NUTRITIONAL COMPOSITION OF FLUTED PUMPKIN LEAVES (*Telfairia occidentalis* HOOK F.) AS AFFECTED BY FOUR DIFFERENT RATES OF UREA FERTILIZER IN UNWANA-AFIKPO, EBONYI STATE

[1]Umekwe, P.N., [2]Okonkwo, P.N., and [1]Okpani, F.M.
[1]Department of Horticulture and Landscape Technology,
Akanu Ibiam Federal Polytechnic, Unwana, Ebonyi State, Nigeria
[2]Department of Agricultural Technology,
Akanu Ibiam Federal Polytechnic, Unwana, Ebonyi State, Nigeria.
paulumekwe@gmail.com 08038556017, akokwupn@gmail.com 08030983945
mgbo.okpani@gmail.com, 08162661665

Abstract
The nutritional composition of Fluted Pumpkin leaves (Telfairia occidentalis Hook F.) as affected by four different rates of Urea fertilizer in Unwana-Afikpo was conducted at the research farm of Department of Horticulture and Landscape Technology, Akanu Ibiam Federal Polytechnic, Unwana. The area is in a humid tropical agro-ecological zone. The objective was to evaluate the nutritional composition under different urea fertilizer rates. The study was laid out in a randomized complete block design (RCBD) replicated three (3) times. Each replicate was made up of four (4) plots. Treatments include urea fertilizer rates of 0, 40, 80 and 120kg. Proximate data collected on the fluted pumpkin leaves at 12 weeks after planting (WAP) were; carbohydrate, crude protein, crude fiber, crude fat and moisture content. Analysis of variance results (ANOVA) indicate that the distribution of carbohydrate, crude protein and other nutrients in the fluted pumpkin leaves was influenced by urea fertilizer. 80kgN/ha produced more carbohydrate (4.96%), more crude protein (12.01%) and more crude fiber content (5.38%) while control plots recorded the least values on all parameters assessed. On the other hand, when the urea fertilizer was increased beyond 80kg/ha, there was declined in the nutritional composition except on crude fat and moisture content with 2.61% and 75.02%, respectively. However, we recommend 80kg/ha of urea fertilizer for better improvement on the nutritional composition of fluted pumpkin leave in Unwana-Afikpo.

Keywords
Application Rates, Fluted Pumpkin, Nutrient Composition, Urea Fertilizer

Introduction

Fluted pumpkin belongs to the family "Cucurbitaceae" and is dicotyledonous crop which are distributed all over the world (Okoli & Mgbeogwu, 1983). The family has 90 general and more than 700 species (Axtela, 1992). In Nigeria, there are two major cultivars; Ugu ala with dark/black red seeds and Ugu elu with brown/yellowish seed (Odinaka and Schippers, 2004).

The conventional method of propagation is by seed sown directly at the rate of 3,000 to 7,000 seeds/ha and spaced at 0.3 to 1m (Ossom, 1986). NIHORT (1998) recommended 40,000 plants per hectare for fruit production. About 1.9tons of seeds can be derived from 3,000 fruits of fluted pumpkin (Akoroda, 1990b). Ossom et al.(2005) reported that *Telfairia occidentalis* thrives well within the temperature range of 30 to 50^0C.

The nutritional value of fluted pumpkin can never be over emphasized. The leaf of fluted pumpkin has high iron and protein content. According to FAO (1988), leaves and edible shoots together contains 85% moisture and dry protein which is usually consumed contains 11% crude

protein, 25% carbohydrate, 3% oil, 11% ash and as much as 700ppm of iron. FAO (1988) reported that the nutritional values of fluted pumpkin leaves contains 86ml water, 47 calories, 2.9g protein, 1.8g fat, 7.0g carbohydrate and 1.7g fibres.

