

Training and Mentoring on Corn Pulp Silage Fermentation for Livestock Farmers in Sambangrejo Village

Ahmad Yani Syaikhudin¹, Muhammad Hafidh Nasrullah²
Putri Avnita Mahfudzoh³, Justin Agusti Wijaya⁴, Nuke Sabelaroyani⁵,
Achmad Nuril Anwar⁶, Ariefah Sundari^{7*}
^{1,2,3,4,5,6,7}Darul Ulum Islamic University, East Java, Indonesia

Article Info

Article history:

Received Agust 11, 2026

Revised Agust 25, 2026

Accepted Oct 25, 2026

Keywords:

feed fermentation;
corn pulp silage;
livestock farmers;
livestock productivity.

Abstract

This community service program aimed to enhance the capacity of livestock farmers through training and mentoring on corn pulp silage fermentation as an alternative feed technology to improve feed availability and livestock productivity in Sambangrejo Village, Lamongan Regency. A participatory community empowerment approach was employed involving 20 livestock farmers. The program consisted of needs assessment, training sessions, hands-on demonstrations, and mentoring activities. Data were collected through observations, interviews, participant evaluations, and documentation, and analyzed using descriptive methods. The program improved farmers' knowledge and practical skills in producing fermented feed from locally available corn pulp. Participants successfully adopted the fermentation technique and utilized agricultural by-products more efficiently. The intervention increased fermented feed production by approximately 25–50% and improved feed reserves for livestock management. Positive participant responses indicate that the technology is feasible, affordable, and relevant to local farming conditions. The integration of training and mentoring effectively supported technology adoption and strengthened farmers' capacity for sustainable livestock development.

This is an open-access article under the [CC BY-SA](#) license.



Corresponding Author:

Ariefah Sundari

Darul Ulum Islamic University, East Java, Indonesia

E-mail: ariefah.sundari@unisda.ac.id

A. Introduction

Livestock farming continues to play an important role in supporting rural livelihoods in Indonesia. For many households, livestock function not only as a source of income but also as a productive asset that provides economic security during periods of uncertainty.

The sustainability of livestock production, however, is closely linked to feed availability. Feed commonly represents the largest component of production costs and directly affects animal growth, health, and productivity¹. When feed resources become scarce or expensive, smallholder farmers often face difficulties maintaining production performance.

This challenge remains evident in many agricultural areas, including Lamongan Regency, East Java. Most small-scale livestock farmers still depend on fresh forage as the primary feed source. During the dry season, forage availability tends to decline, while the demand for feed remains constant. As a result, farmers frequently experience fluctuations in feed supply that affect livestock performance and farm profitability. Similar conditions have been reported in several developing countries where feed insecurity remains one of the major constraints to livestock development.²

Sambangrejo Village, located in Modo District, possesses considerable agricultural potential, particularly in corn production. Corn cultivation generates substantial quantities of agricultural residues and by-products. One of these by-products is corn pulp, locally known as slamper. Despite its abundance, this material is generally underutilized and often regarded as agricultural waste. At the same time, livestock farmers continue to face challenges in securing sufficient feed resources throughout the year. This situation illustrates a clear gap between available local resources and their practical utilization for livestock production.

The concept of sustainable agriculture encourages the efficient utilization of local resources to reduce production costs while minimizing environmental impacts. Agricultural by-products have increasingly gained attention as alternative feed resources due to their availability and economic value.³ Previous studies have shown that crop residues can contribute significantly to livestock feeding systems when processed

¹ Tulu, Diriba, Sintayehu Gadissa, Fikadu Hundessa, Ketema Feyisa, Emesha Kebede, dan Gemechu Erana. "Contribution of Climate-Smart Forage and Fodder Production for Sustainable Livestock Production and Environment: Lessons and Challenges from Ethiopia." *Advances in Agriculture* 2023 (2023): Article 8067776. <https://doi.org/10.1155/2023/8067776>.

² Alimi, Nazirou, Alassan S. Assani, Hilaire S. S. Worogo, Mohamed N. Baco, dan Ibrahim A. Traoré. "Livestock Feed Resources Used as Alternatives during Feed Shortages and Their Impact on the Environment and Ruminant Performance in West Africa: A Systematic Review." *Frontiers in Veterinary Science* 11 (2024): Article 1352235. <https://doi.org/10.3389/fvets.2024.1352235>.

