Improved Dairy and Meat Goat Production for Small-scale Farmers in Asia

Proceedings of the International
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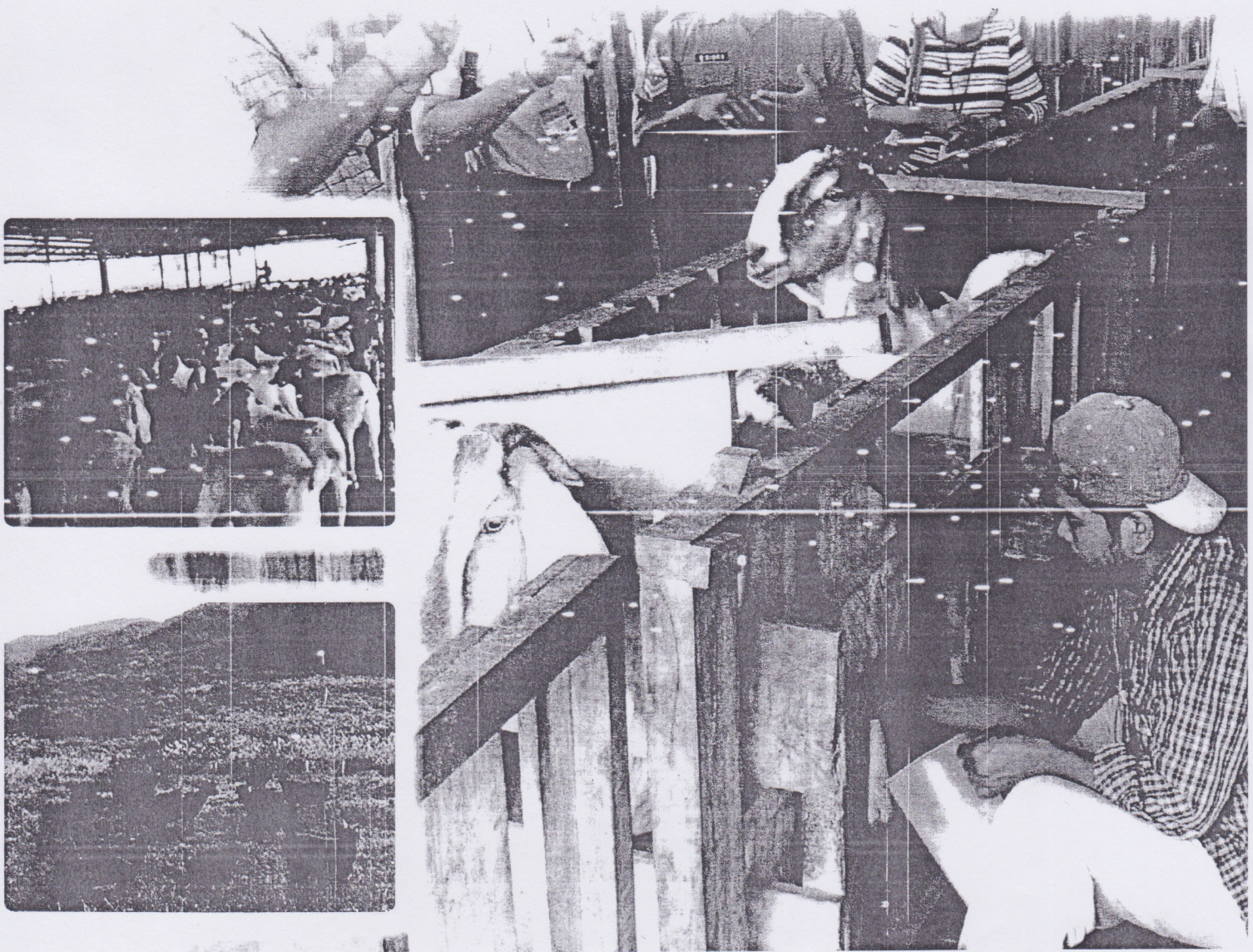
by Incremental Improvements in Technology and Infrastructure
for Small-scale Farmers in Asia
August 04-08, 2008, Bogor, Indonesia

Food and Fertilizer Technology Center for the Asian and Pacific Region
Indonesian Research Institute for Animal Production
Livestock Research Institute, Council of Agriculture, Taiwan ROC



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Supporting papers

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QUESTION-ANSWER

Q : What is the benefit of intensive dairy goat farming in Taurus dairy farm?

