Palatability level of cajuput leaf waste by addition of concentrate as feed substitution for sheep

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Abstract. The purpose of this study was to know the palatability of the combination of waste cajuput leaves, grass field, and concentrates in the form of pellets through physical testing and its palatability on sheep. This research was conducted in Laboratory of Livestock Nutrition Faculty of Animal Husbandry, Universitas Padjadjaran and Community Farms at Pangalengan. Experimental design used completely randomized design with 3 treatments and 3 repetitions. The ration of treatment consist R1 (50% field grass + 50% concentrate), R2(25% field grass + 25% waste of cajuput leaves + 50% concentrate), and R3 (50% of waste of cajuput leaves + 50% concentrate). The data were analyzed by ANOVA followed by Duncan Multiple Range Test. The results showed that R2 has the best level of palatability and potential as livestock feed because nutrients content in its waste is qualify to standard for animal feed and all treatments have impact resistance more than 50%. Cajuput leaves waste, field grass and concentrate had a potency as a substitution feed of sheep.

1. Introduction

Waste is the result of a residual product. Waste comes from a variety of materials ranging from organic matter to inorganic substances. Currently the waste is still a crucial problem for Indonesia. Most people are not aware yet of the dangers that can arise from their wastes. Waste can be polluting for the environment and be a source of disease or other hazards that threaten the area around the waste. Organic waste is one of product that usually resulted from paddies area, plantations or agricultural use. Forage availability in sufficient quantities, with good quality is a basic requirement in developing the livestock especially ruminants. Forage is usually given in the form of grass that comes from the bund, moor and field. Limited availability of forage, especially during the dry season causing fibrous feed is used more derived from waste crops [1]. Recently, fibrous waste is an important source of feed for ruminants, therefore the business system of ruminants in the area with limited availability of forage must be integrated with existing agricultural system as adequate feed resources.

Cajuput plant (Melaleuca cajuputi Powell) is one of the native species in Indonesia which utilized in the refining industry of cajuput. Eucalyptol content of this species is quite high (52-57%), it causing increasing demand for cajuput plant especially its leaf as raw materials of cajuput oil [2]. Cajuput distillation process that occurs throughout the year causing a buildup of cajuput leaves waste around the factory as seen in refineries cajuput oil at BKPH Jatimunggul, District of Indramayu, West Java. The
distillation process of cajuput leaves, annually produces organic waste about 8,000 tons, and only about 50% utilized to be boiler fuel briquettes reused in the cajuput leaf distillation. This indicates that 50% of cajuput leaf waste was not used and if it left in a long time could cause fire risk. In addition, the accumulation of cajuput leaf waste accumulated around the factory area can lead to widespread storage areas and destruction of storage habitats. The content of lignocellulose in the secondary cell wall of cajuput leaves, causing the waste of cajuput leaves were difficult to decompose perfectly. One of the alternatives that can be used to ward off waste of cajuput leaves are used as animal feed [3]. Based on in vitro study, waste of cajuput leaf has the potential be used as cattle feed [3]. Utilization of cajuput leaf waste as a substitution feed should be long-lasting in order to meet the feed requirement when the availability of field grass as a natural feed is reduced in the dry season.

Pellet is one of feed technology which is used to facilitate the transport and storage of feed process especially during the dry season. Generally the pellet-making process consists of mixing, conditioning, extruding and cooling [4]. Feed processing into the form of pellets (pelleting), has a number of advantages, such as increased consumption and feed efficiency, increase levels of metabolizable energy of feed, kill pathogenic bacteria, lowering the amount of feed that is scattered, extend the storage time, ensure a balance of nutrients feed and prevent oxidation vitamin [5].

The purpose of this study was to know the potential of waste cajuput leaves and grass field with the addition of concentrates in the form of pellets by determined a combination of feed nutritional content, physical properties, and best palatability to be used as feed for sheep.

2. Material and methods

The material used in this research were the waste of cajuput leaves, field grass, and concentrate as a raw material of pellets. This research conducted at Laboratory of Livestock Nutrition, UNPAD Jatinangor to anlalyzed the nutrition content of pellets and also at Mini Feed mill UNPAD Jatinangor in formed the pellets of feed and did the physical test by Shatter Test method to knowing the endurability of pellet to its impact in transportation process [6]. The palatability level test of pellets conducted at a Sheep Husbandry, Daarut Tauhid empowering village, Pangalengan West Java. The palatability test conducted to observe the preferences level of each feed treatment for 3 days as ad libitum after adaptation period (5 days). Livestock used for palatability test were local males sheep aged 3-9 months as many as 9 individuals with body weight about 12.9-26.4 kg. The cages used were a stage type enclosure that were partitioned into 9 pieces of cage with the size of 1.5 x 1 x 1 m and equipped with a tub. Sheep were divided into three groups with 3 treatments.