³ Shah, Ali Mujtaba, Huiling Zhang, Muhammad Shahid, Huma Ghazal, Ali Raza Shah, Mujahid Niaz, Tehmina Naz, Keshav Ghimire, Naqash Goswami, Wei Shi, dan rekan-rekan. "The Vital Roles of Agricultural Crop Residues and Agro-Industrial By-Products to Support Sustainable Livestock Productivity in Subtropical Regions." *Animals* 15, no. 8 (2025): 1184. <https://doi.org/10.3390/ani15081184>.

appropriately.⁴ Through suitable treatment methods, low-value agricultural waste can be transformed into productive feed materials capable of supporting animal performance.

One of the most practical approaches is feed fermentation. Fermentation is a biological process involving beneficial microorganisms that modify feed characteristics and improve storage stability. Fermented feed generally has a longer shelf life, reduced spoilage risk, and greater feeding flexibility than fresh forage.⁵ Research has demonstrated that fermentation can improve feed palatability, preserve nutrients, and enhance feed utilization efficiency in ruminant production systems.^{6 ; 7}

Silage technology has become one of the most widely adopted fermentation methods in livestock production. The process creates anaerobic conditions that support lactic acid bacteria growth and preserve feed quality for extended periods. Properly produced silage can help farmers overcome seasonal feed shortages while maintaining nutrient availability.⁸ In corn-producing areas, silage production offers a practical opportunity to convert agricultural residues into valuable livestock feed resources.

Several studies have highlighted the potential of corn-based residues as feed ingredients. Corn by-products contain fiber and energy components that can be utilized by ruminants after appropriate processing.⁹ Research by¹⁰ found that fermented agricultural residues improved feed efficiency and reduced feed waste in smallholder livestock systems.

⁴ Kurnia, Kadek Ayu, dan Silvia Grossi. "Evaluation of Agricultural Waste Utilization As Alternative Feed to Improve Beef Cattle Productivity." *Journal of Animal Husbandry* 2, no. 1 (2026): 1-9. <https://doi.org/10.70716/joah.v2i1.250>.

⁵ Kung, Limin, Jr., R. D. Shaver, R. J. Grant, dan R. J. Schmidt. "Silage Review: Interpretation of Chemical, Microbial, and Organoleptic Components of Silages." *Journal of Dairy Science* 101, no. 5 (May 2018): 4020-4033. <https://doi.org/10.3168/jds.2017-13909>.

⁶ Borreani, G., E. Tabacco, R. J. Schmidt, B. J. Holmes, dan R. E. Muck. "Silage Review: Factors Affecting Dry Matter and Quality Losses in Silages." *Journal of Dairy Science* 101, no. 5 (May 2018): 3952-3979. <https://doi.org/10.3168/jds.2017-13837>

⁷ Daniel, J. L. P., J. M. Bragatto, dan M. G. M. Carvalho. "Advances in Silage Science: From Fundamentals to Future Applications – Optimizing Silage Production in Tropical Climates." *Journal of Dairy Science* (2026) <https://doi.org/10.3168/jds.2026-28813>

⁸ Borreani dkk., "Silage Review," 3952-3979.

⁹ Mafefa, Nitty Cendrabagusti, dan Adyanto Nussy Banamtuan. "Agricultural Waste Processing Technologies (Silage and Ammoniation) for Ruminant Feed in Drylands: Literature Review." *Journal of Tropical Animal Science and Technology* 8, no. 1 (2026): 49-55. <https://doi.org/10.32938/jtast.v8i1.10645>.

¹⁰ Li, Yubo, Ruifang Zhang, Chi Zhang, Qingyun Li, Lanchun Nie, Can Wang, dan Xin-Xin Wang. "Unlocking the Resource Potential of Agricultural Waste: A Systemic Transition from Linear Disposal to Circular Resources." *Environmental Technology & Innovation* 43 (September 2026): 105116. <https://doi.org/10.1016/j.eti.2026.105116>

Similar findings were reported by,¹¹ who observed that silage technology contributed to more stable feed availability and improved livestock management practices.

