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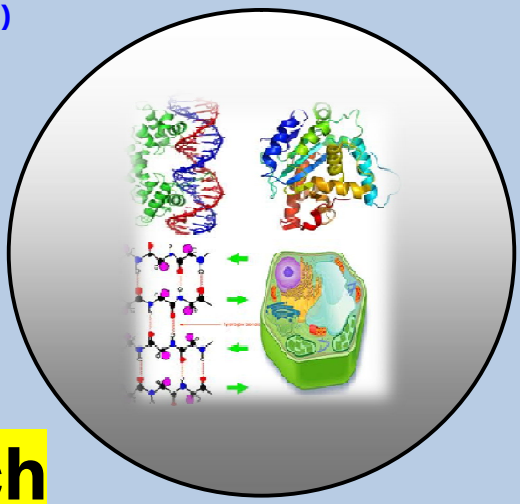

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RESEARCH PAPER

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Effects of N and K Fertilizer on Growth,Nutritional value, Nutrient uptake and Yield Attributes of Fluted pumpkin *telfairia occidentalis* in South-western Nigeria

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ABSTRACT

Nitrogen N and potassium K required for the optimum growth and yield of telfairia occidentalis were investigated in a field experiment conducted at the Ladoke Akintola University of Technology, Ogbomoso in the Guinea savannah agro ecological zone of Nigeria. The treatments involved were 0 and 60 kgNha^{-1}, five rate of potassium fertilizer 0, 15, 30, 45 and 60 kgK_2O ha^{-1} . The experimental was randomized complete block design in a factorial arrangement replicated three times. The parameters taken were the vine length, number of leaves, number of fruits, weight of fruit, fruit diameter, number of seeds and weight of seeds. These traits showed significant increase to the application of N rate with optimum value obtained at 60kgNha^{-1} and 30 kg K_2O ha^{-1}. However, sole fertilizer application has a minimal significant effect on the production of T. occidentalis compared to combined fertilizers application.
Keywords: Telfairia occidentalis, Nitrogen and Potassium Fertilizer, Nutrition value and Yield attributes.

INTRODUCTION

Telfairia occidentalis commonly called fluted pumpkin is a tropical vine grown in West Africa as a leaf vegetable and for its edible seed, which are distributed all over the warm parts of the world purseglove, 1977.

It is an important leaf and seed vegetable indigenous to southern Nigeria. It is a crop of commercial importance grown across the lowland humid tropics in West African in Nigeria, Ghana and Sierra Leone being the major producer Nkang *et al*., 2003 . With the spread of Igbos to other part of Nigeria, *telfairia* is now cultivated in almost all parts of the country Akoroda, 1990 . In recent time, some of the potential benefits of fluted pumpkin have been discovered in terms of its medicinal and industrial ability. *Telfairia* leaves are rich in Mg, Fe and Fibres Taylor *et al*., 1983 and are used as food supplements. The nutritional value of fluted pumpkin seeds are 53% fats and 27% crude protein Taylor *et al*., 1983 , justifies the wide consumption. The seeds have an excellent pattern of amino acids of 93.7% which contains higher levels of most essential amino acids except lysine than soybean meal with 94.9%. Even the K and N availability are higher in t*elfairia* seed 54.9% Esuoso *et al*., 1998 . The leaf has high nutritional, medicinal and industrials uses being rich in protein 29% , fat 18% , minerals and vitamins 20% Akanbi *et al*., 2007. Despite the importance of *telfairia* in Nigeria diet, farmers are still facing a lot of problem concerning its nutrients requirement on the field. Yield and quality of leaves and seed realized by farmers are usually lower than what is being reported under experimental condition. This study determined the optimum levels of nitrogen and potassium fertilizers on the maximum growth, nutritional properties and yield attributes of *telfairia occidentalis*.

