

INTEGRATED TRAINING ON HEALTH MANAGEMENT, NUTRITION, REPRODUCTION, AND BREEDING OF GOATS AND SHEEP

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Abstract. Community-based goat and sheep farming often faces challenges related to animal health management, feed technology, reproductive management, and breeding practices, which limit livestock productivity. This community service program aimed to improve farmers' knowledge and skills through integrated training covering animal health, feed technology, reproductive technology, and molecular breeding using Polymerase Chain Reaction (PCR). The program was implemented using lectures, interactive discussions, demonstrations, and pretest–posttest evaluations to assess participants' knowledge improvement. The results showed increased knowledge across all training topics. In animal health management, knowledge of infectious diseases, reproductive tract infections, and mineral and vitamin deficiencies increased by 30%, while knowledge of parasitic diseases increased by 20%. Feed technology training improved participants' understanding of agricultural waste utilization and feed fermentation by 10%, while knowledge of nutritional requirements and prevention of postnatal kid mortality increased by 20%. Reproductive technology training resulted in knowledge improvements ranging from 20% to 40%, with the highest increase observed in understanding reproductive organs (40%). In breeding training, knowledge of phenotypic selection increased by 10%, whereas understanding of genotypic selection using PCR increased by 40%. Overall, the integrated training effectively enhanced farmers' knowledge and provided practical skills that support sustainable goat and sheep production. Continuous mentoring and technology adoption are recommended to maximize the long-term impact of the training program on livestock productivity and farmer welfare.

Keywords: goat and sheep farming, livestock management, polymerase chain reaction, reproduction

Abstrak. Peternakan kambing dan domba skala rakyat masih menghadapi berbagai kendala dalam manajemen kesehatan ternak, teknologi pakan, reproduksi, dan pemuliabiakan yang berdampak pada rendahnya produktivitas ternak. Kegiatan pengabdian kepada masyarakat ini bertujuan meningkatkan pengetahuan dan keterampilan peternak melalui pelatihan terpadu yang meliputi manajemen kesehatan ternak, teknologi pakan, teknologi reproduksi, serta pemuliabiakan berbasis Polymerase Chain Reaction (PCR). Metode pelaksanaan dilakukan melalui ceramah, diskusi interaktif, demonstrasi, serta evaluasi menggunakan pretest dan posttest untuk mengukur peningkatan pengetahuan peserta. Hasil kegiatan menunjukkan adanya peningkatan pengetahuan pada seluruh materi pelatihan. Pada aspek manajemen kesehatan ternak, pengetahuan mengenai penyakit infeksius, infeksi saluran reproduksi, serta kekurangan mineral dan vitamin meningkat sebesar 30%, sedangkan pengetahuan mengenai kecacingan dan parasit meningkat sebesar 20%. Pada pelatihan teknologi pakan, pengetahuan mengenai pemanfaatan limbah pertanian dan pembuatan pakan fermentasi meningkat sebesar 10%, sedangkan pemahaman mengenai kebutuhan gizi pakan dan pencegahan kematian anak pascakelahiran meningkat sebesar 20%. Pelatihan teknologi reproduksi menunjukkan peningkatan pengetahuan sebesar 20–40%, dengan peningkatan tertinggi pada materi organ reproduksi ternak sebesar 40%. Sementara itu, pada pelatihan pemuliabiakan, pengetahuan mengenai seleksi berdasarkan fenotipe meningkat sebesar 10% dan pemahaman mengenai seleksi berbasis genotipe menggunakan teknologi PCR meningkat sebesar 40%. Secara keseluruhan, pelatihan terpadu berhasil meningkatkan kapasitas peternak dalam penerapan teknologi peternakan yang mendukung peningkatan produktivitas ternak kambing dan domba. Pendampingan berkelanjutan diperlukan agar penerapan teknologi dapat berlangsung secara optimal dan berkelanjutan.

