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Effect of interplanting *Setaria* with *Gliricidia* on chemical composition and nutritive value when fed to growing sheep

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Abstract

Four cultivars of *Setaria sphacelata* were interplanted with *Gliricidia sepium* to study their compatibility. The plot sizes of *Gliricidia* were 8 x 4 m with inter-row spacing of 4 m and within row spacing of 50 cm. The *Setaria* cultivars were two ecotypes of *Setaria sphacelata* var. *Sericea*-Narok and Kazungula and two of *Setaria sphacelata* var. *Splendida* with Kenya and Tanzania origins. The spacing of *Setaria* within and between the rows was 50 cm. As a control, pure stand plots of *Setaria* and *Gliricidia* were also established. The effect of feeding different cultivars of *Setaria* supplemented with *Gliricidia* leaves to growing sheep on dry matter (DM) intake, digestibility and nitrogen balance was studied using a 4 x 4 Latin square design. Results from the compatibility study indicated that DM yield of either crop was not negatively influenced by the presence of the other. However, DM percentage of *Setaria* was significantly lower ($P \leq 0.05$) in the intercrop than in the monocrop. Dry matter yield for *Splendida* ex. Tanzania was significantly higher ($P \leq 0.05$) than that of the other cultivars in both the monocrop and intercrop. The presence of *Gliricidia* significantly increased ($P \leq 0.05$) contents of crude protein (CP) and neutral detergent fibre (NDF) of *Setaria*. Results from the feeding trial indicated no significant ($P > 0.05$) difference in DM intake for the different *Setaria* cultivars. The digestibilities of DM, CP, NDF and acid detergent fibre (ADF) were not different ($P > 0.05$) and nitrogen balance was similar and positive. There was no significant ($P > 0.05$) difference in daily weight gains of sheep fed the different cultivars. It was concluded that *Setaria* can be intercropped with *Gliricidia* without reducing the productivity of either forage and that *Setaria sphacelata* has potential as an alternative fodder crop in Uganda.

Key words: Alternative fodder crops, digestibilities, *Gliricidia sepium*, growing sheep, *Setaria sphacelata*

Introduction

Inadequate feeding is a major limiting factor to smallholder livestock production in Uganda (Bareeba and Mugerwa, 1990). The problems associated with feed shortages in terms of seasonal availability and quality can potentially be overcome by introducing more productive forages and using appropriate management practices. *Setaria sphacelata* is grown by farmers on soil bunds in banana plantations as a soil conservation measure and used as mulch or fodder. However its potential and management requirements as fodder are not well known. *Gliricidia sepium* on the other hand is the most widely cultivated multipurpose legume shrub and is commonly used to supplement grass-based diets (Mpairwe, 1994). The objective of this study was to assess the compatibility and productivity of *Setaria* cultivars grown with *Gliricidia sepium*. The effect of supplementing the different *Setaria* cultivars with *Gliricidia* on performance of growing sheep was also investigated.

Materials and Methods

Four *Setaria* cultivars were interplanted in a four-year stand of *Gliricidia* pruned to a height of 1m from

the ground to study their compatibility. The cultivars were *Setaria sphacelata* var. *sericea* – Narok and Kazungula and *Setaria sphacelata* var. *Splendida* of Kenya and Tanzania origins, respectively. The plot sizes of *Gliricidia* were 8 x 4 m with inter-row spacing of 4 m and within row spacing of 50 cm. The spacing of *Setaria* within and between the rows was 50 cm. As a control, pure stand plots of *Setaria* and *Gliricidia* were also maintained. The experiment was set up following a randomised complete block design with four replicates per treatment.

Setaria was harvested every 6 weeks at a cutting height of 15 cm while *Gliricidia* was harvested every 12 weeks at a cutting height of 100 cm. After taking fresh weight, 500 g samples were saved for laboratory analysis. The rest of the forage was dried under shade to make hay for the feeding experiment.

The effect of feeding different cultivars of *Setaria* supplemented with *Gliricidia* leaves to growing sheep on DM intake, digestibility and nitrogen balance was studied using 4 growing rams in a 4 x 4 latin square design. The animals averaging 7 months of age and 19 kg live weight were housed in digestion crates. The animals were offered a known quantity of *Setaria* hay twice a day at 0900 and 1600 hours to ensure that they feed *ad-libitum*. *Gliricidia* leaves were fed at a level of 8g Dm kg^{-1} body weight day^{-1} and this was done once prior to feeding *Setaria* in the mornings. Mineral lick and water were available all the time.

Animals were weighed before and after each experimental period, which consisted of a 14-day preliminary period, followed by a 7-day collection period. Faeces and refusals were collected from each sheep once a day prior to the morning feeding. Urine was collected in covered plastic buckets containing 50 ml of 0.5N HCl to prevent ammonia loss.

