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ESTIMATION OF THE FEEDING VALUE OF GUINEA GRASS (*Panicum maximum*), AND GLIRICIDIA (*Gliricidia sepium*) FOR GOATS

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ABSTRACT

In search of valuable supplement for Guinea (*Panicum maximum)*, having low feeding value browse species, *Gliricidia sepium* considered to be a promising source of quality protein. Concentrates are usually of high quality but their high cost reduces the profitability margin in goat production.

Based on the economical importance of goats and the value of the forages to achieve maximum profit, an attempt was made to assess the feeding value of Gliricidia and the combination of both Gliricidia and Guinea grass in feeding of goats.

For this study, five local male goats arranged in Latin Square design were fed with different proportions of Gliricidia:Guinea were 0:100, 25:75, 50:50, 75:25 and 100:0. This study was carried out in the Livestock farm of the Eastern Univeristy, Sri Lanka from March to August, 2000. Animals were fed *ad libitum* with different proportions of Guinea and Gliricidia. Feed offered and refused were estimated and composite samples were analyzed by standard proximate analysis.The date were subjected to standard statistical analysis.

The total dry matter intake did not vary significantly among different proportions of Gliricidia supplement but in the treatment of 100% Gliricidia the feed intake was found to be significantly low ($P<0.05$). The highest total digestibility was recorded for 100% Guinea grass ($P<0.05$) while the lowest

was observed for 100% Gliricidia ($P<0.05$). Digestibility of Crude protein was the highest in the 75% Gliricidia and 25% Guinea combination (0.94 ± 0.01). It may be due to high content of Crude protein in the combination. However, weight gain did not show any significant difference among the treatments within this study period.

Guinea grass (100 %) showed a highest total dry matter digestibility. Result of mid rank technique indicated that the best combination to optimize over all digestibility was 75% of Gliricidia and 25% of Guinea grass, thus it was apparent that Gliricidia would be a valuable supplement to add to a diet to improve the feeding value of poor quality tropical grass such as Guinea in this study.

INTRODUCTION

Efficient livestock husbandry can be based on a combination of genetically superior animal and availability of adequate nutrition (forages). In animal nutrition, concentrates are of high quality, but their high cost reduces the profitability margin in animal production. Therefore, if high productivity is to be achieved at low cost, the feeding of livestock must be based as far as possible on forage systems to maximize the margin of profitability from animal production.

Guinea is considered as potentially useful grass for a cut and feeding system, (Hofs and Borders, 1982). Which is a native to tropical Africa. But has now spread to many other countries. The forage is palatable to all classes of livestock. Guinea grass is drought resistant and suited to varied soil and climatic condition. Satisfactory production can be ensured for three to five years period. It is recommended that Guinea can be harvested subsequently at six to eight week's interval depending on growth and management. The yield of green fodder is 60,000 to 1,25,000 Kg per hectare per annum, (Banerjee, 1988).

The rainfall and its distribution in the Eastern province have been shown to be favorable for the growth of several tropical grasses such as guinea, Napier and clone 13 and these can also be grown under irrigation. Total annual dry matter yield of Guinea, (DM %= 26.2 at flowering appear stage) pattern of seasonal availability and nutritional quality (ME= 1.92 Mcal/kg, CP % = 5.6, CF %= 33.8, EE% = 1.5 and Ash %= 13.8) are also greatly influenced by various factors of management such as pattern of harvesting the herbage (Intensity and frequency of cutting) and application of fertilizer (Ibrahim, 1988).

In a drought season of the year and the limited availability of water for irrigation in most of region, grasses alone cannot provide adequate nutrition. But leguminous feed which are cheaply available and the legumes being deep root have the ability to survive at lower soil moisture and their production during dry season is satisfactory. Legume tree crops, which establish easily and do not require extensive agronomic inputs, constitute potentially valuable sources of supplementary feeds that subsistence and medium scale livestock farmers in the tropics could use to improve livestock nutrition and productivity (Smith and van Houtert, 1987). Forage legumes can enhance the utilization of poor quality roughages in smallholder mixed farming systems. They are rich in protein and other nutrients such as minerals and vitamins (Reynolds, 1989). Species like *Leucaena leucocephala* and *Gliricidia sepium* have been considered as promising source of good quality protein for supplementation (Smith and Van Houtert, 1987).

