Sustainable Livestock Production in the Perspective of
Food Security, Policy, Genetic Resources, and Climate Change

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SUSTAINABLE LIVESTOCK PRODUCTION IN THE PRESPECTIVE OF FOOD SECURITY, POLICY, GENETIC RESOURCES, AND CLIMATE CHANGE

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CONTENTS

ORAL PRESENTATION

In vitro Nutritional Evaluation of Dairy Goat's Feed Containing *Indigofera zollingeriana*

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ABSTRACT

This study was aimed to produce a best complete ration formula-based *Indigofera zollingeriana* for dairy goats. This study used a completely randomized design, consisted of five rations containing different levels of *I. zollingeriana*, namely R1 = 80% *I. zollingeriana* leaf meal + 0% soybean cake, R2 = 60% *I. zollingeriana* leaf meal + 0% soybean cake, R3 = 40% *I. zollingeriana* leaf meal + 0% soybean cake, R4 = 20% *I. zollingeriana* leaf meal + 5% soybean meal and R5 = 0% *I. zollingeriana* leaf meal + 28% soybean meal. Each treatment was repeated 3 times. The rations were subjected to *in vitro* incubation by using rumen simulation technique. Variables observed included nutrition, digestibility values, methane emissions and rumen microbial populations. The results showed that crude protein contents in R1 and R5 were significantly higher than those in R2, R3 and R4 ($P<0.05$). Rations containing 40% to 80% of *I. zollingeriana* had the same digestibility values with commercial ration containing 28% of soybean cake. *The R1, R2 and R4* showed the highest acetic and butyric acids. The lowest methane production was obtained in the rumen simulator given 80% *I. zollingeriana.* There was a positive correlation between protozoa populations with methane production. The bacterial population on rations R2, R3 and R4 tended to be higher than the other rations and was inversely related to the population of protozoa. It can be concluded that the rations that met the quality and physiological need of dairy goat were R3 and R4 which contained 40% and 20% *I. zollingeriana*, respectively.

Key Words: Dairy goat, *Indigofera zollingeriana, In vitro,* Nutritional quality

INTRODUCTION

Efforts to improve the productivity of goat milk are often inhibited by the poor quality of feed given by farmers lead to low milk production. The use of grasses and partly tropical forage as a major source of feeds is not sufficient to meet the nutritional requirement of high-producing dairy goats (Fujisaka et al., 2000), considering the protein contents of tropical grasses are relatively low ranging between 4-9%, while the protein requirement of dairy goat ration reaches 18%. The farmer gives concentrate sufficient the nutritional requirements of dairy goat but the price is expensive. An alternative solution to reduce the use of concentrate for dairy goats has been conducted since 2008 by using a forage namely *Indigofera zollingeriana*. The plant has a rapid growth in the defoliation interval of 60 days with a production of 51 tons/ha/year (Abdullah, 2010). *I. zollingeriana* is very adaptive to low fertility rates, easy on maintenance and low prize, and high seed production potential throughout the season (Abdullah and Suharlina 2010). The use of fresh *I. zollingeriana* for local goats increased daily weight gain and feed efficiency up to 45% and 30%, respectively (Tarigan, 2009). Further, an experiment using pure pellet of *I. zollingeriana* leaves increased goat milk production, feed efficiency and nutrient efficiency by approximately 26%, 15-23% and 5-9%, respectively (Abdullah et al, 2012). The purpose of the present research is to produce the best complete ration indicated by the nutrient contents and in vitro nutritional value of the rations in dairy goat rumen liquid.

MATERIALS AND METHODS

General: Leaves and twigs of *Indigofera zollingeriana* were air-dried and then oven-dried at 70°C for 3 h. Indigofera was formulated in rations with varying levels, i.e. 80, 60, 40, 20 and 0% Indigofera as control (Table 1). The materials were ground to pass a 1 mm sieve size and mixed homogeneously. Subsequently, the mixed materials were pelleted with a 4 mm die diameter. Dry matter (DM), organic matter (OM), crude protein (CP), fat, and crude fiber (CF) composition of each complete rasion were determined by proximate analysis (AOAC 1990). The *in vitro* method was based on Rumen Simulation Technique (Rusitec) (Kajikawa et al. 2002). The rumen liquid used was obtained from Etawa crossbred lactating dairy goats. Rumen liquid was taken by using stomach tube as much as 300 ml per goat. The variables observed were digestibility values, methane emissions and rumen microbial population.

