

Morpho Characterization and Nutritive Value of 11 Accessions of Urochloa (Syn Brachiaria) from Cameroon

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Abstract

Urochloa (Syn Brachiaria) grass has the potential to alleviate livestock feed shortage in Africa. The common Urochloa (Syn Brachiaria) cultivated for decades now in Cameroon is supposed to be ruziziensis. The main objective of this work is to make a morphological characterization of Urochloa (Syn Brachiaria) collected around the country and to determine whether there exist any differences or similarities for morphology and nutritional composition among them. 16 samples of Urochloa (Syn Brachiaria) seeds were sowed, and 6 weeks later, the seedlings were transplanted in another site for a morphological characterization experiment. 10 healthy and strong seedlings of each sample were planted in a 2.5 m × 0.5 m size plot in 2 replications. Row to row spacing was 0.5 m while plant to plant spacing was 0.25 m. 70 days after planting, data started to be collected. From the nursery, 11 samples from Cameroon performed well and with *U. decumbens var basilisk* were cut to 5 cm from soil level in 02 replications at 60 days of age and put in paper bags, then pre-dried in an oven for 05 days at 60°C. Then the 02 replications per sample were mixed and put together for nutritional analysis. The first PC component which explains 25.9% of the total variations, was strongly and positively associated with agro morphological character: days at 50% flowering. Accessions with higher values for F1 had long days to 50% flowering and great stem diameter. Accessions with higher values for F2 had less leaf abaxial and adaxial, less days to first flowering, great leaf sheath hairiness. For nutritive values, the results suggest that other studies taking account of stages of harvest should be conducted to evaluate Urochloa (Syn Brachiaria) from Cameroon digestibility.

Keywords

Morphocharacterisation, Nutritive Value, Cameroon, Urochloa

1. Introduction

In developing countries, animal production contributes significantly to the national economies. In sub-Saharan Africa for example, livestock represents 10% - 20% of the GDP and it is almost 50% - 80% of the agricultural GDPs. The demand for animal proteins is to double by 2030 due to population increase, urbanization and change in consumption habits [1]. In 30 years' time, more than 50% of animal products demand will be from developing countries¹. In Cameroon, 30% of the rural population depends on the livestock sector, which globally represents 16% of the country's GDP [2]. Ruminants suffer feed shortage each year especially during the dry season, leading to low productivity. Urochloa (Syn Brachiaria) grass has the potential to alleviate livestock feed shortage in Africa because it shows rapid re-growth under grazing and good persistence under heavy or frequent defoliation, it is mostly drought-tolerant and can withstand waterlogging stress, it also has high forage quality when fertilized and well managed. Also, Urochloa (Syn Brachiaria) is highly palatable to ruminants, maintains high ground cover until it "crashed" under prolonged and heavy grazing at a high stocking rate and once Brachiaria pasture is established, it can last for over 20 years and as such can play an important role in the sustainable creation of pastures for livestock feeding [3].

Urochloa (Syn Brachiaria) grass originates from central and east Africa [4]. The genus Urochloa (Syn Brachiaria) consists of more than 100 species [5], with 33 species having been reported in Kenya [6]; the genus represents the most important grass distributed throughout the tropics [6]. But the majority of research studies available on this grass are in Latin America, Australia and Asia. In Cameroon, research work on Urochloa (Brachiaria) started end 1950th, with the introduction of some commercial species such as Urochloa (Brachiaria) ruziziensis [7]. Taxonomically, the Bracharias are now accepted to belong to the genus Urochloa by the major taxonomic databases such as [8]. Despite the diversity of Urochloa spp. in Eastern and Central Africa, comparatively little information is available on their agro-morphological characteristics [9]. Also, very little is known about other indigenous species of that grass in Cameroon. Though it was reported that Cameroon has its own indigenous species of Urochloa (Syn Brachiaria) (*jubata* and *stigmatisata*) [2], and *brizantha* (Hochst.) Stapf in the Adamaoua Region [4]. The common Urochloa (Syn Brachiaria) cultivated for decades now in the country is supposed to be ruziziensis on which some researchers did nutritional and agronomic works; for example, there are publications on the level of fertilization for best productivity and nutritional values of the grass. Since the improvement of forage production depends on the availability of good seed quality, seed production that has been going along with forage production needs to be checked in order to determine the variety that produces seeds because farmers are interchanging planting materials. To date, no study has been done on Morpho characterization of Urochloa (Syn Brachiaria) produced yearly by farmers; also, there is no control on the seed crossing with local varieties.