In field trial on the growth, yield and nutritional composition of fluted pumpkin as affected by fertilizer types in Ogbomoso, FAO (1988) reported that the nutritional value of pumpkin seeds is different from that of the leaves. They found that the protein contents of seeds and leaves are 20.5g and 2.5g, respectively, and showed that the seeds have high nutritive and calorific values, which make them necessary in diets. Akanbi et al. (2006) noted that the leaf is of high nutritional, medicinal and industrial values rich in protein (29%), fat (18%) and minerals and vitamins (20%). Soil fertilization is one of the main factors increasing yield of plants (Kolodziej, 2006). Nitrogen plays a role in chlorophyll synthesis and hastens the process of photosynthesis and carbon dioxide assimilation (Jasso-chaverria et al., 2005). Insufficient nitrogen reduces individual leaf area, leaf area index and total leaf area resulting in reduced surface light interception for photosynthesis (Cechin and Fumis, 2004).

Despite the important of fluted pumpkin in Nigeria diet, farmers are facing a lot of challenges concerning its production. Fluted pumpkin is cultivated in most part of eastern Nigeria and some part of northern Nigeria. Yield and quality of leaves relies by farmers are usually lower than what is being reported under experimental condition (Fashina et al.,2002). This is probably due to lack of important cultural techniques for maximum yield of these crops. This crop is cultivated without looking at the nutritional values. Research efforts are therefore requires to recommend the urea fertilizer rates that are better for maximizing good nutritional value of fluted pumpkin leaves in Unwana.

Materials and Methods

Experimental Site

The field experiment was conducted at the teaching, demonstration and research (TDR) farm of the Department of Horticulture and Landscape Technology, Akanu Ibiam Federal Polytechnic, Unwana-Afikpo South Local Government Area in the South eastern part of Nigeria during 2021 cropping season. Unwana is located on the latitude 06^0 05^lN and longitude 08^o 03^1E with an elevation of 300m above sea level (NIMET, 2014). The climatic and vegetation types are generally humid tropical rainforest with mean annual rainfall of about 3.500m and mean daily temperature of 32^0C to 21^0C (Njoku et al., 2006).

Experimental Design

The experimental field was cleared manually with cutlass.Soil sample was collected from five different strategic positions on the experimental site using soil auger at 10 to 15cm and bulked into composite sample. The soil sample was taken to National Root Crop Research Institute (NRCRI) Umudike, Abia State for physico-chemical properties (pH in water, pH $CaCl_2$, organic carbon, organic matter, total nitrogen, Available phosphorus, cations and Base saturation).The experiment was laid out in randomized complete block design (RCBD). The length and width of the experimental field was 15.5m x 19m respectively given a total land area of 294.5m^2 (0.02945ha). The treatment comprised of four rates of urea fertilizer (0, 40, 80 and 120kg/ha) and each treatment was replicated three times. Each block consists of four beds, given a total of twelve beds.

Land Preparation

The experimental field was cleared manually with cutlass and a raised bed of 5m x 3m were made with hoe on the already designed field. Fluted pumpkin seeds were extracted from healthy pods gotten from Eke market, Afikpo, Ebonyi State. The seeds were planted by direct sowing at a spacing of 1m x 1m. One seed was sown per hill at a depth of 1.5cm.

Fertilizer Application (Urea)

Urea fertilizer was applied at four rates of 0, 40, 80 and 120kg/ha. This was done fifth weeks after planting when the seedlings are tender with five leaves. Fertilizer was applied at a distance of 10cm radius in a ring around the plant and then covered with sufficient soil.

Crop Protections

Weeding was done manually which hoe when needed. Pest was controlled by the use of zap chemicals when the needed arose.

Harvesting

Harvesting of total herbage yield was carried out once when they are matured at 12^{th} week after planting (WAP). It was done manually by cutting of the vines with knife.

