



Empowering A Partner-Village Goat Farming Group Through Fermented Feed Innovation Using Local Agricultural Residues

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Abstract

Limited access to quality feed and underutilization of agricultural residues constrain smallholder goat farming. This community service program aimed to strengthen knowledge and practical skills among members of the Mendo Berkah Goat Farmers' Group in Kampung Emas, Krapyak IX, Margoagung Village, Seyegan, Sleman, Indonesia. A participatory approach integrated technical instruction, interactive discussions, demonstrations, hands-on fermented-feed preparation, mentoring, and evaluation. Sixteen farmers participated in activities using maize stalks, maize leaves, elephant grass, rice bran, molasses, EM4, and water. Attendance and practical completion both reached 100%, with all participants completing the documented preparation stages. All farmers answered five post-training knowledge questions correctly, yielding a mean converted score of 100 and a mastery rate of 100%. Satisfaction ratings averaged 5.00 out of 5.00 for training materials, practical activities, perceived benefits, and program organization. All participants also expressed willingness to join subsequent activities. The findings demonstrate favorable immediate knowledge-test performance, participation, and acceptance of the training approach. However, unavailable numerical baseline scores prevented estimation of knowledge gains, while feed quality, production costs, livestock performance, and sustained adoption were not measured. Follow-up mentoring and direct assessment of fermentation outcomes and independent farmer practice are needed to establish longer-term benefits and support sustainable local feeding practices.

Keywords: Community Empowerment, Community Service, Fermented Feed, Goat Farming, Local Agricultural Residues.



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INTRODUCTION

Smallholder goat farming contributes to rural livelihoods by providing productive assets, household income opportunities, and agricultural activities that can be integrated with local crop production. However, the sustainability of these enterprises is frequently constrained by fluctuations in forage availability, dependence on purchased feed, and limited access to affordable feed-processing technologies. Recent research on alternative feeding approaches for small ruminants has emphasized the potential of diversified feed resources to support more resource-efficient livestock production (Boudalia et al., 2024). Agricultural residues represent a potentially valuable feed resource because crop production generates biomass that may remain underutilized despite its possible contribution to livestock feeding systems. Community-based initiatives in Indonesia have examined agricultural waste fermentation as a means of improving the utilization of locally available materials and supporting the sustainability of smallholder livestock enterprises (Endrawati et al., 2025). Nevertheless, agricultural residues differ in their physical characteristics, nutritional composition, and suitability for fermentation, making appropriate processing essential before their incorporation into animal diets. Research on fermented high-moisture plant by-products has demonstrated the importance of fermentation characteristics and nutritional evaluation when considering agricultural residues for livestock feeding (Nkosi et al., 2024).

Fermented-feed innovation has received increasing scientific attention because biological processing offers opportunities to preserve agricultural materials and modify their characteristics for use in livestock diets. Research involving fermented rice straw combined with spent mushroom substrates has examined its application in dairy goat feeding, illustrating the potential use of agricultural by-products within productive feeding systems (Fan et al., 2022). Evidence concerning microbial

supplementation has also expanded understanding of the relationships among fermentation, rumen function, and animal performance, particularly through investigations involving *Saccharomyces cerevisiae* in growing goats (Ogbuewu & Mbajiorgu, 2023). Experimental research on fermented *Pennisetum giganteum* has further investigated growth performance, oxidative stress, immunity, and gastrointestinal microbial characteristics in Boer goats under thermal stress (Qiu et al., 2023). These studies collectively indicate that fermented feed should be evaluated through multiple dimensions, including substrate characteristics, microbial processes, nutritional suitability, and animal physiological responses. However, differences in fermentation substrates, processing methods, animal characteristics, and experimental conditions limit the direct transferability of their findings to smallholder production environments. The scientific development of fermented-feed technology consequently requires complementary attention to the practical conditions under which farmers can prepare, store, and utilize processed feed materials.

A distinction emerges between research establishing the technical potential of fermented feed and community-based research examining farmers' capacity to implement the technology. Investigations involving fermented agricultural residues and animal performance generally prioritize biological or nutritional outcomes, whereas implementation-oriented activities must also consider knowledge transfer, procedural competence, and the availability of local resources. Research on agricultural waste-based fermented feed for Etawa crossbred goats has addressed the relationship between alternative feed processing and animal weight gain, providing a production-oriented perspective on the application of locally derived feed materials (Marpaung & Simangunsong, 2025). Community engagement involving fermented *Tithonia* for dairy goat feeding has separately demonstrated the relevance of farmer-group participation in introducing feed innovations under local production conditions (Pazla et al., 2025). These approaches address complementary dimensions of technological development but do not necessarily employ comparable measures of farmers' knowledge, practical performance, or implementation readiness. The contextual research gap concerns the need to document how fermented-feed technology can be introduced through structured participatory activities using agricultural residues available to a specific partner-village farming group. Addressing this gap requires separating immediate educational and practical outcomes from longer-term changes in feed quality, production costs, and livestock productivity that cannot be established without additional measurements.

