SUPPORTING PAPERS
ISBN 979-97243-9-2

THE EFFECT OF *FEED SUPPLEMENT MULTINUTRIENT* SUPPLEMENTATION TO CORN LEAVES SILAGE BASAL DIET ON METHANE PRODUCTION AND PRODUCTIVITY OF PERANAKAN ONGOLE CATTLE

Suharyono[1)], M. Winugroho[2)] and Y. Widiawati[2)]

1) Centre of Research and Development for The Isotope and Radiation Technology, National Nuclear Agency (BATAN), PO Box 7002 JKSKL 12070
2) Research Institute for Animal Production (BPT) Bogor PO BOX 221 Bogor 16002.

ABSTRACT

The study was undertaken to investigate the effect of FSM supplementation to Corn Leaves Silage (CLS) basal diet fed to Ongole generation (PO/ OG) on methane production and their productivity. The study used 6 OG cattle, were divided into 2 groups, namely Control Group fed by CLS and concentrate, and Treatment Group fed by the same diet offered to the Control group plus FSM. The measurements were undertaken on VFA concentration to estimate the amount of methane produced, feed consumption, feed conversion ratio (FCR) and live weight gain (LWG) of the animals. The results showed that the animals fed by CLS and concentrate had less feed consumption and LWG compared to the animals fed by CLS, concentrate and FSM (5.9 kg and 129 g/day ***vs*** 6.3 kg and 398 g/day) ($P<0.05$). Animals in Treatment Group had better FCR compared to the animals in Control Group (15.9 ***vs*** 45.6 g DM/g LWG) ($P<0.05$). The proportion of propionate from VFA total produced in the rumen of animals in treatment Group was higher than that produced in the rumen of animals in Control Group (31.47 % ***vs*** 5.53 %), which indicated less methane produced (21.7 mmol) in Treatment group compared to 88.0 mmol in animals in Control Group. It can be concluded that feeding the animals by FSM reduced methane produced from the rumen and increased feed consumption and LWG of the animals.

Keywords : Methane, Feed Supplement Multi-Nutrient, Live Weight Gain

INTRODUCTION

Availability of good quality feed during a year is a main problem facing by smallholder farmer, particularly in eastern part of Indonesia as the biggest contributor of national meat production. In this region and some region in western part of Indonesia, most of feeds available have high fibre but low protein content, such as rice straw and low quality grass. This feed have potential role on ruminant animal productivity and environmental friendly. Generally, the feed will be fermented by microbes in rumen and the end product of fermentation is microbial protein, volatile fatty acid, ammonia and gas such as CO_2, CH_4, N_2, H_2S, H_2 and O_2.

The amount of methane was produced in the rumen of ruminant and reflected a net loss of dietary energy, which indicated low efficiency of feed utilization. The more methane produced the more dietary energy loss from the animals, which indicated low animal productivity.

SUPPORTING PAPERS
ISBN 979-97243-9-2

Based on the global anthropogenic methane reported that enteric fermentation release methane on air about 23 %. Other part was rice paddies and livestock manure release about 18 % and 7 %, respectively (IPPC, 1995). Among the domestic animals, beef cattle has the biggest enteric fermentation (73 %) compared to buffalo and sheep (10 % each) and goats (4 %) (US Environment Protection Agency, 1994/6). Methane emission to the air had become a greatest environmental issue since it contributes a significant amount on global warming so-called greenhouse effect.

Decreasing on methane released from the ruminant animals could be conducted by good management on feeding animals, health and genetic improvement (Mc Crabb, 2005). Kurihara et al (1999) reported that the methane release decreased 257 g/d to 160 g/d due to good quality of feeding on beef cattle. This supported by Ondiek et. al. (1999) and Widiawati (2000) that good quality feeds can reduced methane production in the rumen as well as increasing of animal productivity.

Thus it is necessary to implement a good quality feed in livestock business in order to solve the two problems, namely low animal productivity and high methane released to the atmosphere.

The using of high quality feeds, namely feed supplement multi – nutrient (FSM) (BATAN) have been reported increased animal productivity (live weight gain and milk production). This supplement contains 22.44 % proteins and 36.64 % fibres and has been disseminated in 8 provinces. However, there was no study regarding the amount of methane produced in the rumen when the animals fed this feed. Therefore the study presented was undertaken to investigate the effect of FSM supplementation to Corn Leaves Silage (CLS) basal diet fed to OG cattle on methane production and their productivity. The objective was to get information of methane release and increasing beef cattle production due to supplementation of FSM.

