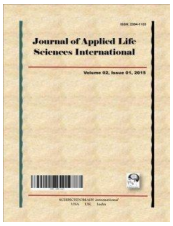

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Fertilizer Micro-dosing on Growth and Vegetative Yield of Fluted Pumpkin *(Telfairia occidentalis Hook. f)*

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Authors' contributions:

This work was carried out in collaboration between all authors. Author PAA designed the study, performed the statistical analysis, wrote the protocol and first draft of the manuscript. Author BJA managed the analyses of the study. Author DJO managed the literature searches. All authors read and approved the final manuscript.

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ABSTRACT

The study evaluated growth and vegetative response of fluted pumpkin (*Telfairia occidentalis*) to levels and time of micro-dosing Urea fertilizer. The experiment was conducted in two growing seasons of late and early cropping seasons of 2015 and 2016 respectively at the Teaching and Research Farm of Obafemi Awolowo University. The experiment was a factorial laid out in a Randomized Complete Block Design (RCBD) with four replications involving seasons, levels of fertilizer (0, 20, 40, 60 and 80 kg/ha micro-dose Urea each season and two times (at sowing and two weeks after emergence. Data were collected on the number of vines, average vine length (cm), number of leaves per plant, total chlorophyll content, biomass and fresh vegetative yield. Data collected were subjected to analysis of variance (ANOVA) to determine the effects of treatments on the parameters and significant means were separated using Duncan Multiple Range Test (DMRT) at 0.05 probability levels. The results indicated that seasons, levels and time of micro-dosing fertilizer significantly ($p< 0.05$) affected the parameters measured and particularly vegetative yield of fluted pumpkin. Significant higher vegetative yield (t/ha) was obtained during the late season but

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with lower total chlorophyll compared to what was obtained in the early season. Micro-dosing fertilizer at 40 kg/ha had a highly significant effect ($p < 0.05$) on fluted pumpkin vegetative yield and was not significantly different from micro-dosing at 60 and 80 kg/ha respectively. Micro-dosing fertilizer at two weeks after emergence had a significant effect on growth and vegetative yield of fluted pumpkin. Hence, micro-dosing of Urea two weeks after emergence at 40 kg/ha was found to be adequate for the vegetative production of fluted pumpkin.

Keywords: Fertilizer micro-dosing; time of application.

1. INTRODUCTION

Fertilizer micro-dosing or point application of fertilizer is an application method of small, (1-4g of fertilizer) and affordable quantity of fertilizer to seed at planting time or as a top dressing 3-4 weeks after emergence with the aim to minimize the return to investment and also to maximizing crop yields [1]. This method as documented by [2,3] to enhance fertilizer use efficiency, high probability of yield response, crop productivity with favorable fertilizer per grain price ratio rather than spreading fertilizer over the field, root systems, and soil water capture. Report from [2] indicated that implementation of micro-dosing technology-enhanced and improved productivity instead of low efficiency of fertilizer usage observed on the yield of most crops. According to [4] Small amounts of applied fertilizer give an economically optimum response on maize, wheat, and sorghum, and if properly placed in the root zone of these widely-spaced crops rather than uniformly distributed, the expected result ought to be more efficient in nutrient uptake. [5] indicated that obtaining maximum profitability lies not only in reducing the amount of fertilizer use per unit area (micro-dosing fertilizer) but also in reducing cost per unit crop produce through higher yields. Improvement of soil fertility and plant nutrition to sustain an adequate yield of the crop is essential since soil degradation has been identified as a major constraint and a root cause of declining crop productivity in many developing countries especially Sub-Saharan Africa (SSA) and very high rate of annual depletion for some essential elements of cultivated land. This according to [6] and [1] amount to an annual loss of 4 billion U.S dollar equivalent of fertilizer in 37 African countries over decades. [7] reported that local farmers lack sufficient fertilizer, money for the purchase, access to the credit, and transportation thus resulting to low fertilizer input and a gradual decrease of soil fertility. Micro-dosing of fertilizer is a technology which has been developed and tested for fertilizer use efficiency on different crops [1,8]. It has therefore been found that it might be a valuable option to increase crop productivity with a relatively limited input of resources [8].

