

## Nutritive attributes of *Sesbania pachycapa* fodder in a crop-livestock farming system

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### Abstract

Two experiments were conducted to investigate and compare the nutritive attributes of *Sesbania pachycapa* (SP) in a crop-livestock farming system. In Experiment 1, the feeding attributes of *Sesbania pachycapa* (SP) fodder was investigated with 15 West African Dwarf (WAD) sheep, by feeding *Panicum maximum* (PM) alone and P. maximum supplemented with S. pachycapa (SP) in the ratio of 70:30. The study lasted 28 days, during which feed intake was monitored daily. In Experiment 2, the nutritive value of SP was investigated with WAD sheep and goats by feeding them as sole diets. The study lasted 15 days consisting of 10 days adjustment and 5 days of data collection using 5 each of bucks and rams in a completely randomised design. In the first trial, DM intake (99.5g/kgBW<sup>0.75</sup>) was higher for the control PM and least (72.8g/kgBW<sup>0.75</sup>) for SP. Total DM intake followed similar trend. In the second trial, DM (185g/kgBW<sup>0.75</sup>), CP (40%) and NDF (645g/kgBW<sup>0.75</sup>) intakes were generally higher ( $p < 0.05$ ) for sheep than for goats. DM (562), CP (421) and NDF 680g/kg digestibility coefficients were also higher ( $p < 0.05$ ) for sheep than for goats. The N balance and retention (g/h/d) was higher in sheep. Results indicated that intake, digestibility and N- utilisation of *S.parcyhcapa* by sheep is better than goats although both had a positive N-balance. It could be concluded that apart from the well known positive impact of *S. pachycarpa* in agro forestry and alley farming systems, it can effectively serve as protein supplement in a small holder crop-livestock farming system.

**Key words:** *Sesbbania pachycarpa*, crop livestock farming, WAD sheep, WAD goats, Nitrogen balance

## Introduction

Sheep and goat keeping makes up about 70% of the domestic ruminant biomass in the savannah zone of Nigeria. Upton (1985) put the stock density at 3-4 small ruminants (sheep or goat) per household. Dwarf goats and dwarf sheep are used for meat, which with their skins form an important source of income for farmers. They are prolific and can subsist on a wide range of feed materials (Silanikove 2000). During the dry season, grass and crop residues are in short supply, so there is deficiency in energy, protein and essential minerals and vitamins (Akinlade et al 2002). Feeding of concentrates during this time is no longer popular because of the exorbitant cost and inadequate supply. The alternative form of supplementation is the use of legumes and browse plants.

The annual legume *Sesbania pachycapa*, is a promising browse plant in agro-forestry and alley farming systems. It grows rapidly, it is highly palatable and very popular among small-holder mixed farmers in Bangladesh (Buckles et al. 1994) and on the Manbilla plateau of Nigeria (Webber 1996), where it has been found efficient in restoring soil fertility and as firewood. As a legume intercrop, it can supply about 100kg/ha N in irrigated rice plantations. *Sesbania* is normally shrub-like, but in crowded stands grows a straight, slender stem that may reach 4m tall. It is native to tropical and subtropical areas and grows on saline and alkaline soils (NAS 1984).

Use of *Sesbania* as a supplement for goats (Ademosun et al. 1988; Ash 1990), dairy cows (Khan et al. 1990) and sheep (Kaitho et al. 1998) has been examined. There is scarcity of information on feeding the genus *S. pachycapa*,

and the use of a total diet of *Sesbania* spp.

The objectives of this study were to compare voluntary intake, nutrient digestibility and nitrogen balance of *Sesbania pachycapa* fodder by sheep and goats when fed as a sole diet, and the supplementary feeding value of *Sesbania* in sheep when fed a basal diet of poor quality grass (*P. maximum*).

## Materials and methods

### Forages

The forage investigated was *Sesbania pachycapa*. Seeds of the legume was sown at the recommended rate for 90% viability; 3kg / ha (Humphreys 1980). Inoculum was not used and no fertiliser was applied.