Table 1. Digestibility of Gliricidia by ruminants

Species	Nutrient (%)		Reference
	DM	CP	
Cattle	57.7	55.3	Falvey, 1982
Sheep	43.1	53.5	Falvey, 1982
Goats	57.5-58.5		University of Ife, goat Research Group, 1984
In Vitro	62.8-65.6		Adejumo, 1984
In vitro	53.3-59.2 (young leaves)		Falvey, 1982
	55.6-63.8 (old leaves)		Falvey, 1982
In vitro	66.0		Carew, 1983

Source: Smith. and Van Houtert, 1987

DM-dry matter; CP-crude protein

There is a paucity of data on the digestibility of gliciridia, as it has rarely been used as a sole feed for livestock. Available data summarized in Table 1, show that gilricidia is fairly well digested and that it should improve the digestibility of poor – quality feeds when used as a supplement, Ruiz *et al.*, (1979), however, reported no differences in digestibility between supplemented and un-supplemented diets of derinded sugarcane stalk, molasses and urea: dry-matter digestibility of both was 76.2 percent. The high digestibility of basal diet probably accounts for the lack of response to gliricidia supplementation.

Table 2 Effect of Gliricidia supplementation on intake and digestibility of low quality of feeds

Treatment group	Feed offered		Feed consumed			Dry matter digested (%)	Digestible dry matter intake
	Hay	Gliricidia	Hay	Gliricidia	Total		
1	77	0	43	0	43	45	19
2	76	11	40	11	51	46	24
3	75	21	37	21	58	51	30
4	75	32	37	32	69	55	38

Source: Smith and Van Houtert, 1987

The beneficial effect of gliricidia supplementation on the digestibility of poor-quality feeds was more clearly demonstrated in a series of trials carried out by researchers in the University of Ife, Nigeria, Goat Research Group (1984). One of these studies, carried out using 24 adult dwarf goats, is summarized in Table 2. The goats averaged 15 kg live weight, and were fed poor –quality quinea grass hay at the rate of 80 g DM/kg live weight (LW) $^{0.75}$ /day. They were supplemented with gliricidia at four different levels (0,10,20,and 30 g DM/kg (LW) $^{0.75}$/day) to constitute four treatment groups. The observed increase in total feed intake with increasing level of supplementation was due to mainly to a substitution of hay with gliricidia, as shown by the increasing proportion of giliricidia dry matter consumed. Digestibility increased with the level of gliricidia supplementation and consumption, leading to a substantial increase in digestible intake. In contrast, Akpegi (1984) obtained no improvement in digestibility of poor – quality guinea grass hay fed to cattle supplemented with gliricidia, probably because the gliricidia intake was low (only 7.6 percent of total dry matter intake).

Table-3. Digestibility of Gliricidia alone and in combination with other feedstuffs

Feed combination	% Digestibility				Mean ± SD	Growth rate (g/ day)
	Trial1	Trial 2	Trial3	Trial 4		
Gliricidia	56.2	55.5	58.5	57.5	56.9 ± 1.3	26.1
Gliricidia + guinea grass (80:20)	56.3	57.8	59.3	58.1	57.9 ± 1.2	27.4
Gliricidia + cassava (65:25)	69.8	70.7	73.7	73.0	71. 8 ± 1.8	14.6
Gliricidia + leucaena (65:25)	57.4	57.2	61.8	62.5	59.7 ± 2.8	40.2

Source: Smith and Van Houtert, 1987

The positive response obtained by the University of Ife group appeared to be due to a fairly high intake of gliricidia. This probably led the researchers to change their experimental approach from using gliricidia as a supplement, to using it as a main feed, supplemented with a variety of other feedstuffs. Four digestion studies were carried out using this approach: goats were fed either gliricidia *ad libitum* with no supplements; fresh guinea grass; dried cassava tubers; or Leucaena leucocephala leaves, all at 30 g DM/kg LW $^{0.75}$/day. The results are summarized in Table 3, and show positive response to all supplements. The digestibility of the gliricidia- cassave combination was the highest. It should be noted, however, that because of low feed intake by this group, digestible nutrient intake was too low to promote weight gains (see Table 3).

