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Education on Feed Provision Through Fermentation Technology in Galang Kangin Goat Farmers Group

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A B S T R A C T

Goat feed fermentation aims to increase nutritional value, extend shelf life, and make feed easier for livestock to digest. The objective of this activity is to enhance partners' knowledge in managing their livestock businesses through the concept of a green economy and to improve their skills in using fermentation technology to convert forage and agricultural waste into high-nutrient feed for goats. The implementation methods of the community service activities included socialization, education, technology transfer, training, and mentoring. The results of these activities demonstrated an increase in knowledge and understanding among partner group members regarding the importance of applying green economy concepts to their livestock businesses. There was also an improvement in partners' knowledge and skills in processing forage and agricultural waste into high-nutrient livestock feed using feed fermentation techniques. The community service activities conducted at the Galang Kangin Goat Farming Group proceeded smoothly, with active participation from the activity partners. Based on the results of the pre-test and post-test administered, there was a 27% increase in knowledge and skills among the partner group members compared to previous levels.

Contribution to Sustainable Development Goals (SDGs):

SDG 1: No Poverty

SDG 2: Zero Hunger

SDG 4: Quality Education

SDG 8: Decent Work and Economic Growth

1. INTRODUCTION

1.1. Research Background

One of the main targets of the Indonesian government in 2026 is to achieve self-sufficiency in meat from both ruminant and non-ruminant livestock. One type of ruminant livestock with potential for development in rural areas is goats. Goats were chosen for breeding because they have many advantages. [1] mentioned that raising goats and sheep has various advantages, such as being easily adaptable to the environment and easy to maintain without requiring a large amount of capital. [2] mention that goats are a

source of animal protein that is rich in nutrients. Goat meat contains various important nutrients, including protein, fat, calcium, phosphorus, and the vitamin B complex, which are beneficial to human health.

Goats are a type of livestock commonly raised by farmers and ranchers in rural areas. As ruminants, they require more than 70% forage in their diet. Due to the abundance of forage that can grow well in the area surrounding Apuan Village, goat farming has potential in Apuan Village, Baturiti District, Tabanan Regency, Bali Province. The Galang Kangin Goat Livestock Group is one livestock group that still exists and continues to develop its goat farm. The group focuses on raising Ettawa crossbred goats (PE). PE goats are one of the most widely raised breeds in Indonesia.



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PE goats are relatively more adaptable to Indonesia's climatic conditions [3]. [4] stated that PE goats have considerable potential as a source of meat and milk. PE goats have higher meat production characteristics than kacang goats in intensive, semi-intensive, and extensive farming systems [5].

The problems currently experienced by partners include having high-quality forage and agricultural waste that is not being fully utilized as animal feed. In addition, partner farmers also complain that often not all of the forage given is eaten by the goats; much of it is scattered on the floor of the pen, mixed with manure, and ultimately wasted. [6] state that larger feeding troughs will increase the capacity of the feeding troughs, and vice versa, so that the possibility of feed scattering is greater and the basic needs of the livestock are not met. However, the opposite condition is experienced by partner farmers. Their feed trough sizes already meet the standards, but the goats they raise often select the forage provided. To overcome this problem, partner farmers have sought out the forage that is most preferred by their livestock. However, this has not had a positive impact due to the lack of diversity in the types of forage and their nutritional content for goats. Good feed is feed that contains complete nutrients in the form of protein, carbohydrates, fat, water, vitamins, and minerals [7].

1.2. Literature Review

1.2.1. Green Economy

The concept of a green economy plays a major role in realizing sustainable livestock farming. [8] A green economy is defined as an economic system that focuses on the use of renewable energy, reduction of emissions and pollution, improvement of energy and resource efficiency, and the creation of green jobs and technologies. Renewable energy, waste management, greenhouse gas emission reduction, and nature conservation are forms of implementing green economy policies [9]. [10] argues that green growth, green economy, and sustainable development are terms that cannot be separated from one another.

