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SEASONAL VARIATIONS IN THE CHEMICAL COMPOSITION OF GRASSES HARVESTED FROM THE NATURAL PASTURE IN OGUN STATE SOUTH-WESTERN NIGERIA

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ABSTRACT

The research was carried was carried out to evaluate the chemical composition of the dominant grasses harvested from the natural pasture in selected villages in Ogun State, South-western Nigeria at different seasons. The study was carried out using a 4 × 6 factorial arrangement comprising four seasons (early rain, late rain, early dry and late dry) at six locations (Afami, Atokun, Ibooro, Ileniku, Ipaaya, and Okerori). Results showed that the crude protein (CP) content significantly ($p<0.05$) varied from 5.56 % for Okerori to 7.34 % for Ibooro and the grasses harvested at Afami had the highest (72.75 %) neutral detergent fibre (NDF) values with the least (68.75 %) value recorded for Okerori, while the acid detergent fibre (ADF) values ranged from 41.00 % for Atokun to 48.25 % for Okerori. Also, CP value as affected by the season ranged from 4.23 % for late rainy to 9.44 % for the early rainy season and NDF values from 67.33% for late dry to 72.33 % for late rainy season while the early dry season had the highest value (48.00 %) for ADF with the least value (40.33 %) was recorded for the early rainy season. The phosphorus (P) value was highest at Ipaaya (2.99 g/kg) with the least value observed at Okerori (1.62 g/kg). The value for calcium ranged from 2.55 g/kg at Afami to 6.59 g/kg at Okerori. The P value of grasses as affected by seasons ranged from 1.46 g/kg for early dry to 2.66 g/kg for early rainy seasons.

Keywords: Grasses, Location, Macro and Trace minerals, Season, Natural pasture

INTRODUCTION

Natural pasture species are the primary sources of feed for animals, and forms a significant part of domesticated animals' feed. However, irregular growth and unavailability of pasture during specific seasons of the year has been considered as a major constraint to sustainable supply of forages to animals. During the dry season, there is a decline in the quantity and quality of forage plants to the level which cannot sustain animal throughout the year. The low dry matter yield and nutritive quality of grasses during the dry season of the year is reflected in low production and reproductive performances, as well as growth development in ruminants

(Ndemanisho *et al*., 1998; Kakengi *et al*., 2001).

In addition, ruminant production during dry season is constrained by the low mineral contents of the natural pasture which barely meets the basic prerequisite for optimal productivity of the animals (McDowell *et al*., 1993; Annison and Bryden, 1998). Furthermore, utilization of low quality roughages such as hays, straws and crop stover could be restricted by their low contents of macro and micro minerals which negatively impact rumen microbial development and activity leading to reduced feed digestibility (Judson and McFarlane, 1998). Grasses remain the most significant source of roughage utilized as feed by ruminants. They contain substantial amount of cell wall carbohydrates and can be quantified by evaluating the neutral detergent fibre (NDF). The NDF is a combination of various fibre components which includes cellulose, hemicelluloses and lignin (Van So est *et al*., 1994).

Minerals are indispensable for normal development, reproduction, wellbeing and proper functioning of the animal body (McDowell, 1992). In addition, minerals protect and maintain the structural components of the body, organs and tissues, and are constituents of body fluids and tissues in form of electrolytes. Furthermore, several enzymatic activities and hormone systems (Underwood and Suttle, 1999) in the body are catalyzed by minerals which also maintain the acid-base and water balance of the body as well as the osmotic pressure of the blood and the cerebral spinal fluids. Livestock production is significantly influenced by the amount and quality of feed which may cause malnutrition as a result of inadequate concentration of minerals present in feeds (Tilahun, 2005). Mineral contents in forages vary widely among species and are affected by numerous factors such as soil chemical composition, growth stage, plant parts, climate and fertilizer application (Minson, 1990, Judson and McFarlane, 1998). Mineral deficiencies or imbalances in soils and forages have long been implicated for low production and reproduction issues among grazing animals, especially in the tropics (McDowell, 1985). Factors affecting the nutritive value of forages are a combination of impacts of hereditary and ecological elements. Seasonal variation as one of the ecological components influence forage nutrient composition which subsequently influence intake, digestibility and energy release to the livestock after been consumed. The objective of this study was to determine the effects of seasonal variation on the chemical composition of grasses harvested from the natural pasture in selected areas of Ogun State, Nigeria**.**

MATERIALS AND METHODS

Experimental sites and sample collection

The experimental sites were selected villages in Yewa North Local Area of Ogun State, South-western Nigeria namely: Afami, Atokun, Ibooro, Ileniku, Ipaaya and Okerori. An area of $100m^2$ plot was mapped out in a selected area of the natural pastures in each of the selected villages. The mapped areas were further divided into five (5) sub-plots of 5 x $4m^2$ each for effective sampling based on the topography of each area. Thereafter, a quadrat measuring $1m^2$ was thrown randomly in each sub-plot and the herbage within it were harvested and separated into grasses, legumes and weeds. The dominant grasses were oven-dried at 105^0C to constant weight and then ground in a laboratory hammer mill for analysis.

