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COMBINATION OF BANANA STEM AND *Clitoria ternatea* SILAGE IMPROVES PRODUCTIVITY OF CROSSBRED ETAWAH GOATS

I.W. Suarna, N.N. Suryani* and M. A. P. Duarsa

Animal Husbandry Faculty-Udayana University of Bali.

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***Corresponding Author**
N.N. Suryani
Animal Husbandry Faculty-Udayana University of Bali.

ABSTRACT

The provision of sustainable and quality feed is essential to increase livestock productivity. This study combined of 35% banana stems. 30% *C. ternatea*. 30% pollard and 5% mixture of molasses and Effective Microorganism made in the form of silage complete. The experiment used 12 crossbred etawah goats divided into 3 treatments and 4 replicates. The treatments were: a) animals were given forage without silage. b) animals were given forage and 25% silage. and c) animals were given forage and 50% silage. The results showed that the nutritional content and digestibility increased with increasing *C. ternatea* content in silage. especially the content of organic matter. Crude protein and energy. The utilization of *C. ternatea* andn banana stem silage gave a positive response to the productivity of crossbred etawahh goats. Giving a complete silage combination of banana stems with *C. ternatea* to crossbred etawah goats is in accordance with the results of research on *in vitro* experiments. where the utilization of *C. ternatea* in banana stem silage gives a positive response to the productivity of crossbred etawah goats. Increasing the level of complete silage increased body weight gain to 80.0 g/d and the lowest Feed Conversion Ratio (FCR) value of 5.83. as well as higher ration and nutrient digestibility values.

KEYWORDS: Silage. banana stem. C. ternatea. production. crossbred etawah goats.

INTRODUCTION

Feed is the main supporting factor for success in a livestock business. Ruminant feed. especially goats. which are forage-based. fluctuates in availability because it is influenced by the season. In an effort to keep the livestock can still produce well. it is necessary to fulfill the feed strategy in terms of quantity. quality and sustainable provision. One solution to overcome the availability of forage is to utilize agricultural waste.

Banana stem (*Musaa spp*) is an agricultural waste that has potential as animal feed because it has not been widely utilized. Banana stems as animal feed have several disadvantages. among others: high water content and otherwise low nutritional content. The shelf life of banana stems as feed ingredients when given in fresh form. cannot last long and will rot quickly because the water content is still very high. In addition. the high water content of feedstuffs when given to livestock will result in low intake of dry matter and organic matter so that nutritional intake is also low. The weakness of banana stems can be overcome in various ways. including being made as a basic ingredient for making silage with the addition of several other feed ingredients so that its nutritional value can increase and its shelf life becomes longer. Banana stems contain 87.7% dry matter (DM). 25.12% ash. 14.23% crude fat (Ether Extract). 29.40% crude fiber (CF). 3.01% crude protein (CP) and 28.24% nitrogen free extract (NFE) (Santi *et al*.. 2012). According to Wahyono and Hardianto (2004). animal feed sourced from agricultural and plantation waste has low nutritional value so it is necessary to optimize its quality through fermentation technology and making complete feed.

Based on the above background. this study was designed to determine the effect of giving banana stem silage combined with *C. ternatea* on the growth and performance of crossbred etawah goats.

MATERIALS AND METHODS

Materials

Banana stem were cut into 5 cm pieces and sun-dried for 1-2 days to reduce the moisture content. When the moisture content of the banana stems had been reduced to approximately 70%. *C. ternatea*. pollard. molasses and EM4 were added. The design used was a Completely Randomized Block Design (CRBD). Grouping is based on the body weight of livestock. The silage used was in accordance with the results of the first phase of research namely with the composition: 35% banana stem + 30% *C. ternatea* + 30% pollard + 5% (molasses + Effective Microorganism). The silage material that has been mixed is stored in plastic bags/drums in an airtight condition for 21 days.

The experiment used 12 crossbred etawah goats divided into 3 treatments and 4 replications. The treatments were as follows:

A = Livestock fed forage without additional silage

B = Livestock fed forage and 25% silage

C = Livestock fed forage and 50% silage

Methods

Body weight gain

Weighing of goat body weight was done every two weeks until the end of the study using an electronic scale with a capacity of 1000 kg with a sensitivity of 100 g. Live weight gain of goats was obtained by reducing the weight at the last weighing with the initial weight. Daily live weight gain was obtained by dividing the overall body weight gain by the length of the study.

