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The effects of mineral N and compost fertilizers on the growth, yield and nutritional values of fluted pumpkin (*Telfairia occidentalis)* in south western Nigeria

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Key words
Compost, mineral fertilizer, *Telfairia occidentalis*, growth, nutritional values, yield

1 SUMMARY

This study investigated the optimum level of mineral nitrogen (N) and compost (C) fertilizers and their combinations for the optimal growth, yield, nutritional values and chemical compositions of *Telfairia occidentalis* in Ogbomoso, southwestern Nigeria. Field experiments were conducted in the cropping seasons of 2007 and 2008. The treatments involved two levels of mineral N (0 and 60 kg. N ha^{-1}), 5 levels of compost (0, 1.5, 3.0, 4.5 and 6.0 t. C ha^{-1}) and their combinations (30 kg. N by 1.5 t. C, 30 kg. N by 3.0 t. C, 30 kg. N by 4.5 t. C and 30 kg. N by 6.0 t. C ha^{-1}). The treatments were assigned into a complete randomized block design with three replications. The parameters assessed were number of leaves, vine length, number of vines, leaf area, dry matter yield and shoot yield per hectare. These traits showed a significant increase as N rate increased, with optimum values obtained at 60 kg. N ha^{-1}. Although the highest growth and yield attributes were obtained from 6.0 t. ha^{-1} compost applications, there was no significant difference between the values obtained at 4.5 and 6.0 t. ha^{-1} applied compost. The nutritional values and essential nutrient elements significantly increased as N-rate and compost rate increased with the optimum values obtained at 60kg. N ha^{-1} and 4.5 t. ha^{-1} of compost, respectively. The combined effects of mineral N and compost fertilizers significantly influenced the growth, yield, quality and chemical compositions of *T. occidentalis*, with the maximum values recorded from 30kg N by 4.5 t ha^{-1} of compost. The yield and nutritional qualities of *T. occidentalis* in the guinea savannah zone of Nigeria could be significantly improved by single application of 60kg. N ha^{-1} or 4.5 t. ha^{-1} of compost or and their combination at 30kg. N and 3.0 t. ha^{-1} of compost.

2 INTRODUCTION

Telfairia occidentalis (fluted pumpkin), a member of Cucurbitaceous family is one of the commonly consumed leafy and seed vegetables in Nigeria. Cucurbitaceae is a plant family commonly known as gourds or cucurbits and includes crops like cucumbers, squashes (including pumpkins), luffas melons and water melons. The family is predominately distributed around the tropics, where those with edible fruits were amongst the earliest cultivated plants in the world. The fruit is often a kind of berry called a pepo (Renner, *et al.,* 2007). The cucurbita species are from primarily Africa and South America (Jeffrey, 2005). The fluted pumpkin is no longer known in the wild, but most likely originated in West Africa's high rainfall forest belt. The largest diversity in plant populations can currently be found in Imo state and surroundings areas in South-eastern Nigeria. The crop is found throughout the former forested areas from Sierra Leone, Benin (Cotonou) to Angola and up to Uganda in the east.

For the Igbo people it is the most popular leafy vegetable. The term fluted refers to the shape of the female flowers which resemble a flute. It is also called fluted gourd and in Nigeria, the Igbo people call it *Ugu,* the Yoruba people use *Ugwu*, and in Cameroon it is referred to as *Ekobon*. (Mutshers, *et al.,* 1981). The main use of *T. occidentalis* is as a leaf and seed vegetable. The tender shoots, succulent leaves and immature seeds are cooked and consumed as a vegetable. The leaves are used alone or together with okra (*Albelmoschus caillei* (A. Chev.) or egusi seeds (*Citrullus lunatus*). They are often cooked with fish, meat and tapioca. The leaves are rich in iron and are used to cure anaemia. The oily seeds also have lactation promoting properties and are widely consumed by nursing mothers. The roots are known locally as potent human, fish and rodents poison. The plant also contains considerable amount of anti-nutrients such as phytic acid, tannin and saponin which could also have some health benefits (Egbekan *et a*l., 1998; Balogun *et al.,* 2006).

