

Growth Response of Fluted Pumpkin (*Telfairia Occidentalis*) to UREA and NPK 15:15:15 Fertigation in Uyo Local Government Area

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Abstract

The purpose of this study was to determine the growth response of fluted pumpkin (*Telfairia occidentalis*) to urea and NPK 15:15:15 fertigation in Uyo Local Government Area. This study adopted experimental research design of Randomized Complete Block Design (RCBD). The experiment was conducted at Agricultural Education Skills Acquisition Farm in the University of Uyo. The population consists of 144 fluted pumpkin seeds of *Telfairia occidentalis* Hook F. The sample size of 108 fluted pumpkin plants were selected for the study using purposive sampling technique. Morphological growth parameters of vine length of fluted pumpkin were measured using measuring tape while number of branches was carried out by counting. 540grammes of urea and 540gramms of NPK 15:15:15 was dissolved in 108 liters of water each and applied through irrigation pipes, and the same measured was applied through ring method. Data collected were analyzed using weighted mean for answering research questions and analysis of covariance (ANCOVA) for testing the null hypotheses at .05 level of significance. Findings indicated that fluted pumpkin grown with urea and NPK 15:15:15 fertigation performed better in terms of length of vine and number of branches than those grown by ring method of fertilizer application. There was significant effect of urea, NPK 15:15:15 fertigation on the length of vine and number of branches, with urea fertigation showing high significant difference. It was concluded that application of urea and NPK 15:15:15 through fertigation significantly improved the growth parameters of fluted pumpkin. It was recommended among others that vegetable farmers should adopt urea and NPK 15:15:15 fertilizers applied through fertigation method to optimize the growth of fluted pumpkin for better yield.

Keywords: Fluted Pumpkin; Urea; NPK 15:15:15 and Fertigation.

Introduction

The pursuit of increasing yield in crop production today by agronomist and farmers is driven by a need to address global problems of food scarcity and nutrients depletion in the soil. One of the approaches to facilitating the growth of crops is the utilization of appropriate fertilizers, especially fluted pumpkin as a vegetable that is gaining popularity in the world due to its nutritional benefits.

Fluted pumpkin (*Telfairia occidentalis* Hook F.) is a leafy vegetable plant that is most popular in the South-East and South-South region of Nigeria. Its popularity has spread to other countries like Ghana, Cameroun and Sierra Leone owing to its nutritional and medicinal versatility values (Ibironke and Iwotome, 2019). It has been reported by Food and Agricultural Organization (FAO) (2023) that there is an overwhelming increase in the level of consumption of fluted pumpkin leaves, seeds and shoots due to its nutritive benefits. This is why it remains popular in rural areas where it is often considered to be more nutritive than exotic vegetables. Also, the favorable climatic conditions makes fluted pumpkin the most important vegetable crop grown by farmers especially in Uyo LGA of Akwa Ibom State, as it is regarded as a seed and leafy vegetable with edible leaves and shoots.

According to Udoh and Ndon (2016), fluted pumpkin (*Telfairia occidentalis* Hook F.) is a diocious, perennial and creeping vegetable shrub that belong to the family of Cucurbitaceae and originated from tropical West Africa. The plant consists of both vegetative and reproductive structures. Vegetative structures include the leaves, roots, stem, and tendrils while reproductive structures include fruits and flowers (Chukwudi *et al.*, 2017). Production of fluted pumpkin encompasses the sum total of all operations involved in agronomic practices (side location and preparation, planting, fertilizers application, weed and disease control and good harvesting method) of the crops. Adebayo *et al.* (2019) stated that to sustain high yield, proper manure and fertilizers must be incorporated. Though, vegetable farmers have adopted various systems and methods to ensure better production of fluted pumpkin despite the numerous challenges like inadequate knowledge on the proper fertilizers to use, pest and disease infestation, poor planting materials (seeds) and off season of the crop. Even when water is available, yet the production gap is still wide with that of the consumers. Therefore, it becomes critical to consider the importance of urea and NPK 15:15:15 fertigation as soil fertility management for better yield of fluted pumpkin.

