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Effect of seasonal changes on the herbage composition of *Stylosanthes hamata* Taub cv. Verano and *Centrosema pascuorum* Mart. Ex. Benth in the Nigeria sub-humid zone.

Efecto de los cambios estacionales sobre la composición del forraje de Stylosanthes hamata Taub cv. Verano y Centrosema pascuorum Mart. Ex. Benth en la zona subhúmeda de Nigeria

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ABSTRACT

A study was conducted in the Nigerian sub-humid zone to find out the effect of seasonal change on herbage crude protein and mineral composition of summer style and Centro. Consequently, plant samples were obtained between September in the establishment year (wet season) through July in the succeeding year (dry season) for analysis. Highest crude protein (CP) and mineral contents were found in the herbage in the wet than in the dry season. The CP levels of center was most different of the time lower than that of summer in the dry season. There was no appreciable difference in P concentration during the dry season but Central had considerable higher P during the rainy season. Micro-nutrients content in the forages were quite variable with season. Crude protein, P and Cu were the most limiting nutrients, particularly, in the dry season, based on recommended critical level requirements. Feed supplementation would then become necessary for improved animal production in the zone, particularly in the dry season.

RESUMEN

Se realizó un estudio en la zona subhúmeda de Nigeria para determinar el efecto del cambio estacional sobre la proteína cruda y la composición mineral de las hierbas de estilo verano y Centro. En consecuencia, se obtuvieron muestras de plantas entre septiembre del año de establecimiento (estación húmeda) hasta julio del año siguiente (estación seca) para su análisis. Los mayores contenidos de proteína cruda (PB) y minerales se encontraron en el forraje en la estación húmeda que en la estación seca. Los niveles de PC del centro fueron más diferentes en la época más baja que la del verano en la estación seca. No hubo una diferencia apreciable en la concentración de P durante la estación seca, pero Central tuvo un P considerablemente mayor durante la estación lluviosa. El contenido de micronutrientes en los forrajes fue bastante variable según la estación. La proteína cruda, P y Cu fueron los nutrientes más limitantes, particularmente en la estación seca, según los requisitos de niveles críticos recomendados. Entonces sería necesario complementar los piensos para mejorar la producción animal en la zona, especialmente en la estación seca.

INTRODUCTION

The sub-humid zone (SHZ) of Nigeria occupies about 50% (455,000 Sq km) of Nigeria's land mass (Bourn and Miligan, 1984). It has a growing season of between 180 and 270 days (Mohamed-Saleem and Suleiman, 1986). The sub-lumud zone accounts for a sizeable proportion of the total livestock population in Nigeria. The zone has the capacity to support increased livestock numbers as well as higher productivity per animal (Von Kaufmam, 1986).

The cone is characterized mainly by savanna grasses with many shrubs and few scattered trees. There are two marked seasons in the zone, the rainy season (may to mid-October) and dry season (mid October – April). In the rainy season, forages, which are mainly native grasses, are abundant though of varying quality. The problems of animal feed resources become compounded in the dry season, both in quantity and quality. Inadequate pasture supply in the dry season necessitates a north-south movement in search of forages (Omoregie and Oshineye, 2002; Omoregie, 2015).

In order to alleviate the dry season feed quality problem in the zone, the National Animal Production Research Institute (NAPRI), Shika, Zaria and the sub-humid zone programme of the defunct International Livestock Centre for Africa (ILCA), Kaduna (now International Research Institute, ILRI, Addis Ababa) carried out some evaluation work for years on the adaptability of some tropical forages. *S. hamata cv.* verano and *C. pascuorum* are among the proven species.

Herbage mineral concentrations vary widely among species (Kim, 2001; Hacker, 1982), stages of growth (Omoregie and Aken Ova, 2000) and plant parts all of which are important with respect to selective grazing.

The objective of this study was to evaluate the protein and mineral profile of two proven forage legumes used in pastures in SHZ of Nigeria, with particular reference to seasons. The results obtained are expected to guide in improving and planning for ruminants nutrition in the zone.

MATERIALS AND METHODS

Field experiments were established at three locations in the Nigerian SHZ viz. Kurmin Biri [Lat. 7^0 55^1E and 10^0 10^1N], Kontagora in the lower part of the northern guinea savannah [10^0 17^1N and 6^0 0 and 0.02^1E] and Shika, Zaria, Lat. 10^0 51, Long. 7^0 35^1E in the upper northern guinea savanna in June (Wet season).

At each location, an area measuring 40x20m was cleared and shrub/tree stumps uprooted. The debris was packed off the plots without burning. The plot was fenced with barbed wire to prevent entrance of free grazing livestock. Land was prepared into fine tilth, manually, using hoes. Forty plots each measuring 3mx3m with 0.6m pathways were laid out.

The experiment was a factorial with two factors viz: two legumes, that is, Verano stylo and *C. pascuorum* (centro) and five levels of phosphorus (P) (0,20,40,60 and 80kg/ha). The source of P was single superphosphate.

