

# HERBAGE PRODUCTIVITY AND QUALITY OF COMMON FORAGE SHRUBS AND BROWSE PLANTS GROWN IN GHANA

P. Barnes, Animal Research Institute, Box 20, Achimota, Ghana.

## ABSTRACT

Two trials on herbage productivity and aspects of herbage quality were conducted on a number of indigenous and exotic forage shrubs and browse plants. The first trial involved 13 species and the second 4 species.

The two studies were carried out concurrently in one year. In the first study, it was found that the species which combined high herbage yield and good quality feed attributes were *Cajanus cajan*, *Calliandra calothyrsus*, *Flemingia macrophylla*, *Gliricidia sepium* and *Leucaena leucocephala*. These species produced more than 60g leaf dry matter yield per metre-length in 6 months and more than 15% crude protein content.

In the second study it was found that the two introduced species - (*Leucaena leucocephala* and *Gliricidia sepium*) showed higher growth rates than the two indigenous species (*Baphia nitida* and *Griffonia simplicifolia*) with which they were compared. However with regard to chemical composition they showed similar levels in ash, crude protein and calcium contents of herbage.

## INTRODUCTION

The importance of browse plants and forage shrubs for ruminant production in Ghana has been highlighted by many workers (Fianu, 1966; Rose Innes, 1977). In studies conducted in Nigeria by Carew *et al.* (1980) it was found that in the derived savanna zone goats and sheep spent 52.2 and 61.1% respectively of their time browsing, while more than 50% of the total dry matter intake of sheep and goats was obtained from browses.

In all parts of the country shrubs, browses and crop residues constitute a very high proportion of intake by ruminants especially in the dry season. Studies have shown many forage shrubs and browse plants to contain high levels of digestible protein, minerals and vitamins and to play major roles in improving intake of roughage by ruminants. Forage shrubs and browses also tend to be productive in herbage yield and are able to provide good quality feed even in the dry season because of their deep rooted nature compared to grasses, most of which are productive only in the wet season.

The objective of the study was to rank in productivity a number of introduced and indigenous forage shrubs and browses with a view to selecting a few species for large scale establishment for ruminant production.

## MATERIALS AND METHODS

**Trial One:** Experimental layout, plant establishment, harvesting and laboratory analysis.

The forage shrubs and browse plants which were studied were obtained from local sources with some of them having been introduced from international germplasm centres some years ago.

The plants which were entries for the evaluation (Table 1) were nursed as seedlings on 6th December 1994. On 13th June 1995 the seedlings were transplanted on to a cultivated field. About 50 seedlings each of 13 forage shrubs and browse plants were raised and these were planted out in two rows in one block on the prepared land with spacing of 3m between rows and 0.5m within rows for shrubs and 3m between rows and 1m within rows spacing for potential trees in the entries.

Data were collected from the plants per row and per plant on 20th November, 1995. Heights of plants were determined in four randomly selected plants per row. The same plants were cut at the ground level per row metre length and leaves stripped to determine both fresh stem and total leaf weights. Subsamples of the leaves were taken for dry matter weights and for palatability tests by about 20 sheep. Samples were dried in laboratory ovens at 60°C for 48 hours for dry matter weights and for palatability tests, leaves and twigs of the 13 species under evaluation were separately hung in a sheep pen for utilisation. Based on the readiness with which the sheep consumed the herbage samples, palatability rankings of the different species were scored. Subsamples of dried herbage of the different species were analysed for crude protein and ash (AOAC 1984).

**Trial two:** The second trial involved comparison of two introduced species (*Leucaena leucocephala* and *Gliricidia sepium*) and two indigenous species (*Baphia nitida* and *Griffonia simplicifolia*) in herbage production and quality.

The trial was established in a randomised block design with three replicates. Plot dimensions were 5m x 5m and seeds for *Gliricidia* and *Leucaena* and suckers (seedlings) for *Griffonia* and *Baphia* were planted at a spacing of 50cm x 50cm per plot on 17th May 1995 for seeds and 25 May 1995 for seedlings. Sampling for herbage dry matter yield and chemical composition was from one metre square quadrat in two replicates. Plants were harvested at ground level in a quadrat and harvests were made up of 6-9 plants per quadrat. Subsamples of plants were taken for dry matter yield and chemical analysis (AOAC, 1984) for crude protein, ash and calcium contents was conducted.

