Potency of Cajuput Leaf Waste as additional feed concentrate

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Abstract. Utilization of Cajuput leaf waste as a sheep feed, especially protein content (10.65%) has not met the SNI standard (> 15%). The addition of concentrate with high protein content is expected to increase the protein content in feed and improving the quality of feed (especially ammonia (NH3) production in rumen). The purpose of this research was to know the effect of addition of concentrate in increasing the protein content and also the potential of Cajuput leaves waste mixture with field grass as a sheep feed by in vitro test. The experiment used a complete randomized design with three treatments (R1 = 50% field grass + 50% concentrate; R2 = 25% Cajuput leaves waste + 25% field grass + 50% concentrate; R3 = 50% Cajuput leaves waste + 50% concentrate) with four repetitions. Statistics test with Anova followed by Duncan test. The results showed that the addition of concentrate to mixture of waste Cajuput leaves, field grass, and concentrate can increased the protein content in feed and affected to the production of NH3, VFA, and the digestibility of feed. From various aspects, treatment of R2 most likely to be used for sheep feed.

1. Introduction
Waste is the something produced from the remaining common materials used from a product. One of them is organic waste. Organic waste is goods that are considered unused and discarded by the previous user, but can still be used if it managed with the correct procedure [1]. That is generally produced from the area of rice fields, plantations, or agriculture [2].

Cajuput species (Melaleuca Cajuputi Powell) is a species of the Myrtaceae family that is used in the production of Cajuput oil because it contains high eucalyptol (1,8-cineol) compounds and is useful in medicine [3]. From the result of distillation process of Cajuput leaves produced ± 8,000 tons of solid waste. It was only 50% was used for boiler fuel briquettes in the process of Cajuput leaf distillation. The abundant waste has not been utilized and is only allowed to accumulated in the land surrounding factory area. The waste of Cajuput leaf is difficult to decompose because the high of ligno cellulose in the secondary cell wall. So to cope with the waste processing of Cajuput leaf is needed as a friendly alternative and beneficial environmentally. This time, some of animal farmer utilizing this organic waste as animal feed especially to fulfill the need of their livestock feed in dry season to substitute field grass.

Livestock ruminant especially sheep is a business that is commonly found in various regions in Indonesia. One of the factors influencing the quality of sheep meat is feed quality such as physical
quality of feed, nutrition content, production of NH3 and VFA and the level of livestock digestibility in sheep [4]. The feed given to ruminant should be of high quality that contains the substances needed by the body of the livestock such as carbohydrates, fats, proteins, minerals and water. Feed itself is a variety of foodstuffs that can be given and beneficial to livestock.

Research on the potential of Cajuput leaves waste as animal feed with in vitro test has been done by [5]. It showed results that a mixture of Cajuput leaves and field grass had a potential to be used as animal feed. Even though it has a potential as a feed but protein content of both Cajuput leaves waste (10.65%) and field grasses (8.82%) did not meet the optimum requirement of protein for livestock (> 15%) [6]. Because of protein values are quite low, so it was also impact to low value of NH3 produced in rumen (3.25 - 4.75mM), so further research is needed to increase the nutrient content of animal feed by adding concentrates with a high enough nutrient content. Usually, concentrate contain solid waste of soybean tofu, solid waste of fish, solid waste of coconut milk and others. There is no other research yet who applied cajuput leaf waste with concentrate and field grass. The result of this research are expected could help the Cajuput oil factory to decrease the amount of Cajuput leaves waste and also help the breeder to meet the needs of animal feed, especially in the dry season.

2. Materials and methods
Sheep rumen fluid used to test the potential of Cajuput leaves waste with its mixture as in vitro. The data were collected by measured variables such as NH3 production by using Conway Micro diffusion, Volatile Fatty Acid (VFA) using steam distillation method, Dry Matter Digestibility (DMD), and Organic Matter Digestibility (OMD). The implementation of an in vitro test was conducted in Ruminant Nutrition Laboratory, Faculty of Animal Husbandry, Padjadjaran University, Bandung. waste of Cajuput leaves resulted from distillation process was taken from BKPH Jatimunggul, District of Indramayu, West Java

Experiments performed using Completely Randomized Design consisting of three treatments that were R1 = 50% Field grass + 50% Concentrate; R2 = 25% Cajuput leaves waste + 25% Field grass + 50% Concentrate; R3 = 50% Cajuput leaves waste + 50% Concentrate, with each test using four replications. Data were analyzed by analysis of variance (ANOVA) and followed by Duncan multiple range test with significance level of 5%.

