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Training on Rice Straw Ammoniation Technology as an Alternative Feed for Ruminant Livestock During the Dry Season in Wangka Village

Laurensius Meze Mala[1]*, Yohanes Freadyanus Kasi[2], German Yohanes Sola[1]

[1]Program Studi Ilmu Peternakan, Institut Nasional Flores, Nusa Tenggara Timur, Indonesia
[2]Program Studi Ilmu Perikanan, Institut Nasional Flores, Nusa Tenggara Timur, Indonesia
*Corresponding author: lhausmezemala@gmail.com

Abstract: The abundant supply of rice straw in Wangka Village has not been optimally utilized as livestock feed, while livestock farmers face a shortage of forage, especially during the dry season. This community service activity aims to improve the knowledge and skills of farmer-livestock breeders in utilizing rice straw as an alternative feed through ammoniation technology using urea fertilizer. The activity was conducted on May 8, 2026, involving 15 participants consisting of farmers and livestock breeders. The methods used included training sessions, demonstrations, hands-on practice, mentoring, and monitoring throughout the 21–28-day fermentation process. Evaluation was conducted through a post-test, observation of practical skills, and monitoring of the rice straw fermentation results. The evaluation results showed that 12 out of 15 participants (80%) understood the procedure for producing ammoniated straw and were able to practice it independently, while 3 participants (20%) still required guidance, particularly regarding urea dosage determination and storage techniques during fermentation. Monitoring results showed that the resulting ammonia-treated straw had a softer texture, a yellowish-brown color, a characteristic ammonia odor, and did not rot, making it suitable for use as livestock feed. In addition, 10 out of 15 participants (66.7%) stated that they would continue to apply the ammonia treatment technology in the next harvest season. These findings indicate that training on rice straw ammoniation technology is effective in building community capacity, promoting the adoption of appropriate technologies, and supporting the sustainable supply of livestock feed during the dry season.

Keywords: Rice straw ammoniation; alternative feed; livestock farmers; community empowerment; appropriate technologies.

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INTRODUCTION

The development of the agriculture and livestock sectors is one of the key pillars in supporting food security, increasing community income, and promoting sustainable rural development. One approach that has been widely adopted is the integration of agricultural and livestock operations through the utilization of agricultural waste as an economically valuable resource. Integrated farming systems not only improve the efficiency of local resource use but also reduce environmental pollution caused by agricultural waste that has not been optimally utilized (Sudarwati & Nasution, 2024; Ani et al., 2025). Among various types of agricultural waste, rice straw is a biomass that is abundantly available during every harvest season and has great potential as a feed source for ruminant livestock when processed using appropriate technology.

Although available in large quantities, the use of rice straw as livestock feed remains relatively low due to its poor nutritional quality. The crude protein content of rice straw ranges only from 3–5%, while its lignin and crude fiber contents are quite high, resulting in low digestibility by livestock (Yanuartono et al., 2019). As a result, rice straw is typically burned or left to rot after harvest, causing environmental pollution while simultaneously wasting a potential feed source that could actually be utilized (Gaina et al., 2019). One technology that has proven effective in improving the nutritional quality of rice straw is ammoniation using urea fertilizer, which can increase crude protein content, improve fiber digestibility, and enhance feed palatability for ruminant livestock (Bata, 2008; Ilham et al., 2018; Khasanah et al., 2023).

This problem is also found in Wangka Village, Nagekeo Regency. Based on field observations and interviews with village officials in April 2026, Wangka Village has approximately 180 ha of rice paddies, 43 livestock farmers, and a population of 118 beef cattle. Each harvest season produces about 50–60 metric tons of rice straw, but most of it is not utilized as livestock feed and is more often burned or left in the fields. At the same time, livestock farmers face a shortage of forage during the dry season, leading to increased feed costs and decreased livestock productivity. These conditions highlight a gap between the abundance of agricultural waste and the livestock feed needs at the farmer level. Therefore, utilizing rice straw through ammoniation technology is a relevant solution to improve feed quality while reducing agricultural waste in Wangka Village.

Various community service activities regarding the utilization of rice straw through ammoniation technology have been reported previously. Santoso (2019) demonstrated that ammoniation training can improve farmers' knowledge regarding the use of rice straw as an alternative feed for ruminants. Furthermore, Nubatonis et al. (2022) reported that the application of ammoniation technology among farmer groups in North Central Timor Regency successfully improved farmers' understanding and skills in processing agricultural waste into livestock feed. Gaina et al. (2022) also demonstrated that demonstration methods and hands-on practice effectively enhanced farmers' knowledge of ammoniation technology. However, most of these activities have focused on technology transfer during training, while evaluations of participants' successful implementation of practices, monitoring of the fermentation process for 21–28 days, and the potential for sustained technology adoption after the activities have not been widely reported. Furthermore, there have been few community service activities that specifically integrate the unique conditions of rice-producing regions with the issue of livestock feed availability during the dry season as the basis for designing community empowerment programs.