Urea is mainly utilized as a source of nitrogen because it is a crucial nutrient for plant growth. Sindha *et al.* (2024) stated that urea application is commonly used because of its high solubility, rapidly and efficiently absorbed by plant. NPK 15:15:15 fertilizers are chemical or synthetic fertilizers which are manufactured artificially and contain mineral chemicals which when added into the soil help to improve crop yield. Nsa *et al* (2013) reported that the use of manure is a traditional method or the conventional method like ring method, is the practice of applying fertilizer to the base of the plant near the root in a circular form is the way of boosting soil fertility, although the use of inorganic fertilizers like urea, NPK (Mg) is becoming increasingly important in Akwa Ibom State, Uyo LGA inclusive.

In actual agricultural production, the growth and development of pumpkin require appropriate water and fertilizer conditions due to the complex interactions between them. Urea and NPK 15:15:15 fertigation is agricultural technique by which fertilizing elements are dissolved in

water and applied to the roots of the plants by means of irrigation systems. In the same view, Thompson *et al.* (2018) asserted that fertigation is a technology that integrates irrigation and fertilization. Its main mechanism uses water as a carrier to cause the migration of water-soluble nutrients to crop roots through two processes: diffusion and mass flow. Compared with traditional fertilization methods, fertigation can not only improve yield of crops but also reduces the application and improves the utilization efficiency of water and fertilizer. Egbebi *et al.* (2023) recorded that micro-dosing fertilizer application with irrigation water in vegetable cultivation is an effective means to apply nutrients and moisture through the subsurface rhizosphere. The method increases nutrient absorption and its accurate placement for optimum plant growth. Chandrasekaran *et al.* (2016) asserted that fertigation is 8-10 times more effective than soil application because it triggers plant response to increased water and nutrient uptake from the soil.

Tao-Zhong *et al.* (2024) reported that the evaluation of water-fertilizer coupling effect on pumpkin growth and yield under different irrigation volumes under two-year-on farm experiment benefited pumpkin plant growth (vine length), dry matter accumulation, and yield while excessive application beyond a certain level had inhibited effects on pumpkin. The increased fertilizers application under the same irrigation volume enhanced the efficiency of water and fertilizer utilization. In the same vein Christo *et al.* (2020) reported that Super-Gro liquid fertilizer level of 15ml and 20ml per 5 liters of water are necessary to improve nutrient contents of fluted pumpkin leaf and higher yield. Similarly, Mounashree *et al.* (2018) studied the influence of fertigation on growth and yield of strawberry (*Fragaria X ananassa* Duch.) and reported that application of 75% RDF through fertigation stands best in terms of plant height (27-29 cm), number of trifoliolate leaves (27-30), plant spread (>50 cm), maximum leaf area (>175 cm²), number of runners per plant (1.75-1.85) and plant dry weight (28-30 g). Fertigation result in greater absorption, assimilation and translocation of nutrients for increased photosynthesis, increased production and ultimately reflected on the final leaves of fluted pumpkin. Gurpreet *et al.* (2024) investigated the impact of drip fertigation on growth, yield and quality of strawberry (*Fragaria × ananassa* Duch.) cultivar using recommended NPK dose through soil and recommended NPK dose through drip fertigation and found that the plant produced the greatest incremental plant height (26.16 cm), leaf area (148.94 cm²), leaf number per plant (26.16), and leaf area index through the application of drip fertigation than those through soil application. Dissolved fertilizer triggers plant response to water and nutrients uptake from the soil.