Table 1. The Composition of feed ingredients

Feed Ingredients	R1(80-0)	R2 (60-0)	R3 (40-0)	R4 (20-5)	R5 (0-28)
Rice Bran	2	3	5	26	27
Soybean meal	0	0	0	5	28
Corn	10	30	30	2	18
Indigofera zollingeriana	80	60	40	20	0
Napier grass	6	5	23	45	25
$CaCO_3$	1	1	1	1	1
NaCl	0.5	0.5	0.5	0.5	0.5
Premix	0.5	0.5	0.5	0.5	0.5

Statistical analysis: The data were analyzed using Analysis of Variance (ANOVA). If there were significantly differences among treatments, the analysis was continued with Least Significance Difference (LSD).

RESULTS AND DISCUSSION

The crude protein of R1 and R5 rations were significantly ($P<0.05$) higher than R2, R3 and R4 (Table 2). The crude fiber of R3 and R4 rations were significantly ($P<0.05$) higher than R2 and R5 while R1 was no significanly to four others rations. The R3 and R4 ration were highly recommended to satisfy dairy goats requirements as sufficient of protein, fat and crude fiber content, although ash content of R3 was too high.

Table 2 Nutritional content of feeds

Rations	Dry matter	Ash	Crude fat	Crude protein	Crude fiber
R1 (80-0)	94.84±2.04	8.83±2.14	3.26±0.21	21.49±2.21 b	16.20±2.31 ab
R2 (60-0)	95.74±1.93	7.79±2.87	2.41±0.76	17.87±1.94 c	14.16±3.34 b
R3 (40-0)	94.83±2.52	10.32±3.19	3.99±0.14	16.54±2.65 c	17.49±1.18 a
R4 (20-5)	95.74±1.14	7.43±1.32	2.60±0.27	15.33±2.49 c	19.83±1.33 a
R5 (0-28)	94.93±2.23	9.42±1.93	4.48±0.16	23.30±0.99 b	9.92±1.74 b

The differences of notations letter in each column are significantly different at $P<0.05$

The R1 ration for dairy goats was good enough if the availability of high protein followed by the availability of soluble carbohydrates to support the formation of microbial protein, while R2 and R5 ration were still lacks of crude fiber sources for dairy goats lactation status. This indicates that the use of Indigofera in the ration could increase the crude protein content which was equivalent to the use of soybean meal up to 28% in this study. The high protein

contribution of Indigofera due to crude protein content of Indigofera in this study was 29.16%.

Increasing amount of Indigofera in the ration could increase the value of the DMD and OMD (Table 3). The rations containing Indigofera 40% up to 80% has the same digestibility values with commercial diet containing 28% soybean meal. This suggests that Indigofera have easily digestible organic matter as well as all soybean meal. R4 showed low digestibility value because it low portion of Indigofera and also very high portion of elephant grass as much as 45%. Elephant grass has low digestibility values between 45-60%. The methane production ranged between 11-18% v/v. The results on simulated rumen methane showed a decrease in methane production with increasing number of Indigofera on rations. The lowest methane production seen in R1 containing 80% Indigofera and 6% elephant grass equivalent to commercial ration containing 28% soybean meal with 23% elephant grass.

Table 3. *In vitro* digestibilty value, methane, and VFA production of rations

Rations	DMD	OMD	Methane (% v/v)	VFA mMol			
				Acetate	Propionate	Butyrate	Valerate
R1(80-0)	75.97±2.14a	72.72±3.24a	12.76±1.14c	61.27 a	17.94 b	8.70 ab	1.43 b
R2(60-0)	76.84±1.20 a	75.12±2.83a	13.42±1.29bc	58.8 b	17.14 b	8.82 ab	1.04 b
R3(40-0)	73.76±3.41ab	72.55±3.21a	15.21±0.72b	44.16 d	14.91 b	6.38 b	0.79 b
R4(20-5)	60.18±2.98b	58.37±3.18b	18.20±0.91a	56.57 b	14.91 b	7.74 b	1.09 b
R5(0-28)	77.53±2.67a	75.62±4.14a	11.25±1.76c	48.84 c	18.44 a	9.22 a	1.60 b

The differences of notations letter in each column indicate significantly different at 5% (LSD).

