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COMBINATION RATION MADE OF CORN STRAW, PEANUT STRAW, GLIRICIDIA LEAVES AND NAPIER GRASS ON BEEF CATTLE

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Abstract

The utilization of agricultural byproducts (waste) in the form of corn straw, peanut straw and gliricidia leaves which are sufficiently available sources of local raw materials so far have not been maximally utilized as animal feed ingredients. Therefore, a combination of straw waste with other materials is needed to complement each other and improve feed quality. This study aimed to examine the effect of the combination of corn straw, peanut straw, gliricidia leaves and napier grass on feed intake, weight gain and feed conversion of Balinese cattle. This study was conducted in Banuroja Village, Randangan Subdistrict, Pohuwato Regency, Gorontalo Province from June to July 2017.The statistical design used was a randomized group design with 4 (four) treatments: (1). Treatment of R_0 = napier grass, (2). R_1 = corn straw and gliricidia leaves (70% + 30%), (3). R_2 = Corn straw and peanut straw (50% + 50%), and (4). R_3 = corn straw, peanut straw and gliricidia leaves (35% + 35% + 30%). The results showed that the treatment (R_3) of the ration combination of corn waste, peanut waste and gliricidia leaves (35% + 35% + 30%) indicated a better response than other rations in weight gain and feed conversion, while treatment (R_0) of napier grass rations showed a better response than other rations in feed consumption.

***Keyword*:** corn straw, peanut straw, gliricidia leaves, napier grass, Balinese cows

Introduction

The use of feed to support the production and productivity of ruminants' livestock in Indonesia is generally influenced by the quality, quantity, and continuity of forage feed. The lack of food availability was one of the reasons for the decline in the quality and quantity of beef cattle (Guerrero *et al.,* 2013; Najim *et al.,* 2015). The reality in the field shows that in producing feed, it is not only required the feed quality, but also economical, inexpensive and affordable feed for farmers. In beef cattle feed, it is preferred to use materials derived from agricultural or plantation waste and agro-industrial waste because the materials have sufficient nutrient content and the price is relatively low (Haskel *et al*., 2018).

The production of agricultural waste to date is still a product that has not been utilized properly, so it is necessary to study the possibility of its use as an optimal animal feed. Corn and peanut straw are two potential agricultural wastes to be utilized as ruminant feed when the grass supply is reduced. The obstacle in the utilization of corn and peanut straw is the limiting factor with a low nutritional value of low crude fat content and high crude fiber. Feed ingredients and agricultural waste contain low levels of protein and high crude fiber, making it difficult to digest (Montenegro *et al.,* 2016; Humer *et al.,* 2019). Furthermore, the product of agricultural residues has a low quality so that livestock that obtains feed from agricultural crop residues for a long time, the productivity of livestock produced becomes low. This is also supported by He *et al.,* (2018) who reported that corn and agro-industrial wastes are quite potential as livestock feed for ruminants. However, because the nutritional value content is generally low, it should be combined with other feed ingredients as a source of protein.

To overcome the limitation of nutritional value in the feed of corn and peanut straw, it is necessary to add gliricidia leaves as a source of protein and energy. Gliricidia leaves have a crude protein content and crude fiber (Shem *et al.,* 2013; Gunasekaran *et al.,* 2017; Amata and Bratte, 2008). Based on the composition, gliricidia leaves are a very valuable source of protein as feed and are used as low-quality forage supplements (Foroughbakhch *et al.,* 2012; Oloruntola *et al.,* 2018). Gliricidia leaves are a forage whose production is continuous and has more value in the nutritional content such as protein, fat, EMWN (Extract Material Without Nitrogen), Ca, P, crude fiber and ash can improve the quality of feed. Therefore, to increase the efficiency of livestock production, potential sources of feed raw materials are required, and it has good nutritional quality for supporting livestock growth and productivity.

Therefore, the utilization of corn and peanut straw wastes, which had been destroyed or burned after harvest, can be preserved and stored in the warehouse. In addition to preserving, the nutritional value can also be increased, and it can be utilized to increase feed digestibility. Gliricidia plants, which have only been grown as a barrier to farmer gardens, can also be used as animal feed. These are the background of this research and at the same time can it be used as a solution to develop animal husbandry, especially the beef cattle.

Materials and Methods

Location and Time of Study : the research activity was located in Banuroja Village, Randangan District, Pohuwato Regency, Gorontalo Province, Indonesia. This research was conducted from June to July 2017 for seven weeks consisting of two weeks of adaptation period and five weeks of measurement data collections.

Materials and Equipment : the materials used in this experiment were corn straw, peanut straw, and cutting leaves of gliricidia plants, napier grass (also known as elephant grass), 12 male Balinese cattle aged 2-2.5 years with a weight of 140-215 kg, injection of complex vitamin B and rice straw bran. The equipments used are hoses, hand sprayers, meters,

buckets, machetes, hoes, cages, feeders, drinking places, brooms, brushes, water hoses, shovels, trident, sickles, binder ropes, digital livestock scales, labels, coper, and writing tools.