Goler and Ibrahim (2018) investigated the effect of fertilizers and cutting frequency on fluted pumpkin (*Telfairia occidentalis* Hook F.) and observed that significant difference exist between the treatment means for the different fertilizer types and cutting frequency, poultry dropping exerted higher effect on the number of leaves, vine length, leaf area, total fresh weight and total dry weight while NPK exerted more effect on the number of branches. Therefore, urea

and NPK15:15:15 fertigation method of application of fertilizers enhances number of branches of fluted pumpkin.

Statement of the Problem

Fluted pumpkin (*Telfairia occidentalis*) is extensively cultivated by small scale farmers virtually by every household in Uyo LGA of Akwa Ibom State. But the cultivation is done only by the peasant vegetable farmers who may not cultivate in large quantities, lack knowledge on the quantities of fertilizers to apply, or the timeliness and appropriate method of fertilizer application. More-so, there is a shift from the use of inorganic fertilizers to poultry manure by vegetable farmers in Uyo LGA.

At present, application of fertilizer by vegetable farmers through conventional methods such as ring method, side placement, top dressing, is not able to give higher yield, and the fertilizer use efficiency is decreasing day by day as a result of run-off by rain, leaching below the root zone and volatilization. Based on this, there is need to use fertigation that may enhance use efficiency by crop and facilitate nutrient circulation especially where soil conditions restrict nutrients availability.

Purpose of the Study

The main purpose of this study was to determine the growth response of fluted pumpkin (*Telfairia occidentalis*) to urea and NPK 15:15:15 fertigation in Uyo Local Government Area. Specifically, the study sought to:

- i. determine the effect of urea, NPK 15:15:15 fertigation and without fertigation on vine length of fluted pumpkin (*Telfairia occidentalis*) in Uyo LGA.
- ii. determine the effect of urea, NPK 15:15:15 fertigation and without fertigation on number of branches of fluted pumpkin (*Telfairia occidentalis*) in Uyo LGA.

Research Questions

The following questions were raised to guide the study.

- i. What is the effect of urea, NPK 15:15:15 fertigation and without fertigation on vine length of fluted pumpkin (*Telfairia occidentalis*) in Uyo LGA?
- ii. What is the effect of urea, NPK 15:15:15 fertigation and without fertigation on number of branches of fluted pumpkin (*Telfairia occidentalis*) in Uyo LGA?

Research Hypotheses

The following null hypotheses were formulated to guide the study

- H₀₁** There is no significant effect of urea, NPK 15:15:15 fertigation and without fertigation on vine length of fluted pumpkin (*Telfairia occidentalis*) in Uyo LGA
- H₀₂** There is no significant effect of urea, NPK 15:15:15 fertigation and without fertigation on number of branches of fluted pumpkin (*Telfairia occidentalis*) in Uyo LGA

Methodology

This study adopted experimental research design with true experimental layout of a Randomized Complete Block Design (RCBD). The experiment was conducted at Agricultural Education Skills Acquisition Farm in the University of Uyo. The area of the land was 120m² where each block were measured 6.5m x 6m and each plot for the beds measured 6.5m x 1m. Each bed was separated by 1m within row and 0.5m between. 144 fluted pumpkin seeds of *Telfairia occidentalis* Hook F were planted 2 per hole at the depth of 3-4cm at the spacing of 1m x 1m. The treatments involved were T₁ urea fertigation, T₂ NPK 15:15:15 fertigation, T₃ urea without fertigation and T₄ NPK 15:15:15 without fertigation on *Telfairia occidentalis* which serves as control. 540grammes of urea and 540gramms of NPK 15:15:15 was dissolved in 108 liters of water each and applied through irrigation pipes, and the same measured was applied through ring method. Standardized instruments such as measuring tape, garden line, and pegs, ranging pole, shovel, hand-fork, thread and electronic compact scale were used. Measurement was taken from 108 fluted pumpkin plants as sample size. The results are presented in tables using weighted mean to answer research questions and Analysis of Covariance (ANCOVA) to test null hypotheses. A post hoc analysis was employed using scheffe'spost hoc to test for significance.

