CHANGES IN MINERAL CONTENT OF *Panicum maximum* var Ntchisi AS INFLUENCED BY POULTRY MANURE RATE AND AGE AT HARVEST

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Abstract
The effects of poultry manure rate and age at harvest on the mineral content of *Panicum maximum* var Ntchisi was carried out at the Federal University of Agriculture, Abeokuta, Nigeria. The N rates were 0, 100, 200 and 300 kgN ha^{-1} and the age at harvest was at 4, 8 and 12 12 weeks after cutback. The experiment was a 4 x 3 factorial in a Randomized complete block design which amount to twelve (12) treatment combinations with four replicates. The results showed that the manure rate had significant ($P<0.05$) effect on the all the macro and micro mineral content of the grass, same was observed for the age at harvest except for the Cu content. The calcium content as affected by manure rate ranged between 2.76 to 4.35 gKg^{-1} DM The age at harvest ($P<0.05$) affected the calcium content, which ranged from 2.90 gKg^{-1} DM in the grass harvested at 12WAC and 3.74 gKg^{-1} DM in the grass harvested at 4WAC. Manure rate influenced the phosphorus content which ranged from 0.76 gKg^{-1} DM in the unfertilized grass to 1.78 gKg^{-1} DM in the grass to which 300 $kgNha^{-1}$ was applied. The phosphorus content declined with maturity.

Keywords: Salinity, grass, manure, unfertilized, forage

Introduction
Natural pasture is known to be the main source of feed in ruminant livestock production in Nigeria, as most stockowners can hardly afford to keep their animals on concentrate rations. The natural pasture, though cheap but is limited both in quantity and quality. In order to mitigate the problem of poor nutrition for ruminant animals because of its over dependence on the natural pasture, the use of sown and purposely managed pastures have been widely suggested (Olanite, 2003; Onifade *et al*., 2005; Dele, 2008). The nutritive quality of the forage has an important role in the productivity of the animals. The factors influencing the nutritive value of forage are many, and these factors may include, plant type, climate, season, weather, soil type and fertility and physiological and morphological characteristics, and may change depending on whether the plants are annuals perennials, grasses or legumes. The stage of growth seems to be the most important factor affecting the chemical composition of forage. This study is aimed at investigation the role of poultry manure rate and age at harvest on the mineral contents of a major grass (*Panicum maximum* var Ntchisi) in southwest Nigeria.

Materials and Methods

The research work was carried out at the Organic Research farms and Laboratory of Pasture and Range Management, Federal University of Agriculture, Abeokuta, Nigeria located on latitude 7^0 12' 15.35'N and longitude 30 20' 52.37'' E at 68 m elevation. The treatment combination comprised 4 poultry manure rates (0,100, 200 and 300 $KgNha^{-1}$) and 3 age at harvest (4, 8, 12 weeks after cutback) of *P. maximum* var Ntchisi which amounted to twelve (12) which were randomly allotted. The experimental area was arranged in a 4 x 3 factorial experiment in a Randomized Complete Block Design (RCBD) with four replicates .The grasses were planted at 50 cm intra rows and 50 inter rows with each plot having a dimension of 3 m x 5 m. The samples of the grasses were dried in a forced draught oven at 105 ^oC for 24 hours and were analyzed for some macro minerals (Ca, P, K, Na and Mg) and micro minerals (Cu, Zn, Mn and Fe). The concentration of Potassium (K) was estimated with a flame photometer after wet digestion in nitric acid and per chloric acid. Concentration of Ca, P, Mg, Mn, Cu and Zn were determined with atomic absorption spectrophotometry (Fritz and Schenk, 1979). Data collected were subjected to two-way analysis of variance (ANOVA) and significant means were separated using Tukey's Studentized Range (HSD) of the SAS (1999) package.

Results

The main effect of poultry manure rate and age at harvest on the macro elements of *Panicum maximum* var. Ntchisi is as presented in Table 1. The macro elements were significantly ($p<0.05$) influenced by the manure rate and age at harvest. The unfertilized grass had the highest Ca and K values, while the highest values of P, Mg and Na were recorded for grass fertilized with 300 $KgNha^{-1}$ of poultry manure. The Ca content ranged from 2.76 gkg^{-1} DM in the grass fertilized with 100kgN/ha to 4.35 gkg^{-1} DM in unfertilized grass. The K content had similar trend with that of the Ca content ranging from 15.58 gkg^{-1} DM in grass fertilized with 100 $KgNha^{-1}$ to 30.80 gkg^{-1} DM in unfertilized grass. The P content increased with increasing rate of manure from 0.76 gkg^{-1} DM to 1.78 gkg^{-1} DM.

