SUPPLEMENTARY VALUE OF TEPHROSIA BRACTEOLATA, TEPHROSIA CANDIDA, LEUCAENA LEUCOCEPHALA AND GLIRICIDIA SEPIUM HAY FOR WEST AFRICAN DWARF GOATS KEPT ON RANGE

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ABSTRACT

Supplementary values of unconventional browse Tephrosia bracteolata (TB) and Tephrosia candida (TC) and commonly utilized browse plants Gliricidia sepium (GS) and Leucaena leucocephala (LL)) were studied in goats grazed on a rangeland in the dry season. Crude protein (g/Kg DM) content of TC (19.25) compared favourably to those of GS (19.78) and that of LL (19.91) while that of TB was low (14.25). Total cell wall content, neutral detergent fibre (NDF, g/Kg DM) was lower in both TB (56.03) and TC (59.11) than in GS (61.20) and LL (37.50). Dry matter intake (g/d) of TB (87.39) was significantly higher than that of TC (76.49) while similar values were recorded in GS (63.81) and LL (63.31). Improved daily weight gain (g/d) of 14.88, 17.86, 14.88 and 17.86 were obtained when goats were fed TB, TC, GS and LL browse supplements responsively compared to the daily gain of 11.90 from the unsuplemented goats. The digestibility of CP, NDF and ADF in both TB and TC compared favourably to those of GS and LL. The findings from this study have shown that Tephrosia bracteolata and Tephrosia candida can be used as alternative browse supplement for goats grazing on natural grassland in the dry season to achieve improved weight gain. This will translate to a reduction in the pressure on the commonly use browse like Gliricidia sepium and Leucaena leucocephala.

KEYWORDS: Hay legumes, range, performance, digestibility

INTRODUCTION

The protein content of the forage for ruminants in the tropics is within the range of 11- 14% of the dry matter sufficient for modest livestock productivity ([19]). This could fall below the critical level of 7% required for ruminal function ([4]) especially in the dry season. Fodder trees, which produce forages of high nitrogen content therefore, provide a valuable source of supplementary protein for goats and could also, improve the overall utilization of other nutrients ([15]) at any season of the year. Prominent among widely used legume trees are Leucaena leucocephala and Gliricidia sepium. Leucaena leucocephala, apart from being high in tannin, is presently under the threat of psyllid insect (Heterosphyla cubana), which attacks its foliage and causes reduction in its productivity in many countries ([8]). Gliricidia sepium is also known to have fallen victim of some foliage diseases such as Cercosporidium gliridiasis, Cladosporium and Sphaceloma species ([17]), in addition to its possession of repulsive smell caused by the content, coumarin ([16]).

However, there is a host of other legume shrubs, which thrive well in the tropics, but little is known about their potential for feeding livestock. Important species found in the wild of the drier part of the west and middle belt zones of Nigeria are Tephrosia bracteolata and Tephrosia candida. Goats and sheep on range and also in pens have shown preference for T. bracteolata ([6]). The shrub is abundantly available in the rainy season being an annual plant that completes its life cycle within six months. Tephrosia candida is mostly found in research institutes where it is being used for improving soil fertility. The scanty report established its nutritive value for ruminants being enhanced in crude protein and minerals ([5]) but has short production cycle, being biennial.

Due to limitations imposed by long dry season period, some of the multipurpose fodder trees lose their foliage, while others quickly complete the production cycle when condition is favourable, thus the need to conserve them as hay. Harvesting and Conservation of foliages affords the opportunity of extending the period of feed supply to cover the critical period of the year. It also optimizes the use of residual moisture for tree coppice and early re-growth ([11]). This study was therefore designed to determine the performance of West African dwarf goats on range supplemented with dried Tephrosia bracteolata, Tephrosia candida, Leucaena Leucocephala and Gliricidia sepium.

MATERIALS AND METHODS

The experiment was carried out at the small ruminant unit of the Teaching and Research Farm, University of Ibadan, Nigeria, (latitude 7^0 20'N and longitude 3^0 50'E. The altitude is about 200 m above sea level).

