Nigerian Journal of Ecology (2003) 5: 28-33

ISSN: 1116-753X

Intensive Feeding Effect of *Tephrosia bracteolata* Perr & Guill on West African Dwarf Goats

O.J. Babayemi[1]*, M.A. Bamikole[2], B.O.Oduguwa[3]
[1]Department of Animal Science, University of Ibadan, Nigeria
[2]Department of Animal Science, University of Benin, Nigeria
[3]Research and Development Centre, University of Agriculture, Abeokuta, Nigeria
* Corresponding author

(Accepted 30 July 2003)

ABSTRACT
Intake, digestibility, utilization and growth rate of twenty 4-5 months old West African dwarf goats intensively fed *Tephrosia bracteolata* (TB) and Guinea grass (GG) (*Panicum maximum*) supplemented with minor concentrate for periods of 84 days were evaluated. In a completely randomized design, goats were randomly allocated to diets: D1 (20 % TB+60 % GG), D11 (40 % TB + 40 % GG), D111 (60 % TB + 2 0% GG) and D1V (80 % TB +0 % GG) with 20 % concentrate supplement across board. Daily dry matter intake values of 48.15, 48.36, 55.26 and 58.43 g/kg $LW^{0.75}$ were obtained for animals on diets 1, 11, 111 and 1V respectively. Similar trends were observed for crude protein and neutral detergent fibre. Dry matter, CP and NDF intakes significantly increased with increasing level of TB. The highest weight gain (54.29 g d^{-1}) was by the animals on 80 % TB while others varied from 40.59-50.24 g d^{-1}. Digestibility of DM, CP and NDF were lowest in diets 1 and 1V. Total N excreted and urinated exhibited similar trend as that of CP intake. The N retention (g/d) differed significantly by animals among treatments. The highest (2.35) and lowest (0.71) N- retentions were obtained by the animals fed 80 % TB and 20 % TB respectively. Results showed that performance of growing WAD goats can be improved by feeding *T. bracteolata* in mixture with *Panicum maximum* and up to 80 % sole feeding without any deleterious effects.

Key words: Guinea grass, legume forage, nutrient utilization, supplement, weight gain.

INTRODUCTION

Tephrosia bracteolata Perr and Guill, a legume shrub is one of the over 300 promising species that are world widely distributed. These forage legumes are found growing in the tropics, sub-tropical Australia and also in the North America (Dutta.1979). *T. bracteolata* (TB) is a peculiar legume that grows in the lower part of the North, West and East of Nigeria (Awodoyin et al., 2000). The legume has a local name that is dependent of the locality. According to reports (Awodoyin et al., 2000) the traditional name for the legume is interchangeably called 'Roro' or 'Iroro' in the Western part of Nigeria. Being an indigenous legume shrub, TB is well adapted to the environmental conditions. It is an erect plant with the height range of 1.5 m - 3.5 m and thrives well in the natural environment ((Daniel, 1971; Awodoyin et al., 2000). It is annual forage, as it appears blossom during the rainy season and dries up after podding at onset of dry season. Ordinary soaking in boiled water for 30 seconds was recommended as pre-germination treatment of seeds to break dormancy and optimize potential seedling establishment (Babayemi et al., 2003b). In the derived Savanna and Guinea Savanna of Nigeria, the legume dispersed its seeds in the dry season. The unavoidable annual bush burning probably breaks the seed dormancy, as early showers in the rainy season result in profuse germination of the seeds.

There is paucity of literature information about the feeding potential of the shrub for the sustainability of small ruminant production. In the preliminary study, De-Leeuw (1979), reported that livestock in the Northern Nigeria relishes *T. bracteolata*. Attempt had also been made to determine the intake and digestibility of the legume by goats in some comparative studies (Okagbare and Bratte, 1999). In a separate study, Babayemi et al., (2003a) established that *T. bracteolata* possessed an attribute

of accelerated growth when cultivated, excellent nutritive value and improved dry matter rumen degradability. One of the ways to assess acceptability and nutritive value of forage is to feed it intensively to livestock. Thus, the present study was set to determine the performance of West African dwarf goats fed *T. bracteolata*/Guinea grass mixture based diets.

