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M-Bio Feed Fermentation for Student Empowerment and Sheep Productivity at Al Muminun Islamic Boarding School

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Abstract

This community service program aimed to improve the capacity of santri (students) at Pondok Pesantren Murottalulquran Al Muminun in managing sheep livestock feed. The program was initiated in response to the participants' limited knowledge of feed processing and their high dependence on fresh forage, which was seasonally unstable. The methods employed included socialization, training, technology implementation, mentoring, and evaluation. A total of 20 santri participated in this community service program, comprising 15 male and 5 female students, all of whom were enrolled at the Senior High School level. The pre-test results indicated that none of the participants had prior knowledge of fermented feed or had previously received training on its production. The post-test results demonstrated that 87% of participants improved from 63.5 to 72.35. Their scores and the production of 50–100 kg of fermented feed per cycle. This initiative also supported the Sustainable Development Goals (SDGs), particularly Quality Education and the promotion of economic independence for the pesantren.

Keywords: feed fermentation; M-Bio; sheep livestock; santri; food security

Introduction

Islamic boarding schools (pesantren) in Indonesia serve not merely as centers of religious education but also as important drivers of community-based economic development. Various programs such as *santripreneur* initiatives and the strengthening of economic literacy among santri have proven capable of fostering economic independence within the pesantren environment while simultaneously building the entrepreneurial capacity of santri (Rahmawati & Indrarini, 2021; Suryani et al., 2024; Yamani & Faiz, 2022). Building on this potential, *pesantren* provide an appropriate setting for community service programs that introduce and implement appropriate technologies to improve the productivity and sustainability of their economic activities. In the livestock sector, the adoption of feed fermentation

technology offers a practical solution to enhance feed availability, reduce production costs, and increase sheep productivity, thereby contributing to the long-term economic sustainability of the Islamic boarding school.

Pondok Pesantren Murottalulqur'an Al-Mu'minin in Tasikmalaya is one such Islamic boarding school that integrates religious education with community-based economic activities. The pesantren accommodates approximately 35 santri and operates a small-scale sheep farming unit of approximately nine sheep as one of its productive economic enterprises. Consistent with efforts reported elsewhere to strengthen entrepreneurial capacity among santri (Rahmawati & Indrarini, 2021; Suryani et al., 2024; Yamani & Faiz, 2022), the pesantren's management is committed to promoting entrepreneurship and livestock development as a means

of building students' practical skills while supporting the institution's economic sustainability. Favorable agro-climatic conditions, together with steadily growing market demand for sheep, further indicate considerable potential for expanding the pesantren's sheep farming activities. However, preliminary field observations and needs assessment revealed that livestock management practices remained largely conventional: feed preservation technology had not yet been adopted, and farmers relied heavily on fresh forage, whose availability fluctuates considerably during the dry season. These conditions have resulted in recurring seasonal feed shortages that constrain livestock productivity, underscoring the need for training in and adoption of feed fermentation technology. Feed scarcity during the dry season is a common constraint widely reported among small-ruminant farmer groups across various regions of Indonesia (Zullaikah et al., 2023).

The limited adoption of feed processing technology results in feed with low nutritional quality and a short shelf life, making it difficult for farmers to maintain a consistent feed supply throughout the year. This condition directly affects livestock productivity: unstable nutrient intake has been shown to impair growth and reproductive performance in small ruminants (Muqit et al., 2021), while fermented feed has been shown to improve growth performance specifically in sheep (Abrori et al., 2022). Despite this need, no feed preservation or fermentation technology had previously been introduced to the sheep farming unit at Pondok Pesantren Murottalulqur'an Al-Mu'minin, leaving the pesantren without a practical means of stabilizing feed supply during the dry season. Feed fermentation technology utilizing microorganisms, such as M-Bio, has become one of the widely adopted solutions in community service programs to address comparable challenges elsewhere. The fermentation process has been shown to improve nutritional value, enhance digestibility, and extend the shelf life of feed materials derived from local agricultural by-products, such as straw, corn stover, and other forages (Fadilah & Hidayat, 2023; Jabar et al., 2023; Yanuartono et al., 2019). The application of fermentation technology based on local microorganisms has also proven effective in farmer empowerment programs involving collaboration between universities and pesantren as community service partners.

Based on these challenges and the pesantren's underlying potential, this community service program aims to empower santri through hands-on training in feed fermentation technology, thereby ensuring a stable, year-round feed supply and improving sheep productivity within the pesantren. Beyond its direct economic benefits, this program contributes to Sustainable Development Goal (SDG) 4 on Quality Education, which emphasizes equipping young people with life

skills and vocational competencies as part of lifelong learning (Nurfatimah et al., 2022). Within the pesantren context specifically, this type of life-skills training has been shown to strengthen santri's independence and readiness for productive life beyond the pesantren (Noor, 2015). Accordingly, this program is designed not only to resolve an immediate feed-management constraint but also to build santri's transferable technical and entrepreneurial capacity.

