EVALUATION OF PROXIMATE COMPOSITION OF SOME GRASSES GROWN AT BINYAMINU USMAN POLYTECHNIC, HADEJIA, NIGERIA

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Abstract

This study examined the proximate composition, fibre fractions and energy content of ten common grasses grown in Binyaminu Usman Polytechnic, Hadejia, Nigeria. The grasses evaluated were: *Pennisetum pedicellatum, Digitaria velutina, Eragrostis ciliaris, Eragrostis tremula, Axonopus compressus, Cyperus rotundus, Kyllinga erecta, Cenchrus biflorus, Cynodon dactylon,* and *Dactyloctenium aegyptium.* Result showed that all proximate fractions evaluated were significantly ($p < 0.05$) different among the grasses. The average dry matter content was 93.85% with minimum and maximum values of 91.20% in *Cyperus rotundus* and 97.20% in *Digitaria velutina,* respectively. The crude protein (CP) contents of the grasses were slightly low, which ranged from 1.24% in *Dactyloctenium aegyptium* to 9.12% in *Axonopus compressus;* while the crude fibre ranges from 24.90% in *Digitaria velutina* to 35.60% in *Pennisetum pedicellatum.* Neutral Detergent Fibre was recorded with a minimum and maximum values of 40.60% in *Digitaria velutina* and 66.30% in *Axonopus compressus* respectively, while the Acid Detergent Fibre ranges from 31.00% in *Digitaria velutina* to 37.90% in *Axonopus compressus*. The energy contents of the grasses were also significantly ($p < 0.05$) different, this ranges from 176.89kcal/kg in *Axonopus compressus* to 809.59kcal/kg in *Pennisetum pedicellatum* with an average of 329.07kcal/kg. The proximate composition of the grasses revealed that the DM and energy contents are satisfactory to facilitate ruminant feeding, although; a little supplementation may be required for CP that is averagely below a threshold of 8%.

Keywords: Energy content, fibre fraction, grass, nutritive values, proximate fraction.

Introduction

Grasses have a significant role in feeding grazing livestock in pastures and rangelands (Khan *et al.,* 2017). The health and performance of ruminants depend largely on the availability and concentration of nutrients and mineral elements present in these grasses (Khan *et al.,* 2013). Different physiological disorders, reproductive problems and diseases in livestock are directly related to lower nutrient contents and deficiency of minerals. Quantity of nutrients and minerals

vary at different phenological stages and also influenced by climatic condition, grazing pressure, soil fertility and geographical distribution (Khan *et al.*, 2017). Reduction in milk production and many diseases are the direct cause of mineral deficiency of both major and trace elements (Khan *et al.*, 2013). Evaluating the contribution of these grasses to animal nutrition is an integral component of any range and pasture improvement programme (Muhammad *et al.*, 2023). Amount and quality of nutrients of fodder available to animals are important in the determination of animals' productivity and growth. About 90% of the dry weight of a diet is composed of carbohydrates, fats and proteins (Hussain and Durrani, 2009). Akram *et al.* (2008) evaluated the effects of uncontrolled grazing that leads to overgrazed pastures.

Grasses are the most abundant on earth and found almost in every habitat from equator to poles. They can be best choice for fodder purposes due to their cosmopolitan availability, easy accessibility, good taste, fast digestibility and high nutritive values (Muhammad *et al.*, 2023). Grasses have a great potential to be utilized as an alternative source of forages for livestock and can be used to feed and provide the nutritive requirements (Manzoor *et al.*, 2013). They provide feed to about 53% of the total fodder to the ruminants (Ukanwoko and Igwe, 2012). Most of the grasses are weeds on different crops, but they also have rich nutrients and possess a great potential to be used as forage grasses. The study on mineral and nutritive value will provide base line data for the use of these forage species in feeding livestock. The chemical assay of these grasses will result in the identification of potential forage species. This will result in better health of livestock and will play important role in increasing the financial stability of the farmers and will contribute to the economic development of the country. In this study; ten common grasses, namely: *Pennisetum pedicellatum, Digitaria velutina, Eragrostis ciliaris, Eragrostis tremula, Axonopus compressus, Cyperus rotundus, Kyllinga erecta, Cenchrus biflorus, Cynodon dactylon,* and *Dactyloctenium aegyptium* were evaluated for their potential use as fodder in feeding ruminants, more especially during dry seasons. Therefore, ascertaining the availability of nutrients in these grasses to meet the animal's requirements will determine if the available grasses are of adequate feeding value for animal production.