MATERIAL AND METHODS

Experiments were conducted during 2007 and 2008 cropping seasons at the Ladoke Akintola University of Technology, Teaching and Research farm, Ogbomoso 8^0 10'N and 4^0 10'E , Nigeria. The bimodal rainfall of the area is between 1100mm-1250mm of rain. The temperature regime is high all year round. The mean minimum temperature is 28^0C and the maximum temperature is 33^0C with a high humidity of about 74^0C all year round except in January, when the dry wind blows from the North. The soil was sandy loam and well drained which had been left fallowed for 6 years without inorganic fertilizer application. Initial soil samples were collected from the soil depth of 15cm for analysis before the field was cleared. The soil particle size was done by hydrometer method Bouyoucos, 1951 . The treatments involved fluted pumpkin subjected into two rates of nitrogen fertilizer Urea as its source at 0, 60 kg N ha^{-1}, 5 rates of potassium fertilizer Muriate of potash as its source at 0, 15, 30, 45 and 60 kgK_2O ha^{-1} and their various combinations. The 10 treatment combinations was laid out in a factorial experiment and fitted into a randomized complete block design with three replicates. The. Planting was done in early December 2007 and 2008, with fluted pumpkin seeds procured from the Agronomy Department, LAUTECH, Ogbomoso. Two seeds were sown at a spacing of 1.0m x 1.0m and later thinned down to one seedling per stand at four weeks after sowing WAS . The different fertilizer rates were applied to their respective plots according to the treatment combinations at six weeks after sowing, based on the results of the soil chemical analysis. The application was by band placement. Watering of seedlings was done every morning at two days interval during the drought periods to avoid wilting and to improve the growth and development. Staking was also erected to expose leaves to full solar radiation. Weeds were controlled thrice manually by hoeing at 4, 8 and 12 weeks after sowing.

Other crop management included spraying with karate at 2 weeks interval after sowing against defoliating Insect pests. Data on growth parameters were collected from six plants selected from each plot. Data collected at the early bloom stage 10 WAS include 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 65^0C till constant weight was obtained. Total N was determined using kjedahl digesting method, phosphorus P using technicon AA1, calcium Ca using flame photometer and iron using atomic absorption spectroscopy Tee *et al*., 1996 .

Digested samples were diluted and used to determine the concentration of K using an atomic absorption spectrophotometer.The crude protein was determined by the kjeldah method described by AOAC,2000 . Concentrations of nutrient were expressed on the basis of percentage dry plant material. All data collected were subjected to analysis of variance ANOVA using the SAS-GLM procedure SAS, 1989 . The differences between treatment means were evaluated using the least significant different at 5% level of probability.

RESULTS AND DISCUSSION

Growth parameters measured on *T. occidentalis* at different sampling occasions are presented in Tables 1 and 2. The mean number of leaves and vine length increased as the applied N rate increases with the highest value obtained at 60kgN ha^{-1}. These were significantly influenced by the applied N rate. Likewise, the number of leaves and vine length of *telfairia* were significantly improved by the application of different K rates. There are no significant differences between the values obtained from 15kgK_2O ha^{-1} and the control treatment. Although, the highest number of leaves value was obtained at 60kgK_2O ha^{-1} there are no significant differences between the values obtained from 30kgK_2O and 60kgK_2O ha^{-1}. The combined application of N and K fertilizers significantly improved the number of leaves and vine length of *telfairia* more than sole application of either of the two fertilizers. The best values were obtained from combined application of 60kgN ha^{-1} by 45kgK_2O ha^{-1}. The increase in the growth parameters as the applied N rate increases is in accordance with the findings of Okoro, 2006 who reported the highest growth parameters at 60kgN ha^{-1} for *telfairia*. The highest growth parameters recorded at 60kgK_2O ha^{-1} in this study is less than 100kgK ha^{-1} recommended for *telfairia* by Obiagwu and Odiaka 1995 in area. The best growth parameters obtained from combined application of 60kgN ha^{-1} by 45kgK_2O ha^{-1} may be due to the interactive effect of the mineral element in these fertilizers. The fresh and dry shoot yields of *telfairia* are presented in Figure 1 and 2, respectively. The mean fresh and dry shoot yields increased as the applied N rate increases with the highest values obtained at 60kgN ha^{-1}. These were significantly influenced by the applied N rate at 8 weeks after transplanting. Similarly, the fresh and dry shoot yields were significantly improved by the sole application of K rates. Although, the highest fresh and dry shoot yields values were obtained at 60kgK_2O ha^{-1} , there are no significant differences between the values obtained from 30kgK_2O and 60kgK_2O ha^{-1}.The combined application of N and K fertilizers significantly influenced the fresh and dry shoot yields with the highest values obtained at 60kgN ha^{-1} by 30kgK_2O ha^{-1}.

