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Comparison of the Nutrient Uptake of Five Local Varieties of Millet (*Pennisetum typhoides* Burm. F.) grown on Loamy Sand in Ekpoma, Nigeria

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ABSTRACT

The study was conducted to evaluate five local varieties of millet (*Pennisetum typhoides*) for dry matter yield and mineral composition on a loamy sand soil in a forest-savanna transition zone of Edo state, Nigeria. The experiment was laid out in a randomized complete block design (RCBD) with five varieties replicated four times. The varieties used were: Gero agai, Gero kachia, Gero bida, Gero badeggi and Gero mokwa. The dry matter weight and mineral composition were determined and hence the nutrient uptake per hectare was calculated. Gero agai significantly ($P<0.05$) had the highest dry matter yield while Gero bida had the least. Mineral composition from the flag leaves of the crops showed that millet has a high potential in the nutrients analyzed. However, Gero agai had the highest concentration of macro- and micro- nutrients while Gero bida had the least. The five varieties had significant ($P<0.05$) differential nutrient uptake. Gero agai however, had the highest uptake of both macro- and micro- nutrients while Gero bida had the least.

Keywords: Nutrient uptake, varieties, millet, *Pennisetum typhoides*, loamy sand.

INTRODUCTION

Millet (*Pennisetum typhoides* Burm. F.) belongs to the family Poaceae (Remison, 2005). It is an annual forage and grain crop in many countries of the world. It is a high quality forage crop in the United States, Australia, South America and Korea (Van Oosterm *et al*., 2002). Millet is the 6th most important cereal in the world. It is, however, the second in importance in Nigeria after sorghum as a staple food in the savanna areas (ICRISAT, 2000).

Most of the production of the crop is in the drier areas of Nigeria and it is commonly referred to as 'Gero' (Izge *et al.,* 2007). In Nigeria, over 40% of the land sown annually to cereals is devoted to millet (Van Oosterm *et al*., 2002).

Plants have different ability to absorb nutrients from their growth media. Plants take up essential elements mainly from the soil through their roots. Photosynthesis takes place in the leaves. Consequently, water and nutrients needed for this activity are absorbed by the roots and passed through the stem to the leaves for this very important process.

Nutrient uptake is a mechanism by which plants take up those elements that are essential for their growth. Plants are able to take up ions selectively, which suggests that plant cells can take up certain ion species from their soil environment and transport them into the interior of the cell while excluding others.

The study was therefore undertaken to evaluate the relative uptake of nutrients by five local varieties of millet grown on a loamy sand in a forest-savanna transition zone of Edo state, Nigeria.

MATERIALS AND METHODS

Experimental site:

A field experiment was conducted in the 2013 wet season at Ekpoma, situated between Latitude 6° 45' North and Longitude 6° 8' East. The area lies within the rain forest-savanna transition zone of southern Nigeria. The soils of the area of study are mainly ultisols with udic soil moisture regime (Fapohunda *et al*., 1985). Annual rainfall is about 1200 – 1500 mm with a mean air temperature of 29° C. The area experiences a distinct wet (April – November) and dry (December – March) seasons.

Prior to planting, representative soil samples were obtained at a depth of 0 – 15cm. These were processed and analyzed for physical and chemical properties according to the methods described by IITA (1979).

Five local varieties were obtained from the National Cereal Research Institute (NCRI) Badeggi, Niger State, Nigeria. These were Gero agai, Gero kachia, Gero bida, Gero badeggi and Gero mokwa. The experiment was set up as a Randomized Complete Block Design with replicated four times.

The land was manually prepared. Planting was done on 10th May, 2013 at the onset of the rains. A pinch of each of the 5 varieties was sown on prepared beds at a spacing of 75 cm x 25 cm inter and intra- row, which was later thinned to one plant per stand at 8 days after planting (DAP). The plot size was 3 m x 1.25 m with a spacing of 1m within plots and between replicates to give equivalent population density of 53,333 plants/ha. Weeding was done manually at 3 and 7 weeks interval.

After flowering, the flag leaves of each variety were harvested, weighed and oven dried at 60°C for 48 hours for nutrient analysis according to the method of AOAC (1990). The nutrient uptake on dry matter basis was determined as: dry matter yield multiplied by nutrient concentration.