¹Spore magazine issue No 174 -February-March 2015 Published by CTA (Technical Centre for Agricultural and Rural Cooperation).

So, no one can tell exactly what genotype of *Urochloa* (Syn *Brachiaria*) is cultivated in which part of the country, or what their nutritional characteristics are. The main objective of this work is to make a morphological characterization of *Urochloa* collected in all the country and to determine whether there exist any differences or similarities for nutritional composition among them.

2. Material and Method

2.1. Sample Sites Collection

Plant Establishment

Urochloa (Syn *Brachiaria*) seeds were brought to ILRI lab in September 2018 and were used for morphological characterization and nutritive value studies. 5000 grains per sample were sowed in two rows separated from each other by 10 cm on a nursery of 1.25 m × 5 m. Samples also were separated with 10 cm. So 16 samples of *Urochloa* (*Brachiaria*) seeds were sowed, and 6 weeks later the seedlings were transplanted to another site for morphological characterization experiment. From the 15 samples brought from Cameroon, 04 performed very bad and were removed from the experiment. From the nursery, the seedlings of the 11 samples were transplanted on a completely randomized block design plot with basilisk as control.

2.2. Data Collection

Morphological Characterization of the Samples

10 healthy and strong seedlings of each sample were planted in a 2.5 m × 0.5 m size plot in 2 replications on 19th December 2018. Row to row spacing was 0.5 m while plant to plant spacing was 0.25 m.

The border rows were planted with basilisk (B). The plot was watered in the afternoons; and the data collected were plant height, Leaf length, leaf width, ligule length, date at 50% and 75% flowering, stem diameter, inflorescence length, width ... Treatments or samples were labeled (t) sample 1 to 16; the ones lacking are those which were removed (**Figure 1**).



Figure 1. Measurements of flower width, length, raceme length and stem diameter.

70 days after planting, data started to be collected. And from each side of the rows, 2 plants were left. The plants from which data were collected on a row were average six per rows.

2.3. Nutritional Analysis

From the nursery, the 11 samples from Cameroon and *U. decumbens var basilisk* were cut to 5 cm from the soil level in 02 replications at 60 days of age and put in paper bags, and then pre dried in an oven for 05 days at 60°C. Then the 02 replications per sample were mixed and put together for nutritional analysis (proximate and *in vitro* digestibility at Nairobi University Nutrition Lab).

2.3.1. Proximate Analysis or Wende

Were done according to AOAC (2000). The samples in the lab were put in an oven at 105°C. Then they were removed and grind and sieved, then kept in a glass container. They were analyzed for crude protein, Ether extracts, crude fiber, Nitrogen free extract, total ash (Na, P).

2.3.2. In Vitro Analysis

For *in vitro* analysis, NDF, ADF, lignin and ash were determined using Van Soest method. Rumen fluid was collected from a fistulated Simmental bull with average weight of 1500 kg and transferred to thermal bottles previously heated at 39°C and taken immediately to the laboratory. Three milliliters of rumen fluid were added to the flasks containing samples and buffered culture medium. Finally, flasks were sealed with a silicone stopper and aluminum washers to avoid gases escaping. Triplicates of each sample were incubated and kept heated at 39°C. Flasks containing only inoculum and culture medium were used as a blank.

In the laboratory, the ruminal strained through four layers of cheesecloth, kept in a water bath at 39°C under CO₂ saturation until adding the other solutions (buffer (artificial saliva), minerals) for culture medium. It was used rumen fluid and buffer solution at a ratio of 1:4. The inoculum (50 mL) was then transferred to incubation flasks, then sealed and placed on an orbital shaker rack set at 120 oscillations per minute in an incubator at 39°C.

