Mineral Profile of *Panicum maximum* var. Ntchisi as Influenced by Organic Nitrogen Rate and Age at Harvest

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Abstract
The study was aimed at profiling the mineral contents of *Panicum maximum* var Ntchisi as influenced by organic (poultry) nitrogen rate and age at harvest. The study was carried out at the organic research farm of the Federal University of Agriculture, Abeokuta, Nigeria in 2016. The experiment was laid in a 4 x 3 factorial arrangement in a split plot design with four (4) organic nitrogen rate (0, 100, 200 and 300 $kgNha^{-1}$) as the main plot and three (3) age at harvest (4, 8 and 12 weeks after cutback) as the subplot which amounts to twelve (12) treatment combinations with four replicates. The macro mineral contents were significantly ($P<0.05$) influenced by the nitrogen rate. The calcium (Ca) content was up to 4.35 gkg^{-1}DM for the grass at 0 $KgNha^{-1}$ which was the highest value. The magnesium (5.59 – 8.43 gkg^{-1}DM) content had a linear increment with increased nitrogen rate. The potassium content ranged from 15.58 to 30.80 gkg^{-1} DM with the grass fertilized at 0 $KgNha^{-1}$ having the highest K content. The phosphorus was linearly ($P<0.05$) influenced with the grass fertilized at 300 $KgNha^{-1}$ with the highest (1.78 gkg^{-1}DM) content. The micro mineral contents were significantly ($P<0.05$) influenced by the nitrogen rate though without a definite pattern. The macro and micro mineral contents were significantly ($P<0.05$) influenced by age at harvest except for the copper content. The macro mineral contents decreased with advancement in age at harvest. It was concluded that the grass harvested at younger age will make a good feed resource in terms of mineral requirement of ruminants in the tropics.

Introduction
Minerals are important to the health and well-being of ruminant animals in the tropics as their deficiency as well as abundance could amount to low productivity. Minerals are required by both plants and animals in critical and balance amount, the excess and deficiency both reduces the efficiency of vegetation and dependant livestock production (Dele, 2012). Majorly, the deficiencies of these mineral elements are more pronounced. Forages are the major sources of minerals in the diets of ruminants in the tropics. The natural pasture is considered the major source of forages which is given little or no management input, thereby supplying insufficient nutrient and biomass (Mohammed-Saleem, 1994). Sown pasture, which is a purposely managed pasture with better nutrient and carrying capacity is been considered the way to go (Onifade *et al*., 2005; Dele, 2008). *Panicum maximum* is a major grass in the tropics with relatively high biomass and nutrients if management inputs like fertilizer/manure are applied as well as good cutting/grazing schedule are employed. Hence, this paper reports the effect of organic nitrogen rate and age at harvest on the mineral composition of *P. maximum* var. Ntchisi.

Methods and Study Site

The field trial was carried out at the Organic Research farms and laboratory of the Department of Pasture and Range Management, Federal University of Agriculture, Abeokuta, Nigeria. The experimental site was ploughed twice and harrowed. Composite soil samples were randomly collected from the site at the depth of 0-30 cm. The soil samples were thoroughly mixed and sub-samples taken for analysis to determine the pre – planting nutrient status of the soil. The poultry manure was applied and incorporated into the soil two weeks prior to planting to enhance mineralization and the plots were weeded throughout the period of the experiment. The *P. maximum* var. Ntchisi was planted through vegetative propagules which were sourced from established plots. The grass was planted at 50 cm intra rows and 50 cm inter rows with each plot having a dimension of 3 m x 5 m with total experimental area measuring 1680 m^2 which was sub- divided into four blocks. The study was a 4 x 3 factorial experiment in a split-plot design making a total of twelve (12) treatment-combinations with four (4) replicates. The poultry manure rate (0,100, 200 and 300 $KgNha^{-1}$) was allotted to the main plot while the age at harvest (4, 8, 12 weeks after cutback (WAC)) was allotted to the sub-plot. The poultry manure was also analyzed to know its nutrient composition (N (g/kg) 30.2, P (g/kg) 10.6, K (g/kg) 10.3, Ca (g/kg) 37.2, Mg (g/kg) 17.3, Na (g/kg) 2.1, Fe (mg/kg) 630.9, Zn (mg/kg) 75.4, Cu (mg/kg) 32.7 and Mn (mg/kg) 217.9) prior to application as this was use to determine the quantity of manure applied per subplot. At each age at harvest, samples were harvested and oven-dried at 60^0C until constant

weight was achieved and the dried samples were milled to pass through a 2 mm sieve and thereafter stored up before analysis. The samples were analyzed for some macro minerals (Ca, P, K 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 Calcium, Phosphorus, Magnesium, Manganese, Cobalt, Copper and Zinc were determined with atomic absorption spectrophotometry (Fritz and Schenk, 1979). Data collected were analyzed using the General Linear Model Procedure of SAS (1999) computer package.

Results

The mineral contents were significantly ($p<0.05$) influenced by the organic nitrogen rate. The calcium ranged from 2.76 gkg^{-1}DM to 4.35 gkg^{-1}DM with the *P. maximum* not fertilized having the highest value. The phosphorus content was directly related to the rate of organic nitrogen. The age at harvest was observed to affect the macro-minerals with the macro-elements decreasing with maturity. With the exception of copper which was not significantly ($p>0.05$) affected others were affected by the age at harvest. The manganese decreased with advancing maturity while other micro-element had no definite pattern.

