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COAST
JOURNAL OF THE SCHOOL OF SCIENCE
Volume 5, Issue 1. May, 2023 ISSN: 2714-3716
Coast, J. Sch. Sci. 5 (1): 835 - 849

FORAGE NUTRITIONAL PROPERTIES OF FOUR ACCESSIONS OF *Andropogon gayanus-Andropogon tectorum* IN SOUTHWESTERN NIGERIA

OJO, F. M.

Department of Biological Sciences (Botany Programme), Olusegun Agagu University of Science and Technology, Okitipupa. Ondo State, Nigeria.
Corresponding Author's Email: fm.ojo@oaustech.edu.ng
https://doi.org/10.61281/coastjss.v5i1.2

Abstract

Accessions of *Andropogon gayanus-Andropogon tectorum* collected from Southwestern Nigeria were evaluated for theirforage nutritional properties and potentials as fodder using standard procedures. Field trips for plant collection covered the agro-ecological zones of the following states in Nigeria: Ekiti, Ogun, Ondo, Osun and Oyo and the parts used were leaves and young stems. The proximate analysis revealed that moisture contents were moderate in all plant parts used (45.56%-71.46%) and the highest were recorded in the stem of *A. gayanus*. The percentage fat and nitrogen contents were low in all the accessions studied (0.20-0.38%) and (0.60-0.90%) respectively. The lowest value of crude fibre, ash and dry matter contents were recorded in the leaves and stems of *A. gayanus*. The lowest and the highest values of Lignin contents and carbohydrate contents were recorded in the leaves and stems of *A. gayanus*. *A. gayanus* had the lowest source of protein (3.75-3.78%). The concentrations of these mineral elements are within recommended range for animal feeds except for phosphorous. The study revealed the species (*A. gayanus* and *A. tectorum*) are good sources of proteins and carbohydrates, calcium, magnesium, potassium, sodium, manganese, iron, copper and zinc and are high enough to meet the requirements of animals; sheep and most especially cattle (for beef and dairy). . The presence of these substances in good quantities indicates the potentials of the examined Andropogon species as good fodders.

Keywords: *Andropogon gayanus, Andropogon tectorum*, mineral compositions, proximate.

Introduction

The genus *Andropogon* Linn., is a fairly large genus of the grass family, Poaceae, belonging to the tribe Andropogoneae (Olorode 1984; Hutchinson and Dalziel 1972). *Andropogon* is a pantropical genus of grasses of about 29 species almost confined to the tropical and warm temperate regions of the world, frequently forming an important part of the savanna vegetation in the tropics. The genus is composed of annual and perennial species frequently with tall culms, and leaf blades which can be linear to lanceolate or ovate.

The spikelets occur in pairs at each node of the raceme, each pair consisting of a pedicellate and a sessile spikelet. The sessile spikelet is bisexual while the pedicellate is unisexual male (Hutchinson and Dalziel, 1972). *Andropogon* is represented by about 14 species in Nigeria (Lowe, 1989) although Stanfield (1970) reported about 12 species. They are articulated in such a way that at maturity, the spikelets, pedicel and internodes all break apart leaving no central inflorescence stalk. The sessile spikelet bears a prominent awn which is flexed at an angle to the vertical axis of the glumes. A distinct colour difference exists between the two arms of the awn (Clayton, 1969; Stanfield, 1970).

Andropogon gayanus Kunth is a tall, tufted perennial grass that grows taller than 3 m. It has various tillers and abundant foliage especially during the rainy season (Chlleda and Crowder, 1982). Itforms a significant part of the vegetation of many savanna areas throughout Africa south of the Sahara, including South Africa. It is a polymorphic species. In Nigeria, four main varieties were recognized (Clayton, 1962). These are: var. *gayanus* (var. *genuinus*) Hack; var. *bisquamulatus* (Hochst) Hack var. *squamulatus* (Hochst) Stapf and var. *tridentatus.* Pagot, (1993) considered var. *tridentatus* as split from var*. bisquamulatus* thus recognizing only three varieties. *A. gayanus* is widespread and abundant in the Northern and Southern Guinea Savanna as well as in the drier areas of the derived savanna whereas *A. tectorum* occupies vast areas in the derived savanna, preferring moderate shade (Stanfield, 1970). However, certain areas in the derived savanna support the growth of both species equally well (Okoli and Olorode, 1983). *Andropogon gayanus* is propagated by seeds, which are broadcasted or planted in rows and vegetatively by splitting of the tufts. It is relatively free of major pests and diseases and is resistant to grazing and burning. This makes it a useful grass for supporting a large number of ruminant animals in Northern Nigeria. It is also one of the high-yielding grasses in West Africa (Pagot, 1993). The economic importance of *Andropogon gayanus* for livestock grazing is that it is very palatable when young and serves as basic materials for woven houses. *Andropogon gayanus* is a highly-productive grass, which increases fuel loads, and produces intense, late dry season fires which seriously damage native woody species; it is also useful as forage in permanent pastures grazed by ruminants. The stems are used for thatching and, when flattened, for weaving coarse grass mats as well as sometimes being planted for erosion control and soil restoration.