Data obtained were subjected to analysis of variance at 5% level of probability and means separate using Duncan Multiple Range Test.

RESULTS AND DISCUSSION

The physico-chemical properties of the site used for the experiment are presented in Table 1. The experimental site was high in sand, slightly acidic, deficient in both macro- and micro- elements. The texture was loamy sand with low exchangeable bases. Although the soil was deficient in the macro- and micro- nutrients, it favoured millet dry matter yield which is essential for ruminant livestock nutrition during lean period.

Table 1. Physico-chemical properties of the site prior to planting

Parameters	Values
Sand (gkg^{-1})	842
Silt (gkg^{-1})	61
Clay (gkg^{-1})	97
Textural class	Loamy sand
pH (H_20 1:1)	5.90
Conductivity (μs/cm)	350
Organic carbon (gkg^{-1})	8.22
Total nitrogen (gkg^{-1})	0.51
Available phosphorus ($mgkg^{-1}$)	10.56
Calcium ($cmolkg^{-1}$)	0.85
Magnesium ($cmolkg^{-1}$)	0.50
Potassium ($cmolkg^{-1}$)	0.08
Sodium ($cmolkg^{-1}$)	0.06
Total exchangeable bases ($cmolkg^{-1}$) $[Ca^{2+} + Mg^{2+} + K^{+} + Na^{+}]$	1.49
Total exchangeable acidity ($cmolkg^{-1}$) $[Al^{3+} + H^{+}]$	0.49
Effective cation exchange capacity ($cmolkg^{-1}$)	1.98
Base saturation %	75.25

Dry matter yield, mineral composition and nutrient uptake

The dry matter yield, mineral composition and nutrient uptake of millet are presented in Tables 2, 3 and 4. The DM yield presented in Table 2 indicated Gero agai was significantly ($P<0.05$) different from the other varieties but did not differ significant from Gero kachia. Abd El-Latief observed high dry matter yield for feeding ruminants during dry periods.

Table 2: Dry matter yield of five local varieties of millet in Ekpoma

Crop variety	DM (t/ha)
Gero agai	13.08^{a} *
Gero kachia	12.10^{ab}
Gero bida	3.63^{c}
Gero badeggi	9.16^{b}
Gero mokwa	4.42^{c}

* Means with same superscript are not significantly different at 5% level (DMRT).

The nutrient composition of the varieties evaluated, indicated that they were generally sufficient in both macro- and micro- nutrients (Table 3) except for Cu in Gero agai and Gero kachia for ruminant livestock production.

Table 3: Nutrient composition of five varieties of millet in Ekpoma

Crop Variety	N	P	K	Ca	Mg	Na	Mn	Zn	Cu
	←		%		→		←	mg/kg	→
Gero agai	4.52	0.38	6.40	0.42	0.51	0.09	22.00	26.9	3.31
Gero kachia	3.55	0.24	3.60	0.35	0.43	0.06	13.10	6.70	5.00
Gero bida	3.04	0.26	3.60	0.34	0.46	0.04	45.90	10.10	11.10
Gero badeggi	2.63	0.26	2.55	0.37	0.47	0.10	45.90	26.90	11.10
Gero mokwa	3.67	0.27	3.42	0.40	0.41	0.03	51.40	51.40	11.10
Mean	3.48	0.35	3.91	0.38	0.46	0.06	35.66	24.40	8.32
S.E	0.26	0.03	0.65	0.02	0.02	0.03	7.59	12.66	1.72

SE= Standard Error.

The nutrient uptake profile of the five local varieties of millet is presented in Table 4. The nutrient uptake varied according to the nutrients involved and the varieties used. Gero agai had the highest nutrient uptake when compared to all other varieties planted, except in iron (Fe), manganese (Mn) and zinc (Zn) for which Gero kachia, Gero badegi and Gero mokwa had the highest, respectively. Ahmad *et al.* (2011) reported significant difference in the nutrient by millet under drought stress condition.

