ANIMAL RESEARCH INTERNATIONAL

Volume 4 Number 3 (2007)

An International Journal Publishing Original Research Involving the Use of Animals and Animal Products

ISSN: 159-3115

Website: zoo-unn.org

FEED INTAKE AND NUTRIENT DIGESTIBILITY OF WEST AFRICAN DWARF (WAD) GOAT FED *Pennisetum purpureum* SUPPLEMENTED WITH *Gmelina arborea*

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ABSTRACT

Nine (9) West African dwarf goats (8 weeks of age, averaging 6.3 ± 1.3 kg body weight) were used in a 42 day feeding trial to determine the effect of feeding Pennisetum purpureum supplemented with Gmelina arborea on diet intake and nutrient digestibility of goats. The experimental diets were diets 1, 2 and 3 with 0%, 25%, 50% Gmelina arborea leaves and 100%, 75%, 50% Pennisetum purpureum inclusion respectively. The diets contained between 9.1 – 10% crude protein and the goats were fed 2.5% of body weight DM or 900 g of fresh feed per day. Result indicated lack of significant (P > 0.05) differences in the final body weight, although there were significant differences (P < 0.05) on feed intake, weight gain and feed efficiency among the treatment. However, goats on diet 2 performed better than others in all production parameters measured when compared with the control diet. All the nutrients digestibility investigated were significantly affected (P < 0.01). Result obtained from this study showed that West African dwarf goats can be fed up to 25% Gmelina arborea and 75% Pennisetum purpureum inclusion in diet without loss in body weight performance.

Keywords*: Pennisetum*, *Gmelina*, Nutrient digestibility, WAD goats, Feed intake

INTRODUCTION

Smallholder goat production systems are mostly based on traditional methods. Goats have advantage over other ruminants because they can walk for long distances in search of feed and this behaviour assist them in meeting their nutrient requirements (Devendra and Mcleroy, 1982). This situation exists in many regions of the tropics, where goats raised in traditional systems mostly roam freely in fallow land, forest and grassland. The main feed resources of animals are native grasses, legumes that occur naturally in grass lands, tree leaves and crop residues.

Recently, in addition to problems with parasites that seriously affect small ruminants, there is also a problem of feed shortage, which occurs especially in intensive crop production. The increasing human population and resultant change in the environment (lower soil fertility and deforestation) in the last few years have resulted in increasing crop areas. Fences are often constructed around the cropping area, to prevent crop destruction by goats and thus reduce overall grazing areas. Therefore feed resources that were plentiful in the past do not exist any longer on many farms. Farmers have to spend more time finding feed for their animals (Horne and Stur, 1999).

The effect of season on native forages is another problem that leads to feed shortage since feeds are abundant only during the wet season. In the wet season, animals need to be confined or tethered in many areas to avoid damaging of the crops, thus farmers spend a lot of time and labour to find, cut and carry natural grasses for their animals (Phonepaseuth, 1997). Fodder trees and shrubs, which are part of the natural vegetation are accessible to the majority of small-holders farmers and may be useful feed supplements in small ruminant production (Otsyina and Mckell, 1985). The species used for feed (leaves and fruits), primarily often have additional benefits when integrated into farming system. The benefits include fuel and timber, increased soil fertility (leguminous species), control of wind erosion, shade for man and livestock, folk medicine, etc (Le Houeron, 1980). These species are referred to as multipurpose trees. *Gmelina arborea* is one of such multipurpose trees. According to Little (1983), the leaves are harvested as fodder for animals. Although *G. arborea* is a well known tree of tropical plantation forestry, and closely related to the native white beech, there is little experience with it in Nigeria as dry season feedstuff . It's use in wood/grazing agro forestry system would be quite novel, and is suggested here because all the leaf falls in the dry season appears to be of remarkably high feed value. Other attractions are the fine timber and rapid growth rate (Lowry and Jayne, 1997). The planting of multipurpose trees such as *G. arborea* on waste lands as shade trees and to check erosion may over come the constraints to animal production caused by lack of fodder in the dry seasons. The tree has the leaves on its branches all year round. Even though Gmelina can shed some of its leaves when the dry season is approaching, the regrowth of new leaves could serve as animal feed during this period. It is against this background that this study was designed to determine the effect of supplementing dry season *Pennisetum purpureum* grass with *Gmelina* leaves when fed to weaner goats.

MATERIALS AND METHODS

Study Area: The study was carried out at the Sheep and goat Unit, Teaching and Research Farm, Department of Animal Production and Fisheries Management, Ebonyi State University, Abakaliki. The station is located between latitude 06^{o} 2^{1} N and longitude 08^{o} 5^{1} E. The annual rainfall ranges from 1500 to 1800 mm with a temperature range from 21^{o} to 30^{o} C (Ofomata, 1975).