## RESULTS AND DISCUSSION

Data for mean plant height, leaf dry matter yield, fresh wood yield, crude protein content, ash content and palatability score for the 13 forage shrubs and browse plants under evaluation in trial one are presented in Table 1.

In plant height *Cajanus cajan* and *Sesbania sesban* exhibited significantly the greatest heights whilst *Cratylia argentea* and *Desmanthus virgatus* showed the lowest heights. *Codariocalyx gyroides* and *Gliricidia sepium* were the next two entries to show very pronounced extension growth.

*Cajanus cajan* showed the highest leaf dry matter production. A lot more of the entries demonstrated similar leaf dry matter yields than they did in plant height. The species which yielded low leaf dry matter were *Baphia nitida*, *Cratylia argentea*, *Desmanthus virgatus* and *Leucaena leucocephala*.

Fresh wood yield estimates of *Cajanus cajan* and *Sesbania sesban* followed the trend shown for plant heights. The species which were close to these two in wood production were *Gliricidia sepium*, *Codariocalyx gyroides* and *Sesbania grandiflora*.

Crude protein of most species ranged between 14 - 17%. *Leucaena leucocephala*, *Sesbania sesban*, *Cajanus cajan* and *Albizia lebbbeck* produced the highest CP contents respectively. *Cratylia argentea* and *Desmanthus virgatus* showed the poorest levels in CP content (12.2% and 9.6% respectively). In ash content, apart from *Cratylia argentea*, which showed a very high level (13.4%), the remaining

entries exhibited similar levels from 5 to 6.9%.

Palatability ranking of the species under evaluation confirmed long observed trends in palatability of various shrubs and browse plants. *Leucaena leucocephala* was observed to be the most preferred species by 20 sheep made up of ewes and lambs. *Baphia nitida*, *Samanean saman* and *Flemingia macrophylla* followed in that order in preference next to *Leucaena*. The high preferability of *Flemingia macrophylla* is contrary to what has long been observed of the plant. The high preferability of *Baphia nitida*, an indigenous species, underscores the need to propagate indigenous species alongside introduced ones for ruminant feeding.

Considering leaf dry matter yield (or herbage yield), and crude protein content as criteria for selecting the different forage shrubs and browse plants for intensive planting for ruminants the following species would merit selection: *Cajanus cajan*, *Calliandra calothyrsus*, *Flemingia macrophylla*, *Gliricidia sepium* and *Leucaena leucocephala*. Many studies in West Africa and elsewhere have confirmed the attributes of the selected five species as listed above (Ella *et al.*, 1981; Cobbina *et al.*, 1990; and Larbi *et al.*, 1993).

In Table 2 is presented mean plant height, herbage dry matter yield and its crude protein percent, calcium percent and ash percent in two well known introduced shrub plants and two well known indigenous browse plants. *Gliricidia sepium* showed the greatest height (significant at  $P < 0.05$ ). The same trend of results was seen in herbage dry matter yield with *Gliricidia sepium* producing the highest yield. The other species gave similar mean plant heights and herbage dry matter yield. With regard to CP% and Ca% *Gliricidia sepium* gave significantly higher CP% content similar to *Baphia nitida* and high Ca% similar to levels in *Baphia nitida* and *Griffonia simplicifolia*. *Leucaena leucocephala* showed significantly lower levels of the two mineral elements. Ash content of all four species showed similar levels.

This second study has shown that the two indigenous species could not match the growth and quality attributes of *Gliricidia sepium*. The first trial demonstrated the excellent palatability of *Baphia nitida* compared to the rejection of fresh *Gliricidia sepium* when both are offered to sheep. An extension of time for study of the four species will throw more light on whether indigenous plants should be cultivated for stock, given that the well known ones like *Baphia nitida*, *Griffonia simplicifolia* and *Ficus exasperata* exhibit very slow growth rates.