In Nigeria there are two main types of *T. occidentalis* namely '*Ugu-ala'* characterized by succulent, broad leaves, small black seeds, thick stem and slow growth, and '*Ugu-elu'* which has a high growth rate, large brownish seeds with high viability and thin stem with small leaves (Akoroda, 1990). The large succulent leaves of '*Ugu-ala'* make this cultivar a commercial vegetable with high demand, while the fast emergence and high growth rate of '*Ugu-elu'* is preferred by farmers because of quick returns (Akoroda, 1990)**.**

The moisture content and composition of the leaves show large variations as a function of cultivar, plant age, ecological conditions and cultural practices. The composition of the leaves per 100g edible portion is water 86.0g; energy 147kj (47k cal); protein 2.9g; fat 1.8g; carbohydrates 7.0g and fiber 1.7g. The high content of mineral nutrients, magnesium, Iron, Potassium, carotene and Vitamin C makes the leaves potentially useful as food supplements. Young leaves contain the anti-nutrients factors such as cyanide at 60mg per 100g dry matter and tannins at 41mg per 100g, but these do not necessarily affect the bio-availability of the minerals. Young leaves should be cooked to remove the potential toxic effects before consumption. The composition of the seed per 100g edible portion is water 6.0g; energy 2280kj (543k cal); protein 20.5g; fat 45.0g; carbohydrate 23.5g; fiber 2.2g; calcium(Ca) 84mg and Phosphorus (P) 572mg; (leung, *et al.,* 1968). The seeds are high in essential amino acids (except lysine) and can be compared to soya bean meal with 95% biological value. The fruit pulp has a protein content of about 1.0%. The main constituents of the seed oil are oleic acid (37%), steric and palmetic acid (both 21%); and linoleic acid (15%) (FAO, 1988). Variation between samples however is large.

Fluted pumpkins prefer a loose, friable soil with ample humus and shade. These conditions are hard to find and fortunately this crop will grow in conditions that are far less favorable. Nitrogen is essential for adequate vegetation and should ideally be given in the form of manure, applied before planting. The use of well decomposed manure is essential for fruit production and in this case it is recommended that about 1kg manure/plant be applied. For maximum leaf yields, it is advisable to top dress with a nitrogen fertilizer immediately after each harvest (Akanbi, *et al.,* 2004). Manure inform of compost also contains phosphorous and other nutrients needed for seed production (Olaniyi & Akanbi, 2008).

Composting is a natural biological process carried out under controlled aerobic conditions (it requires oxygen). In this process microorganisms including bacteria and fungi breakdown organic matter into simpler substances. Finished compost can be classified as a 100% organic fertilizer containing primary nutrients, trace minerals, humus and humic acids in a slow release form. Compost improves soil porosity, drainage and aeration and moisture holding capacity and reduces compaction. Compost helps buffer against the absorption of chemicals and heavy metals, releases nutrients over a wide time window; promotes the development of healthy root zones; suppresses diseases associated with certain fungi, and helps plants to tolerate drought conditions (Ngeze, 1998; Akanbi *et al.,* 2004).

Despite numerous benefits of compost to both soil and crops, information on its use to improve crop production and nutritional values are scanty. In recent times, the recycling of organic residues, in order to re-utilize them as an alternative source for the production of fertilizers is a strategic measure from an environmental stand point, and is convenient as long as it is economically feasible. The objective of this study was therefore to determine the optimum level of mineral 'N' and compost fertilizers required for maximum growth, yield, chemical compositions and nutritional values of *Telfairia occidentalis*.

3 MATERIALS AND METHODS

3.1 Study site: Field experiments were conducted on a loamy soil of an affisol at the Teaching and Research farm, Ladoke Akintola University of Technology (LAUTECH), Ogbomoso, Nigeria. Ogbomoso (latitude 8^0 10'N and longitude 4^0 10'E) is located in the guinea savannah zone of south - west Nigeria. The region has two rainy periods with more than 1000mm of rainfall per annum (Olaniyi, 2006). Pre – plant soil samples were taken and it was determined that the soil contained total N, 0.14 $g.kg^1$; available P, 10.03 $mg.kg^{-1}$; and exchangeable bases of Ca, Mg, and K, with values of 5.37, 4.32 and 2.01 C mol. kg^{-1}, respectively, with a soil pH of 6.7(Olaniyi, 2006).