A : Raising dairy goat especially imported dairy goat from temperate region such as Saanen does under an intensive management in Taurus dairy farm resulted in some benefits such as various partial cumulative milk yields and total cumulative milk yield were produced more optimal. Though the values of converting feed to milk yield (per day or per lactation) became an uninterested aspect of this research, but as informed by seller in this farm selling processed milk to consumer was a more promising because of its high price (compared to milk price of dairy cattle). The goat milk price currently is around Rp 8000/ltr at which quit beneficial to be marketed to consumer in big cities such as in Jakarta.

SUPPLEMENTATION OF BANGUN-BANGUN LEAF (*COLEUS AMBOINICUS* LOUR) AND ZINC-VITAMIN E IN RATION TO IMPROVE RUMEN FERMENTATION IN *VITRO* AND MILK PRODUCTION OF ETAWAH GOAT

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ABSTRACT

The main objective of this study is to investigate the effects of bangun-bangun leaf (*Coleus amboinicus* Lour) and zinc-vitamin E supplementation in basal ration on rumen fermentation *in vitro* and milk production of Etawah goat. This studies was conducted in two experiments. The first experiment, 6 bangun-bangun leaf (BL) combination treatments with Zn-vitamin E were evaluated using *in vitro* batch culture. It was found that BL and Zn-vitamin E supplementation significantly ($P< 0.01$) increased dry matter and organic matter digestibility and Volatile Fatty Acid concentration 6.17 – 29.37 %, 6.46 – 29.58 % and 9.27 – 50.47 % , respectively, but decreased NH_3 concentration 0.29 – 16.71 %, rumen pH 0.08 – 0.10 point and total microbe 1- 4 (x 10^5) cfu/ml. In the second experiment, 8 BL combination treatments with Zn-vitamin E were evaluated by *in vivo* experiment using 24 Etawah goats. The result showed that supplementation treatment significantly increased ($P<0.01$) dry matter and total digestible nutrient intake and milk production. BL and Zn-Vitamin E supplementation increased milk production by 67.22 - 98.65 %. In conclusion, BL and Zn-vitamin E can be used as supplement until 9 g/kg BW to improve rumen fermentation and increase milk yield of Etawah goat.

Keyword : coleus amboinicus, zn-vitamin E, rumen metabolism, milk production, Etawah

INTRODUCTION

Etawah goats have potency as producer of milk, but their milk production is still low, due to low of feed quality and sub-optimal rumen fermentation. Feed quality can be increased by feed supplementation such as bangun-bangun leaf (*Coleus amboinicus* Lour) which has lactagogue component to stimulate milk production. Milk yield is also depended on rumen fermentation which is influenced by Zn-Vitamin E. Zn acts as cofactor for more than 30 different enzymes. According to Piliang (2000), Zn was less available in the ruminant feed, and only 33 % Zn in the feed could be absorbed (Cousins 1996), and this could be improved by presence of vitamin E. Vitamin E is expected to improve metabolism and trigger the role of bangun-bangun leaf in increasing milk production. The present research was aimed to study the influence of bangun-bangun leaf and Zn-vitamin E in ration on rumen fermentation and milk production of Etawah goat.

MATERIALS AND METHODS

The experiment was conducted in Laboratory of BALITBANG Pascapanen Cimanggu Bogor and BALITNAK Ciawi, during 15 months, using Factorial Randomized Block Design. For *in vitro* experiment: the first factor was the level of bangun-bangun leaf (0, 3, 9 %/ kg ration) and second factor was the level of Zn-Vitamin E (0 and combination of Zn (20ppm) and Vit E 10ppm). For *in vivo* experiment, the first factor was the level of bangun-bangun leaf (0, 3, 6, and 9 g/kg body weight) and second factor was the level of Zn-Vitamin E (0 and combination of Zn (20ppm) and Vit E 10ppm) using 24 Etawah goats with the first lactation stage.

The animal was given forages as much as 10% of body weight (BW) and concentrate 500 - 700 g/head/day. The experimental ration was given at first day after partus. Milk yield measured twice a day (morning and afternoon) at 4 days intervals. Parameters measured in the *in-vitro* study were digestibility of dry matter (DMD) and organic matter (OMD), volatile fatty acid production (VFA), N-NH3, pH and number of microbes. In the *in-vivo* study, parameters measured were dry

matter and total digestible nutrient intake, milk yield during 3 months of lactation and FCM (Fat Corrected Milk). Data subjected to statistical analyses using General Linear Model (GLM) and continued with Tukey test in Minitab 13.0 program Release 2001.