Despite these advantages, the adoption of feed fermentation technology among smallholder farmers remains limited. The challenge is often not the absence of technology itself but the limited capacity of farmers to understand and apply it. Human resource development therefore becomes a critical factor in successful technology adoption. According to capacity-building theory, sustainable community development depends on strengthening knowledge, skills, and the ability of community members to utilize available resources effectively. Farmers who receive practical training and continuous assistance are generally more confident in adopting new technologies than those who receive information alone.¹²

Training serves as an important mechanism for transferring knowledge, while mentoring facilitates the application of knowledge into routine practice. Community empowerment programs that combine both approaches tend to produce more sustainable outcomes because participants gain direct experience during implementation.¹³ In livestock development programs, hands-on learning has been shown to improve farmers' technical competence and increase the likelihood of technology adoption.¹⁴

A review of previous studies indicates that most research has focused on the nutritional quality of silage, fermentation performance, and livestock productivity outcomes.¹⁵ , ¹⁶ Community service activities involving feed fermentation have also been reported in several regions. However, studies that specifically integrate local corn pulp

¹¹ Dejene, M., Kehaliew, A., Feyissa, F., Kebede, G., Kitaw, G., Terefe, G., Walelegne, M., Mekonnen, B., Biratu, K., & Geleti, D. (2024). Enhancing Production, Nutritional Qualities and Utilization of Fibrous Crop Residues in Smallholder Crop-Livestock Systems: Potential Intervention Options and Progress toward Sustainable Livestock Production. In *Veterinary Medicine and Science*. IntechOpen. <https://doi.org/10.5772/intechopen.1006058>

¹² Njuki, Jemimah, Sarah Eissler, Hazel Malapit, Ruth Meinzen-Dick, Elizabeth Bryan, dan Agnes Quisumbing. "A Review of Evidence on Gender Equality, Women's Empowerment, and Food Systems." *Global Food Security* 33 (2022): Article 100622. <https://doi.org/10.1016/j.gfs.2022.100622>.

¹³ Sjakir, Muhammad, Abd Hair Awang, Abdul Manaf Azima, Mohd Yusuf Hussain, dan Ramli Zaimah. "Learning and Technology Adoption Impacts on Farmer's Productivity." *Mediterranean Journal of Social Sciences* 6, no. 4s3 (2015): 126. <https://doi.org/10.5901/mjss.2015.v6n4s3p126>.

¹⁴ Tiambo, Christian K., Olubunmi Opoola, Moses Okpeku, Isidore Houaga, Blasius A. H. Touko, dan Tadelle Dessie. "Capacity Building in Livestock Breeding and Genetic Improvement in Achieving UN Sustainable Development Goals for Africa." Dalam *African Livestock Genetic Resources and Sustainable Breeding Strategies: Unlocking a Treasure Trove and Guide for Improved Productivity*, diedit oleh Eveline M. Ibeagha-Awemu, Samuel O. Peters, Appolinaire Djikeng, dan John E. O. Rege, 1123-1148. Cham, Swiss: Springer, 2025. <https://hdl.handle.net/10568/177534>

¹⁵ Borreani dkk., "Silage Review," 3952-3979.

¹⁶ Li dkk., "Unlocking the Resource Potential of Agricultural Waste," 105116..

utilization with structured farmer capacity development through training and intensive mentoring remain relatively limited, particularly at the village level. This gap is important because the long-term success of technological innovation depends not only on the innovation itself but also on the ability of local communities to adopt and sustain it.

The novelty of this community service program lies in the integration of locally available corn pulp as a feed resource with a participatory capacity-building approach. Rather than focusing solely on feed production, the program emphasized farmer learning through practical training, direct demonstration, and continuous mentoring. This approach enabled participants to acquire technical skills while simultaneously building confidence to implement the technology independently.

Therefore, this community service program aimed to strengthen the capacity of livestock farmers in Sambangrejo Village through training and mentoring on corn pulp silage-based feed fermentation. The program was expected to improve farmers' knowledge and technical skills, encourage the utilization of local agricultural by-products, support feed availability, and contribute to increased livestock productivity and sustainability.

B. Method

This community service program was conducted in Sambangrejo Village, Modo District, Lamongan Regency, East Java, Indonesia. The activity was implemented from July to August 2026 as part of the Community Service Program (Kuliah Kerja Nyata – KKN) of Universitas Islam Darul 'Ulum Lamongan. The program was designed in response to two conditions identified during the preliminary field assessment. First, livestock farmers experienced periodic feed shortages, particularly during periods when forage availability declined. Second, corn cultivation in the village generated substantial quantities of corn pulp, which remained underutilized despite its potential as an alternative feed resource.