Research design : this study used a randomized group design (RGD) consisting of four treatments and three replications. The treatments studied were:

R_0 = Napier Grass (Control) ad libitum

R_1 = Corn Waste (CW) and Gliricidia Leaves (70% : 30%)

R_2 = Combination of CW and Peanut Waste (PW)(50% : 50%)

R_3 = Combination of CW, PW and Gliricidia Leaves (35% : 35% : 30%)

Experiment

Preparation of Animal Feed Materials : Preparation of forage sources of corn, peanut, and napier grass wastes was using a coper chopper, and gliricidia cutting leaves results in each treatment were cut into 3-5 cm using a machete. Each forage was then ready to be used according to the treatment.

Cattle Raising : The cattle that were raised are local Balinese cows with a high production appearance. Cows were kept in individual cages continuously during the study. This individual cage was for onecow measuring 2 x 1 meter. This experiment consisted of four treatments and three replications. Therefore 12 cages were used to place 12 livestock.

Feed and drinking water were given by ad libitum according to the treatments. The type of feed given was napier grass as a control, feed combination of corn waste, peanut waste, and gliricidia plant cutting leaves. The observations were made for seven weeks on feed use. Feed consumption data was taken every day by weighing the amount of feed given in the morning and weighing the rest of the feed the following morning before feeding, while body weight data were measured every week.

Prevention of the development of germs was carried out by cleaning the cage and bathing the livestock. Cleaning the cage from dirt and food scraps was done two times in the morning and evening.

Observation and Measurement Parameters :

The parameters observed in this study were:

Feed Consumption

Feed consumption was measured from the difference in the amount of feed given with the leftover feed every day which was recorded every day during the research.

Average Daily Gain (ADG)

Calculation of weight gain (Average Daily Gain) was using the formula

$$ADG = \frac{W_2 - W_1}{t_2 - t_1}$$

Where :W_1= Initial life weight

W_2 = Final life weight

t_2 = Final weighing time

t_1 = Initial weighing time

Weighing body weight was carried out every week in the morning before feeding

Feed Conversion

Feed conversion was calculated

$$\text{Converstion} = \frac{\text{Feed consumption}}{\text{Weight gain}}$$

The data obtained were processed using the analysis of Randomized Group Design (RGD). The difference between treatments was tested using the Least Significance Different test (LSD).

Data Analysis : To determine the effect of treatments, the analysis of variance (ANOVA) was used. To test the difference between treatments, the 5% Duncan's Multiple Range Test (DMRT) test was used. Data analysis was performed using the software Minitab 14, Ms. Excel and SPSS 16.0.

Results and Discussion

The analysis of variance results showed that there were significant differences ($\alpha = 0.05$) in the four feed treatments for kg/cattle/day dry materials consumption where napier grass ration showed the highest amount of feed consumption (7.80 kg/cattle/day) compared to other rations, followed by ration combination of corn, peanut waste and gliricidia leaves (R_3), ration combination of corn and peanut wastes (R_2), and ration combination of corn waste and gliricidia leaves (R_1) (Table 1). The feeding is required to meet the needs of nutrients with the correct amount. In addition, the feed must also meet requirements such as safe for consumption, palatable and economical, where palatability is the taste of feed ingredients so that it will affect the high level of feed consumption (Sharma *et al.,* 2006). Palatability is determined by taste, smell and color In ruminants, the factors that affect palatability are the brightness of the green color, taste, texture and nutrient content (Miller-Cushon *et al.,* 2014).

Table 1: Feed consumption of the average consumption of dry feed ingredients (kg/cattle/day)

Treatment	Average	$LSD_{0.05}$
R_0	$7,80^a$	1,0784
R_1	$4,74^d$	
R_2	$5,23^c$	
R_3	$5,64^b$	

Note: The numbers followed by the same letters mean that they are not significantly different from the test level $LSD_{\alpha=0.05}$

This is apparently to be a result of the cows' tendency to consume more feed to meet the needs of protein in their feed. Increased consumption of napier grass and followed by the ration combination of corn, peanut wastes and gliricidia leaves was apparently due to the high level of livestock palatability to feed due to good quality (physical and chemical) of waste, and good quality of nutrients, especially the protein nutritional content as shown in the proximate analysis of treatment rations (Table 2).

This is in accordance with the report of McCrickerd & Forde, (2015) that the physical form of a feed ingredient can affect the palatability of these feed ingredients. In addition, the increase in weight gain was also suspected because the nutritional content was higher than the control treatment so

that the protein nutrients contained in the ration treated with a combination of corn and peanut wastes and gliricidia leaves can be digested and absorbed by the digestive tract in an amount that is in large quantities becomes weight compared to wasted through feces and urine (Table 2). This finding is supported by (Sarma *et al.,* 2014; Bodas *et al.,* 2014) mentioned that fattening requires adequate food in both quality and continuity.