MATERIALS AND METHODS

Experimental site

The experiment was conducted at the small ruminants unit, Teaching and Research Farm, University of Ibadan, Ibadan ($7^{0}20^{1}$N, $3^{0}50^{1}$E, and altitude 200m above sea level). The annual rainfall, temperature and relative humidity range at the period of study (July-November, 2002) were 1200-1350mm, 26-35^{0}C and 71-82% respectively.

Animal and design

Twenty female West African dwarf (WAD) goats, 4-5 months old and average body weight of 5.85 ± 0.38 kg were used for the study. The purchased animals from the University of Ibadan and its environs were subjected to prophylactic treatments by the veterinarian. In a completely randomized design (CRD), the animals were allotted into four groups of five animals each, allocated to the four experimental forage diets: I (20 % TB + 60 % GG), II (40 % TB + 40 % GG), III (60 % TB + 20 % GG) and IV (80 % TB + 0 % GG). The animals were put individually in a separate pen that was previously sanitized and that provides maximum comfort. Bedding for the goats was made of wood shavings that were replaced every two weeks in order to get rid of accumulated urine and faeces. Animals were also routinely dipped in diazintol whenever ticks and fleas were observed on the body of the animals.

Feeds and feeding

Tephrosia bracteolata harvested at 2-5 months old and 6-week old regrowth of Guinea grass (*Panicum maximum* var. Ntchisi) were supplied to the animals. The leaves plus petioles of *T. bracteolata* (TB) and Guinea grass (GG) were chopped to 10 cm-15 cm length and were allowed to wilt for six hours before given to the animals. The forage was fed at 80 % as basal diet while 20 % concentrate was served as supplement. The concentrate composed of 40 % dussa, 40 % corn offal, 13 % palm kernel cake, 1 % common salt, 3 % bone meal and 3 % oyster shell. The animals were offered diets at 5 % of their respective body weights. Forage was supplied in a separate feeder at 0800 Hr and the concentrate at 1600 Hr, paving way for 25 % addition to DM consumed in the previous day. Feed supplied and orts collected were measured daily for DM determination. The feeding trial lasted for 84 days. Samples of the forages and concentrate offered and those rejected were measured to calculate for the DM intake. Animals were weighed weekly before feeds and water were offered in the morning. The samples from the offered feed and that refused were taken for proximate analysis.

Digestibility and nitrogen balance

The last 14 days of feeding trial were used for digestibility study. Animals were placed in modified metabolism cages (Akinsoyinu, 1974) for separate collection of urine and faeces. The animals were then adjusted to the cages and also emptied the gut of the previous feeds for 7 days while the remaining 7 days were employed for collection of urine and faeces. About 10 % and 30 % of the total amount of fresh faeces and urine collected respectively were taken daily and frozen in a freezer cabinet at –20 ^{0}C pending the analysis. Possible bacterial invasion of the urine was curtailed by adding 10 ml of 50 % hydrochloric acid to the collecting plastic container.

Chemical analysis and statistical method

The oven dried (65 ^{0}C for 48 Hr) feed supplied, refusal and faecal samples for DM determination were analyzed for crude protein, crude fibre, ether extract and ash using the procedure (AOAC, 1990). The neutral detergent fibre and acid detergent fibre were obtained according to Van-Soest (1994). Mineral elements were determined by atomic absorption spectrophotometer model 490 Gallenkamp, London. Nitrogen in the urine was also analyzed for by the method AOAC (1990). Data obtained were subjected to analysis of variance (ANOVA) employing procedure of statistical analysis system (SAS, 1995). Statistical differences among means were declared at 5 % level. Means were separated using Duncan (1955) multiple range-tests.

