

Effect of method of offering foliages of *Gliricida sepium* and *Stylosanthes guianensis* CIAT 184 (Stylo) to goats on intake and digestibility

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Abstract

A study was made of different ways of offering two plant species (*Stylosanthes guianensis* CIAT 184 [ST] and *Gliricidia sepium* [GS]) to growing goats. The feeding methods were stripping the leaves from the plants and putting them in the feed trough (L), putting the foliage (leaves attached to stems) in the feed trough (T) or hanging it from a bar above the feed trough (H). The design was a 3*3 factorial arrangement for each foliage with 3 feeding methods and 3 periods of 14 days.

In both plant species, leaves were higher in DM and lower in crude fibre and NDF than stems. Intake of leaves and of total foliage DM, and DM digestibility, were lower when only leaves were offered compared with offering the whole foliage.

It is concluded that factors associated with eating behaviour and / or with components present in stems (or in leaves) could have been responsible for the lower values of DM intake and digestibility associated with feeding only the leaves as compared with feeding intact foliage in which the leaves are attached to the stems.

Key words: digestibility, foliage, gliricidia, intake, leaves, stylosanthes

Introduction

Farmers raising goats in Cambodia and Lao traditionally hang the foliages (with leaves attached to the stems) from the sides of the pen (Photo 1), or on some raised structure (Kouch et al 2003a).



Photo 1: Farmer feeding her goats in Cambodia

It has recently been shown that this method resulted in higher intake and digestibility by goats of three tree foliages (Jackfruit - *Artocarpus heterophyllus*; Cassava - *Manihot esculenta* and Mulberry - *Morus alba*) compared with giving the leaves in the feed trough (Kouch et al 2003b).

This paper reports a comparison of these feeding methods applied to goats offered as the only feed two plant species commonly available in Lao (*Gliricida sepium* and *Stylosanthes guianensis* CIAT 184).

Methods and materials

Location and duration

The experiment was conducted at the Livestock Research Center, Nam Xuang about 44 km from Vientiane City, Lao PDR. The experiment started on 3 November 2003 and finished on 21 December 2003.

Experimental animals

Six growing goats (local breed) of 14 to 17 kg live weight were confined in cages made from wood and bamboo fitted with plastic mesh and plastic sheet to collect separately the faeces and urine (Photos 2 and 3).



Photo 2: Metabolism cage for goats made from bamboo and wood

Photo 3: Hanging the foliage in the feed trough

Experimental design

The design was an arrangement of two 3*3 Latin Squares (one for *Gliricidia sepium* [GS] and the other for Stylo CIAT 184 [ST]), with 6 goats (3 in each square) and 3 periods to compare 3 feeding methods: hanging the foliage above the feed trough (H); putting the foliage in the feed trough (T) or putting only the leaves (L) in the feed trough.

Feeds and feeding system

The foliages were collected from within the Livestock Research Center. In the case of the *Gliricidia*, the foliage comprised green stems, petioles and leaves. For stylo the components were stems and leaves.

For GSH and STH, the branches of *Gliricidia* and stylo were hung from a bamboo stick placed above the feed trough. For GST and STT, these feeds were placed in the feed trough. For GSL and STL the leaves were separated and put in the feed trough. In all cases feeding was ad libitum with an offer level of about 20% above actual intake. Feeds were offered twice daily: about 7.00am and 14.00pm. Days 1 to 8 of each period were for adaptation to the new treatment; on days 9 to 13 faeces and urine were collected.

Measurements

Faeces were collected twice daily and stored at -20°C until analysed. Urine was collected in a bucket with 50 ml of 25% sulphuric acid to maintain the pH below 4 so as to prevent escape of ammonia. Feeds offered and refused were weighed and samples separated into leaves, petiole and stems, which were then analysed for DM to determine the amounts that were consumed. The goats were weighed at the beginning of each adaptation period in the morning before offering feed. Dry matter was determined by microwave radiation (Undersander et al 1993), crude fibre according to procedures of AOAC (1990) and NDF by the method of Van Soest et al (1991).

Statistical analysis

The data were analyzed separately for each forage, using the GLM option of the ANOVA software of Minitab (Version 13.31) 2000. Sources of variation were periods, animals, feeding method and error. Comparisons between forages were analysed by combining the data for both Latin squares. In this case the sources of variation were forage species, periods and error. When the "F" test was significant ($P < 0.05$), the means were compared using the Tukey test in the Minitab software.

