The Effect of King Grass Silage on the Nitrogen Balance and Hematological Profile of Ettawa Grade Male Goat

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Abstract – The aims of this research was to study the nutritional value of ensiled King Grass (*Pennisetum purpuphoides*) to be applied for goat. Twelve Ettawa grade male (PE), ± 10 months old, and with average body weight of 19.45 ± 3.03 kg were used to determine the voluntary intake, balance nitrogen and their hematological profile. All of the animals were randomly allotted at individual pens. Data were analyzed statistically using analysis of variance, based on completely randomized design arrangement with four treatments (level of King Grass silage) and three replicates. Treatment means were compared using Duncan multiple range test. The result showed that increasing level of King Grass silage within ration significantly increased the average dry matter (DM) intake per metabolic body weight. In fact, the daily DM intake, nitrogen balance, blood hemoglobin and blood hematocrit of the experimental animals were not affected by level of King Grass silage feed. Experiment had no bad effect on healthy condition of the treated goat, so it implies that conserving grass as silage and then feeding grass silage to goat might be implemented by farmers to secure the continuous supply of green forage to keep the goat production sustainability all year round.

[*Keywords: silage, nitrogen balance, haemoglobin, haematocryt, goat*]

I. INTRODUCTION

Grass production fluctuates depend on the season. At rainy season, the supply of water and nutrient is sufficient that leads to fast growth, high productivity and good quality of green forage crops. Meanwhile, at dry season, the production yields low quantity and quality. To overcome the problem faced in dry season, technology which could be introduced in order to preserve green forage is carrying out fermentation process to produce silage forage. Silage is produced by an-aerobic fermentation in certain placed called silo. This silage production process is better conducted at high volume and quality of green forage production which is usually occurred at rainy season. The ensiled green forage is then could be used when farmers faces lack of green forage supply at dry season. The objective of this research is to evaluate and study the effect of King Grass (*Pennisetum purpuphoides*) silage feeding to male Ettawa grades. The parameters investigated were dry matter feed consumption, digestibility, nitrogen balance, and hematological profile of male Ettawa grade goat.

Good silage quality is a good fermented product to be utilized to produce high productive livestock. In nutritional aspect, fermentation process could decrease pathogenic substance in terms of nitrate, cyanide acid and oxalate (McDonald, 1981; Komar, 1984; Church and Pond, 1988). However, the consumption of DM in silage form is lower than fresh green forage or in hay form (Church and Pond, 1988; Kustono, 1988).

The result of Sunarso *et al.* (1991) and Sunarso (1993) presents that Setaria grass production includes process as follows, i.e.: 1) among the silo material (drum, concrete, plastic) and additives such as molasses; the best silage quality is produced at molasses level 4-6% (weight/weight) in plastic silo and after ripened at 30 days at density 600-700 kg/m^3; 2) oxalate content of Setaria grass is relatively lower than fresh green grass particularly in concrete silo; 3) addition of molasses at 6% significantly increases the dry matter consumption as well as digestibility in terms of DM, organic matter, crude protein, neutral detergent fiber and acid detergent fiber; 4) no bad effect including sickness found in goat treated by Setaria grass silage at 100% which is characterized by the hemoglobin (Hb) and hematocrit (Ht) or packed cell volume (PCV) concentration which is in normal range; 5) DM intake of goat which is treated by Setaria grass silage is lower than goat fed by fresh King Grass including Setaria.