Experimental design
The experiment was laid out as a 6 × 4 factorial arrangement comprising six (6) villages (Afami, Atokun, Ibooro, Ileniku, Ipaaya and Okerori) and four seasons (early rainy, late rainy, early dry and late dry season) in a randomized complete block design with three replicates.

Laboratory analysis
The crude protein (CP) content of the milled sample was determined (A.O.A.C. 2000). Neutral detergent fibre (NDF) and Acid detergent fibre (ADF) were determined with the procedure of Van Soest *et al.* (1991). The concentrations of macro minerals (Ca, P, K, Mg and Na) and trace minerals (Fe, Cu, Zn and Mn) were determined using atomic absorption spectrophotometer after wet digestion in nitric acid and hydrochloric acid (Fritz and Schenk, 1979).

Statistical analysis
Data collected were subjected to two-way analysis of variance and the treatment means were separated using Duncan's Multiple Range Test (SAS, 1999) package.

RESULTS

Effect of location on the CP, NDF and ADF was significant ($p<0.05$) and the CP content varied from 5.56 % in grasses harvested in Okerori to 7.34 % for Ibooro. The effect of season on the CP, NDF and ADF values was significant ($p<0.05$). The CP as affected by season ranged from 4.23 % in the late rainy to 9.44 % in the early rainy season. The NDF values ranged from 68.75 % for Okerori to 72.75 % for Afami, while Okerori had the highest value (48.25 %) for ADF and the least value (41.00 %) at Atokun (Fig. 1). The NDF values ranged from 67.33 % for late dry season to 72.33 % for late rainy season while the early dry season recorded the highest value (48.00 %) for ADF and the least value (40.33 %) for early rainy season. Similarly, the ADL values varied significantly ($p<0.05$) from 11.17 % for early rainy season to 13.00 % for early dry season (Fig. 2). The grasses harvested at Ipaaya during the early rainy season contained the highest CP (12.00 %) compared with the lowest value (2.51 %) recorded for those harvested at Atokun in the late rainy season (Fig. 3). Grasses harvested at Atokun in late rainy season had the highest (79.00 %) for NDF value compared with the lowest value (63.00 %) for Okerori during late dry season (Fig. 4). The ADF values ranged from 36.00 % for grasses harvested at Atokun and Ipaaya during the early rainy season to 51.00 % for grasses harvested at Afami, Ileniku and Okerori in late dry, early dry and late dry seasons, respectively (Fig. 5).

The effect of locations on the mineral contents of the grasses was significant ($p<0.05$) (Table 1). The value for phosphorus (P) was highest (2.99 g/kg) for grasses harvested form Ipaaya and the least (1.62 g/kg) for those from Okerori. The value for calcium (Ca) ranged from 2.55 g/kg for grasses harvested from Afami to 6.59 g/kg for those harvested from Okerori. Magnesium (Mg) values significant ranged from 2.90 g/kg for Atokun to 4.33 g/kg for Ibooro while the potassium (K) recorded the highest values at Afami (48.60 g/kg) with the least value observed for Okerori (37.95 g/kg). The trace elements values determined in the grasses from the study areas were significant ($p<0.05$). The highest value for copper (Cu) (61.25 mg/kg) was recorded for Ileniku while Ibooro accounted for the least value (7.25 mg/kg). The values for zinc (Zn) significantly ($p<0.05$) ranged from 36.80 mg/kg at Okerori to 49.25 mg/kg at Afami. Afami also recorded the highest value (615.00 mg/

kg) for Iron (Fe) but that for manganese (Mn) was lower (22.63 mg/kg) for Afami than Atokun (40.08 mg/kg).