The practical significance of fermented-feed innovation becomes particularly evident in communities where livestock feeding depends heavily on fresh forage and agricultural resources that vary with seasonal production cycles. Such conditions were identified among members of the Mendo Berkah Goat Farmers' Group in Kampung Emas, Krapyak IX, Margoagung Village, Seyegan Subdistrict, Sleman Regency, where feeding practices relied primarily on fresh forage while commercial concentrates were used sparingly because of their cost. Local agricultural activities generated rice straw, maize stalks and leaves, and other crop residues that could potentially supplement existing feed resources when processed appropriately. Community-based silage production initiatives have highlighted the relevance of feed preservation activities to efforts aimed at strengthening livestock feed availability and farmer self-reliance (Sulastadi et al., 2025). Farmer capacity-building programs involving counseling and feed-fermentation training have also demonstrated the practical relevance of combining technical instruction with opportunities for participants to develop processing skills (Widiastuti et al., 2025). Without sufficient understanding of feedstock preparation, fermentation procedures, and storage requirements, farmers may encounter difficulties reproducing the technology independently, regardless of its potential nutritional value. These considerations justify an intervention focused on practical knowledge development and locally adaptable processing skills rather than assuming that the provision of technical information alone will generate sustained changes in feeding practices.

The proposed community engagement program positions fermented-feed innovation as both a livestock-feed processing activity and a participatory mechanism for strengthening the technical capacity of a partner-village farming group. Unlike studies primarily assessing animal performance under controlled feeding conditions, its immediate analytical focus concerns the transfer of processing knowledge, farmer participation, and practical engagement with locally available agricultural residues. Research on fermented agricultural waste utilization within a farmer group provides a relevant implementation precedent, while the present program specifically addresses the preparation of

alternative feed resources within the circumstances of the Mendo Berkah Goat Farmers' Group (Endrawati et al., 2025). Previous farmer-group activities involving fermented *Tithonia* also provide a comparative basis for considering how feed innovation can be introduced through organized community engagement rather than laboratory assessment alone (Pazla et al., 2025). The contribution proposed here lies in integrating local feed-resource identification, procedural instruction, practical demonstrations, hands-on participation, and mentoring within a single community-based intervention. Training programs designed to strengthen ruminant farmers' fermentation skills further support the relevance of practical learning as a distinct component of feed-technology implementation (Widiastuti et al., 2025). This positioning differentiates the program's intended educational and capacity-building contribution from claims of improved feed composition, reduced production expenditure, or increased goat productivity, which require separate empirical evaluation.

This community engagement program aimed to strengthen the knowledge and practical skills of the Mendo Berkah Goat Farmers' Group in Kampung Emas, Krapyak IX, through the introduction of fermented-feed technology utilizing locally available agricultural residues. The activities were designed to introduce relevant feed materials and provide practical understanding of their preparation, fermentation, handling, and potential utilization in smallholder goat feeding systems. Implementation involved technical instruction, demonstrations, hands-on practice, and mentoring to support participants' understanding of procedures that could be adapted to locally accessible resources. The immediate evaluation focused on participant involvement, performance on a post-training knowledge assessment, and satisfaction with the training activities. These indicators were intended to characterize educational participation and initial implementation responses rather than establish statistically verified improvements in livestock productivity or economic performance. The program's applied contribution concerns the integration of locally available agricultural materials with farmer-oriented technical learning and participatory feed-processing practices. Its findings are expected to provide a context-specific basis for assessing the initial implementation of fermented-feed training and identifying requirements for subsequent evaluation of feed quality, production efficiency, and sustained technology adoption.

RESEARCH METHODS

The community service program employed a participatory training and mentoring approach involving 16 members of the Mendo Berkah Goat Farmers' Group in Kampung Emas, Krapyak IX, Margoagung Village, Seyegan Subdistrict, Sleman Regency, Special Region of Yogyakarta, Indonesia. The intervention focused on strengthening farmers' knowledge and practical skills in processing locally available agricultural residues into fermented feed, with particular attention to the utilization of rice straw, maize stalks, leaves, and other accessible feed materials. The program followed five interconnected stages comprising identification of local needs and resources, technical training, continued mentoring, group-capacity strengthening, and evaluation and documentation, as illustrated in Figure 1. Initial needs identification involved direct observation and discussions with group members concerning feed availability, feeding constraints, and the potential utilization of agricultural by-products, consistent with community-based initiatives emphasizing the productive application of agricultural residues (Endrawati et al., 2025). Technical instruction addressed raw-material selection, fermentation starters, feed preparation, fermentation procedures, storage, and feeding practices, followed by demonstrations and hands-on activities involving chopping, mixing, compacting, and storing feed ingredients, with the instructional content informed by established considerations of fermentation quality and feed preservation (Kung et al., 2018). Continued mentoring supported participants in applying the procedures and addressing practical difficulties, while group-capacity activities introduced raw-material management, feed-production recording, and sustainable resource utilization, reflecting the capacity-building orientation of community-based feed-fermentation training (Widiastuti et al., 2025).



