

THE EFFECT OF DELAYING TIME OF *Gliricidia sepium* OFFERED TO THE ANIMAS FED GRASS BASAL DIET ON RUMEN ECOSYSTEM AND DRY MATTER DIGESTIBILITY

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ABSTRACT

Supplementation of *Gliricidia sepium* (*Gliricidia*) leaves had been quite successful in improving the quality of grass diets fed to ruminant animals. There was a difference in the rate of degradation, in the rumen, between grass and *Gliricidia* leaves thus resulting in different on the rate of VFA produced from the grass and N-ammonia produced from *Gliricidia*. Synchronous production, in the rumen, of VFA and N-ammonia would be required for achievement of optimum rumen microbial activity in feeds digestibility. Thus the delaying time of *Gliricidia* offered to the animals fed grass basal diet was assumed would be had similar rate of VFA produced from the grass and N-ammonia produced from the *Gliricidia* thus influences rumen microbial activity. The study was used 18 local Indonesian sheep (8 months old), which were divided into three groups of treatment, namely, Control group (Group I) fed by grass only; Group II fed by grass supplemented by *Gliricidia*, which was offered in the same time, and Group III fed by grass supplemented by *Gliricidia*, which was offered at three hours after the grass. The measurements were undertaken on rumen VFA and N-ammonia concentration, total rumen bacteria population and dry matter digestibility. The results of the study showed that there were differences in the N-ammonia and VFA concentration among the three Groups. Group II had the highest N-ammonia concentration (122.4 mg/L) then followed by Group III (93.8 mg/L) and Group I (77.5 mg/L). Group III had the highest VFA concentration (79.5 mmol) then followed by group II (75.8 mmol) and Group I (75.1 mmol). Group III had the highest rumen bacteria population (5.68×10^9 cell/ml) then followed by Group II (1.44×10^9 cell/ml) and Group I (1.23×10^9 cell/ml). Group II and Group III have similar dry matter digestibility (63 % and 64 %) but higher than that in Group I (53 %) ($P < 0.01$). It can be concluded that delaying time of *Gliricidia* offered to the animals fed grass basal diet had no significant effect on dry matter digestibility although it influence the VFA and N-ammonia concentration and the total bacteria population in the rumen.

Keywords : *Gliricidia*, *vfa*, *amonia*, *digestibility*.

INTRODUCTION

The introduction of the shrub legume *Gliricidia sepium* (*Gliricidia*) leaves, as feed supplement had been quite successful in improving the quality of roughage diets fed to ruminant animals (Abdulrazak et al., 1997; Widiawati, 2002). However, there were difference in the rate of degradation, in the rumen, between Elephant grass as basal diet and *Gliricidia* leaves. In the rumen, *Gliricidia* was degraded faster than the Elephant grass (Widiawati, 2002). In consequence of such difference is asynchrony in the rate of

rumen Volatile Fatty Acids (VFA) produced from basal grass diet and the rate of rumen N-ammonia produced from shrub legume *Gliricidia* leaves. Synchronous production, in the rumen, of VFA and N-ammonia would be required for optimum rumen microbial activity and growth in order to achieve the optimum feed efficiency by the animals (Hogan and Weston, 1970; Bonsi et al., 1996).

Thus, on-farm ruminant animal feeding of such diets, a delayed or staggered introduction of the supplement of shrub legume leaves, in relation to the basal grass feed, might be considered to optimise the utilisation of VFA from the basal grass feed and N-ammonia from the legume leaves for microbial activity. The optimum microbial activity is required for optimum digestibility of the feed in the rumen.

Widiawati (2002) reported that the VFA produced from the grass diet reached the peak concentration at three hours later than the peak concentration of N-ammonia produced from *Gliricidia* diet. This result indicated that there was a difference in the peak of VFA production from the grass and ammonia production from *Gliricidia*. Therefore in order to synchronise the peak concentration of both VFA from grass diet and N-ammonia from *Gliricidia* diet, the *Gliricidia* diet was offered to the animals three hours after the grass diet. The experiment undertaken was to investigate the effect of delaying time of *Gliricidia* diet offered to the animals fed grass basal diet on dry matter intake and digestibility, and VFA and N-ammonia concentration, and total bacteria population in the rumen.