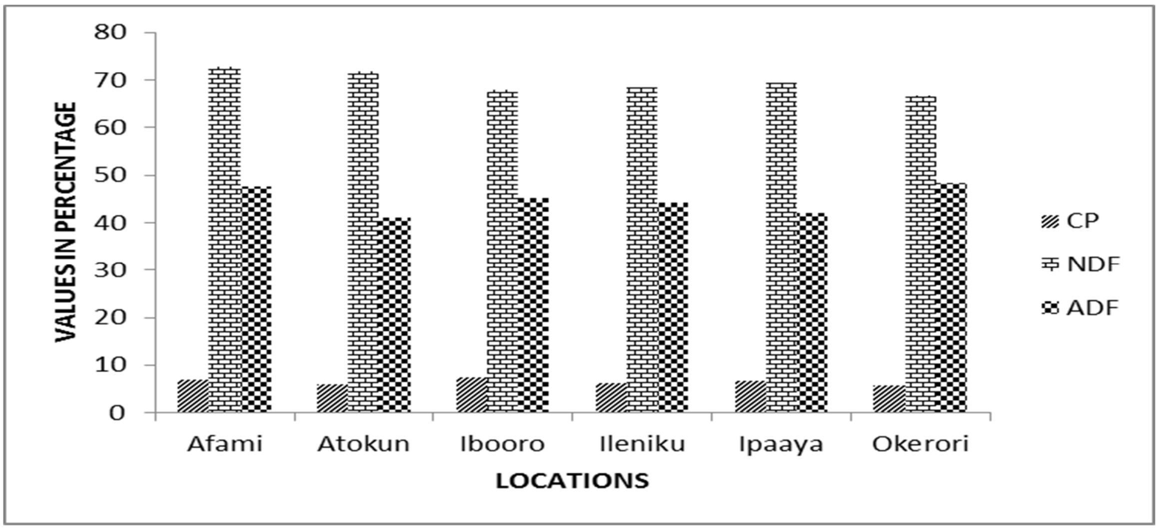

Figure 1: Main effect of locations on crude protein (CP), neutral detergent fibre (NDF) and acid detergent fibre (ADF) of grasses harvested from the natural pasture at varoius locations

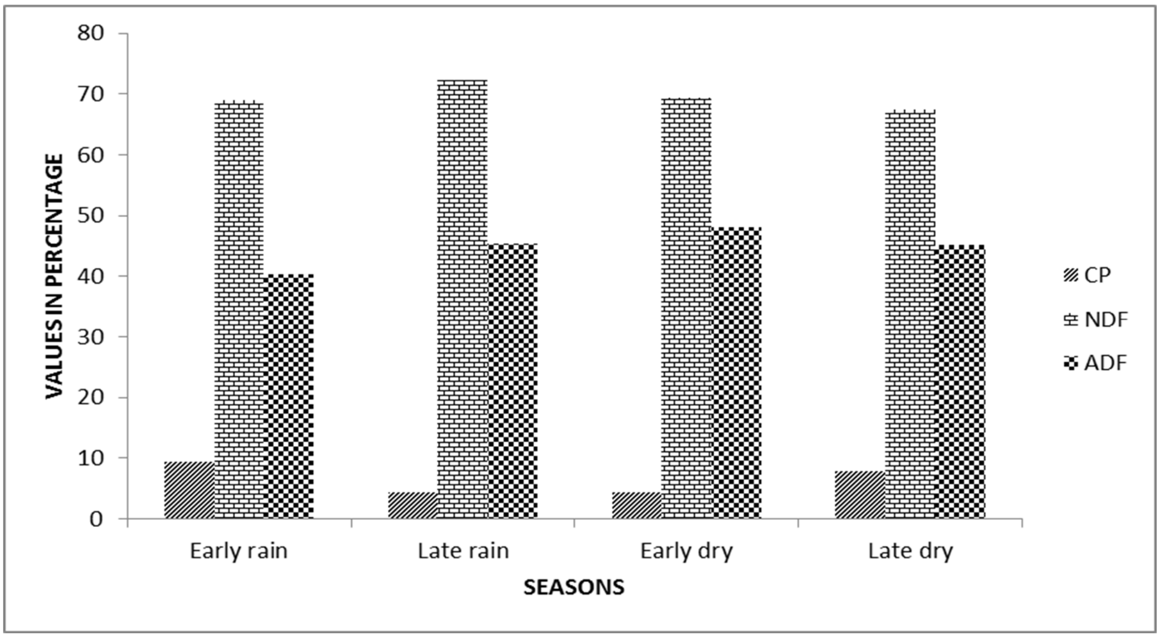

Figure 2: Main effect of seasons on crude protein (CP), neutral detergent fibre (NDF) and acid detergent fibre (ADF) of grasses harvested from the natural pasture at various seasons