Figure 1. Participatory Stages of the Community Service Program

Program evaluation employed practical observation, group discussions, a post-training knowledge assessment, and a participant satisfaction questionnaire to document immediate educational outcomes and participants' responses to the activities. Practical observation focused on participants' involvement in feed preparation and fermentation procedures, while group discussions provided opportunities to identify implementation difficulties and clarify technical instructions, consistent with the participatory orientation of farmer-group feed innovation programs (Pazla et al., 2025). The knowledge assessment comprised five post-training questions addressing silage ingredients, the purposes and benefits of fermentation, the utilization of local agricultural residues, and the characteristics of suitable fermented feed, with these topics corresponding to established considerations in silage preparation and evaluation (McDonald et al., 1991). Participant satisfaction was assessed using a five-point Likert scale covering the relevance of training materials, practical activities, perceived benefits, and organizational implementation, providing descriptive information about participants' evaluations of the community engagement activities. Although the original evaluation framework included assessments before and after training, only post-training knowledge scores and satisfaction results were available for reporting, preventing calculation of individual knowledge gains or statistical comparisons with baseline performance. Evaluation findings were presented descriptively using the available assessment scores, satisfaction responses, practical observations, and discussion records, without inferential testing or claims concerning unmeasured changes in feed nutritional quality, production costs, or goat productivity, thereby maintaining a distinction between immediate training outcomes and longer-term livestock performance indicators discussed in fermented-feed research (Marpaung & Simangunsong, 2025).

RESULTS AND DISCUSSION

Implementation of Participatory Fermented-Feed Training and Farmer Engagement

The community service program was implemented at the Mendo Berkah Goat Farmers' Group livestock facilities in Kampung Emas, Krapyak IX, Margoagung Village, Seyegan Subdistrict, Sleman Regency, Special Region of Yogyakarta, Indonesia. The activities involved 16 group members and focused on strengthening their capacity to utilize locally available agricultural residues through fermented-feed processing. The intervention combined technical instruction, participatory discussions, practical demonstrations, and direct involvement in feed preparation, allowing farmers to engage with

the technology through structured learning activities. Community-based livestock development requires attention to the compatibility between introduced technologies and the productive resources available to farmers, particularly when feed availability represents a recurring operational constraint (Boudalia et al., 2024). The program addressed this relationship by positioning agricultural residues as potential feed resources rather than treating them exclusively as materials remaining after crop harvesting. Similar community initiatives have examined the use of agricultural waste fermentation to support more sustainable smallholder livestock management through locally accessible processing techniques (Endrawati et al., 2025). The implementation framework consequently emphasized practical participation and the development of processing capabilities, while reserving claims concerning nutritional improvement and livestock productivity for assessments supported by appropriate measurements.

Initial activities focused on identifying existing feeding practices, locally available agricultural materials, and practical difficulties affecting feed provision among group members. Observations and discussions indicated that farmers primarily depended on fresh forage, while the use of commercial concentrates was constrained by purchasing costs. Agricultural activities around the partner village generated materials such as maize stalks, maize leaves, and rice straw that could potentially be incorporated into alternative feed-processing arrangements. The identification of these materials was relevant because agricultural by-products differ in their nutritional characteristics and may require specific treatment before being incorporated into animal diets (Fanelli et al., 2023). Studies of agricultural-residue utilization for Etawa crossbred goats have likewise addressed the potential contribution of locally derived feed resources to alternative livestock-feeding arrangements (Ridwan, 2025). These observations established the practical basis for introducing fermentation techniques that could be undertaken using materials familiar to participants and accessible within their agricultural environment.

The participatory training activities integrated extension instruction, interactive discussion, technical demonstrations, and direct preparation of fermented-feed materials. Technical explanations addressed the principles of fermentation, selection of agricultural residues, preparation of supporting ingredients, and procedures for maintaining suitable storage conditions. Participants were encouraged to relate the information to their existing feeding practices and to discuss difficulties associated with seasonal forage availability and the preparation of alternative feed. Community-based training involving fermented-feed technology has demonstrated the relevance of practical instruction and farmer participation to the introduction of alternative feeding practices (Sulastiadi et al., 2025). Comparable capacity-building activities for ruminant farmers have incorporated counseling and fermentation training as mechanisms for strengthening technical knowledge and practical processing skills (Widiastuti et al., 2025). The combination of explanation and direct participation enabled farmers to observe the processing stages while receiving clarification concerning procedures and material handling. Figure 2 documents the community engagement activities and the involvement of members of the Mendo Berkah Goat Farmers' Group during implementation.