Consumption of feed nutrients

Dry matter (DM) consumption is obtained by reducing the dry matter of the ration given with the dry matter of the remaining ration. Measurement of ration consumption was carried out every day during the study. Nutrient consumption was calculated using the following equation:

Dry matter (DM) consumption obtained by reducing the DM gave with the rest of it.

Organic matter consumption = total ration consumption x % DM x % Organic matter (OM)

Crude Protein consumption = total ration consumption x % DM x % Crude Protein (CP)

Crude Fiber consumption = total ration intake x % DM x % Crude Fiber (CF)

Nutrients digestibility

Dry matter digestibility :

$$\frac{\text{DM consumption} - \text{DM feces}}{\text{DM consumption}} \text{ X } 100\%$$

Organic matter digestibility

$$\frac{\text{OM consumption} - \text{OM feces}}{\text{OM consumption}} \text{ X } 100\%$$

Crude protein digestibility

$$\frac{\text{CP consumption} - \text{CP feces}}{\text{CP consumption}} \text{ X } 100\%$$

Crude fiber digestibility

$$\frac{\text{CF consumption} - \text{CF feces}}{\text{CF consumption}} \text{ X } 100\%$$

Data Analysis

The data obtained were analyzed using variance analysis (Anova). If there were significantly different results (P < 0.05) between treatments. the analysis was continued with an orthogonal contrast test at the 5% level (Steel and Torrie. 1995).

RESULTS AND DISCUSSION

Consumption of Nutrients

The highest DM consumption was produced by goats that received treatment C at 466.69 g/d (Table 1). Goats with treatment A did not contain complete silage and treatment B contained 25% complete silage but did not show a significant difference with goats that received treatment A. Treatment B did not show a significant difference with treatment C. On the other hand, OM consumption of treatment B was significantly different from treatment C. The high consumption of OM resulted in higher consumption of crude protein (CP) and energy, while the consumption of crude fiber did not show significant differences among the three treatments.

Table 1: Nutrient consumption of rations.

Variables	Ration Treatment			SEM
	A	B	C	
Dry matter consumption (g/d)	398.81 b	442.82 ab	466.69 a	7.79
Organic matter consumption (g/d/)	319.06b	354.26 b	396.69 a	10.48
Energy consumption (kcal)	1430.24 b	1656.88 a	1836.24a	16.13
Crude protein consumption (g/d)	71.26 b	79.48 ab	85.13a	3.22
Crude fiber consumption (g/d)	79.63 a	77.32a	72.13a	2.01

Notes:

A = Livestock fed forage without additional silage

B = Livestock fed forage and 25% silage

C = Livestock fed forage and 50% silage

Different superscripts on the same line are significantly different (P<0.05)

SEM = "Standard Error of the Treatment Means"

The high dry matter consumption in treatment C is due to the higher level of complete silage so that the *C. ternatea* content is also more. As the chemical composition of silage which contains organic matter and protein is quite high so that the consumption of organic matter and protein is also higher. This is in accordance with the statement of Cook *et al*. (2005) that *C. ternatea* is a high-quality legume and is a type of legume that is rich in protein nicknamed tropical alfalfa. often referred to as a protein bank that can grow with low production costs. The results of this study are also higher than the results of research by Thiasari and Setiyawan (2016) in the study of three banana stem silage added with concentrate in a ratio of 50:50 with protein levels of 12%. 14% and 16%. The higher the protein content of silage the higher the dry matter digestibility respectively 71.56%; 75.06%; and 74.32% and organic matter digestibility: 65.53%; 68.50%; and 69.82% respectively.

Goat Weight Gain and FCR

The research goats showed a better response when given ration treatment C compared to rations A and B. Table 2 shows that the difference in body weight gain produced by goats receiving treatment C was significantly ($P<0.05$) higher at 35.67% and 55.67% respectively compared to goats receiving treatment B and A respectively.

One factor that greatly influences body weight gain is ration consumption. The consumption of DM and OM as well as nutrients, especially CP and energy was significantly ($P<0.05$) higher in treatment C compared to treatments B and A. The body weight gain of treatment C in this study was even higher than the results of research conducted by Putra *et al*. (2009) which used 85% forage in the form of natural grass, *calliandra*, *Hibiscus tiliaceus L.* and 15% molamix concentrate in crosbred etawah goats resulting in body weight gain of 62 g/d with dry matter consumption of 451 g/d.