RESULTS AND DISCUSSION

In vitro experiment

Dry matter digestibility (DMD), organic matter digestibility (OMD), total VFA, N-NH3, pH and number of rumen microbes in the *in vitro* study is shown in Table 1. Supplementation of bangun-bangun leaf significantly ($P<0.01$) increased DMD, OMD and total VFA, but decreased N-NH_3, pH and number of microbes. Supplementation of Zn-Vitamin E significant ($P<0.01$) increased DMD, OMD and total VFA, but did not influence N-NH_3, pH and number of microbes. There were no interaction between two supplementation treatments on DMD, OMD and total VFA.

Supplementation of bangun-bangun leaf in ration could improved DMD, OMD and total VFA. This condition was caused by the presence of active compound of carvacrol in bangun-bangun leaf. Carvacrol reduced rate of deamination of amino acid and protein degradation (Castillejos *et al.*, 2005), and reduced rate of peptidolisis (Calsamiglia *et al.*, 2007). Reduction of deamination of amino acid and protein degradation and peptidolysis, would increase of protein (Busquet *et al* 2006). This protein would be released as protein by pass and would be absorbed after rumen. This condition increased OM digestibility and the whole feed digestibility. Feed digestibility was also influenced by Zn-Vitamin E supplementation. This is due to the catalytic role of Zn and vitamin E to protect both cell damage and fat oxidation. All of these gave positive effect on fat digestibility and the whole feed digestibility.

Table 1. Dry matter and organic matter digestibility, production of VFA and N-NH3, pH and number of rumen microbes *in-vitro* from ration which supplemented with bangun-bangun leaf and Zn-Vitamin E

BL Level	RO	R1	Means
		Dry matter digestibility (%)	
0	58.40 ± 0.16	62.00 ± 0.33	60.20 ± 1.94[a]
3	64.83 ± 0.67	67.15 ± 0.82	65.99 ± 1.42[b]
9	72.50 ± 1.64	75.55 ± 0.86	74.03 ± 2.03[c]
Means	65.24 ± 6.09[a]	68.23 ± 5.87[b]	
		Organic matter digestibility (%)	
0	60.35 ± 0.13	64.25 ± 0.76	60.30 ± 2.15[a]
3	66.28 ± 0.67	68.70 ± 0.26	67.49 ± 1.38[b]
9	74.30 ± 1.07	78.20 ± 1.47	76.25 ± 2.40[c]
Means	66.98 ± 6.01[a]	70.38 ± 6.14[b]	
		VFA (mM)	
0	111.15 ± 4.84	121.30 ± 2.56	116.23 ± 6.50[a]
3	130.20 ± 4.71	140.10 ± 0.58	135.15 ± 6.14[b]
9	157.00 ± 2.47	167.10 ± 2.64	162.05 ± 5.89[c]
Means	132.78 ± 20.00[a]	142.83 ± 19.73[b]	
		N-NH3 (mM)	
0	10.29 ± 0.07	10.26 ± 0.09	10.28 ± 0.07[a]
3	9.36 ± 0.19	9.34 ± 0.18	9.35 ± 0.17[b]
9	8.59 ± 0.17	8.57 ± 0.17	8.58 ± 0.16[b]
Means	9.41 ± 0.74	9.39 ± 0.74	
		pH	
0	6.25 ± 0.01	6.23 ± 0.03	6.24 ± 0.02[a]
3	6.17 ± 0.06	6.15 ± 0.01	6.16 ± 0.04[b]
9	6.15 ± 0.06	6.14 ± 0.02	6.15 ± 0.04[b]
Means	6.19 ± 0.06	6.17 ± 0.05	
		Number of Microbes ($x10^5$ cfu/ml)	
0	52.00 ± 1.83	54.00 ± 0.82	53.00 ± 1.69[a]
3	51.00 ± 1.41	49.00 ± 1.63	50.00 ± 1.77[b]
9	48.00 ± 1.83	46.00 ± 1.41	47.00 ± 1.85[b]
Means	50.33 ± 2.35	49.67 ± 3.65	

BL = bangun-bangun leaf, R0 = 0 ppm Zinc and Vitamin E, R1 = Zinc 20ppm and Vit E 10ppm
For each parameter, means with different superscript in one column and one row are significantly different ($P<0.01$)

Increasing in total VFA production, and followed by decreasing in N-NH_3 production could be due to reduction of proteolysis, peptidolysis and deamination protein by microbes, and all of these increased protein by pass, and reduced NH3 production. Therefore, protein as a substrate for fermentation by the microbes decreased. According to Clarke and Bauchop (1977), availability of substrate was vital for both rumen microbes and providing energy for animal. Availability of fiber component such as cellulose and hemicelluloses would increase VFA production. This condition indicated there was a change of rumen microbial population from proteolytic type to cellulolytic type. Leng (1990) reported that availability of substrate influenced population of microbes, so that the final product of this microbe type would also change. Reduction of pH had a positive correlation with VFA production. According to Clarke and Bauchop (1977), rumen condition influenced microbes activity and population. The result of the present study showed that supplementation of bangun-bangun leaf significantly decreased rumen pH which in turn would cause a decrease in microbial population. However, the presence of buffer compound in bangun-bangun leaf (Lawrence *et al.* 2005) would stabilize the rumen condition, so that the microbial activity and population could be maintained (Chavez *et al.* 2007).