Figure 2. Community Service Activities With the Mendo Berkah Goat Farmers' Group

The practical demonstration utilized maize stalks, maize leaves, and elephant grass as the principal feed materials, with rice bran, molasses, EM4, and water incorporated as supporting

ingredients. These materials were selected for the training activities to demonstrate the preparation of fermented feed using agricultural resources and fermentation inputs available for practical application. Participants received technical guidance concerning the preparation and combination of ingredients before undertaking the processing procedures. The suitability of forage and agricultural by-products for ensiling depends on substrate characteristics, moisture conditions, and the availability of fermentable components that support appropriate preservation processes (Nkosi et al., 2024). Experimental research involving corn straw and cassava leaves has also examined how differences in material composition relate to the physical characteristics and fermentation indicators of silage (Juliantoni et al., 2026). The training therefore treated raw-material preparation and ingredient handling as essential procedural elements without assuming that the resulting product had achieved a particular nutritional composition or fermentation quality.

During the practical session, participants were involved in chopping feed materials, combining the prepared ingredients, compacting the mixture, and storing it for fermentation. The sequence of activities was intended to introduce the operational stages required to convert agricultural residues into materials suitable for subsequent evaluation as fermented feed. Chopping and mixing provided opportunities to discuss material preparation and the distribution of supporting ingredients throughout the mixture, while compaction introduced the importance of limiting air exposure during storage. Established silage research identifies substrate composition, fermentation conditions, and microbial characteristics as important considerations when interpreting preservation quality (Kung et al., 2018). The biological basis of silage preparation also indicates that the preservation process is influenced by interactions among feed materials, microbial activity, and conditions within the storage environment (McDonald et al., 1991). Participants completed the practical activities under the guidance provided during the program, allowing the processing sequence to be demonstrated through direct involvement rather than through verbal explanation alone. Nevertheless, completion of the preparation stages should be distinguished from confirmation of successful fermentation because the reported evaluation did not include laboratory measurements of the produced feed.

Participation records indicated that all 16 members of the Mendo Berkah Goat Farmers' Group attended the community service activities, corresponding to an attendance rate of 100%. All 16 participants also completed the practical training session, demonstrating full participation in the documented processing activities. The attendance and practical completion results provide evidence of participant engagement during the implementation period, although they do not independently establish subsequent technology adoption. Research on farmer-group engagement involving fermented *Tithonia* has illustrated the relevance of organized practical activities to the introduction of alternative feed-processing innovations (Pazla et al., 2025). Community empowerment initiatives involving fermentation of locally available plant materials similarly emphasize practical participation as a component of developing alternative livestock-feed capabilities (Radiyah et al., 2026). The principal implementation outcomes, including attendance, practical completion, knowledge assessment, participant satisfaction, and willingness to participate in subsequent activities, are presented in Table 1.

Table 1. Evaluation Outcomes of the Community Service Program

Evaluation Component	Result
Number of participants	16 farmers
Attendance rate	100%
Completion of the practical session	16 farmers (100%)
Mean knowledge-test score	100
Knowledge-test mastery rate	100%
Mean rating of training materials	5.00 (100%)
Mean rating of practical training	5.00 (100%)
Mean rating of perceived benefits	5.00 (100%)
Mean participant satisfaction	5.00 (100%)
Willingness to attend follow-up activities	16 farmers (100%)

Source: Primary data from the community service program, 2025

The evaluation results in Table 1 indicate that full attendance and practical completion were accompanied by a reported mean knowledge-test score of 100 and a knowledge-test mastery rate of 100%. Participants also assigned the highest reported mean rating of 5.00 to the evaluated training dimensions, while all 16 expressed willingness to attend subsequent activities. These findings describe immediate participation, post-training assessment performance, and favorable perceptions of the program rather than verified changes in production efficiency or livestock outcomes. Community-based fermented-feed initiatives have emphasized the relationship between practical training and farmers' capacity to process locally available agricultural materials, providing a relevant comparison for interpreting the implementation approach (Welerubun, 2026). Research concerning agricultural-residue fermentation in livestock groups has also highlighted the importance of technical assistance in facilitating the practical utilization of materials that might otherwise remain underused (Endrawati et al., 2025). However, the absence of documented baseline knowledge scores prevents calculation of individual learning gains, while the lack of subsequent monitoring limits conclusions concerning independent implementation after training. The findings support an interpretation of successful immediate program participation and completion of introductory technical activities, with longer-term effectiveness remaining dependent on additional observation and evaluation.