The effect of age at harvest was observed to be significant as the grass harvested at 4WAC recorded the highest macro element values. There was a decline in the content of the minerals with advancement in age at harvest.

The main effect of manure rate and age at harvest on the microelement content of *P. maximum* is as presented in Table 2. There were significance differences ($P<0.05$) as influenced by manure rate for the microelements, with the unfertilized grass had the highest value of 41.55 $mgKg^{-1}$DM for the Mn content and the grass fertilized with 300 $KgNha^{-1}$ recorded the highest values for Fe (104.67 $mgKg^{-1}$DM) and Cu (8.33 $mgKg^{-1}$DM). The Zn content was observed to be the highest with the grass fertilized with 200 $KgNha^{-1}$.

The effect of age at harvest was significant ($P<0.05$) for the microelements except for Cu content. The Mn content ranged from 28.08 $mgKg^{-1}$DM to 47.33 $mgKg^{-1}$DM with the grass harvested at 4WAC having the highest value. The grass harvested at 4WAC recorded the highest values for Fe and Zn with 86.42 $mgKg^{-1}$DM and 29.50 $mgKg^{-1}$DM, respectively.

Discussion

Minerals are known and required for their functional roles in all metabolic processes, but their amount either in excess or deficit can result in much economic losses in animal productivity (Spears and Weiss, 2014), the calcium content of the grass as affected by manure rate in this study is in line with that reported by Dele (2012) where zero manured grasses had higher Ca content than the manured grasses. This could be as a result of the salinity attached to manure application as reported by Chang *et al.* (1991). The decrease in the Ca content with advance maturity as observed in this study is in consonance with the report of Dele *et al*. (2018). The Ca content of the grass under study fell within the range (1.8 – 8.2 g/kg DM) reported by McDowell (1997) for different classes of ruminants. The grass fertilized with 300kgN/ha had the highest P content, though slightly lower than the recommended range for different classes of ruminants (McDowell, 1997). The low content of P in this study is a true reflection of tropical forages as reported by McDowell (1984) which reported that tropical forages are generally low in P content and this could be as a result of the properties of tropical soils that are known to be deficient in major nutrient especially phosphorus (Oberson *et al.*, 2006). The Mg content increased with advanced maturity and is in line with the findings of Dele *et al*. (2018) and Kering *et al.* (2011). The Mg content of the grass in this study is higher than the range (1.0 to 2.0 g/kg DM) reported by McDowell (1997) as requirement different classes of ruminants. Minson and Norton (1984) reported that tropical forages contain sufficient Mg.

The K concentration in this study is above 8 g/kg recommended for grazing animals (Underwood, 1981). However, it has been suggested that ruminants with high producing ability in terms of milk and other animal products may require K level above 10 g/kg under stress particularly heat stress (McDowell, 1985) of which the grass in this study could be a good source of.

The Fe content is higher than the desirable threshold concentration for all classes of ruminants and could not lead to iron toxicity as reported by NRC (2001) as it is known that Fe generally low in terms of bioavailability in forages. Zinc is important to a variety of biological and metabolic processes in ruminant animals; it is widely distributed throughout the body as a component of metalloenzymes and metalloproteins (Vallee and Falchuk, 1993), with its germane roles, it was observed that the range recorded in this study is high enough to meet the nutritional requirements of all classes of ruminants. The Zn concentration of the grass in this study fell within the marginal (20-40 mg/kg) level for cattle nutritional requirement (MacPherson, 2000).