Nutrition is important to improve the growth and reproductive performance of goats and in order to improve this supplementary feed is necessary. Concentrate forms the major constituent as supplementary but income of production is not satisfactory. Therefore, freely available and cheep natural protein substitute has become vital. From literature it was evident that Gliricidia is a valuable source of supplemental energy and

protein and also it is a better alternative source for concentrate feed for ruminants (Ajiboye , 1983).

In Sri Lanka potential for goat meat (mutton) is very high and demand does exist in rural and urban areas. Small ruminants are preferred to large ruminant due to smaller body size, lower feed requirement, early maturity, shorter generation interval, superior prolificacy, ready market, easy management, low input and less capital investment (Adugna *et al*,. 2002)

In the previous experiments it has been shown that Leucaena and Gliricidia are valuable supplements for poor quality tropical forage for goats. Therefore, an experiment was designed to study the performance of Gliricidia and Guinea fed on indigenous goat in the eastern Region of Sri Lanka. Based on the economical importance of the goat and the value of forages to achieve maximum profit from the goats an attempt was made to assess the following objectives:

1) To determine the total digestibility of guinea grass and gliricidia of different combinations in goats.
2) To determine the digestibility of Crude protein at different combination of grass and gliricidia.
3) To determine the growth performance of local goats at different combination of guinea grass and gliricidia.

MATERIALS AND METHODS

The experiment was carried out in the period of March/August of 2000. Five indigenous goats. Weighing an average live weight 15 kg, were purchased from Batticaloa region. These animals were arranged in Latin Square design. Animal were *fed ad libitum* with different proportion of guinea : gliricidia. Animals were given free access to clean water through out the experiment period. Following diets were formulated using guinea grass and gliricidia (Table 4).

Animals were cage fed and feces and urine collected were used to form the composite sample. After an adaptation period 0f 10 days, feed intake and digestibility were measured for a period of 10 days. The animals were weighted at the beginning and at the end of the experiment.

Both feed offered and refused were recorded daily at each feeding and samples were used to determine the nutrient contents. Faeces collected from individual animals were dried in a unitherm oven at 60 ^{0} C until a uniform weight was obtained and the dry weights were recorded. Composite samples were stored for chemical analysis.

Samples were subjected to chemical analysis to determine the contents of moisture, Ash, Crude Protein, Ether extract and Crude Fibre with standard procedures (A.O.A.C, 1980)

The experimental design used was Latin Square Method and experimental results were analyzed for statistical significant though analysis of variance and mean separation procedure using SAS statistical software.

Table - 4 :Composition of the different treatments used in this study

Ration	Guinea grass	Gliricidia
T_1	100	00
T_2	75	25
T_3	50	50
T_4	25	75
T_5	00	100

RESULTS AND DISCUSSION

Table- 5 summarizes the feed offered, feed intake and total digestibility. There was no significant difference among total dry matter intake up to 75% of gliricidia replacement. There was a significant reduction ($p < 0.05$) in total dry matter intake at 100% gliricidia replacement compares to all other treatments. This may be due to the properties of gliricidia such as, reduction in palatability, high fibre content and high stem: leave ratio. The properties of less palatability and change in physical characters due to high stem: leaves ratio were reported by Smith and Van Houtert, 1987) and Devendra ,1983) respectively.

Total digestibility also showed the similar trend as for total feed intake. The reduction in digestibility may be due to the fact of high fibre content and high lignin content of gliricidia (McDonald *et al.*, 1997 and Aron, 1987).

Table 6 summarizes the results of digestibility of organic components viz, Fibre, ADF, Crude fat, Crude Protein and Ash.