Given these conditions, this community service program was designed not only to provide training on the production of ammoniated rice straw but also to provide guidance and

monitoring throughout the fermentation process and to evaluate the participants' mastery of the technology. This approach is expected to enhance the knowledge and skills of farmer-livestock breeders in utilizing rice straw as an alternative feed, encourage the adoption of appropriate technologies at the community level, and support the sustainable supply of livestock feed during the dry season. Thus, this initiative not only contributes to building community capacity but also supports the development of a more productive, economical, and environmentally friendly integrated crop-livestock system.

METHOD

The community service activity was held on May 8, 2026, in Wangka Village, Aesesa Subdistrict, Nagekeo Regency, with 15 farmers and livestock breeders participating. The target area was selected based on preliminary observations indicating that the community had an abundance of rice straw waste, which had not yet been optimally utilized as livestock feed, while during the dry season, livestock farmers faced a shortage of forage. The activity employed a Participatory Action Research (PAR) approach, which emphasizes active community involvement in every stage of the program from problem identification and training implementation to technology practice and evaluation of activity outcomes. This approach was chosen so that participants would not only receive information but also gain hands-on experience in applying rice straw ammoniation technology in accordance with local conditions and needs.

The project began with identifying problems through field observations and interviews with village officials and farmer-rancher groups to gather information on the availability of livestock feed, the utilization of rice straw, and the challenges faced during the dry season. Based on the results of this identification, an extension session was conducted on the characteristics of rice straw as a feed ingredient, the principles of ammoniation technology using urea fertilizer, the benefits of improving the nutritional quality of rice straw, and the potential for its use as an alternative feed for ruminant livestock. The next phase consisted of demonstrations and hands-on practice in the production of ammoniated rice straw, which included chopping the straw, mixing the urea solution, spraying it evenly, arranging the straw in fermentation bins, sealing them airtight, and allowing the fermentation process to take place for 21–28 days.

After the fermentation process is complete, monitoring and guidance are provided to evaluate the success of the ammoniation process based on physical indicators, namely a change in color to yellowish-brown, a softer straw texture, the presence of a characteristic ammonia odor, and the absence of signs of decay or mold growth. Monitoring also involved discussions with participants regarding challenges encountered during the fermentation process, the appropriateness of the procedures implemented, and the participants' readiness to adopt the technology in their daily livestock farming activities. This guidance aims to ensure that the introduced technology can be applied independently and sustainably by the community after the outreach activities are completed.

The activity was evaluated to measure the program's success in terms of participants' knowledge, skills, and responses. Knowledge was assessed through a post-test and discussions on the principles of ammoniation technology, the benefits of ammoniated straw, and the production procedures. Skills were assessed using an observation sheet to evaluate participants' ability to independently carry out each step of ammoniated straw production in accordance with the demonstrated procedures. Meanwhile, participants' responses were evaluated through interviews and discussions regarding the benefits of the activity, the ease of implementing the technology, and their commitment to adopting ammonia treatment technology for livestock

feed production. The program was deemed successful if the majority of participants demonstrated a good grasp of the material, were able to practice the technology independently, and expressed a willingness to apply the technology in their livestock farming activities in Wangka Village.