Results and Discussion

Research Question 1: What is the effect of urea, NPK 15:15:15 fertigation and without fertigation on vine length of fluted pumpkin (*Telfairia occidentalis*) in Uyo LGA?

Table 1: Mean Analysis of Responses of Vine Length of Fluted Pumpkin to Urea, NPK 15:15:15 Fertigation and without Fertigation in Uyo LGA

Categories	Number of Plants	Mean Length of Vine(cm)
Urea Fertigation	27	46.59
NPK15:15:15 Fertigation	27	44.92
Urea without Fertigation	27	43.58
NPK15:15:15 without Fertigation	27	43.44
Total	108	44.65

Results in Table 1 show the mean effect of urea, NPK 15:15:15 fertigation and without fertigation on vine length of fluted pumpkin (*Telfairia occidentalis*). It indicates that the mean length of vine of fluted pumpkin grown with urea fertigation is 46.59cm, NPK 15:15:15 fertigation is 44.92cm, while urea without fertigation is 43.58cm and NPK 15:15:15 without fertigation is 43.44cm. This implies that, fluted pumpkin grown with urea fertigation performs better in terms of length of vine followed by those grown with NPK15:15:15 fertigation then urea without fertigation and NPK15:15:15 without fertigation.

Null Hypothesis 1: There is no significant effect of urea, NPK 15:15:15 fertigation and without fertigation on vine length of fluted pumpkin (*Telfairia occidentalis*) in Uyo LGA

Table 2: Analysis of Covariance Showing Effect of Urea, NPK 15:15:15 Fertigation and without Fertigation on Vine Length of Fluted Pumpkin (*Telfairia occidentalis*) in Uyo LGA.

Source of Variation	Sum of Squares	Df	Mean Square	F	Sig.
Corrected Model	173.886 ^a	3	57.962	28.334	.000
Intercept	215168.374	1	215168.374	105181.677	.000
CODING	173.886	3	57.962	28.334	.000
Error	212.751	104	2.046		
Total	215555.011	108			
Corrected Total	386.637	107			

a. R Squared = .450 (Adjusted R Squared = .434)

Result in the Table 2 indicated that the calculated F-value 28.33 and the F-Sig .000 at 3 and 104 degrees of freedom and 0.05 level of significance. Since the F-Sig value .000 is less than the p-value of .05 the null hypothesis which stated that there is no significant effect of urea, NPK 15:15:15 fertigation and without fertigation on vine length of fluted pumpkin (*Telfairia occidentalis*) in Uyo LGA is rejected. Hence, there is significant effect of urea, NPK 15:15:15 fertigation and without fertigation on vine length of fluted pumpkin (*Telfairia occidentalis*) in Uyo LGA

Since there is a significant effect, a post hoc analysis was employed using scheffe's post hoc test. The result of the analysis is presented in table 3.

Table 3: Scheffe Post Hoc Showing Interactive Effect of Urea, NPK 15:15:15 Fertigation and without Fertigation on Vine Length of Fluted Pumpkin (*Telfairia occidentalis*) in Uyo LGA.

(I) CODING	(J) CODING	Mean Difference (I-J)	Std. Error	Sig.
Urea Fertigation	NPK15:15:15 Fertigation	1.67*	.389	.001
	Urea without Fertigation	3.01*	.389	.000
	NPK15:15:15 without Fertigation	3.15*	.389	.000

NPK15:15:15 Fertigation	Urea Fertigation	-1.67*	.389	.001
	Urea without Fertigation	1.34*	.389	.010
	NPK15:15:15 without Fertigation	1.48*	.389	.003
Urea without Fertigation	Urea Fertigation	-3.01*	.389	.000
	NPK15:15:15 Fertigation	-1.34*	.389	.010
	NPK15:15:15 without Fertigation	.137	.389	.989
NPK15:15:15 without Fertigation	Urea Fertigation	-3.15*	.389	.000
	NPK15:15:15 Fertigation	-1.48*	.389	.003
	Urea without Fertigation	-.137	.389	.989

* The mean difference is significant at the 0.05 level.