### Experiment 1: *Sesbania pachycapa* as supplement

*Sesbania pachycapa* was harvested at the flowering stage at a height of about 3m. The plant was about 4 months old at the time of harvesting. The plant was cut at 6cm above ground level and bunched. Each bunch was made to stand in order that the leaves spread out and air dried. After drying, the edible portion (leaves and leaf stalks) were packed in jute bags and stored on a raised platform until required for feeding. *Panicum maximum* was harvested daily (zero grazing) from 15-week regrowth plots, at about 6cm above ground level and chopped manually into 3-5cm lengths before feeding.

*Animals and their management.* Ten West African Dwarf (WAD) sheep aged between 24-36 months with an average weight of about

18±1.4kg were used in this study. The animals were divided into 2 groups of 5 animals each, balanced for sex and weight. Each group was assigned to one of the following rations: Panicum maximum alone (control) and P. maximum plus S. parhycapa. The animals were dewormed and sprayed as a routine practice to control internal and external parasites before the start of the trial. They were housed in individual feeding cubicles. The floors of the cubicles were made of concrete and covered with wood shavings. The basal diet and the supplement were offered in separate troughs at a ratio of 70:30. The feed was offered at the rate of 3% of individual animal live weight at 09.00h daily, after removal of the feed refused the previous day. Fresh drinking water and a mineral salt block were provided to all animals at all times.

The trial lasted for 28 days consisting of 7 days adjustment and 21 days of data collection.

*Experiment 2: Digestibility trial/Nitrogen balance*

Five each of West African Dwarf (WAD) rams and goat bucks aged 24 – 30 months were selected and randomly assigned to a sole diet of *Sesbania parhycapa*. The animals were kept in separate metabolic cages and offered the diet at 3% body weight of individual animals in a 15-day digestibility trial consisting of a 10-day adjustment and a 5-day collection period. During the 5-day collection period total feed offered and refused, total faeces and urine volume were recorded daily. About ten percent samples of the total daily output of faeces and urine were taken and kept in a refrigerator for chemical analysis. Urine was preserved by addition of 5ml of concentrated sulphuric acid in the container prior

to the urination by animals.

#### *Chemical analysis*

Forage samples from Experiment 1 and samples of feed offered, feed refused and faeces from Experiment 2 were analysed for total nitrogen (AOAC 1990), neutral detergent fibre (NDF), acid detergent fibre (ADF) and lignin using methods described by Van Soest *et al.* (1991). Urine was analysed for nitrogen by the Kjeldahl extraction method. Hemicellulose was estimated as the difference between NDF and ADF.

#### *Statistical analysis*

Data from Experiments 1 and 2 were subjected to analysis of variance for a completely randomised design and student T test was used to separate the means (SAS, 1988).

## **Results**

### *Chemical composition of fodders*

The chemical composition of the fodders and voluntary dry matter intake by WAD sheep fed a basal diet of *P. maximum* supplemented with *S. parhycapa* or *A. hypogea* shows that *Panicum maximum* had 98,666, 467, 82, 350 and 199g/kg of crude protein, Neutral detergent fibre, lignin, cellulose and Hemi cellulose respectively. While the *S. parhycapa* had 215, 346, 217, 71,137 and 129g/kg of crude protein, Neutral detergent fibre, Acid detergent fibre, lignin, cellulose and hemicellulose respectively. All the values except for crude protein were higher for *Panicum maximum* than *S. parhycapa*. The dry matter intake (99.5g/kg<sup>0.75</sup>) for *Panicum maximum* was higher than 72.8g/kg<sup>0.75</sup> for *S. parhycapa*.

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### Experiment 1

Sheep utilised *S. pachycapa* better than *P. maximum*. The supplementation of *P. maximum* with *S. pachycapa* fodder hays resulted in significantly ( $P < 0.05$ ) lower dry matter intake of the basal diet.