In Africa, vegetables remain popular in rural areas where they are often considered to be more nutritive than exotic vegetables [9]. Fluted pumpkin is an important leaf and seed vegetable indigenous to Southern Nigeria and grown in the forest zone of the west and central Africa (Nigeria, Ghana, and Sierra Leone being the major producers). It is a tropical vine grown mainly for its leaf and edible seed and distributed by *Igbos* tribes of southern Nigeria who have been cultivating it since time immemorial [10], [11]. The leaf is of high nutritional, medicinal and industrial values rich in protein (29%), fat (18%) and minerals and vitamins (20%) [12]. Recently, fluted pumpkin had gained medicinal recognition as it has been discovered to be blood purifiers and could, therefore, be useful in maintaining good health [13].

In Nigeria, fluted pumpkin is becoming an important vegetable because it is an excellent source of vitamins, minerals and its potential for medicinal therapy. However, several studies have revealed the inability of farmers to utilize available resource to maximize yield in fluted pumpkin production. Generally, farmers grow fluted pumpkin with the use of inorganic fertilizer which is usually applied indiscriminately without resort to recommendation rate. The method of fertilizer application also resulted in poor yield and to several reasons such as inappropriate placement and wrong time of application which normally result in fertilizer being washed away by water run-off or some may cause phytotoxicity of the plant especially at tender stage. However the proper placement of small fertilizer to the root zone of growing plant is still a novel idea to farmers in southwestern Nigeria which is still unknown.

Rapid depletion of soil nutrients and poor physical condition of the savannah soils constitute strong limitations to crop production

[14]. Also, soil fertility depletion in small holder farm is the fundamental cause of declining per capita food production [6]. The shortage and high cost of inorganic fertilizers have limited their use for crop production among the peasant farmers in Nigeria. Nitrogen is usually ascribed with the build-up of leaf tissues. This is one of the essential elements most commonly used to increase crop yield. It is a constituent of all protein and chlorophyll. Plant tissue usually contains more nitrogen than any other nutrients. Nitrogen application is used to produce rapid vegetative growth of vegetables [15] in order to promote luxuriant growth and increase the number of leaves.

The amount of fertilizer introduced into the soil, including mineral fertilizers affects the amount of mineral nitrogen available to the plants and the organic carbon content of the soil [16].

Limited information is available on the response of fluted pumpkin yield to micro-dose fertilizer. The yield obtained from the use of normal fertilizer by farmers has been reported to fall short of expectation, hence the need for this study. Research on the optimum fertilizer Micro-dosing usage for the left yield is recently being explored. Though small scale farmers are eager to produce the crop but there is the need to develop an economically viable technology that will favor sustainable production among the small holders of fluted pumpkin in South western Nigeria.

The research objectives evaluated the fertilizer micro-dosing technology that favored fluted pumpkin production in south-western Nigeria and determine the growth response of fluted pumpkin to different fertilizer micro-dosing and time of application; also to determine the influence of fertilizer micro-dosing and time of application on vegetative yield of fluted pumpkin.

2. MATERIALS AND METHODS

The study was conducted at the Teaching and Research Farm of Obafemi Awolowo University, Ile-Ife during the late and early cropping seasons of 2015 and 2016 respectively. The experimental design was a 2x4 factorial arranged in a randomized complete block design with four replications. There were two application times (at seed sowing and at two weeks after emergence) and four fertilizer levels which were micro-dosed at 20, 40, 60, 80 kg N ha^{-1} and 0 as the control. Soil sample was taken before planting to determine the soil physical and chemical properties. Fluted pumpkin seeds were planted at the rate of one seed per hole in a well-tilled and leveled raised bed to a depth of 3-4 cm at a spacing of 0.75 m x 0.50 m inter and intra space in a plot of 3 m by 2 m to give a total population of 26,667 plants/ha. The Urea fertilizer used was micro-dosed very close to the root zone while the one applied at planting was done close to the seed at different rates. Field maintenance against weed and pest was done as required. Data were collected on a weekly basis on a number of vines, the average length of vines, an average number of leaf (cm), total chlorophyll content using (SPAD-502, Minolta, Tokyo, Japan) and total biomass while vegetative yield was obtained and calculated per hectare. Data collected were subjected to Analysis of Variance using SAS version 9.1 statistical package. Significant means were separated using Duncan Multiple Range Test (DMRT) at 0.05 probability level.