RESULTS

Crude protein and energy values for the diets were between 13.09 and 22.04 %, and 3.55 and 3.63 kcal respectively (Table 1). Crude protein in TB was higher with a corresponding lower NDF than what was contained in GG. Calcium and magnesium contents in the legume were also prominent than the amount in GG. However, phosphorus seemed to be higher in GG than in the legume (Table 1).

Table 1. Proximate composition (%) of forage and concentrate fed West African dwarf goats

Nutrient	*Tephrosia bracteolata*	Guinea grass	Concentrate
DM	67.01	65.21	96.53
CP	23.36	8.44	16.82
EE	2.1	2.92	5.35
CF	23.15	33.61	25.22
NDF	66.14	74.30	21.46
ADF	31.06	29.10	16.11
Ash	5.31	12.42	8.93
NFE	47.0	48.11	43.91
Gross Energy (Kcal/g)	3.61	3.45	3.79

Dry matter intake (DMI), nutrient intake and live weight gain of the animals are in Table 2. DMI by the goats significantly ($P<0.05$) increased with increasing TB content. There was higher preference for DMI at 80 % TB as the animals placed on it consumed twice intake compared to those on grass-legume diets. Meanwhile, in the 1:1 ratio of TB and GG diet, the animals voluntarily accepted 59.91 and 41.09 % of TB and GG respectively. Goats placed on high GG diets had no left over for concentrate. Aggregate CP and NDF intake by the animals were apparently differed in diets following the order I < II < III < IV. There were significant differences in the weight gain among animals placed on the treatments. The weight gain increased significantly ($P<0.05$) with increasing and decreasing levels of TB and GG respectively. However, the animals that were fed with 60 % TB and 20 % GG had better feed efficiency ratio significantly ($P<0.05$) higher than other treatments.

All the diets contained increasing amount of DM, CP, and NDF (Table 2) as the level of TB increased. This then followed that as the level of GG increases, the amount of NDF fell. Intake, digestibility of nutrients and the nitrogen utilization by goats are in Table 3. The DM, CP and NDF intakes differed significantly ($P<0.05$). This also followed the trend that as TB increases in the diet, nutrient intakes increased. Digestibility of DM, CP and NDF varied apparently ($P<0.05$) among the treatments. Animals fed forage diets III and IV had similar digestibility for CP and DM but significantly higher than those on treatments II and I. Digestibility coefficient of NDF increased arithmetically ($P<0.05$) by the animals consumed increasing levels of TB than those placed on GG.

Statistical analysis showed that N intake by the goats among treatments significantly ($P<0.05$) differed in diets following the order IV > III > II > I. Nitrogen excreted by the animals also varied significantly ($P<0.05$). The percentage N excreted by the animals on treatments I, II, II and IV were 54.27, 47.86, 46.11 and 46.90 % respectively. Nitrogen excreted through urine correspondingly increased with an increasing consumption of the legume. When expressed as percentage, N urinated by the animals on diets I, II, III and IV were 29.05, 31.28, 33.04 and 31.02 % respectively. Nitrogen balance and retention were observed to vary significantly ($P<0.05$). However, animals placed on the four treatments had positive N balance.