II. MATERIALS AND METHOD

The research was conducted using male Ettawa Grade goat fed by King Grass silage (*Pennisetum purpuphoides*). Twelve male Ettawa Grade goats, aged at 10 month, weighed at 19.45 ± 3.03 kg were allotted individually and randomly in pen. Feeding ration treatments based on DM used in this research were as follow:

T0: Field grass + Rice Bran 200 gram
T1: Field Grass + Rice Bran 200 gram + Silage 100 gram
T2: Field Grass + Rice Bran 200 gram + Silage 200 gram
T3: Field Grass + Rice Bran 200 gram + Silage 300 gram

Pre-research was conducted in one week followed by collecting period in two weeks based on total collection method (Ranjhan, 1986). Individual feces were removed every day (before feeding application) from collection place in 24 hours during collection period. To avoid nitrogen evaporation, HCl 2 N solution was sprayed sufficiently. After weighing, 10% sample was taken. Total feces during collection stage were mixed in homogeny form and take 10% for sample to be used for proximate analysis. Individual urine from collection place in 24 hours during collection period was then collected by connecting the plastic pipe and collecting

bottle. The capacity of collecting bottle is 100 ml. To prevent nitrogen evaporation, HCl 2 N at 100 ml was applied to the collecting plastic bottle. After measuring the volume, 10% was taken out and mixed with others urine sample during collection period in homogeny form. Urine sample at 10% was taken out for proximate analysis. Remain feces and urine at the same collecting place was then stored in refrigerator.

Observed blood sample was obtained from *vena jugularis* by using syringe 5 ml and then put in anticoagulant (EDTA) tube. The blood sample was then delivered to laboratory for hemoglobin and hematocrit analysis.

King Grass was cut at defoliation aged at 60 days, and then cut using chopper sized at ± 5 cm, withered in 1-2 days to obtain moisture content at ± 65%, added with molasses at 4% weight/weight and then ripened in plastic silo for five weeks at density 650 kg/m^3. Before applied to the goat, the King Grass silage was tempered for ± 15 minutes to prevent from strong acid odor.

The ration feeding application was controlled as follows: 1) rice bran at 200 gram was fed at 07.00 (until complete), 2) King Grass silage was fed (correspond to treatment) at 10.00, and 3) field grass forage was fed at 14.00.

Dry matter (DM) intake = (Feeding amount x % DM) – (remain amount x % DM)

Nitrogen intake = DM intake amount x % N ration

Nitrogen-feces = Feces amount x % DM x % N

Nitrogen-urine = Urine amount x % N

Nitrogen-retention = N intake – (Feces-N + Urine-N)

III. RESULTS AND DISCUSSION

The summary of tested parameters towards male Ettawa grade regarding of King Grass silage consumption is shown in Table 1.

TABLE 1.
THE EFFECT OF KING GRASS SILAGE FEEDING TO MALE ETTAWA GRADE

Parameter	Treatment			
	T0	T1	T2	T3
DM intake, gram/head/day (g/h/d)	449.42	328,76	441.79	471.05
DM intake, g/kg^{0,75}	51.82^{ab}	36.97^{c}	42.51^{bc}	54.98^{a}
DM intake, % net weight	2.54	1.79	2.01	2.70
N intake, g/h/d	7.15	5.37	6,25	7.53
N-feces, g/h/d	3.08	3.01	2.36	2.95
N-urine, g/h/d	1.07	0.87	2.44	3.79
N-retention, g/h/d	2.51	1.49	1.44	3.79
Hb., g/100 ml	8.55	8.05	7.33	8.00
Ht., %	28.50	29.00	27.33	28.60

Dry Matter Intake

Table 1 shows that DM intake of male Ettawa grade in this research ranged at 328.76-471.05 g/h/d. This result shows that there was no significant different upon King Grass silage feed compared to fresh forage. In condition lack of fresh forage, King Grass silage feed had no different flavor and predilection so intake was relatively similar. However, the treatments resulted significant different ($P<0.05$) if DM intake was calculated based on metabolic weight. T3 (300 g silage/t/d) was proven to be higher than T1 (100 g silage/h/d) and T2 (200 g silage/h/d), and similar to T0 (no silage feeding). Devendra and Burns (1994) stated that if average intake level is 1.79-2.70% of body weight so the DM intake exceeds the basic life needs accounted at 1.70%.