3. RESULTS

The results of the physical and chemical properties of the soil of the experimental sites are presented in Table 1. The surface soil was partially acidic with low organic matter and very low nitrogen. Available phosphorus (mg kg^{-1}) was 23.03 mg kg^{-1} and 31.16 mg/kg in both late and early seasons of 2015 and 2016 respectively. Though the available phosphorus was high, other exchangeable cations were low and the textural class of the soil was sandy loam (Table 1)

All sources of a factor had a highly significant effect ($P< 0.01$) on chlorophyll content. Also, there were significant interaction effects on chlorophyll at weeks four and six. Season effect was highly significant ($P <0.01$) as the week chlorophyll increases. Also, the time the fertilizer was micro-dosed and level of fertilizer not found to significantly affect ($P <0.01$) total chlorophyll content. There was a significant interaction between season and fertilizer level, season and time of micro-dosing and also between season, fertilizer level and time of micro-dosing (Table 2). The total chlorophyll observed in a fluted pumpkin during the early season were found to be significantly higher ($P <0.01$) than values obtained in late season. Also consider the time of micro-dosing the fertilizer at two weeks after sowing were found to be significantly higher than when the fertilizer was applied during planting.

As the fertilizer levels increased, there was a significant increase of the total chlorophyll value as the level of nitrogen fertilizer increased. The

highest chlorophyll content was obtained at 80 kg/ha followed by 60 kg/ha which was not significant from the application of 40 kg/ha of fertilizer (Table 3).

Season effect was highly significant (P <0.01) as the week chlorophyll increases. Also, the time the fertilizer was micro-dosed and level of fertilizer not found to significantly affect (P <0.01) total chlorophyll content. There was a significant interaction between season and fertilizer level, season and time of micro-dosing and also between season, fertilizer level and time of micro-dosing (Table 4).

The total vine length observed on a fluted pumpkin during the late season were found to be significantly higher than values obtained in the early season while the number of leaves observed during early season were found to be significantly higher than values obtained in late season. Also considering time of micro-dosing the fertilizer at two weeks after sowing were found to be significant than when the fertilizer were applied during planting. The effect of fertilizer level gradually increased the total chlorophyll value as the level of nitrogen fertilizer increased, least values were obtained at control plots while the highest were obtained at 80 kg/ha (Table 5).

Season effect was highly significant (P <0.01) as the week of chlorophyll increases. Also, the time the fertilizer was micro-dosed and level of fertilizer not found to significantly affect (P <0.01) total chlorophyll content. There was a significant interaction between season and fertilizer level, season and time of micro-dosing and also between season, fertilizer level and time of micro-dosing (Table 6).

Table 1. Soil chemical and physical properties of the experimental site

Soil Analysis	Properties	O.A.U., Ile Ife, 2015-2016	
		Late Season	Early season
Chemical Property	pH (H_20) (1:2)	6.5	6.3
	pH ($CaCl_2$)	6.1	6.1
	Organic Carbon (%)	0.53	0.97
	Organic matter (%)	1.33	1.67
	Total N (%)	0.09	0.06
	Available P (mg kg^{-1})	23.03	31.16
Exchangeable cations (cmol kg^{-1})	K^+	2.06	0.02
	Ca^{2+}	2.27	0.22
	Mg^+	0.27	0.11
	Na^+	0.27	0.010
Physical Property	Sand g kg^{-1}	626.8	531.5
	Silt g kg^{-1}	120.0	220.2
	Clay g kg^{-1}	253.2	207.9
	Textural class	Sandy loam	Sandy loam

Table 2. Mean squares from combined analysis of variance showing the influence of fertilizer micro-dosing and time of application on chlorophyll content at 4, 5 and 6 WAS of fluted pumpkin

SV	DF	Total Chlorophyll value		
		4 WAS	5 WAS	6 WAS
Season (S)	1	28.44*	419.07**	611.62**
Rep (Season)	6	10.25*	10.81*	1.03*
Microdozing Time (MT)	1	208.34**	101.03*	0.18*
Fertilizer level (FL)	4	106.48**	194.00**	98.02**
Fertilizer Level x Season	4	111.49**	124.31**	25.71**
Season x MT x Season	1	208.34**	2.49	1.06*
FertxTOA	4	13.27*	4.09	8.44*
FLxMTxS	4	19.0*	12.81*	34.55**
Error	54	6.43	5.76	1.74
CV		5.20	4.88	2.45
R^2(%)		81	86	93

