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Technical Assistance in Producing Alternative Feed Using Silage Techniques to Boost Productivity Among Duck Farmers in Buket Pulo Village

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ABSTRACT

Background: The village of Buket Pulo has potential for duck farming development. However, farmers' limited knowledge and skill in processing alternative feed using silage techniques have resulted in high production costs and suboptimal livestock productivity.
Contribution: This community service activity aims to improve farmers' skills in producing alternative feed using silage techniques by utilizing local waste as a sustainable feed source. The activity integrates participatory mentoring and hands-on practice to improve farmers' technical capacity in feed production.
Method: This study employed a quantitative descriptive approach combined with the participatory action research (PAR) method. Participants were selected through purposive sampling. Data collection was conducted via pre-test and post-test, observation, and focus group discussion (FGDs). The data were analyzed descriptively to assess improvements in participants' knowledge and skills.
Results: Training on the production of alternative feed using silage techniques demonstrated an increase in farmers' knowledge, as evidenced by the difference between the pre-test score (40,6) and the post-test score (86,6), representing a 113% increase. In addition, observations of participants' practical skills yielded an average score of 88,6%, which falls in to the very good category.
Conclusion: The results of the activity indicate that guidance on the production of alternative feed using silage techniques is effective in improving farmers' knowledge and skills. This participatory guidance model has the potential to be applied to other farming communities to support increased productivity and efficiency in livestock farming.

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1. Introduction

Duck farming is a sector with high economic potential in rural areas [1], [2]. One of the challenges frequently faced by farmers in rural areas is the availability of commercial feed and high feed costs [3]. Feed is a major component of livestock farming, accounting for 70-80% of total production costs, thereby affecting farmers' profit margins [4]. Farmers' reliance on commercial feed leads to high and inefficient production costs, particularly for small-scale farmers [5]. This reliance on commercial feed results in low productivity and limits farmers' ability to develop their businesses sustainably [6].

Buket pulo village is one of the villages located in the city of Langsa, Aceh. The village is characterized by low-lying terrain and a pristine rural environment. Most of the residents earn their livelihoods through agriculture, plantations, and small business. The community's social life remains deeply rooted in Acehnese culture values. The village holds significant potential for development through community empowerment, particularly in agriculture, livestock, and education grounded in local wisdom. Given its location in an agricultural and plantation area, Buket Pulo Village has abundant organic waste and agricultural byproducts, such as water spinach, rice husks, and other harvest residues. However, these resources have not been optimally utilized and are simply discarded as waste. This agricultural waste is often simply discarded, burned, or even left to rot, even though it has the potential to serves as an alternative raw material. Agricultural waste can be processed into livestock feed using silage techniques, thereby gaining high utility values and enabling linger-term storage [7], [8]. However, the limited knowledge and skills of livestock farmers in processing this waste remain the primary obstacle to its utilization.

Silage technology has been widely adopted as a solution to feed shortages because it preserves feed materials through anaerobic fermentation while maintaining nutritional quality and supporting livestock productivity [9], [10]. Silage production training programs typically focus on large-scale ruminant livestock, such as cattle and goats, and thus have not paid much attention to the practical needs of small-scale duck farmers [11], [12]. In many cases, feed production training lacks participatory guidance and follow-up support, leaving farmers struggling to independently apply silage techniques in their daily practices [13]. Consequently, the adoption of silage technology among rural duck farmers remains relatively low, particularly in areas with feed resources that fluctuate seasonally [14]. Additionally, farmers still rely on conventional feed, which is relatively more expensive and subject to price instability [5].

This community service activity contributes by bridging the gap between theoretical training on silage and its practical application in small-scale duck farming systems. Unlike previous community service activities that emphasized general techniques in feed preservation, this activity integrates technical mentoring, hands-on practice, and the use of feed ingredients available in Buket Pulo Village in accordance with the conditions of the duck farmers. The participatory approach used in this program enables farmers not only to understand the concept of silage fermentation but also to develop practical skills in

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independently and sustainably producing alternative feed. This approach is crucial because farmer participation and contextual training methods are considered key factors influencing the successful adoption of agricultural technological innovations [15]. Silage technology is a method of preserving forage such as grass, leaves, and agricultural waste through anaerobic fermentation under airtight conditions [16]–[18]. Microorganisms convert soluble carbohydrates into lactic acid, thereby lowering the pH level and inhibiting the growth of spoilage microbes [19]. Through proper fermentation, feed can be stored for longer periods, retain its nutritional value, become more digestible for livestock, and reduce unpleasant odors during storage [20]. This extension program is expected not only to enhance farmers' knowledge but also to improve feed efficiency, reduce reliance on commercial feed, and ultimately boost the productivity and sustainability of duck farming in Buket Pulo Village.