3.2 Composting: *Gliricidia* and poultry manure were the major components while water, wood ash and soil were minor. The materials were collected and laid out in layers; *Gliricidia* forming the base in ratio of 3 to 1 of poultry manure followed by wood ash, soil and water. The procedure was repeated twice (2 layers) in a plastic drum as described by Olaniyi & Akanbi (2008). The *Gliricidia* form the carbon source, poultry droppings form the nitrogen sources, wood ash to control pH and soil to introduce microbes that aid decomposition. After the laying out of each composting material, water was added to facilitate microbial activities. Turning and watering was repeated every 2 weeks.

Seeds were collected from ripped *Telfairia* pods obtained from the department of Agronomy, LAUTECH, Ogbomoso. Pods were opened and seeds extracted from the pulp. Sawdust and soil were collected, mixed together at equal ratio, put into seed boxes and watered. The seeds were planted and watered again. The nursery activities included watering at 2 days intervals, control of pest and diseases and weeding as at when necessary.

3.3 Experimental layout: Treatments consisted of *Telfairia occidentalis* as test crop subjected into Gliricidia compost (C) at rate of (0, 1.5, 3.0, 4.5, 6.0 t. ha^{-l}) and mineral fertilizers (N) at 0 and 60kg. ha^{-l} recommended rate (Okoro., 2006) and their various combinations (30kgN by 1.5t.C; 30kgN by 3.0t.C; 30 kg.N by 4.5t.C; 30 kg N by 6.0 t. C ha^{-l}). This gives a total of 10 treatment combinations laid out in a factorial experiment and fitted into a randomized complete block design with three replications. Experimental plot was manually cleared and raised beds measured 1.2m by 2.2m in sizes were made. There were 10 beds in a replicate, giving a total of 30 beds for the 3 replicates used. *Telfairia* seedlings were transplanted 4 weeks after sowing (WAS) at a spacing of 1m x 0.5m and watered for quick plant establishment. The various fertilizer treatments were applied to their respective plots 2 weeks after transplanting. The plants were staked at vine initiation. Weeding was done manually as required and insect pests were controlled by applying neem extract bi-weekly, beginning from 4 WAS at the rate of 5 ml per liter of water.

3.4 Data recording: Data was collected by destructive sampling of four randomly chosen plants per plot. Data collected at early bloom stage (10 WAS) included vine length, number of vines, number of leaves, and plant fresh and dry shoot yield per hectare. Dry matter yield was determined by placing the harvested plant in brown envelops, and dried in an oven at 65^0 C till constant weight was obtained. The dried plant samples were ground with a Wiley mill, and passed through a 0.5mm sieve. Total N was determined by the macro-kjeldahl procedure as described by IITA (1975). The P and K contents of the plants were determined by wet digestion with a mixture of nitric, sulphric, and perchloric acids. Phosphorus concentration was determined by the vanadomolybdate yellow colorimetry method (Jackson, 1962). Digested samples were diluted and used to determine the concentrations of K using an atomic absorption spectrophotometer.

Other proximate analysis of *Telfairia* shoots was done chemically according to the official methods of analysis described by A.O.A.C. (1984, 1990, and 1998). Nutrient contents were expressed on the basis of percentage dry plant material. All data were subjected to analysis of variance (ANOVA) using the SAS – GLM procedure (SAS, 1989). The significance of the main factors and interactions effects were determined on the basis of the F ratios. The differences between treatment means were evaluated using Duncan's Multiple Range Test at 0.05 probability level.