DISCUSSION

Both CP and GE values were above the range recommended (NRC, 1981; Onwuka and Akinsoyinu 1989; Mtenga and Shoo 1990). The excess supply of the requirements probably emanated from the little 20 % concentrate supplement of the whole ration. Such minute concentrate supplement could be essential as booster of CP for the diet containing low legume (60 % GG) and as energy make up for the diet with more legume (60 or 80 % TB). Encouraging results were obtained with goats in the southern zones of Nigeria when fed *Leucaena leucocephala* and *Gliricidia sepium* leaves as supplements to grass diets (Sumberg, 1985; Reynolds andAdeniran, 1988; Odeyinka, 2001). There are scanty documented reports on the utilization of Tephrosia as a supplement for grass by the West African dwarf goats. The available reports in recent times on this legume were more of the preliminary studies on composition, intake and digestibility (Adeloye, 1994; Ayoade et al, 1998; Okagbare and Bratte1999). Improved DMI with increasing proportion of *Tephrosia bracteolata* by the animals as sole forage or as grass-legume mixtures was probably an evidence of high palatability or acceptability of the legume as reported (Adeloye, 1994). This apparent acceptance of the legume might be connected with the exceedingly high CP content in it. It was reported elsewhere (Kruager et al, 1974) that small ruminants preferred sweet or sour plant and generally reject bitter plant. High CP in the diets has been considered an important factor that enables high intake of the feed. Oldham and Alderman (1980), established that sometimes *ad-libitum* intake by the animals is increased by an increase in CP content of the diet. The enhanced intake at the various level of inclusion by the animals points to the fact that *T. bracteolata*

Table 2. Performance characteristics of West African Dwarf goats fed *Tephrosia bracteolata* and Guinea grass. Values shown are means (n=3).

DIETS					
	I	II	III	IV	SEM
Initial live weight (kg)	5.85	5.90	5.55	5.85	
Final live weight (kg)	9.26	9.53	9.77	10.41	
Weight gain (kg)	3.41c	3.63c	4.22b	4.56a	0.19
Daily weight gain (g)	40.59d	43.21c	50.24b	54.29a	1.36
Dry matter intake (g/d)					
Telphrosia bracteolata	75.71d	114.85c	157.38b	284.61a	11.40
Guinea grass	119.27a	80.11b	69.12c	-	5.13
Concentrate	60.70b	67.16a	61.18b	54.27c	0.80
Total	225.68d	262.12c	287.69b	333.88a	13.10
Total DMI (g/kgLW $^{.75}$/d)	48.15c	48.36c	55.26b	58.43a	0.51
Nutrient intake (g/kgLW $^{.75}$/d)					
Crude protein	7.16d	8.28c	9.56b	13.04a	0.77
Neutral detergent fiber	28.57d	27.65c	30.48b	34.46a	0.18
Feed efficiency	6.30a	6.07b	5.72c	6.24a	0.09

a.b.c = Means on the same row with different subscripts are significantly (P<0.05) different

Table 3 Utilization of nutrients by West African Dwarf goats fed *Tephrosia bracteolata* and Guinea grass. Values shown are means (n=3).

DIETS					
PARAMETERS	I	II	III	IV	SEM
Forage intake (g/d)					
DM	194.37c	194.96c	226.51b	284.61a	8.61
CP	27.75d	33.54c	42.59b	66.48a	1.26
NDF	138.69c	135.48d	155.45b	188.24a	2.05
Apparent digestibility (%)					
DM	70.61b	71.53b	78.08a	77.41a	1.14
CP	69.14b	69.58b	72.11a	71.28a	1.27
NDF	57.19d	60.53c	62.15b	66.24a	1.33
Nitrogen utilization (g/d)					
N-intake	4.44d	5.37c	6.81b	10.64a	0.91
N-faecal	2.41c	2.57c	3.14b	4.99a	0.18
N-urine	1.29d	1.68c	2.25b	3.30a	0.05
N-retention	0.71d	1.14c	1.43b	2.35a	0.11

a.b.c = Means on the same row with different subscripts are significantly (P<0.05) different

could be used strategically depending on the availability of *P. maximum*. The outstanding weight gain heralded by better feed conversion ratio as observed by the goats fed with more of TB could largely be due to a greater intake of the legume than that of the grass. According to Beever et al.. (1986). the effect of legumes on intake and animal performance relates to enhance proportionate production. ruminal outflow of undigested forage. ruminal organic matter digestion and pest ruminal digestion of protein. Digesta fill of the rumen is commonly lower for legume than for the grass. In a separate study. Smith et al. (1995) indicated that the consumption of Gliricidia leaf increased significantly while voluntary DMI of grass (*Panicum maximum*) declined with increasing level of supplementation.