The challenge faced by our partners is the lack of knowledge and skills among farmers in processing organic waste into alternative feed that is nutritious and safe for livestock. Until now, farmers have relied on commercial feed, resulting in high production costs and reduced profit potential for duck farming businesses. On the other hand, the abundant local agricultural waste available in Buket Pulo Village has not been optimally utilized as a more economical and sustainable source of alternative feed. Previous silage-making training activities have focused primarily on theoretical instruction and have not sufficiently addressed the practical needs of small-scale farmers, particularly duck farmers. Furthermore, practice-based mentoring utilizing local agricultural waste remains limited, so the adoption of silage technology at the farmer level has not been optimal. Silage technology has the potential to improve feed storage life, preserve nutrient content, and support farm efficiency through the anaerobic fermentation process [21].

Given these conditions, there is a need for practical, participatory solutions that leverage local resources through training and technical assistance in the production of silage-based alternative feed. This initiative is not only focused on enhancing farmers' skills but also supports the utilization of agricultural waste to make it more economically valuable and environmentally friendly. Therefore, this community service project aims to evaluate the effectiveness of participatory technical assistance in improving farmers' knowledge and skills in producing silage-based feed from local agricultural waste in Buket Pulo Village.

2. Method

This Study adopts the Participatory Action Research (PAR) framework, supported by quantitative descriptive evaluation using pre-test and post-test measurements. The PAR approach was used because it positions the community as both the subject and an active partner in the problem-solving process through the stages of planning, action, evaluation, and reflection [22], [23]. In this activity, farmers not only received materials but were also directly involved in the training, practice, and mentoring process for the production of alternative feed based on silage techniques. The community service activity was conducted in Buket Pulo Village, East Langsa District, Langsa City, Aceh, targeting duck farmers. This program aimed

to improve farmers' knowledge and skills in utilizing local agricultural waste as alternative feed through silage techniques. Data collection was conducted through three stages. First, pre-tests and post-tests were conducted to measure participants' knowledge gains. Second, practical skill observations were conducted to assess participants' ability to apply silage production techniques. Third, focus group discussions (FGDs) were held to gather feedback on the implementation of the activities.

The activity was implemented in seven phases: a) preparation; b) outreach; c) training; d) hands-on practice; e) mentoring; f) evaluation; and g) follow-up. The preparation phase involved problem identification and coordination with partners. The socialization and training phases focused on providing an understanding of how to produce silage feed based on local agricultural waste. Subsequently, participants engaged in hands-on practice and received periodic mentoring to enable them to apply silage techniques independently. The evaluation phase involved comparing pre-test and post-test results, as well as observing and assessing participants' skills during the practical sessions.

The sampling technique used in this activity was purposive sampling, which involves the deliberate selection of samples based on specific criteria relevant to the activity's objectives [24], [25]. The criteria used included participants being active duck farmers, having a need for alternative feed, and being willing to participate in all stages of the community service activity. Based on these criteria, five duck farmers in Buket Pulo Village were selected as activity partners. A relatively small number of participants was chosen because this activity employs an intensive mentoring model aimed at maximizing participant engagement, the effectiveness of hands-on practice, and the strengthening of technical competencies in silage feed production. Data collection was conducted through direct observation, semi-structured interviews, Focus Group Discussions (FGDs), and documentation [26], [27].

Observation was used to directly observe the process of producing silage-based alternative feed. Semi-structured interviews were conducted to gather information regarding the knowledge, experiences, and challenges faced by farmers in managing livestock feed. FGDs were used to obtain feedback and build a shared understanding among partners regarding the application of silage technology. Meanwhile, documentation was used as supporting data to record the entire series of community service activities.