Preparation of Samples

The fluted pumpkin leaves as affected by four rates of urea fertilizer samples harvested at 12WAP were dried on electric oven at 70^0C for 48 hours. The leaves of each sample were ground to pass through 1mm sieve in order to provide enough surface area for thorough action of solvents and reagents to be used. The ground samples were preserved in cellophane bags and kept in desiccators.The proximate analyses for carbohydrate, crude protein, crude fiber, crude fat and moisture contents on the samples were determined at the Laboratory unit of National Root Crop Research Institute (Umudike), Abia State.

Data Collections/Measurement

Carbohydrate content on the prepared samples was determined by the method described by AOAC (2005). The crude proteins of the 4 samples were determined by the Micro Kjedahl method as described by Pearson (1976). Crude fiber and fat were also determined accordingly. Moisture content was determined by placing the harvested leaves in a brown envelop and dried in an electric oven at 70^0C till constant weight is obtained. The dry matter weight was subtracted from the original fresh weight.

Statistical Analysis

Nutritional composition data were subjected to analysis of variance for completely randomized design (CRD). The proximate compositions (carbohydrate, crude protein, crude fibre, fat and moisture contents) were compared using Fishers Least Significant Difference i.e. F-LSD as outlined by Obi (2012).

Results and Discussion

The results of chemical and physical properties of the experimental plots showed that the surface soils were slightly acidic with pH values of 5.80. This is in line with the report of Azu et al.(2017) who reported high acidity in most soils of Ebonyi State. According to Azu et al. (2018), the high concentration of oxides of iron and aluminum coupled with the presence of 1:2 clay minerals in the clay fraction of most hydromorphic soils of Ebonyi State is responsible for high exchangeable

acidity and pH as observed in the study. The soils of the plots were low in organic carbon, 1.43% and nitrogen was 0.15%. The available P was 7.80mg/kg. The exchangeable cations (Cmol/kg), Ca^{2+}, Mg^{2+}, K^{+} and Na^{+} were 3.00, 1.00, 0.32 and 0.02, respectively (Table 1). Total nitrogen and available phosphorus were low and below the critical level of 0.15% and 12mg/kg as proposed by Osodeke and Ubah (2005). Generally, the basic cations, except Calcium were low which might be responsible for the high pH. The exchangeable acidity was high (2.82cmol/kg), owing to the high concentration of sexquoxide in the soil. The effective cation exchange capacity (ECEC) and base saturation were moderately high (7.16cmol/kg and 60.11%, respectively).

The potential of a particular food is determined primarily by its nutrient composition. Leafy vegetables are known to add taste and flavor, as well as substantial amounts of crude protein, crude fibre, minerals and vitamins to the diet (Nnamani et al.,2009). The results of the analysis of variance of percentage carbohydrate, crude protein, crude fat, crude fibre and moisture contents of fluted pumpkin leaves as affected by four rates of urea fertilizer are presented in Table 2. The nutritional composition showed very highly significant effects in percentage carbohydrate, crude protein and crude fiber except percent crude fat and moisture content (see Table 2).

Percentage carbohydrate content of fluted pumpkin as influenced by urea fertilizer showed significant differences P = 0.01 (Table 2). 80kgN/ha produced the highest carbohydrate of 4.96% and they differed from the other urea fertilizer rates (Table 3). However, 0kgN/ha produced the least carbohydrate content of 3.28%. The carbohydrate values obtained for urea fertilizer, 80kgN/ha (4.96%) were comparable with the value of 6.39 ± 2.66% reported by Loukou et al. (2007) for *Arachis hypogaea.* 80kgN/ha gave the highest crude protein content (12.01%) whereas, 0kgN/ha had the least protein content (8.53%) and they differed significantly from each other. The protein content produced at 80kgN/ha differed significantly from other percentage protein content recorded on other urea fertilizer rates used (Table 3). This crude protein values differed favourably with the crude protein values reported for yam (7.31% and 9.67%), *Zanthoxylum zanthoxyloides* (Hercules Club,'Nka') (8.74%) (Nnamani et al.,2009). They also stated that any plant foods that provide about 12% of their calorific value from protein are considered good source of protein. All the urea fertilizer rates, therefore meet this requirement with crude protein contents mentioned above.