Pennisetum purpureum: This is a tall, turfted perennial and high leafy grass with a height of 3-5 m. It is distributed throughout tropical Africa and occurs naturally near streams and rivers. It is indigenous and distributed widely in Nigeria. Napier grass is palatable, drought-resistant, and high yielding (over 180 tons of green fodder per hectare per year). Its nutritive value is high and has been used in Uganda for restoration of soil fertility. Establishment of the grass is either sexually through seed or asexually by stolon. The grass is less in quantity during the dry season but newly grown ones are used to feed animals at this period (Horne and Stur, 1999).

***Gmelina arborea*:** This is a fast-growing tree that grows up to 70 ft. high and 6ft. in girth. Its habitat is forest and is cultivated in plantations. The leaves are 6-10 inches long and 4-7 inches wide and are ovate, tapering gradually to the apex and almost flat at the base but usually cuneat at the junction with the leaf-stalk. *G. arborea* has a high digestibility (Lowry, 1995) but showed that most of the rumen fermentation occurred very rapidly in the first 24 hrs. It was grown at wide spacing in pasture, in the wet-dry tropics and had a substantial dry-season leaf fall with a digestibility so high that it could be regarded as an energy supplement (Wilson, 1990). *G. arborea* is not nitrogen fixing, and the canopy is moderately dense, more so in the wet tropics than in Townville and there is every possibility that its shading would promote shade tolerant grasses (Lowry, 1995).

West African Dwarf Goat: Nine West African Dwarf goat weaners (6.3 $\pm$ 1.3 kg body weight) about 8 weeks old were used in a completely randomized design with three animal replicate per treatment. The animals were randomly allotted to three dietary treatment groups as follows: diet 1 (control) 100 % *P. purpureum*; diet 2 (25 % *G. arborea* + 75 % *P. purpureum*); diet 3 (50 % *G. arborea* + 50 % *P. purpurenum*). Each treatment consisted of three (3) animals that were each housed in pens through out the experimental period**.**

Feed Intake and Nutrient Digestibility: Feed was offered daily at 0900 h and water provided *ad libitum* during the experimental period. The goats were adapted for 10 days to the experimental diets before actual data collection commenced. The feed offered and refusals for each goat was weighed and recorded daily. Goats were weighed weekly and their growth rate determined. At the end of the trial, there was an 8-day collection period of daily feaces from each goat in addition to feed offered and refusals for the determination of nutrient digestibility.

Analytical Methods: Feed samples were ground in a hammer mill to pass a 1 mm mesh sieve for proximate analysis according to the procedure described by (AOAC, 1990) Crude protein was calculated from N x 6.25. Samples of faeces were dried at 65 ^{o}C for 48 h, ground through a 1 mm diameter screen and were analysed proximate composition (AOAC, 1990). Gross energy of feed and faeces were measured by bomb calorimetry using benzoic acid as a standard (26437 J/g).

Statistical Analysis: Data generated were subjected to Analysis of Variance technique in a completely randomized design (CRD) Steel and Torrie (1980). Means were separated using Duncan's Multiple range test (Duncan, 1955).

RESULTS

The chemical composition and gross energy content of the experimental diets and *G. aborea* is presented in Table 1. The crude protein content of Gmelina leaves (10.05 %) is relatively higher than that of the *P. purpureum* (9.10 %). Feed intake, growth rate and nutrient digestibilities of weaner goats supplemented with *G. aborea* is summarised in Table 2. There were significant differences ($P < 0.01$) in the dry matter intake, growth rate, feed efficiency and nutrient digestibilities among the treatments. Supplementation of *G. arborea* leaves, significantly ($P < 0.05$) influenced the average dry matter intake (DMI). Goats on diets 2 and 3 had significantly ($P < 0.05$) higher DMI than goats in the control diet. There was however no difference in DMI of goats on diets 2 and 3 respectively. Similarly, goats on diets 2 and 3 respectively, had a higher ($P < 0.05$) growth rate than those of the control. A lower ($P < 0.05$) feed effciency was observed with goats on the control diet compared with diet 2 but not with diet 3. Dry matter, crude protein and ether extract digestibility were higher ($P < 0.01$) in the supplemented diets compared with the control diet. However, the NFE digestibility and total digestible nutrient (TDN) of diet 2 was higher ($P < 0.01$) than that of diet 3 which in turn was higher ($P < 0.01$) than the controls.

DISCUSSION

The effects of using multipurpose trees as supplement to basal grass diets on growth and survival rates of WAD sheep and goats have been reported (ILCA, 1988). Supplementation of *P. purpureum* with increasing level of *G. arborea* leaves brought about increased total dry matter intake and weight gain in weaner goats.