The DM of forages, faeces and refusals were determined by drying to constant weight in a forced air oven at 60 °C. The dried samples were milled to pass through a 1mm screen before chemical analysis. Nitrogen content of feeds, faeces and urine were determined by micro Kjeldahl method (AOAC, 1984). Neutral detergent fibre (NDF) and acid detergent fibre (ADF) were determined using procedures of Goering and van Soest (1970) and *in vitro* organic matter digestibility (IVOMD) was determined according to Tilley and Terry (1963). Data were subjected to analysis of variance (ANOVA) using MSTAT-C computer package and where significant, means were compared using Duncan's Multiple Range Test (Steel *et al.*, 1997).

Results and Discussion

The DM percentage and the DM yield of the *Setaria* cultivars are given in Table 1. The %DM was significantly lower ($P \leq 0.05$) in the intercrop than in the monocrop. Cultivar *Splendida* ex.Tanzania had lowest ($P \leq 0.05$) %DM than the other cultivars in both cropping systems. This could be attributed to cultivar reaction to reduced irradiance as a result of shadding which causes decreased leaf thickness and plant dry weight (Crowder and Chedda, 1982).

Although the DM yield of the monocrop was not significantly different ($P \geq 0.05$) from that of the intercrop, the values for the monocrop tended to be slightly higher than those for the intercrop (Table 1). The slight reduction in DM yield in the intercrop could be attributed to competitive interference for light at the grass/tree interface (Whiteman, 1980). But the DM yields were different ($P \leq 0.05$) among the cultivars under each system with *Splendida* ex. Tanzania registering the highest DM yield.

The results indicate no significant effect of intercropping on the DM yield of *Gliricidia* (Table 2). However, the %CP was significantly lower ($P \leq 0.05$) for the intercrop than the monocrop system. Similar results were obtained by Mpairwe (1994) who reported reduced DM yields of *Gliricidia* when interplanted with elephant grass. Therefore, *Setaria* would be more appropriate than elephant grass in an intercrop system.

The %CP for *Setaria* was higher ($P \leq 0.05$) in the intercrop than the monocrop probably due to improved microenvironment by the *Gliricidia* through nitrogen (N) fixation (Table 3). The fibre

fractions (NDF and ADF) were significantly higher ($P \leq 0.05$) for the intercrop than for the monocrop. The %IVOMD for the cultivars in both systems was not different ($P \geq 0.05$), though *Setaria* cultivars in the monocrop had higher values than those in the intercrop.

There was no significant ($P > 0.05$) difference between the DM intake of growing sheep fed the different cultivars supplemented with *Gliricidia* (Table 4). Supplementation with *Gliricidia* did not affect *Setaria* DM intake or total DM intake. On the contrary, Mpairwe (1994) reported decreased ($P < 0.05$) elephant grass (another commonly used grass fodder) DM intake as supplementation level of *Gliricidia* increased from 0 to 12% of body weight. This implies that *Setaria* is a better alternative

Table 1. Dry matter (DM) yield of Setaria cultivars in the intercrop and monocrop cropping systems.

Cultivars	Intercrop		Monocrop	
	DM (%)	DM yield (t ha^{-1})	DM yield (%)	DM yield (t ha^{-1})
Kazungulu	12.9^{b}	15.85^{b}	15.8^{b}	16.70^{bc}
Splendida ex. Kenya	12.7^{b}	14.22^{b}	17.3^{a}	14.67^{a}
Narok	13.4^{b}	18.88^{b}	16.6^{a}	18.57^{b}
Splendida ex.Tanzania	10.5^{a}	20.98^{a}	13.8^{c}	25.08^{a}

Means within a column with different superscripts are significantly different ($P \leq 0.05$).

Table 2. Edible dry matter (EDM) yield and crude protein (% of DM) of G. sepium intercropped with Setaria cultivars.

Treatment	EDM (t ha^{-1})	%CP
Gliricidia monoculture	21.8	27.5^{a}
Gliricidia/Kazungula	20.3	24.2^{b}
Gliricidia/Splendida ex. Kenya	20.3	24.0^{b}
Gliricidia/Narok	19.6	21.9^{b}
Gliricidia/Splendida ex. Tanzania	20.1	23.6^{b}

Means within a column with different superscripts are significantly different ($P \leq 0.05$).

Table 3. The effect of cropping system on the chemical composition and IVOMD of four cultivars of Setaria sphacelata.

