, managerial decisions must be made including site of preference, priority of resources, external partnership, potential development opportunities, approaches to use the strengths, limiting the weaknesses and threats, as well as competitive and innovative ways to deal with the crisis. Second, applying technology and new approaches are key to long-term financial success. Finally, adapting to industrial dynamics, competitive settings, and industry limitation is necessary to maintain market position (Boehlje et al., 2011).

In dairy goat farming, gender issues were often related to the distribution of responsibilities and decision-making control in production. Males and females could have different perceptions and justifications for maintaining dairy goats and the number of goats to be raised (Bett et al., 2009). The results showed that the majority of Simpay Tampomas farmers group were males, leading to the idea of rearing dairy goats as a profitable investment. Meanwhile, only 10% of women in Simpay Tampomas farmers group reared dairy

goats for additional income to the family. The majority of the participants were aged 41-59 years, indicating that they had a stable emotional condition and were more receptive to innovation and technology. Younger farmers often had a willingness to gain experience and perform effective and efficient methods within the group.

Moreover, the results show that farmers around 20-40 years old in the "Simpay Tampomas" group were only 10% of the total population, because dairy goat farming has been implemented from generation to generation on a small scale in the "Simpay Tampomas" group, and only a few of the younger generation are interested in continuing the livestock business due to a variety of factors. The first issue could be a lack of enthusiasm among the younger generation in becoming breeders. Second, there is a lack of technical innovation at the farmer level, as well as technology uptake by other parties. Third, there is a paucity of parents who pass on their expertise to the next generation from an early age. Fourth, this is attributable to a lack of breeders improving virtual access to information about technological livestock cultivation. Fifth, there is a lack of assistance programs for the younger generation who want to work in the livestock industry. The efforts for regenerating livestock breeders can be carried out by implementing support programs for the younger generation interested in entering the livestock business, such as experience-sharing sessions with prospective breeders, training, and opening internships at livestock companies.

Based on formal education, the majority of the participants barely completed junior or senior high school, and less than 10% finished compulsory education. The questionnaire response showed moderate awareness of the breeding manner, indicating that Simpay Tampomas farmers group accepted innovation to enhance productivity and minimize cost expenditure. However, they were likely to encounter challenges due to limited managerial competency. A large proportion of the participants, namely >70% had been in the field for more than a decade. Therefore, the familiarity of farmers with goat behavior, sustenance, season change, nursing health problems, and disease prevention affected their method of maintaining livestock. The longer the experience, the more knowledge gained about the intricacies of raising livestock (Guntoro et al., 2016).

An adequate understanding of reproductive management was a crucial component in improving the productivity of dairy farming goats. Simpay Tampomas Farmers Group already had satisfactory lore about signs of heat, length of pregnancy, signs of delivery, and weaning of kids. The majority of the participants who encountered heat for the first period carried out mating immediately. This showed that farmers' understanding of recognizing indicators of estrus was sufficient and they did not delay mating when it appeared during heat. They were aware that post-partum heat could be re-detected 65-70 days after delivery, and mating could occur during this period. Simpay Tampomas farmers group also had decent practice in preserving appropriate room for parturition by making bedding, immediately cleaning the mucous, and suckling their newborn after delivery. However, does naturally arrange their location for delivery.

Based on the findings, it is extremely feasible to introduce the Assisted Reproductive Technology (ART) techniques to farmers in the "Simpay Tampomas group" since they already have a good understanding of dairy goat symptoms of oestrus. Oestrus synchronization and artificial insemination are two reproductive technologies that could be implemented so that the offspring can be obtained at the same time concurrently and the kidding interval time is shorter, which results in increased dairy goat farming productivity.

The data showed that several components had not been adopted in the does' parturition aftercare, particularly in fostering newborn kids. A total of <30% of farmers performed livestock weaning, even though the majority of the participants were aware the weaning transpired for 3 to 5 months. The breeders performing the weaning claimed that the kids and does were separated aggressively. Meanwhile, breeders who did not wean the kids stated that when the mother became pregnant again, the kids were not nursed by the mother. This indicated that weaning occurred naturally in the majority of the respondents.