Andropogon tectorum Schum. & Thonn. is a perennial grass; caespitose. Culms can be 200 – 300 cm long without nodal roots or with prop roots. Ligules are eciliate membrane or a ciliolate membrane, 1–2 mm long. Leaf blade base tapers to the midrib and bears false petiole. Leaf-blades are lanceolate; 30 – 45 cm long; 10 – 25 mm wide; flaccid; light-green, apex is acuminate.

Andropogon gayanus and *A. tectorum* are important natural fodder grasses in Nigeria. They are also useful in crop rotation, thatching and mat-making (Bowden, 1963) and offer an interesting opportunity for ecological, cytogenetic and evolutionary studies.

Besides, the last study of the complex in Nigeria was about two decades ago, hence a re-assessment of these two agriculturally-important grasses is overdue. The study was aimed at elucidating the nutritional potentials of these two species as fodder.

Materials and Methods

Germplasm Survey, Collection and Field Culture

Field trips for plant collections covered agro-ecological zones of the following states: Osun, Ondo, Ogun, Oyo and Ekiti (Fig. 1.). Whole plants of *Andropogon gayanus* and *Andropogon tectorum* were collected from different locations in Southwestern, Nigeria. Garden populations were raised from the vegetative parts of some accessions and they were also maintained in the Botanical Garden of the Obafemi Awolowo University, Ile- Ife, Osun State. The accessions (Plates 1 and 2) were nurtured to maturity and used for nutritional studies