4 RESULTS AND DISCUSSION

4.1 Growth parameters and shoot yield: The growth parameters at flowering initiation are presented in table 1. The mean number of vines, length of vine and number of leaves of *Telfairia* increased as the applied mineral N rates increased, with the highest values obtained at 60kg N ha^{-1}. These growth parameters were significantly influenced by the applied mineral N rates. Likewise, the growth parameters were improved by the compost rate with the optimum value obtained at the maximum rate of 6.0t ha^{-1}. There were no significant differences between the values obtained at 4.5 and 6.0 t. ha^{-1} of applied compost.

Compost applications also significantly influenced the growth parameters of *Telfairia*. The combined application of mineral N and compost fertilizers significantly increased the number of vines, length of vine and number of leaves of *Telfairia* more than the sole application of the two fertilizers. The best growth parameters of *Telfairia* were obtained from combined application of 30kg N and 4. 5. ha^{-1} of compost.

The results of the fresh and dry shoot yields, and shoot yield per ha^{-1} of *Telfairia* are shown in Table 1. The mean fresh and dry shoot yields, and shoot yield per ha^{-1} increased as the applied mineral N rates increase d, with the highest value obtained at 60kg N ha^{-1}. The fresh and dry shoot yields and shoot yield per ha^{-1} were significantly influenced by the applied mineral N rates. Likewise, the fresh and dry shoot yields, and shoot yield per ha^{-1} of *Telfairia* were significantly influenced by the compost rates.

Although the optimum values were obtained at maximum rate of 6.0t ha^{-1}, there were no significant differences between the values obtained at 4.5 and 6.0 t. ha^{-1} of applied compost. The combined application of mineral N and compost fertilizers significantly increased the fresh and dry shoot yields, and shoot yield per ha^{-1} of *Telfairia* more than the sole application of the two fertilizers. The best fresh and dry shoot yields, and shoot yield per ha^{-1} were obtained from combined application at 30kg .N by 4.5 t. ha^{-1} of compost.

4.2 Marketable seed yield and yield components: The mean yield and yield components of *Telfairia* as affected by mineral N and compost fertilizers are presented in table 2. The mean number of fruits per plant, length of fruit, fruit diameter, fruit weight, number of seed per fruit, seed diameter, weight of seeds per fruit, seed yield per plant, and seed yield per t. ha^{-1} increased as the applied mineral N rates increases, with the highest values obtained at 60 kg. N ha^{-1}. The yield and yield components were significantly influenced by the applied mineral N rates. Likewise, the yield and yield components of *Telfairia* increased as the compost rate increased with the optimum value obtained at 4.5 t. ha^{-1} , then remained stable at 6.0 t. ha^{-1}.

There was no significant difference between the values obtained at 4.5 t. and 6.0 t. ha^{-1}. Compost application significantly influenced the number of fruits per plant of *Telfairia*. The combined application of mineral N and compost fertilizers significantly increased the number of fruits per plant, length of fruit, fruit diameter, fruit weight, number of seed per fruit, seed diameter, weight of seeds per fruit, seed yield per plant, and Seed yield per t. ha^{-1} of *Telfairia* more than sole application of the two fertilizers. The best marketable seed yield and yield components were obtained from combined application of 30kg N by 4.5 t. ha^{-1} of compost.

Table 1: The mean growth parameters and shoot yield of *telfairia* as affected by the mineral N and compost fertilizers application.

Treatments	No. of vines	No. of leaves	Length of vine	Fresh shoot yield (kg)	Dry shoot yield/plant (g)	Shoot yield per ha-1
0	8.6F	53.0 F	120.0 H	0.5 F	28.2 G	5 F
60Kg. N	18.7 A	187.7 C	192.0 AB	2.6 AB	105.5 BCD	26 AB
1.5t. C ha-1	10.7 EF	76.3 I	125.5 G	1.1 E	416.0 F	11 E
3.0 t. C ha-1	11.3 DEF	108.3 H	158.0 E	1.8 E	93.3 E	18 D
4.5t.C ha-1	15.0 BC	121.3 G	186.0 C	2.0 D	101.4 D	20 CD
6.0t.C ha-1	16.2 ABC	130.0 F	189.7 C	2.3 C	103.0 DC	23 BC
30N x 1.5 t. C ha-1	12.7 CDE	139.0 E	142.0 F	2.5 BC	108.7 ABC	25 AB
30N x 3.0 t. ha-1	14.3 CD	150.5 D	176.0 D	2.6 AB	110.0 AB	26 AB
	17.5 AB	254.4 A	196.5 A	2.8 A	112.8 A	28 A
30N x 6.0 t. ha-1	13.3 CDE	228.6 B	162.0 E	2.6 AB	109.1 AB	28 A