The implementation experience highlights the practical relationship between farmer engagement, material accessibility, and the introduction of fermented-feed processing within smallholder livestock systems. Direct participation allowed group members to encounter the procedures involved in preparing agricultural residues while discussing their potential relevance to recurring feed-supply constraints. The use of locally available materials may provide an operational basis for future feed-resource management, although the economic and nutritional benefits of the prepared feed were not measured during the reported program. Studies involving treated agricultural by-products in goat diets demonstrate that improvements in animal feeding outcomes require specific assessment of feed characteristics, ruminal responses, and livestock performance rather than inference from processing activities alone (Saphaphan et al., 2025). Research on fermented forage supplementation has likewise examined physiological and production-related responses in goats, indicating that the biological implications of fermented feed constitute a separate level of investigation from farmer training outcomes (Qiu et al., 2023). The reported participation and evaluation results provide a basis for considering the training process acceptable to the participating group, but they do not demonstrate sustained application or measurable changes in feeding expenditure. Further technical assistance and follow-up assessment would be required to establish whether the group can independently reproduce the procedures, maintain suitable feed-processing conditions, and incorporate the resulting materials into routine goat-management practices.

Post-Training Knowledge Assessment and Practical Learning Outcomes

The post-training knowledge assessment was conducted to document participants' understanding of the fundamental principles and procedures introduced during the fermented-feed training program. The assessment involved all 16 members of the Mendo Berkah Goat Farmers' Group and consisted of five questions addressing the identification of silage ingredients, the purposes of fermentation, its potential benefits, the utilization of agricultural residues, and the characteristics of suitable fermented feed. These assessment components reflected the instructional content delivered through technical explanations, interactive discussions, and practical demonstrations. Knowledge concerning feed preservation is particularly relevant because fermentation outcomes depend on interactions among substrate characteristics, microbial activity, and environmental conditions during storage (Kung et al., 2018). Research examining the ensiling of plant by-products has also emphasized the importance of understanding fermentation characteristics when evaluating materials intended for livestock feeding (Nkosi et al., 2024). The assessment therefore concentrated on introductory technical knowledge directly associated with the procedures practiced during the program, rather than attempting to measure advanced nutritional analysis or animal-performance outcomes.

Understanding the characteristics of raw materials constitutes an essential component of fermented-feed preparation because agricultural residues differ in moisture content, physical structure, and nutritional composition. During the training, participants were introduced to maize stalks, maize leaves, and elephant grass as principal materials, together with rice bran, molasses, EM4, and water as supporting ingredients. The knowledge assessment examined whether participants could identify

relevant silage materials and explain the basic purposes of fermentation in preserving feed resources. Studies investigating agricultural by-products have demonstrated that their nutritional characteristics differ according to the original plant material and processing conditions, making feedstock identification important for subsequent feed formulation (Fanelli et al., 2023). Research involving fermented rice straw and spent mushroom substrates has also examined the incorporation of processed agricultural materials into dairy goat feeding systems, indicating the practical relevance of residue-based feed development (Fan et al., 2022). These findings provide a scientific basis for the instructional emphasis on material identification, although the present assessment did not measure participants' ability to formulate nutritionally balanced diets. The training consequently addressed the foundational understanding required for processing locally available materials without treating correct questionnaire responses as evidence of comprehensive feed-formulation competence.

The assessment also addressed participants' understanding of agricultural-residue utilization and the characteristics associated with suitable fermented feed. These topics were relevant to the partner group's existing dependence on fresh forage and the availability of crop residues within its agricultural environment. Training discussions connected the processing procedures with potential opportunities to preserve feed materials that might otherwise remain underutilized after harvesting. Research concerning fermented agricultural waste for Etawa crossbred goats provides a related example of efforts to develop alternative feed resources from locally available materials (Marpaung & Simangunsong, 2025). Experimental studies of fermented forage in Boer goats have also examined physiological and production-related responses, demonstrating that the biological implications of processed feed require evaluation beyond the preparation stage (Qiu et al., 2023). The inclusion of these topics in the knowledge assessment was intended to establish whether participants understood the introductory relationship between local feed resources, fermentation procedures, and the intended application of processed materials.

The recorded post-training assessment results indicated that all 16 participants answered the five questions correctly, producing a mean raw score of 5.00 out of a maximum possible score of 5. The corresponding mean converted score was 100, while the highest and lowest recorded converted scores were both 100. These results demonstrate complete attainment of the administered assessment items among the participating farmers at the time of evaluation. The absence of variation in the reported scores indicates that the instrument did not distinguish different levels of performance within the group during the final assessment. Previous community-based initiatives involving agricultural-residue fermentation have emphasized practical knowledge development as an important component of introducing alternative livestock-feed technologies (Endrawati et al., 2025). Capacity-building activities involving ruminant farmers have similarly incorporated technical instruction and practical fermentation training to support the introduction of feed-processing procedures (Widiastuti et al., 2025). Table 2 presents the recorded assessment characteristics and results without introducing additional measurements or comparisons not documented in the original evaluation.