The increased mean shoot parameters as the applied N rate increases with the highest value obtained at 60kgN ha^{-1} is in accordance with recommendation of Okoro, 2006. The highest shoot yield parameters obtained from the combined application of 60kgN ha^{-1} by 30kgK ha^{-1} may be due to the interactive effect of these mineral fertilizers. Seed yield and yield components of *telfairia* as affected by N and K
fertilizers application at harvesting is presented in Table 3. The mean number of fruits, fruit weight, fruit diameter, number of seeds, seed weight per plant and per hectare significantly improved by the N effect, K effect, and N and K interactive effects. These seed yield and yield attributes increased as the applied N rate increases with the optimum value obtained at 60kgN ha^{-1}. Likewise, the sole application of K influenced the seed yield and yield components of telfairia. The highest values were recorded at 30kgK_2O ha^{-1} applied K rate. The combined application of N and K fertilizers improved the seed yield and yield attributes examined in this study. The highest values were obtained from the combined application of 60kgN by 30kgK_2O ha^{-1}. At maturity the fruit weight 3 – 6 kg and average width of 27 cm Van Ephenhuijsen, 1974. Due to its recalcitrant nature. Akoroda, 1986 , there is always difficulty in steady supply of *Telfairia* seeds. Each fruits contain 60 seeds on average with a normal range of approximately 30 – 110 fruits. The fruit yield parameters increased as the applied N rate increases. The fruit yield parameters were significantly influenced by the applied N rates and it is in accordance with the findings of Okoro, 2006. These parameters were significantly influenced by the applied K rates and this is in similar to findings of Sobulo *et al.,* 1975 who recommended 20-60kgK ha^{-1} for increased tomato production.

Table 1. Number of leaves of *telfairia* as affected by N and K fertilizers application at different sampling periods.

Treatment	2WAT	4WAT	6WAT	8WAT
O control	10.25^{E}	21.33^{J}	36.08^{J}	56.58^{F}
60N	14.41^{A}	29.92^{G}	48.92^{F}	71.08^{D}
15K	13.97^{B}	26.25^{I}	42.53^{I}	57.36^{F}
30K	13.00^{C}	28.92^{H}	46.33^{H}	68.92^{E}
45K	10.00^{F}	33.50^{E}	47.33^{G}	69.08^{E}
60K	11.17^{D}	31.75^{F}	54.92^{D}	69.17^{E}
60N 15K	10.75^{F}	37.83^{C}	53.85^{E}	74.75^{C}
60N 30K	12.66^{DC}	40.17^{B}	58.08^{B}	81.17^{B}
60N 45K	11.92^{DE}	48.92^{A}	73.58^{A}	92.92^{A}
60N 60K	11.58^{E}	35.67^{D}	55.42^{C}	81.92^{B}

Mean with the same letter within the column are not significantly different.

Nitrogen fertilizer application is very essential for plant growth and yield. It is the first essential plant nutrient. The required amount of nitrogen fertilizer varies due to the type of crop, instability of crop and crop combination. The optimum level of nitrogen fertilizer that is suitable to give maximum yield performance of *Telfairia* is 60kgNha^{-1} as also recommend by Okoro 2006. It was noticed that the combination of 60kgNha^{-1} and 30kgKha^{-1} recorded better growth and yield performance of *telfairia.*

However, sole fertilizer application has a minimal significant effect on the production of *T. occidentalis* compared to combined fertilizers application.At the application of 60kgNha^{-1} and 30kgK ha^{-1} has a more significant effect on the production of *T. occidentalis* because; it produce the highest yield when compared to 60kgKha^{-1}. The nutritional qualities of *telfairia* as affected by N and K fertilizers application is presented in Table 4.