MATERIALS AND METHODS

The activity on the FSM intervention used 6 OG cattle with an average of body weight was 195 kg. They were divided in two groups which was control (7 kg CLS + 5 kg concentrate) as Group I and Group I + 500 g FSM as Group II. Adaptation period of feeding was carried out on two weeks. Feed quality, feed consumption, live weight gain and fermentation production were measured. The measurement of feed consumption was conducted during on seventh days whereas live weight gain were measured during three months. The rumen liquid was taken 4 hours after feeding. All the data collected was tabulated by using an Excel® for Microsoft word 2000 the statistically analysed by using SPSS 11.0.

RESULT AND DISCUSSION

The result on nutrient content of feed used in the experiment was presented on Table 1.

Experimental feed of FSM was as protein and energy sources, which was crude fibre form, so the offering to the animals was only 7%. Protein content of CLS in this experiment was lower than other CLS, which was usually used. That is 2,21 % compared to 12 %. Winugroho, et al. (2003) reported that by products of corn leaf can be increased the quality by addition of elite microbes via fermentation processing. This

SUPPORTING PAPERS
ISBN 979-97243-9-2

result was supported by reports of Kusumawardani, (2004) that fermentation processing on corn leaf increased the protein content from 9% to 11.9%.

Generally, crude protein content in concentrate for cattle feeding is 12%, however, in this experiment the CP of concentrate only contained 8.6%. The lack of this nutrient may be fulfilled by the FSM offered, so the requirement of protein for maintaining and increasing of cattle production was completed (NRC, 1985).

Table 1. Dry matter (DM), crude protein (CP) crude fibre (CF) and gross energy (GE) content of three experimental feed

Materials	DM (%)	CP (%)	CF (%)	GE (Kcal)
CLS	20.63	2.21	11.51	1.0840
Concentrate	88.71	8.60	12.71	3.1669
FSM	88.55	21.34	24.35	0.3207

Table 2. Feed consumption Daily live weight gain (DLWG) of OG cattle and feed conversion ratio (FCR) due to FSM intervention

Parameters	Group I (control)	Group II (feed treatment)	P	SE
Feed Consumption (g)	5879.6	6322.5	0.046	108.46
DLWG (g/d)	129	398	0.014	69.78
FCR (g DM/g DLWG)	45.58	15.88	0.030	8.84

The result indicated that there was significantly different on consumption of DM between control (5879.6 g) and feed treatment group (6322.5) (FSM intervention). It means that feed treatments on Group II have good quality. Regarding of feed fermentation processing in rumen expected that loss energy in related to gas form will be lower and the LWG will increase. The LWG of cattle increased by 1.2 kg/d due to high quality of feed supplied, whereas medium quality of feed only increased by 0.5 kg/d. This is supported by the FSM intervention on this experiment as showed in Table 2.

These results were supported by the report of Kurihara et al., (1999) that consumption of DM, daily LWG and methane production were significantly different as a result of offering different feed quality on three groups feed intervention.

Feed supplement intervention on OG cattle was really has a good effect on daily LWG compared to the control group. The values were 398 vs 129 g/d. The increasing in LWG was significantly influenced by total amount of DM consumption because of FSM treatment. The consumption of DM on feed treatment was higher than control. It was 6322.5 vs 5879.6 g. Feed conversion ratio values indicated that Group II (FSM treatment) was also more efficient than control namely 15.88 vs 45.58 g for increasing of 1 g daily LWG.

A part from above information, rumen ecosystem of two groups has also potential role on feed digest by microbes in rumen. The result of rumen fermentation, particularly on VFA production is presented on Table 3.

The concentration of acetate, propionate and butyrate in the rumen liquid of OG cattle in control group was higher than that in the rumen of OG in feed treatments group. Based on the propionate proportion, animals in feed treatment group has higher proportion (31,47 %) than that in animals in control group (5.53%). It means that FSM may be more efficient to be used by animal. Whitelaw et al., (1984) reported that

SUPPORTING PAPERS
ISBN 979-97243-9-2

methane production has negative correlation with propionate proportion, which is resulted during feed fermentation by rumen microbe. If propionate proportion were high thus, the methane released as energy loss to the air will be low.

Regarding on the relation to the calculation of methane released, the calculation of this concentration can be done by using the formula reported by Owens and Goetsch (1988) : Methane released = (0.5 x acetate) + (0.5 x butyrate) – (0.25 x propionate)

The result of methane estimation was lower on FSM intervention than control (21.69 vs 88.01 mmol). Methane production decreased ± 70%. It supported the enhance of daily LWG and FCR between the treatment group compared to control group through 398 vs 129 g/day and 15.88 vs 45.58 g DM/DLWG, respectively.

Table 3. Volatile Fatty Acids (VFA) in rumen liquid of OG cattle.

Parameters	Group I (control)	Group II (feed treatment)	P	SE
C2	169.98	49.69	0.030	29.6783
C3	10.7	26.61	0.023	5.6525
C4 +C5	12.89	8.26	0.088	3.8960
Total	193.56	84.56	0.011	28.7318

Table 4. Methane production estimated from VFA concentration in the rumen due to feed intervention.