Twenty-five West African dwarf goats aged 6 - 8 months and weighing 5.5 - 7.0 kg were used. The animals were obtained from a local market of about 5 km away from the farm. Prior to the arrival of the goats, the pens were cleaned and disinfected with 'Morigad Lysol' solution on two occasions at two weeks intervals. The floor was covered with wood shaving as bedding for the goats. The goats were housed in individual pen (4 m x 5 m) with drinking and feeding troughs They were adapted for two weeks and during this period, they were given vitaflash and oxytetracycline (injections), through intracellular route to prevent bacteria infection .They were also vaccinated against Peste de Petits Ruminante (PPR) disease and treated for diarrhoea using flagyl and sulphadimidine. Water and salt lick were provided ad-libitum.

Leucaena leucocephala, Gliricidia sepium, Tephrosia candida and Tephrosia bracteolata were harvested from the Teaching and Research farm. The three year old L. leucocephala, G. sepium trees and one year old T. candida were strategically cut back to obtain a three months regrowth. The leaves were wilted under shade and later sun dried on a concrete floor for 24 hrs to maintain the greenish characteristics. Foliage of T. bracteolata, being annual, was harvested at three months old and thinly spread under a ventilated shade for 3 - 7 days before sun dried to attain about 14% DM. The sun dried forages were packed in a jute bag and stored in a well-ventilated room until were used.

In a completely randomized design, the twenty five goats were grouped into five by weight and were assigned to the browse supplement treatments of L. leucocephala, G. sepium, T. candida, T. bracteolata and no supplement (i.e grazing alone). Animals on no supplement were released for grazing 2 hr ahead of those that received supplementation, and grazing lasted for 6 hrs daily. Browse supplement was offered at 2.0% of the goat body weight. Voluntary intake was determined by deducting the refusals from the amount supplied. Body weight was taken weekly in the morning before morning feeding was served and the study lasted for 105 days. Forage grazed by the goats were monitored and was sampled following the procedure described ([24]). The common grasses in the rangeland were Cynodon dactylon and Panicum maximum. Other less common plants in the area were Azadirachta indica, combretum hispidum, Aspilia africana, Tridax procumben, Cyprus haspan, Gomphrena celosioides, Kylinga erecta, Synedrella nodiflora, Centrosema pubescens and Euphorbia hyssopifolia.

Animals were placed in individual metabolic cages for

a separate collection of urine and faeces and lasted for 14 days. The goats were adapted to the metabolic cages and were fed the test forage supplements for first 7 days in order to get rid of the forages previously grazed. The last 7 days were used for the collection of data. The total faeces voided were collected, weighed and 10% aliquots taken and oven-dried at 65°C for 48 hrs to determine the percentage dry matter. Urine was collected in bottles containing 2 – 3 drops of 10 % (v/v) sulphuric acid to prevent N-loss, and then stored in freezer cabinet at -5°C until required for chemical analysis.

Browse feeds offered, forage plants sampled and faeces were analyzed for their contents of dry matter, crude Protein and ash as described ([3]) while neutral detergent fibre and acid detergent lignin were determined according to Van Soest et al ([23]).

Data collected were subjected to analysis of variance ([21]). Where significant differences were found, the means were separated using Duncan multiple range F-test.

RESULTS

Tables 1 and 2 present the chemical compositions and fibre fractions of browse offered and those forages grazed on the field. Crude protein of the browse ranged from 14.25 -19.91 %. Acid detergent fiber varied from 24.0 % to 49.5 % being lowest and highest in Gliricidia sepium and Tephrosia candida respectively. Lowest ash was obtained in Tephrosia bracteolata and high values in Leucaena leucocephala, Gliricidia sepium and Tephrosia candida. Among the forage grazed, crude protein was least in Panicum maximum (7.35%) and highest (20.35%) in Synedrella nodiflora. The content of neutral detergent fibre for the grazed forages was lowest in Synedrella nodiflora (47.0%) and highest in Panicum maximum.(94 %).