1.2.2. Fermentation of Forage-Based Feed and Agricultural Waste

Forage is the staple food of ruminants. [11] argues that sustainable feed availability can be achieved through the application of animal feed processing technology using fermentation technology. The fermentation process involves biochemical reactions using microorganisms that have been proven effective in reducing anti-nutritional compounds, which can interfere with animal digestion. This process improves digestibility and increases the nutritional value of forage (protein and vitamins). [12], [13]. On the other hand, it was argued that using fermentation in feed processing technology can increase the nutritional value of feed ingredients and the utilisation of agricultural residues when feed availability in the area is insufficient [14]. [15] stated that nutritional factors greatly affect livestock growth. Nutrient deficiencies during the growth period will be a significant obstacle to the growth process.

1.3. Research Objective

This community service activity was carried out among the members of the "Galang Kangin" Goat Farming Group, which consists of 10 people. This farming group is chaired by I Ketut Sandita Yasa. This program will focus on educating and assisting in fermenting forage and agricultural waste from the surrounding

area to produce high-nutrient feed for goats. It will provide forage choppers, fermenters, and other equipment needed to create a green economy.

The objectives of this community service activity for partners include enhancing their knowledge and skills in applying fermentation technology to forage and agricultural waste in the surrounding area as highly nutritious feed for goats. Through the provision of grants for forage choppers, fermenters, molasses, and feed fermentation equipment, it is hoped that partners will assist in increasing the population of goats raised and reducing environmental pollution through the use of agricultural waste as fermented feed, and can implement a green economy so that the sustainability of their business will be realized.

2. MATERIALS AND METHODS

The Community Empowerment Partnership Program (PKM) was implemented in July 2025 with the involvement of a partner, namely the Galang Kangin Goat Farming Group located in Banjar Tinungan, Apuan Village, Baturiti District, Tabanan Regency. This farming group has 10 members whose main livelihood is farming. The community service program was implemented through socialization, outreach, technology transfer, training, and mentoring activities. The types of activities carried out are as follows:

(1). Socialization Of The Community Service Program

During the socialisation of the community service activity plan for the Galang Kangin Goat Breeding Group, the service team gave a detailed presentation of the program based on the problems currently being experienced by the partners. In addition, the objectives, methods, and benefits of the activities were explained, and the partners' needs for preparation and increased active participation in the activities were discussed. The main objectives of this socialisation were to reach a mutual agreement on implementing community service, ensure that the activities aligned with the community's conditions, and increase the empowerment of the partner group.

(2) Education Through Counseling And Group Discussions

The counselling sessions focused on applying the Green Economy concept to running livestock businesses, supporting the group's future existence. Group members need to be equipped with the green economy concept to manage their livestock businesses sustainably and efficiently, utilising natural resources for livestock feed.

(3). Technology Transfer Through and Hands-on Practice

Technology transfer is achieved by applying techniques to ferment forage-based animal feed using high-quality forage and agricultural waste, in collaboration with members of the partner group. The use of high-quality forage and agricultural waste through fermentation will certainly be useful for producing feed that is highly nutritious, easily digestible by goats, and reduces the negative impact of agricultural waste on the surrounding environment.

(4) Provision Of Equipment Grants

During the training, the service team will provide partners with grants in the form of forage choppers, barrels, fermenters, plastic,

and other supporting tools to enable them to carry out forage fermentation on an ongoing basis.

3. RESULT AND DISCUSSION

Community service activities began with preparations at the service location, specifically at the group meeting hall and group barn, which would later be used for chopping and fermenting forage for goats. The community service activity began with a pre-test administered to partner farmers to assess their knowledge of the community service material, which would be provided through both counselling and hands-on practice.



Figure 1. Pre-test Completion by Members of The Galang Kangin Goat Farmers Group

After farmers completed the pre-test, the activity continued with extension and discussion on the concept of green economy in goat farming. Here, farmers were given material on the importance of applying the concept of green economy to their farming businesses. Ref. [16] mentioned that the green economy has an important role in improving various aspects of social welfare in the community, including job creation, poverty reduction, increased access to basic services, and environmental preservation. Goat farmers, in addition to being economically oriented, are also expected to play an active role in environmental conservation efforts in their surrounding areas. Moreover, Apuan Village is a village often passed by tourists en route to tourist attractions in Jatiluwih Village.



Figure 2. Presentation of Extension Material by the Community Service Team to Members of the Galang Kangin Goat Farmers Group

After the presentation by the speaker, who was also a member of the community service team, the activity continued with a break. The event then continued with the handover of aid,

including 1 unit of forage chopper, plastic barrels, buckets, tarpaulins, large plastic rolls, fermenters, molasses, and other supporting equipment, from the volunteer team to the group members, represented by the group leader, Mr I Ketut Sandita Yasa.