The effectiveness of the mentoring activities was measured by comparing pre-test and post-test results to determine the partners' increased understanding of the material on producing alternative feed using silage techniques. Participants' skill improvement is measured through observation using a practical assessment sheet that covers the ability to select materials, silage production skills, and the participants' level of independence in practice. Additionally, this activity is conducted with due regard for ethical principles of service, such as obtaining voluntary informed consent and maintaining the confidentiality of partner data. All participants were provided with explanations regarding the objectives of the activity, their rights to participate, and their freedom to withdraw at any stage of the activity. With a systematic, participatory, and ethical methodological approach using the Participatory

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Action Research (PAR) method, this activity is expected to contribute to improving the knowledge, skills, and productivity of duck farmers through the utilization of agricultural waste as alternative feed in Buket Pulo Village.

3. Results and Discussion

Mentoring program was attended by five farmers from Buket Pulo Village, East Langsa Subdistrict, Langsa City, Aceh. The mentoring sessions were held periodically from September 15 to October 10, 2025, at the Nanggroe Duck Farm. The community service activities are shown in Figure 1.

Figure 1. Feed Production Assistance Activities

In the early stages of the program, participants were introduced to the concept of producing alternative feed using silage techniques from organic waste and agricultural byproducts such as water spinach, rice husks, and other crop residues. Participants were provided with training modules designed to be contextually relevant and practical, tailored to local farm conditions. These modules covered the basics of silage fermentation, sanitation, equipment use, and guidelines for monitoring feed quality based on indicators such as aroma, texture, and pH. In addition to learning about the utilization of local resources as a strategy for livestock feed security, participants also engaged in hands-on silage production practices, ranging from material collection, chopping using a grinder, mixing ingredients, anaerobic packaging, to the product labeling process to facilitate identification and quality control. Participants were then asked to produce a trial batch of silage and apply it to broiler ducks while keeping simple records regarding feed consumption and livestock condition. A flowchart of the silage production process is shown in Figure 2.

The training on the production of alternative feed using silage techniques in Buket Pulo Village demonstrated a significant improvement in farmers' understanding of how to produce alternative feed from agricultural waste using silage techniques. As shown in Table 1, the pre-test results indicated an average understanding score of 40.6, while the post-test score increased to 86.6—a 113% improvement. This improvement indicates that participatory, practice-based training activities are effective in enhancing participants' understanding of silage techniques and the utilization of agricultural waste as alternative feed. The rise in scores suggests that participants not only grasp the basic concepts of silage fermentation but are also able to connect the training material to their real-world needs in managing their livestock

operations. The improvement in participants' understanding was influenced by several factors. First, the hands-on learning method allows participants to be directly involved in every stage of silage production, making the learning process easier to understand. Second, the use of local materials that are familiar to farmers' daily lives makes the training content more relevant and practical. Third, intensive mentoring during the activities helps participants overcome technical difficulties directly, particularly regarding the use of choppers, the fermentation process, and anaerobic packaging. Thus, the program's success is influenced not only by the delivery of content but also by the participatory and contextual approach applied during the mentoring.

