

## Evaluation of Nutrient Contents of Different Forms of *Altemanthera brasiliana* and Free Choice Intake by WAD Sheep

Mako A.A.\*, Akinwande V.O., Sodique F. R. and Oyekale, B. I

Department of Agricultural Production and Management Sciences, Tai Solarin University of Education, PMB, 2118, Ijebu-Ode, Ogun State, Nigeria. email: Jokemako2006@yahoo.com; jokemako2006@gmail.com, \* Corresponding author

### ABSTRACT

Ruminant production is constrained by inadequate supply of forage, during the dry season in Nigeria. *Altemanthera brasiliana* (AB) is a perennial herb that is available all seasons and can serve as fodder for livestock. This study evaluated the proximate compositions of *Altemanthera brasiliana* harvested during four seasons (early rainy, late rainy, early dry and late dry seasons) of the year and the different forms of *Altemanthera brasiliana* by West African, Dwarf (WAD) sheep. Results showed that season had no effect on proximate composition of the species. The DM ranged from 20.10 - 20.49% in late rainy and late dry. The crude protein (CP) ranged from 20.35 to 25.42% in late dry to late rainy. The nutrient contents of different forms of AB showed that wilting and sun-curing improved the dry matter; ranging from 21.56 to 58.78% in fresh and sun-cured respectively. All minerals tested were similar except for manganese; ranging from 49.98 to 62.41ppm in late rain to late dry. The coefficient of preference revealed that all forms of AB were acceptable, but the wilted AB was most preferred. *Altemanthera brasiliana* has potential as forage for ruminants especially in the dry season.

Keywords: *Altemanthera brasiliana*, free choice feeding trial, mineral content, nutrient composition, WAD sheep

### INTRODUCTION

Inadequate nutrition is one of the factors that generally affect livestock productivity (Mako 2009). Despite the naturally endowed vegetations, there are still inadequate feeds and feedstuffs for livestock in Nigeria. Period of dry season is always a stressful time for livestock, as the environment is characterised by insufficient feed, occasioned by scarce forage and fibrous standing hays (Bamikole and Babayemi 2004). The negative effect of the period is obvious in the loss of weight, reduced milk production and high mortality of animals (Babayemi *et al* 2003). Incidence of disease outbreak is rampant as a result of low immunity arising from malnutrition as a result of low quantity and poor quality feed. Ruminants relish guinea grass (Bamikole and Babayemi, 2004) but such forage become very scarce in the dry season. This situation causes the nomads to travel long distances in search of greener pastures for their livestock (Daodu *et al.*, 2009) and in the process, losing their animals to snake bite and exposure to inclement weather.

In the Southern part of Nigeria, livestock farmers make supplementary use of the common leguminous trees including *Leucaena leucocephala* and *Gliricidia sepium* (Babayemi *et al.*, 2006). Due to the scarcity of other known forages, there is always high pressure on these tree leguminous tree species, consequently they become inadequate to sustain the usual prolonged dry season periods. The search for and revalidation of other known forages is necessary if livestock industry in Nigeria must grow and be sustained. There are a number of under-utilized forages and browse plants that are well adapted and may be sustainable for Nigerian economy. Such forages have long been ignored and almost forgotten by livestock keepers as research updates on their

nutritive value is scanty. There is therefore a need to develop a package to cater for farmers' interest by conducting research on alternative indigenous forages that are indigenous to the environment. The system must discover what farmers can benefit from cultivating such forage and the utilization of the forages.

*Altemanthera brasiliana* (L.) O. Kuntze (AB) is an important perennial forage herb, well adapted to varying weather conditions and available throughout the year. It is native to tropical and subtropical regions. The common name for the species is 'JOY WEED' while the local name is 'SAJEJE'. Saawan *et al* (2011) reported that the species (leaf and stem) contain crude protein of 21.04 %. This study was designed to examine the nutrient contents of different forms of *Altemanthera brasiliana* and free choice intake by West African Dwarf (WAD) Sheep.

### MATERIALS AND METHODS

#### Collection of samples

*Altemanthera brasiliana* leaf and stem samples were harvested in the months of May, August, November and February to coincide with early rainy, late rainy, early dry and late dry seasons, respectively. The harvested samples were washed thoroughly. A known sample weight was oven dried at 105 °C until constant weight was attained. The dried samples were milled in a Thomas Willey laboratory mill fitted with 0.5 mm mesh. The milled samples were kept in air tight bottles until they were needed for chemical analysis.

#### Proximate composition

Proximate components, crude protein, crude fibre, ether extract

and total ash of samples were analyzed in triplicates using standard procedure of AOAC (2012). The crude protein was determined with the micro Kjeldahl distillation apparatus, while fibre fractions; the acid detergent fibre, neutral detergent fibre and acid detergent lignin were determined using Van Soest (1994) method.