The program employed a participatory community empowerment approach, combining training, practical demonstrations, and intensive mentoring. This approach was selected because technology adoption among smallholder farmers is generally more effective when knowledge transfer is accompanied by direct practice and continuous assistance. The program was designed not only to introduce feed fermentation technology but also to strengthen the capacity of livestock farmers to independently apply and sustain the innovation in their farming activities.

Participants and Sampling Technique

Participants consisted of 20 members of the livestock farmer group in Sambangrejo Village. The participants were selected using purposive sampling. This technique was chosen because the program specifically targeted farmers who actively managed livestock and faced challenges related to feed availability. The selected participants represented the primary beneficiaries of the program and possessed direct experience in livestock management.

Program Design and Implementation

The implementation process consisted of four sequential stages: preliminary assessment, training, practical demonstration, and mentoring.

1. Preliminary Assessment

The initial stage involved field observations, informal interviews, and group discussions with livestock farmers. The purpose of this activity was to identify existing feeding practices, assess farmers' knowledge regarding feed fermentation, and map locally available resources that could be utilized as alternative feed materials.

2. Training Activities

Training sessions were conducted to provide participants with fundamental knowledge regarding feed fermentation technology. The materials covered the concept of feed preservation, benefits of fermentation, feed ingredient selection, fermentation procedures, storage techniques, and feeding applications. Particular emphasis was placed on the utilization of corn pulp as the primary feed ingredient because of its local availability and potential economic value.

3. Practical Demonstration

Following the training session, participants were directly involved in the preparation of fermented feed. The demonstration utilized materials consisting of corn pulp, rice bran, molasses, salt, and water, as described in the fermentation guide developed during the program.

The feed preparation process followed several steps. Corn pulp was spread on a tarpaulin and mixed evenly with rice bran. A solution containing molasses, salt, and water was then prepared and poured onto the mixture. All materials were thoroughly mixed until a homogeneous composition was obtained. The fermented feed was subsequently stored under anaerobic conditions using airtight containers to prevent contamination by external air.

4. Mentoring Activities

Mentoring was conducted after the practical sessions to ensure that participants were able to independently implement the fermentation process. During this stage, the service team provided technical guidance, monitored implementation progress, and assisted participants in addressing challenges encountered during feed production and utilization. The mentoring phase also aimed to reinforce participants' confidence in adopting the technology within their daily livestock management practices.

Data Collection Instruments

Data were collected using observation sheets, interview guides, documentation records, and participant evaluation forms. Observation sheets were used to assess participant involvement and practical skills during the training and demonstration activities. Interview guides facilitated the collection of qualitative information regarding participants' perceptions, challenges, and experiences before and after the program. Documentation records included photographs, attendance lists, and field notes generated throughout the implementation process.

Participant evaluation forms were administered before and after the training sessions to assess changes in knowledge and understanding related to feed fermentation. The instrument consisted of structured questions addressing feed management practices, fermentation procedures, storage methods, and feed utilization techniques.

Validity and Reliability of Instruments

Content validity was established through expert review involving academics with expertise in livestock production and community empowerment. The evaluation instrument was reviewed to ensure that all items accurately reflected the objectives of the program and the competencies expected from participants.

Instrument reliability was assessed through internal consistency testing prior to implementation. The reliability coefficient exceeded the minimum acceptable threshold of 0.70, indicating that the instrument was sufficiently reliable for measuring participant knowledge and understanding throughout the program.

Data Analysis

The study employed both qualitative and quantitative descriptive analysis. Quantitative data obtained from participant evaluation forms were analyzed using

descriptive statistics, including frequency distributions, percentages, and comparisons between pre-training and post-training results. These analyses were used to identify changes in participant knowledge and understanding following program implementation.

Qualitative data derived from observations, interviews, and field notes were analyzed through data reduction, categorization, interpretation, and conclusion drawing. The analysis focused on identifying changes in farmers' attitudes, skills, and adoption of feed fermentation practices after participating in the training and mentoring activities.