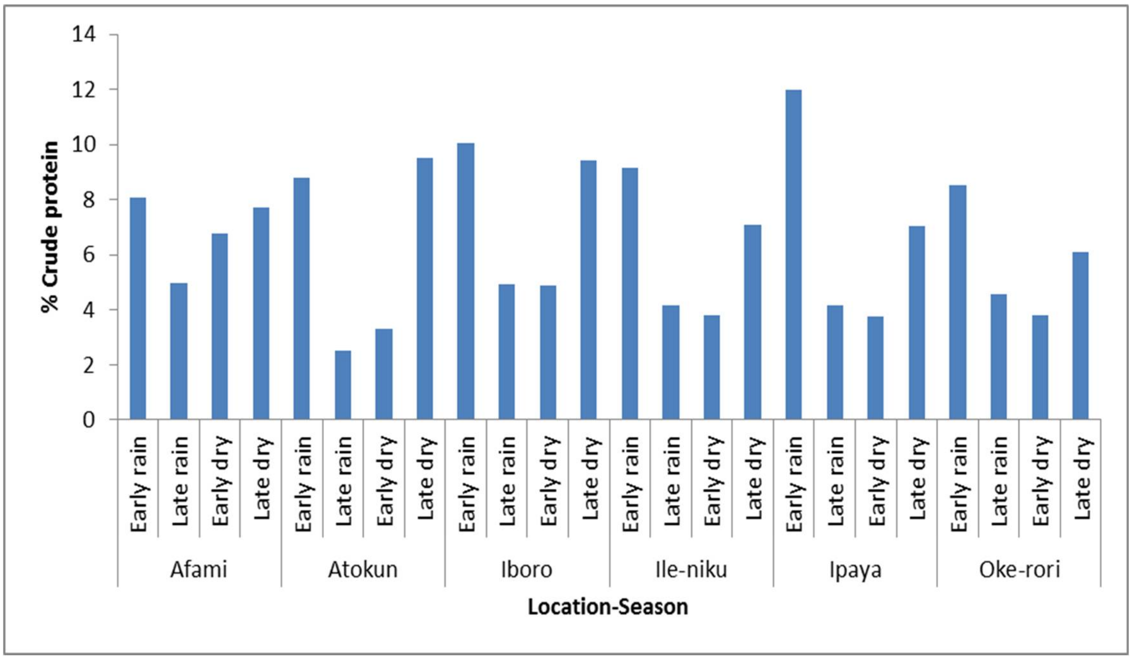

Figure 3: Interaction effects of location and season on the crude protein (CP) of grasses harvested from the natural pasture

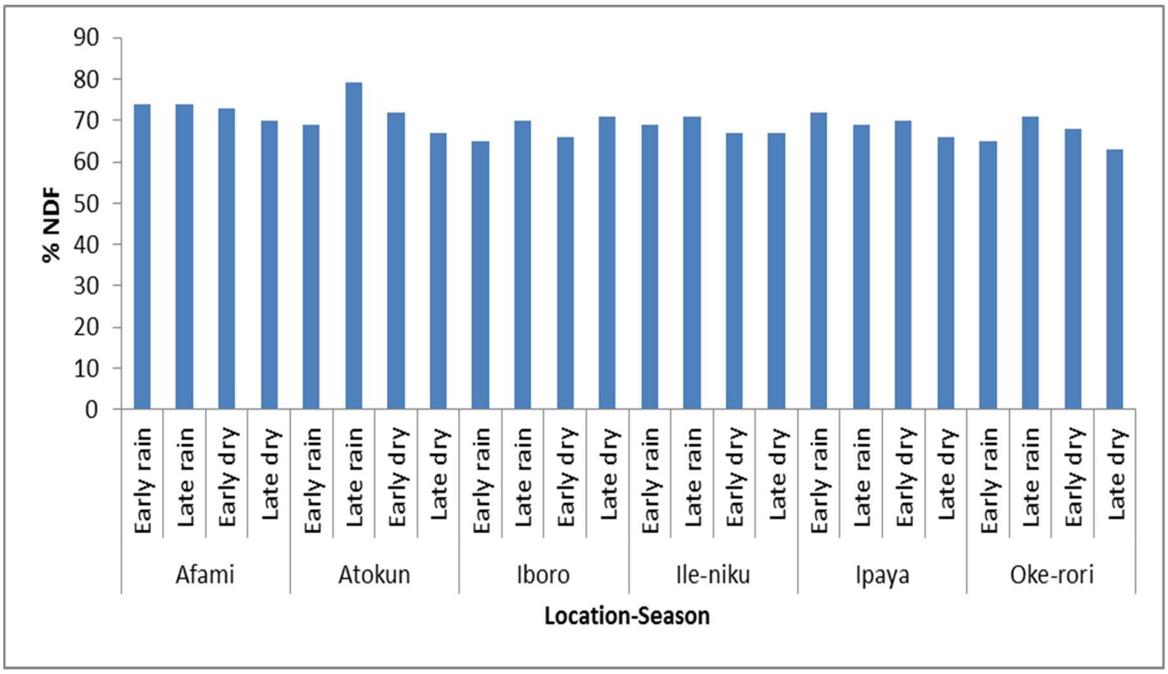

Figure 4: Interaction effects of location and season on the neutral detergent fibre (NDF) of grasses harvested from the natural pasture