Means with the same letter in each column are not significantly different.

4.3 Proximate analysis: Proximate analysis of *Telfairia* shoots as affected by the mineral N and compost fertilizers application is presented in table 3. Except for percent nitrogen and carbohydrate contents, nitrogen rate, compost rate, and nitrogen and compost fertilizers interaction significantly affected all measured nutritional values.

Nitrogen, crude protein, phosphorus, potassium, calcium, magnesium, carbohydrate, crude fiber, iron, and vitamin C contents of t*elfairia* shoots increased as the applied mineral N rates increased. The highest values were obtained at 60 kg. N ha^{-1}. . Likewise, all the nutritional values of *Telfairia shoots* increased as the applied compost rates increased with the optimum value obtained at 4.5 t ha^{-1} , and then decreased thereafter at 6.0 t ha^{-1}. Compost application had a large effect on the nutritional values of *Telfairia* shoots more than mineral N fertilizer. The best nutritional values of *Telfairia* shoots were obtained from combined application of mineral N and compost fertilizers at 30 kg. N by 4.5 t. ha^{-1} of compost.

Generally, the significant increase in the growth and yield attributes of *Telfairia* as applied N rates increased confirmed the roles of N in the promotion of vegetable growth and yield, especially when applied at the recommended rate. This result is similar to the findings of Akanbi *et al.* (2005), Olaniyi (2006); who reported an increased in the performance fruit vegetables. The highest growth, yield and nutritional values obtained at 60 kg N ha.$^{-1}$ is in agreement with the N fertilizer recommendation of *Telfairia* as reported by Okoro (2006).

Table 2: The mean yield and yield components of *telfairia* as affected by mineral N and compost fertilizers Mean with the same letter are not significantly different.

Treatments	No of fruits per plant	Length of fruit (cm)	Diameter of fruit (cm)	Weight of fruit (kg)	No of seeds per fruit	Weight of seeds per fruit	Seed yield per plant (kg)	Seed yield per ha^{-1}	Seed Diameter (cm)
0	1.0^{E}	32.0^{G}	15.0^{F}	2.5^{H}	61.3^{J}	1.23^{F}	1.23^{G}	12.30^{G}	3.0^{H}
60Kg N	3.0^{A}	48.2^{BCD}	29.7^{AB}	4.4^{AB}	128.6^{B}	2.57^{A}	7.71^{A}	77.10^{A}	3.9^{B}
1.5tha^{-1}c	1.7^{D}	36.0^{F}	17.3^{F}	2.9^{G}	68.9^{I}	1.38^{F}	2.35^{F}	23.50^{F}	3.0^{D}
3.0 tha^{-1}c	2.0^{C}	44.6^{E}	23.0^{E}	3.0^{G}	85.1^{H}	1.70^{E}	3.40^{E}	34.00^{E}	3.5^{C}
4.5 tha^{-1}c	2.5^{B}	46.5^{DE}	26.7^{CD}	3.5^{F}	105.3^{G}	2.11^{D}	5.28^{CD}	52.80^{CD}	3.5^{C}
6.0 tha^{-1}c	2.5^{B}	47.9^{BCD}	26.5^{D}	3.8^{DE}	111.0^{F}	2.22^{CD}	5.55^{BCD}	55.50^{BCD}	3.5^{C}
30N + 1.5 tha^{-1}c	2.0^{C}	46.8^{CDE}	27.3^{BCD}	4.0^{CD}	119.0^{D}	2.38^{BC}	4.76^{D}	47.60^{D}	3.5^{C}
30N + 3.0 tha^{-1}c	2.5^{B}	49.7^{B}	29.4^{ABC}	4.2^{BC}	125.5^{C}	2.51^{AB}	6.28^{B}	62.80^{B}	3.8^{BC}
30N + 4.5 tha^{-1}c	3.0^{A}	53.3^{A}	31.3^{A}	4.5^{A}	137.5^{A}	2.63^{A}	7.89^{A}	78.90^{A}	4.5^{A}
30N + 6.0 tha^{-1}c	2.5^{B}	49.0^{BC}	28.6^{ABCD}	3.7^{EF}	115.0^{E}	2.30^{C}	5.75^{BC}	57.50^{BC}	4.3^{A}