Result in Table 3 indicated that urea fertigation and NPK 15:15:15 fertigation had the significant interactive mean effect ranging from 1.34 to 3.15 with other treatments. Other treatments such as urea without fertigation and NPK 15:15:15 without fertigation had lower interactive mean effects ranging from -1.34 to -3.34. This implies that urea fertigation and NPK 15:15:15 exert significant effect on length of vine of fluted pumpkin when compared to other treatments; urea without fertigation and NPK15:15:15 without fertigation.

Research Question 2: What is the effect of urea, NPK 15:15:15 fertigation and without fertigation on number of branches of fluted pumpkin (*Telfairia occidentalis*) in Uyo LGA?

Table 4: Mean Analysis of Responses of Number of Branches of Fluted Pumpkin to Urea, NPK 15:15:15 Fertigation and without Fertigation in Uyo LGA

Categories	Number of Plants	Mean Number of Branches
Urea with Fertigation	27	5.19
NPK15:15:15 Fertigation	27	4.41
Urea without Fertigation	27	4.33
NPK15:15:15 without Fertigation	27	4.08
Total	108	4.50

Results in Table 4 show the mean effect of urea, NPK 15:15:15 fertigation and without fertigation on number of branches of fluted pumpkin (*Telfairia occidentalis*). It indicates that the mean number of branches of fluted pumpkin grown with urea fertigation is 5.19, NPK 15:15:15 fertigation is 4.41 while urea

without fertigation is 4.33 and NPK 15:15:15 without fertigation is 4.08. This reveals that, fluted pumpkin grown with urea fertigation performs better in terms of number of branches, followed by NPK 15:15:15 fertigation than those grown with urea and NPK 15:15:15 without fertigation respectively.

Research Hypothesis 2: There is no significant effect of urea, NPK 15:15:15 fertigation and without fertigation on number of branches of fluted pumpkin (*Telfairia occidentalis*) in Uyo LGA

Table 5: Analysis of Covariance Showing Effect of Urea, NPK 15:15:15 Fertigation and without Fertigation on Number of Branches of Fluted Pumpkin (*Telfairia occidentalis*) in Uyo LGA

Source of Variation	Sum of Squares	Df	Mean Square	F	Sig.
Corrected Model	36822.819 ^a	3	12274.273	7.234	.000
Intercept	934670.550	1	934670.550	550.838	.000
CODING	36822.819	3	12274.273	7.234	.000
Error	176468.764	104	1696.815		
Total	1147962.132	108			
Corrected Total	213291.582	107			

a. R Squared = .173(Adjusted R Squared = .149)

Result in the Table 5 indicated that the calculated F-value 7.23 and the F-Sig .000 at 3 and 104 degrees of freedom and 0.05 level of significance. Since the F-Sig value .000 is less than the p-value of .05 the null hypothesis which stated that there is no significant effect of urea, NPK 15:15:15 fertigation and without fertigation on number of branches of fluted pumpkin (*Telfairia occidentalis*) in Uyo LGA is rejected. Hence, there is a significant effect of urea, NPK 15:15:15 fertigation and without fertigation on number of branches of fluted pumpkin (*Telfairia occidentalis*) in Uyo LGA. Since there is a significant difference, a post hoc analysis using Scheffe's Test was employed. The result of the analysis is presented in Table 6.