MATERIALS AND METHODS

Animals and Feeds

The experiment used eighteen Thin Tail sheep (8 months old; 12.4 kg). They were divided into three equal groups of treatments, which were evenly matched for live weight. Each group of animals was allocated at random to one of the dietary treatments, namely grass only (Group I), grass + *Gliricidia* offered at the same time (Group II), grass + *Gliricidia* offered three hours after the grass.

The feed used in the study consisted of fresh leaves of Elephant grass (40-50 days regrowth) and fresh leaves of *Gliricidia* (3-4 months of regrowth). The animals were offered their respective diets at 125 % of their intake of the previous day. The feed for each sheep was divided into two equal portions, one of which was offered at 0800 h and the other at 1600 h. The animals were allowed to adapt to the experiment diets for 14 days before the measurements were undertaken.

Measurement and sampling

The measurements were undertaken on dry matter (DM) intake and digestibility and VFA and N-ammonia concentration and total population of bacteria in the rumen. The amount of feed offered and feed residue for each animal and faeces excreted by each animal were recorded at 0800 h each day. A sub-sample of each was taken and dried at 100° C for 24 hours in a fan-forced drying oven (Wessberg Martin, Wessberg and Martin Pty. Ltd. Australia) to measure DM content of each sample.

Rumen fluid from each animal was collected three hours after the animals received *Gliricidia* diet by using stomach tube attached to a vacuum pump. The rumen fluid collected from each animal was kept in a 150 mL glass tube covered by butyl rubber, placed in the portable incubator (39°C). The rumen fluids collected immediately

processed in the Laboratory to analyse the concentration of VFA and N-ammonia and the microbial population in the rumen.

Laboratory analysis

The concentration of acetate, propionate and butyrate in each sample of rumen fluid was determined using Gas Liquid Chromatography (GLC; Hewlett Packard, 3700, USA). The NH₃ concentration of the rumen fluid from each animal was determined by using the Conway technique developed by Conway and Malley (1942) by using boric acid (2 % g/v), Conway indicator (bromo-cressol green : methyl red (1 : 2 wt/wt) in 95 % ethanol solution, sodium hydroxide (40 % g/v), and 0.03 N HCl.

Rumen bacterial population of rumen fluid from each animal was determined by using Rolling tube methods developed by Ogimoto and Imai (1980). One mL of sample from 10⁹ dilutions was inoculated into test tube containing 4 mL growth medium specific for rumen bacteria (Ogimoto and Imai, 1980), then incubated in the incubator (39°C) for 5 days. The amount of colonies present in the test tube after 5 days of incubation time then recorded.

All the data collected were tabulated by using excel then statistically analysed by using Anova test (Steel and Torrie, 1980) by using SPSS program.

RESULTS AND DISCUSSION

The results of experiment showed that delaying time of *Gliricidia* offered to the basal diet, elephant grass had no significant effect on DM intake and digestibility ($P>0.05$). Significant differences on DM intake and digestibility were recorded between the animals fed grass only and the animals fed grass supplemented with *Gliricidia* either offered in the same time or delaying 3 hours after the grass. Such differences were because there was a difference in the cell structure between the grass and the legume. The grass has higher cell wall content (NDF) (75 %) compared to the legume (51 %) which is hardy digested (Chadhocar, 1982; Kariuku, et al., 2001).

The means of N-ammonia concentration of rumen fluid from sheep fed experimental diets are presented in Figure 1.

Among the three Groups, sheep in Group T2 had the highest concentration of N-ammonia (122.4 mg/L) followed by Group T3 (93.8 mg/L) and Group T1 (77.5 mg/L) ($P<0.05$). However, there was no difference in the value between Group T2 and Group T3.

The means of VFA concentration of rumen fluid from sheep fed experimental diets are presented in Figure 2.

The effect of delaying time of Gliricidia on dry matter intake and digestibility

Data on DM intake and digestibility are presented in Table 1.