2.4. Statistical Analysis

For the proximate and digestibility analysis Xlstat was used for analysis while for agro morphological analysis Eigen value diagram was used to classify the accessions from Cameroon. The least significant difference was used to differentiate the means when there were differences among them.

3. Results

3.1. Morpho Characterization

The principal component (PC) analysis revealed 5 components with Eigen values greater than 1 (see **Table 1**). The first PC component which explains 25.9% of the

total variations was strongly and positively associated with agro morphological character: days at 50% flowering ($r = 0.785$, $P \leq 0.000$). The second PC component which explains 18.22% of the total variations was positively associated with agro morphological characters: days at first flowering ($r = 0.401$, $P \leq 0.203$), growth habit ($r = 0.833$, $P \leq 1.000$), leaf hair adaxial ($r = 0.514$, $P \leq 0.220$), leaf hair abaxial ($r = 0.654$, $P \leq 0.066$) and stigma color ($r = 0.605$, $P \leq 0.890$). The third PC component which explains 13.8% of the total variations was positively associated with agro morphological character: raceme length ($r = 0.612$, $P \leq 0.612$), and leaf length ($r = 0.655$, $P \leq 0.080$). The fourth component which explains 13.42% of the total variations was positively associated with agro morphological character: leaf sheath hairiness ($r = 0.744$, $P \leq 0.506$). The fifth component which explains 8.53% of the total variations was positively associated with agro morphological character: plant height growth habit ($r = 0.428$, $P \leq 1.000$). The first and second PCs are plotted on **Picture 2** and described 44.22% of the variations. Accessions with higher values for F1 (Basilisk, A5, A6 and E11) had long days to 50% flowering and great stem diameter. Accessions with higher values for F2 (ng1, n2l, w12, and nw13) had less leaf abaxial and adaxial, less days to first flowering, great leaf sheath hairiness.

Table 1. Eigenvector coefficient of 16 characteristics for the first five principal components with eigenvalue, individual and cumulative percentage of the total variance.

Characteristics	F1	F2	F3	F4	F5
Days to first flowering	-0.120	0.235	-0.422	0.200	-0.161
Days to 50% flowering	0.385	-0.114	-0.235	-0.164	0.164
Plant height	-0.389	-0.063	0.191	0.047	0.314
Leafiness	-0.169	-0.097	0.040	-0.293	0.492
Ligule length	-0.202	-0.198	-0.090	0.287	-0.332
Inflorescence length	-0.353	-0.138	-0.267	-0.049	-0.162
Inflorescence width	-0.338	-0.099	-0.384	0.148	0.084
Racemelength	-0.069	-0.232	0.411	0.289	-0.232
Growth habit	0.020	0.488	0.022	0.139	0.367
Culm thickness	0.184	-0.367	-0.104	0.262	0.154
Leaf width	-0.334	-0.201	-0.018	-0.197	-0.042
Leaflength	-0.324	-0.033	0.440	0.108	0.176
Leafhairadaxial	-0.208	0.301	0.018	-0.327	-0.236
Leafhairsabaxial	-0.227	0.383	-0.035	-0.167	-0.132
Leafsheathhairiness	-0.121	0.140	-0.236	0.508	0.339
Stigma color	0.113	0.354	0.264	0.351	-0.171
Eigenvalue	4.159	2.916	2.215	2.148	1.365
Individualvariability (%)	25.994	18.222	13.841	13.428	8.530
Cumulative variability (%)	25.994	44.217	58.058	71.486	80.016