Table 2: Proximate analysis results of corn and peanut wastes, gliricidia leaves and napier grass treatments

Composition (%)	Treatment			
	R_0 (Napier Grass)	**R_1 (Corn Straw)**	**R_2 (Peanut Straw)**	**R_3 (Gliricidia Leaves)**
Water content	6,65	7,54	7,91	8,74
Protein	7,03	4,93	13,96	22,4
Crude Fat	0,99	0,43	1,01	2,92
Crude Fiber	17,4	17,8	16,96	20,6
Ash content	12,6	7,95	16,88	15,3

The average consumptions of dry ingredients of rations in Balinese cattle that received control rations in the form of napier grass, combination of corn straw and gliricidia leaves (ratio 70% : 30%), corn and peanut straw (50% : 50%) and corn, peanut straw and gliricidia leaves (35% : 35% : 30%) were 7.80, 4.74, 5.23 and 5.64 kg/cattle/day, respectively. Data on dry ingredients consumption in treatment (R_0) was able to exceed the feed consumption of ration treatment (R_1), (R_2) and (R_3), whereas the ration treatment (R_1) showed the lowest consumption (Table 3).

The treatment of a combination of corn and peanut wastes and gliricidia leaves (R_3) in Balinese cattle achieved a higher level of palatability compared to the treatment (R_1) and (R_2). The level of feed consumption of a beef cattle is influenced by various complex factors, i.e., the animals themselves, the food provided, and the environment in which the animals are kept. Substances which are negatively correlated with the level of consumption include NH_3, acetate, total VFA concentrations, while those that are positively correlated with the level of consumption are lactic acid. In addition, dry matter of waste and particle size of waste also influence both direct and indirect levels of consumption (Jayathilakan *et al.,* 2011; Wadhwa & Bakshi, 2013).

Table 3: Average weight gain (kg/cattle/day)

Treatment	Average	$LSD_{0.05}$
R_0	$0,41^b$	0,0336
R_1	$0,30^c$	
R_2	$0,44^b$	
R_3	$0,54^a$	

Note : The numbers followed by the same letters mean that they are not significantly different from the test level $LSD_{\alpha=0.05}$

The analysis of variance results showed that the Average Daily Gain (ADG) within the four feed treatments had significant differences ($\alpha = 0.05$). In the observation of the average weight gain, it was observed that the ration combination (R_3) of corn and peanut waste and gliricidia leaves with a ratio of 35% : 35% : 30% achieved higher average weight gain compared to other rations. This was because the protein and energy requirements of the rations consumed have sufficiently fulfilled the daily needs of protein and energy for beef for basic living compared to the control treatment and other combination treatments.

The use of 35% peanut waste and 30% gliricidia leaves visually has better nutritional value than other treatments. The percentage of 35% peanut waste and 30% gliricidia leaves in the field indicated cattle that consume this ration, feces become runnier (diarrhea) and tend to reduce their consumption. This is in accordance with a study by Saun (Steinshamn, 2010; Goldstein, 2017) mentioned that cattle can be given waste from legumes (beans) between 30-35% of the feed given, because if they are given with more composition than that, the livestock will have excess Ca (calcium) and lack of other substances, so that it is better combined with corn waste. Feed conversion (R_3) showed results that are not too high which means that the amount of feed used to increase each kg of body weight is not too much. The less amount of feed to increase each kg of body weight means the better the quality of the feed. According to Castro Bulle *et al.* (2007) and Fidelis *et al.* (2017) through providing good quality feed, livestock will grow faster, and the conversion rate will also be better.

Table 4: Average feed conversion

Treatment	Average	$LSD_{0.05}$
R_0	$19,13^a$	3,4534
R_1	$15,83^b$	
R_2	$11,81^c$	
R_3	$10,38^d$	

Note : The numbers followed by the same letters mean that they are not significantly different from the test level $LSD_{\alpha=0.05}$

The analysis of variance results showed that there were significant differences ($\alpha = 0.05$) in the four feed treatments on feed conversion that were treated by (R_3) the combination of corn and peanut wastes and gliricidia leaves with a ratio of 35%: 35%: 30% showing the lowest feed conversion 10.38 kg/cattle/day. This means that if cattle consume a type of treatment ration (R_3), it will produce a more efficient feed conversion than cattle with feed treatment (R_0), (R_1), and (R_2). Feed conversion values showed that the greater the conversion of animal feed, the more inefficient use of rations to increase body weight gain. This is because the lower feed conversion values indicate that the efficiency of feed use is better because the amount of feed needed to produce one kilogram of weight gain is less.

Conclusion

The treatment of combination ration (R_3) of corn waste, peanut waste, and gliricidia leaves (35% : 35% : 30%) showed a better response than other rations for the highest daily body weight gain of 0.54 kg/cattle/day and it was more efficient compared to other treatments, with the lowest feed conversion of 10.38 kg/cattle/day. The treatment of napier grass ration (R_0) showed a better response than other rations on feed consumption which was 7.80 kg/cattle/day.

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