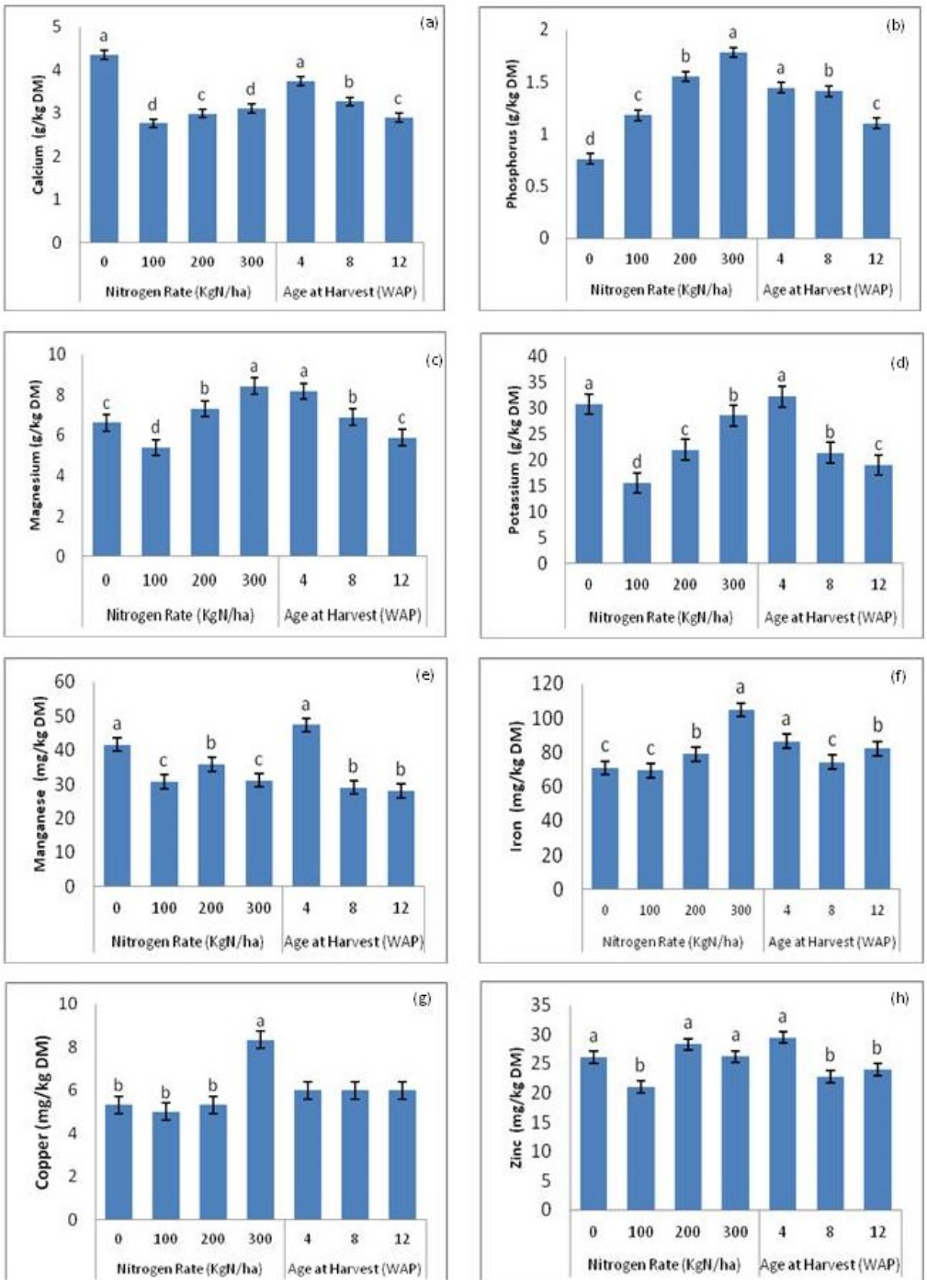

Figure 1: Effect of organic nitrogen rate and age at harvest on the calcium (a), phosphorus (b), magnesium (c) potassium (d), manganese (e), iron (f), copper (g) and zinc (h) content of *P. maximum* var. Ntchisi

Discussion

The values recorded for Ca content of the grass understudied as influenced by the organic nitrogen rate in this study is in consonance with the report of Chang *et al.* (1994) in which the Ca content of zero manured Barley had higher concentration. This might be as a result of salinity associated with manure application (Chang *et al*., 1991), also chelating properties of manure could be responsible in which elements such as calcium are bond into a chelate with the soil colloids which are thereafter released. The value of phosphorus increasing with increased organic nitrogen rate is in line with the reports of Almeida *et al.* (2019) and Pinto *et al*. (2012) which stated that poultry manure is a good source of enriching the soil with phosphorus. The decline in the phosphorus content with maturity could be as result of retranslocation of nutrients from leaves during senescence which is a strategy to efficiently retain P (Killingbeck, 1996). The declining Mg concentration in the grasses as influenced by age at harvest is line with the findings of Cheema *et al.* (2011). Following the report of McDowell (1992; 1997), the grass under study is higher in Mg content as the requirements of the different ruminant animals are put between 1-2 g/kg.

In conclusion, the calcium content of the grass is sufficient to meet the nutrient requirement of different classes of cattle except that of cows nursing calves which will need supplementation. The phosphorus content of the grass is sufficient enough for growing calves and yearling with 200 kg weight but for other classes of cattle there will be the need for supplementation especially for the manured grass and across the age at harvest. The grass have sufficient micro-elements to meet the nutritional requirement of different classes of ruminants

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