Table 3: Proximate analysis of *Telfairia* shoot as affected by application of mineral N and compost fertilizers.

Treatment.	%N	%CP	%C.fibre	%CHO	%K	%P	%Ca	%Mg	Fe (mg/kg)	Vit. C (mg/kg)
0	2.16^{A}	13.50^{F}	15.89^{G}	21.68^{A}	0.47^{EF}	0.64^{BCD}	0.26^{G}	0.42^{BC}	29.65^{ABC}	8.29^{C}
60kg N	2.23^{A}	13.94^{E}	16.28^{A}	23.46^{A}	0.53^{G}	0.66^{BC}	0.33^{DEF}	0.44^{AB}	31.28^{AB}	9.39^{AB}
1.5 t ha^{-1}	2.18^{A}	13.63^{F}	15.54^{E}	22.13^{A}	0.44^{F}	0.59^{CD}	0.31^{EFG}	0.39^{CD}	28.32^{C}	8.26^{C}
3.0 t ha^{-1}	2.27^{A}	14.19^{CD}	15.96^{CD}	23.49^{A}	0.46^{F}	0.57^{E}	0.29^{FG}	0.35^{B}	30.69^{ABC}	8.44^{BC}
4.5 t ha^{-1}	2.34^{A}	14.63^{B}	16.15^{ABC}	22.65^{A}	0.63^{AB}	0.69^{AB}	0.35^{CDE}	0.35^{CD}	30.69^{A}	9.46^{A}
6.0 t ha^{-1}	2.29^{A}	14.31^{C}	15.98^{BCD}	22.44^{A}	0.51^{DE}	0.66^{BC}	0.30^{EFG}	0.46^{A}	28.47^{BC}	9.12^{ABC}
30 N + 1.5 t ha^{-1}	2.25^{A}	14.06^{DE}	15.39^{E}	23.52^{A}	0.55^{CD}	0.62^{CDE}	0.41^{AB}	0.36^{D}	30.46^{ABC}	9.18^{ABC}
30 N + 3.0 t ha^{-1}	2.29^{A}	14.31^{C}	16.03^{BCD}	22.69^{A}	0.59^{BC}	0.65^{BC}	0.43^{A}	0.39^{CB}	31.26^{AB}	9.23^{ABC}
30 N + 4.5 t ha^{-1}	2.41^{A}	15.06^{A}	16.33^{A}	23.55^{A}	0.61^{AB}	0.73^{A}	0.37^{BCD}	0.47^{A}	30.84^{ABC}	9.35^{AB}
30 N + 6.0 t ha^{-1}	2.38^{A}	14.88^{A}	16.21^{AB}	22.86^{A}	0.65^{A}	0.69^{AB}	0.39^{ABC}	0.44^{AB}	30.21^{ABC}	9.25^{ABC}

Mean with the same letter are not significantly different.