Table 1. Means* of intake of dry matter (DM) and apparent digestibility of DM in sheep fed elephant grass (T1); elephant grass + *Gliricidia* offered at the same time (T2) and elephant grass + *Gliricidia* offered three hours later (T3)

Variables	T1	T2	T3	± SE	P
DM intake (gram)	349 ^a	430 ^b	436 ^b	12.1953	0.001
DM digestibility (%)	53 ^a	63 ^b	64 ^b	1.2329	0.000

- Within rows, means with different superscripts differ significantly

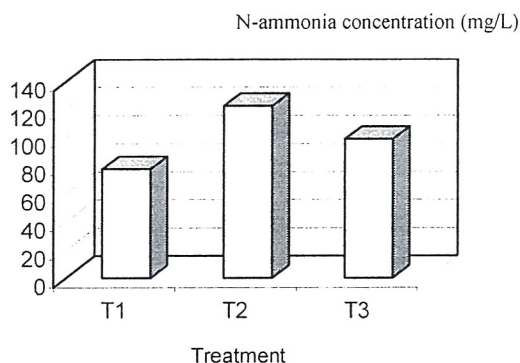


Figure 1. Means of NH_3 of rumen fluid from sheep fed elephant grass (T1); elephant grass + *Gliricidia* offered at the same time (T2) and elephant grass + *Gliricidia* offered three hours later (T3) collected 3 hours after feeding.

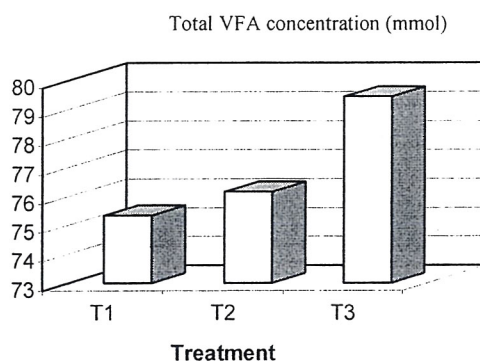


Figure 2. Means of total VFA concentration of rumen fluid from sheep fed elephant grass (T1); elephant grass + *Gliricidia* offered at the same time (T2) and elephant grass + *Gliricidia* offered three hours later (T3) collected 3 hours after feeding.

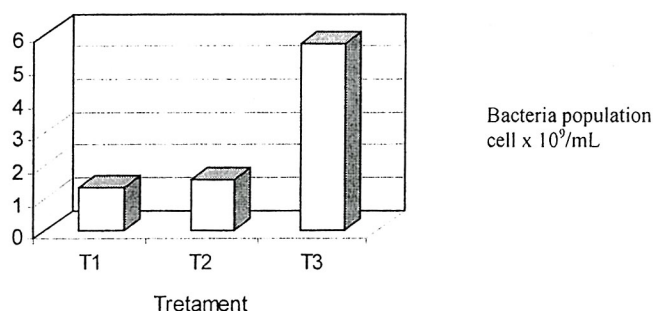


Figure 3. Means of total bacteria population of rumen fluid from sheep fed elephant grass (T1); elephant grass + *Gliricidia* offered at the same time (T2) and elephant grass + *Gliricidia* offered three hours later (T3) collected 3 hours after feeding.

Delaying time of *Gliricidia* offered to the basal diet, elephant grass did not significantly change concentration of total VFA (Figure 2). However, there was a significant difference in the total amount of bacteria in the rumen as showed in Figure 3.

Among the three Groups of treatments, sheep in Group T3 had the highest total population of rumen bacteria ($5.68 \times 10^9/\text{mL}$) ($P < 0.01$). The population is almost 3.5 times of the population in rumen of sheep in Group T1 and T2. This data might indicate better nutrition ratio available for microbial growth, namely nitrogen in the form of N-ammonia and energy in the form of VFA in Group T3 compared to the ratio in animals in Group T2 and T1. Thus the delaying time of *Gliricidia* offered to the animals for three hours seems could improve microbial growth and activity due to the better ratio between N-ammonia and VFA concentration in the rumen.

The experiment conducted only collected rumen fluid once and not in a frequent within 12 hours, where the animals finished the feeds offered. Therefore, the experiment could not figure the rate of N-ammonia and VFA concentration started from 0 time after feeding to at least 12 hours after feeding in which *Gliricidia* might be completely digested in the rumen. Data in the rate of N-ammonia and VFA production during the day might be useful to explain the rate of grass and legume digested in the rumen.

CONCLUSION

It may be concluded from the results of the study that delaying time of *Gliricidia* offered to the basal diet, elephant grass, did not change the pattern of end product of rumen fermentation, namely N-NH₃ and VFA concentration, However, there was a positive effect on the bacteria population. The delaying time also had no significant effect on dry matter intake and digestibility.

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