Presented in Table 3 are the performance characteristics of goats that received browse supplementation in addition to grazing and those that were grazed only. Dry matter intake (22.43 – 28.51 g/d) of the browse supplements varied significantly ($P < 0.05$) and was higher in Tephrosia bracteolata and followed by Tephrosia candida and lowest in Gliricidia sepium and Leucaena leucocephala. The weight gain of goats supplemented with browse increased between 25 to 50% over those on grazing alone but the difference was not significant ($P > 0.05$). Crude protein intake ranged between 12.45 % in Tephrosia bracteolata and 14.72% in Tephrosia candida and did not show any significant differences. Higher intake of ADF and NDF was observed in Tephrosia forages than the conventional browse plants of Gliricidia sepium and Leucaena leucocephala.

The apparent nutrient digestibility and nitrogen utilization of the experimental goats are presented in Table 4. Crude protein digestibility values ranged from 49.26 – 62.12 % and were significantly different. The digestibility of ADF and NDF for animals that consumed Tephrosia bracteolata and Tephrosia candida were significantly enhanced ($P < 0.05$) as compared to those goats on Gliricidia sepium and Leucaena leucocephala. The nitrogen intake of goats (Table 4) did not significantly vary but apparent ($P < 0.05$) variations were observed in their faecal and urinary nitrogen excretion as well as the amount of nitrogen absorbed and retained. Nitrogen retained by the goats on Tephrosia bracteolata, Tephrosia candida and Gliricidia sepium supplements were better than those on Leucaena leucocephala.

DISCUSSION

Crude protein content of the supplements and forage grazed by the animals was well above 7 %, which is the critical level required for ruminal function ([4]). The CP value for Leucaena leucocephala and Gliricidia sepium is within the range reported ([22]; [1]) and in agreement with the value obtained by Garcia ([12]) during the dry season. The value of CP for Tephrosia bracteolata and Tephrosia candida in the present study is lower than 19.25 and 14.25 % respectively earlier reported ([5]).

Table I: Proximate composition and fibre components (g/100 g DM) of browse legumes fed as supplement to grazing WAD goats

Forage species	DM	OM	CP	Ash	ADF	NDF
Tephrosia bracteolata	29.72	97.00	14.25	3.00	36.50	56.03
Tephrosia candida	25.77	88.00	19.25	12.00	49.50	59.11
Gliricidia sepium	23.41	90.00	19.78	10.00	24.00	61.20
Leucaena leucocephala	25.88	89.00	19.91	11.00	37.50	66.12

Table 2: Proximate composition and fibre analysis (g/100 g DM) of the forages grazed by WAD goats

Forage species	DM	OM	CP	Ash	ADF	NDF
Panicum Maximum	30.71	92.88	7.35	7.12	47.50	94.00
Cynodon dactylon	27.60	91.10	9.2	8.90	65.33	89.00
Azadirachta indica	34.43	94.94	17.40	5.06	38.50	71.00
Combretum hispidum	43.37	93.12	15.40	7.88	56.00	75.00
Leucaena leucocephala	25.88	89.00	19.91	11.00	37.50	75.00
Gomphrena celosioides	21.93	98.70	11.38	1.30	32.00	53,60
Aspilia africana	21.47	96.00	15.34	4.00	48.00	51.10
Synedrella nodiflora	17.73	95.00	20.35	5.00	38.67	47.00

Table 3 Performance characteristics of WAD goats under grazing with and without forage supplementation