The analysis of variance showed non-significant (P = 0.05) differences on percentage crude fat content as affected by urea fertilizer rates (Table 2). Although, 120kgN/ha gave the highest percentage crude fat content of 2.62% whereas control plots (0kgN/ha) produced the least crude fat content of 1.84% (Table 3).There was highly significant (P = 0.01) effect in crude fiber content of fluted pumpkin under four rates of urea fertilizer investigated (Table 2). The 80kgN/ha, produced the highest percentage crude fiber content (5.38%) which differed from the other urea fertilizer rates studied. However, 0kgN/ha gave the least crude fiber content of 3.79% (Table 3).The highest crude fibre contents produced at 80kgN/ha across the Urea rates used, were high when compared with soybean (0.2%), (Saurez *et al.,* 1999), *Talinum triangulare* (6.20%), *Piper guineensis* (6.40%), bitter leaves (*Vernonia amygdalina*), 6.5% and *Corchorus olitorius* (7.0%), (Oboh et al., 2003). Crude fiber is the part of food that is not digested by human beings but the normal functioning of the intestinal tract depends upon the presence of adequate fiber. This increases stool bulk and decreases the time that waste materials spend in the gastrointestinal tract. Fiber helps in the maintenance of human health and has been known to reduce cholesterol level in the body (Lajide et al.,2008).

Urea fertilizer at the rates of 120kg/ha, had high moisture contents of 75.02% and this could imply short shelf life. High amount of moisture content on leafy vegetables makes them vulnerable to microbial attack, hence, spoilage. The moisture content of any food is an index of its water activity and is used as a measure of stability and the susceptibility to microbial contamination (Scott, 1980). This high moisture content could also means that dehydration would increase the relative concentration of other food nutrient and therefore improve the shelf-life and preservation of the fruits. The relative high moisture content observed in this study is in line with the report by Umoh (1998). He reported that high moisture content is typical for fresh fruits at maturity. Thomas and Oyediran (2008) had earlier reported 82.8% moisture content for *C. esculenta* which is in the same range of moisture content obtained in the study.

Conclusion

However, the influenced of urea fertilizer at four rates on the proximate composition showed that the plots treated with 80kg/ha, produced the highest proximate composition on carbohydrate, crude protein and crude fiber while 120kgN/ha gave the best in crude fat and moisture content of fluted pumpkin leaves. The plots with no urea fertilizer consistently gave the lowest values on all the nutrient parameters measured. However, we recommend 80kg/ha of urea fertilizer for better improvement on the nutritional composition of fluted pumpkin leave in Unwana-Afikpo. More research, however, is needed, especially in the areas of the proximate composition of fluted pumpkin vines or seeds with different urea fertilizer rates.

References

Akanbi, W. E., Adeboye, C. O., Togun, A.O., Ogunrinde & Adeyeye, S. A. (2006). Growth, herbage and seed yield and quality of *Telfairia occidentalis*.

Akoroda, M. O. (1990b). Seed production and breeding potential of fluted pumpkin, *Telfairia occidentalis*. *Euphytica* 49: 25-32.

Association of Official Analytical Chemist, (2005). Official methods of analysis (14th edition). Association of Official Analytical Chemist, Wishington, D.C. U.S.A pp 19.

Axtela, B. L. (1992). Minor oil crops. FAO Agricultural Services Bulleting No. 94 FAO of the united nation.

Azu Donatus, E.O., Osodeke, V. E., and Nwanja, O.U. (2017). Effect of algae on phosphorus sorption characteristics of an ultisol of Southeastern Nigeria. *Direct Research Journal of Agriculture and Food Science,* 5(2): 88-95.