Results and discussion

Feed characteristics

The leaves accounted for slightly over 50% of the dry biomass in both plant species (Table 1), the stems making up the rest in stylo whereas in *gliricidia* the non-leaf biomass was divided between petioles and stem. The DM content of both leaves and stems was higher in *gliricidia* than in stylo.

Table 1: Feed characteristics of the foliage of Stylo 184 and *Gliricidia*

	Dry matter (%)	Crude fibre (% in DM)	NDF (% in DM)	Proportion (% DM basis)
Stylo				
Leaves	20.0 – 28.0	13.3	16.9	51.8
Stem	27.0 – 31.0	17.3	23.1	48.2

Gliricidia					
Leaves	33.0 – 35.0	-	-	-	58.5
Petiole	35.0 – 36.0	-	-	-	13.5
Stem	35.0 – 36.0	-	-	-	28.0

Feed intake

In both plant species, the intake of DM as leaves and as total biomass was lower when the leaves were stripped from the stems and given as the only feed (Tables 2 and 3 and Figure 1). This result is similar to the findings of Theng Kouch et al (2003) with Jackfruit, Mulberry and Cassava foliages and Samkol (2003) who fed foliage of *Muntingia calabura*. DM intake was higher for Gliricidia than for Stylo 184 (Table 5).

Table 2: Feed intake of goat fed stylo 184 by hanging the foliage (STH), putting the foliage in the feed trough (STT) or putting only the leaves in the feed trough (STL)

	STH	STT	STL	SEM	Prob.
Intake, g fresh/day					
Leaves	1039	1022	956	7.41	0.001
Stem	667	623	0	11.1	0.001
Total fresh	1706	1644	956	11.8	0.001
Intake, g DM/day					
Leaves	254	248	212	3.5	0.022
Stem	134	109	0	17.9	0.06
Total DM	388	357	212	20.0	0.043
DM, % BW	2.73	2.53	1.50	0.07	0.001

Table 3. Feed intake of goat fed gliricidia by hanging the foliage (GSH), putting the foliage in the feed trough (GST) or putting only the leaves in the feed trough (GSL)

	GSH	GST	GSL	SEM	Prob.
Intake, g fresh/day					
Leaves	894	875	790	15.7	0.001
Petiole	190	183	0	3.0	0.001
Stem	225	187	0	14.5	0.001
Total fresh	1309	1244	790	17.9	0.001
Intake, g DM/day					
Leaves	303	296	264	9.13	0.16
Petiole	67.0	64.3	0.0	0.94	0.001
Stem	77.2	63.3	0.0	6.14	0.022
Total DM	448	424	264	14.3	0.02
DM, % BW	2.98	2.51	1.68	0.09	0.019

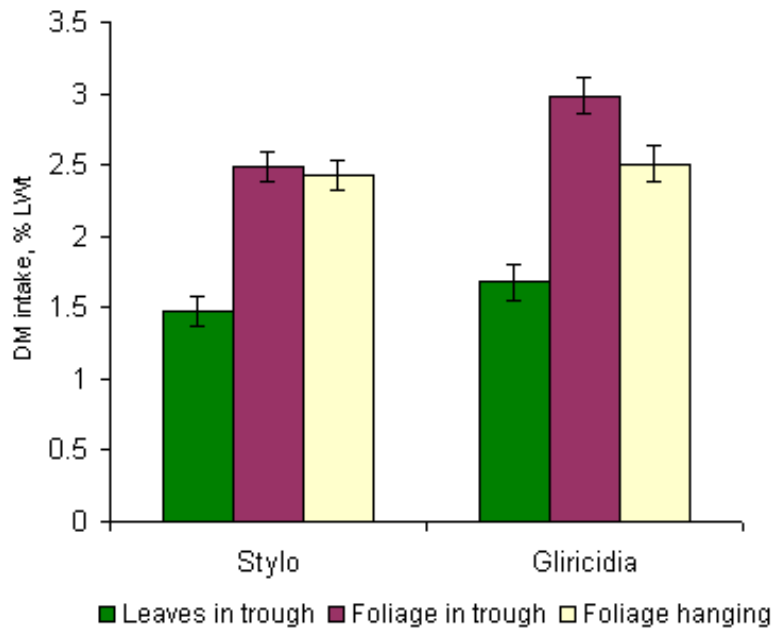


Figure 1: DM intake (% of Live weight) by goats offered Stylo or Gliricidia as foliage hanging or placed in the feed trough, or as leaves in the feed trough