Heat production of homoeothermic animal directly relates with the body surface area which proportionally similar with 0.75 degree (W $^{0.75}$). In this research, DM intake (g/h/d) was included in metabolic body weight standard due to the variance of treated goat weight. The calculation result showed that DM intake was significantly caused by King Grass silage feeding. Higher silage was proven to increase DM intake per metabolic body weight, even though that in 300 g/h/d King Grass silage feeding had no significant different compared to no silage feeding (T0 used field grass). Average DM intake per metabolic body weight at T0, T1, T2 and T3 were 51.82 g/h/d, 36.97 g/h/d, 42.51 g/h/d and 54.98 g/h/d, respectively.

Nitrogen-Intake

Table 1 shows that nitrogen (N) intake was proven to have un-significantly different among treatments, approximately at 5.37-7.53 g/e/d. Principally, N intake depended on DM intake ration and N content of each treatment. It considers that the quantity of DM intake was relatively similar as well as the quality of N percentage content, so statically, it caused un-significant different effect. The amount of consumed N rations is used by rumen microbe for synthesis process and to support its growth of associated microbes and the remain will pass from degradation process in reticula-rumen and then moved to digestion organ behind the rumen. For ruminant livestock (Ettawa Grade goat), N which distributes in first process is from N-microbe rumen, N ration which pass from degradation process in reticula-rumen and N-endogenous is from worn-out or used digestive N and N-recycling. The quality and quantity amount of distributed N is equal to available N which will be absorbed and utilized. Increasing amount of quantity and quality of available N will increase positive impact of associated livestock performance.

Nitrogen-Feces

The amount of feces-N as shown in Table 1 (2.36-3.08 g/h/d) was proven to have nosignificant different among treatments. Nitrogen amount of feces is consumed N which cannot be absorbed in digestion duct and thrown away as feces. Increases thrown N decreases absorbed or utilized N. Nitrogen (crude protein) is substance to support body growth and change the damaged or used tissue as well as the main material to support livestock production in regard to the production objective. Less thrown N through feces is expected that utilized N increases for production support which means that N ration utilization is getting better.

Urine-Nitrogen

Table 1 shows the amount of excreted N-urine per head per day which had no significant different at ranged 0.87 – 3.79 g/h/d. N-urine express the amount of un-utilized N of available N-absorbed through digestive duct and mix with few amount of N-endogenous from the body itself. Increased N-urine leads to increase of un-utilized N-absorbed. It means that the advantage value decreases which conforms to the declination of livestock performance due to increase amount of thrown N in urine forms.

Nitrogen-Retention

Table 1 shows that N amount retention was calculated by utilized N minus N-feces and N-urine. N-retention of each treatment ranged about 1.49 – 3.79 g/h/d and was proven to have no significant different among treatments. Increases N-retention increased the advantage of consumed N ration and livestock performance. For livestock ruminant, available N was ± 60% which included contribution of rumen microbe protein (N), 30-40% of feeding-N and 1-2% obtained from N-endogenous. Rumen microbe includes crude protein at ± 70% which consists of complete essential amino acid and has high biological value (Orskov, 1982).

T3 with King Grass silage feed at 300 g/h/d has the highest value, but statistically was similar with others treatments. The highest N retention but had un-significant different with field grass ration meant King Grass silage feed could replace the application of fresh field grass forage. This result can be well implemented also particularly to overcome the problem in lack availability of green forage in dry season and the replacement with grass silage form have no bad effect so the sustainability of production is secure.

According to Lubis (1952), muscle in the fresh form has 23% DM and 77% water; while DM in meat has 16.67% N and 52.54% C (charcoal material). Based on the aforementioned value, it can be accounted that 1 gram nitrogen retention is equal to {(100/16.67) x1 gram} = 6 gram DM of meat. Due to the amount number of DM content in muscle is 23%, it can be calculated that fresh meat obtained from 1 gram nitrogen retention is {(100/23) x 6 gram} = 26.09 gram.