Feed in the form of pellets with basic ingredients consisting of cajuput leaves waste, grass field, and concentrate. Three treatments were made, which were combination of the three feed ingredients. R1 = 50% field grass+ 50% concentrate; R2 = 25% cajuput leaves waste + 25% field grass + 50% concentrate; R3 = 50% cajuput leaves waste + 50% concentrate.

The data were analyzed by ANOVA, otherwise the palatability test analyzed using SPSS 17.0 by Univariat analysis followed by Duncan Multiple Range Test.

3. Result and discussion

3.1. Content of the food substance pellets

Pellet is a product of the processing of animal feed, which consists of fiber feed sources of forage and concentrate with a composition that is based on nutritional needs of cattle and in its manufacture undergo compaction. composition of feeds from each treatment, are listed in table 1.
Table 1. Nutrition content of pellet.

| Substance          | Food Content of Substances (%) | SNI 3148.1:2009 Animal Feed |
|--------------------|-------------------------------|----------------------------|
|                    | R1          | R2       | R3       |                          |
| Water Content      | 12.76      | 11.15    | 12.34    | <14%                     |
| Ash                | 9.71       | 9.12     | 8.26     | <15%                     |
| Crude Protein      | 13.47      | 12.72    | 10.92    | >15%                     |
| Crude Fiber        | 17.76      | 17.08    | 17.90    | <35%                     |
| Crude Lipid        | 8.65       | 7.79     | 8.90     | <7%                      |
| BETN               | 50.41      | 53.29    | 54.02    |                         |
| TDM                | 69.19      | 69.35    | 69.53    | >70%                     |
| Calcium            | 0.89       | 0.86     | 0.86     | 0.1-0.8%                 |
| Phosphorus         | 0.43       | 0.46     | 0.46     | 0.6-0.8%                 |
| Lignin             | 2.43       | 2.33     | 1.86     |                         |
| Energy Bruto (Kkal/kg) | 3916   | 3814     | 3946     |                         |

The content of feed substances on the analysis of the pellets showed good results. The value of crude protein (CP) of all treatments range from 10-13%. This result is much better than the results obtained in cattle feed, with the composition of the waste Cajuput leaves and field grass that produces about 7% of crude protein. Comparison of the composition of field grasses and Cajuput leaves based on the study of Widiana et al. could be seen at table 2 [3].

Table 2. Comparison of the composition of field grasses and Cajuput leaves.

| Substance          | Feed Grass Field | Cajuput Leaves | SNI 3148.1:2009 Animal Feed |
|--------------------|------------------|----------------|-----------------------------|
|                    | R1          | R2       | R3       |                          |
| Water Content      | 12.13      | 10.56    | <14%     |                          |
| Crude Protein      | 7.94       | 7.04     | >15%     |                          |
| Crude Fiber        | 22.70      | 21.47    | <35%     |                          |
| Crude Lipid        | 1.93       | 9.06     | <7%      |                          |
| Ash                | 8.48       | 6.57     | <10%     |                          |

The value of crude protein increasing, ranged between 3-6% after the addition of concentrate. In general, the concentrate composition consisted of fine rice bran (40.0%), onggok (32.05%), coconut meal (16.59%), and soybean pulp (11.25%). Concentrate containing 12% of crude protein in feed material can increase the content of crude protein in the feed. Water content, ash, and crude fiber of pellets in this study were in accordance ISO 3148.1:2009 of fodder. The diverse water content is thought to be due to the grass field and waste of Cajuput leaves dried under the sun, which can cause the water content of the ration pellet to be various as well. Also in the mixing process before the pelleting process took place, done manually. But the water content of all complete ration pellets had a value below 14% and still in accordance with the SNI of animal feed. Feed ingredients with moisture content less than 14% have longer durability and shelf life than fresh conditions (higher water content) [7]. In addition, the pellet ration is complete, resistant to the fungus, due to low moisture content. This was presumably because water is one of the elements needed by organisms, to grow and multiply, especially in fungi (yeasts and molds). With low water content it can minimize the process of fungal metabolism and cause the development process is inhibited.