Treatment	Replication	Methane estimation (mmol)	P	SE
Group 1 (Control)	1	94.625		
	2	81.385		
Average		**88.005**		
Group II	1	20.6875		
(FSM treatment)	2	16.0375		
	3	28.3525		
Average		**21.6925**	0.043	16.4952

Kurihara, et al., (1998) reported that the animal produces lower methane the daily LWG will be higher than animal produces higher methane. In addition, Kurihara, et al., (1999) also reported that feed intervention has influence on DM consumption, daily LWG and gas production. If the methane production were fully substituted by acetate, propionate and others fermentation product that useful for ruminant animal growth, so the animal will get energy addition 4 – 15 % to increase LWG (Joblin, 1996; Nolet et al., 1997).

Less methane gas produced in the rumen of animal fed FSM showed that feeding the animal by FSM is becomes one of some alternatives to reduce methane release from ruminant animal through lower air pollution/greenhouse effect and higher ruminant animal productivity.

SUPPORTING PAPERS
ISBN 979-97243-9-2

CONCLUSION

The FSM intervention (500 g) on OG cattle has potential to increase feed consumption, and daily LWG, improve feed efficiency as showed by low FCR, decreased methane released to the atmosphere. Therefore an environmental pollution can be reduced by addition of FSM to the feed of ruminant animals.

REFERENCES

Joblin, KN. 1996. Options for reducing methane & Emissions from Ruminants in New Zealand and Australia. In : "Greenhouse : Coping with Climate Change" (Eds. WJ Bouma, GJ Pearman and MR Manning). CSIRO Publishing, Collingwood. PP. 437 – 449.

Kurihara, M., Magner, T., Hunter, RA, and McCrabb, GJ. 1999. Methane Production and Energy Partition of Cattle in the Tropics. *British J. of Nutrition.* 81:263-272.

Kurihara, M., Terada, F., Hunter, RA, Nishida, T and McCrabb, GJ. 1998. The Effect of Diet and Live weight Gain on Methane Production in Temperate and Tropical Beef Cattle. In. "Proceedings of the 8th World Conference on Animal Production, Seoul National University, Seoul, Korea. Vol: 1 (Eds. JK Jung and HW Lee). Pp. 364-365.

Kusumawardani, 2004. Kandungan Nutrisi Limbah Daun/Tanaman Jagung Sebelum dan Setelah Dibuat Silase. Hasil Analisa Laboratorium Proximate Balitnak.

Nollet, L., Demeyer, D and Verstraete, W. 1997. Effect of 2-Bromoethanesulfonic Acid and Peptostretococcus Productus ATCC 35244 Addition on Stimulation of Reduction Acetogenesis in The Ruminal Ecosystem by Selective Inhibition of Methanogenesis. *Applied and Environmental Microbiology* 63, 194-200.

NRC. 1985. Nutrient Requirement of Sheep. 6 th rev. Ed. ed. National Academy Press, Washington, D.C.

Ondiek, J. O., S. A. Abdulrazak, J. K. Tuitoek, and F. B. Bareeba. (1999). The Effects of *Gliricidia Sepium* and Maize Bran as Supplementary Feed to Rhodes Grass Hay on Intake, Digestion and Liveweight of Dairy Goats. *Livestock Production Science* 61: 65-70.

Owens, F. N., and A. L. Goetsch. 1988. Ruminal Fermentation. In: D. C. Church (ed.) The Ruminal Animals, Digestive Physiology and Nutrition. p 145-171. Prentice

Suharyono, Asih. K, Firsoni., Ali. A., and Adiarto. 2005. Biological Evaluation of Available Local Feed Resources and Field Testing of New Feed Supplements in Indonesia. Centre of The Research and Development for The Technology Isotope and Radiation, BATAN, Jakarta, Indonesia. (Unpublished data)

US EPA (Environment Protection Authority). 1994. International Anthropogenic Methane Emission: Estimates for 1990. EPA 230-R93-010 (Office of Policy, Planning and Evaluation : Washington DC).

Whitelaw, FG, Eadie, JM, Bruce, LA, Shand, WJ. 1984. Methane Formation in Faunated and Ciliate-Free Cattle and Its Relationship With Rumen Volatile Fatty Acids Proportions. *British J. Nutrition.* 52(2): 261-275.

SUPPORTING PAPERS
ISBN 979-97243-9-2

Widiawati, Y. 2002. The utilisation of shrub legumes: *Leucaena leucocephala, Gliricidia sepium* and *Calliandra calothyrsus* for growing sheep. PhD Thesis, James Cook University, Townsville-Australia.