Kata kunci: manajemen peternakan, peternakan kambing dan domba, reaksi berantai polimerase, reproduksi

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INTRODUCTION

Goat and sheep farming is one of the livestock subsectors that plays a strategic role in supporting food security, providing animal protein, and increasing the income of rural communities in Indonesia (Sujarwanta et al., 2024). Goats and sheep are highly adaptable to various environmental conditions, require relatively low capital investment, and have high reproductive rates, making them widely raised by smallholder farmers (Bashiru et al., 2026). Nevertheless, the productivity of goats and sheep at the smallholder level remains relatively low due to the limited adoption of improved farming technologies, inadequate health management, insufficient provision of high-quality feed, suboptimal reproductive management, and breeding programs that are still largely conventional (FAO, 2023; Directorate General of Livestock and Animal Health Services, 2024).

The major challenges faced by farmers include a high incidence of infectious diseases, parasitic infestations, and reproductive disorders, as well as limited availability of high-quality feed year-round (Ape et al., 2025; Mugoti et al., 2025). Infectious diseases and parasitic infections remain the primary causes of reduced livestock productivity, increased mortality rates, and economic losses in smallholder farming systems (Rashid et al., 2019). In addition, farmers' limited knowledge of disease prevention, biosecurity practices, and animal health management has hindered effective disease control (WOAH, 2023; FAO, 2022). Furthermore, deficiencies in essential minerals and vitamins in animal feed contribute to poor growth performance, reduced reproductive efficiency, and increased susceptibility to diseases (National Academies of Sciences, Engineering, and Medicine, 2021).

Nutrition is a critical factor determining the success of goat and sheep farming. Most farmers still rely on natural forages and untreated agricultural by-products, resulting in feed quality that is insufficient to meet the nutritional requirements of livestock (Shah et al., 2025). Feed fermentation technology has emerged as a practical solution to improve the quality of agricultural residues by enhancing digestibility, nutritional value, and feed preservation (Alvarez et al., 2025). The application of this technology can improve the efficiency of local resource utilization while reducing production costs for farmers (Makkar, 2021; FAO, 2022).

In addition to health and nutrition, low reproductive efficiency remains a major constraint in the development of goat and sheep farming. Inaccurate estrus detection, inadequate reproductive record-keeping, improper sire selection, and the limited application of reproductive technologies have resulted in suboptimal pregnancy rates and livestock productivity (Mohammed Ali, 2024). The application of reproductive technologies, such as accurate estrus detection, artificial insemination, estrus synchronization, and proper reproductive management, has been shown to improve reproductive efficiency and the productivity of small ruminants (Rahman et al., 2022; FAO, 2023).

Advances in biotechnology have also created opportunities for implementing genetic-based breeding programs in goats and sheep. Conventional selection, which relies solely on phenotypic characteristics, requires a relatively long period and is strongly influenced by environmental factors. In contrast, genotype-based selection using Polymerase Chain Reaction (PCR) technology enables the identification of genes associated with production traits, reproductive performance, and disease resistance at an early age, thereby making the selection process more accurate and efficient. This technology has been increasingly adopted in livestock breeding programs in many countries as part of strategies to improve the genetic quality of livestock populations (Colli et al., 2021; Abdelsayed et al., 2024).

Based on preliminary observations and discussions with farmer groups, it was found that most farmers still have limited knowledge of animal health management, feed technology, reproductive technology, and the application of molecular technologies in breeding programs. This situation poses a significant challenge to improving livestock productivity in a sustainable manner. Therefore, a community service program in the form of integrated training is needed to provide not only theoretical knowledge but also demonstrations and hands-on practical sessions, enabling farmers to understand and apply livestock technologies that are appropriate to local conditions.

This community service program aims to enhance the knowledge and capacity of goat and sheep farmers in animal health management, feed technology, reproductive technology, and PCR-based breeding. Through this capacity-building initiative, farmers are expected to adopt appropriate technologies in their livestock management systems, thereby improving livestock productivity, farming efficiency, and farmers' welfare sustainably.

METHOD

This community service program was implemented using a participatory approach, involving goat and sheep farmers as the primary partners throughout all stages of the program. The implementation began with problem identification through field observations and discussions with farmer groups to assess their needs and the challenges they encountered in livestock management. Based on the findings, training materials were developed covering animal health management, feed technology, reproductive technology, and livestock breeding using Polymerase Chain Reaction (PCR) technology.