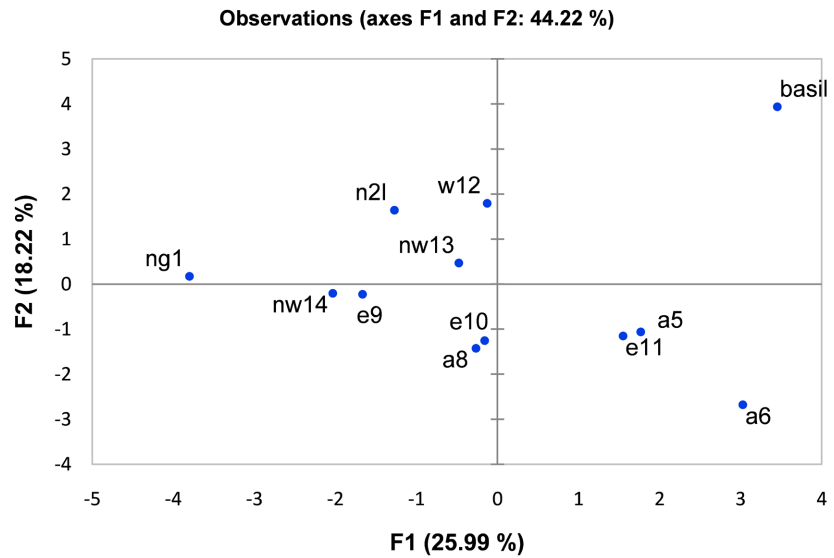


Figure 2. Scatter diagram of 12 *Brachiaria* grass genotypes (eleven genotypes from Cameroon and one improved *Brachiaria* grass cultivar Basilisk) against the first two principal components of the correlation matrix, explaining 44.22% of the total variations.

Only 2 characters (days to 50% flowering, plant height) showed a significant difference ($P \leq 0.046$) among the accessions (**Table 2**).

Table 2. Mean of agro morphological characteristics showing difference among the clusters of 12 *Brachiaria* grass genotypes (eleven genotypes from Cameroon and one improved *Brachiaria* grass cultivar Basilisk) in Nairobi, Kenya.

Characteristics	Cluster group 1	Cluster group 2	P-value
Number of genotypes	8	4	-
First flowering (days)	59.19 a	53.60 a	0.203
50% flowering (days)	86.75 b	118.500 a	0.000
Plant height (cm)	42.43 a	24.54 b	0.046
Leafiness (1 - 10)	5.94 a	5.10 a	0.579
Growth habit (1 - 5)	2.75 a	2.75 a	1.000
Culm thickness (mm)	1.22 a	1.28 a	0.478
Leaf length (mm)	14.74 a	12.66 a	0.080
Leaf width (mm)	1.70 a	1.58 a	0.102
Ligule length (mm)	0.20 a	0.20 a	0.250
Inflorescence length (cm)	14.76 a	13.14 a	0.056
Inflorescence width (cm)	7.39 a	6.41 a	0.057
Raceme length (cm)	0.74 a	0.59 a	0.351
Leaf hair abaxial (1 - 5)	1.88 a	1.38 a	0.066
Leaf hair adaxial (1 - 5)	1.75 a	1.38 a	0.220
Leaf sheath hairiness (1 - 5)	1.69 a	1.50 a	0.506
Stigma colour (1 - 5)	1.88 a	2.00 a	0.890

Means with different letters in a line are statistically different.

Cluster analysis based on agro morphological characters highlighted 2 main groups as shown on the dendrogram (**Figure 3**). **Figure 3** shows 2 genotypes groups. The second one has 8 accessions (n2l, e10, w12, ng1, nw13, nw14, a8 and e9); and the first group is composed of 4 accessions (Bsk, a5, a6, e11). The first level of separation (Group I vs Group II) was mainly for days to 50% flowering. The 4 accessions classified in Group 1 were late flowering and took 118 days to flower (meaning almost 4 months to flower). While the 8 accessions in Group 2 were early flowering and took 86 days to flower (meaning almost 3 months). The second level of separation (Group 1 vs Group 2) was for plant height. The 4 accessions in Group 1 had high height (42 cm) while the 8 for Group 2 had low height (24 cm).