Azu Donatus, E.O., Osodeke, V. E., Ukpong, I. M. & Osisi, A. F. (2018). Chemistry and mineralogy soils derived from different parent materials in Southeastern Nigeria. *Int. Journal of Plant and Soil Science,* 25(25): 1-16.

Cechin, I. & Fumis, T. (2004).Effect of nitrogen supply on growth and photosynthesis on Sunflower plants grown in the greenhouse. *Plant Science.*166:1379 – 1385

FAO (1988).Traditional Food Plant. Food and Agricultural Organization of the United Nations, Rome, Italy.

Fashina, A. S., Olatunji, K. A.& Alasiri, K. O. (2002). Effect of different plant populations and poultry manure on the yield of Ugu (*Telfairia occidentalis*) in Lagos State, Nigeria. In: *Proceedings of the Annual Conference of Horticultural Society of Nigeria (HORTSON),* NIHORT, Ibadan, Nigeria.

Jasso-Chaverria, C., Hoehmuth, J. J., Hochmuth, R. C. & Sargent, S. A. (2005). Fruit yield, size and colour response of two greenhouse cucumber types of nitrogen fertilization in perlite soilless culture. Horticulture Technology.15: 565.

Kjeldahl, J. (1883). Determination of protein nitrogen in food products.*Encyclopedia of Food Science,* 439 – 441.

Kolodziej, B. (2006). Effect of mineral fertilization on ribwort plantain (*Plantagolanceolata* L.) yielding (in Polish).*Acta Agrophysica.*141: 637 - 647.

Lajide, L., Oseke, M.O. & Olaoye, O.O. (2008).Vitamin C, Fibre, Lignin and Mineral contents of some edible legume seedlings. *Journal of Food Technology* 6(6): 237-241.

Loukou, A.L., Gnakri, D., Djel, Y., Kippre, A.V. Malice, M., Baudoin, J. P & Zoro Bil, I. A. (2007). Macronutrient composition of three cucurbit species cultivated for seed consumption in Cote d'Ivoire. African Journal of Biotechnology 6(5), pp. 529-533.

NIHORT (1998). Guide to production of (*Telfairia occidentalis* Hook F.). National Horticultural Research Institute Ibadan, Nigeria. 5: 8-12

NIMET (2014). Meteorological Station Akanu Ibiam Federal Polytechnic, Unwana-Afikpo. National Meteorological Bulletin.

Njoku, N., Lemond, J., Everest, G., & Manu, P. (2006). Climate change and soil conditions in the tropical rainforest of Southeastern Nigeria. *International Journal of Agricultural Research* 2(1):62-68.

Nnamani, C.V., Oselebe, H.O. & Agbatutu, A. (2009). Assessment of nutritional values of three underutilized indigenous leafy vegetables of Ebonyi State, Nigeria. *African Journal of Biotechnology* 8(9):2321-2324.

Obi, I. U. (2012).*Statistical Methods of Detecting Differences Between Treatment Means and Research methodology Issues on Laboratory and Field Experiments (Second Edition).* Optimal International Limited, Enugu. Xi + 131pp.

Oboh, G., Akindahunsi, A. A. and Oshodi, A. A (2003).Plants Food.*Hum. Nutr.*58:1-7.

Odinaka N. I. & Schippers, R. R. (2004). *Telfairia occidentalis* Hook F. (internet) record from protabase.Grubben, G.J.H. and Denton, O.A. (Editor). PROTA (Plant Resources of Tropical Africa/Resources Vegetales d'I Afrique tropicale, Wageningen, Netherlands.

Okoli, B. E & Mgbeogu, C. M. (1983). "Fluted pumpkin *Telfairia occidentalis*. WestAfrican Vegetable" *Economic Botany.* 37 (2) 145 – 147.

Osodeke, V. E. & Ubah, A. F. (2005). Determination of phosphorus fraction in selected soils of Southeastern Nigeria. *International Journal of Natural and Applied Science* 1(1):10-14.