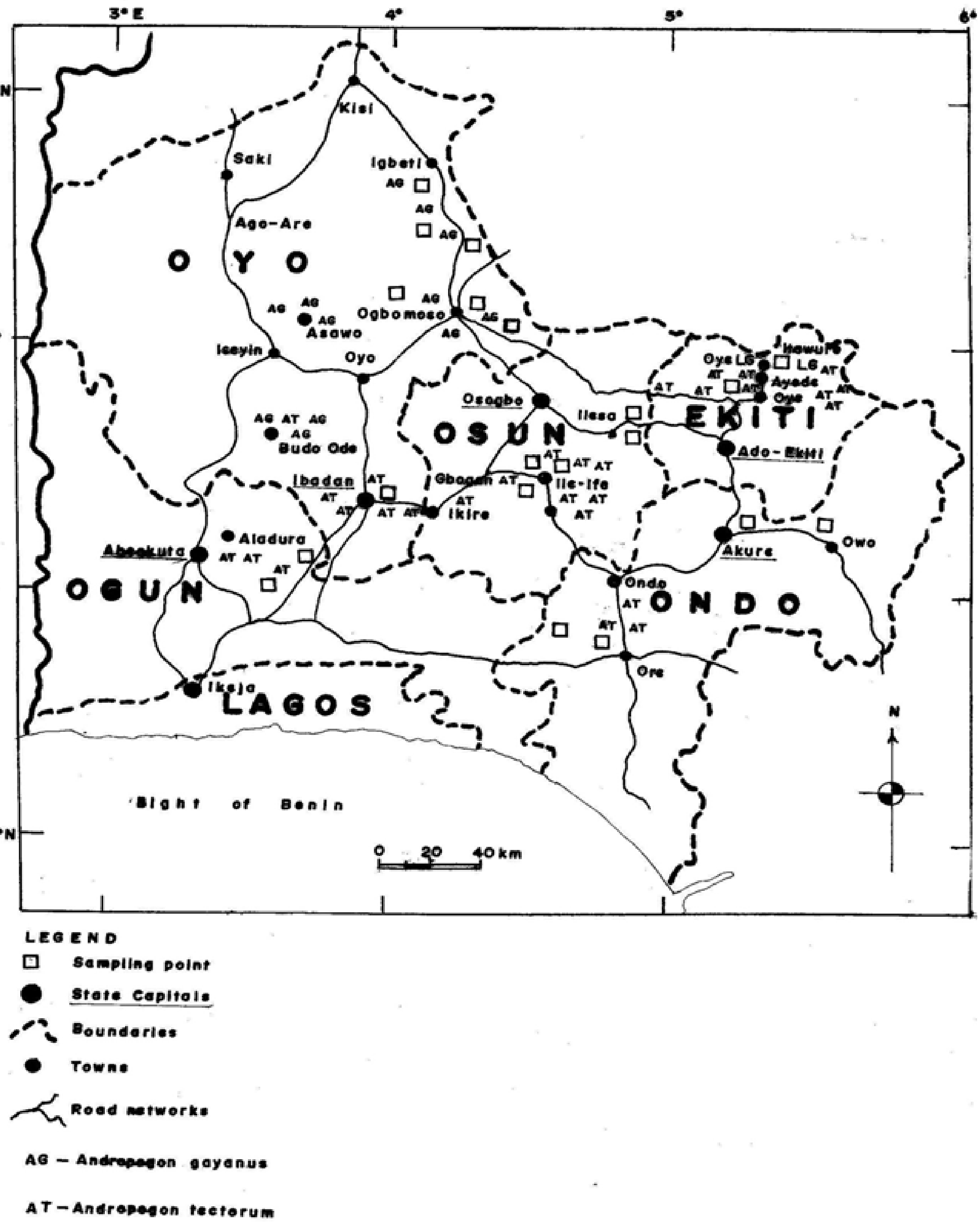

FIG 1: Map showing Collection sites

Plate 1: Morphological features of *Andropogon gayanus*

Key: A- Plant form and adaptation, B- Internode, C- Hairy leaf sheath, D - Raceme pairs, E- Seeds, F- Spikelet

Plate 2: Morphological Features of *Andropogon tectorum*

A- Plant form and adaptation (Insect- Rooting at the node), B- Flowering Scape, C- Spikelet, D- The leaf showing sheath, keel and ligule, lg – lower glume

Forage studies

This was done by excising the same number of tillers from the stock of all accessions on the same day. The forage yield attributes used are as mentioned under the morphological characterization subsection. Moisture content, crude fat, protein, carbohydrates, dry matter, ash, lignin and crude fibres of leaves and young stems were determined on representatives

Mineral Elements Analysis

Hydrochloric acid (6NHCL) 587ml of conc. HCl was added to 400 ml of distilled water and was made up to 1 litre with distilled water. The digestion mixture was made up to 500 ml of perchloric acid ($CHClO_4$) was added to 1 litre of nitric acid and then mixed together. The leaves, unripe matured fruits and young stems of 0.5g of each species were transferred into a 75 ml digestion tube. A digestion mixture of 5 ml was added, swirled and placed in a fume cupboard. Digestion was done for two hours at 150 °C. The mixtures were removed from the digester and cooled for 10 minutes. Then 3 ml of 6HCl was added to each tube. These mixtures were digested for another one and a half hours and were subsequently removed from the digester, cooled and 30 ml of distilled water was added to each tube. Each tube was stirred vigorously using the vortex mixer.

The digested samples from the leaves and young stems of each species were analyzed for the following materials: Mg, K, Na, Mn, Cu, Zn, Ca, P and Fe using the atomic absorption spectrophotometer (Analyst 400, S/N 201S10114102 Autosampler Model) at the Central Laboratory, Obafemi Awolowo University, Ile-Ife.

Results

Proximate Analysis

The Proximate analysis of the leaves and stems of representative accessions are presented in Tables 1 and 2 and Figures 2 and 3. The analysis shows that the moisture contents were moderate in all the plant parts used (45.58%-71.24%). The highest moisture contents were recorded in the stem of *A. gayanus*. The percentage fat content and nitrogen contents were low in all the accessions studied (0.21-0.36%) and (0.60-0.90%) respectively. The lowest value of crude fibre content was recorded in the leaves and stems of *A. gayanus*. The lowest value of dry matter content was recorded in the stem of *A. gayanus*. The lowest value of ash content was recorded in the stem of *A. gayanus*. The lowest and the highest values of Lignin contents were recorded in the leaves and stems of *A. gayanus*. The stem of AT2 was the lowest in the source of protein (2.25%). The carbohydrate contents ranged between 20.11% and 41.99 %. The lowest and the highest values were recorded in the leaves and stems of AG1 (Table 1). Table 2 shows the mean and standard errors of the representative accessions studied with the Duncan multiple Range test values showing significance in all plant parts analyzed.