/ Significant at 0.05 and 0.01 level of probability [ns] Not significant; CV- coefficient of variation; R^2- Regression coefficient. REP: Replication. FL: Fertilizer levels. MT: Micro-dosing Time. SES: Season. CHL: Chlorophyll. VL: WAS: Weeks after sowing.*

Table 3. Mean values of total chlorophyll as influenced by the treatments on fluted pumpkin

		Total chlorophyll value		
		4 WAS	5 WAS	6 WAS
Season	Late	48.15b	46.91b	51.03b
	Early	49.35a	51.49a	56.56a
MICRO-DOSING TIME	ATS	47.14b	48.08b	53.75ans
	2WAS	50.36a	50.32a	53.85ans
Fertilizer levels	0 kgN/ha	46.21c	43.64d	50.28e
	20 kgN/ha	46.46c	48.14c	52.58d
	40 kgN/ha	47.74b	50.65b	54.18c
	60 kgN/ha	48.85b	51.07ab	55.26b
	80 kgN/ha	52.48a	52.49a	56.69a

Letters with the same alphabet along the same column are not significantly different at 0.05 probability level using Duncan's Multiple Range Test (DMRT)
KG: Kilogram. HA: Hectare. FL: Fertilizer levels. MT: Micro-dosing Time. ATS: At sowing. 2WAS: 2 Weeks after sowing. SES: Season. CHL: Chlorophyll

Table 4. Mean squares from combined analysis of variance showing the influence of fertilizer micro-dosing and time of application on vine length per plant and number of leaves per plant at 4, 5 and 6 WAS of fluted pumpkin

SV	DF	Vine length			Number of leaves		
		4 WAS	5 WAS	6 WAS	4 WA S	5 WAS	6 WAS
Season	1	6985.20**	13207.230**	27728.905**	372.385**	1311.23**	2122.83*
Rep(Season)	6	123.162*	618.544*	832.952*	29.285*	77.15*	277.69*
Microdosing Time	1	1470.098**	2573.046*	4404.512*	228.488**	453.25*	118.58*
Fertilizer Level	4	1046.994**	1988.582**	2173.747**	93.152**	154.72*	299.78*
FL*Season	4	368.762*	935.128*	505.469*	3.312	7.80	25.99
MT*Season	1	67.234*	625.521*	7.938	64.800*	169.42*	14.96
FL*MT	4	149.986*	222.731*	766.062*	33.811*	78.81*	293.78*
FL*MT*Ses	4	28.612	26.010	198.687	17.857*	52.62*	110.59
Error	54	55.24	186.55	286.95	9.28	50.68	165.29
CV		17.46	20.75	18.33	20.68	30.58	32.14
R^2(%)		84	77	77	74	57	43

/ Significant at 0.05 and 0.01 level of probability; ^{ns} Not significant; CV- coefficient of variation; R^2- Regression coefficient. REP: Replication; FERT: Fertilizer; MT: Micro-dosing Time; SES: Season; CHL: Chlorophyll; VL: Vine length; NL: Number of leaves; WAS: Weeks after sowing*

The total chlorophyll observed on a fluted pumpkin during the early season were found to be significantly higher than values obtained in the late season while vine length observed during the late season performed than the early season. Also consider the time of micro-dosing the fertilizer at two weeks after sowing were found to be significant than when the fertilizer was applied during planting.

The effect of fertilizer level gradually increased the total chlorophyll value as the level of nitrogen fertilizer increased, least values were obtained at control plots while the highest were obtained at 80 kg/ha (Table 7).

The total number of leaves observed on a fluted pumpkin during the early season were found to be significantly higher than values obtained in the late season while a number of vines during the late season gave the highest value. Also, consider the time of micro-dosing the fertilizer at two weeks after sowing were found to be significant than when the fertilizer was applied during planting.