The result shows that N retention was accounted at 1.44 s/d 3.79 g/h/d, so weight gain was (1.44 x 26.09) s/d (3.79 x 26.09) gram = 37.57 s/d 98.88 g/h/d. Based on this number, treated livestock weight gain is sufficient. This conformed to Rangkuti and Pulungan (1985) which stated that wafer sugarcane top feeding added with gliciridia yields daily weight gain at 30 – 37 g/h/d. The addition of soybean extracted oil residue in commercial ration in female goat yields crude protein intake at 65-80 g/h/d yields weight gain at 61.40-86.90 g/h/d (Martawidjaja *et al*., 1996). While additive material such as *gamal*, *turi* and aras *feunkase* (*Thevetia peruviana*) at 20, 40 and 60% yields weight gain at 62.93-66.33 g/h/d of male weight goat (Panjaitan and Tiro, 1996). According to Haris (2004), organic zinc substance added in nut goat forage yields weight gain at 14.9-27.8 g/h/d, while organic zinc supplementation (Zn-PUFA and lysine-Zn-PUFA) yields N-retention 0.83-3.35 g/t/h and higher weight gain than no supplementation with range value at 31.65-72.03 g/h/d (Muhtarudin, 2005).

Hemoglobin

Table 1 shows hemoglobin (Hb) concentration value at range 7.33-8.55 g/100 ml or averagely equal to 7.98 g/100 ml and had significant different due to the application of King Grass silage forage. This result was relatively similar with Schalm *et al.*, (1975) statement who said that the lowest level number is 8 – 16 g/100 ml. However, it had lower value than the result obtained by Ginting (1987) which stated that goat livestock Hb in Java is averagely at 11 g/100 ml. The lowest Hb level was obtained from T2 (7.22 g/100 mL) followed by T1 (8.05 g/100 mL). This apparently conformed to low N-intake (crude protein) at T2 (6.25 g-N/h/d) and T1 (5.37 g/h/d) and was proven that N-retention at both treatments were low i.e. 1.44 g N-retention and 1.49 g retention-N/t/d. This low intake and N-retention could cause bad effect to physiologic condition which is expressed by low level of Hb-blood. Low protein intake and lack of Fe will interrupt red blood synthesis which results in lack of red blood cell then the Hb will also decrease (Tillman *et al*., 1989) as well as the possibility of anemia occurrence due to this condition (Church and Pond, 1988). Compare to Setaria grass silage fed to local male goat, it results in higher Hb concentration at 10.3-13.6 g/100 ml which express that silage feeding has no bad effect to livestock healthy (Sunarso, 1993).

Hematocrit

The result (Table 1) shows that King Grass silage feed had no significant different effect to hematocrit (Ht) concentration of treated blood goat. Ht concentration ranged at 27.33-29%. This obtained Ht value was lower by 30% than Ginting (1987) which conducted research upon goat in Java. This low Ht concentration is associated with crude protein intake (N-consumption) and N-retention and also low Fe intake which result in lack of blood development (Frandson, 1993). The feeding of Setaria Grass silage at local male goat yields Ht concentration ranged at 27.7-36.7% which shows that this application has no bad effect for treated livestock (Sunarso, 1993).

IV. CONCLUSION

Based on the result, it can be concluded that:

1. The addition of King Grass silage in ration had no bad effect to average daily DM intake, average DM consumption based on weight percentage, moreover it proved that the application increased average DM intake based on metabolic weight.
2. N-consumption, N-feces excretion, N-urine excretion and N-retention relatively showed similar value range among ration treatments. Increased of silage feed led to increase of N-retention.
3. The concentration of hemoglobin and hematocrit relatively had low amount which was assumed by low N-intake (crude protein). Even so, sickness symptoms were not seen in treated goat.
4. Increasing of King Grass silage had no bad effect towards ration consumption, nitrogen balance and hematologist profile. In fact, the pattern was relatively increase. Due to this result, the production and utilization of King Grass silage feed by farmers as a substitution for green forage during dry season has high prospective and highly recommended.

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