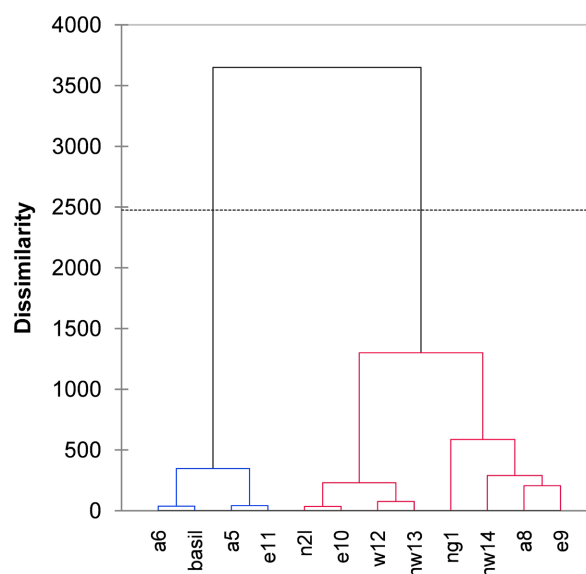


Figure 3. Dendrogram of agro-morphological classification of 12 Brachiaria grass genotypes (eleven genotypes from Cameroon and one improved Brachiaria grass cultivar Basilisk) obtained from agglomerative hierarchical clustering (AHC) of 16 major characteristics.

3.2. Nutritional Analysis

The ANOVA shows a significant difference among dry matter of different genotypes. Basilisk (Bsk) as control group is significantly different to e10, n1, n2, w12, e9 and a8. While there is no significant difference ($P \leq 0.001$) between Basilisk and nw13, e11, a6 and a5 for dry matter (DM) content (**Table 3**).

e10 has the highest performance of ash (14.260%) content and is significantly different to all the other accessions for ash content. There is no significant difference between nw13, n1, e11, n2, and w12 for ash content. Bsk and a8 has no significant difference.

The highest crude fiber content is recorded among nw13 which is significantly different ($P \leq 0.0001$) to Bsk. Bsk has similar crude fiber content as W12, e10, e11, a5 and a6. A8, e9, n1, n3, n4, and nw14.

Table 3. Chemical and nutritional composition of different accessions of Brachiaria.

Génotypes	DM (%)	Ash (%)	N (%)	CP (%)	Crude fiber (%)
e10	96.285 ab	14.260 a	2.249 a	14.053 a	28.510 abc
nw13	95.950 abc	13.258 b	1.901 d	11.881 d	29.340 a
Bsk	95.181 cde	11.550 d	2.164 ab	13.526 ab	28.060 bc
n1	96.585 a	12.860 bc	2.010 cd	12.563 cd	26.455 e
e11	95.739 abcd	13.383 b	1.942 d	12.139 d	29.075 a
n2	96.356 ab	13.140 bc	2.224 ab	13.903 ab	27.611 cd
w12	96.392 ab	13.365 b	0.094 g	0.585 g	28.900 ab
a6	94.921 de	12.506 c	1.611 e	10.077 e	28.720 ab
nw14	95.778 abc	11.825 d	2.018 cd	12.614 cd	26.415 e
a5	95.646 bcd	12.534 c	1.339 f	8.307 f	28.750 ab
e9	94.764 e	12.535 c	2.122 bc	13.261 bc	26.100 e
a8	96.493 ab	11.420 d	0.078 g	0.489 g	26.787 de
Pr > F (Model)	0.002	<0.0001	<0.0001	<0.0001	<0.0001
Signifiant	Yes	Yes	Yes	Yes	Yes

DM = dry matter; CP = crude protein; N = Nitrogen.

Generally, the accessions show high crude protein content except for w12 and a8. The less percentage is for a8 (0.489) and W12 (0.585) which should be an error and is significantly different ($P \leq 0.0001$) to all the accessions. The highest percentage is for e10 followed by Bsk, e9, n2, n1, and nw14. There is no significant difference between Bsk and e9, e10 and n2.

Table 4. Percentages of components of digestibility for 11 accessions from Cameroon.