Analysis of Mineral Elements

The mineral element compositions in leaves and stems of accessions studied are presented in Tables 3 and 4 and Figures 4 and 5. The proportions of Manganese, Copper, Zinc and Iron are not well shown on the graph because the values are very low. However, Calcium, Potassium and Sodium were found to be more in both leaves and stems of the accessions though with variations. The lowest content found in the leaf was documented in AG1 as 74.96 mg/l and that of young stems was observed in AT1 as 13.55 mg/l. Both leaves and stems of AT2 had the highest value of Calcium, 164.36 and 169.10 mg/l respectively while the lowest value (30.22 mg/l) was recorded in the leaves of AT1. The Sodium content in the leaves and stems of the accessions ranged between 2.90 mg/l and 40.23 mg/l. The lowest was recorded in the leaf of AT1 with a value of 2.90 mg/l and the highest was observed in the stem of AT2 with a value of 40.23 mg/l. The Sodium content in the leaves and stems of the accessions ranged between 2.90 mg/l and 40.23 mg/l. The lowest was recorded in the leaf of AT1 with a value of 2.90 mg/l and the highest was observed in the stem of AT2 with a value of 40.23 mg/l. Magnesium in the leaves of the accessions studied ranged between 5.96-40.40mg/l (Tables 3 and 4), the least was found in the AT1. The highest value was recorded in the stems of AT2. Manganese content was between 1.22mg/l in the stems of AG1 and 6.31mg/l in the leaves of AT1. The least value of 1.63mg/l was recorded in the stems of AG2 accessions and the highest value of 13.53mg/l was recorded in leaves of AG2. Phosphorus content in the leaves and stems of the accessions ranged between 0.83 mg/l and 26.43mg/l. The lowest was observed in the stems of AT2 with value 0.83 mg/l and the highest was observed in the stems of AG1with value 26.43mg/l. Copper was observed in the leaves and stems of the accessions studied (0.12 – 0.54mg/l). The highest copper content was recorded in the leaf of accession of AG2. The concentration of zinc estimated in the accessions ranged between 0.7– 3.93 mg/l, 0.63– 1.49 mg/l in the leaves and stems respectively, In the leaves, the lowest value was recorded in the leaf of AT2and the highest value was 3.93 mg/l was recorded in the leaves of AT1 but in the young stems, the highest was recorded in AT2.

Discussion

Table 1: Means and Standard errors of Nutritive contents in the Leaves and Stems of Accessions Studied.

PARTS	ACCN	PROTEIN (%)	MOISTURE (%)	FAT (%)	ASH (%)	CRUDE FIBRE (%)	CHO (%)	DRY MATTER (%)	NITROGEN (%)	LIGNIN (%)
LEAF	AG1	4.90±0.01	60.39±0.05	0.24±0.01	2.62±0.02	3.12±0.01	28.81±0.02	39.61±0.05	0.78±0.00	12.12±0.04
LEAF	AG2	5.60±0.01	45.58±0.01	0.32±0.01	3.20±0.01	3.27±0.01	41.99±0.03	54.42±0.05	0.90±0.00	9.78±0.03
LEAF	AT1	5.28±0.01	59.30±0.01	0.27±0.01	2.64±0.01	3.16±0.01	29.35±0.03	40.64±0.01	0.85±0.00	14.47±0.19
LEAF	AT2	5.54±0.00	58.48±0.01	0.28±0.01	2.78±0.01	3.24±0.01	29.67±0.02	41.53±0.02	0.89±0.00	14.33±0.03
STEM	AG1	3.76±0.01	71.24±0.18	0.21±0.01	1.80±0.01	2.86±0.01	20.11±0.19	28.76±0.18	0.60±0.00	15.26±0.10
STEM	AG2	4.30±0.01	58.05±0.03	0.36±0.01	2.80±0.01	3.23±0.02	31.26±0.02	41.95±0.03	0.69±0.00	16.42±0.01
STEM	AT1	4.00±0.01	64.46±0.01	0.25±0.01	2.05±0.03	2.88±0.01	26.33±0.05	35.54±0.01	0.64±0.00	13.38±0.01
STEM	AT2	2.25±0.02	65.26±0.03	0.25±0.01	1.90±0.01	2.92±0.01	25.41±0.04	34.74±0.03	0.68±0.00	15.26±0.01

Accn. – Accessions, **AG** – *Andropogon gayanus*, **AT** – *Andropogon tectorum*, %- Percentage

Table 2: Means and Standard errors of Nutritive contents in the Leaves and Stems of Accessions Studied with Duncan Multiple Range

	Test Values								
ACCN	PROTEIN (%)	MOISTURE (%)	FAT (%)	ASH (%)	CRUDE FIBRE (%)	CHO (%)	DRY MATTER (%)	NITROGEN (%)	LIGNIN (%)
AG1	4.33 ± 0.25^{d}	65.82 ± 2.43^{a}	0.22 ± 0.01^{c}	2.21 ± 0.18^{c}	2.99 ± 0.06^{d}	24.46 ± 1.95^{d}	34.18 ± 0.69^{c}	0.69 ± 0.04^{d}	13.69 ± 0.70^{c}
AG2	4.97 ± 0.30^{a}	51.82 ± 2.79^{c}	0.34 ± 0.01^{a}	3.00 ± 0.09^{a}	3.25 ± 0.01^{a}	36.62 ± 2.40^{a}	48.19 ± 0.80^{a}	0.80 ± 0.05^{a}	13.10 ± 1.48^{d}
AT1	4.65 ± 0.28^{c}	61.88 ± 1.15^{b}	0.26 ± 0.00^{b}	2.34 ± 0.13^{b}	3.02 ± 0.06^{c}	27.84 ± 0.68^{b}	38.09 ± 0.74^{b}	0.74 ± 0.05^{c}	13.91 ± 0.26^{b}
AT2	4.90 ± 0.29^{b}	61.87 ± 1.52^{b}	0.27 ± 0.01^{b}	2.35 ± 0.20^{b}	3.08 ± 0.07^{b}	27.54 ± 0.95^{c}	38.14 ± 0.78^{b}	0.78 ± 0.05^{b}	15.26 ± 0.41^{a}