### Experiment 2.

The results of nutrient digestibility and nitrogen balance of *S. pachycapa* by WAD sheep and goats are presented in Table 1. The dry matter and crude protein intakes of *S. pachycapa* were higher for sheep. The digestibilities of dry matter,

crude protein, neutral detergent fibre and acid detergent fibre digestibility were significantly ( $P < 0.05$ ) influenced by the specie of animal. In all, sheep digested all the nutrients by about 22% over goats, resulting in a higher positive N balance.

### Discussion

The level of crude protein (9.8%) of the guinea grass used in this study reflected the stage of maturity and was slightly lower than the (11-12% CP) recommended for moderate levels of production (ARC 1980) but higher than the

Table 1. Daily voluntary intake, nutrient digestibility and nitrogen balance of *Sesbania pachycapa* by West African Dwarf sheep and goats.

Parameters	Sheep	Goats	SED
<b>Intake (g/kg BW<sup>0.75</sup>)</b>			
Dry matter	185	168	1.9
Crude protein	40	36	0.42
Neutral detergent fibre	64	58.1	0.66
Acid detergent fibre	40	36.5	0.42
Lignin	13.2	12.0	0.25
Cellulose	24.0	21.6	0.25
Hemicellulose	25.3	23.0	0.26
<b>Digestibility (g/kg)</b>			
Dry matter	562	434	55.40
Crude protein	421	267	40.20
Neutral detergent fibre	680	432	64.70
Acid detergent fibre	423	267	40.70
<b>Nitrogen balance (g/day)</b>			
N intake	6.8	4.3	0.74
N output			
Faecal	3.2	1.7	0.25
Urine	2.1	2.0	0.25
N-retained	1.5	0.6	0.49

6-8% below which feed intake is impaired (Minson 1980).

The relatively higher CP and lower NDF, ADF and lignin in *S. parhycapa* could be due to its comparably lower shedding of leaves during hay making. Practically, hay-making will result in unavoidable loss of leaf (Said and Adugma, 1993). The differences in DM and other nutrient intake between sheep and goats are explained by a specie effect. The present results are however, in contrast with those of Ademosun, *et al.* (1988) and Ash (1990) who reported that supplementation of a hay diet with *Leucaena leucocephala*, *G. sepium* and *S. sesban* led to an increased total DM intake. The significant decrease in the intake of the basal diet in this study indicated strong substitution of the basal diets by supplements. The feeding behaviour of sheep and goats differs. It could further be explained that since fibrous components are digested mainly in the rumen and are slowly degraded, the shorter rumen means retention times in goats than in sheep can explain the lower digestion of the fibrous diet. (Ramanzin *et al.*, 1997) Goats are usually browsers while sheep are mainly grazers (Rutagwenda *et al.*, 1990). Goats are also more selective feeders than sheep (Van Soest 1991). Previous studies on comparative digestibility of sheep and goats gave varied responses (Adebowale, 1989; Flachowsky and Tiroke, 1993). However, a review by Brown and Johnson (1984) stated that differential specie advantage is only important in low quality high fibre diets, where sheep tend to digest dry matter and fibre more efficiently than goats.

## Conclusion

Sheep utilised *S. parhycapa* better than goats in term of nutrient intake, digestibility and nitrogen balance. *S. parhycapa* was well utilised by West African dwarf sheep. The results generally indicated that *S. parhycapa* could serve as an efficient protein source for smallholder mixed farmers in the derived savannah zone of Nigeria.

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## References

- Adebowale, E. A. (1989). Response of WAD sheep and goats fed maize cobs treated with different concentrations of caustic soda. *Tropical Agriculture* (Trinidad), 66, 213-216.
- Ademosun, A. A., Bosman, F.G. and Jansen, H.G. (1988). Nutritional studies with West African dwarf goats in the humid tropics. In: Smith, O. B. and Bosman, H.G. (eds) *Goats Production in the Humid Tropics*. Pp.51-61.
- Akinlade, J. A., Smith, J.W., Larbi, A. Archibong, I.O. and Adekunle, I.O. (2002). Forage from cropping systems as dry season supplements for sheep. *Tropical Grasslands*, 36, 102-106.