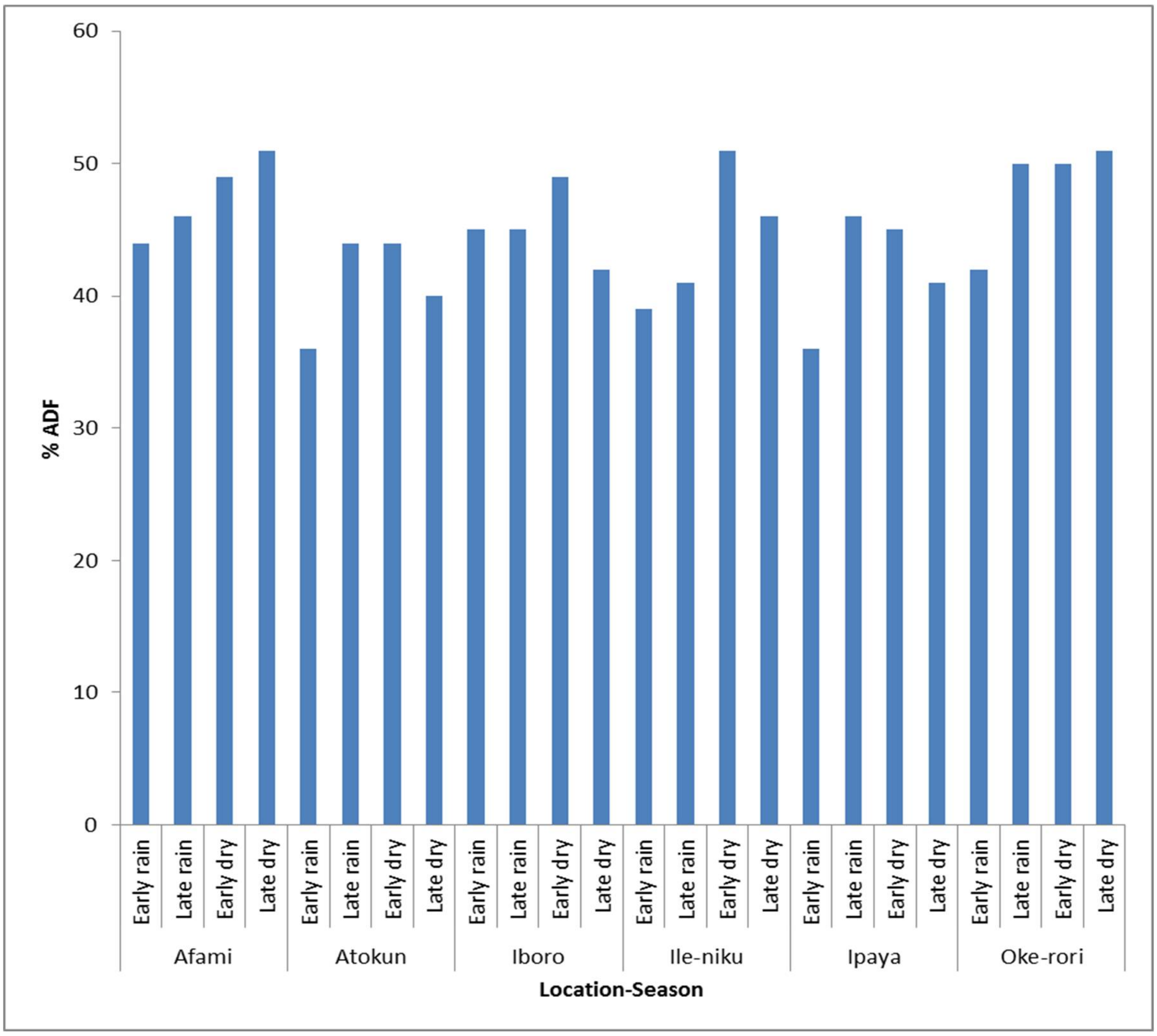

Figure 5: Interaction effects of location and season on the acid detergent fibre (ADF) of grasses harvested from the natural pasture

Similarly, the mineral contents of grasses in study areas as affected by seasons were significant ($p<0.05$). The values for P ranged from 1.46 g/kg for early dry season to 2.66 g/kg for early rainy season. The values for Ca also ranged from 3.15 to 6.56 g/kg for early rainy and early dry seasons, respectively; Mg recorded the highest (4.21 g/kg) and lowest (2.24 g/kg) values respectively for early dry and late dry seasons. K significantly ($p<0.05$) varied from 33.00 g/kg for late rainy to 50.47 g/kg for early rainy seasons. Copper had values of between 12.33 mg/kg for late dry season and 34.48 mg/kg for late rainy season. The content of Zn in the grasses also ranged in values between 36.33 mg/kg for late dry season and 50.89 mg/kg for early dry season. Whereas, the highest value (305.00 mg/kg) for Fe was observed in late dry season with the least value (248.33 mg/

kg) recorded for late rainy season. Mn significantly ($p<0.05$) ranged from 20.95 mg/kg for late rainy season to 43.15 mg/kg for early dry season (Table 1).

The highest P value (3.14 g/kg) was recorded for grasses from Afami during late rainy season with the lowest value (1.22 g/kg) for Atokun recorded for late dry season. The value for ca was 1.56 g/kg recorded at Afami during the early rainy season and 10.00 g/kg recorded at Atokun during the early dry season with Mg which was highest (5.92 g/kg) at Ibooro during early dry season and K which ranged in value from 16.40 g/kg at Okerori during the early dry season to 55.29 g/kg at Ibooro and Ileniku during early rainy season. The value for Na also ranged from 0.82 g/kg for Ibooro during early dry season to 1.88 g/kg for Atokun in late rainy season. The trace elements as effected by interaction between locations and seasons were significant ($p<0.05$). The value for Cu ranged from 1.00 mg/kg in grasses from Ibooro during late rainy season to 154.00 mg/kg in grasses from Ileniku in the late rain season, and the Zn recorded the highest value (72.00 mg/kg) for Ibooro during the early dry season and the lowest value (5.00 mg/kg) at Okerori during late dry season. The value for Fe ranged from 150.00 mg/kg for grasses at Ipaaya in the late rainy season to 1450 mg/kg at Afami during late dry season and Mn had values that significantly ($p<0.05$) ranged from 4.60 mg/kg at Ileniku during late rainy season to 57.40 mg/kg for that grasses at Atokun during late dry season (Table 1).