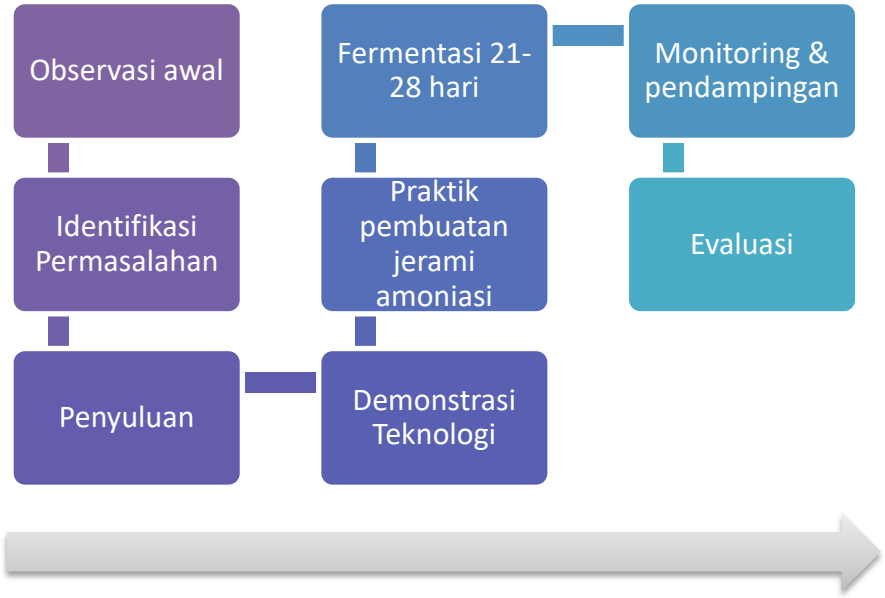

Figure 1. Implementation Process for Community Service Activities

RESULTS AND DISCUSSION

Implementation of the Rice Straw Ammoniation Technology Training Program

This community service activity was carried out in Wangka Village, involving 15 farmers and livestock breeders who had previously made only limited use of rice straw as livestock feed or even left it to become waste after harvest. Based on initial observations, most participants had never received training on ammoniation technology, resulting in very low utilization of rice straw as an alternative feed source. This situation caused livestock farmers to struggle to meet their forage needs, especially during the dry season when grass availability decreases significantly.

The program began with an educational session on the potential of rice straw as an alternative feed ingredient and the benefits of ammoniation technology in improving the nutritional quality of the straw. In addition to the presentation of materials, the program also included interactive discussions that gave participants the opportunity to share the various challenges they face in providing livestock feed. This participatory approach allowed the training content to be tailored to the community's needs, making it easier for participants to understand the benefits of the introduced technology.

Figure 2. Outreach and training on rice straw ammoniation technology for farmer-livestock breeders in Wangka Village.

The high level of enthusiasm among participants during the activity indicates that ammoniation technology is an innovation relevant to the community's needs. This is in line with the principles of Participatory Action Research (PAR), which positions the community as the primary subject in the learning and problem-solving process (Cornish et al., 2023). According to Baum et al. (2006), active community involvement from the problem-identification stage through program implementation will increase a sense of ownership of the introduced innovation, thereby increasing the likelihood of program sustainability.

Enhancing Participants' Knowledge and Skills through Rice Straw Ammoniation Technology

The next stage consisted of the core activities: demonstrations and hands-on practice in the production of ammoniated rice straw. The outreach team demonstrated all stages of the process, starting from chopping the straw, preparing the urea solution, spraying the solution evenly, arranging the straw in the fermentation bin, to sealing it airtight. After the demonstration, all participants were given the opportunity to practice each step independently with guidance from the outreach team.

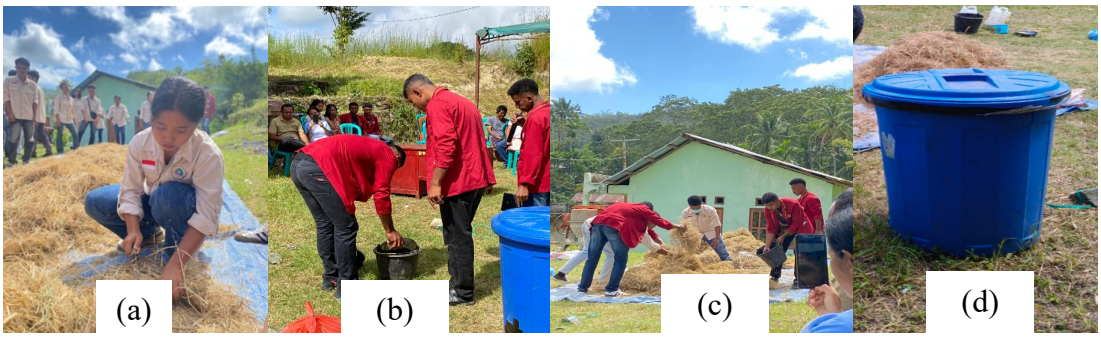

Figure 3. Practical steps in the production of ammoniated straw, including (a) chopping the straw, (b) mixing the urea solution, (c) spraying the solution onto the straw, and (d) sealing the straw during the fermentation process.

The demonstration method, combined with hands-on practice, proved to help participants understand each stage of the ammoniation process. Based on observations during the activity, most participants were able to follow the procedures for producing ammoniated straw systematically and demonstrated improved skills in processing agricultural waste into livestock feed. These findings align with the concept of adult learning proposed by Knowles et al. (2015), which states that adults find it easier to master skills when they have learning experiences

directly related to their work needs. Furthermore, the theory of Experiential Learning (Kolb, 2015) explains that hands-on practice allows participants to build new knowledge through concrete experiences, thereby making learning more meaningful.

This training also demonstrated that participants began to understand the benefits of ammoniation technology in improving the quality of straw as livestock feed. This increased understanding was evident in the participants' ability to explain the role of urea in the ammoniation process, the importance of anaerobic conditions during fermentation, and the changes in the physical characteristics of straw after fermentation was complete. These findings support the results of community service projects by Gaina et al. (2022) and Nubatonis et al. (2022), who reported that demonstrations and hands-on practice are effective methods for improving farmers' knowledge and skills in adopting feed processing technologies based on agricultural waste.