Accn. – Accessions, **AG** – *Andropogon gayanus*, **AT** – *Andropogon tectorum*, %- Percentage

*Means with the same letter along columns are not significantly different at $P \leq 0.05$

Table 3: Means of Mineral Elements Composition in the Leaves and Stems of Accessions Studied in Mg/l with Duncan Multiple Range Test Values.

PARTS	Accn.	Calcium	Magnesium	Potassium	Sodium	Manganese	Iron	Phosphorus	Copper	Zinc
Leaf	AG1	74.96±0.02d	22.77±0.03c	191.51±0.01b	28.94±0.01b	2.03±0.00b	7.63±0.00b	5.68±0.00c	0.24±0.01b	0.90±0.01b
Leaf	AG2	123.80±0.03b	39.75±0.38a	251.53±0.02b	231.45±0.03a	2.31±0.00b	13.5±0.00a	16.19±0.00a	0.54±0.01a	0.84±0.00c
Leaf	AT1	78.53±0.02c	5.96±0.00d	30.24±0.01d	2.90±0.00d	6.31±0.00a	2.30±0.00d	1.86±0.00d	0.12±0.00c	3.93±0.00a
Leaf	AT2	164.36±0.02a	24.50±0.00b	285.52±0.01a	18.06±0.01c	1.77±0.00c	3.41±0.00c	11.07±0.00b	0.20±0.00b	0.79±0.05d
Stem	AG1	77.30±0.00c	40.20±0.00a	76.11±0.02d	22.93±0.01d	1.85±0.00c	1.63±0.00c	26.43±0.01a	0.22±0.00a	1.13±0.01c
Stem	AG2	126.03±0.00b	22.46±0.00c	226.60±0.03c	31.07±0.01c	1.22±0.00d	3.79±0.00b	8.58±0.01b	0.14±0.00c	0.63±0.00d
Stem	AT1	13.56±0.00d	37.19±0.00b	320.51±0.01b	38.11±0.00b	2.18±0.00b	5.08±0.00a	1.57±0.01c	0.16±0.01b	1.18±0.00b
Stem	AT2	169.1±0.00a	40.40±0.00a	364.60±0.02a	40.22±0.01a	2.53±0.00a	5.10±0.00a	0.83±0.00d	0.21±0.01a	1.49±0.05a

*Means with the same letter along columns are not significantly different at P ≤ 0.05)

Accn – Accession, AG – *Andropogon gayanus,* AT- *Andropogon tectorum.*

Table 4: Mean of Mineral Contents in the Leaves and Stems of Accessions Studied in Percentage (%) with Duncan Multiple Range Test Values

PARTS	Accn.	Calcium	Magnesium	Potassium	Sodium	Manganese	Iron	Phosphorus	Copper	Zinc
Leaf	AG1	0.75±0.02d	0.23±0.03c	1.92±0.01b	0.29±0.01b	0.02±0.00b	0.08±0.00b	0.06±0.00c	0.002±0.01b	0.009±0.01b
Leaf	AG2	1.24±0.03b	0.40±0.38a	2.52±0.02b	2.31±0.03a	0.02±0.00b	0.14±0.00a	0.16±0.00a	0.005±0.01a	0.008±0.00c
Leaf	AT1	0.79±0.02c	0.06±0.00d	0.30±0.01d	0.03±0.00d	0.06±0.00a	0.02±0.00d	0.02±0.00d	0.001±0.00c	0.039±0.00a
Leaf	AT2	1.64±0.02a	0.25±0.00b	2.85±0.01a	0.18±0.01c	0.01±0.00c	0.03±0.00c	0.11±0.00b	0.002±0.00b	0.007±0.05d
Stem	AG1	0.77±0.00c	0.40±0.03a	0.76±0.02d	0.23±0.01d	0.018±0.00c	0.02±0.00c	0.26±0.016a	0.002±0.00a	0.011±0.01c
Stem	AG2	1.26±0.00b	0.23±0.00c	2.27±0.03c	0.31±0.01d	0.01±0.00d	0.04±0.00b	0.09±0.01b	0.001±0.00b	0.006±0.00d
Stem	AT1	0.14±0.00d	0.37±0.00b	3.21±0.01b	0.38±0.00b	0.02±0.00b	0.05±0.00a	0.02±0.01c	0.001±0.01b	0.012±0.00b
Stem	AT2	1.69±0.00a	0.40±0.00a	3.65±0.01a	0.40±0.01a	0.03±0.00a	0.05±0.00a	0.01±0.00d	0.002±0.01a	0.015±0.05a