Expected Outcomes

The program was expected to generate both short-term and long-term impacts. In the short term, participants were expected to gain practical knowledge and skills related to corn pulp silage-based feed fermentation. In the long term, the program aimed to encourage wider adoption of fermentation technology, improve feed availability, increase livestock productivity, and promote the sustainable utilization of local agricultural by-products within the community. By strengthening farmers' technical capacity, the program was expected to contribute to more resilient and economically sustainable livestock production systems in Sambangrejo Village.

C. Results and Discussion

Initial Condition of Livestock Farmers

The program began with a preliminary assessment involving direct observation and discussions with livestock farmers in Sambangrejo Village. The assessment revealed that most participants relied on conventional feeding practices based on fresh forage collected from agricultural fields and surrounding areas. Feed availability was generally sufficient during the rainy season but became increasingly limited during periods of low rainfall.

Discussions with participants indicated that feed preservation practices had not yet been widely adopted. Most farmers provided fresh feed immediately after harvesting and rarely stored feed reserves for future use. As a consequence, livestock productivity often fluctuated according to seasonal feed availability. Similar conditions have been reported by Makkar (2023), who noted that feed insecurity remains one of the primary constraints affecting smallholder livestock production systems.

Another finding was the abundance of corn-processing by-products in the village. Corn pulp was readily available following harvest periods, yet its utilization remained

limited. Although farmers recognized the availability of this resource, knowledge regarding its processing into fermented feed products was still relatively low. This finding suggests that the challenge was not the lack of feed resources, but rather the limited capacity to transform locally available materials into productive feed alternatives.

Implementation of Training and Practical Demonstration

The training activities were attended by 20 livestock farmers and were conducted through classroom discussions followed by practical demonstrations. The training materials focused on feed fermentation principles, benefits of silage technology, feed ingredient selection, fermentation procedures, storage methods, and feeding applications.

Participants showed strong interest throughout the training process. Many farmers actively engaged in discussions and shared experiences regarding feed shortages encountered during previous dry seasons. This active participation indicates that the technology introduced addressed an issue directly relevant to their farming activities.



Figure 1 Training Session on Corn Pulp Silage Feed Fermentation for Livestock Farmers

The practical demonstration represented the core component of the program. Participants directly practiced the preparation of fermented feed using corn pulp, rice bran, molasses, salt, and water as the primary ingredients. The process followed the technical procedures outlined in the fermentation module developed for the program.

The demonstration enabled participants to observe every stage of feed preparation, from material mixing to storage under anaerobic conditions. Hands-on participation encouraged greater understanding compared with conventional lecture-based approaches. This finding supports previous studies suggesting that experiential learning and farmer-centered extension approaches contribute significantly to technology adoption among rural

communities.¹⁷



Figure 2 Practical Demonstration of Corn Pulp Silage Feed Preparation

Improvement of Farmers' Knowledge and Skills

One of the primary objectives of the program was to strengthen farmers' technical capacity regarding feed fermentation technology. To evaluate learning outcomes, participants completed pre-training and post-training assessments.

Table 1 Changes in Participants' Knowledge Following Training Activities

Indicator	Before Training (%)	After Training (%)	Increase (%)
Understanding of feed fermentation concepts	45.00	90.00	45.00
Knowledge of fermentation ingredients	50.00	95.00	45.00
Understanding of feed storage techniques	40.00	85.00	45.00
Ability to produce fermented feed independently	35.00	90.00	55.00
Understanding of feed application methods	50.00	95.00	45.00

Table 1 shows a substantial improvement in participants' understanding across all indicators. The largest increase occurred in the ability to independently produce fermented feed, which rose from 35.00% before training to 90.00% after training. This result indicates that practical demonstrations and mentoring activities successfully improved participants' technical competencies.

The mentoring process also played an important role in reinforcing knowledge acquired during the training sessions. Farmers were able to discuss practical difficulties encountered during implementation and receive immediate feedback from facilitators. Such interactions strengthened participants' confidence in applying the technology independently.

¹⁷ Knook, Jorie, Vera Eory, Matthew Brander, dan Dominic Moran. "Evaluation of Farmer Participatory Extension Programmes." *The Journal of Agricultural Education and Extension* 24, no. 4 (2018): 309-325. <https://doi.org/10.1080/1389224X.2018.1466717>.