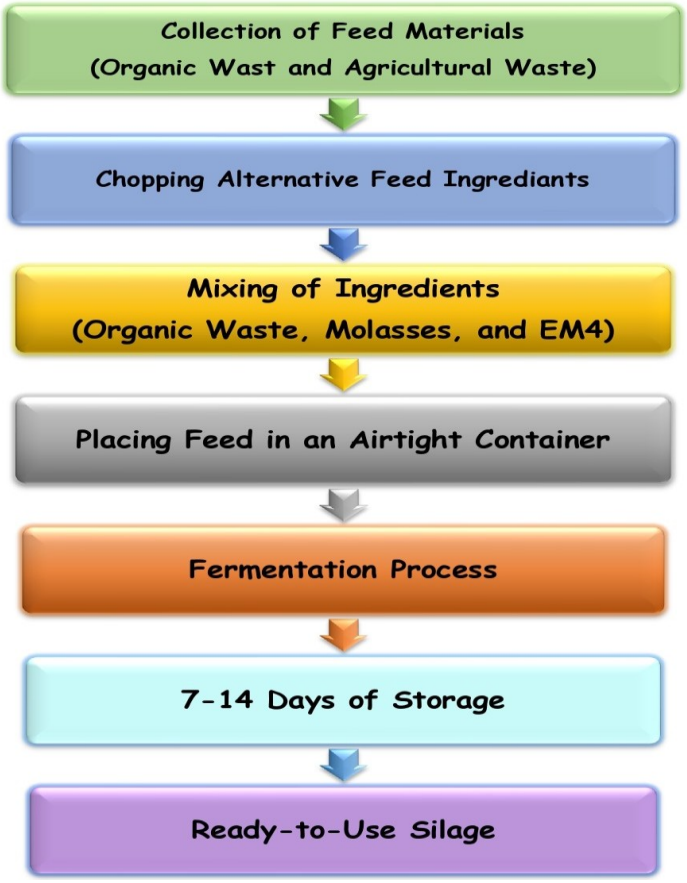

Figure 2. Flowchart of Silage Production

The evaluation used pre- and post-tests to measure improvements in knowledge, along with practical observations to assess participants' skills in producing silage independently. The results of the pre-test and post-test evaluations are shown in Table 1.

Table 1. Participants' Average Score on Silage Techniques

Test	Average Score	Category
Pre-test	40,6	Low
Post-test	86,6	High

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Observations of the practical training revealed that participants demonstrated strong skills in silage production. Seven aspects of the training were evaluated on a scale of 1–5: ingredient selection, chopping, mixing, anaerobic packaging, sanitation, silage quality assessment, and practical independence. The assessment results showed that the participants' average score reached 31 out of a maximum score of 35, or 88.6%, which falls into the "very good" category. These findings indicate that a practice-based and participatory training approach is effective in improving farmers' technical skills in independently producing silage feed. The results of the practical skills observations can be seen in Table 2.

Table 2. Results of Practical Skills Observations

Practical Aspect	Average Score	Category
Selection of Ingredients	4,4	Good
Chopping of Ingredients	4,2	Good
Mixing of Materials	4,6	Very Good
Anaerobic Packaging	4,5	Very Good
Equipment Sanitation	4,3	Good
Silage Quality Evaluation	4,4	Good
Practical Independence	4,7	Very Good
Average Practical Score	31	

To calculate the percentage of practical skills, the following formula is used: (Score obtained) / (Maximum score) × 100%. After plugging the values into the formula, i.e., 31/35 × 100%, it can be determined that the participant's practical skills percentage is 88.6%. This indicates that the participant has demonstrated excellent ability in applying silage feed production techniques. These results suggest that the training and mentoring provided have successfully enhanced farmers' practical skills in processing agricultural waste into alternative feed.

The results of this study are consistent with the findings of Regis Silda (2025), who concluded that training in silage production can improve farmers' skills and understanding in independently producing alternative feed for Garut sheep [28]. Research by Yusuf (2025) also underscores the importance of ongoing mentoring in enhancing farmers' understanding of the nutritional content of feed ingredients and optimizing their utilization [29]. Additionally, Alliya (2023) state that practice-based training can help farmers develop the skills to formulate feed independently according to livestock needs [30], [31].These findings reinforce that the success of alternative feed training is significantly influenced by a hands-on approach, the relevance of the material, and the active engagement of participants. This indicates that knowledge enhancement occurs not only in theoretical aspects but is also accompanied by changes in participants' skills and behaviors toward more independent and efficient livestock feed management.

The integration of agricultural waste utilization with silage techniques also shows potential as a sustainable strategy to support the efficiency of duck farming in rural areas. Waste

materials such as water spinach, rice husks, and crop residues hold significant potential as alternative feed ingredients due to their ease of acquisition and local availability [32], [33]. Through anaerobic fermentation, these materials can be processed into feed with longer shelf life, softer texture, and improved palatability for livestock [34]. In addition to reducing dependence on commercial feed, the utilization of agricultural waste also supports the reduction of environmental waste and the implementation of a circular economy at the community level [35]. This activity not only impacts the improvement of farmers' skills but also contributes to strengthening feed security and the sustainability of duck farming operations.