Table 2. Post-Training Knowledge-Test Results

Assessment Item	Result
Number of respondents	16 farmers
Number of questions	5
Maximum raw score	5
Mean raw score	5.00
Mean converted score	100
Highest converted score	100
Lowest converted score	100

Source: Primary data from the community service program, 2025

The findings presented in Table 2 establish that participants demonstrated correct responses to the five introductory knowledge questions administered after training. The mean score of 100 indicates complete achievement on this particular assessment, but its interpretation must remain restricted to the knowledge domains represented by the questions. The instrument addressed fundamental concepts of fermentation and local feed-resource utilization rather than independently measuring the quality of

fermented feed produced during the practical activities. Research on silage characteristics demonstrates that fermentation quality involves chemical, microbial, and physical attributes that require appropriate evaluation methods beyond questionnaire-based knowledge assessment (Kung et al., 2018). Studies investigating fermentation characteristics and nutritional values of ensiled materials likewise distinguish the biological properties of processed feed from procedural understanding of the ensiling process (Tarekegn et al., 2024). The reported assessment results consequently indicate mastery of the administered questions without establishing that participants could independently produce nutritionally adequate or consistently preserved feed under different operational conditions.

Practical learning represented an important component of the training because participants were exposed to the processing procedures while engaging directly with materials available within their agricultural environment. The activities required farmers to observe and undertake ingredient preparation, chopping, mixing, compaction, and storage, allowing conceptual information to be associated with specific operational tasks. This combination provided opportunities for participants to identify practical difficulties and seek clarification during implementation, rather than relying exclusively on written or verbal instructions. Community training involving locally available feed materials has highlighted the relevance of practical demonstrations to introducing alternative feeding procedures among livestock producers (Welerubun, 2026). Farmer-group initiatives concerning fermented *Tithonia* have also demonstrated the applicability of organized community engagement to feed-processing innovations in smallholder production settings (Pazla et al., 2025). However, the available records do not provide individual competency scores for each processing stage, preventing a quantitative assessment of differences in participants' practical performance. The documented completion of the practical session should therefore be interpreted as evidence of participation in the required activities rather than verified independent proficiency in fermented-feed production.

The educational outcomes can be considered alongside previous community engagement programs that have employed extension activities, technical demonstrations, and participatory learning to introduce feed-processing technology. Research concerning silage production in Keteleng Village has examined community-based activities intended to improve feed availability and strengthen livestock farmers' capacity to manage local feed resources (Sulastiadi et al., 2025). Similarly, fermented-feed extension activities in Kalijaga Village have addressed the introduction of fermentation technology as a practical alternative for ruminant farmers (Sofieyudin, 2024). These initiatives illustrate the relevance of technical communication and direct practice in community-based livestock development, although their evaluation approaches and reported outcomes are not necessarily equivalent. The Mendo Berkah program provides a more specific account of final knowledge-test performance by reporting the number of participants, assessment items, and converted scores. Nevertheless, differences in instruments, participant characteristics, and implementation conditions prevent direct comparisons of educational effectiveness across the respective programs. The principal contribution of the present assessment lies in documenting immediate knowledge attainment within a clearly identified partner group using questions directly related to the delivered training materials.

Several methodological considerations limit the interpretation of the post-training knowledge results despite the uniform maximum scores recorded among participants. Although the evaluation framework included assessment before and after training, comparable numerical baseline scores were unavailable, preventing calculation of individual knowledge gains or changes attributable to the intervention. The five-question assessment also represented a limited range of introductory content and did not provide evidence concerning long-term knowledge retention or independent technical application after program completion. Research investigating microbial supplementation and goat performance illustrates that fermentation-related technologies involve biological processes and outcomes that extend beyond farmers' immediate conceptual understanding (Ogbuewu & Mbajorgu, 2023). Evaluations of alternative feeding approaches for small ruminants likewise demonstrate the breadth of nutritional and management considerations relevant to implementing new feeding practices (Boudalia et al., 2024). A subsequent assessment could examine retained knowledge, independently performed processing procedures, and the characteristics of fermented materials using appropriately documented measurement methods. The available evidence supports the conclusion that participants achieved the maximum scores on the administered post-training questions, while the magnitude and durability of learning attributable to the program remain undetermined.

Participant Satisfaction, Farmer Empowerment, and Sustainability Implications

Participant satisfaction was evaluated to examine farmers' responses to the relevance, accessibility, and implementation of the fermented-feed training program. The evaluation involved 16 members of the Mendo Berkah Goat Farmers' Group and employed a five-point Likert scale covering training materials, practical activities, perceived benefits, and program organization. These dimensions were intended to capture participants' immediate assessments of the educational activities rather than determine the economic or biological effectiveness of the resulting fermented feed. Community-based livestock development programs have emphasized the importance of aligning technical assistance with farmers' operational needs and locally available resources (Endrawati et al., 2025). Capacity-building activities involving feed fermentation have also demonstrated the relevance of instructional accessibility and practical participation when introducing processing technologies to ruminant farmers (Widiastuti et al., 2025). The satisfaction assessment consequently provided information about participants' acceptance of the training arrangements and their perceptions of the usefulness of the introduced procedures. However, favorable evaluations should be distinguished from independently measured improvements in knowledge retention, production efficiency, or sustained adoption of fermented-feed technology.