Materials and methods

Study location

The study was conducted at the livestock grazing areas of Binyaminu Usman Polytechnic, Hadejia, Jigawa State, Nigeria. The area is located on latitude $12^0\ 28^I$ N of the equator and longitude $10^0\ 01\ ^I$E of the Greenwich meridian. The annual rainfall ranges between 200 and 600 mm per annum with relative humidity of 75 % during the rainy season and a mean annual temperature of 28^0C (Birdlife International, 2021; Muhammad *et al.*, 2023). The area is conducive for livestock production.

Experimental procedure

A total of three (3) hectare land area was identified in Binyaminu Usman Polytechnic, Hadejia the area was part of the grazing land

available for livestock. The area was traversed and twenty-five (25) plant species present were identified and categorized into grasses, forbs, legumes, and browses. Thereafter, the three hectares land was divided into three (3) transects. Each measuring one (1) hectare to provide three (3) replication plots. Forage species composition was randomly sampled using 100 × 100 cm^2 open ended quadrant from each replication plot. Within each quadrant sampling, the species were identified and scored percentage (%) relative to their proportion within the quadrant. The species found were then harvested using a knife at 2 cm above the ground level, the harvested species were sorted out and weighed. The samples were air- dried to constant weight and taken to laboratory for analysis. The twenty-five (25) native forage species in the area were identified, recorded and categorized with their respective percentages (Table 1).

Table 1: Categories of the common forages in the study area

S/N	Category	Number	Percentage
1.	Grasses	10	40%
2.	Legumes	5	20%
3.	Forbs	7	28%
4.	Browses	3	12%
	Total	**25**	**100%**

Forage samples collection

The samples of forage species used in this study were harvested from grazing land available for livestock in Binyaminu Usman Polytechnic, Hadejia. The common native grass species utilized in this study are presented in Table 2.

Table 2: Nomenclature of the common grasses

S/N	Local name	Common name	Scientific name
1.	Kyasuwa	Kyasuwa	*Pennisetum pedicellatum*
2.	Harkiya	Velvet fingergrass	*Digitaria velutina*
3.	Komayya	Gophertail love grass	*Eragrostis ciliaris*
4.	Love grass	Love grass	*Eragrostis tremula*
5.	Carpet grass	Carpet grass	*Axonopus compressus*
6.	Aya-aya	Nutgrass	*Cyperus rotundus*
7.	Gemun kwado	Spikesedge	*Kyllinga erecta*
8.	Karangiya	Indian sandbur	*Cenchrus biflorus*
9.	Kiri-kiri	Bermuda grass	*Cynodon dactylon*
10.	Gude-gude	Crowfoot grass	*Dactyloctenium aegyptium*

Sample preparation

The harvested samples were then oven dried at 105ºC for 24h to constant weight and milled to pass through a 1.0 mm sieve using Tecator Cyclotec 1093 sample mill. The samples were further sub-sampled to obtain three samples for each species and used for the laboratory analysis.

Determination of proximate composition

The determination of dry matter (% DM), crude protein (% CP), crude fibre (% CF), ether extract (% EE), nitrogen free extract (% NFE) and ash (% ASH) were carried out according to the methods of AOAC (2013); while, fibre fraction; acid detergent fibre (ADF) and nitrogen detergent fibre (NDF) were determined in accordance with Van Soest *et al.* (1991) method. Metabolizable energy was calculated using Pauzenga (1985) formula.

Statistical analysis

The data obtained in this study were subjected to analysis of variance (ANOVA) in completely randomized design (CRD) of GENSTAT (2014), where significant differences between the means were detected and separated using Duncan Multiple Range Test (DMRT). Differences between the means were considered at 5% probability level.