The program consisted of five stages: preparation, training implementation, demonstrations, discussions, and evaluation. During the preparation stage, coordination was conducted with the partner groups, training materials were developed, learning media were prepared, and evaluation instruments in the form of pre-test and post-test questionnaires were designed. The training was then delivered through interactive lectures supported by presentation media, followed by discussion and question-and-answer sessions to enhance participants' understanding of the topics presented.

The animal health management module covered the identification of infectious diseases, reproductive tract infections, control of helminth and parasitic infestations, and the importance of adequate mineral and vitamin supplementation for goats and sheep. The feed technology module introduced participants to the utilization of agricultural by-products as feed resources, feed fermentation techniques, ration formulation based on livestock nutritional requirements, and feeding management strategies to reduce postnatal kid mortality. The reproductive technology training included reproductive recording techniques, estrus detection, introduction to the reproductive organs, superior sire selection, artificial insemination, and estrus synchronization. In addition, participants received instruction on the basic concepts of livestock breeding through phenotypic and genotypic selection, as well as an introduction to Polymerase Chain Reaction (PCR) technology as a genetic identification method in livestock breeding programs.

To reinforce the theoretical materials, practical demonstrations were conducted on several technologies that could be directly applied by farmers. These included feed fermentation techniques, observation of livestock phenotypic characteristics, identification of reproductive organs, and demonstrations of genotype identification using laboratory-based learning media. Throughout the program, participants were encouraged to discuss the challenges they faced in their farming practices so that the proposed solutions could be tailored to the specific conditions of their respective farms.

The effectiveness of the program was evaluated using pre-test and post-test assessments to measure changes in participants' knowledge before and after the training. The evaluation instrument consisted of a questionnaire containing questions related to the topics covered in each training session. Knowledge scores were calculated as percentages and compared between the pre-training and post-training assessments to determine the extent of participants' knowledge improvement. The evaluation data were analyzed descriptively by presenting the mean knowledge scores before and after the training, as well as the percentage increase for each training topic. The results were subsequently presented in tabular form to illustrate the effectiveness of the community service program in improving farmers' knowledge of animal health management, feed technology, reproductive technology, and goat and sheep breeding. Descriptive analysis was selected because it is appropriate for evaluating knowledge gains achieved through community service activities.

RESULT AND DISSCUSION

The community service program was implemented through an integrated training program covering animal health management, feed technology, reproductive technology, and goat and sheep breeding (Ojango et al., 2023). Evaluation using pre-test and post-test assessments demonstrated an increase in farmers' knowledge across all training topics. These findings indicate that the training approach, which combined interactive lectures, discussions, and practical demonstrations, effectively enhanced farmers' capacity to adopt improved livestock management technologies at the farm level (Mgendi et al., 2022).

Goat and Sheep Health Management Training

Table 1. *Improvement in farmers' knowledge of goat and sheep health management following the training*

Topic	Before After Improvement (%)		
Infectious diseases	50	80	30
Reproductive tract infections	40	70	30
Helminth and parasitic infestations	50	70	20
Mineral and vitamin deficiencies	30	60	30

The evaluation results showed improvements in participants' knowledge across all training topics following the program. The greatest improvements were observed in knowledge of infectious diseases, reproductive tract infections, and mineral and vitamin deficiencies, each increasing by 30%, while knowledge of helminth and parasitic infestations increased by 20%. These findings indicate that the training successfully enhanced farmers' understanding of disease prevention, proper housing sanitation, parasite control, and the importance of balanced nutrition in maintaining livestock health. These improvements are consistent with the report by WOA (2023), which emphasizes that strengthening farmers' capacity through animal health education plays a crucial role in reducing the incidence of infectious diseases, improving early disease detection, and enhancing livestock productivity through the implementation of effective biosecurity measures and sound animal health management practices.