The effect of fertilizer level gradually increased the total chlorophyll value as the level of nitrogen fertilizer increased, least values were obtained at control plots while the highest were obtained at 80 kg/ha (Table 8).

The total emergence count, fresh weight, yield and dry weight observed on a fluted pumpkin during the late season were found to be significantly higher than values obtained in the early season. Also, consider the time of micro-dosing the fertilizer at two weeks

after sowing were found to be significant than when the fertilizer was applied during planting.

The effect of fertilizer level gradually increased the total chlorophyll value as the level of nitrogen fertilizer increased, least values were obtained at control plots while the highest were obtained at 80 kg/ha (Table 9).

4. DISCUSSION

The experimental soil analysis of late and early planting seasons showed that the total Nitrogen percentage 0.09% and 0.06% were very low while available P and K were considered high and moderate. Also, the pH 6.6 and 6.5 of the soil were considered moderate for fluted pumpkin production. The result showed that there was significant difference in the agronomic growth parameters of fluted pumpkin by the application of the different rate of nitrogen fertilizer and this confirm the role of nitrogen as an essential nutrient for proper vegetation of *Telfairia occidentalis* as reported by [17].

Also, there was an increase in the growth parameters of *Telfairia occidentalis* as nitrogen application rates increases in accordance with the findings of [18] who reported a significant increase in the growth parameters of *Telfairia occidentalis* with applied nitrogen rates. Nitrogen can be applied solely to *Telfairia occidentalis* but the best yield can be gotten when 40 kg/ha of nitrogen fertilizer is applied as against the findings of [18] and [19] which recommend 60 kg/ha of nitrogen fertilizer on the fluted pumpkin, pepper, and melon respectively. Considering the cost implication, 40 kg/ha can be applied to minimize the cost of production knowing that the

Table 5. Mean value from combined analysis of variance showing the influence of fertilizer micro-dosing and time of application on vine length per plant and number of leaves per plant at 4, 5 and 6 WAS of fluted pumpkin

		Vine length			Number of leaves		
		4 WAS	5 WAS	6 WAS	4 WAS	5 WAS	6 WAS
Season	Late	51.91a	78.69a	111.03a	12.57b	19.23b	34.85b
	Early	33.22b	52.99b	73.79ab	16.89a	27.33a	45.15a
Micro-dosing Time	ATS	38.28b	60.17b	84.99b	13.04b	20.90b	38.78a
	2WAS	46.85a	71.51a	99.83a	16.42a	25.66a	41.21a
Fertilizer levels	0 kgN/ha	34.91b	55.39c	78.21b	10.88c	19.30c	34.86b
	20 kgN/ha	32.90b	53.28c	81.44b	13.81b	20.55bc	36.02ab
	40 kgN/ha	46.19a	67.64b	101.74a	16.55a	25.39ab	42.76ab
	60 kgN/ha	50.58a	77.55a	102.44a	16.23a	25.19ab	41.61ab
	80 kgN/ha	48.25a	75.33ab	98.22a	16.16a	25.98a	44.73a

Letters with the same alphabet along the same column are not significantly different at 0.05 probability level using Duncan's Multiple Range Test (DMRT).
KG: Kilogram. HA: Hectare. FERT: Fertilizer. MT: Micro-dosing Time. ATS: At sowing. 2WAS: 2 Weeks after sowing. SES: Season. VL: Vine length. NL: Number of leaves.

Table 6. Mean squares from combined analysis of variance showing the influence of fertilizer micro-dosing and time of application on number of vine at 4, 5 and 6 WAS, emergence, yield, fresh weight and dry weight of fluted pumpkin

SV	DF	Number of vines			Fresh weight	Dry weight	Emergence (%)	Yield (kg)
		4WAS	5WAS	6WAS				
Season	1	0.013	145.37**	14.60*	77085.98*	18313.66**	26.45*	9.113*
Rep(Season)	6	0.13*	1.79*	2.66*	6050.47	710.51*	3.22	3.237
Micro-dosing Time	1	1.62**	2.51*	15.47*	20275.08*	704.54*	14.45*	10.368*
Fertilizer Level	4	13.75**	3.11*	8.04*	19579.75*	1585.75**	181.43**	15.529**
FL*Season	4	0.13	2.31*	4.59*	7615.87	1759.99**	0.20	5.390*
MT*Season	1	0.01	3.62*	5.01*	3647.16	1428.98*	0.45	0.001
FL*MT	4	0.42*	0.25	3.36*	11717.65*	159.11	12.33*	0.802
FL*MT*Ses	4	0.01	1.23	1.84*	8187.41	99.98	0.33	2.194
Error	54	0.07	1.51	1.19	10417.61	232.23	5.30	1.75
CV		47.70	34.79	24.75	65.71	43.05	11.82	10.85
R^2(%)		94	71	66	37	76	75	72