C-treated goats are very efficient at converting feed into body weight. This fact is supported by coefficient of FCR. The smaller the FCR number, the more efficient the animal is at converting feed into body weight. The efficiency of C-treated goats in converting feed into body weight gain may be due to the better palatability of ration C compared to rations B and A. The more components that make up the ration the better the palatability and quality. Because among these ingredients can complement each other's shortcomings.

Table 2: Weight Gain and Feed Conversion Ratio.

Variables	Ration Treatment			SEM
	A	B	C	
Initial body weight (kg)	14.00 a	14.00 a	12.67 a	0.5092
Final body weight (kg)	15.95 b	16.83 b	17.07 a	0.2117

Body weight gain (kg)	1.95 b	2.83 b	4.40 a	0.3203
Weight gain per day (g)	35.45 b	51.45 b	80.00 a	5.0203
Feed Conversion Ratio	11.25 a	8.60 a	5.83 b	0.3878

Notes:

A = Livestock fed forage without additional silage

B = Livestock fed forage and 25% silage

C = Livestock fed forage and 50% silage

Different superscripts on the same line are significantly different (P<0.05)

SEM = "Standard Error of the Treatment Means"

Forage, although containing low energy, is the largest source of fiber. Feed fiber plays a fundamental role in ruminants to maximize dry matter intake (DMI), stimulate chewing activity and the fermentation process in the rumen. DMI will decrease linearly with decreasing Neutral Detergent Fiber (NDF) content of forage in the diet (Nadeem and Sufyan, 2005). However, in this study the low crude fiber content in the silage will support more efficient feed utilization.

Feed Nutrients Digestibility

The diverse composition of forage in ration C caused the coefficient of digestibility of dry matter, organic matter, crude protein (CP) and crude fiber (CF) to be significantly (P<0.05) higher than treatment B which received 25% silage addition and treatment A where the ration consisted of field grass only (Table 3).

Crude fiber digestibility did not differ among all treatments. However, crude fiber digestibility in goats with treatment C tended to be the highest followed by treatments B and A. Although ration C contains complete silage (50%) ration C also contains high crude fiber, but with the presence of more silage so that the bloom is also more has been able to increase the activity of fiber-digesting rumen microbes so as to produce the highest crude fiber digestibility.

Table 3: Coefficient of Digestibility of Rations and Nutrients.

Variables	Ration Treatment			SEM
	A	B	C	
Dry matter digestibility (%)	66.18b	68.59b	79.69a	1.4215
Organic matter digestibility (%)	72.25b	77.04b	82.27a	1.4184
Crude protein digestibility (%)	61.73b	72.96a	79.84a	2.0049
Crude fiber digestibility (%)	66.09a	66.71a	67.33a	4.9262

Notes:

A = Livestock fed forage without additional silage

B = Livestock fed forage and 25% silage

C = Livestock fed forage and 50% silage

Different superscripts on the same line are significantly different ($P<0.05$)

SEM = "Standard Error of the Treatment Means"

The ration composition in treatments B and A has not been able to balance the nutrient requirements for rumen microbes, resulting in lower digestibility compared to treatment C. Nitrogen produced from *C. ternatea* in ration B has not been maximally utilized by rumen microbes. The degradation of feed protein will affect fermentation in the rumen and will ultimately affect the efficiency of nutrient absorption (Gabler and Heinrichs, 2003). Optimizing protein degradation in the rumen and microbial protein synthesis can reduce N excretion losses (Reynal and Broderick, 2003). The ultimate goal of nutrient availability in the rumen is to maximize rumen degradable protein utilization so that microbial growth will also be maximized. Maximizing rumen degradable protein utilization will not only increase the supply of amino acids to the small intestine but also increase N utilization (Javaid, 2007). N losses can be reduced through balancing the ratio of rumen degradable protein to rumen undegradable protein and increasing N utilization by microbes (Bach *et al.*, 2005).

CONCLUSIONS AND SUGGESTIONS

Conclusion

1. Giving a complete silage combination of banana stems with *C. ternatea* to crossbred etawah goats is in accordance with the results of research on *in vitro* experiments, where the utilization of *C. ternatea* in banana stem silage gives a positive response to the productivity of crossbred etawah goats.
2. Increasing the level of complete silage increased body weight gain to 80.0 g/d and the lowest FCR value of 5.83. as well as higher ration and nutrient digestibility values.

Suggestions

Feeding banana stems as animal feed should be done by making silage by adding *C. ternatea* and molasses containing effective microorganism. This is because making silage with *C. ternatea* will be able to increase the nutritional content of banana stem silage so that livestock productivity increases because their nutritional needs are met.

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