**Analysis of mineral compositions**

A total of ten minerals were analysed. Plant parts were digested with HNO<sub>3</sub>/HClO<sub>3</sub> mixtures (nitric acid and perchloric acid) in ratio of (20:5 v/v). The digest was made up to 100 ml in standard volumetric flask with deionized water. Ca, Na, K, Fe, Cu, Mn, Zn, Mg and Pb in the digest were determined with the atomic absorption spectrophotometer model 420. Phosphorus in the digest was estimated with vanadomolybdate solution. The colour so developed was read with spectrophotometer at 420 m/u.

**Experimental site for forage acceptability**

The study of the relative acceptability of different forms of *Altemanthera brasiliiana* leaf and stem was carried out at the sheep and goat unit of the Department of Agricultural Production and Management Science, Tai Solarin University of Education, Ijebu-Ode, which is situated in the low rainfall area of Ogun State, Nigeria The location is 7°21' N and 3° 45' S at an altitude of between 200m and 300m above sea level. The mean temperature is 25-29 °C with an average rainfall of about 1250mm. The surrounding of the sheep house was sprayed with herbicides while the inside of the pen was fumigated at 3 days interval before the arrival of the sheep. The feed and water troughs were washed thoroughly to get rid of any pathogens present.

**Free choice feeding trial (Acceptability)**

Eight adult female WAD sheep were used in a cafeteria feed preference study, which lasted for 2 weeks including a week for the animals adaptation to the forage. The average pre-experimental weight of the sheep was 10.13 kg and they were between 12 and 18 months old. They were housed in a group pen within the small ruminant house constructed to achieve good ventilation. The floor of the house was made of concrete which was covered with wood shavings for easy cleaning of the faeces and urine. Different forms of *Altemanthera brasiliiana* (fresh, wilted and sun-cured) was introduced on a free choice basis to the animals in three different wooden feeders, each measuring 90 x 35 x 50 cm so that all the animals had free access to each of the forage forms in the troughs. The positioning of the forages in the pen was changed daily to prevent the adaptation of animals to a particular type of forage. The consumption was monitored for 8 hrs per day and the quantity consumed was recorded. Dried samples (about 200 g) of each of the differently processed AB taken during the 14-day acceptability trial were used to determine the Dry matter content. Forage preference was determined from the coefficient of preference (COP) values, calculated from the ratio between the intakes of each individual forage, divided by the average intake all forms of AB (Mako and Babayemi, 2008). On this basis, a forage

was taken to be relatively preferred if the COP was greater than unity.

**Statistical analysis**

The experiment was arranged in completely randomized design (CRD). The data collected were subjected to one way Analysis of variance procedure (ANOVA) of SAS (1999). Significant means were separated using the Duncan multiple range test of the same package.

**RESULTS**

The proximate compositions of *Altemanthera brasiliiana* during the four sub-seasons of the year are shown in Table 1. It was observed that seasonal variation had no significant effects on the proximate compositions of *Altemanthera brasiliiana* parts. The dry matter ranged from 20.10 to 20.49% in late rainy and late dry seasons. The same trend was observed for the neutral detergent fibre (NDF) which ranged from 15.49 to 19.47%. The crude protein ranged from 20.35 to 25.42% in the late dry and late rain respectively. The mineral content of the species is presented in Table 2. No significant difference was observed among seasons for minerals tested, expect manganese which were 49.98ppm and 62.41 ppm during the late rainy and late dry respectively.

**Table 1:** Dry matter (%) and proximate compositions (%) of *Altemanthera brasiliiana* harvested during the four sub seasons of

Parameters	Season				SEM
	Early rainy	Late rainy	Early dry	Late dry	
Dry matter	20.13	20.10	20.25	20.49	1.44
Crude protein	24.14	25.42	21.04	20.35	1.42
Crude fibre	4.00	3.78	5.00	4.83	0.53
Ether extract	3.89	3.92	3.33	3.01	0.44
Ash	8.32	8.39	6.15	5.98	0.25
Neutral detergent fibre	16.79	15.49	19.13	19.47	1.43
Acid detergent fibre	6.89	6.49	7.94	8.86	1.03
Acid detergent lignin	4.32	3.89	4.89	5.43	1.02

SEM= Standard error of mean

**Table 2:** Mineral contents of *Altemanthera brasiliana* harvested during the four sub seasons of the year

Minerals	Seasons				SEM
	Early rainy	Late rainy	Early dry	Late dry	
Calcium (%)	0.61	0.57	0.75	0.78	0.05
Magnesium (%)	0.25	0.23	0.28	0.32	0.03
Potassium (ppm)	0.13	0.12	0.16	0.17	0.02
Phosphorus (ppm)	15.34	10.69	19.64	22.37	5.12
Sodium (ppm)	6.57	5.99	7.98	8.55	1.02
Manganese (ppm)	50.22 <sup>c</sup>	49.98 <sup>c</sup>	59.96 <sup>b</sup>	62.41 <sup>a</sup>	0.10
Iron (ppm)	38.75	37.44	41.18	42.64	1.23
Zinc (ppm)	16.11	15.87	16.59	17.39	1.13
Copper (ppm)	2.93	2.88	3.67	4.07	1.02
Lead (ppm)	0.003			0.004	0.01
		0.002	0.003		

