

BODY WEIGHT RESPONSE OF WEST AFRICAN DWARF GOATS FED *GLIRICIDIA SEPIUM*, *PANICUM MAXIMUM* AND CASSAVA (*MANIHOT*) PEELS

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ABSTRACT

Six diets, 100% *Gliricidia sepium* (T1), 100% *Panicum maximum* (T2), 100% cassava peels (T3), 35% *G. sepium* plus 35% *P. maximum* plus 30% cassava peels (T4), 70% *G. sepium* plus 30% cassava peels (T5) and 70% *P. maximum* plus 30% cassava peels (T6) were fed to 24 intact male West African Dwarf goats in a completely randomised experiment. Four bucks were randomly assigned to each dietary treatment for 90 days. Treatment T3 was discontinued after 28 days and results for this treatment are not presented.

Goats on T4 consumed the most dry matter (DM) and organic matter (OM) ($P < 0.05$); those on T2 consumed most acid detergent fibre (ADF) and neutral detergent fibre (NDF); and those on T1 consumed the highest amount of nitrogen (N). Least N consumption was by goats on T2 and T6. Goats on T1 digested DM and OM least ($P < 0.05$); those on T2 digested ADF most ($P < 0.05$); N and NDF were best digested ($P < 0.05$) by goats on T5. Goats on diet T4 achieved the highest liveweight gains ($P < 0.05$).

Supplementing equal proportions of *G. sepium* and *P. maximum* with 30% cassava peels appeared most beneficial to goats.

RESUME

Performances pondérales de chèvres naines d'Afrique occidentale soumises à des rations composées de *Gliricidia sepium*, de *Panicum maximum* et de pelures de manioc (*Manihot*)

Les rations constituées de 100% de *Gliricidia sepium* (T1); 100% de *Panicum maximum* (T2); 100% de pelures de manioc (T3); 35% de *G. sepium* plus 35% de *P. maximum* plus 30% de pelures de manioc (T4); 70% de *G. sepium* plus 30% de pelures de manioc (T5); et 70% de *P. maximum* plus 30% de pelures de

manioc (*T₆*) ont été servies chacune pendant 90 jours à quatre boucs entiers de la race naine d'Afrique occidentale. Cette expérience a été conçue sur le modèle des blocs aléatoires complets et les animaux ont été assignés au hasard à l'un ou l'autre de ces traitements. Les résultats enregistrés pour le traitement *T₃* n'ont pas été présentés car celui-ci avait été interrompu au bout de 28 jours d'essai.

La consommation de matière sèche (MS) et de matière organique était maximum pour la ration *T₄*. Celle de lignocellulose et de fibres NDF était la plus élevée pour la ration *T₂*, tandis que celle d'azote était maximum pour la ration *T₁*. Quant au niveau minimum de consommation d'azote, il avait été enregistré pour les rations *T₂* et *T₆*. Le taux de digestibilité de la matière sèche et celui de la matière organique étaient minimums ($P < 0,05$) pour la ration *T₁*; celui de la lignocellulose était maximum ($P < 0,05$) pour la ration *T₂* tandis que ceux de l'azote et de la fibre NDF étaient maximum pour la ration *T₅* ($P < 0,05$). Enfin, les gains de poids les plus élevés étaient associés à la ration *T₄* ($P < 0,05$).

La combinaison alliant *G. sepium* et *P. maximum* en proportions égales avec en poids 30% de pelures de manioc semble être la plus indiquée pour les caprins.

INTRODUCTION

West African Dwarf goats are among the few important trypanotolerant livestock species of humid Nigeria. Matthewman (1979) reported an average of four goats per household in humid Nigeria but larger numbers are kept in the savannah parts of the country. Nigeria has an estimated 26 million goats.

Inadequate nutrition has been recognised as the major constraint to livestock, especially goat, production in Nigeria (Olubajo and Oyenuga, 1974).

The use of *Gliricidia sepium* as livestock feed has received attention in Nigeria only recently (Mba et al, 1982; Onwuka, 1983; Ademosun et al, 1985). The chemical composition of *G. sepium* has been variously reported as 7.4–34.5% dry matter (DM) ("as-fed basis"), 81.9–92.3% organic matter (OM), 3.1–4.2% nitrogen (N), 30.8% neutral detergent fibre (NDF), 18.5–44.4% acid detergent fibre (ADF) and 12.7–32.5% crude fibre (CF) (Chadhokar, 1982; Ifut, 1987).

Panicum maximum is highly palatable to ruminant animals and has 23.5–29.9% DM at harvest (Olubajo, 1977; Aken'ova and Mohamed-Saleem 1982; Ifut, 1987). Nitrogen content in *Panicum maximum* ranges from 0.8 to 2.0% DM and CF from 29.5 to 42.2% DM (Akinyemi and Onayinka 1982; Ifut, 1987).