Material and Method

The program was conducted at Pondok Pesantren Murottalulquran Al Muminun, Cilembang, Tasikmalaya. A total of 20 *santri* participated in this community service program, comprising 15 male and 5 female students, all of whom were enrolled in Senior High School. The materials used for feed production included fresh forage, straw, or agricultural waste as the main substrate, supplemented with rice bran as a carbohydrate source, molasses as an energy starter, and M-Bio as the microbial inoculant. Equipment included a simple chopper for size reduction and 100-liter plastic drums for anaerobic fermentation. The implementation followed five systematic stages:

1. Preliminary Survey and Pre-test: A preliminary survey and participatory discussion identified partners' needs, existing livestock management practices, and priority problems. A pre-test assessed participants' baseline knowledge of sheep nutrition, feed fermentation, M-Bio bioactivators, and the benefits of fermented feed.

Table 1. Components of the Pre-test and Post-test Assessment

Assessment Aspect	Instrument	Time
Sheep nutrition	Multiple-choice questionnaire	Pre-test & Post-test
Feed fermentation concepts	Multiple-choice questionnaire	Pre-test & Post-test
M-Bio application	Multiple-choice questionnaire	Pre-test & Post-test
Feed preparation procedures	Multiple-choice questionnaire	Pre-test & Post-test
Benefits of fermented feed	Multiple-choice questionnaire	Pre-test & Post-test

The pre-test and post-test consisted of the same multiple-choice questionnaire to ensure consistency in measuring participants' knowledge before and after the training. Each correct answer was awarded one point, and the total score was converted into a percentage for analysis.

2. Training and Technology Demonstration: Participants received theoretical instruction on

sheep nutrition and M-Bio-based feed fermentation, followed by a hands-on demonstration of the fermentation procedure.

3. **Technology Implementation:** Working groups produced fermented feed from locally available forage and M-Bio bioactivators, yielding approximately 50–100 kg per production cycle.
4. **Mentoring and Evaluation:** Continuous mentoring was provided throughout the fermentation process. Program effectiveness was evaluated using identical pre- and post-training questionnaires to measure gains in participants' knowledge and practical understanding.
5. **Program Sustainability:** A santri livestock working group was established to continue fermented feed production and transfer knowledge to new members, supported by SOPs and a practical manual. The team also coordinated with pesantren management to integrate fermentation into routine livestock activities and provided periodic technical assistance after program completion.

Results and Discussion

The community service program focused on empowering *santri* through the implementation of feed technology to address the seasonal instability of forage. The results and discussion are elaborated as follows:

Preliminary Survey and Pre-Test

Prior to the training, the community service team conducted a preliminary needs assessment through field observations and discussions with pesantren management and participating santri. The assessment found that sheep farming relied on conventional, fresh-forage practices with no feed preservation techniques, and that this program represented the first introduction of M-Bio-based feed fermentation technology at the pesantren.

A pre-test was then administered to establish participants' baseline knowledge prior to the theoretical and practical training sessions—a pre-test–post-test framework widely used in community service programs for its objective measure of training effectiveness (Banuwa & Susanti, 2021). The instrument consisted of a 10-item multiple-choice questionnaire covering basic feed management, fermentation principles, M-Bio application, preparation procedures, and the benefits of fermented feed (Table 1).

Of the 20 participating santri, none had prior knowledge or training in feed fermentation. The average pre-test score was 63.5 (Figure 4), reflecting limited baseline understanding of fermentation principles, M-Bio application, and their role in improving feed quality and sheep productivity—consistent with conditions

commonly reported among smallholder farmers without prior technical guidance. These results were used both to tailor the training content and practical sessions to participants' knowledge gaps and as the baseline for the post-test comparison.



Figure 1. Conducting the Pre-Test in the Classroom

Explanation of the Material and Procedure

This extension activity prepared santri for hands-on fermentation practice, with training topics designed around the knowledge gaps identified in the needs assessment and pre-test—namely, limited understanding of feed fermentation, M-Bio application, and livestock feed management. The curriculum covered feed processing fundamentals, M-Bio-based microbial fermentation, identification of local feed materials, step-by-step fermented feed production, and basic marketing strategies for sheep products, delivered through lectures, discussions, Q&A, and hands-on demonstrations. This combined approach has been shown to effectively improve farmers' knowledge and motivation to adopt fermentation technology (Fadilah & Hidayat, 2023; Jabar et al., 2023).

Beyond technical skills, the training introduced economic aspects of sheep farming—marketing, branding, supply chain management, and digital platforms—to strengthen participants' entrepreneurial knowledge and the pesantren's economic independence (Suryani et al., 2024; Yamani & Faiz, 2022). Integrating technical and entrepreneurial competencies has similarly been shown to enhance the long-term sustainability of bioresource-based business units in other pesantren settings (Paksi et al., 2023). Islamic values and ecopreneurship principles—*tauhid*, honesty, responsibility, and *barakah*—were woven throughout the training to encourage santri to apply these innovations responsibly while supporting the pesantren's long-term economic sustainability (Fauzia, 2018).