Figure 1. *Delivery of animal health management training to goat and sheep farmers*

Goat and Sheep Feed Technology Training

Table 2. *Improvement in farmers' knowledge of goat and sheep feed technology following the training*

Topic	Before After Improvement (%)		
Processing agricultural by-products	75	85	10

Topic	Before	After	Improvement (%)
Preparation of fermented feed	60	70	10
Postnatal kid mortality	40	60	20
Feed nutritional requirements	40	60	20

The feed technology training improved participants' knowledge across all topics. Although the improvements in knowledge regarding the processing of agricultural by-products and the preparation of fermented feed were relatively modest (10%), the participants' relatively high baseline scores indicate that many farmers were already familiar with these technologies before the training. In contrast, knowledge of feed nutritional requirements and the relationship between nutrition and postnatal kid mortality increased by 20%, demonstrating a better understanding of the importance of balanced ration formulation for improving livestock health and survival. These findings are consistent with the study by Rashid et al. (2022), which reported that training on feed formulation using agricultural by-products and fermentation technology enhanced farmers' knowledge, improved feed utilization efficiency, and increased the productivity of small ruminants through better feed nutritional quality.

Goat and Sheep Reproductive Technology Training

Table 3. *Improvement farmers' knowledge of goat and sheep reproductive technology following the training*

Topic	Before	After	Improvement (%)
Reproductive recording	70	90	20
Estrus detection	60	80	20
Reproductive organs	30	70	40
Artificial insemination	60	80	20
Selection of superior sires	60	80	20
Estrus synchronization	40	60	20

The training results showed improvements in participants' knowledge across all reproductive technology topics. The greatest increase (40%) was observed in participants' understanding of livestock reproductive organs, whereas knowledge of the remaining topics increased by 20%. These findings indicate that before the training, many farmers had limited knowledge of reproductive anatomy and physiology. Following the training, however, participants demonstrated a better understanding of the relationships among estrus detection, superior sire selection, and reproductive success. These findings are supported by Khan et al. (2024), who reported that training in reproductive technologies including estrus detection, reproductive record-keeping, and artificial insemination improves farmers' decision-making related to reproduction, thereby enhancing the reproductive efficiency of small ruminants.

Goat and Sheep Breeding Training Using Polymerase Chain Reaction (PCR) Technology

Table 4. *Improvement in farmers' knowledge of goat and sheep breeding following the training*

Topic	Before	After	Improvement (%)
Phenotype-based selection	80	90	10
Genotype-based selection	30	70	40

The livestock breeding training demonstrated that farmers already had a relatively good understanding of phenotype-based selection before the training, as indicated by a baseline score of 80. However, their knowledge of genotype-based selection was still limited, with an initial score of 30. Following the training, participants' knowledge of genotype-based selection increased to 70, representing a 40% improvement, indicating that the training on Polymerase

Chain Reaction (PCR) technology was well understood and effectively received by the participants. Advances in molecular technology have enabled the identification of genes associated with livestock productivity and reproductive performance more rapidly and accurately than conventional selection methods (Gutierrez-Reinoso et al., 2021; Chakraborty et al., 2022; Husien et al., 2024). According to Moghaddar et al. (2023), the application of PCR-based molecular markers in ruminant breeding programs can improve selection accuracy and accelerate genetic improvement within livestock populations.

CONCLUSION

The community service program through integrated training on animal health management, feed technology, reproductive technology, and goat and sheep breeding successfully enhanced farmers' knowledge and capacity to adopt improved livestock management technologies. The training approach, which combined lectures, interactive discussions, and practical demonstrations, proved effective in strengthening participants' understanding of animal health, feed formulation, reproductive management, and the application of Polymerase Chain Reaction (PCR) technology as an introduction to genetic selection. This increased capacity is expected not only to improve farmers' competencies but also to promote the adoption of more efficient, productive, and sustainable livestock management practices, thereby enhancing goat and sheep productivity and improving farmers' livelihoods.

As a follow-up, continuous extension and mentoring programs are required to ensure that the technologies introduced during the training are consistently implemented at the farm level. Future activities may include regular monitoring and evaluation, the establishment of farmer learning groups, advanced training on reproductive and molecular breeding technologies, and technical assistance in formulating feed based on locally available resources. Furthermore, collaboration among universities, local governments, and farmer groups should be continuously strengthened to facilitate sustainable technology transfer and generate tangible improvements in the productivity and competitiveness of goat and sheep farming enterprises.

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