Means along the same row with different super scripts are significantly ( $p < 0.05$ ) different

SEM= Standard error of mean; ppm= parts per million

The Dry matter and proximate composition of different forms of *Altemanthera brasiliana*, are presented in Table 3. Dry matter, crude protein, ash and neutral detergent fibre differed significantly. The dry matter ranged from 21.56 to 58.78 % in fresh and Sun-cured respectively, NDF followed the same trend with the value ranging from 16.83 to 21.42 % depending on the form. The crude protein was 14.78, 18.35 and 23.89% for sun-cured, wilted and fresh *Altemanthera brasiliana* samples respectively. The result of the ANOVA revealed significant difference in each proximate composition for the three forms of *Altemanthera brasiliana* investigated (Table 3)

**Table 3:** Dry matter (%) and proximate composition (%) of different forms of *Altemanthera brasiliana*

Parameters	Forms			SEM
	Fresh	Wilted	Sun-cured	
Dry matter	21.56 <sup>c</sup>	41.32 <sup>b</sup>	58.78 <sup>a</sup>	0.53
Crude protein	23.89 <sup>a</sup>	18.35 <sup>b</sup>	14.78 <sup>c</sup>	0.05
Crude fibre	5.34 <sup>c</sup>	6.31 <sup>b</sup>	8.01 <sup>a</sup>	0.03
Ether extract	3.93	3.23	3.01	1.02
Ash	9.01 <sup>a</sup>	6.15 <sup>b</sup>	5.13 <sup>c</sup>	0.05
Neutral detergent fibre	16.83 <sup>c</sup>	19.45 <sup>b</sup>	21.42 <sup>a</sup>	0.13
Acid detergent fibre	7.01	7.36	8.01	1.03
Acid detergent lignin	3.89	4.32	5.63	1.03

Means along the same row with different super scripts are significantly ( $p < 0.05$ ) different; SEM= Standard error of mean

The coefficient of preference is presented in Table 4. The result revealed that all the different forms of the plant were acceptable to the animals. However, the wilted was the most preferred by the animals.

**Table 4:** Mean of daily intake of different forms of *Altemanthera brasiliana* and the coefficient of preference by WAD sheep

Forage forms	Mean daily (kg/DM) consumption by all eight animals	Coefficient of preference
Fresh	1.23	1.05
Wilted	2.26	1.89
Sun-cured	1.40	1.35

## DISCUSSION

Analyses of samples of *Altemanthera brasiliana* harvested during the different seasons of the year revealed that seasonal variation had no effect on the proximate composition of the species, which is considered to be an advantage for nourishment of animal. It is an indication that the forage could be harvested any time of the year to feed animals and the nutrients available to the animals will be approximately the same. There is indication that the proximate composition of this forage harvested during the four sub seasons considered in this study are lower than those of some conventional forages (Babayemi *et al* 2006). However, the proximate composition of *Altemanthera brasiliana* could be improved upon by wilting or sun-curing (Mako and Babayemi 2008). It was observed in this study that wilting and sun-curing improved the proximate composition of the plant significantly (Table 3). The crude protein (CP) of *Altemanthera brasiliana* is higher than those of some conventional forage, for example, Ajayi *et al.* (2005) reported a value of 7% CP for *Panicum maximum*. However, CP of *Altemanthera brasiliana* in this study agrees with the findings of Bamikole *et al* (2003) who reported CP range of 10 – 37 % for most tropical forages and browse plant. The CP content of this plant is higher than the recommended 8% value for ruminants (Minson 1990). Intake is depressed when taken at below recommended level, inferring that the plant will adequately supply the protein requirement of ruminants. The fibre fractions are lower than the values recorded for some forages, like the DM, wilting or Sun-curing will improve this.

The effect of season on the mineral content was not significant, which is an indication that the plant will supply the mineral requirement of animals throughout the year. The level of these mineral tested for the species in this study is within the range recommended for grazing livestock (NRC 2001). The values obtained in this study agrees with the (0.78 % for calcium, 21.35ppm for phosphorus) of Lizama *et al.* (1989)

The coefficient of preference (COP) by the sheep showed that all the different forms of *Altemanthera brasiliana* were acceptable to the animals, which is based on the fact that as the COP for all the forages in this study were greater than one (Mako and Babayemi, 2008). A number of factors may influence acceptability of feed by ruminants. Provenza and Cinocotta (1994) reported that plant physical structure and chemical composition are the most vital factors that influence preference for feed by animals. It can then be inferred that the high CP content of the wilted form of *Altemanthera brasiliana* made it to be most preferred by the

animals than the other forms, while the low DM content of the fresh plant made it to be the least accepted.

## CONCLUSION

The nutrient and mineral content revealed that *Altemanthera brasiliiana* has potential as forage for ruminants especially in the dry season. However, wilting improved the CP and DM of the plant and coefficient of preference showed that the wilted plant was most preferred

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