***In vivo* experiment**

Dry matter intake, TDN intake and milk production of Etawah goats in the *in vivo* study is shown in Tables 2. Supplementation of bangun-bangun leaf significantly ($P<0.01$) increased dry matter and TDN intakes. There was an interaction between supplementation of bangun-bangun leaf and Zn-Vitamin E in increasing milk production of Etawah goats.

According to Mertens (1987), feed consumption was essential for productivity of animal. Feed consumption was closely related with body weight, level of production, physiology status (such as suckling, lactation) and feed characteristic (nutrient content).

Table 2. Dry matter and TDN intakes and milk production of Etawah goat fed ration supplemented with bangun-bangun leaf and Zn-Vitamin E

BL Level	RO	R1	Means
	Dry Matter Consumption (g/head/day)		
0	755.31 ± 16.02	767.59 ± 21.32	765.45 ± 18.16[a]
3	779.39 ± 48.83	804.82 ± 18.87	792.11 ± 35.92[b]
6	822.87 ± 26.90	839.55 ± 8.17	831.21 ± 19.99[b]
9	881.36 ± 21.42	886.84 ± 12.94	884.10 ± 16.11[b]
Means	809.73 ± 56.57	824.70 ± 47.97	
	TDN Consumption (g/head/day)		
0	574.40 ± 8.65	581.03 ± 11.51	577.72 ± 9.80[a]
3	590.33 ± 26.37	604.06 ± 10.19	597.19 ± 19.40[b]
6	616.40 ± 14.53	625.41 ± 4.41	620.90 ± 10.79[b]
9	650.58 ± 11.56	653.54 ± 6.99	652.06 ± 8.70[b]
Means	607.93 ± 33.31	616.01 ± 28.92	
	Milk Production (kg/head/day)		
0	0.42 ± 0.01[a]	0.44 ± 0.01[a]	0.43 ± 0.01
3	0.60 ± 0.02[b]	0.70 ± 0.02[c]	0.65 ± 0.06
6	0.75 ± 0.01[c]	0.79 ± 0.01[d]	0.77 ± 0.02
9	0.80 ± 0.01[d]	0.83 ± 0.01[d]	0.81 ± 0.02
Means	0.64 ± 0.15	0.69 ± 0.16	

BL = bangun-bangun leaf, R0 = 0 ppm Zinc and Vitamin E, R1 = Zinc 20ppm and Vit E 10ppm
For each parameter, means with different superscript in one column and one row are significantly different ($P<0.01$)

Milk production of Etawah goats in this study increased by 67.22 %, 88.46 % and 98.65 %, for each level of bangun-bangun leaf use 3, 6 and 9 g/kg BW and Zn-Vitamin E, respectively. The result was better than those reported on white mice (Silitonga, 1993) and human (Santosa, 2001, Damanik *et al.*, 2006) with an increase of 30-65 %. Increasing in milk production was might be due to an active compound acts as lactagogue in bangun-banung leag. This active component

influences proliferation of secretory cell of mammary gland. Bangun-bangun leaf has also a component with oxytosic characteristic or equivalent to oxytocin hormone which stimulates mammary gland to release milk (Subanu *et al.*, 1982). This hormone has a function to release milk.

CONCLUSION

Supplementation of bangun-bangun leaf (*Coleus amboinicus* Lour) up to level of 9 g/kg BW in ration could improve rumen fermentation and increased milk production until 90.14 %. However, increasing level of bangun-bangun leaf in the ration had some negative effects (reducing pH and number of rumen microbes). Supplementation of Zn-Vitamin E (20 : 10 ppm) in ration containing bangun-bangun leaf was effective only at the level of 6 g/kg BW by increasing milk production up to 88.46 %.

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QUESTION-ANSWER

Q : 1. What is the source and name of Zn and vit E
2. What is the mechanism that supplementation of bangun-bangun leaves increase digestibility?

A : 1. ZnO and commercial nature E was used in the experiment
2. Supplementation bangun-bangun leaf increased dry matter and organic matter digestibility because this leaf contained carvacrol which active compound that could reduce degradation and deamination and peptidolysis. This condition increase by-pass protein and protein absorption as a result, dry matter and organic matter digestibility increased.