*Means with the same letter along columns are not significantly different at P ≤ 0.05)

Accn – Accession, AG – *Andropogon gayanus,* AT- *Andropogon tectorum.*

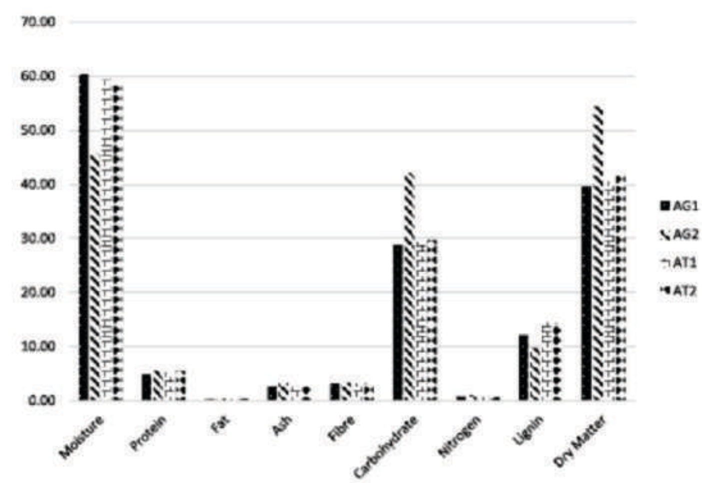

Figure 2: Mean values of nutritive contents of leaves of*Andropogon gayuanus-Andropogon tectorum* species

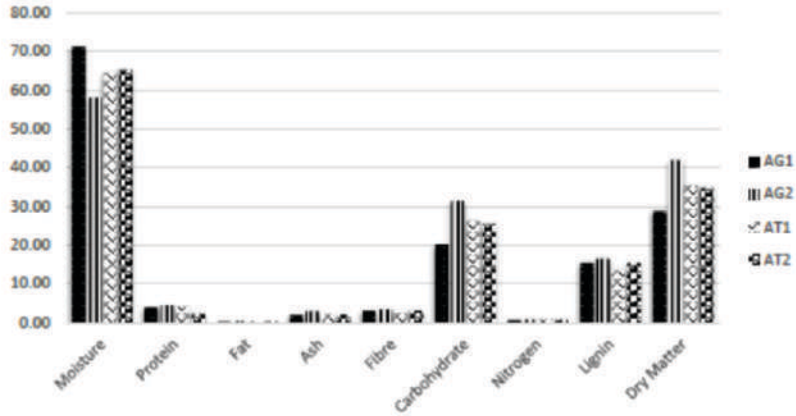

Figure 3: Mean values of nutritive contents of stem of *Andropogon gayuanus-Andropogon tectorum* species

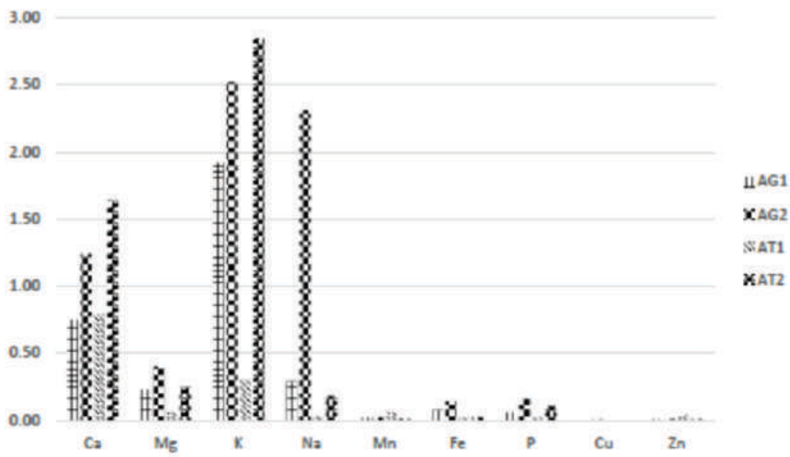

Figure 4: Mean values of mineral compositions of leaves of *Andropogon gayuanus-Andropogon tectorum* species