Table 1: Effect of manure rate and age at harvest on the macro-mineral (gKg^{-1} DM) of *P. maximum* var Ntchisi

Manure rate	Age at harvest	Ca	P	Mg	K	Na
0		4.35^{a}	0.76^{d}	6.61^{c}	30.80^{a}	0.90^{c}
100		2.76^{d}	1.18^{c}	5.58^{d}	15.58^{d}	0.73^{d}
200		2.99^{c}	1.55^{b}	7.31^{b}	22.01^{c}	0.98^{b}
300		3.11^{b}	1.78^{a}	8.43^{a}	28.57^{b}	1.04^{a}
SEM		0.01	0.1	0.03	0.04	0.01
	4	3.74^{a}	1.44^{a}	8.18^{a}	32.28^{a}	1.04^{a}
	8	3.27^{b}	1.41^{b}	6.89^{b}	21.40^{b}	0.96^{b}

	12	2.90^{c}	1.09^{c}	5.89^{c}	19.05^{c}	0.73^{c}
	SEM	0.02	0.01	0.02	0.03	0.00
0	4	5.05^{a}	0.88^{g}	7.84^{e}	42.10^{a}	1.01^{b}
	8	4.50^{b}	0.82^{h}	7.16^{g}	30.21^{c}	0.96^{c}
	12	3.49^{d}	0.58^{i}	4.84^{k}	20.10^{i}	0.72^{g}
100	4	3.86^{c}	1.45^{de}	7.57^{f}	15.81^{j}	1.00^{b}
	8	2.80^{g}	1.24^{f}	5.61^{j}	22.45^{g}	0.80^{f}
	12	1.62^{j}	0.85^{gh}	3.57^{l}	8.47^{k}	0.40^{h}
200	4	3.50^{d}	1.78^{b}	9.18^{a}	41.12^{b}	1.20^{a}
	8	2.48^{i}	1.40^{e}	6.06^{i}	4.72^{l}	0.87^{e}
	12	3.00^{f}	1.46^{d}	6.70^{h}	20.20^{h}	0.87^{e}
300	4	2.55^{h}	1.67^{c}	8.12^{d}	30.11^{d}	0.96^{c}
	8	3.27^{e}	2.18^{a}	8.74^{b}	28.22^{e}	1.20^{a}
	12	3.49^{d}	1.49^{d}	8.43^{c}	27.40^{f}	0.94^{d}
SEM		0.01	0.01	0.00	0.01	0.00

abc..: means with same superscript along same column are not significantly different (P>0.05); SEM=Standard error mean

Conclusion

From the result of this study, it could be concluded that application of organic manure and harvesting at a relatively younger age or stage do enhances quality of forage.

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Table 2: Effect of manure rate and age at harvest on the micro-mineral (mgKg^{-1} DM) of *P. maximum* var Ntchisi

Manure rate	Age at harvest	Mn	Fe	Cu	Zn
0		41.55^{a}	70.89^{c}	5.33^{b}	26.11^{a}
100		30.78^{c}	69.33^{c}	5.00^{b}	21.00^{b}
200		35.78^{b}	78.89^{b}	5.33^{b}	28.33^{a}
300		31.11^{c}	104.67^{a}	8.33^{a}	26.22^{a}
SEM		0.04	0.02	0.91	0.41
	4	47.33^{a}	86.42^{a}	6.00	29.50^{a}
	8	29.00^{b}	74.25^{c}	6.00	22.75^{b}
	12	28.08^{b}	82.17^{b}	6.00	24.00^{b}
	SEM	0.05	0.03	0.99	0.50
0	4	52.00^{a}	82.00^{d}	5.00^{ab}	30.33^{ab}
	8	42.00^{b}	70.00^{e}	8.00^{ab}	29.00^{bc}
	12	30.67^{c}	60.67^{f}	3.00^{b}	19.00^{d}
100	4	52.00^{a}	92.00^{c}	6.00^{ab}	29.00^{bc}
	8	20.00^{d}	62.00^{f}	3.00^{b}	21.00^{d}
	12	20.33^{d}	54.00^{g}	6.00^{ab}	13.00^{e}
200	4	53.33^{a}	100.67^{b}	6.00^{ab}	35.00^{a}
	8	23.00^{d}	65.00^{ef}	4.00^{ab}	22.00^{d}
	12	31.00^{c}	71.00^{e}	6.00^{ab}	28.00^{bc}
300	4	32.00^{c}	71.00^{e}	7.00^{ab}	23.67^{cd}
	8	31.00^{c}	100.00^{b}	9.00^{a}	19.00^{d}
	12	30.33^{c}	143.00^{a}	9.00^{a}	36.00^{a}
SEM		0.06	0.04	1.00	0.40

abc..: means with same superscript along same column are not significantly different (P>0.05); SEM=Standard error mean

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