Génotypes	ndf (%)	adf (%)	ivdm (%)	lignin (%)
e10	57.650 g	26.964 c	73.380 a	7.130 a
nw13	69.300 a	29.495 a	59.870 d	4.190 b
Bsk	68.445 ab	27.055 c	55.740 f	3.090 bcd
n1	65.455 c	27.090 c	52.260 gh	3.590 bc
e11	63.703 d	28.169 b	52.140 gh	2.400 cde
n2	59.374 f	25.192 d	53.440 g	2.670 cde
w12	60.721 e	28.173 b	70.250 b	2.090 de
a6	63.734 d	27.274 c	53.560 g	2.460 cde
nw14	61.084 e	27.269 c	57.755 e	3.000 bcd
a5	67.672 b	28.224 b	51.290 h	1.745 e
e9	59.610 f	26.856 c	63.205 c	1.770 e
a8	60.215 ef	23.219 e	55.110 f	3.515 bc
Pr > F (Model)	<0.0001	<0.0001	<0.0001	<0.0001
Significant	Yes	Yes	Yes	Yes

NDF (ndf) = neutral detergent fiber; ADF (adf) = acid detergent fiber; Ivdm = *In vitro* digestible matter.

For ndf percentage, none of the accessions reach the level of 70%. The higher percentages are for nw13 (69.3%), n3 (68.988%) and Bsk (68.445%) that have no significant difference ($P \leq 0.0001$) among each of them. These 3 are followed in value by a5 (67.67%). W12 is among the leasts with nw14 and a8. There are many differences among all the assesions for ndf percentage (**Table 4**).

Adf percentage values are higher in nw13 (29.49%), with no significant difference ($P \leq 0.0001$) among the accessions, followed by w12 and e11. While Bsk has the same ndf percentage as nw14, n1 and e9.

The highest amount of adl is from e10, and the lowest is from a5.

The average lignin content for all the samples is 3.7% with the lowest value coming from a5 (1.745%) and the highest from e10 (7.130%), followed by n3 (4.810%), and nw13.

Ivdm (*in vitro* digestibility matter) is lower in n1 and e11. Ivdm values range from 75.365% to 51.290%.

4. Discussion

Days to 50% flowering and plant height were the main characters that differentiate the accessions. Early flowering being very good for areas with less rainfall; late flowering is also good for plants in areas with long rainy season. These accessions (n2l, e10, w12, ng1, nw13, nw14, a8 and e9) were late flowering and coming from various environments. For example, n2l and ng1 were from areas with short rainfall period then this character is sweet for them; while the other ones are from areas with long rainfall period. These same accessions have lower plant height; then can be used to cover the soil. While the accessions in the first cluster group (Bsk, a5, a6, e11) have high heights and can be used as cut and carry forages.

Among the total of 21 agro morphologic characters, 16 were selected. The 2 first components that counted the most in differentiating the 12 accessions weighed for 44%, a relatively low percentage compared to the $\geq 75\%$ obtained by [9]. But the percentage obtained in this study is similar to what [5] obtained in Kenya by studying 47 *Urochloa* from 8 different species. It has been showed that a percentage of $\geq 75\%$ is good enough to differentiate the variations among species.

In general, increased neutral detergent fiber (NDF) digestibility will result in higher digestible energy and forage intakes. This means that in this study Basilisk, nw13, and n3 should have the highest digestible energy and forage intake. But their level of lignin is greater than W12 and e9. In general, when grasses are in the vegetative stage, NDF digestibility is very high ($>70\%$ of NDF). However, when stem elongation occurs in grass forage, NDF digestibility declines at a relatively fast rate. Meaning that though these 3 samples have good percentages of NDF, the level of lignin in them may reduce their digestibility and then forage intake. For grasses, $<50\%$ NDF is considered high quality and $>60\%$ as low-quality forage [10]. According to this statement all our samples showed a high level of NDF then are of low quality then low intake and digestibility. This can also be an indicator that forages cut at 60 days and above have already lost their nutritive value.

As for crude protein (CP), the best samples are e10 and n2, which have significant difference with basilisk though lower in CP content than the first 2. It is good to notice that n2 is from the Northern region while e10 is from East. Two samples show very low protein content which is probably due to errors in the lab; these 2 are respectively from West and Adamaoua Regions.

Low lignin content is important because lignin is not a carbohydrate but rather an amorphous polymer that has a phenylpropanoid structure and is considered indigestible and inhibitory to plant digestibility [11]. So, for our samples, the more digestive was a5 followed by w12. The average value of the samples for lignin was similar to those obtained by [12] for *Brachiaria Brizantha* cuttings at 30 cm. As for individuals, the values were high for mostly all the samples except for a5 and w12.