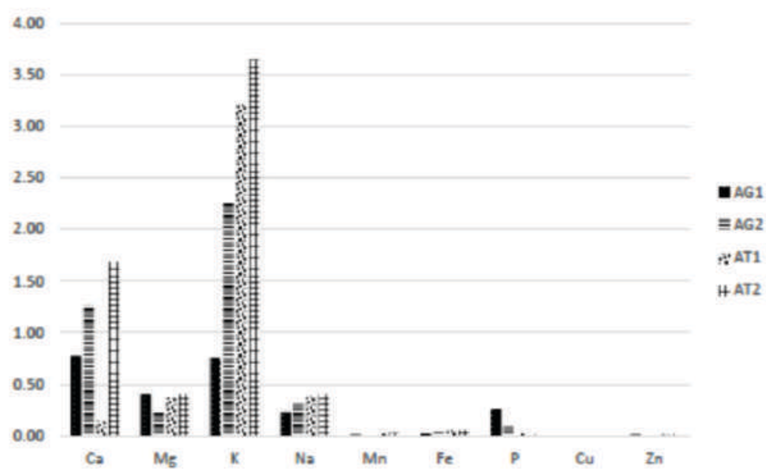

Figure 5: Mean values of mineral compositions of stem of*Andropogon gayuanus-Andropogon tectorum* species
AG - *Andropogon gayuanus,* **AT-** *Andropogon tectorum*

When different genotypes are grown within a species in a similar environment and under standardized control, their chemical composition and feeding value estimates often reveal significant differences (Reid *et al.*, 1973; Klock *et al.*, 1975).

The maximum crude protein content of grasses occurs at the beginning of the wet season. During this period, leaf production is greater than stem production and thus, the leaf contains a higher percentage of crude protein than the stem (Haggar, 1970).

The crude protein and carbohydrate contents in the accessions studied ranged from 3.75 – 5.78% for proteins and 19.92 – 42.02% (Tables 1 and 2) and the maximum value was recorded in the leaves. From these values, it is obvious that all the accessions of *A gayanus* and *A. tectorum* studied met the protein and carbohydrate demands of the animals most especially cattle since the crude protein and carbohydrate values are within the recommended values of 5% and 20% estimated by Miller *et al.* (1963) as being necessary to maintain the body weight of cattle. Grass proteins are particularly rich, and have high biological value for growth, replacement of old, damaged or worn-out cells/tissues, and formation of milk. They are of great value to growing animals and lactating ruminants. This is congruent with the report of Chesworth (1992) and Payne (1994). When analytically compared with some other important Nigerian forage grasses, Oyenuga (1957) also concluded that *A. gayanus* is a very good source of protein and carbohydrates and ranked the highest in palatability.

The dry matter contents in this study range from 28.54 – 54.44% (Tables 1 and 2). The values obtained is in agreement with the findings of Mecha and Adegbola (1980) (14.48 - 55.22%) and Oji and Isilebo (2000) (26.54 – 47.69%) and Bello (2003) (8.32 - 40.0%). However, they differed from those reported by Oduozo and Adegbola (1992) (90.50- 92.70%) and Okoli *et al.* (2001; 2003) (85.71- 88.73%; 91.40 -93.60%). The difference in the dry matter content of the grasses with the earlier results could be due to the processing methods adopted, period of establishment (wet or dry season) or harvesting (Ajayi, 2012).

The percentage of ash contents in the accessions studied range from 1.78 – 3.22%. Ash content reflects the mineral composition of the forage plants which is an indication of the intrinsic ability of the plants to supply minerals to farm animals. Lignin contents are higher in stems, 14.70% than leaves, 9.77% of the accession studied, it plays a vital role in conducting water in plant stems. The fibre contents range from 2.84 – 3.28%, fibre is part of cell wall material which consists mainly of cellulose, hemicellulose and lignin, fibre is important component in ruminant diet; to maintain normal ruminal fermentation and may be to prevent post-calving diseases (Mc Donald *et al.*, 2002). Ademosun (1970), Olubajo *et al.,* 1974 and Karue (1975) have reported increase in fibre and lignin with increasing maturity.

Adams (1974), Church (1980), Moniello *et al.* (2005) and NRC (2016) provided tables on mineral requirements of beef, cattle, recommended nutrient contents of rations for dairy cattle and mineral requirements of sheep (Appendix I). According to these authors, Calcium, Magnesium, Potassium, Sodium, Manganese, Iron, Copper and Zinc concentrations are within the recommended range in all the accessions of *A. gayanus and A. tectorum* studied but phosphorus was below the recommended range (Tables 1, 2 and Appendix I). Calcium concentration was low in AT1 collected in a ruderal location with dwarf morphotypes propagating from crevices along OAUTHC road (N 07° 30.870` E 04° 33.065), Ile-Ife. This low value could be attributed to the restricted environment of growth and soil type. The low Phosphorus content levels in grasses are generally credited to the low content of this element in most soils (Milligan and Sule, 1982). The low values recorded in Nitrogen and Phosphorus concentrations was attributed to the initial rapid vegetative growth of plants which resulted in the dilution of the inorganic nutrient resources with increased dry matter (i.e., cell wall materials being accumulated more rapidly than cell contents) and later translocate nutrients out of the above-ground biomass (Egunjobi, 1974; Isichei, 1979). The highest values of Calcium and Potassium contents recorded in Kiwani, AG2 collaborated to its large biomass.