Practice Session and Technology Implementation

The practical training phase constituted the core of this community service program, focusing on fermented feed production to ensure a consistent, periodic supply. M-Bio was selected as the bio-activator over alternative

starters such as EM4 or locally sourced microorganisms (MOL) due to its affordability, ease of application, higher microbial count, and strong suitability for smallholder-scale production.



Figure 2. Explanation of the Subject Matter and the Steps for Preparing Fermented Feed

Participants were actively engaged in every stage of the process, which included chopping the raw forage into uniform sizes (Figure 3), weighing and mixing the substrate, spraying the M-Bio solution evenly while

manually turning the material to ensure homogeneous distribution, and packing the mixture into drums under the guidance of the facilitation team. The drums were subsequently sealed airtight to establish anaerobic conditions, adhering to the principle that feed fermentation is fundamentally a preservation process driven by anaerobic starter microorganisms (Junaidi et al., 2024). The Lactic Acid Bacteria (LAB) in M-Bio accelerate crude fiber decomposition and enhance nutrient bioavailability during fermentation. The active fermentation phase generally lasted 14–21 days under ambient temperature, which aligns with standard practices in similar feed fermentation initiatives (Fadilah & Hidayat, 2023).

Fermentation success was evaluated through organoleptic (sensory) testing conducted by the participants, focusing on aroma, color, and texture. High-quality fermented feed is typically characterized by a fresh, slightly acidic aroma resembling fermented fruit, a preserved greenish-yellow hue, and a compact, non-clumping, non-slimy texture.



(a)



(b)

Figure 3. Practical Training Session. (a) Chopping Fresh Grass and (b) Mixing Feed Components for Fermented Feed Preparation

Monitoring and Evaluation

To measure learning outcomes, a post-test using the same multiple-choice questionnaire as the pre-test was administered following the extension and practical training sessions (Banuwa & Susanti, 2021). The average participant score increased from 63.5 to 72.35 (Figure 4), with 87% of participants showing score improvements. This indicates that combining theoretical instruction with hands-on practice effectively enhanced participants' understanding of fermentation principles, M-Bio application, and feed management (Widiastuti et al., 2025).

Beyond knowledge gains, the program yielded tangible operational outcomes. Participating *santri* successfully produced 50–100 kg of fermented feed per

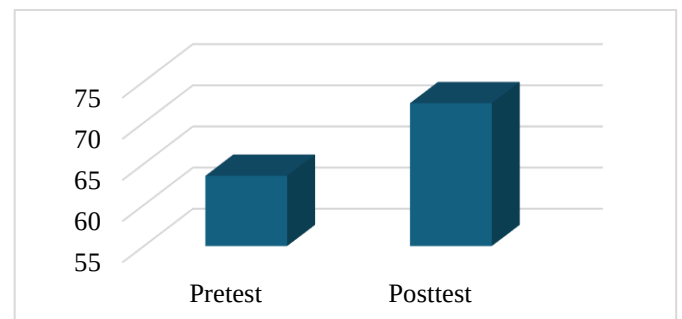


Figure 4. The Average of Pre-Test and Post-Test Scores

cycle, effectively securing short-term feed supplies and reducing dependence on fresh forage. To ensure program sustainability, a dedicated *santri* livestock working group was formed to manage routine production, monitor quality, and train new members. This was

reinforced by the provision of Standard Operating Procedures (SOPs), a practical guidebook, integration into the *pesantren*'s daily livestock management, and ongoing technical follow-up by the implementation team.

Conclusion

Islamic boarding schools (*pesantren*) hold strong potential as hubs for community economic development. However, sheep farming at Pondok Pesantren Murottalulqur'an Al-Mu'minin in Tasikmalaya faced seasonal feed scarcity and low nutritional supply due to reliance on conventional fresh forage. The aim of this community service program was to improve the knowledge and practical skills of *santri* in producing fermented feed using M-Bio technology. To resolve this issue, the program trained 20 *santri* in feed fermentation technology using M-Bio inoculants, rice bran, molasses, and local agricultural waste. Aligned with SDG 4 (Quality Education) and *santripreneurship*, the program followed five stages: preliminary survey, classroom instruction, hands-on implementation, evaluation, and sustainability planning. Instruction covered livestock nutrition, anaerobic fermentation, marketing strategies, and Islamic ecopreneurship. During practical sessions, *santri* chopped forage, mixed substrates with M-Bio, sealed them in 100-liter drums for 1–3 weeks, and evaluated quality through sensory parameters (acidic aroma, greenish-yellow color, non-slimy texture). The intervention yielded significant learning outcomes, as evidenced by a knowledge gain where scores rose from a baseline pre-test average of 63.50 to a post-test average of 72.35, representing an overall 13.94% improvement. Ultimately, the program enabled the *santri* to independently produce 50–100 kg of fermented feed per cycle, significantly enhancing their technical capacity and establishing a sustainable, year-round feed supply for the *pesantren*'s livestock.

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