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Solution for Providing Ruminant Feed during the Dry Season in Pesisir Selatan Regency using Ammonia-treated Rice Straw

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ABSTRACT

The potential of rice straw in Pesisir Selatan Regency can be utilized to ammoniate straw as a solution to providing feed for ruminants. The abundance of agricultural waste can address livestock problems in Pesisir Selatan Regency during the dry season. The dry season makes the availability of forage stocks low. Through fermentation in ammoniation technology, straw waste can be used. The activity began with discussion, socialization, demonstration, and evaluation of the activity results. Fermented feed, such as straw ammoniation, has advantages and disadvantages. Ammoniated straw can increase digestibility, nutritional value, and long shelf life. The characteristics of good ammoniated straw are that it turns brownish yellow or does not change much from the color of the straw, when opened, it smells quite pungent of ammonia, the texture of the rice straw is soft, not rotten, and not moldy. Ammoniation as an alternative feed has high potential in supporting healthy and efficient livestock production. Community Service activities are an important step in encouraging sustainable agriculture and livestock.

Keywords: agricultural waste, ammoniated straw, livestock, ruminant

INTRODUCTION

South Pesisir Regency has a land area of ± 5,749.89 km^2 and a coastline length of ± 234 km. Based on administrative areas, South Pesisir Regency has 15 subdistricts, 182 villages, and 480 hamlets. The topography of Pesisir Selatan is lowland and hills, which are an extension of the *Bukit Barisan* highland, range with an altitude of between 0-1,000 meters above sea level. The population of Pesisir Selatan Regency aged 15 years and above generally work as farmers, accounting for 48.50%. It makes South Pesisir Regency a rice center with the largest standard rice field area in West Sumatra, namely 31,225 hectares. In addition, South Pesisir Regency is the largest producer of beef cattle in West Sumatra Province with a population of 86,630 head (BPS, 2022).

Cattle farming in South Pesisir Regency is still dominated by small-scale farmers, so the development of ruminant farming, especially beef cattle, is an important issue that needs to be improved. One of the important factors in farming is feed. However, in this case, the problem faced by farmers is the availability of quality forage, especially during the dry season. The types of plants that are mostly used by farmers as animal feed are several types of legumes and grasses. However, when the dry season, these types of feed crops become scarce, forcing farmers to look for alternative feed. Farmers are sometimes forced to feed their livestock unprocessed agricultural waste, which is certainly not good in terms

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of nutrition. One type of agricultural waste that is abundant in the South Coast Regency and has the potential to be utilized is rice straw.

Rice straw is a waste product or by-product of rice cultivation that is produced in large quantities. According to Suherman (2017), it has considerable potential as a source of fiber feed, especially during the dry season. Based on data from the Agricultural Research and Development Agency (2012), it was known that 37% of rice straw is not utilized because it was burned, while 36% is used as compost for animal bedding. Furthermore, only approximately 15%-22% was used as animal feed. The use of rice straw as animal feed is not optimal due to its high crude fiber content and low crude protein content, making it difficult for ruminants to meet their basic needs and produce. In addition to its low protein content, rice straw also has low dry matter and organic matter digestibility, which are between 34-52% and 42-59% (Winugroho et al., 1983), respectively, so that the dry matter consumption capacity of ruminants is only 2% of their body weight (Utomo et al., 1998).

However, with the development of science and technology, this should no longer be a serious problem. One way to do this is through fermentation. Fermentation is one way to extend the shelf life of feed. The advantages of fermentation technology are that it increases the nutritional value of feed and saves farmers time and energy in providing feed for their livestock. Fermentation is easy to implement and apply. Liu et al. (2015) stated that fermentation is a method to increase nutritional value that is suitable for rice straw characteristics because the process is relatively easy and the results are palatable, making it easier to feed to ruminants. The fermentation used is ammoniation technology, which is a chemical feed processing technology using ammonia (NH_3) to increase the digestibility of fibrous feed ingredients while also increasing their protein content.

Based on the above issues and conditions, the engagement activities to be carried out in community service are counseling and training in feed processing by making ammoniated rice straw. Through this activity, it is hoped that the community can apply the knowledge and skills provided, so that it can be a solution when experiencing obstacles in providing forage during the dry season and ultimately improving cattle growth.

METHOD

Implementation Methods

a. Field observations to identify problems faced by farmers in Pesisir Selatan Regency, which are then discussed to find solutions. An exploratory method was used through special dialogues with farmer groups to explore all the problems they face and their basic needs that must be addressed immediately (Suwitari, Yudiastari, & Suariani, 2018).
b. Socialization of the community service program to one of the farmer groups in Pesisir Selatan Regency.
c. Demonstration of the production of fermented animal feed in the form of ammoniated straw, which took place in a barn owned by one of the farmer groups, witnessed and assisted by members of the existing farmer groups.
d. The fermented animal feed product was delivered and will be tested directly by one of the farmer groups.

Activity Stages

a. First Stage: Presenting ideas/concepts as solutions to problems.
b. Second Stage: Socializing or explaining ideas/concepts for solving problems related to animal feed to specific parties.

c. Third Stage: Establishing cooperation with the community in solving problems related to animal feed.
d. Fourth Stage: Demonstrating the production of straw ammoniation.
e. Fifth Stage: Monitoring and evaluating the success or failure of straw ammoniation product production.