The evaluation results indicated that participants assigned a mean rating of 5.00 to the training materials, corresponding to the highest category on the administered satisfaction scale. This finding reflects participants' favorable perceptions of the explanations concerning fermentation principles, agricultural-residue utilization, and feed preparation procedures. The practical training component also received a mean rating of 5.00, indicating similarly positive responses to the opportunities for direct participation in feed-processing activities. Previous community engagement activities involving fermentation technology have highlighted the relevance of combining technical explanations with practical instruction for farmers managing alternative feed resources (Sofieyudin, 2024). Farmer-group training involving fermented *Tithonia* has likewise provided an example of introducing feed innovation through organized community activities directed toward dairy goat production (Pazla et al., 2025). The results suggest that participants considered both the instructional content and practical arrangements acceptable, although the evaluation did not independently measure differences in technical proficiency before and after training.

Perceived benefits constituted another evaluation dimension because the program sought to introduce an alternative approach to managing locally available agricultural materials. Participants assigned this dimension a mean rating of 5.00, reflecting favorable assessments of the potential usefulness of fermented-feed processing for their livestock activities. Discussions during implementation indicated that farmers associated the introduced procedures with opportunities to address seasonal forage limitations and utilize agricultural residues that might otherwise remain underused. Research examining alternative feeding strategies for small ruminants has identified diversified feed resources as a relevant consideration in livestock nutritional management (Boudalia et al., 2024). Studies investigating the ensiling of plant by-products have also examined their fermentation characteristics and potential nutritional applications, providing a technical basis for considering agricultural residues as alternative feed resources (Nkosi et al., 2024). Nevertheless, participants' perceptions of potential benefits cannot establish reductions in feeding expenditure, improvements in feed nutritional value, or increases in goat productivity without corresponding measurements. The reported results are therefore interpreted as indicators of perceived practical relevance rather than evidence of verified economic or production-related improvements.

Program organization received a mean satisfaction rating of 5.00, while the reported overall mean across the evaluated dimensions was also 5.00. These results indicate consistently favorable participant responses to the organization and implementation of the community service activities. The evaluations also reflected positive responses to activity timing, opportunities for discussion, and the perceived usefulness of practical feed preparation. Community empowerment initiatives involving fermented agricultural materials have emphasized the relevance of participatory activities in strengthening livestock farmers' engagement with alternative feeding technologies (Radiyatunnisah et al., 2026). Research concerning capacity development through local feed-processing activities similarly supports the importance of accessible training arrangements and practical engagement in community-based livestock programs (Welerubun, 2026). The satisfaction results are summarized in Table 3, which preserves the recorded mean ratings and assessment categories for each evaluation dimension.

Table 3. Participant Satisfaction With the Community Service Program

Evaluation Aspect	Mean Rating	Category
Training materials	5.00	Very good
Fermented-feed practical training	5.00	Very good
Perceived benefits	5.00	Very good
Program organization	5.00	Very good
Overall mean	5.00	Very good

Source: Primary data from the community service program, 2025

The uniform ratings presented in Table 3 indicate that participants evaluated every recorded dimension of the training program within the highest satisfaction category. The absence of variation among the reported mean ratings suggests consistently favorable responses, although it does not establish that the different components contributed equally to participants' learning or subsequent behavior. High satisfaction may reflect the relevance of the training topic, the accessibility of the instructional procedures, and participants' positive experiences during practical activities. Community-based silage initiatives have emphasized the relationship between practical training and efforts to strengthen farmers' management of locally available feed resources (Sulastiadi et al., 2025). Research concerning farmer training in fermented-feed preparation has also identified technical guidance and participatory learning as relevant components of introducing livestock-feeding innovations (Widiastuti et al., 2025). Nevertheless, the reported mean ratings do not provide sufficient information to evaluate individual response variation or establish the reliability of the satisfaction instrument. The findings support a conclusion of favorable immediate participant acceptance while leaving the relationship between satisfaction, independent technology application, and sustained behavioral change unresolved.

All 16 participants expressed willingness to attend subsequent community engagement activities, representing 100% of the participating farmer group. This response indicates interest in continued learning opportunities related to livestock management and the development of alternative feed-processing practices. The expressed willingness is relevant to the program's empowerment objectives because continued participation may provide opportunities to reinforce technical knowledge and address difficulties encountered during independent application. Community-based fermentation training in Indonesian livestock groups has demonstrated the practical relevance of continued guidance when introducing alternative feed-processing technologies (Pazla et al., 2025). Similar initiatives emphasizing agricultural-residue processing have connected technical assistance with efforts to strengthen the capacity of smallholder farmers to manage available resources (Endrawati et al., 2025). However, willingness to participate in future activities represents a stated intention rather than documented attendance at subsequent training or evidence of sustained technology adoption.