The ten-treatment combinations were replicated four times and were arranged within a randomized complete block layout.

Potassium as KCl, S as Na_2SO_4, Mg as MgCl and Ca as $CaCO_3$, were applied at 85.6, 239.6, 56.3 and 190.4g per plot, respectively. The fertilizers were applied by broadcasting evenly on the soil surface during land preparation.

Scarified seeds of Verano sytlo and centro were sown by broadcasting at 10kg/ha in June.

The crude protein and mineral composition of plant materials obtained at 1cm above soil surface using 0.3x0.3m quadrants were analyzed using the method outlined by AOAC (2002). Plant samples were obtained between September in the establishment year and July the following year, cutting across both wet and dry seasons.

RESULTS AND DISCUSSION

The effect of seasonal changes on the crude protein and mineral contena of Verano stylo and centro for the three study locations in the SHZ are presented in Table 1.

In general, the highest crude protein (CP) and mineral contents were recorded in September (wet season). The period of lowest concentration of CP in the legumes was between November and May which coincided with most of the dry season.

Crude protein content in the plants and hence availability to livestock would be less problematic in the wet season (June - September). CP levels of centro were most of the time lower than that of Verano stylo in the dry season.

Both legumes did not show appreciable difference in P content during the dry season but centro had considerably higher P during the rainy season. It was observed that herbage K content at the locations except Shika were relatively high in February and lowest in May. Calcium levels were such as would meet animal requirements throughout the period which included rainy as well as dry season. As noted for K, Ca contents were higher in February, except for verano stylo at Shika.

Locational differences in soil contents seemed to be reflected in the CP and mineral contents of the legumes (Table 1). The concentrations of micro-nutrients in the forages were quite variable with the season (Table 2).

From Table 2, CP, P and Cu were the most limiting nutrients in the forages in this zone, particularly, in the dry season; based on recommended critical requirements.

Quality and yield are influenced by season. As already indicated, the quality of forages in the SHZ is very poor in the dry season while earlier studies have shown dry malter yields to be low (Omoregie, 1995; Mohamed

Saleem, 1986). This combination can result in feed crisis in which animals lose weight and in extreme cases may die (Otchere *et al*., 1987).

The critical dietary P requirement of beef cattle suggested by NRC (1976) is 0.8% in plant herbage. The requirement for lactating cow ranges from 0.18 to 0.29% of the dry ration. However, little (1980) suggested a level of 0.12% as adequate for growth of cattle. The P requirement of sheep was given as between 0.16 and 0.37% (NRC, 1975). The values obtained in this study can at best meet only the maintenance requirement of the three classes of ruminants. Also, Cu was consistently low and inadequate on the basis of a critical value of 10mg/kg (McDowell *et al*., 1984). Iron, Mn, Zn contents in the legumes are not likely to present a problem, based on a critical level of 30mg/kg for ruminants (McDowell, *et al*., 1984).

CONCLUSION

Crude protein, P and Cu on the basis of NRC critical requirements by ruminants are inadequate for livestock growth and production, particularly, in the dry season. Feed supplementation would thus be necessary for improved animal production/output in the zone.

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Table 1: Physical and Chemical Properties of Soils Used.

Location and Horizon	Sand	Silt	Clay	Texture Class	P^H H_2O	$CaC1_2$	Organic Carbon	Total N	Exchangeable Mg	Ca	Na	K	Acidity	ECEC	BS	Available P	Cu	Zn	Fe_2O_3	$A1_20_3$
	%						%		cmol/kg						%	mg/kg			%	
Kurmin Biri																				
0 – 20	60.8	19.2	20.0	Sandy loam	5.8	5.3	0.67	0.06	1.42	1.85	0.22	0.56	0.20	4.25	96.29	4.50	0.06	0.72	0.74	0.12
20 – 60	52. 8	21.2	26.0	Sandy loam	5.7	5.3	0.3 3	0.03	1.42	0.80	0.23	0.20	0.40	3.05	86.88	1.42	0.05	0.32	ND[1]	ND
Kontagora																				
0 – 20	62.8	31.2	6.0	Sandy loam	6.5	6.2	0.91	0.06	2.67	2.20	0.23	0.23	0.20	5.53	96.4	5.35	0.01	0.49	0.34	0.18
20 – 60	52.8	35.2	12.0	Sandy loam	6.1	6.0	0.12	0.04	3.83	1.10	0.02	0.16	0.40	5.59	92.97	0.51	0.01	0.33	ND	ND
Shika																				
0 – 20	78.8	13.2	8.0	Sand	6.3	6.0	0.60	0.06	2.71	5.32	0.31	0.57	0,20	9.12	97.89	8.00	0.05	0.90	0.94	2.84
20 – 60	84.8	92	6.0	Sand	6.0	5.3	0.45	0.05	2.08	3.35	0.24	0.21	0.40	6.28	93.63	1.35	0.09	0.27	ND	ND