- Ash, A.J. (1990).** The effect of supplementation with leaves from the leguminous trees *Sesbania glandiflora*, *Albizia chirensis* and *Gliricidia sepium* on the intake and digestibility of guinea grass hay by goats. *Animal Feed Science and Technology* **28**, 255-256
- AOAC (1990).** Official Methods of Analysis 15th Edn. pp 69-88. (Association of Official Analytical Chemists. Washington DC, USA).
- Brown, L. E. and Johnson, W. L. (1984).** Comparative intake and digestibility of forages and by-products by goats and sheep: A review. *Small Ruminant Research*, **2**, 212-226.
- Buckles, D., Ponce, I., Sain, G. and Medina, G. (1994).** Cowardly land becoming brave'. The use and diffusion of fertiliser beans (*Mucuna deeringaanum*) on the hillside of atlantic hondires. In: Topado, H.D., Thurston, M., Smith G., Abaci and Karl, S. (eds) pp.249-262.(Cornell University: Ithaca).
- Flachowsky, G. and Tiroke, K. (1993).** Influence of type of feeding and rumen incubation time on insaco dry matter degradability of ryegrass straw and concentrate in sheep and goats. *Small Ruminant Research*, **9**, 321-330.
- Humphreys, L.R. (1980).** *A Guide to Better Pastures in the Tropics and Subtropics*. 4<sup>th</sup> Edn. Wright Stephenson and Co (Australia): Australia).
- Khaitho, R. J., Umunna, N.N., Nsahlai, I.V., Tamminga, S. and Vanbruchem J. (1998).** Utilization of browse supplements with varying tannin levels by Ethiopian Menz sheep *Agroforestry systems* **39**, 161-173
- Khan, M.A.S, Jabbar, M.A. Akbar, M.A. and Topps, J.H. (1990).** A legume browse, *Sesbania sesban* an alternative protein supplement to fishmeal for lactating cows in Bangladesh. *Animal Production*, **50** (3), 153A.
- Minson, J.D. (1980).** Nutritional differences between tropical and temperate pastures. In: Morley, F.W (ed.) *Grazing animals* pp.167-182. (C.A.B International: Farnham Royal Slough, UK.
- National Academy of Science, (1984).** *Tropical legumes: Resources for the future*. Pp. 323.
- Ramanzin M., Bailoni L. and Schiavon (1997).** Effect of forage to concentrate ratios on captive digestibility of sheep, goats and fallow deer. *Animal Science* **64**: 163-170.
- Rutagwenda, T., Lechner-Doll, M. Schwart, H.J., Schiltka W. and Von Engelhardt, W. (1990)** Dietary preference and degradability of forage on a semi-arid thombush savannah by indigenous ruminants, camels and donkeys. *Animal Feed Science and Technology*, **31**, 179-192.

**Said, A.N. and Adugna Tolera (1992).** The supplementary value of forage legume hays in sheep feeding: Feed intake, nitrogen retention and body weight change. *Livestock Production Science*, **33**, 229-237.

**SAS (1988).** SAS User's Guide. Statistical version. 6<sup>th</sup> Edn. (Statistical Analysis Systems Institute: Cary, NC, USA).

**Silankove, N. (2000).** The physiological basis of adaptation in goats to harsh environment. *Small Ruminant Research*, **35**;181-193.

**Upton, M. (1985).** Returns from small ruminant production in Southwest Nigeria. *Agricultural Systems*, **17**, 65-68.

**Van Soest, P.J., Robertson J.B. A and Levis, B.A (1991).** Methods for dietary fibre, neutral detergent fibre and non-starch polysaccharides in relations to animal nutrition. *Journal of Dairy Science*, **74**, 3583-3597.

**Webber, G. (1996).** Legume-based technology for African savannahs: challenges for research and development. *Biology Agriculture and Horticulture*, **13**, 309-333.

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