3. Results and discussion

3.1. Feed nutrition
Nutrient content in the diet determines the quality of feed [7]. The result of the proximate analysis on the feed in each treatment is shown in Table 1.

| Parameter      | R1       | R2       | R3       | SNI 3148.1:2009 Livestock Feed standard |
|----------------|----------|----------|----------|----------------------------------------|
| Water content  | 12.76±0.8| 11.15±0.8| 12.34±0.8| < 14%                                  |
| Ash            | 9.71±0.7 | 9.12±0.7 | 8.26±0.7 | < 10%                                  |
| Crude Protein  | 13.47±1.31| 12.72±1.31| 10.92±1.31| > 15%                                  |
| Crude Fiber    | 17.76±0.4 | 17.08±0.4 | 17.90±0.4 | <35%                                   |
| Crude Fat      | 8.65±0.5  | 7.79±0.5  | 8.90±0.5  | < 7%                                   |

From five treatment parameters observed, most parameters have met the standard of livestock feed. While crude protein content of all treatments has not met the quality standard (> 15%). Nevertheless, the addition of concentrate on feed ingredients could increased the protein value compared by the result of Firsoni before with no concentrate mixed (field grass protein content: 8.82% and Cajuput leaves protein content: 10.65%) [8]. Crude fat is a reflection of all soluble feed compounds in organic
solvents. The crude fat content in all treatments are higher (7.79-8.90%) than the standard of SNI (<7%). This was assumed because the use of rice bran in concentrate which has high enough fat content (13.8%) [8].

3.2. NH3 (Ammonia) production

NH3 (ammonia) is the main nitrogen source for rumen microbes. NH3 production on all treatments are shown in Figure 1.

![Figure 1. Production of Ammonia (NH3) from all treatment.](image)

The ammonia (NH3) production of each treatment was significantly different (R1 = 4.40 mM, R2 = 3.74 mM, and R3 = 5.09 mM). Ammonia is released in the rumen during the fermentation process in the form of NH4 ions. One of the factors affecting the production of ammonia in the rumen is the amount of protein consumed [9]. Ammonia is the result of fermentation of nitrogen compounds by rumen microbes. Ammonia in the rumen is derived from protein degradation by rumen microbes. The low value of ammonia production was thought to be due to a mixture of rations with the addition of field grass that is low in protein causing microbes in the rumen to synthesize only a small amount of protein. The high NH3 production at R3 (5.09 mM) showed that the addition of concentrate to the eucalyptus leaf waste was able to increase the maximum microbial performance in the rumen and produce high ammonia production values.

3.3. Volatile Fatty Acid (VFA) production

The rate result of VFA production from all treatments are shown in Figure 2.

![Figure 2. Production of VFA in each treatments.](image)
Duncan’s advanced test showed that the treatment of R2 (128.38nM) was significantly different from the treatment of R1 (114.63mM) and R3 (114.25mM) in VFA production (Fig. 2). The resulting VFA concentration, high enough for livestock survival. The range of VFA concentrations (80-160 mM) can meet the needs of microbes to develop in the rumen. High VFA values in R2 were thought to be due to the addition of field grass that has high cellulose content so that microbes in the rumen were able to worked well and degraded carbohydrates in the form of cellulose in the field grass. Hindratiningrum states that one of the factors affecting VFA production in the rumen is the amount and fermentability of the carbohydrate feed source [10]. The structural components of plant tissues such as cellulose and hemicellulose are the slowest carbohydrates of the fermentation rate.

Ratio of feed given to ruminants generally contain about 60-75% carbohydrates. Carbohydrates that enter the rumen will be hydrolyzed into mono-saccharides, especially glucose with the help of enzymes produced by rumen microbes. The glucose will be fermented into VFA as acetate, propionate, and butyric, CH₄ and CO₂. Fermentation could increased VFA concentration because of carbohydrates in feed will be easily fermented in the rumen by increasing the feed degradation process. Meanwhile, VFA is the the last product resulted from fermentation process of carbohydrates presented in the rumen. In accordance to the opinion of McDonald et al. who stated that feed into rumen was fermented to produce the main products of VFA, microbial cells, as well as methane and CO₂ gas [11].

3.4. Feed digestibility

3.4.1. Dry Matter Digestibility (DMD). Dry matter digestibility is indispensable as an early description of the digestibility of organic matter feed. It was because the dry matter digestibility is the content of non-aqueous compounds in the feed that can be absorbed by livestock. The calculation results of dry matter digestibility level in pellets of all treatments is shown in Figure 3.

![Figure 3. Dry Matter Digestibility (DMD) in each treatment.](image)

The average percentage of dry matter digestibility (DMD) from the three treatments have range of 40-60%. Pellet treatment R2 has a range of optimal DMD values between the three treatments with a percentage of 56.30%. One of the factors affecting pellet digestion in ruminants is the composition of feed composition and the composition ratio between feed ingredients with one other feed ingredient [11]. The treatment of R2 had the lowest fiber level among all treatments, i.e 17.08% (Table 1).

3.4.2. Organic Matter Digestibility (OMD)

The level of organic matter digestibility (OMD) in all treatments is shown in Figure 4.
Figure 4. Organic Matter Digestibility (OMD) in each treatment.

The data presented in Fig. 4 shows that the treatment of R2 had the highest level of OMD (47.68%) followed by R1 (41.12%) and R3 (36.67%). The level of organic matter digestibility of the three treatment samples included into the low category, i.e in the range of 36 - 48%. High or low content of organic matter needed to be adjusted to the level of OMD. The organic matter digestibility is the level of livestock ability to digest the organic matter of feed in the rumen.

4. Conclusion
The results showed that the addition of concentrate to mixture of 25% waste Cajuput leaves and 25% field grass, and 50% concentrate can increased the protein content in feed and affected to the production of NH3, VFA, and the digestibility of feed. From various aspects, treatment of R2 most likely to be used for sheep feed.

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