Program Success Evaluation

The program evaluation was conducted to determine the participants' level of mastery of rice straw ammoniation technology after completing the entire training series. The assessment focused on the participants' ability to understand the procedures for producing ammoniated rice straw and to independently carry out each step in accordance with the procedures that had been demonstrated. Evaluation results were obtained through direct observation during practical sessions, group discussions with participants, and monitoring of the rice straw fermentation process.

Table 1. Participants' Success Rates in Rice Straw Ammoniation Practice

Category	Number of Participants	Percentage (%)
Understands the procedure and is able to perform ammonization independently	12	80.00
Understands some of the procedure but still requires supervision	3	20.00
Total	15	100.00

According to Table 1, 12 out of 15 participants (80.00%) understood the entire procedure for producing ammoniated straw and were able to apply the technology independently. Participants were able to carry out each step from preparing the straw, making the urea solution, spraying it evenly, arranging the straw in the fermentation bin, to sealing it airtight in accordance with the procedures provided. This achievement demonstrates that a training method combining instruction, demonstrations, hands-on practice, and mentoring can enhance participants' skills in mastering ammonia-treated straw technology as an appropriate technology in the livestock sector.

Meanwhile, 3 participants (20.00%) still required mentoring, particularly in determining the correct urea dosage, maintaining straw moisture during the mixing process, and ensuring that fermentation conditions remained airtight. Nevertheless, participants in this group had understood the basic concepts of ammoniation technology and were able to follow most of the practical steps well. These findings indicate that differences in participants' proficiency levels are more influenced by prior experience and the intensity of hands-on practice than by their level of acceptance of the introduced technology.

The participants' success in mastering ammoniation technology was supported by the application of a practice-oriented learning method ("learning by doing"). According to Knowles et al. (2015), adult learning is more effective when participants have the opportunity to directly apply the material they have learned in a context that aligns with their needs. This view is reinforced by Kolb (2015), who explains that direct experience is a key component in the process of developing knowledge and skills through the experiential learning cycle.

Therefore, the combination of demonstrations, hands-on practice, and mentoring applied in this activity was a crucial factor in enhancing the participants' mastery of rice straw ammoniation technology.

Monitoring conducted over 21–28 days showed that the ammoniated rice straw produced by the participants exhibited physical characteristics consistent with indicators of successful fermentation: it was yellowish-brown in color, softer in texture than fresh rice straw, emitted a characteristic ammonia odor, and showed no signs of decay or fungal growth. These results indicate that the majority of participants were able to correctly implement the fermentation procedures, thereby producing ammoniated rice straw suitable for use as feed for ruminant livestock.

Figure 4. Monitoring the results of ammoniated straw fermentation and evaluating the participants' practices following a 21–28-day fermentation process.

The results of this evaluation show that the training not only successfully improved the participants' understanding of ammoniation technology but also built practical skills that can be applied in daily livestock farming activities. These findings are consistent with the research by Nubatonis et al. (2022), Gaina et al. (2022), and Kadju et al. (2026), which reported that training based on demonstrations and hands-on practice can improve farmers' ability to adopt technologies for processing agricultural waste into livestock feed. From a community empowerment perspective, the fact that 80% of participants were able to independently apply the technology indicates that the program has successfully achieved its primary objective: enhancing the capacity of farmers and livestock breeders to utilize rice straw as a high-quality alternative feed source, thereby potentially supporting livestock feed security during the dry season.

CONCLUSION

The training on rice straw ammoniation technology conducted in Wangka Village successfully improved the knowledge and skills of farmer-livestock breeders in utilizing rice straw waste as an alternative feed for ruminant livestock. Through a Participatory Action Research (PAR) approach that integrated extension, demonstrations, hands-on practice, mentoring, and monitoring, participants gained practical learning experiences tailored to on-the-ground conditions. Evaluation results showed that 12 out of 15 participants (80%) understood the procedures for producing ammoniated rice straw and were able to practice them independently, while 3 participants (20%) still required mentoring on several technical steps. Monitoring results during the fermentation process also indicated that the resulting ammoniated rice straw met the physical success indicators, making it suitable for use as livestock feed.

This initiative demonstrates that rice straw ammoniation technology is an effective solution for improving the utilization of agricultural waste while supporting the supply of livestock feed during the dry season. In addition to enhancing the community's capacity to adopt appropriate technologies, this program also has the potential to reduce post-harvest straw burning, improve the efficiency of local resource utilization, and support the development of more sustainable agricultural and livestock systems.

The program's sustainability requires ongoing support focused on consistent technology implementation at the farmer level, strengthening the institutions of farmer and livestock breeder groups, and fostering collaboration among universities, local governments, agricultural extension workers, and relevant agencies. This support is expected to increase technology adoption rates, expand the use of rice straw as an alternative feed, and have a greater impact on livestock productivity and the well-being of rural communities.

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