Cultivar	Chemical composition and IVOMD[1]							
	Monocrop system				Intercrop system			
	CP	NDF	ADF	IVOMD	CP	NDF	ADF	IVOMD
Kazungula	12.1	60.2	42.0	62.7	12.6	62.1	35.6	60.6
Splendida ex. Kenya	13.3	61.4	37.3	58.8	14.6	65.7	41.5	53.9
Narok	11.2	56.6	36.7	61.5	11.1	67.1	38.4	52.5
Splendida ex. Tanzania	13.5	56.8	35.4	71.1	15.7	63.7	38.2	62.0
Mean	12.5	58.8	36.3	63.5	14.7	64.7	38.4	60.5

[1] IVOMD = *In vitro* dry matter digestibility

fodder crop to elephant grass which has along growth cycle. There were no significant ($P<0.05$) differences in the digestibility coefficients of DM, CP, NDF and ADF of the diets (Table 4). Dietary protein supplementation is known to improve intake by increasing N supply to the rumen microbes which enables them to increase the rate of breakdown of digesta (van Soest, 1994). The high digestibility coefficients obtained in this study confirm the optimal level of *Gliricidia* supplementation of 0.8 Bwt as recommended by Mpairwe (1994).

Table 4. Daily dry matter intake and apparent digestibility by growing sheep fed Setaria hay supplemented with giricidia.

	Setaria cultivars				
	Kazungula	Splendida ex. Kenya	Narok	Splendida ex. Tanzania	SEM
DM intake (g/day)					
Setaria	517.9	511.1	500.1	559.1	± 21.2
Gliricidia	144.5	148.2	146.1	144.5	± 1.8
Total	662.4	659.3	646.6	703.6	± 20.1
Total DMI g/kg $W^{0.75}$	67.6	66.0	65.3	72.2	± 2.3
Apparent digestibility coefficients (%)					
DM	68.4	68.4	67.1	64.4	± 1.7
CP	66.5	64.8	65.1	61.7	± 2.1
NDF	63.9	65.1	59.7	61.7	± 4.4
ADF	65.6	61.7	62.4	62.6	± 3.2

SEM = standard error of the mean

Table 5. Nitrogen utilisation and weight gain by sheep fed Setaria cultivars supplemented with Gliricidia.

	Setaria cultivars				
	Kazungula	Splendida ex. Kenya	Narok	Splendida ex. Tanzania	SEM
Nitrogen balance/day					
Ingested	15.19[ab]	15.96[ab]	12.88	17.55[a]	±0.79
Faecal	5.15	5.77	5.05	6.07	±0.47
Urine	4.58	3.78	3.94	4.68	±0.53
Total excreted	9.73	9.55	8.99	10.76	±0.67
Absorbed (apparent)	10.05	9.92	7.84	11.39	±0.54
Retained	5.47	6.14	3.89	6.71	±0.64
Percent intake					
Faecal	33.48	35.18	38.23	34.88	±2.14
Urine	30.23	23.86	30.29	27.28	±2.28
Absorbed	66.51	64.82	61.67	65.12	±2.14
Retained	36.19	40.96	31.29	37.85	±3.65
Percent of absorbed					
Retained	54.42	61.90	49.62	58.90	±9.01
Weight gain (g/day)	46.00	71.40	53.60	57.10	±10.90

Means in the same row with different superscripts are significantly different ($P<0.05$).
SEM = standard error of the mean

The results of nitrogen (N) intake, excretion and retention by sheep are presented in Table 5. Nitrogen intake by sheep fed on Narok cultivar was significantly ($P<0.05$) lower than those fed *Splendida* ex. Tanzania due to the differences in the DM intake of the two cultivars. Nitrogen voided in faeces and urine was similar ($P>0.05$) among the diets. The results of the study indicated no significant ($P>0.05$) difference in the efficiency of N absorption and retention between the cultivars. In contrast, Mpairwe (1994) reported improved N retention in sheep fed elephant grass supplemented with *Gliricidia*. There was no significant ($P>0.05$) difference in live weight gain of sheep fed the different diets. However, supplementation of a basal diet of elephant grass with *Gliricidia* improved live weight gains of sheep (Mpairwe, 1994). Similar results were reported for *Chloris gayana* supplemented with lablab seed meal (Maferwe and Mtenga, 1992).

Conclusion

The fact that DM yields of *Setaria* cultivars were not affected by intercropping with *Gliricidia* indicates that the two fodder crops are compatible. Hence *Setaria* may be an appropriate crop besides elephant grass in *Gliricidia*/grass intercrop systems. The results showed that supplementation of *Setaria* with *Gliricidia* leaves increased the efficiency of utilisation of the grass by sheep. Therefore *Gliricidia* leaves could be used as an economic protein supplement to improve nutritive value of grass based diets.

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