1 CEC = Effective cation exchange capacity
2 BS = Base saturation
3 ND = Not determined

Table 2: Effect of Seasonal Change on Composition of Verano Stylo and Centro in the SHZ

Location /	Verano Stylo																	
Month	Cp	P	K	Mg	Ca	Mn	Fe	Cu	Zn	Cp	P	K	Mg	Ca	Mn	Fe	Cu	Zn
Kurmin Biri																		
September	14.31	0.14	1.86	0.33	1.91	174.12	180.90	7.14	30.94	14.26	0.09	1.67	0.22	1.68	126.90	148.24	6.08	32.78
November	11.81	0.08	1.45	0.20	1.45	135.48	101.28	28.20	11.38	0.08	0.08	1.53	0-24	1.57	111.90	118.24	5.42	24.78
February	8.31	0.04	2.32	0.41	2.29	173.18	198.28	7.04	36.18	5.00	0.04	2.20	0.43	2.70	180.84	241.92	6.72	43.04
March	4.50	0.03	1.01	0.22	1.67	139.94	250.52	4.72	16.12	4.31	0.03	1.03	0.77	1.17	76.06	193.96	3.58	18.32
April	4.25	0.02	1.57	0.22	1.48	77.20	193.86	5.38	23.45	4.06	0.02	1.15	0.33	1.90	136.20	202.44	6.04	12.40
May	7.88	0.02	0.23	0.21	1.59	146.62	166.64	3.08	20.80	6.88	0.03	0.02	0.24	1.70	260.28	278.66	7.88	21.56
June	13.31	0.09	1.61	0.32	1.90	204.42	127.38	7.32	54.84	16.04	0.10	1.78	0.28	1.76	190.00	148.52	9.52	51.86
July	13.50	0.12	1.60	0.29	1.75	198.14	167.04	10.36	56.5	12.38	0.15	1.72	0.26	1.86	170.20	148.52	12.12	51.94
Kontagora																		
September	14.50	0.08	1.75	0.41	1.96	91.94	195.40	5.64	52.22	14.19	0.09	1.76	0.28	2.00	74.26	172.46	4.98	49.70
November	9.31	0.08	2.16	0.38	2.27	140.30	153.18	6.36	49.74	10.31	0.09	2.28	0.43	2.19	121.17	149.46	7.05	71.72
February	4.91	0.03	2.22	0.37	2.84	139.54	298.34	4.38	74.04	5.0	0.04	2.20	0.43	2.61	180.34	241.92	6.72	43.04
March	3.86	0.03	1.21	0.11	0.92	14.32	109.22	1.54	29.28	4.50	0.03	1.13	0.23	2.04	96.80	260.98	3.38	38.85
April	4.06	0.02	1.143	0.14	1.05	40.56	122.54	3.56	24.64	4.50	0.03	1.37	0.32	1.54	108.50	139.16	4.28	15.88
May	6.25	0.04	0.23	0.18	168	89.18	370.84	4.40	55.04	4.50	0.04	0.16	0.18	1.49	106.94	236.22	3.96	64.46
June	12.31	0.14	1.85	0.37	1.64	115.26	142.30	8.90	88.04	16.38	0.18	2.05	0.29	1.96	141.56	181.34	9.10	56.92
July	11.44	0.11	1.61	0.38	1.81	114.10	191.46	7.52	41.36	14.69	0.14	1.77	0.32	2.02	114.52	124.88	8.54	47.65
Shika																		
September	18.0	0.30	1.07	0.41	1.50	109.30	345.62	6.46	47.84	13.31	0.31	1.05	0.31	1.14	79.14	535.82	5.60	38.80
November	12.69	0.09	0.35	0.22	2.16	114.94	116.92	5.16	30.06	8.13	0.04	1.55	0.23	1.47	81.30	217.18	2.70	21.34
February	7.81	0.04	0.96	0.27	1.53	100.26	361.26	1.76	45.68	6.0	0.03	0.97	0.27	1.61	93.34	241.72	1.78	68.52
March	4.99	0.04	1.14	0.17	1.09	50.20	134.88	2.24	51.54	4.8	0.03	1.07	0.21	1.26	53.16	174.12	2.44	29.28
April	3.76	0.02	1.27	0.15	0.94	50.12	301.18	2.00	17.52	4.88	0.02	1.51	0.26	1.21	70.48	268.70	2.22	12.34
May	3.38	0.03	0.12	0.12	0.84	92.54	191.60	4.10	22.10	3.81	0.03	0.09	0.16	1.18	70.60	268.70	4.64	16.86
June	13.75	0.18	1.61	0.35	1.47	156.32	273.30	5.98	55.78	13.75	0.18	1.56	0.32	1.17	140.40	269.90	4.44	48.36
July	11.81	0.12	1.60	0.39	1.45	170.70	471.88	6.92	471.88	6.92	47.64	13.63	0.13	1.35	137.78	1437.62	6.98	35.40
	----------%DM----------			----------mg/kgDM----------						----------%DM----------					----------mg/kgDM----------			

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