Results and Discussion

Proximate composition of the common grasses in the study area

The proximate composition of common grasses grazed by ruminant livestock at the grazing area of Binyaminu Usman Polytechnic, Hadejia Jigawa State, Nigeria is presented in Table 3. The dry matter (DM) content of the grasses was significantly ($p< 0.05$) different among the grass species. The average dry matter content was 93.85 % with a minimum and maximum values of 91.20% in *Cyperus rotundus* and 97.20 % in *Digitaria velutina*, respectively. The result was slightly higher than the range (88.30 - 91.74 %) reported by Khan *et al.* (2020). The DM content was in line with the report of Njidda (2010), who reported a range (95.20 - 97.00%) on some semi-arid browse forages of Northeastern Nigeria. The dry matter yield falls within the range of 500 -1200 kg/ha reported in the Sudan savannah zone (Aduku, 2004). Moreover, it is important to note that forage dry matter yield varies with rainfall and soil condition (Aduku, 2004). The crude protein (CP) content of the grasses was significantly ($p<0.05$) different, which ranged from 1.24 % in *Dactyloctenium aegyptium* to 9.12% in *Axonopus compressus*. The average CP content was 4.96 %; the average CP content of the grasses was lower than the values 5.44 % reported during the early dry season of semi-arid rangeland of Sudan (Awad and El-Hadi, 2010). This could possibly be due to the low rainfall recorded in the season, despite the fact that this study was carried out during the rainy season. The CP content of the grasses was also lower than the 8% CP, which is the lower threshold that will warrant giving supplements to livestock (Aduku, 2004). Aina and Onwukwe (2002) reported that the chemical composition and nutritive value of the grasses and legume species grown in Nigeria vary greatly depending on the species and season of growth at which the grasses and legumes are cut or grazed.

Furthermore, the result is in agreement with the observation of McDowell (1972); who reported that pastures, even if established and well managed more often than not fail to yield adequate supplies of protein for livestock production, especially when the forage consists mainly of grasses. The crude fibre (CF) contents of the grasses were also

significantly ($p<0.05$) different that ranged from 24.90 % in *Digitaria velutina* to 35.60 % in *Pennisetum pedicellatum* with an average CF content of 28.82 %. The CF content of the grasses could also be compared to the report of Mckell (1980) that CF usually ranges between 30 and 40 % in mature plants. The CF content of both grasses are in line with the report of Norton (1995), that tropical legumes and grasses have a CF content of above 28 %. Low fibrous grasses have been reported to increase digestibility and performance (Richard *et al.*, 1994). The ether extract (EE) of the grasses was significantly ($p<0.05$) different as values ranged from 1.73 % in *Axonopus compressus* to 9.41 % in *Cenchrus biflorus* with an average of 4.49 %. The grasses had slightly higher EE content than the legumes species. The overall means were slightly higher than the values 3.6 % and 4.2% reported for forages of West Africa (Le Houerou, 1980). Okoli *et al.* (2001) also reported a range of 0.95 – 5.3 % which is almost similar to this result. The ash content of the grasses was also significantly ($p<0.05$) different ranged from 9.70 % in *Pennisetum pedicellatum* to 13.11 % in *Eragrostis ciliaris* with an average of 10.97 %. The overall mean values for all the forages in this study were lower than the value of 10.90 % reported for West African forage (Le Houerou, 1980), but is higher than 6.29 % (Mecha and Adegbola, 1985). The Nitrogen Free Extract (NFE) content of the grasses was also significantly ($p<0.05$) different and ranged from 39.00 % in *Pennisetum pedicellatum* to 53.42 % in *Digitaria velutina* with an average value of 44.56 %. The result is similar to the range (40.90 - 51.10 %) (Aregheore, 2000).

Table 3: Proximate composition of the common grasses in the study area

Scientific Name	DM (%)	CP (%)	CF (%)	EE (%)	ASH (%)	NFE (%)
Pennisetum pedicellatum	96.10^{b}	9.08^{b}	35.60^{a}	2.72^{g}	9.70^{i}	39.00^{i}
Digitaria velutina	97.20^{a}	5.86^{d}	24.90^{j}	3.10^{f}	9.92^{g}	53.42^{a}
Eragrostis ciliaris	92.40^{h}	1.92^{i}	29.70^{d}	8.02^{b}	13.11^{a}	39.65^{h}
Eragrostis tremula	94.20^{d}	3.12^{g}	29.20^{e}	4.74^{d}	10.49^{f}	46.65^{c}
Axonopus compressus	95.40^{c}	9.12^{a}	30.80^{b}	1.73^{j}	11.82^{c}	41.93^{f}
Cyperus rotundus	91.20^{i}	3.76^{f}	26.50^{h}	3.55^{e}	10.73^{e}	46.66^{c}
Kyllinga erecta	92.70^{g}	4.11^{e}	28.40^{f}	2.63^{h}	9.88^{g}	47.68^{b}
Cenchrus biflorus	93.70^{e}	2.35^{h}	25.30^{i}	9.41^{a}	11.21^{d}	45.43^{d}
Cynodon dactylon	93.20^{f}	9.01^{c}	27.90^{g}	2.11^{i}	9.82^{h}	44.36^{e}
Dactyloctenium aegyptium	92.40^{h}	1.24^{j}	29.90^{c}	7.41^{c}	13.03^{b}	40.82^{g}
Means	**93.85**	**4.96**	**28.82**	**4.49**	**10.97**	**44.56**
LSD	**0.17**	**0.02**	**0.17**	**0.06**	**0.06**	**0.17**

$^{a, b, c, d}$Means with different superscripts along the same column differ significantly at ($p<0.05$). DM = Dry Matter, CP = Crude Protein, CF = Crude Fibre, EE = Ether Extract, ASH = Ash and NFE= Nitrogen free extract.