Table 1: Effects of locations and seasons on the mineral composition of the grasses in the study areas

Location	Season	P	Ca	Mg	K	Na	Cu	Zn	Fe	Mn
			g/kg					Mg/kg		
Afami		2.68^{b}	2.55^{e}	3.83^{c}	48.60^{a}	1.39^{c}	44.92^{b}	49.25^{a}	615.00^{a}	22.63^{e}
Atokun		1.66^{e}	4.98^{bc}	2.90^{e}	39.95^{c}	1.66^{a}	18.00^{c}	46.83^{a}	387.50^{c}	40.08^{a}
Ibooro		1.73^{d}	3.66^{d}	4.33^{a}	42.85^{b}	1.20^{d}	7.25^{f}	42.00^{b}	526.50^{b}	31.73^{c}
Ileniku		1.74^{c}	4.87^{c}	4.05^{b}	39.95^{c}	1.43^{bc}	61.25^{a}	47.50^{a}	340.00^{d}	27.63^{d}
Ipaaya		2.99^{a}	5.08^{b}	3.63^{c}	39.15^{c}	1.48^{b}	10.25^{e}	41.00^{b}	332.50^{d}	31.80^{c}
Okerori		1.62^{f}	6.59^{a}	3.13^{d}	37.95^{d}	1.65^{a}	14.50^{d}	36.80^{c}	332.50^{d}	34.05^{b}
SEM		0.22	0.54	0.34	2.99	0.06	7.29	3.34	56.10	3.28
	Early rain	2.66^{a}	3.15^{d}	4.16^{a}	50.47^{a}	1.46^{c}	27.61^{c}	46.22^{b}	411.67^{b}	22.33^{c}
	Late rain	2.17^{b}	4.63^{b}	3.96^{b}	33.00^{d}	1.60^{a}	34.83^{a}	41.67^{c}	248.33^{d}	20.95^{d}
	Early dry	1.46^{d}	6.56^{a}	4.21^{a}	36.97^{c}	1.51^{b}	29.33^{b}	50.89^{a}	348.33^{c}	43.15^{a}
	Late dry	1.98^{c}	4.14^{c}	2.24^{c}	45.20^{b}	1.30^{d}	12.33^{d}	36.33^{d}	705.00^{a}	38.87^{b}
	SEM	0.21	0.47	0.23	2.14	0.06	8.04	2.82	38.46	1.92
Location x Season interaction										
Afami	Early rain	2.84^{d}	1.56^{l}	4.04^{fgh}	48.20^{d}	1.54^{de}	16.67^{gh}	42.00^{hijk}	360.00^{hi}	19.20^{k}
	Late rain	3.14^{b}	2.20^{k}	5.30^{bc}	51.00^{c}	1.08^{j}	19.00^{fg}	38.00^{jklm}	280.00^{k}	22.50^{ij}
	Early dry	1.63^{o}	3.36^{h}	3.82^{hi}	46.60^{de}	1.74^{abc}	136.00^{b}	54.00^{c}	370.00^{gh}	26.10^{gh}
	Late dry	3.10^{c}	3.06^{hij}	2.16^{m}	48.60^{d}	1.18^{ij}	8.00^{k}	63.00^{b}	1450.00^{a}	22.70^{ij}
Atokun	Early rain	1.88^{h}	3.18^{hi}	3.96^{ghi}	47.80^{d}	1.54^{de}	21.00^{f}	47.00^{efgh}	360.00^{hi}	23.60^{hij}
	Late rain	1.78^{j}	3.35^{h}	2.92^{kl}	36.60^{g}	1.88^{a}	11.00^{jk}	39.00^{jkl}	210.00^{l}	30.80^{f}
	Early dry	1.74^{m}	10.00^{a}	3.72^{ghi}	32.40^{h}	1.72^{bc}	5.00^{l}	49.33^{cdef}	270.00^{k}	48.50^{c}
	Late dry	1.22^{hi}	3.38^{h}	0.98^{o}	43.00^{f}	1.50^{ef}	35.00^{d}	52,00^{cde}	710.00^{b}	57.40^{a}
Ibooro	Early rain	1.53^{p}	3.82^{g}	2.80^{l}	55.20^{a}	1.32^{ghi}	9.00^{k}	43.00^{ghij}	530.00^{d}	25.00^{ghi}
	Late rain	2.14^{g}	2.70^{j}	4.16^{fg}	17.00^{j}	1.40^{efgh}	1.00^{n}	37.00^{klm}	340.00^{i}	24.80^{ghi}
	Early dry	1.45^{q}	4.16^{efg}	5.92^{a}	52.40^{bc}	0.82^{k}	17.00^{gh}	72.00^{a}	670.00^{c}	40.90^{d}
	Late dry	1.81^{i}	3.94^{fg}	4.44^{ef}	46.80^{de}	1.26^{hi}	2.00^{mn}	16.00^{n}	710.00^{b}	36.20^{e}
Ileniku	Early rain	1.29^{t}	3.42^{h}	4.60^{de}	55.20^{a}	1.42^{efg}	71.00^{c}	43.00^{ghij}	370.00^{gh}	24.10^{hi}
	Late rain	2.16^{f}	4.38^{e}	3.56^{hij}	35.00^{g}	1.66^{bcd}	154.00^{a}	53.00^{cd}	300.00^{j}	4.60^{m}
	Early dry	1.24^{v}	4.24^{ef}	4.98^{cd}	43.00^{f}	1.28^{ghi}	12.00^{j}	4.00^{defg}	310.00^{j}	51.60^{b}
	Late dry	2.27^{e}	7.44^{c}	3.06^{kl}	26.60^{i}	1.36^{fgh}	8.00^{k}	46.00^{fghi}	380.00^{gh}	30.20^{f}
Ipaaya	Early rain	7.17^{a}	4.14^{efg}	5.60^{ab}	45.00^{e}	1.30^{ghi}	20.00^{f}	41.00^{ijkl}	460.00^{f}	21.10^{jk}
	Late rain	1.65^{n}	5.34^{d}	3.98^{hi}	26.60^{i}	1.76^{abc}	9.00^{k}	50.00^{cdef}	150.00^{m}	16.00^{l}
	Early dry	1.39^{r}	7.96^{b}	3.26^{jk}	31.00^{h}	1.72^{bc}	4.00^{lm}	37.00^{klm}	210.00^{l}	40.50^{d}
	Late dry	1.76^{k}	2.88^{ij}	1.66^{n}	54.00^{ab}	1.12^{j}	8.00^{k}	36.00^{lm}	510.00^{e}	49.60^{bc}
Okerori	Early rain	1.28^{u}	2.76^{j}	3.96^{ghi}	51.40^{c}	1.64^{cd}	28.00^{e}	61.33^{b}	390.00^{g}	21.00^{kj}
	Late rain	2.14^{g}	9.82^{a}	3.84^{ghi}	31.80^{h}	1.80^{ab}	15.00^{hi}	33.00^{m}	210.00^{l}	27.00^{g}
	Early dry	1.32^{s}	9.66^{a}	3.54^{ij}	16.40^{j}	1.80^{ab}	2.00^{mn}	45.00^{feghi}	260.00^{k}	51.10^{b}
	Late dry	1.75^{l}	4.12^{efg}	1.16^{o}	52.20^{bc}	1.36^{fgh}	13.00^{ij}	5.00^{o}	470.00^{f}	37.10^{e}
SEM		0.14	0.29	0.15	1.37	0.03	4.59	1.64	31.00	1.55