The applied N, K, and N by K combined effects had significant influenced on the nutritional values of *Telfairia occidentalis.* The protein, N, P, K, Ca, Mg and Fe contents of telfairia leaves increased as the N rate increases with the highest values obtained at 60kgN ha^{-1}. Likewise, these nutritional values were improved by the sole application of K rates. The highest values were obtained at 30kg ha^{-1} of applied K fertilizer.

Table 2. Vines length cm of *telfairia* as affected by N and K fertilizers application at different sampling occasions.

Treatment	2WAT	4WAT	6WAT	8WAT
O control	58.72^{B}	81.48^{H}	106.83^{G}	155.09^{E}
60N	59.18^{A}	97.08^{D}	130.81^{C}	183.57^{C}
15K	51.97^{C}	84.79^{G}	106.91^{G}	144.57^{G}
30K	36.40^{I}	96.34^{E}	110.41^{F}	158.34^{DE}
45K	45.95^{G}	95.25^{E}	110.74^{F}	150.29^{F}
60K	49.68^{DE}	96.49^{E}	115.23^{C}	165.18^{D}
60N 15K	43.84^{H}	86.39^{F}	101.02^{H}	152.81^{F}
60N 30K	48.99^{EF}	103.53^{C}	136.60^{B}	185.17^{BC}
60N 45K	50.04^{D}	113.89^{A}	145.62^{A}	196.32^{A}
60N 60K	48.72^{F}	106.55^{B}	126.77^{D}	187.66^{B}

Mean with the same letter within the column are not significantly different

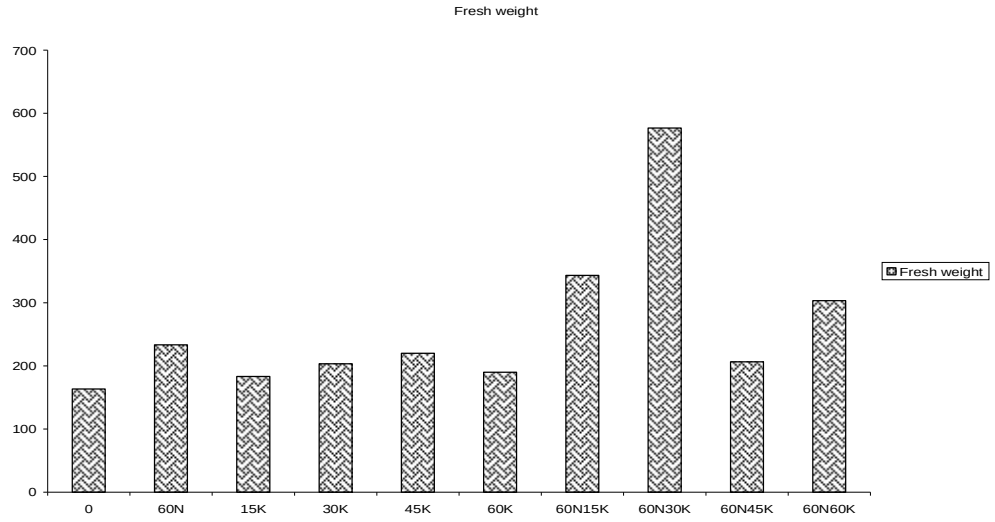

Figure 1. Fresh shoot yield of *telfairia* as affected by N and K fertilizers application at 8 weeks after transplanting.