Live weight gains observed in the present study for the animals fed 40. 60 and 80 % TB contained diets compare favourably with other reports (Adeloye. 1994). Generally. an apparent live weight gain has been established with basal grass supplemented with browse legumes (Alayon et al.. 1998). Elevated digestibility of the nutrients by the animals fed TB was in conformity with the report by Ayoade et al. (1998). Digestibility of fodder is a correlate with species. nutrient intakes. CP percentage and the state {mature or tender. dry or fresh} of the fodder. It was somewhere observed that forage with protein content above 6-8 % have greater digestibility's as a result of the presence of required N for ruminant microbes {Krueger et al. 1974). However. in a separate experiment reported by some researchers (Rafique et al.. 1993}. low digestibilities of DM {48.0- 53.5 %} were obtained for barley straw with mixtures of alfalfa. forbs and shrubs. Positive and preponderance N retention observed for the animals across the diets in the present study probably indicate low or bearable concentration of tannins and phenolics. The present study did not analyze for possibility of such toxins. as the acceptability of the plant was high without any sign of reaction to the forage nor mortality record. This in actual fact was not insinuating the absence of the antinutritional factors that may be inherent in the plant. The stage of growth of the legume offered to animals probably affected digestibility and eventual positive nitrogen retention by the animals. The trend of the retention was in consonance as reported {Nastis and Malechek. 1981} that goats fed diets containing 40 % and 80 % mature Gambel oak with alfalfa hay had small reduction in nitrogen compared with all alfalfa hay diets. However. when goats were fed diets containing 80 % immature oaks. N retention was depressed severely. Gregorio et al. {1989} then established that stage of maturity. percentage of the diet and shrub species can influence N retention when goat's diets contain high levels of soluble phenolic/ tannins.

CONCLUSION

Smallholder farmers and home livestock keepers could feed the legume to animals under a 'cut and carry' system. Goats fed higher inclusion of *Tephrosia bracteolata* had an encouraging weight gain and improved feed efficiency. Although the inherent limiting factors were not determined. better performance characteristics of the animals showed that such antinutritional factors are minimal. bearable and utilizable.

REFERENCES

Adeloye A.A (1994). Preliminary investigation of *Parkia filicoidea* and *Tephrosia bracteolata* leaf meals in the diet of the goat. *Nig. J. Anim. Prod.* 21: 105-107.

Akinsoyinu A.O (1974). Studies on protein and energy utilization by the West African dwarf goats. PhD thesis. University of Ibadan. Nigeria.

Alayon J.A. Ramirez - Aaviles L.. and Ku - Vera J.C (1998). Intake. rumen digestion and microbial nitrogen supply in sheep fed *Cynodon nlemfuensis* supplemented with *Gliricidia sepium*. *Agrofor.* 41: 115-126.

Association of Official Analytical Chemistry (1990). Official methods of analysis 15th Edition AOAC Incorporation. Virginia.

Awodoyin R.O..Ogunyemi S.and Isichei A.O (2000). Overcoming seed coat dormancy in *Tephrosia bracteolata*. a fodder legume of west African Savannah. *Nig. J. Ecol.* 2: 23-27.

Ayoade J.A. Ogede P.O.. Okwori A.J and Ogbeide J.O. (1998). Nutritional potential of *Tephrosia bracteolata* leaves as a sole feed for goats. In : sustainability in question. Proc. Silver Anniv. Conf. Nig. Soc. Anim. Prod. Pp53-54

Babayemi O.J.. Bamikole M.A. Daniel I.O.. Ogungbesan A. Babatunde A.. (2003a) Growth. nutritive value and dry matter degradability of three Tephrosia species. *Nig. J. Anim. Prod.* 30 {1}.62-70

Babayemi O.J.. Bamikole M.A.. Daniel I.O.. Ogungbesan A. and Oduguwa. B.O. (2003b). Preliminary studies on Tephrosia species: Effect of seed treatments on germination. *Nig. J. Anim. Prod.* 30 {2}:209-216