However, crude protein and crude lipid in pellet were not in accordance with SNI. It was suspected that the protein content of the ration complete, denatured during the process of conditioning. Pujaningsih et al. explained that during the process of conditioning, the dry matter content decreased up to 20% due to an increase in water content of materials and the evaporation of most of the organic material [8]. To prevent protein shrinkage in the pellets after forming required concentrate protein source so that protein denaturation at the time of the process of conditioning did not significantly affect the protein content in the pellet. However, the crude protein content of the pellets was consistent with Osaugwu & Akinsoyinu that gave statement, where the crude protein requirement (CP) and total digestible nutrients (TDN) for fatted sheep were 10.90 - 12.70% and 55 - 60% [9], respectively were 14 - 15% [10] and 45 - 63%. Stanton, & Levalley recommend CP for fatted sheep with a weight of 31.50 kg are 12-14% [11].
The crude lipid content obtained after the proximate test of each treatment, averaging greater than 7%, was not in accordance with the SNI of animal feed which states that crude lipid content in livestock feed should be <7%. The content of crude lipid that has not been in accordance with the SNI of animal feed was supposedly derived from the comparison of nutrient content of the concentrate ingredients used. It was because the crude lipid content in the field grass and waste of cajuput leaves in a fresh condition based on the research of Widiana et al. that was equal to 1.93% for the field grass and 9.06% for the waste of cajuput leaves, mixing of cajuput leaves waste with concentrates having a high crude fat content that will affect the increasing of crude lipid in pellets [3]. The level of lipid content in pellets will affect the level of pellet consumption in livestock. The lipid content which is too high or low will affect the condition of livestock physiological status.

3.2. The Physical Properties of the Pellets

Today, there is a tendency feed given to cattle in complete form (complete feed) because it is considered very effective. Some research shows a complete feed shaped pellets are more acceptable by livestock, the giving is easy to do and not dusty [4]. Physical form pellets in this study showed a solid oval shape with a diameter of 5 mm and a length of 2-3 cm. This form is very advantageous because it simplifies the transportation, storage, and handling by livestock to the administration so that it can increase the level of consumption.

Texture pellets in figure 1 shows that R1: smooth rough, R2: smooth, and R3: rugged. Texture of the pellets was determined on the raw materials used in the manufacturing of pellets. Physical form of complete feed can affect the response of livestock. Goats, for example is reported to prefer the physical form of Rugged feed (large particle size) than the feed in the form of powder with a small particle size because these animals are very sensitive to irritation of the respiratory tract caused by feed particles are smooth [12]. The pellets produced in this study have different flavors based on their constituent material. R1 has a distinctive aroma of caramel, R2 smelted of cajuput but not too stinging and R3 smelted sting enough of cajuput.

| Treatment | Impact Endurable (%) |
|-----------|----------------------|
| R1        | 85 ± 5.22<sup>a</sup> |
| R2        | 88 ± 5.22<sup>b</sup> |
| R3        | 96.5 ± 2.00<sup>b</sup> |

Figure 1. Pellet of complete feed.
From table 3 it can be seen that the pellets that have the highest impact endurable is the treatment of R3, whereas pellets which have the lowest impact endurable is the treatment of R1. Duncan advanced test showed the average impact endurable of pellets in the treatment of R3 significantly different (P <0.05) and higher than the average impact endurable of pellets in the treatment of R1 and R2. The optimum pellet quality must have a durability index above 96%, so that the pellets by treatment with R3 have optimum quality based on its impact endurable [13]. Differences pellets resistance against impact, allegedly because of differences in the characteristics of the manufacture of pellets at each treatment, the fiber content in the leaves of cajuput higher than usual field grass. Thomas & Poel stated that a high fiber content can make the pellets become more brittle.

3.3. Palatability of feed
According to Jobling, palatability can be defined as the attractiveness of a feed or feed ingredients for unappetizing meal and immediately eaten by livestock [15]. From the results, known pellets in treatment R2 has a fairly good level of palatability, compared with pellets in the treatment of R1 and R3. This can be seen in Figure 2.

Based on the analysis of ANOVA, the palatability generate a significant level of 0.99 which means there is no real difference to the palatability of the pellets. However, based on Duncan test that can be seen in Figure 4 which shows that R2 has a different effect was significantly higher compared with the treatment of R1 and R3. Feeding in pellet form can be used to control the consumption of feed concentrates and rough feed, also according to the proportions given as well as to improve the palatability of feed [16]. Differences in the level of palatability on each treatment can occur because of the different level of adaptation in sheep trials. Generally sheep have adaptation period of about 14 days to accept new feed [16]. Besides the experience factor, the nutrients contained in the pellets affect the level of palatability of livestock when consuming the feed. According to Arifin, feeding in the form of pellets can be used to control the consumption of feed concentrate and rough feed according to the proportions given, as well as to improve the palatability of the feed [16].

4. Conclusion
The content of nutrients cajuput leaves waste and grass field with the addition of concentrates in pellet form as a whole almost meet ISO 3148.1: 2009 fodder with the best nutrition content is at the pellets treatment of R2. The physical properties of cajuput leaves waste and grass field with the addition of concentrates in pellet form has a water content of $> 14\%$ that already meet ISO 3148.1: 2009 of animal feed. The best water content in the pellet treatment of R2 and impact durable is best found in the pellet treatment of R3 is equal to 96\%. Waste of cajuput leaves and grass field with the addition of concentrates in pellet form has the best level of palatability on treatment pellet of R2.
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