The improved performance obtained after application of compost, and compost by mineral N fertilizers corroborated the findings of Akanbi *et al.*, (2004) and Olaniyi & Ajibola (2008) who reported significant increase in the yield and nutrients uptake of tomato as a result of compost application. The values of the yield attributes obtained at optimum compost rate of 4.5 t ha^{-1} were comparable to those recorded from 60 kg. N $ha.^{-1}$. The application of compost had significant effects on *Telfairia* growth, yield and nutrient uptake, possibly due to the ability of compost to support plant growth for an extended period of time. Compost may be called a slow release fertilizer, which makes essential nutrients available to crops over a long period. The N in compost is released slowly by microorganisms through the process of mineralization. Hence, compost need not be applied frequently and crops make use of it more efficiently than mineral N fertilizer.

5 REFERENCES

Adetunji IA, 1997: Effect of time interval between pod set and harvesting on the maturity and seed quality of fluted pumpkin. Experimental Agriculture 33 (4): 449 – 457.

Akanbi WB. & Olabode OB., 2004. Organic farming in elements of farming system. Ola printers, California hotel Idi-Oro, Ogbomoso ISBN 978 30637 07B Pg 27-37.

Akanbi WB., Togun AO, Adediran JA , Olaniyan AB , Olabode OS. & Olaniyi JO, 2004: Effect of spilt application of organic mineral fertilizer on Okra growth, nutrient uptake and fruit yield. Nigerian Journal of Horticultural Science. 9:102-109.

Akoroda MO, 1990: Ethnobotany of *Telfairia occidentalis* among Igbos of Nigeria. Economic Botany 44 (1):29-39.

Balogun MO, Afolabi OO, Kupolati MD. & Ajibade SA, 2006: Journal of Food, Agriculture and Environment 4 (1) 155-156.

Egbekan MK, Ada-sulelman EO. & Akinyeye O, 1998: Utilization of fluted pumpkin fruit (*Telfairia occidentalis*) in marmalade manufacturing. Plant foods for human nutrition 52 (2): 171-176.

Ebiaba RO, 1982: Cultivating the fluted pumpkin in Nigeria. World crops, 34 (2):70-72.

Food and Agricultural Organization, FAO, 1988. Traditional food plants.

Jeffrey C, 1967: Cucurbitaceae. In: Miline- Redhead, E. and Polhill, R.M. (Editors). Flora of tropical East Africa Crown Agents for oversea Governments and Administrators, London, United Kingdom. 157 Pp.

Leung WTW, Busson F. & Jardin C, 1968: Food composition table for use in Africa. FAO, Rome, Italy. 306 Pp.

Muutsaers HJW, Mbouemboue P. & Bogomo M, 1981. Traditional food crop growing in the Yaoundé area (Cameroon). Port 1 synopsis of the system. Agro-Ecosystem, 6 (4):273-287.

Obiaguu CJ. & Odiaka NI, 1995: Fertilizer schedule for yield of fresh fluted pumpkin (*Telfairia occidentalis*) grown in lower Benue river basin of Nigeria. Indian Journal of Agricultural Sciences 65 (2): 98-101.

Odiaka NI, 1997: Aspect of seed quality in fluted pumpkin. M. Phil. Thesis submitted to the Faculty of Agriculture and Forestry, University of Ibadan, Nigeria. Pp 109-113.

Okoro, 2006.. Effect of Nitrogen fertilizer on growth yield chemical composition on telfairia. Master Thesis, Department of Agronomy, Faculty of Agricultural Sciences, Ladoke Akintola University of Technology, Ogbomoso, Nigeria..

Olaniyi JO. & Ajibola AT, 2008. The effects of inorganic and organic fertilizers application on the growth, fruit yield and quality of tomato (*Lycopersicon lycopersicum*). Journal of Applied Biosciences 8(1): 236-242.

Onwueme RO. & Schippers RR, 2002. African indigenous vegetables, an overview of the cultivated species 2002. revised edition on CD-ROM. National Resources International Limited, Ayleslord, United Kingdom.

Obbom EM, 1986. Influence of harvest interval on yield, crude protein, N, P and K contents and longevity of the fluted pumpkin (*Telfairia occidentalis* Hook). Tropical Agriculture (Trinidad and Tobago), 63 (1): 63-65.

Renner SS, Scaefer H. & Koccyan A, 2007: Phytogenetics of cucumis (curcurbitaceae).