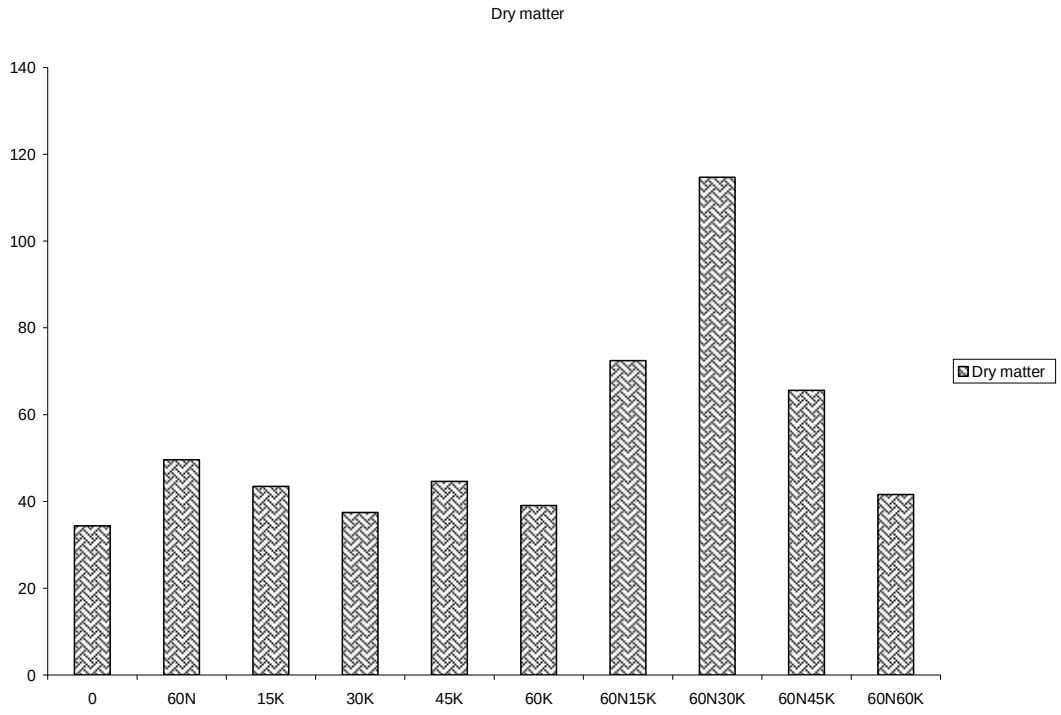

Figure 2 Dry shoot yield of *telfairia* as affected by N and K fertilizers application at 8 weeks after transplanting.

Table 3. Yield and yield components of *telfairia* as affected by N and K fertilizers application at 8 weeks after transplanting.

Treatment kg/ha	Number of fruits/ plant	Weight of fruit kg	Fruit diameter cm	Number of seeds/ fruit	Weight of seeds/ fruit kg	Seed yield/ Plant	Seed yield kg/ha	Fruit yield kg/ha
O control	1.1^{D}	2.45^{F}	62.99^{E}	45^{F}	1.05^{BC}	2.70^{F}	27^{F}	11^{D}
60N	3.0^{B}	3.56^{C}	72.42^{B}	102^{B}	2.15^{A}	10.70^{BC}	107^{BC}	30^{B}
15K	2.0^{C}	2.95^{DE}	52.98^{G}	53^{E}	1.25^{BC}	6.00^{D}	60^{D}	20^{C}
30K	3.2^{B}	3.15^{D}	58.93^{F}	87^{C}	2.01^{A}	10.10^{C}	101^{C}	32^{B}
45K	1.0^{D}	2.75^{DEF}	50.29^{H}	49^{E}	0.12^{D}	2.75^{F}	28^{F}	10^{D}
60K	1.0^{D}	2.73^{EF}	44.19^{I}	39^{G}	0.95^{C}	2.73^{F}	27.3^{F}	10^{D}
60N 15K	2.0^{C}	5.40^{A}	68.99^{C}	65^{D}	1.20^{BC}	11.00^{B}	110^{B}	20^{C}
60N 30K	4.0^{A}	5.80^{A}	75.95^{A}	115^{A}	2.25^{A}	23.20^{A}	232^{A}	40^{A}
60N 45K	1.0^{D}	4.25^{B}	61.98^{E}	66^{D}	1.52^{B}	4.25^{E}	43^{E}	10^{D}
60N 60K	1.0^{D}	4.10^{B}	66.04^{D}	52^{E}	1.22^{BC}	4.10^{E}	41^{E}	10^{D}

Mean with the same letter within the column are not significantly different.

Table 4. The nutritional compositions of *telfairia* as affected by N and K fertilizers application.