In the same vein, micro- nutrient uptake was lower than those of the macro-nutrients. Nutrient uptake has been found to be of great importance in their yield performance (Yakubu *et al*., 2010). Differential nutrient uptake is determined by a number of factors which include plant species, environmental conditions, nutrient supply and interrelationship among nutrients and between plant and soil (Bationo *et al*., 2002).

Table 4: Nutrient uptake of five local varieties of millet grown on loamy sand in Edo state

Variety	N	P	K	Ca	Mg	Na	Fe	Mn	Zn	Cu
	← kgha^{-1} →									
Gero agai	425.90^{a}	35.81^{a}	803.04^{a}	39.58^{a}	48.06^{a}	8.48^{a}	28.27^{a}	0.19^{c}	2.83^{b}	2.82^{a}
Gero kachia	387.01^{a}	26.20^{b}	393.00^{b}	38.21^{ab}	46.94^{a}	6.55^{b}	28.38^{a}	1.09^{c}	0.76^{c}	0.55^{b}
Gero bida	218.87^{b}	18.72^{b}	259.19^{c}	24.48^{c}	33.12^{a}	2.86^{c}	1.44^{b}	3.60^{a}	0.72^{c}	0.72^{b}
Gero badeggi	162.58^{b}	21.26^{b}	208.54^{c}	30.26^{ab}	38.44^{a}	8.18^{ab}	0.41^{b}	4.12^{a}	2.45^{b}	0.82^{b}
Gero mokwa	248.76^{b}	18.30^{b}	231.81^{c}	27.11^{bc}	31.86^{a}	2.04^{c}	1.36^{b}	3.39^{a}	5.42^{a}	0.68^{b}

Means with same superscript indicated in the columns are not significantly different at 5% level of probability using Duncan's Multiple Range Test.

CONCLUSION

In this study, nutrient uptake was found to relate to varietal and elemental differences. However, nutrient uptake was significantly higher in Gero agai and Gero kachia which underline the possible requirement for nutrient.

REFERENCES

Abd El-Latief, E.A. (2011). Growth and forage yield of pearl millet in newly cultivated land as affected by dates of planting and integrated use of mineral and organic fertilizers. *Asian Journal of Crop Science* 3: 35-42.

Ahmad, G.; Baratali, S.; Aboifazl, T.; Yaser, E. and Mahdi, B. (2011). Effects of uniconazole and cycocel on growth, yield and nutrient uptake of pearl millet under drought stress condition. *American-European Journal of Agriculture and Environmental Science* 10: 857-862.

A.O.A.C. (1990). Official Methods of Analysis, 15th (ed). Association of Official Analytical Chemists. Washington, DC.

Bationo, A., Christianson, C.B. and Baethgen, W.E. (2000). Plant density and nitrogen fertilizer effects on pearl millet production in a sandy soil in Niger. *Agronomy Journal* 82: 290-295.

Fapohunda, A. Donald, W., Kola, O., Ogunshola, A.O., Tayo S., Ucheaugu, H. and Arutu, N. (1985). The reconnaissance soil survey of Bendel State, Nigeria Soil Reports. Federal Department of Agricultural Land Resources 19 pp.

ICRISAT (2006). Pearl millet *http://www.icrisat.org/pearl millet/pearl millet.htm*.

IITA (1979). Selected methods for soil and plant analysis. Manual series No.1. International Institute of Tropical Agriculture, Ibadan, Nigeria. 70 pp.

Izge, A.U., Kadama, A.M. and Sajo, A.A. (2007). Agronomic Performance of selected cultivars of pearl millet (*Pennisetum glaucum* .L.R. Br) and their hybrid in North-Eastern Nigeria. *Agronomy Journal* 6:344-349.

Remison, S.U. (2005). *Arable and Vegetable Crops of the Tropics*. Gift print associate, Benin City. 39 pp.

Van Oosterm, E.J.O., Leavy, G.J., Cranberry, P.S. and Craufaud, P.Q. (2002) Stimulating growth, development and yield of tillering pearl millet-iii. Biomass Accumulation and Partitioning. *Field Crops Research* 79:85-106

Yakubu, H., Ngala, A.L. and Dugje, I.Y. (2010). Screening of millet varieties for salt tolerance in semi-arid soil of Northern Nigeria. *World Journal of Agricultural Science* 6: 374-380.