The utilization of agricultural organic waste through silage techniques in duck farming extension activities aligns with the Sustainable Development Goals (SDGs), particularly in enhancing food security, resource efficiency, and the economic well-being of rural communities. Therefore, a participatory approach is key to ensuring that this alternative feed innovation is relevant to local conditions, easy to implement, and economically viable for farmers. Empowering farmers with knowledge and skills, as well as the use of simple tools such as a shredder to process waste into valuable feed, is a tangible form of transformation in local resource management. The mentoring activities on the production of alternative feed based on silage techniques in Buket Pulo Village demonstrated a significant increase in the participants' knowledge and skills. This was evidenced by the pre-test and post-test results, which showed improved understanding, as well as the results of practical observations that demonstrated the participants' ability to produce feed independently.

These results indicate that a hands-on Participatory Action Research (PAR) approach has a strong influence on participants' behavioral changes. Compared to previous training activities that focused more on theoretical instruction, this activity yielded better results because participants were actively involved in every stage of the silage-making process. This direct involvement made it easier for participants to understand fermentation techniques, the use of tools, and the application of silage feed in their livestock businesses. Additionally, intensive mentoring during the practical process helped participants overcome technical difficulties directly, making the technology adoption process more effective. These behavioral changes indicate that the PAR method not only enhances participants' cognitive aspects but also builds their confidence and independence in managing their livestock businesses. Interviews with participants revealed that they had previously relied heavily on commercial feed, but after participating in the mentoring program, they began to realize that local agricultural waste could be utilized as a more economical alternative feed source. Some participants even began incorporating silage into the feed for their broiler ducks and conducting simple monitoring of feed intake and livestock health. This demonstrates that the learning process does not end at the training stage but continues through independent implementation, which has the potential for sustainable development.

The success of this initiative was also influenced by the local context of Buket Pulo Village, which has an abundant supply of agricultural waste that is easily accessible to farmers. These

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conditions made it easier for participants to apply what they learned in the training, as the raw materials used were readily available in the surrounding area and did not require significant additional costs. The participants' proximity to local material sources is one reason why this program was able to drive behavioral change and enhance farmers' self-reliance in feed management. Unlike some previous studies that used specific feed ingredients difficult to obtain at the small-scale farmer level, this initiative was more contextually grounded by aligning with the local resources available in the village. Some participants have begun implementing silage feed for broiler ducks and conducting simple monitoring of feed consumption and livestock conditions. This indicates that the learning process does not end at the training stage but continues through independent practice that has the potential for sustainable development. These changes suggest that the increased knowledge gained by participants has successfully been translated into concrete actions in the management of their livestock businesses.

Nevertheless, the implementation of the program still faces several challenges. Due to the limited duration of the mentoring, participants have not yet fully explored variations in ingredient composition and more optimal fermentation techniques. In addition, limited equipment and the participants' lack of prior experience in using the shredder posed challenges during the early stages of the practical training. However, through intensive mentoring and repeated practice, these challenges have been gradually minimized.

Overall, this mentoring activity demonstrates that a participatory approach based on hands-on practice can enhance farmers' knowledge, skills, and behavioral changes in utilizing agricultural waste as silage-based alternative feed. The program also shows that the utilization of local resources can serve as a sustainable solution to support production cost efficiency, feed security, and increased duck farm productivity in Buket Pulo Village. To strengthen the program's sustainability, continued mentoring, institutional strengthening of livestock groups, and support from local governments and relevant stakeholders are needed so that silage-based alternative feed innovations can be implemented more widely and sustainably.

4. Conclusion

The mentoring program on the production of alternative feed using silage techniques in Buket Pulo Village has proven effective in enhancing duck farmers' knowledge, technical skills, and self-reliance in livestock feed management. Participants' improved understanding is evident from the increase in the average pre-test score from 40.6 to 86.6 on the post-test, and an average practical score of 88.6%. The Participatory Action Research (PAR) approach, combined with hands-on practice and the utilization of local agricultural waste, has successfully fostered behavioral change, improved practical skills, and strengthened farmers' confidence in producing feed independently. This initiative demonstrates that utilizing local resources through silage techniques can serve as a practical and sustainable solution to support production cost efficiency, feed sustainability, and increased duck farm productivity in rural areas. This participatory mentoring model also holds potential for application in other farming

communities with similar characteristics. Further research is recommended to assess the effectiveness of using various types of local agricultural waste on the nutritional quality of silage and livestock productivity in the long term. Additionally, research with a larger number of participants and a longer mentoring period is needed to evaluate the sustainability of silage technology implementation in small-scale farming operations.

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