$^{a, b, c……k}$: Means in same column with different superscripts are significantly different ($p<0.05$)

SEM = Standard Error of Mean

DISCUSSION

The growth and sustainable production of ruminants are impacted by the nutritional qualities of natural pastures (Hussain and Durrani, 2009). Tolera *et al*. (1999) indicated that over 90% of the feed for ruminants were derived from native forages, where the nutritional status of native forages might be influenced by different factors such as seasonality, species and site differences which are known to be the main factors influencing the nutritive value of native pasture (Mahala *et al*., 2009; Subhalakshmi *et al*., 2011). The crude protein content of the grasses was considerably influenced by location and season. The CP content as influenced by location varied as similarly reported by Teka *et al*. (2012); and aside from the values recorded for grasses at Okerori (5.76 %) which was marginally lower, the range of CP value recorded in this study were generally within the range (6-8%) recommended as being adequate for satisfactory performance of ruminants (Ganskopp and Bohnert, 2001). This indicated the potentiality of the nutritive value of forage species among the various locations which were in consistent with report of Mittal *et al*. (2012). The impact of season on the CP of the grasses for late rainy and early dry seasons, respectively might be related to the fluctuating precipitation pattern in the year during which the research was conducted. Teka *et al*. (2012) had reported that there was declined in CP content during the dry season.

The NDF content of the grasses as affected by location and season in this study was above the range of 60-65% suggested as the critical limit, which might hinder the effective utilization of tropical forages by ruminants (Muia, 2000), however the values were similar to the report by Teka *et al*. (2012) for forages from natural pasture. The higher value of the NDF in the late rainy season might be because of incessant grazing of the natural pastures by cattle under the pastoral system of production as well as fluctuation of rainfall pattern in the study areas. Accordance to report by Teka *et al*. (2012), towards the late rainy season grazing frequency becomes low giving room for the grasses to overgrow and allowing their cell walls to become lignified thereby increasing their NDF value. With further advancement into the dry season, the NDF and ADF value recorded corroborated the findings by Gebrehiwot *et al*. (1996), which indicated increases in these parameters and their close relationship with decrease in leaf-to-stem ratio and increase in cell lignification with advanced stages of growth. The high fibre levels of the grasses in this study might be a hindrance to the colonization of the ingesta by rumen microorganisms with subsequent reduction in rumen fermentation rates and consequently digestibility, feed intake and animal performance.