The level of concentration of the chemical elements in a plant change as the season progresses from wet season to dry season. Muoghalu (1984) reported that some plant tissues showed a seasonal trend in concentrations of nitrogen, phosphorus and potassium and that peak concentrations of these elements in the above-ground biomass were observed in May and lower values prevailed as the season progressed.

According to Milligan and Sule (1982), differences in crude protein content and mineral content of individual grass species are affected by the season of sampling, the plant part selected and inter-specific differences. *A. gayanus* is one of the most important natural range fodder grasses in Nigeria.

The variability in the nutrient content of fodder, trees and shrubs has been attributed to the state of hydration (fresh, wilted, dry) and drying procedure (Palmer and Schlink, 1992; Dzowela *et al.,* 1995), age of cutting, season and geographical location (Ajayi, 2012). Variations in values have been ascribed to soil type, age of the plant, season and geographical location (Smith, 1992; Norton, 1994; Nworgu and Ajayi, 2005). Oguntona (1998) ascribed wide variation in the values of the nutrient content of leafy vegetables to variations in the nutrient status of the soil on which the crops were grown, sample preparation procedure before analysis and analytical procedure which may vary in technique and quality.

Conclusion

The nutritive study revealed that these grass species are good sources of proteins and carbohydrates. They are high enough to meet the requirements of animals, most especially cattle. Based on the mineral requirements of beef cattle, dairy cattle and sheep, this study shows that *A. gayanus* and *A. tectorum* are good source of calcium, magnesium, potassium, sodium, manganese, iron, copper and zinc. The concentrations of these mineral nutrients are within the recommended range for animal feeds. The potentials of the complex as fodder was good.

Acknowledgement

The research was financially supported by Bill Dahl Graduate Student Research Grant Award (2019), Botanical Society of America, United States of America and Academic Staff Union of Universities (ASUU) Research Grant Award in support of Doctoral thesis for 2019/2020 Academic Session.

APPENDIX I

Mineral Requirements of Beef Cattle

Minerals	Growing and finishing steers and heifers	Pregnant cows	Breeding bulls and lactating cows
*Na%	0.06	0.06	0.06
*Ca%	0.018 – 1.04	0.18	0.18 – 0.44
*P%	0.18 – 0.70	0.18	0.18 – 0.39
*Mg%	0.04 – 0.10	-	-
*K%	0.60 – 0.80	-	-
**Fe%	0.002 – 0005	0.005	0.005
**Mn%	0.002	0.002	0.002
**Cu%	0.001	0.001	0.001
**Zn%	0.001 - 0.003	0.003	0.003

Recommended Nutrient Content of rations for Dairy Cattle

Minerals	Pregnant cows	Mature bulls	Growing heifers and bulls	Calf starter concentrate mix	Calf milk replacer
*Na%	0.10	0.10	0.10	0.10	0.10
*Ca%	0.37	0.24	0.40	0.60	0.70
*P%	0.26	0.18	0.26	0.42	0.50
*Mg%	0.16	0.16	0.16	0.07	0.07
*K%	0.80	0.80	0.80	0.80	0.80
***Fe%	2.22	1.25	2.22	2.22	2.30
***Mn%	0.44	0.44	0.44	0.44	0.44
***Cu%	0.13	0.08	0.13	0.19	0.25
***Zn%	0.28	0.18	0.28	0.44	0.52

Recommended Nutrient Content of rations for Dairy Cattle

Minerals	Requirements
*Na%	0.04 – 0.10
*Ca%	0.21 – 0.52
*P%	0.16 – 0.37
*Mg%	0.04 – 0.08
*K%	0.50
****Fe%	0.03 – 0.05
****Mn%	0.02 – 0.04
****Cu%	0.007 - 0.011
****Zn%	0.02 – 0.33

*Digestive Physiology and Nutrition of Ruminants, Church D. C. (1980).
**Nutrient Requirements of Beef Cattle, Eighth Edition (2016 NRC).
***Variability in Mineral and Trace Element Content of Dairy Cattle Feeds, Adams, R. S. (1974)
****Mineral requirements of dairy sheep, Moniello *et al.*, (2005).

KEYS: Na – Sodium, Ca – Calcium, P – Phosphorus, Mg – Magnesium, K – Potassium, Fe – Iron, Mn – Manganese, Cu – Copper, Zn – Zinc.

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