The potential contribution of fermented-feed innovation to farmer empowerment depends on whether participants can independently reproduce processing procedures and integrate suitable feed materials into routine livestock management. The training introduced locally available agricultural residues as possible alternatives or supplements to existing feeding arrangements, providing a basis for considering more systematic feed-resource utilization. Research involving agricultural waste-based fermented feed for Etawa crossbred goats has examined production-related applications, indicating that processed agricultural materials may warrant further investigation within smallholder feeding systems (Marpaung & Simangunsong, 2025). Experimental studies involving treated rice straw in goat diets have similarly examined relationships among feed processing, ruminal function, and animal growth, demonstrating the relevance of nutritional evaluation before drawing conclusions about livestock performance (Saphaphan et al., 2025). These findings provide scientific justification for investigating the subsequent use of fermented feed, but they cannot be treated as direct evidence of production improvements among the Mendo Berkah participants. Farmer independence would require not only procedural knowledge but also access to suitable materials, appropriate storage conditions, consistent preparation practices, and the capacity to evaluate feed suitability. The program's immediate contribution is therefore better characterized as an initial strengthening of practical learning and participation than as demonstrated achievement of feed self-sufficiency or measurable increases in livestock productivity.

Several limitations should be considered when interpreting the reported satisfaction and empowerment outcomes. The evaluation involved a single group of 16 farmers, restricting the extent to which the findings can be generalized to livestock communities with different production conditions and resource availability. Although the post-training knowledge assessment and satisfaction questionnaire produced favorable results, the absence of comparable numerical baseline data prevents estimation of changes in participants' knowledge attributable to the intervention. No laboratory analysis of fermentation quality, nutritional composition, or feed safety was reported, despite the importance of these characteristics in evaluating ensiled materials (Kung et al., 2018). Measurements of feed-production costs, independent technology adoption, and goat performance were also unavailable, preventing conclusions concerning economic efficiency or biological productivity. Future activities should document farmers' independent application of processing procedures, assess the physical and nutritional characteristics of fermented materials, and examine production-related outcomes through appropriate follow-up measurements. The available findings establish full participation, maximum recorded post-training knowledge scores, favorable satisfaction ratings, and stated interest in continued activities, providing a documented starting point for evaluating the longer-term implementation of fermented-feed innovation within the partner-village farming group.

CONCLUSION

The fermented-feed community service program engaged all 16 members of the Mendo Berkah Goat Farmers' Group in participatory learning and practical activities utilizing locally available maize stalks, maize leaves, elephant grass, and supporting fermentation ingredients. All participants attended the training and completed the practical session, resulting in attendance and practical completion rates of 100%. The post-training knowledge assessment showed that all participants answered the five questions correctly, producing a mean converted score of 100 and a knowledge mastery rate of 100%. Participant satisfaction reached a mean rating of 5.00 across all evaluated dimensions, including training materials, practical activities, perceived benefits, and program organization. All 16 participants also expressed willingness to participate in subsequent activities, indicating favorable acceptance of the training and interest in continued technical learning. These findings establish the program's immediate educational relevance and demonstrate the feasibility of introducing agricultural-residue fermentation through participatory activities within the partner-village farming group. Nevertheless, the reported outcomes do not establish improvements in feed nutritional quality, production costs, or goat productivity because these indicators were not measured during program implementation.

The program contributes to community-based livestock development by integrating local agricultural-residue utilization, technical instruction, practical demonstrations, and mentoring into a participatory farmer-capacity-building approach. Its practical contribution lies in introducing feed-processing procedures that may help farmers utilize locally available agricultural materials and develop alternative strategies for managing seasonal forage limitations. However, the absence of comparable numerical baseline knowledge scores prevents quantification of learning improvements attributable to the intervention, while the single-group implementation limits the generalizability of the findings. The lack of laboratory feed-quality measurements and longitudinal monitoring also restricts conclusions concerning fermentation effectiveness, sustained technology adoption, and improvements in livestock-production efficiency. Continued mentoring should prioritize independent feed preparation, appropriate fermentation and storage procedures, systematic production documentation, and monitoring of farmers' capacity to reproduce the introduced technology. Future research should incorporate assessments of fermented-feed nutritional composition and safety, feed-production expenditure, goat performance, and longer-term adoption patterns to determine the biological and economic consequences of agricultural-residue processing. Such evaluations would provide a stronger empirical foundation for assessing whether participatory fermented-feed innovation can contribute to sustainable feed management, improved resource utilization, and greater operational self-reliance among smallholder goat farmers.

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