Parameters	Browse treatments					
	TB	TC	GS	LL	Control	SEm
Initial live weight (Kg)	6.25	7.00	6.50	6.75	7.00	
Final live weight (Kg)	7.5^{b}	8.5^{a}	7.75^{b}	8.25^{a}	8^{a}	0.15
Mean live weight (Kg)	6.875	7.75	7.125	7.5	7.5	
Weight gain (Kg)	1.25	1.50	1.25	1.50	1.00	0.15
Daily weight gain (g)	14.88	17.86	14.88	17.86	11.90	1.88
Feed conversion ratio	5.88^{a}	4.29^{b}	4.42^{b}	3.54^{b}	ND	0.31
*Daily DM intake (g)	87.39^{a}	76.49^{ab}	63.81^{b}	63.31^{b}	ND	5.03
*Daily DM intake (g/kgBW$^{0.75}$)	20.56^{a}	16.45^{ab}	14.64^{b}	13.98^{b}	ND	1.24
*CP intake	12.45	14.72	12.70	12.52	ND	0.74
*ADF intake	31.90^{ab}	37.86^{a}	24.89^{c}	30.07^{bc}	ND	1.87
*NDF intake	64.67^{a}	62.72^{a}	53.60^{ab}	47.48^{b}	ND	3.72

a, b, c= Means on the same column with different superscripts are significantly different ($P < 0.05$).
TB = Tephrosia bracteolata, TC= Tephrosia candida, GS = Gliricidia sepium LL = Leucaena leucocephala
*Intake value were from browse supplements only
ND – Value not determined

Table 4 Digestibility of nutrients and nitrogen balance of browse plants used as supplemented for grazing WAD goats

Treatments	TB	TC	GS	LL	SEm
N-intake	1.99	2.36	2.03	2.00	0.12
N-faeces	0.32^{c}	0.42^{b}	0.19^{d}	0.70^{a}	0.02
N-urine	0.14^{d}	0.24^{c}	0.35^{b}	0.39^{a}	0.01
N-absorbed	1.67^{ab}	1.94^{a}	1.84^{a}	1.30^{b}	0.11
N-retained	1.53^{a}	1.70^{a}	1.49^{a}	0.91^{b}	0.12
		Digestibility values (%)			
DM	71.6^{a}	69.7^{b}	770.5^{b}	68.1^{c}	0.176
CP	56.74^{ab}	49.46^{b}	62.12^{a}	56.20^{ab}	2.59
ADF	43.56^{a}	45.93^{a}	34.78^{ab}	29.22^{b}	3.57
NDF	52.86^{a}	58.18^{a}	56.30^{a}	40.52^{b}	2.90

a, b= Means on the same column with different superscripts are significantly ($P < 0.05$) different.

The ADF values for Leucaena leucocephala, Gliricidia sepium and the Tephrosia species in the present study were similar with the values reported previously ([13]; [6]). The value of CP, NDF and ADF for the grasses and other forages grazed were within the range reported by ([2]) in the dry season. Low crude protein and high fibre are normal, which correspond with increasing age of tropical pastures.

The relatively low performance of goats not given browse supplement could be attributed to the low nitrogen intake from the range. Goats supplemented with browse legumes had higher body weight gains, suggesting that the various browse legumes had beneficial effects on the animals. Legume supplementation has been observed to improve animal performance ([19]. Dzowela et al. ([11]) reported that animals on native pasture alone other than those on graded levels of legumes lost weight throughout the experiment. However, it is noteworthy that the goats on grazing alone in the present study did not lose weight. This is probably due to the animals had access to some other browse the in the field which they could have shown preference for due to their natural instinct to browse rather than grazing. This therefore, implies that the survivability of goats on a rangeland depends on the availability and quality of browse to which the animal have access.

Nitrogen intake by the animals was the same among treatments. MacDonald et al. ([18]) reported that the dietary nitrogen intake by animals was directly related to the proportion of nitrogen in the feed. All animals had positive nitrogen retention but highest for animals supplemented with Tephrosia candida. This may be associated to its low rumen degradable protein characteristics ([14]; [7]).

.CONCLUSION

Some new and underutilized browse like Tephrosia candida and Tephrosia bracteolata can be used as supplementary feed for goats grazed on rangeland in the dry season to sustain their weight gain. This will reduce the pressure on the commonly utilized browse like Gliricidia sepium and Leucaena leucocephala. There is also the possibility of grazing goats to gain weight in the dry season if they have access to good quality browse on the field when they are grazing.

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