Figure 3 Mentoring Activities and Farmer Participation During Feed Fermentation Practice

These findings are consistent with capacity-building theory, which emphasizes that sustainable technology adoption requires not only knowledge transfer but also opportunities for repeated practice and guided implementation.¹⁸

Adoption of Corn Pulp Silage Technology

Following the training and mentoring activities, participants began applying the fermentation technique in their livestock operations. Monitoring results showed that farmers were able to replicate the fermentation process independently using locally available materials.

One of the most notable outcomes was the increased utilization of corn pulp that had previously been treated as a low-value agricultural by-product. Farmers reported that the material became easier to manage and more practical to store after undergoing fermentation. The ability to preserve feed for longer periods reduced concerns regarding seasonal feed shortages.

Table 2 Farmers' Responses Toward Corn Pulp Silage Technology

Response Indicator	Percentage of Participants (%)
Technology is easy to apply	90.00
Materials are easily available	100.00
Feed preparation is more efficient	85.00
Technology should be continued	100.00
Will recommend technology to other farmers	95.00

As shown in Table 2, all participants agreed that the technology should be continued and further disseminated within the community. Farmers particularly appreciated the accessibility of raw materials and the simplicity of the fermentation process.

These results align with previous studies indicating that locally based feed technologies tend to achieve higher adoption rates because they rely on resources already

¹⁸ United Nations Development Programme (UNDP). Capacity Development: A UNDP Primer. New York: UNDP, 2009

available within the community.^{19, 20}

Impact on Feed Production and Livestock Productivity

Program monitoring demonstrated a positive impact on feed production capacity among participants. Before the intervention, most farmers relied solely on daily forage collection. After the program, farmers began producing fermented feed as an additional feed reserve.

Table 3 Changes in Fermented Feed Production After Program Implementation

Indicator	Before Program	After Program
Farmers producing fermented feed	2 persons	20 persons
Availability of feed reserves	Limited	Available
Average feed production capacity	Baseline	Increased by 25–50%

The results indicate that fermented feed production increased by approximately 25–50% among participating farmers. This increase reflects both improved technical skills and greater confidence in utilizing local agricultural resources for livestock feeding.

Farmers also reported that fermented feed reduced the time required for daily feed preparation because feed reserves could be stored and utilized when needed. Similar benefits have been reported in studies highlighting the role of silage technology in improving feed management efficiency and supporting livestock productivity; Wang et al., 2024).²¹



Figure 4 Fermented Feed Product Produced by Participants

Factors Supporting Successful Technology Adoption

The findings demonstrate that capacity-building interventions combining training,

¹⁹ Mata, Fernando, Meirielly Jesus, and Joana Santos. 2026. "The Role of Livestock in Circular Agriculture and Waste Valorisation" *Sustainability* 18, no. 11: 5780. <https://doi.org/10.3390/su18115780>

²⁰ Togo, Beatrice Ghati, Salum O. Kuwi, Kabuni T. Kabuni, George F. Fupi, Onesmo J. Lyahama, dan Jovith A. Kajuna. "Crop Residues as Alternative Livestock Feed Resources for Enhancing Climate Resilience During Dry Seasons in Tanzania." *Asian Journal of Advances in Agricultural Research* 26, no. 5 (2026): 27-37. <https://doi.org/10.9734/ajaar/2026/v26i5729>.

²¹ Borreani dkk., "Silage Review," 3952-3979.

practical demonstrations, and mentoring can effectively support technology adoption among livestock farmers. The success of the program was influenced by three key factors.

First, the technology utilized materials that were already familiar and readily available within the community. This reduced barriers associated with implementation costs and resource accessibility. Previous research has shown that innovations based on local resources are more likely to be adopted and sustained in rural communities.²²

Second, participants were actively involved throughout the implementation process. Rather than receiving information passively, farmers directly practiced fermentation techniques and experienced the benefits firsthand. This participatory approach strengthened learning outcomes and encouraged behavioral change.

Third, the mentoring component ensured that knowledge acquired during training was translated into practical application. Farmers received continuous support during implementation, allowing them to overcome technical challenges and develop confidence in using the technology. This finding supports community empowerment theory, which emphasizes that sustainable development depends on strengthening local capacity and fostering self-reliance.

From a broader perspective, the program contributed not only to livestock productivity but also to the promotion of circular agriculture practices. Agricultural by-products that were previously underutilized gained economic value through conversion into livestock feed. This approach supports resource efficiency, reduces waste generation, and creates opportunities for more sustainable rural production systems.