In parts of Nigeria where *Manihot* (cassava) is grown, the average annual yield of tubers is 21.1 t/ha. Since peels constitute about 20% of the tuber, large quantities of cassava peels could be available to feed ruminants, especially goats. Currently, however, cassava peels are largely under-exploited as livestock feed.

Cassava peels have been found to contain 86.5–94.5% DM, 89.0–93.9% OM, 10.0–31.8% CF and 0.7–1.0% N (Oyenuga, 1968; Adegbola, 1980; Carew,

1982; Onwuka, 1983; Ifut, 1987). Sun-dried cassava peels have been reported to contain 14.2–116.9 mg HCN/kg, depending on variety. Sun-drying has been reported to reduce HCN content by 89.4–94.0% rendering the peels innocuous (Maner and Gomez, 1973; Tewe et al, 1976).

Average *G. sepium* DM intake of goats has been reported as 66.7 g/kg^{0.75} per day (Ademosun et al, 1988) and 21.3 g/kg^{0.75} per day (Carew, 1983; Onwuka, 1983; Ademosun et al 1985). Mba et al (1982) also noted DM intake values of *G. sepium* by kids ranging from 54.8 to 71.3 g/kg^{0.75} per day.

Growing West African Dwarf goats fed *Panicum* achieved daily DM intakes ranging from 54.9 g/kg^{0.75} for young, well fertilised grass to 43.1 g/kg^{0.75} for standing hay (Ademosun et al, 1988).

Reported liveweight gains by growing West African Dwarf goats on a sole *Gliricidia* diet were 17.5–20.0 g/day (Onwuka, 1983) 27.0 g/day (Mba et al, 1982) and 23.3 g/day (Ademosun et al, 1988).

This paper reports work on intake and body weight response by goats fed *Gliricidia* and cassava peels, *Panicum* and cassava peels and *Gliricidia* plus *Panicum* plus cassava peels.

MATERIALS AND METHODS

Twenty-four growing, parasite-free, intact West African Dwarf bucks aged six to nine months and weighing an average of 6 kg (range 5–10 kg), obtained from the University of Ibadan Teaching and Research Farm, were used for this experiment. The bucks were housed for 90 days in previously sanitised individual metabolism cages and offered liberal, but known, quantities of the experimental diets daily for a 21-day preliminary period to adapt the animals to the diets and cage environment. Fresh water and salt lick were available *ad libitum* in the cages.

Fresh *G. sepium* branches (about 1.2 m long and 1.5 cm thick) with leaves and branchlets and fresh *P. maximum*, chopped to about 2 cm length, were obtained daily from ILCA, Ibadan, during the wet season (April–July). Cassava peels from low-HCN TMS 30572 and TMS 1425 varieties were obtained fresh from local cassava grating plants in and around the University of Ibadan campus. The peels were sun-dried for three to four days.

Diets fed to the goats were:

- 100% *G. sepium* (T1)
- 100% *P. maximum* (T2)
- 100% dried cassava peels (T3)
- 35% (w/w) each of *G. sepium* and *P. maximum* plus 30% cassava peels (T4)
- 70% *G. sepium* plus 30% cassava peels (T5)
- 70% *P. maximum* plus 30% cassava peels (T6).

Treatment T3 was discontinued after 28 days because the animals were losing weight and were in danger of dying.

The amount of each diet offered to each experimental animal ensured at least a 5% left-over. Residues were collected after a 24-hour feeding, weighed and the voluntary intake determined.

Samples of the diets offered and rejected were taken daily during the 90-day period. Subsamples of each were taken for DM and chemical determination according to standard methods (AOAC, 1975; Van Soest and Robertson, 1980).

Total faeces and total urine were collected in the mornings before feeding and watering during days 22–28 and 84–90 of the experiment. The faeces were weighed fresh and 10% aliquots of each day's collection for each animal were taken, dried at 60°C for 48 hours in a forced draught air oven and bulked. A subsample of faeces from each animal was dried in a similar oven at 100–105°C for 48 hours for DM determination. The two seven-day faecal samples for each experimental animal were thoroughly mixed and milled to pass through a 0.6-mm sieve and put in sealed polythene bags until analysed.

The urine was collected in a plastic bucket placed under each cage; 75 ml of 25% sulphuric acid was added to the bucket daily to curtail volatilisation of ammonia from the urine. The total output of urine per animal was measured and 10% aliquots were saved in stoppered, numbered plastic bottles and stored at –5°C. At the end of each seven-day collection period the sample collections were bulked for each animal and subsamples were taken for analysis.

The animals were weighed once a week in the morning before feeding and watering. Liveweight change was estimated as the difference between the initial and final body weights of the animals during the experiment.

The data obtained were subjected to analysis of variance and correlation analyses. Differences between treatment means were determined by Duncan's multiple range test using the Genstat V computer program, release 4.04B (1984, Lawes Agricultural Trust, Rothamsted Experimental Station, UK).