/ Significant at 0.05 and 0.01 level of probability; ns Not significant; CV- coefficient of variation; R^2- Regression coefficient. REP: Replication. FL: Fertilizer levels. MT: Micro-dosing Time. SES: Season. NV: Number of vines.*

Table 7. Influence of fertilizer micro-dosing on chlorophyll and vine length per plant at 4, 5 and 6 weeks after sowing of fluted pumpkin during late and early cropping of 2015 and 2016

		Total chlorophyll value			Vine length		
		4 WAS	**5 WAS**	**6 WAS**	**4 WAS**	**5 WAS**	**6WAS**
Season	Late	48.15b	46.91b	51.03b	51.91a	78.69a	111.03a
	Early	49.35a	51.49a	56.56a	33.22b	52.99b	73.79ab
Micro-dosing Time	ATS	47.14b	48.08b	53.75a	38.28b	60.17b	84.99b
	2WAS	50.36a	50.32a	53.85a	46.85a	71.51a	99.83a
	LSD (0.05)	**1.14**	**1.08**	**0.59**	**3.33**	**6.12**	**7.59**
Fertilizer Level	0 kgN/ha	46.21c	43.64d	50.28e	34.91b	55.39c	78.21b
	20 kgN/ha	46.46c	48.14c	52.58d	32.90b	53.28c	81.44b
	40 kgN/ha	47.74b	50.65b	54.18c	46.19a	67.64b	101.74a
	60 kgN/ha	48.85b	51.07ab	55.26b	50.58a	77.55a	102.44a
	80 kgN/ha	52.48a	52.49a	56.69a	48.25a	75.33ab	98.22a
	LSD (0.05)	**1.79**	**1.70**	**0.93**	**5.27**	**9.68**	**12.01**

KG: Kilogram. HA: Hectare. FERT: Fertilizer. MT: Micro-dosing Time. ATS: At sowing. 2WAS: 2 Weeks after sowing. SES: Season. VL: Vine length.

Table 8. Influence of fertilizer micro-dosing on numbers of leaves per plant and numbers of vine per plant at 4, 5 and 6 WAS of fluted pumpkin

		Number of leaves			Number of vines		
		4 WAS	**5 WAS**	**6 WAS**	**4 WAS**	**5 WAS**	**6 WAS**
Season	Late	12.57b	19.23b	34.85b	0.56a	4.90a	4.84a
	Early	16.89a	27.33a	45.15a	0.54a	2.16b	3.99a
Micro-dosing Time	ATS	13.04b	20.90b	38.78a	0.41b	3.38a	3.97b
	2WAS	16.42a	25.66a	41.21a	0.69a	3.68a	4.85a
	LSD (0.05)	**1.37**	**3.19**	**5.96**	**0.21**	**0.55**	**0.49**
Fertilizer Level	0 kgN/ha	10.88c	19.30c	34.86b	2.19a	3.64ab	3.89b
	20 kgN/ha	13.81b	20.55bc	36.02ab	0.05c	2.85b	3.99b
	40 kgN/ha	16.55a	25.39ab	42.76ab	0.05c	3.71ab	4.40b
	60 kgN/ha	16.23a	25.19ab	41.61ab	0.08c	3.38ab	4.14b
	80 kgN/ha	16.16a	25.98a	44.73a	0.38b	4.08a	5.63a
	LSD (0.05)	**2.16**	**5.05**	**9.11**	**0.19**	**0.57**	**0.77**

NL: Number of leaves. NV: Number of vine. WAS: Weeks after sowing. KG: Kilogram. HA: Hectare. FERT: Fertilizer. MT: Micro-dosing Time. ATS: At sowing. 2WAS: 2 Weeks after sowing. SES: Season. VL: Vine length. NL: Number of leaves