When 100% gliricidia was fed, the digestibility of organic component was very low except for protein. It may be due to the high fiber content of gliricidia, which retards the digestibility. Protein digestibility was high due to the initial higher percentage of crude protein content of gliricidia. There was no significant difference among the treatments in the digestibility of fiber and ash among the treatments except for 100% gliricidia where the digestibility was significantly lower than other treatments. The reason for low digestibility of fiber is, in ruminants fiber digestibility is enhanced by microbial activity, for the proper functioning of microbes, there should be adequate amount of protein and soluble carbohydrates. But gliricidia lacks in soluble carbohydrates, which reduces the digestibility of fiber (Smith and Van Houtert, 1987). As far as the crude fat digestibility is concerned, the digestibility was significantly higher for the first

Table- 5 : Feed intake and digestibility of different proportions of Gliricidia and guinea

Treat	Feed Offered (DM in Kg/10days)		Feed intake (DM in Kg/10 days)		Total intake(DM in Kg/10days)	DMD%	OMD%
	Guinea	Gliricidia	Guinea	Gliricidia			
1	3.22	0.00	2.55	0.00	$2.55^{a} \pm 0.64$	$0.59^{a} \pm 0.06$	$0.66^{a} \pm 0.04$
2	2.55	0.96	1.81	0.63	$2.44^{a} \pm 0.34$	$0.58^{a} \pm 0.12$	$0.64^{ab} \pm 0.08$
3	1.55	1.86	1.26	1.18	$2.44^{a} \pm 0.32$	$0.57^{a} \pm 0.06$	$0.61^{ab} \pm 0.34$
4	0.74	2.72	0.59	1.81	$2.41^{a} \pm 0.51$	$0.59^{a} \pm 0.10$	$0.66^{a} \pm 0.08$
5	0.00	3.71	0.00	1.74	$1.75^{b} \pm 0.52$	$0.41^{b} \pm 0.19$	$0.53^{b} \pm 0.13$

Means in the same column with same letter do not differ significantly ($p < 0.05$).

Table 6 : Fibre, ADF, Crude fat , Crude protein and ash digestability and weight change in local goats with different

Treat	Fibre Digestibility %	ADF Digestibility %	Crude fat Digestibility %	Crude protein Digestibility %	Ash Digestibility %	Body weight Change (Kg)
1	$0.53^{a} \pm 0.04$	$0.72^{a} \pm 0.05$	$0.44^{a} \pm 0.09$	$0.087^{c} \pm 0.02$	$0.50^{a} \pm 0.1$	$0.30^{a} \pm 0.55$
2	$0.45^{a} \pm 0.14$	$0.69^{ab} \pm 0.08$	$0.38^{ab} \pm 0.18$	$0.90^{b} \pm 0.02$	$0.49^{a} \pm 0.13$	$0.30^{a} \pm 1.51$
3	$0.32^{a} \pm 0.10$	$0.69^{ab} \pm 0.04$	$0.17^{bc} \pm 0.11$	$0.93^{a} \pm 0.01$	$0.5^{a} \pm 0.06$	$0.40^{a} \pm 0.65$
4	$0.35^{a} \pm 0.18$	$0.73^{a} \pm 0.07$	$0.15^{bc} \pm 0.16$	$0.94^{a} \pm 0.01$	$0.44^{a} \pm 0.19$	$0.60^{a} \pm 0.74$
5	$0.02^{b} \pm 0.25$	$0.61^{b} \pm 0.14$	$0.03^{c} \pm 0.33$	$0.93^{a} \pm 0.02$	$0.19^{b} \pm 0.19$	$0.2^{a} \pm 0.67$

Mean in the same column without a common superscript differ significantly ($p < 0.05$).

two treatments compared to other three treatments. It is because as the gliricidia level increases there is an increase in fiber content. As the fiber level goes up it will absorb the bile and excrete it through feces. As the bile is excreted via faeces there will not be enough bile for emulsification of Crude fat, it hinders the Crude fat digestion (Cramton and Harries, 1969).

There was no significant difference among the treatments for weight gain. But earlier studies with gliricidia reported that there will be loss in weight at the initial stages and later there will be an increase in weight. Mid rang techniques revealed that the treatment four is the best treatment combination.

CONCLUSIONS

100 % guinea grass gave the best dry matter digestibility. However the overall digestibility of Guinea grass and Gliricidia and Crude protein digestibility was high for the treatment combination of Gliricidia and Guinea 75 % : 25%.

The treatment combination did not affect the weight gain up to three months.

Fiber, ether extract and ASH digestibility were not much changed when we use Gliricidia as supplement. Gliricidia is a valuable supplement for poor quality tropical grass. Further research is needed to determine whether high level of Gliricidia will still enhance dry matter intake and digestibility.

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