Treatment	% N	% P	% Ca	% Mg	% K	% Fe	% Crude protein
O control	2.25^{D}	0.70^{B}	0.35^{E}	0.36^{G}	0.38^{A}	22.52^{G}	14.06^{E}
60N	3.58^{A}	1.21^{A}	0.68^{D}	0.57^{E}	0.53^{CD}	41.47^{E}	22.38^{A}
15K	2.76^{C}	0.41^{C}	0.76^{A}	0.65^{AB}	0.38^{C}	50.41^{C}	17.25^{D}
30K	3.21^{C}	0.43^{C}	0.81^{B}	0.64^{C}	0.44^{B}	60.59^{A}	20.06^{B}
45K	3.21^{AB}	0.39^{C}	0.81^{A}	0.60^{B}	0.40^{CD}	50.06^{C}	16.75^{D}
60K	2.73^{C}	0.38^{C}	0.84^{A}	0.64^{B}	0.41^{CD}	44.89^{D}	17.06^{D}
60N 15K	2.98^{BC}	0.46^{C}	0.73^{BC}	0.59^{CD}	0.38^{CD}	38.77^{F}	18.63^{C}
60N 30K	3.21^{AB}	1.07^{A}	0.87^{A}	0.67^{A}	0.45^{B}	59.56^{B}	20.06^{B}
60N 45K	2.97^{BC}	0.39^{C}	0.68^{D}	0.50^{F}	0.34^{E}	50.58^{C}	18.56^{C}
60N 60K	2.68^{AB}	0.37^{C}	0.71^{CD}	0.58^{DE}	0.39^{CD}	50.30^{C}	20.19^{D}

Mean with the same letter within the column are not significantly different.

Table 5. Nutrient uptake of *telfairia* as affected by N and K fertilizers application.

Treatment	% N	% P	% Ca	% Mg	% K
O control	77.36^{H}	24.07^{D}	12.03^{G}	12.38^{H}	14.99^{J}
60N	177.64^{D}	60.04^{B}	33.74^{E}	28.28^{D}	18.86^{D}
15K	119.92^{F}	16.50^{E}	33.90^{E}	26.76^{E}	17.82^{F}
30K	120.28^{F}	17.82^{E}	36.50^{D}	28.24^{D}	18.22^{E}
45K	119.53^{F}	14.61^{F}	30.35^{F}	23.98^{G}	16.95^{G}
60K	106.55^{G}	14.83^{F}	32.79^{E}	24.98^{G}	15.61^{I}
60N 15K	215.87^{B}	52.76^{C}	63.02^{B}	48.54^{B}	32.60^{B}
60N 30K	368.19^{A}	77.51^{A}	83.73^{A}	67.67^{A}	43.59^{A}
60N 45K	188.83^{C}	24.80^{D}	43.23^{C}	31.79^{C}	21.62^{C}
60N 60K	134.30^{E}	17.88^{E}	29.52^{F}	24.12^{G}	16.22^{G}

Mean with the same letter within the column are not significantly different.

The nutritional values of telfairia increased as the combined N and K application rates increases with the best values obtained at 60kgN ha^{-1} by 30kgK_2O ha^{-1}. Nutrients uptake of *telfairia* was significantly influenced by the applied N, K, and N by K combined fertilizers effects. The applied fertilizer rates improved the quantity of N, P, Ca, Mg and K absorbed by the plants. The plants under the sole application of N and K at the rate of 60kgN $ha.^{-1}$ and 30kgK ha^{-1} respectively, absorbed more amount of nutrients than other treatments. The highest nutrients uptake was obtained from plants treated with the combined fertilizers treatment at the rate of 60kgN ha^{-1} by 30kgK_2O ha^{-1} that produced the highest number of fruits and shoot yield. Hikaru Akamine *et al.* 2007 reported that an imbalance or excessive of nutrients prevent information which cause trouble in nutrient absorption for plant and could determine quality of turmeric.Based on the findings I suggest the combination of N fertilizers and potassium application at the rate of 60kgN ha^{-1} and 30kgK ha^{-1} because it is relatively cheap compared to 60kgKha^{-1}, less harmful due to the low level of chemical and it gives the highest production rate of *T. occidentalis.*

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