Table 9. Influence of fertilizer micro-dosing on emergence, fresh weight, yield and dry weight, of fluted pumpkin

		Emergence	**Fresh(g)**	**Yield(kg/ha)**	**Dry(g)**
Season	Late	20.05a	186.37a	3.53a	50.53a
	Early	18.90b	124.28b	2.86b	20.27b
Micro-dosing Time	ATS	19.05a	139.41a	2.84b	32.44a
	2WAS	19.90a	171.25a	3.56a	38.37a
	LSD (0.05)	**45.76**	**6.83**	**1.03**	**0.59**
Fertilizer Level	0 kgN/ha	16.63c	134.96ab	2.13d	21.85c
	20 kgN/ha	15.25c	157.87ab	2.36cd	31.34bc
	40 kgN/ha	20.50b	107.42b	3.26bc	35.76b
	60 kgN/ha	22.38a	185.21a	3.70ab	39.16ba
	80 kgN/ha	22.63a	191.18a	4.53a	48.89a
	LSD (0.05)	**1.63**	**2.35**	**0.94**	**10.80**

KG: Kilogram. HA: Hectare. FERT: Fertilizer. MT: Micro-dosing Time. ATS: At sowing. 2WAS: 2 Weeks after sowing.

variation between 40 kg/ha and 80 kg/ha is not wide in terms of production. Most vegetable crops require some nutrient elements for proper germination and emergence, an example of these elements are; N, P, K, Ca, Mg e.t.c. and the rates at which vegetables absorb N is much higher than other nutrient elements and *T. occidentalis* leaves have various nutrients embedded in it which include crude protein, moisture, fat, crude fiber, ether extract, ash contents.

The number of leaves, number of vines and vine length showed seasonal influence, late season

was significantly different from early season because late-season produced higher vine length, number of leaves, number of vines compared to the early season and seasons of planting had a significant effect on chlorophyll content on vine length and numbers of leaves across the weeks except for chlorophyll content at four weeks after planting. The significant effect of fertilizer was also evident on the chlorophyll content and vine length across weeks while a number of leaves was significant across weeks as against the findings of [20] who reported that early planting season had a better yield than late planting season.

The yield from the experiment was in agreement with the report of [21] who found the increased yield of crops through the application of inorganic fertilizer and the findings of [22] who reported that the best way to increase maize yield was by the combination of organic wastes and inorganic fertilizer. The 80 kg/ha of Nitrogen fertilizer gave the best agronomic parameters trait. This affirmed the report of Mathew and [23] who reported that inorganic fertilizers have much higher concentration of nutrient than organic fertilizers, the vigorous growth in fluted pumpkin which was experienced during the growing period as evidenced in the vine length, number of leaves, number of vines was in agreement with the findings of [24] who reported that nutrients from mineral fertilizers enhanced the establishment of crops and promoted yield of crops.

5. CONCLUSIONS

Fertilizer utilizing methods have been developed for small subsistence farmers aiming to reduce the quantity of fertilizer used in other to maintain the desired level of crop production and replenish the fertility of the soil. Many farmers were aware of soil fertilization but they are not able to have access to those fertilizers due to the financial shortage. Therefore, alternative fertilizer micro-dosing have been introduced. It can be concluded that sole application of Urea fertilizer in *Telfairia occidentalis* has been observed to be essential for plant growth and yield as it contained essential plant nutrients and gave better growth and yield performance.

From this experiment it can be concluded that 40 kg/ha of sole application of Nitrogen is at the peak to reduce cost of production knowing that the variation between 40 kg/ha and 80 kg/ha is not wide in terms of production because it gave a better growth and yield performance on *Telfairia occidentalis* economically. This shows that Urea fertilizer application of 40 kg/ha has a significant effect on yield of *Telfairia occidentalis*. It is therefore recommended that Urea fertilizer at the rate of 40 kgN/ha when considering the yield, other growth parameter and nutrient quality because it is highly effective when compared to other fertilizer rate ecomomically. However, further trials at other location should be conducted within the zone to confirm this study.

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COMPETING INTERESTS

Authors have declared that no competing interests exist.

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