RESULTS AND DISCUSSION

No results are presented for treatment T3. This treatment was discontinued after only 28 days, because the animals were losing weight dramatically. HCN toxicity could not have been implicated in this liveweight loss because sun-dried, low-HCN varieties of cassava were used, but it is clear that a diet of sole cassava peels is not a suitable feed for goats.

The chemical compositions of the other five experimental diets are shown in Table 1. Chemical components of *G. sepium*, *P. maximum* and cassava peels compare favourably with values reported in literature (Oyenuga, 1968; Olubajo, 1977; Adegbola, 1980; Aken'ova and Mohamed-Saleem, 1982; Carew, 1983; Chadhokar and Sivasupiramaniam, 1983; Onwuka, 1983; Ifut, 1987).

Dry-matter and nutrient intakes and digestibilities by West African Dwarf goats are summarised in Table 2.

The highest DM and OM intakes were from diet T4 probably because this combination was more palatable than the other diets.

Table 1. Chemical composition of the diets fed to West African Dwarf goats (means of six determinations)

Diet	DM (%)		% of DM			
	As fed	Residual	OM	ADF	NDF	N
T1	31.0	87.3	91.3	28.3	41.5	3.8
T2	24.7	88.9	87.7	40.2	65.5	1.7
T4	45.4	87.9	89.4	31.1	47.7	2.2
T5	47.7	87.3	90.7	27.0	39.3	2.9
T6	43.2	88.4	88.1	35.3	56.1	1.5

Diet T1 = 100% *Gliricidia sepium*

Diet T2 = 100% *Panicum maximum*

Diet T4 = 35% *G. sepium* + 35% *P. maximum* + 30% cassava peels

Diet T5 = 70% *G. sepium* + 30% cassava peels

Diet T6 = 70% *P. maximum* + 30% cassava peels

Table 2. Dry-matter and nutrient intakes, digestibility coefficients and body weight changes of West African Dwarf goats

Parameter	Diet T1	Diet T2	Diet T4	Diet T5	Diet T6	SE
Intake (g/kg ^{0.75} per day)						
Dry matter (DM)	46.3	63.5	86.4	76.0	73.8	8.7
Organic matter (OM)	43.0	55.1	77.3	67.5	64.6	7.8
Acid detergent fibre (ADF)	18.7	27.5	20.8	20.5	26.9	3.9
Neutral detergent fibre (NDF)	27.7	44.4	36.2	36.9	41.1	5.6
Nitrogen (N)	1.8	1.1	1.5	1.5	1.1	0.3
Digestibility coefficients (%)						
DM	54.2	58.8	71.9	74.3	65.2	4.1
OM	56.8	61.1	73.1	76.6	67.5	4.0
ADF	42.9	60.1	36.1	46.2	58.4	3.6
NDF	48.2	54.5	57.4	67.7	62.6	4.7
N	56.5	27.1	41.0	57.3	56.7	7.2
Body weight change (g/day)	51.0	25.7	66.3	54.2	41.5	0.3

Diet T1 = 100% *Gliricidia sepium*

Diet T2 = 100% *Panicum maximum*

Diet T4 = 35% *G. sepium* + 35% *P. maximum* + 30% cassava peels

Diet T5 = 70% *G. sepium* + 30% cassava peels

Diet T6 = 70% *P. maximum* + 30% cassava peels

The highest intake of NDF and ADF was by goats on T2. ADF intake from T6 was significantly ($P < 0.05$) the highest among the composite diets. However, there were no differences ($P > 0.05$) in NDF intake among the composite diets.

Dry matter of T5 was digested best by goats, probably due to a better balance of nutrients resulting from the simultaneous feeding of N-rich *Gliricidia* (70%) and soluble carbohydrate-rich (30%) peels. DM digestibility of T6 was superior ($P < 0.05$) to that of T2.

The N of T5 was digested most, which suggests that a favourable energy:N balance resulted from the diet. However, the N digestibility of T5 was not different ($P > 0.05$) from that T1 or T6.

Supplementing either *Gliricidia* or *Panicum* with 30% cassava peels did not seem to improve ($P > 0.05$) ADF digestibility. However, the composite diets contained NDF which was distinctly superior ($P < 0.05$) in digestibility to that contained in T1. The highest NDFD of T5 might have been due to a better balance of nutrients, particularly N from *Gliricidia* and soluble carbohydrates from the peels.

The highest average daily body weight gain was by goats on T4, probably because this diet provided the best balance of nutrients for growth. Goats gained more weight when *Gliricidia* or *Panicum* was supplemented with 30% cassava peels than when each was fed alone.

CONCLUSION

Cassava peel, as a supplement to a leguminous and/or grass feed, is potentially beneficial to goats as a source of readily available carbohydrates. The most beneficial diet appeared to be equal proportions of *G. sepium* and *P. maximum* supplemented with 30% (w/w) cassava peels.

ACKNOWLEDGEMENT

I am grateful to the University of Ibadan, ILCA Humid Zone Programme, Ibadan, and the International Institute of Tropical Agriculture (IITA), Ibadan, Nigeria, for making available the materials and facilities for this research.

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