## REFERENCES

AOAC (1984). Association of Official Analytical Chemists. Official Methods of Analysis, 14th edition, Washington, DC, USA.  
**Carew B.A.R., A.K. Mosi, A.U. Mba and G.N. Egbunike.** (1980). The potential of browse plants in the nutrition of small ruminants in the humid forest and derived savanna zones of Nigeria. In: Le Houerou HN (ed). Browse in Africa, the current state of knowledge pp 307-311. ILCA Addis Ababa, Ethiopia.  
**Cobbina, J., A.N. Attah-Krah, A.O. Meregin and B. Duguna.** (1990) Productivity of some browse plants on acid soils of southeastern Nigeria. *Tropical Grasslands* **24**: 41-45.  
**Ella, A., C. Jobsen, W.W. Stur and G. Blair.** (1989). Effect of plant density and cutting frequency on the productivity of four tree legumes. *Tropical Grasslands*, **23(1)** :28-34.  
**Fianu, F.K.** (1966). Activities of cattle at pasture. Legon, Accra University of Ghana. (B.Sc. thesis).  
**Kang, B.T. and L. Reynolds.** (1989). Alley farming in the humid and subhumid tropics; proc. of an international workshop held at Ibadan, Nigeria, 10-14 March 1986. Ottawa, Ontario, IDRC 252pp.

**Larbi, A., M.A. Jabar, E.J. Orok, N.B. Idiong and J. Cobbina.** (1993). *Alchornea cordifolia*, a promising indigenous browse species adapted to acid soils in southern Nigeria for integrated crop-livestock agroforestry production systems. *Agroforestry Systems* **22**: 33-41.  
**Rose-Innes, R.** (1977). A Manual of Ghana grasses. Ministry of Overseas Development, Surbiton, England. 365pp

**Table 1**

Some growth and quality parameters of some forage shrubs and trees under evaluation for productivity

Species	Mean plant height (cm)	Leaf DM yield/ m-length (g)	Fresh Wood Yield/plt(g)	CP%	Ash%	Palatability ranking
<i>Albizia lebeck</i>	136.3c	49.8cd	150.0cd	20.47a	5.38c	13
<i>Baphia nitida</i>	73.8fg	8.0e	23.8d	15.72bc	5.57c	2
<i>Cajanus cajan</i>	242.5a	146.1a	825.0a	19.79a	6.66c	6
<i>Calliandra calothyrsus</i>	96.3ef	61.9bc	62.5d	16.00bc	6.34c	5
<i>Codariocalyx gyroides</i>	149.0bc	64.7bc	268.8bc	14.86c	6.84bc	7
<i>Cratylia argentea</i>	48.8g	5.0e	18.8d	12.21d	13.41a	8
<i>Desmanthus virgatus</i>	60.0g	11.5e	150.0cd	9.61e	5.40c	9
<i>Flemingia macrophylla</i>	125.0cd	83.7b	156.3cd	14.93c	6.33c	4
<i>Gliricidia sepium</i>	165.0b	77.3bc	296.3bc	15.59bc	6.91bc	12
<i>Leucaena leucocephala</i>	106.3de	7.1e	57.5d	21.21a	6.88bc	1
<i>Samanean saman</i>	94.5ef	28.4de	75.0d	16.86b	5.02c	3
<i>Sesbania grandiflora</i>	147.5b	60.4bcd	415.8b	17.19b	6.06c	10
<i>Sesbania sesban</i>	232.5a	55.3bcd	650.0a	21.17a	8.82b	11
Mean	129.0	50.7	242.3	16.6	6.9	
LSD (P.05)	28.36	33.18	188.70	1.64	2.00	
CV%	10.1	30.0	35.8	4.5	13.3	

(Values in the same vertical column with different letter subscripts are significantly different,  $P < 0.05$ ).

**Table 2**

Some growth and quality parameters of two indigenous and two introduced forage shrubs being compared in productivity

Species	Mean plant height (cm)	Herbage DM yield (g/m <sup>2</sup> )	CP%	Ca%	Ash%
<i>Baphia nitida</i>	24.3b	12.8b	14.75ab	1.24ab	8.73a
<i>Gliricidia sepium</i>	151.7a	217.9a	16.76a	1.72a	9.54a
<i>Griffonia simplicifolia</i>	26.7b	14.0b	13.13b	1.50ab	7.33a
<i>Leucaena leucocephala</i>	17.0b	16.0b	14.23b	1.11b	8.07a
Mean	54.9	65.2	14.72	1.39	8.42
LSD (P< 0.05)	42.16	91.91	2.11	0.56	2.60
CV%	38.43	70.58	7.19	20.00	15.44

(Values in the same vertical column with different letter subscripts are significantly different).