Fibre fractions and energy contents of the common grasses grazed by ruminant livestock in the study area

The fibre fractions and energy contents of the common grasses grazed by ruminant livestock at Binyaminu Usman Polytechnic, Hadejia Jigawa State, Nigeria are presented in Table 4. The Neutral Detergent Fibre (NDF) of the grasses was significantly ($p<0.05$) different. The average NDF was 47.26% with a minimum and maximum values of 40.60 % in *Digitaria velutina* and 66.30 % in *Axonopus compressus*, respectively. This was close to the range 37.30 - 51.20% reported by Njidda (2010). The Acid Detergent Fibre (ADF) of the grasses were significantly different ($p<0.05$), which ranged from minimum of 31.00 % in *Digitaria velutina* to maximum of 37.90 % in *Axonopus compressus*. The average ADF was 33.34 %. The ADF was also in line with the range of 16.20 - 41.20 % (Njidda, 2010). Aina and Onwukwe (2002) reported that the chemical composition and nutritive value of the grasses and legume species grown in Nigeria vary greatly depending on the species and season of growth at which the grasses and legumes are cut or grazed. The energy content of the grasses was also significantly ($p<0.05$) different (that ranged from 176.89 kcal/kg in *Axonopus compressus* to 809.59 kcal/kg in *Pennisetum pedicellatum* with an average energy content of 329.07 kcal/kg. The energy content of the grasses could be compared to the report of Magdalene *et al.* (2019) in which an energy content range (381.20 - 560.35 kcal/kg) was given for wild-edible plants.

Table 4: Fibre fractions and energy content of the common grasses grazed by ruminant livestock in the study area

Scientific Name	NDF (%)	ADF (%)	ENERGY (Kcal/Kg)
Pennisetum pedicellatum	43.00^{g}	32.90^{e}	809.59^{a}
Digitaria velutina	40.60^{j}	31.00^{h}	304.08^{e}
Eragrostis ciliaris	44.00^{d}	33.70^{d}	307.22^{d}
Eragrostis tremula	41.70^{h}	32.10^{g}	311.74^{c}
Axonopus compressus	66.30^{a}	37.90^{a}	176.89^{j}
Cyperus rotundus	43.80^{e}	33.60^{d}	285.90^{h}
Kyllinga erecta	43.50^{f}	34.70^{b}	317.62^{b}
Cenchrus biflorus	41.20^{i}	32.30^{f}	293.00^{g}
Cynodon dactylon	63.40^{b}	34.10^{c}	185.22^{i}
Dactyloctenium aegyptium	45.10^{c}	31.10^{h}	299.46^{f}
Mean	**47.26**	**33.34**	**329.07**
LSD	**0.17**	**0.17**	**0.02**

$^{a, b, c, d}$ Means with different superscripts along the same column differ significantly at ($p<0.05$), NDF = Nitrogen Detergent Fibre and ADF = Acid Detergent Fibre

Conclusion

This study evaluated the proximate composition, fibre fractions, and energy content of selected grasses within Binyaminu Usman Polytechnic, Hadejia, to determine their suitability for ruminant feeding. The results revealed notable variations in nutritional quality among the grasses, particularly in crude protein, fibre components, and metabolizable energy,

which have direct implications for intake, digestibility, and animal performance. While some grasses demonstrated adequate nutritive potential to support maintenance and moderate production, others require supplementation to meet livestock nutritional requirements. Overall, the findings confirm that locally available grasses can serve as valuable feed resources when properly managed, contributing to sustainable ruminant production in the study area.

Recommendations

Based on the study findings, it is recommended that nutritionally superior grasses identified in the area be preferentially utilized for grazing and fodder production, especially for productive classes of ruminants. Where crude protein levels are inadequate, appropriate supplementation should be adopted to improve animal performance. Improved pasture management and forage conservation practices such as hay or silage making are encouraged to mitigate seasonal feed shortages. Further research focusing on mineral composition, digestibility, seasonal variation, and animal performance trials is necessary to complement the present findings.

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