Ossom,, E. M. (1986). Influence of harvest interval on yield, crude protein, N.P and K contents on longevity of fluted pumpkin (*Telfairia occidetalis* Hook F.) Tropical Agriculture (Trinidad) and Tobago) 63 (1): 63-65.

Ossom, E. M., Igbokwe, J. R. & Rhykerd, C. L. (2005). Effect of mixed fertilizer levels and harvest intervals on the yield and mineral concentration of fluted pumpkin, *Proc. Indiana Acad. Sci.* 105(13-14).169-176.

Pearson, D. (1976). The chemical Analysis of Foods. 7th Edn.Churchll Livingstone Pub. Co. London and New York, pp. 575.

Saurez, F. L., Springfield, J., Fume, J. K., Lohrmann, T.T., Kerr P. S. & Levitt, M. D. (1999). Gas Production in Humans infesting Soybean Flour Derived from Beans.

Scott, W.S. (1980). Water relations of food spoilage microorganisms.*Adv. Food Res*. 7:84-127.

Thomas, A. O. & Oyediran, O. E. (2008).Nutritional Importance and Micronutrient Potential of Two Non-Conventional Indigenous Green Leafy vegetables from Nigeria. *Agric. J.* 3(5): 362-365

Umoh, F. B. (1998). Commonly used fruits in Nigeria. In: Nutritional Quality of Plant Foods. (Eds Osagie A.U, Eka O.U). Post Harvest Research Unit, University of Benin, Benin City. Nigeria

Table 1. Pre-Planting Soil Chemical and Physical Properties of the Experimental Plots

Constituents	Quantities
pH (H_2O)	5.28
pH ($CaCl_2$)	4.10
Organic Carbon (%)	1.43
Organic Matter (%)	2.49
Total Nitrogen (%)	0.15
Available Phosphorus (mg/kg)	7.80
Ca^{2+} (Cmol/kg)	3.00
K^{+} (Cmol/kg)	0.32
Mg^{2+} (Cmol/kg)	1.00
Na^{+} (Cmol/kg)	0.02
ECEC (Cmol/kg)	7.16
TEA (Cmol/kg)	2.82
BS (%)	60.11
Sand (%)	39.67
Silt (%)	16.35
Clay (%)	43.98
Texture	Clayey Loam

Table 2. Form of Analysis of Variance showing Sources of Variation, Degrees of Freedom and Mean Squares for Proximate Composition of Fluted Pumpkin Leaves as affected by Four Different Rates of Urea Fertilizer (kg/ha)

		Mean Squares				
Sources of Variation	**Degrees of Freedom**	**Carbohydrate**	**Crude Protein**	**Crude Fat**	**Crude Fiber**	**Moisture**
Block	1	0.000112	1.12500	0.09031	0.01051	1.8336
Urea	3	0.996046^{**}	4.48208^{**}	$0.45015^{n.s}$	1.17965^{**}	$1.4966^{n.s}$
Error	3	0.001779	0.07210	0.07688	0.01265	0.3356
Total	7	_____	_____	_____	_____	_____

**** Very Highly Significant Effect (P = 0.01)**
n.s Non Significant Effect (P<0.05)

Table 3. Proximate Composition of Fluted Pumpkin Leaves as affected by Four Different Rates of Urea Fertilizer (kg/ha)

	Percentage (%)				
Urea Fertilizer Rates (kg/ha)	**Carbohydrate**	**Crude Protein**	**Crude Fat**	**Crude Fiber**	**Moisture**
0	3.275	8.525	1.535	3.790	72.95
40	3.880	9.620	2.230	3.950	73.65
80	4.960	12.010	2.445	5.380	74.10
120	4.260	10.755	2.615	4.935	75.02
$LSD_{0.05}$	0.1342	0.8545	n.s.	0.3579	n.s.

n.s Non Significant Effect (P<0.05)