The use of an increasing elephant grass can increase ($P<0.05$) the population of protozoa in the rumen fluid. However, the rate growth of protozoa population can be inhibited by the addition of Indigofera in the ration. The highest population of protozoa in the rumen fluid obtained fed rations containing 20% Indigofera and 45% elephant grass. Although the ration get additional 5% soybean meal but can not inhibit the growth of protozoa. Protozoa population can reduce the effectiveness of the rumen as a predator for rumen bacteria. The presence of protozoa in the rumen fluid also lead to higher production of methane in the rumen fluid as indicated by the correlation between protozoan populations with methane production (Figure 1).

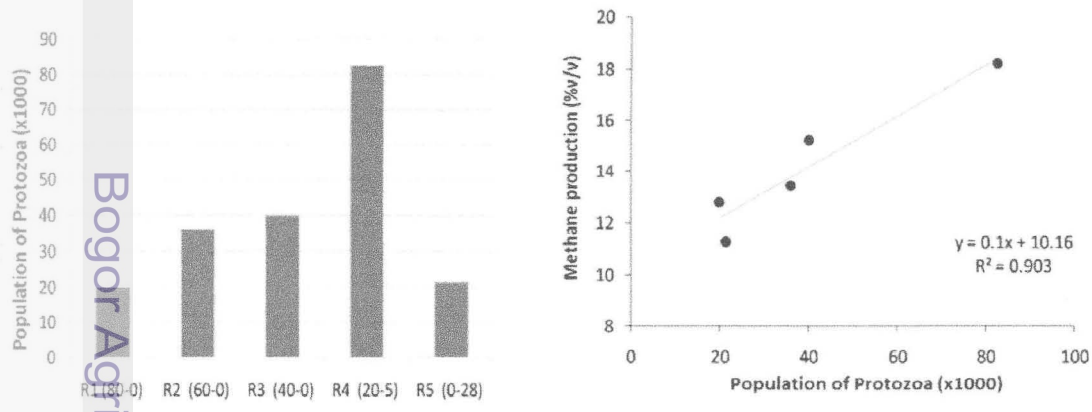

Figure 1. Population of protozoa and their correlations with methane production in the rumen liquid given by Indigofera rations

The positive correlation between protozoan populations with methane production indicated that protozoa was instrumental in producing of methane in the rumen. The protozoa have a positive symbiotic relationship with methanogens that produce methane. The existence of Indigofera in the ration can reduce the population of protozoa in the rumen fluid. Milk fat

precursors are acetic and butyric acid, therefore the high acetate-propionate ratio demonstrated that ration suitable for dairy goats. Ration R1, R2 and R4 produced a high acetic and butyric acid and were best ration to dairy goats. Ration R1 significantly highest (P> 0.05) produced of acetic acid and R5 significantly highest (P>0.05) produced butyric acid (Table 3). The best ration for dairy goats was R4 that the most of the percentage acetate-propionate ratio that would support quality of milk with a high fat content.

CONCLUSION

It can be concluded that the rations that met the quality and physiological need of dairy goat were R3 and R4 which contained 40% and 20% *I. zollingeriana*, respectively.

REFERENCES

Abdullah, L. and Suharlina. 2010. Herbage yield and quality of two vegetative parts of *Indigofera* at different time of first regrowth defoliation. Med. Pet. 33(1):44-49

Abdullah, L. 2010. Pengembangan Pelet *Indigofera zollingeriana* sebagai Sumber Pakan Hijauan Berkualitas. Laporan Hibah Insentif Kementrian Riset dan Teknologi. Republik Indonesia.

Abdullah, L., Suharlina, A. Tarigan and D. S. Budhie. 2012. Use of Indigofera zollingeriana as forage protein source in dairy goat ration. Proceeding of the 1st Asia Dairy Goat Conference, Kuala Lumpur, Malysia, 9-12 April 2012. ISBN 978-983-44426-2-0, p.72-74

Fujisaka, S., I. K. Rika, T. M. Ibrahim and Le Van An. 2000. Forage tree adoption and use in Asia. In "WW Stur, PM Horne, JB Hacker and PC Kerridge Eds. Working With Farmers: The key to adoption of forage technologies". ACIAR Proceedings No. 95: 243-253.

Kajikawa, H., J. Hai, F. Terada, and T. Suga. 2002. Operation and characteristic of newly improved and marketable artificial rumen (Rusitec). Department of animal physiologi and nutrition. Sanshin Industrial Co. Ltd.

Tarigan, A. 2009. Productivity and utilization of *Indigofera sp.* as goat's feed obtained from different interval and intensity of cutting. Thesis. Bogor Agricultural University, Indonesia.