Minerals are required by plants and animals in critical and balanced amounts, and their excessive or insufficient supply to the animal through the forage lessens the effectiveness of the forage as a feed resource, and by extension, hampers the production of the animal that depend on the forage. As indicated by Akinsoyinu and Onwuka (1988), the presence of mineral elements in the feed is essential for the metabolic processes of animals. Forages from the natural pastures in Nigeria have been generally reported to be deficient in P for most of the year (McDowell *et al*., 1984). The P values obtained for the grasses as influenced by location in this study were similar to the report by Ashagre (2008) for grasses from the natural pasture. The P values also generally fell within the prescribed range(1-4.8 g/kg) for optimal performance of various classes of ruminants as reported by McDowell (1992; 1997). The observed effects of seasons on P content of the grasses which indicate higher values in the rainy season was similar to earlier reports that there were decreases in P contents in grasses with advancement into the dry season (Faria *et al*., 1981) Declined in P levels of forages in the dry season could be attributed partly to lack of moisture in the soil which restricts plants' uptake of nutrients during this period. The values recorded for Ca in this study was in consonance with the range of 1.8-8.2 g/kg specified as adequate for ruminants (McDowell, 1992; 1997). The Ca values recorded in the present study were however, higher than reported as the average value for tropical grasses (Minson, 1990). Even though, the values recorded for Afami were outside the reported range for the tropics, they were still sufficient for ruminants. The Ca content of the grasses as revealed in this study was also in accord with the report by Faria *et al*. (1981) which indicated no definite pattern with respect to the impact of season on grasses in the natural pasture. The Ca content as influenced by season in this study was higher than reported by AFRC (1991). The increase in the Ca level in grasses in the dry season might be as a result of accumulation of the mineral to deal with the stress occasioned by the effects of the drought. This is in conformity with observation by Ejaz *et al*. (2011) that a possible mechanism to limit impeding impact of dry season on crop plants was to improve the Ca level in the plants. The significance of Mg in forages is its relationship with the genuine metabolic issue of grass tetany (hypomagnesaemia). Grass tetany is an intricate ruminant metabolic issue that is influenced by mineral composition in soil and consequently in forages, soil properties, fertilizer application practices, season of the year, temperature, animal species, breed and age (McDowell and Valle, 2000). The Mg contents of the grasses in this study as influenced by location and season generally exceeded 2 g/kg, a level above which grass tetany is unlikely to occur (Committee on Mineral Nutrition, 1973). The mean value of Mg content in this study was similar to that reported by Minson (1990) with the exception of grasses from Atokun and Okerori, and this might be attributed to the prevailing soil properties of the various locations (Elkins *et al*., 1986). The seasonal variations in Mg contents in this study were similar to report by Gomide *et al*. (1969) which indicated decline with progression into the dry season. The decline in Ma content of grasses in the dry season could be attributed to completion between cations in the soil during this season which prevents uptake of Mg plant. This concurs with reports by Mengel and Kirkby (2001) and Shaul (2002), that Mg insufficiency in plants can be prompted, not only by direct lack of Mg in the soil buy also by the presence of competing cations that prevent magnesium uptake by plants. It could also be due to high utilization of magnesium by plants in root development in the dry season for the plant to be able to retain all accessible water and nutrients in the soil during the dry season when there is water stress on the plant. The K content in this study was above 8 g/kg recommended for grazing animals (Underwood, 1981). However, it has been proposed that high producing ruminants may require K level above 10 g/kg under stress especially heat stress (McDowell, 1985), the requirement which the grasses in this present study also met. The K content of the grasses evaluated as influenced by location and season were similar to report by McDowell and Valle (2000) which indicated that K in young growing forages is typically very high (10-40 g/kg); hence, it is expected that grazing animals consuming primarily forage diets would receive sufficient K. The decline in K level in forage during the dry season could be due to its excessive utilization by plants during that season to complete its physiological processes, and this concurs with report by Ejaz *et al*. (2011), that K plays a significant role in the survival of plants under water stress conditions.

CONCLUSION

The CP content of grasses in the study areas was higher during the rainy season but drastically declined as the plants matured towards the dry season while the NDF and ADF contents were higher at advanced stages of maturity of the grasses. The mineral content of the grasses were influenced by location and season. The research revealed that the Ca level in the grasses in the wet seasons were lower compared to dry season and there were significantly higher level of Mg, P and K in the grasses for the wet season than dry season. It could therefore be concluded that variations in location and season have significant impacts on the nutritional qualities of grasses at different stages of maturity from the natural pasture in the study areas.

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