Table 1: The proximate composition of the dietary treatment

Item	[a]Control diet	[b]Diet 2	[c] Diet 3	*Gmelina*
Dry matter	67.36	84.02	73.63	89.04
Crude protein	9.10	10.50	9.60	10.05
Ether extract	0.70	1.07	0.90	1.04
Crude fibre	30.33	25.87	28.03	30.46
Ash	9.70	11.03	9.98	12.96
Nitrogen free Extract	50.17	51.53	51.43	44.69
Gross energy (kJ/g DM)	3.77	3.73	3.68	3.59

[a]Control diet = Pennisetum purpureum (100%); [b]Diet 2 = 75% Pennisetum purpureum + 25% Gmelina arborea; [c]Diet 3 = 50% Pennisetum purpureum + 50% Gmelina arborea

Table 2: Feed intake, growth rate and nutrient digestibilities of goats fed Pennisetum purpureum supplemented with Gmelina arborea leaves

Item	Control diet	Diet 2	Diet 3
DM Feed Intake (g/d)	$0.673^{b} \pm 0.02$	$0.84^{a} \pm 0.02$	$0.736^{a} \pm 0.02$
Growth rate (g/d)	$1.47^{b} \pm 0.15$	$2.67^{a} \pm 0.12$	$2.2^{a} \pm 0.12$
Feed Efficiency	$2.17^{b} \pm 0.16$	$3.18^{a} \pm 0.21$	$2.99^{ab} \pm 0.18$
Dry matter digestibility	$0.696^{b} \pm 0.01$	$0.849^{a} \pm 0.01$	$0.764^{a} \pm 0.01$
Crude protein digestibility	$0.568^{b} \pm 0.03$	$0.814^{a} \pm 0.01$	$0.671^{a} \pm 0.02$
Crude fibre digestibility	$0.704^{b} \pm 0.02$	$0.831^{a} \pm 0.01$	$0.746^{ab} \pm 0.01$
Ether extract digestibility	$0.534^{b} \pm 0.13$	$0.775^{a} \pm 0.01$	$0.619^{a} \pm 0.05$
NFE digestibility	$0.684^{c} \pm 0.02$	$0.854^{a} \pm 0.01$	$0.755^{b} \pm 0.01$
Total digestible nutrient	$0.617^{c} \pm 0.02$	$0.759^{a} \pm 0.01$	$0.669^{b} \pm 0.02$

[a, b ,c] Means in a row with common letter(s) superscript do not differ (P > 0.05).

The high daily dry matter intake observed here is in agreement with the report of Haque *et al*. (1997). It would appear Gmelina leaves was probably more palatable and more acceptable to goats than *P. purpureum*. The importance of protein intake as the determinant of performance in ruminants has been strongly emphasized (Preston and Leng, 1987).

The superior feed efficiency of diets 1 and 2 respectively compared with the control was a reflection of the higher growth rates observed in diets 2 and 3 compared with the control.

Average final body weight was not different among the treatment. Nevertheless, there was a marginal increase of 25 % and 11 % in the final body weight of diets 2 and 3 respectively when compared with the control. *Gmelina* leaves appeared to increase the appetite of the goats at 25 % level of inclusion and began to depress it at 50 % level of inclusion. This observation is in tandem with the report of Osakwe *et al*. (2000). This could have led to the increase in weight gain and improvement in feed efficiency observed respectively at 25 % level of supplementation.

Nutrient digestibility showed that the digestibility values of dry matter, crude protein, crude fibre, ether extract and NFE were significantly different among the treatment. Leng (1992) observed *G. arborea* as one of the leaves with high protein content of even up to 34 % and the protein do not seem to change with leaf maturity even when they dry and fall of on the ground. Crude fibre digestibility was significantly lower in the control compared with diet 2. This finding agreed with the earlier report of Lowry (1995) that Gmelina leaves has a high digestibility but noted that most of the rumen fermentation occurred very rapidly within the first 24 hrs. Lascano and Palacios (1993) observed that the intake and digestibility of tropical dry season grasses by goats and sheep tend to be low due to high fibre and low crude protein concentration in these forages. The implication of this observation is that *Gmelina* leaves, when used as a suplement to dry season *P. purpureum* has improved the dry matter intake and digestibility in the diets of West African dwarf goats.

Conclusion: Data from this study showed that there is a great potential for improvement in dry matter intake, growth rate and nutrient digestibilities of weaner goats supplemented with leaves of *G. aborea*. The results of the present study has shown that inclusion of *G. arborea* at 25 % and *P. purpureum* at 75 % in the diet of WAD goats gave the optimum performance. The availability of such multipurpose trees during dry season would improved the quality of the declining nutritive value of available grass species, and hence reduced the characteristic weight loss during this period. In addition, to weight loss reduction, the use of such multipurpose tree improves soil fertility and structure, provides firewood to the household and acts as a windbreak when planted in the farm..

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