5. Conclusion

The results showed that the characters that contributed to differentiating the samples had low percentage to conclude that the *Brachiarias* from Cameroon are different from each other. The fact that there appeared differences among them for plant height and days at 50% flowering suggests that former research should continue, may be to the molecular level. For nutritive values, the results suggest that other studies taking into account the stages of harvest should be conducted to evaluate *Brachiarias* from Cameroon digestibility.

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Conflicts of Interest

The authors declare no conflicts of interest regarding the publication of this paper.

References

- [1] FAO (2014) World Agriculture: Towards 2015/2030. An FAO Perspective. <https://www.fao.org>
- [2] Pamo, E.T., Yonkeu, S. and Onana, J. (1997) Evaluation of Introduced Forages in Adamaoua Cameroon. *Cahiers Agriculture*, **6**, 203-207.
- [3] Pamo, E.T., Tendonkeng, F., Kana, J.R., Boukila, B. and Nanda, A.S. (2006) Effects of *Calliandra calothyrsus* and *Leucaena leucocephala* Supplementary Feeding on Goat Production in Cameroon. *Small Ruminant Research*, **65**, 31-37. <https://doi.org/10.1016/j.smallrumres.2005.05.023>
- [4] Mba, J.H., Motsa'a Sob, J. and Keambou Tiambo, C. (2018) Morpho-Biometric Characterisation of *Brachiaria* Spp Germplasm in the Area of Mount Cameroon. *Agricultural Advances*, **7**, 455-468. <https://doi.org/10.14196/aa.v7i1.2485>
- [5] Njarui, D.M.G., Gatheru, M. and Ghimire, S.R. (2021) *Brachiaria* Grass for Climate Resilient and Sustainable Livestock Production in Kenya. In: Oguge, N., Ayal, D., Adeleke, L. and da Silva, I., Eds., *African Handbook of Climate Change Adaptation*,

- Springer, Cham, 755-776. https://doi.org/10.1007/978-3-030-45106-6_146
https://link.springer.com/rwe/10.1007/978-3-030-42091-8_146-1
- [6] Mureithy, J.G. and Djikeng, A. (2016) Overview of the Climate Smart Brachiaria Grass Programme. *Proceedings of the Workshop*, Naivasha, 14-15 September 2016, 1-2.
- [7] Ondabu, N., Maina, S., Kimani, W., Njarui, D.M.G., Njikeng, A. and Ghimire, S.R. (2016) Genetic Diversity of Brachiaria Grass Ecotype in Kenya in Climate Smart Brachiaria Grasses for Improving Livestock Production in East Africa-Kenya Experience. *Proceedings of the Workshop*, Naivasha, 14-15 September 2016.
- [8] Piot, J. and Rippstein, G. (1976) *Brachiaria brizantha*. Meilleurs temps de repos. *Revue d'élevage et de médecine vétérinaire des pays tropicaux*, **29**, 173-177.
<https://doi.org/10.19182/remvt.8044>
- [9] Wassie, W.A., Tsegay, B.A., Wolde, A.T., *et al.* (2018) Évaluation des caractéristiques morphologiques, du rendement et de la valeur nutritive de l'écotype d'herbe Brachiaria dans le nord-ouest de l'Éthiopie. *Agriculture et Sécurité Alimentaire*, **7**, Article No. 89.
- [10] Hassen, A., Rethman, N.F.G. and Apostolides, Z. (2006) Morphological and Agronomic Characterisation of Indigofera Species Using Multivariate Analysis. *Tropical Grasslands*, **40**, 45-59.
- [11] Maranhão, C.M.d.A., Silva, C.C.F.d., Bonomo, P. and Pires, A.J.V. (2009) Produção e composição químico-bromatológica de duas cultivares de braquiária adubadas com nitrogênio e sua relação com o índice SPAD. *Acta Scientiarum. Animal Sciences*, **31**, 117-122. <https://doi.org/10.4025/actascianimsci.v31i2.4305>
- [12] Linn, J.G. and Martin, N.P. (1999) Forage Quality Tests and Interpretations.