Group members indeed requested the grant of forage choppers to partners because the group did not yet have forage choppers. These choppers are needed to facilitate the work of farmers in preparing feed for their goats. In addition, supporting equipment was also provided to ferment feed ingredients. With the forage chopper machine, farmers can mix various types of forage into a complete fermented ration and reduce goats' tendency to choose only their favorite types of forage. [17] explained that feeding through a complete feed system is useful for avoiding feed selection, where most of the feed will be consumed and livestock tend not to be selective when eating.

Ref. [18] stated that fermented feed produces good physical quality and high palatability compared to unfermented feed. The provision of fermented feed and complete feed aims to increase goat productivity, especially during the dry season. [15] state that nutritional factors greatly influence livestock growth; nutrient deficiencies during the growth period will be a major obstacle in the growth process. With the realisation of this grant assistance, the members of the partner group are happy and greatly benefited from the community service activities carried out by the service team from Warmadewa University.



Figure 3. Handover of Forage Choppers, Barrels, Fermentation Materials, And Other Supporting Equipment.

The hands-on activity of making fermented goat feed, based on high-quality forage and agricultural waste, began after the community service team had finished handing over the equipment grants. This activity was carried out by all members of the community service team, the students involved, and the Galang Kangin Goat Farming Group. By learning and understanding how to ferment high-quality forage and agricultural waste, it is hoped that group members will have more time to engage in traditional community activities and increase their livestock population.



Figure 4. Direct Practice of Fermenting High-Quality Forage and Livestock Waste into High-Nutrient Goat Feed.

After all the counseling activities and hands-on practice of feed fermentation were completed, the activity ended with a post-test for the group members. [19] states that the assessment of learning outcomes can also be done by comparing the pre-test results with the post-test results, either through written tests or performance tests. The results of the pre-test and post-test data analysis are presented in Table 1.

Table 1. Pre-test and Post-test Data Analysis

Statistics	Pre-test (%)	Post-test (%)
Average	65.0	91.9
Standard Deviation	3.3	2.3
Maximum Score	70	95
Minimum Score	60	88

Notes:

- t-value = 21.7
- p-value < 0.001

The results of the pre-test and post-test data analysis indicate a significant increase in respondents' knowledge after participating in the counselling and training provided by the community service team. The average knowledge score on the pre-test was 65%, which increased to 91.9% on the post-test. The standard deviation in the pre-test was higher (3.3) than in the post-test (2.3), indicating that the variability of respondents' scores decreased after the training. The maximum and minimum scores also showed an increase in all respondents. The paired t-test produced a p-value of less than 0.001, which means that this increase in knowledge is statistically significant. Thus, the counselling and training conducted have proven effective in enhancing respondents' knowledge of the green economy concept in goat farming management and their skills in fermenting forage

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from superior forage and agricultural waste available in the surrounding environment. These results align with [20]'s statement, where guidance from extension workers on processing coffee waste as feed for Bali cattle has successfully changed farmers' perceptions, which will continue at every stage of innovation adoption by farmers. The completion of the post-test by partners can be seen in Figure 5.



Figure 5. Post-test Completion by Members of The Galang Kangin Goat Farmers Group

Community empowerment, especially for farmers living in rural areas, requires concrete efforts from all parties. The limitations faced by rural communities in terms of knowledge, technology, and information, along with the absence of appropriate government programs to empower them, have made it difficult for them to effectively develop their potential [21]. Through the community service activities carried out by the service team, it is hoped that there will be an increase in the income and welfare of farmers.

4. CONCLUSION

Based on the activities carried out above, it can be concluded that the community service at the Galang Kangin Goat Farming Group has run smoothly and successfully. This is evident from the achievement of all targets and goals. The main output target is for members of the Galang Kangin Goat Farming Group to learn how to properly ferment forage, agricultural waste, and other widely available forage in the surrounding environment into highly nutritious feed for goats. Furthermore, the partner group members have understood the concept of a green economy in managing their livestock businesses. In the future, it is hoped that group members will apply this concept in their livestock businesses to achieve business sustainability and environmental preservation.

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