Productivity indicators in dairy goat farms included the efficient reproductive performance of does from the age of the first heat until delivery and re-mating (El-Hosainy et al., 2017). The results showed that the reproductive performance of the Etawah crossbreed in Simpay Tampomas farmers group was not satisfactory. Goats typically reached puberty at the age of 6 months, while the age of first-time mating in this study was around 7 months. This indicated that mating occurred immediately at the age of sexual maturity, (Sutama, 2009). The body weight at first mating affected subsequent productive performance and the recommendation suggested that does must have 60% of mature body weight before the process (Mellado et al., 2006). Mating in the first estrous usually led to a low pregnancy rate of 60–73%. Therefore, breeders were often advised to delay the first mating until the second or third estrous after puberty, which occurred approximately 12 months for small breeds and 15 months for large breeds (Suhartini et al., 2018) to attain the proper body weight. The majority of the participants in this study mated them does in the first estrous cycle, leading to the early occurrence of the first delivery at the age of 12 months. This was lower compared to a previous study, where the

age of first conception of the Etawah goat was around 18 months, and the first kidding occurred at 23 months (Sumartono and Nuryadi, 2015)

The average days open (DO) of Etawah crossbred goat in this study were lower compared to previous studies, which normally ranged from 120-136 days (Suyadi et al., 2021) and 144 days (Gautam et al., 2018), possibly due to the unusual post-partum oestrus cycle. The dose could typically be re-mated after 90 days post-partum or after the weaning period ended because the uterine involution and ovarian cycle hormone level had recovered to the original state (Mwaanga and Janowski, 2000). Oestrus post-partum was influenced by several factors, including breastfeeding, the quality and quantity of food given, and hormonal activity. It is important to note that farmers must be cautious of reproductive disorders, such as prolonged pregnancies, mating failure, and embryo death during prolonged days open (Christopher et al., 2020).

The kidding interval of the Etawah crossbreed in this study varied from 240 to 310 days, and this was similar to a previous study with a range of 265 to 277 days (Suyadi et al., 2021). However, it was quite late compared to the Black Bengal goat with 185.97-187.49 days and 199.88-200.40 days for the Jamnapari goat (Miah et al., 2016). This could be due to differences in breed type, breeding management, nutrition, genetics, environmental condition, parity, and season (Sodiq et al., 2003). A length of kidding more than 300 days could affect farmers who did not perform weaning by delaying the re-mating after delivery. In conclusion, farmers in the Simpay Tampomas farmers group generally had adequate knowledge of reproductive physiology but had little experience regarding the management of dairy farming goats. Furthermore, the results of the reproductive performance of the does were unsatisfactory, indicating that further planning and implementation of the existing literacy were needed to enhance productivity.

All in all, according to the findings, the strategies given to improve the "Simpay Tampomas" farmer group are increasing farmers' knowledge and awareness of how to implement reproductive management in dairy goat farming, particularly in (1) Mating management, which involves delaying mating of livestock until the third cycle and reaching body maturity; (2) Early pregnancy recognition and treatment so that farmers can immediately separate pregnant and non-pregnant livestock to avoid miscarriage; (3) Weaning management, the kidding should be weaned immediately after the end of the breastfeeding a period so that the goat can be re-mated after the uterine involution process quits and show signs of heat post parturition, hence shortening the kidding interval. Furthermore, improving the production of dairy goats dealt with traditionally can be achieved by establishing and implementing good dairy farming practice, particularly environmental, health, and reproductive technology management.

The long-term sustainability of dairy cattle productivity enhancement in low-scale farmhouses remains an issue. To improve the efficiency of smallholder dairy production and the competitiveness of production systems, measures aimed at reinforcing productivity rather than increasing population numbers must be advocated and implemented. Smallholder farmers with limited resources are unlikely to be able to counter sustainably to the growing demand for animal products unless there is substantial public investment in innovation and support platforms necessary to promote technological innovations required to increase productivity.

Intervention to support future development including empowering local farmers to increase the efficiency of their dairy production by identifying and implementing demand-driven inputs in the sectors. In addition, improving the knowledge, experience and skill of smallholder goat farmers is critical to enhance the efficiency of rearing goats. Furthermore, seeking opportunities and advocacy to the governance in assisting and adopting technology innovatively and cost-effectively suitable to smallholder farming systems. Finally, recruit a younger generation of farmers who are willing and able to collect, exchange, and use information and communications through technology platforms.

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NOVELTY STATEMENT

This study provides information on characteristics, existing knowledge, and behaviour of small-holder dairy goat farming and traditional breeding practice in Indonesia. We investigated that traditional farmer has already adequate understanding about reproductive physiology of the goat, yet the reproductive performance result was not satisfactory. Intervention to improve gap understanding in local farmers are by collaborating multiple stakeholders' partnership to implement suitable technique and technology for the local farmers and direct field-practice by the expert.

AUTHOR'S CONTRIBUTION

RW, AL, MRAAS: Research and ethical clearance preparation, designing the study, conducting the experiment, acquisition of data, and data analysis.

RW, RS, KH, SP: Data analysis, data interpretation.
RW, RS, AL, SD, KH, NS, MAM: Manuscript drafting, revision, and editing.
TS, AB: Supervision, and manuscript correction.
All authors have read and approved the final version of the manuscript.

Conflict of interest

The authors declare that they have no competing interests. All data supporting the findings of this study are available within the manuscript.

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