D. Conclusion

This community service program was designed to strengthen the capacity of livestock farmers in Sambangrejo Village through training and mentoring on corn pulp silage-based feed fermentation. The findings demonstrate that the program successfully achieved its objectives. Farmers showed significant improvements in their knowledge and practical skills related to feed fermentation, feed preservation, and feed utilization. The participatory approach adopted in this program enabled participants to gain direct experience and confidence in applying the technology independently.

The program also contributed to the increased utilization of locally available agricultural by-products, particularly corn pulp, which had previously been underutilized. Through the fermentation process, this agricultural residue was transformed into a more

²² Mata, Jesus, dan Santos, "Role of Livestock in Circular Agriculture." Swadaya: Jurnal Pengabdian Masyarakat Vol. 4, No. 2, 2026. Page: 170-185

valuable feed resource capable of supporting livestock production. Monitoring results indicated that fermented feed production among participants increased by approximately 25–50% following the training and mentoring activities. The availability of feed reserves also improved, providing farmers with greater flexibility in managing feed resources throughout the year.

The findings suggest that technology-based community empowerment programs are more effective when technical training is accompanied by continuous mentoring. The combination of knowledge transfer, hands-on practice, and field assistance encouraged greater adoption of innovation among farmers and strengthened local capacity for sustainable livestock development.

From a broader perspective, the program supports the principles of circular agriculture by promoting the productive utilization of agricultural by-products while reducing feed-related constraints in livestock production. This approach creates both economic and environmental benefits for rural communities.

Future community service initiatives may focus on expanding participation to other farmer groups, improving feed quality through nutritional evaluation, and developing small-scale community-based feed enterprises. Further studies may also examine the long-term effects of fermented feed utilization on livestock growth performance, production efficiency, and farm income to strengthen the evidence base for wider implementation.

E. Acknowledgements

The authors would like to express their sincere appreciation to the Livestock Farmer Group of Sambangrejo Village, Modo District, Lamongan Regency, for their active participation and cooperation throughout the implementation of this community service program. The authors also thank the students of the 2026 Community Service Program of Universitas Islam Darul 'Ulum Lamongan for their assistance during the planning, implementation, and evaluation stages of the activity.

F. References

- Alimi, Nouroudine, Alassan S. Assani, Hilaire Sanni Worogo, Nasser Mohamed Baco, dan Ibrahim Alkoiret Traoré. "Livestock Feed Resources Used as Alternatives during Feed Shortages and Their Impact on the Environment and Ruminant Performance in West Africa: A Systematic Review." *Frontiers in Veterinary Science* 11 (2024): Article 1352235. <https://doi.org/10.3389/fvets.2024.1352235>
- Borreani, G., E. Tabacco, R. J. Schmidt, B. J. Holmes, dan R. E. Muck. "Silage Review: Factors Affecting Dry Matter and Quality Losses in Silages." *Journal of Dairy Science* 101, no. 5 (May 2018): 3952-3979. <https://doi.org/10.3168/jds.2017-13837>