Beever D.E.. Dhanoa M.S.. Losada H.R.. Evans R.T.. Cammel S.B.. and Framce L. (1986). The effect of forage species and stage of harvest on

the processes of digestion occurring in the rumen of cattle. *Br. J. Nutri.* 56: 439- 454

Daniel F.R., (1971). Floral of Tropical Africa Vol. II Leguminosae of filicoidea by Reeve L and Co. 5. Henrienlta street. Convent Garden

Dutta A.C (1979). Botany for degree student. Calcutta. Oxford University Press. Delhibit. Pp 728

Duncan D.B., (1955). Multiple range and multiple F - tests. Biometrics 11: 1- 42

Gregorio N.H., Holechek J.L., Wallance J.D., Galyean M.L., Tembo A., Valdez R. and Cardenas M., (1989). Influence of native shrubs on nutritional status of goats : Nitrogen retention. *J. Range Manage.* 42{3}, 228 - 232.,

Krueger W.C., Laylock W.A., and price D.A., (1974). Relationship of taste, smell and touch to forage selection. *J. Range Manage.* 27: 258 – 262

Mtenga L.A., and Shoo R.A., (1990). Growth rate, feed intake and feed utilization of small East African goats supplement with Leucocephala. *Small Ruminant Res.* 3, 9- 18

Nastis A.S. and Malechek J.C., (1981). Digestion and utilization of nutrients in oak browse by goats. *J. Anim. Sci.* 53:283- 289

NRC. (1981). Nutrient requirement of goats. National Research Council. National academy press. Washington DC.

Odeyinka S.M., (2001). Effect of feeding varying levels of *Leucaena leucocephala* and *Gliricidia sepium* on the performance of West African dwarf goats. *Nig. J. Anim. Prod.* 28{10): 61- 64.

Okabgare G.O. and Bratte L., (1999). Comparative utilization of *Parkia filicoidea*, *Tephrosia bracteolata* and *Gmelina cirborea* leaves by goats. *Trop. J. Anim. Sci.* 2{2}: 113-117}

Oldham J.D., and Aldernman G., (1980). Recent advances in understanding protein - energy interrelationships in intermediary metabolism in ruminants. In: Protein and energy supply of high producing of milk and meat. Pergamon Press. Oxford. Pp33.

Onwuka C.F.I., and akinsoyinu A.O., (1989). Protein and energy requirement for maintenance and gain by West African dwarf goats fed cassava {*Manihot utilisima*} leaves with peels as supplement., *Small Ruminant. Res.* 2.291- 298

Rafique S., Wallance J.D., Holechek J.L., Galyean M.L., and Arthum D.P., (1993). Influence of forbs and shrubs on intake, digestibility, and nitrogen and energy balance in sheep fed low-quality straw. *Agrofor. Sys.* 24 : 95

Reynolds L., and Adeniran S.O., (1988). The effect of browse supplementation on the productivity of West African dwarf sheep over two reproductive circles. In: Smith OB, Bosman HG {eds}. Goat reproduction in the humid tropics. PUDOC, Wageningen, The Netherlands. Pp83- 91

Smith J.W., Larbi A, Jabbar A., and Akinlade J., (1995). Voluntary intake by sheep and goat of three levels of supplement to a basal diet of *Panicum maximum*. *Agroforestry System* 32: 289 - 295.

Statistical Analysis System Institute (1995). SAS User`s Guide. SAS Institute.

Sumberg J.E., (1985). Small ruminant feed production in a farming system context. In: Sumberg JE, Cassaday K {eds.} sheep and goats in humid West Africa. International Livestock center for Africa. Addis Ababa, Ethiopia Pp41 - 48.

Van-Soest P.J., (1994). Nutritional ecology of the ruminant livestock. Constock. Publishing Associates. Ithaaca, N.Y .