Partners Involved

Partners involved in the production of fermented animal feed, namely ammoniated straw, include Andalas University as the provider of funds to prepare the necessary tools and materials, livestock farmer groups and the community who are the target consumers of fermented feed, as well as village officials who assist in granting permits and providing venues for socialization and demonstrations on the production of ammoniated straw.

Based on the above issues and conditions, the activities to be carried out in community service are counseling and training in feed processing by making rice straw ammoniation. Through this activity, it is hoped that the community can apply the knowledge and skills provided, so that it can be a solution when experiencing obstacles in the provision of forage during the dry season and ultimately improve cattle growth.

RESULTS AND DISCUSSION

The first activity carried out was to conduct observations and discussions to identify the obstacles faced by residents, especially farmers and ranchers. From the observations, it was found that the problem often faced by ranchers was the availability of feed during the dry season. After identifying the obstacles faced by the community, solutions were provided to the community regarding one way of providing animal feed that is difficult to obtain during the dry season. Fermented feed is animal feed that has undergone a chemical structure change process.

The purpose of fermentation processes such as straw ammoniation is to improve the nutritional content of the feed that will be used. There are many benefits of fermented feed, including reducing odor pollution in livestock and the surrounding environment, increasing livestock appetite or palatability, and most importantly, it can last a long time, helping farmers provide feed during the dry season. The advantage of fermented feed is that it can last up to 3-4 months with proper storage. The disadvantage of fermented feed is that farmers must chop the feed into small pieces for the fermentation process to work properly, so farmers who do not have a chopper will expend more energy and time. One thing to note in the production of fermented feed is that the feed must be stored anaerobically and away from sunlight (Liu et al., 2015).

Some of the tools and materials needed in the process of making fermented feed were tarpaulin (as a base for mixing fermented feed ingredients), scales (for weighing raw materials), a machete (as a tool for chopping feed ingredients), a bucket (as a container for urea solution), and the ingredients used are rice straw, water, and urea. The first step in the manufacturing process was to weigh the straw to be used, then cut/chop the straw into 5-10 cm pieces. Use 5% urea of the total straw used, weigh and dissolve the urea with water in a 1:1 ratio. Next, mix the solution with the straw and put the straw into plastic bags, stacking them until there is no air inside. Then tie and seal it tightly. The storage period is approximately 3 weeks or 21 days. The characteristics of good fermentation are a brownish-yellow color change or no significant change from the color of the straw, a strong ammonia smell when opened, a soft texture, no rot, and no mold (Amin et al., 2015).

Fermentation can be indicated by a change in the color of ammoniated rice straw from yellow to brown, but the color still follows the original color of the straw. Ammonia-treated straw that fails to ferment will be darker and blacker. According to Reksohadiprojo (1998), this color change occurs in plants undergoing ensilage because of changes that occur in the plants due to anaerobic respiration, which continues as long as oxygen is available until the plant's sugar is depleted. Thus, CO_2 levels increase when oxygen decreases, causing the fermentation temperature to rise.

Figure 1. Rice straw before ammonia-treated

Figure 2. Rice straw after ammonia-treated

The good straw ammoniation has an ammonia smell. This smell is caused by alkaline conditions during the ammoniation process, which converts urea with the formula $CO(NH_2)_2$ into NH_3 (ammonia), which is then absorbed by the rice straw and produces a pungent ammonia smell. A weak odor indicates that the straw ammoniation process did not proceed properly, was inefficient, or even failed. Factors causing a weak odor can be influenced by the amount of urea used being too little or not in the correct proportion, or the silo or container not being tightly closed. According to Marjuki (2013), technical errors during straw ammoniation cause most of the ammonia formed to evaporate and not be bound by the rice straw, the urea is not yet or not completely hydrolyzed, there is a lack of water used or humidity in the silo, and there is a lack of ureolytic bacteria or urease sources in the rice straw used.

The bonds between lignin, cellulose, and silica in loose straw walls cause the straw to become soft. In principle, the longer the fermentation process, the softer and more pliable the texture of ammoniated rice straw will be, making it easier for rumen microbes to digest. According to Directorate General of Livestock and Animal Health (2011), one of the criteria for good ammoniation is that ammoniated straw is softer than the original straw.

Based on the results of the proximate analysis of ammoniated rice straw conducted by Paga et al. (2022), there was an increase in crude protein content from 4.30% to 6.17%, or 30.31%. There was an increase in the crude protein content of ammoniated rice straw using urea because urea contains about 46% nitrogen, which is equivalent to 284% crude protein (Puastuti, 2010). The crude fat content increased by 24.76%, from 0.79% to 1.05%. The hydrolysis of urea into ammonia occurs effectively at temperatures ranging from 30-60°C.

CONCLUSION

The potential for rice straw waste in South Pesisir Regency is very high due to its geographical location and the livelihoods of its residents. Straw waste is processed through fermentation. Straw ammoniation is a chemical feed processing technology that uses ammonia (NH_3). Its advantages include extending feed shelf life, improving digestibility, and increasing the nutritional value of rice straw. The characteristics of good ammoniation of rice straw are that it turns brownish-yellow or does not change much from the color of the straw, when opened it has a strong ammonia smell, the texture of the rice straw is soft, not rotten, and not moldy. Therefore, ammoniation of rice straw can be a solution for providing animal feed when the dry season.

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