- Daniel, J. L. P., J. M. Bragatto, dan M. G. M. Carvalho. "Advances in Silage Science: From Fundamentals to Future Applications – Optimizing Silage Production in Tropical Climates." *Journal of Dairy Science* (2026). <https://doi.org/10.3168/jds.2026-28813>
- Dejene, M., Kehaliew, A., Feyissa, F., Kebede, G., Kitaw, G., Terefe, G., Walelegne, M., Mekonnen, B., Biratu, K., & Geleti, D. (2024). Enhancing Production, Nutritional Qualities and Utilization of Fibrous Crop Residues in Smallholder Crop-Livestock Systems: Potential Intervention Options and Progress toward Sustainable Livestock Production. In *Veterinary Medicine and Science*. IntechOpen. <https://doi.org/10.5772/intechopen.1006058>
- Kung, Limin, Jr., R. D. Shaver, R. J. Grant, dan R. J. Schmidt. "Silage Review: Interpretation of Chemical, Microbial, and Organoleptic Components of Silages." *Journal of Dairy Science* 101, no. 5 (May 2018): 4020-4033. <https://doi.org/10.3168/jds.2017-13909>
- Kurnia, K. A., & Grossi, S. (2026). Evaluation of Agricultural Waste Utilization as Alternative Feed to Improve Beef Cattle Productivity. *Journal of Animal Husbandry*, 2(1), 1-9. <https://doi.org/10.70716/joah.v2i1.250>
- Li, Yubo, Ruifang Zhang, Chi Zhang, Qingyun Li, Lanchun Nie, Can Wang, dan Xin-Xin Wang. "Unlocking the Resource Potential of Agricultural Waste: A Systemic Transition from Linear Disposal to Circular Resources." *Environmental Technology & Innovation* 43 (September 2026): 105116. <https://doi.org/10.1016/j.eti.2026.105116>
- Mafefa, Nitty Cendrabagusti, dan Adyanto Nussy Banamtuan. "Agricultural Waste Processing Technologies (Silage and Ammoniation) for Ruminant Feed in Drylands: Literature Review." *Journal of Tropical Animal Science and Technology* 8, no. 1 (2026): 49-55. <https://doi.org/10.32938/jtast.v8i1.10645>
- Mata, Fernando, Meirielly Jesus, dan Joana Santos. "The Role of Livestock in Circular Agriculture and Waste Valorisation." *Sustainability* 18, no. 11 (2026): 5780. <https://doi.org/10.3390/su18115780>.
- Njuki, Jemimah, Sarah Eissler, Hazel Malapit, Ruth Meinzen-Dick, Elizabeth Bryan, dan Agnes Quisumbing. "A Review of Evidence on Gender Equality, Women's Empowerment, and Food Systems." *Global Food Security* 33 (2022): Article 100622. <https://doi.org/10.1016/j.gfs.2022.100622>. <https://doi.org/10.1016/j.gfs.2022.100622>
- Shah, Ali Mujtaba, Huiling Zhang, Muhammad Shahid, Huma Ghazal, Ali Raza Shah, Mujahid Niaz, Tehmina Naz, Keshav Ghimire, Naqash Goswami, Wei Shi, dan rekan-rekan. "The Vital Roles of Agricultural Crop Residues and Agro-Industrial By-Products to Support Sustainable Livestock Productivity in Subtropical Regions." *Animals* 15, no. 8 (2025): 1184. <https://doi.org/10.3390/ani15081184>.
- Sjakir, Muhammad, Abd Hair Awang, Abdul Manaf Azima, Mohd Yusuf Hussain, dan Ramli Zaimah. "Learning and Technology Adoption Impacts on Farmer's Productivity." *Mediterranean Journal of Social Sciences* 6, no. 4s3 (2015): 126. <https://doi.org/10.5901/mjss.2015.v6n4s3p126>
- Tiambo, Christian K., Olubunmi Opoola, Moses Okpeku, Isidore Houaga, Blasius A. H. Touko, dan Tadelde Dessie. "Capacity Building in Livestock Breeding and Genetic Improvement in Achieving UN Sustainable Development Goals for Africa." Dalam *African Livestock Genetic Resources and Sustainable Breeding Strategies: Unlocking a*

Treasure Trove and Guide for Improved Productivity, diedit oleh Eveline M. Ibeagha-Awemu, Samuel O. Peters, Appolinaire Djikeng, dan John E. O. Rege, 1123–1148. Cham, Swiss: Springer, 2025. <https://hdl.handle.net/10568/177534>

Togo, Beatrice Ghati, Salum O. Kuwi, Kabuni T. Kabuni, George F. Fupi, Onesmo J. Lyahama, dan Jovith A. Kajuna. "Crop Residues as Alternative Livestock Feed Resources for Enhancing Climate Resilience During Dry Seasons in Tanzania." *Asian Journal of Advances in Agricultural Research* 26, no. 5 (2026): 27-37. <https://doi.org/10.9734/ajaar/2026/v26i5729>.

Tulu, D., Gadissa, S., Hundessa, F., Feyisa, K., Kebede, E., & Erana, G. (2023). Contribution of Climate-Smart Forage and Fodder Production for Sustainable Livestock Production and Environment: Lessons and Challenges from Ethiopia. *Advances in Agriculture*, 2023, Article 8067776. <https://doi.org/10.1155/2023/8067776>

United Nations Development Programme (UNDP). Capacity Development: A UNDP Primer. New York: UNDP, 2009.