Digestibility

For both foliages, the dry matter digestibility was much lower when the leaves were offered as the only feed compared with the foliage (Table 4; Figure 2). There were no differences between hanging the foliage or putting it in the feed trough. The lower digestibility when only leaves were fed agrees with the findings of Theng Kouch et al (2003), working with Mulberry, Cassava and Jackfruit foliages.. These researchers also found that hanging the foliage in the trough led to higher coefficients of dry matter digestibility compared with laying the foliage in the feed trough. This latter effect did not appear to be evident for stylo and Gliricidia in the present experiment.

Table 4: Mean values for DM digestibility in goats fed stylo or Gliricidia by hanging the foliage, putting the foliage in the feed trough, or putting only the leaves in the feed trough

	Foliage		Leaves	SEM	Prob.
	Hanging	Trough	Trough		
Stylo	61.1a	63.0a	36.1b	1.38	0.001
Gliricidia	75.1a	72.3a	50.3b	3.63	0.067

ab Means within rows without letter in common differ at P<0.05

Table 5: Mean values for DM intake and DM digestibility for Stylo and Gliricidia foliages fed to growing goats

	Gliricidia	Stylo	SEM	Prob.
DM intake, % of LW	2.39	2.13	0.11	0.11
DM digestibility, %	65.9	51.7	2.9	0.001

Dry matter digestibility was higher for Gliricidia than for Stylo 184 (Table 5), presumably because of the higher content of stems in the foliage of Stylo 184 (Table 1).

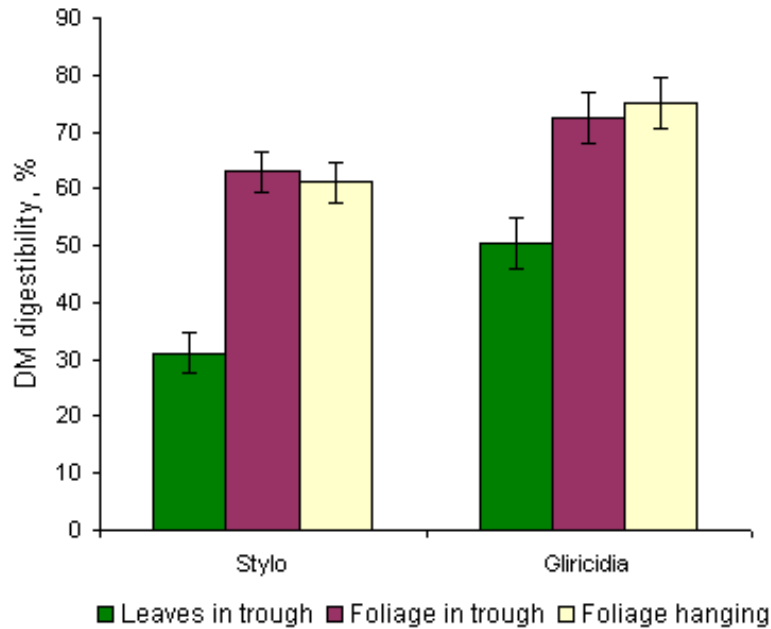


Figure 2: DM digestibility coefficients for goats offered Stylo or Gliricidia as foliage hanging or placed in the feed trough, or as leaves in the feed trough

There are no simple explanations for the major differences in intake and digestibility in favour of foliage (leaves plus stems) compared with leaves. From a theoretical standpoint, leaves should be of higher digestibility than the foliage which contains stems which are lower in crude protein and higher in crude fibre and NDF (Table 1). It would appear that the factors influencing intake and digestibility are likely to be associated with: (i) the process of collecting and chewing of the feed; and / or (ii) components present in the stems. This is an area requiring further research.

Conclusions

Dry matter intake and dry matter digestibility were considerably lower when growing goats were offered only fresh leaves of either stylo 184 or *Gliricidia sepium* as compared with the foliage either hung above, or placed in, the feed trough.

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