Table 6: Scheffe Post Hoc Showing the Interactive Effect of Urea, NPK 15:15:15 Fertigation and without Fertigation on Number of Branches of Fluted Pumpkin (*Telfairia occidentalis*) in Uyo LGA

(I) CODING	(J) CODING	Mean Difference (I-J)	Std. Error	Sig.
Urea Fertigation	NPK15:15:15 Fertigation	1.67*	.39	.001
	Urea without Fertigation	3.01*	.39	.000
	NPK15:15:15 without Fertigation	3.15*	.39	.000
NPK15:15:15 Fertigation	Urea Fertigation	-1.66*	.39	.001
	Urea without Fertigation	1.34*	.39	.010
	NPK15:15:15 without Fertigation	1.48*	.39	.003
Urea without Fertigation	Urea Fertigation	-3.01*	.39	.000
	NPK15:15:15 Fertigation	-1.34*	.39	.010
	NPK15:15:15 without Fertigation	.14	.39	.989
NPK15:15:15 without Fertigation	Urea Fertigation	-3.15*	.39	.000
	NPK15:15:15 Fertigation	-1.48*	.39	.003
	Urea without Fertigation	-.14	.39	.989

* The mean difference is significant at the 0.05 level

Result in Table 6 indicated that only urea fertigation and NPK 15:15:15 fertigation had the more significant interactive mean effect ranging from 1.67 to 3.15 with other treatments. Other treatments had lower positive and negative interactive mean effects ranging from -1.34 to -3.15. This implies that urea fertigation and NPK 15:15:15 fertigation exert significant effect on number of branches of fluted pumpkin when compared to other treatments; urea without fertigation and NPK 15:15:15 without fertigation.

Discussion of Findings

Effect of Urea and NPK 15:15:15 Fertigation on Length of Vine of Fluted Pumpkin

The Findings of the study on the vine length indicated that fluted pumpkin grown with urea and NPK15:15:15 fertigation perform better, and there is significant effect with urea showing high significant difference than those grown with urea and NPK15:15:15 without fertigation. This implies that urea and NPK15:15:15 irrespective of method of application (either by fertigation or by ring method) support the growth of fluted pumpkin in terms of vine length development. Meanwhile, urea and NPK15:15:15 fertigation fastens vine length development. This is due to the fact that the nutrients are readily dissolved and made available to crop. The finding is in agreement with the findings of Tao-Zhong *et al.* (2024) who conducted a study on the evaluation of water-fertilizer

coupling effect on pumpkin growth and yield under different irrigation volumes under two-year-on farm experiment and found that it benefited pumpkin plant growth (vine length), dry matter accumulation and yield. The finding is also supported by the findings of Mounashree *et al.* (2018) who study on the influence of fertigation on growth and yield of strawberry (*Fragaria X ananassa* Duch.) in India and reported that application of 75% RDF through fertigation stands best in terms number of trifoliolate leaves (27-30), maximum leaf area (>175 cm), number of runners per plant (1.75-1.85) and plant dry weight (28-30 g). Fertigation stands the best due to the increased nutrient absorption that overcome the soil inability to transfer nutrients to plant on time and nutrients balance as it was precisely mixed to prevent over or low concentration.

Effect of Urea and NPK 15:15:15 Fertigation on Number of Branches of Fluted Pumpkin

Finding indicated that fluted pumpkin grown with urea and NPK15:15:15 fertigation perform better in terms of number of branches than those grown with urea and NPK15:15:15 without fertigation respectively. It was further observed that there was a significant effect of urea, NPK 15:15:15 fertigation and without fertigation on number of branches of fluted pumpkin (*Telfairia occidentalis*) in Uyo LGA. Fertigation result in greater absorption, assimilation and translocation of nutrients for increased photosynthesis, increased production and ultimately reflected on the final leaves of fluted pumpkin. The finding is in-line with the finding of Gurpreet *et al.* (2024) investigated the impact of drip fertigation on growth, yield and quality of strawberry (*Fragaria × ananassa* Duch.) cultivar using recommended NPK dose through soil and recommended NPK dose through drip fertigation and found that the plant produced the greatest incremental plant height (26.16 cm), leaf area (148.94 cm²), leaf number per plant (26.16), and leaf area index through the application of drip fertigation than those through soil application. The finding is also in agreement with the submission of Goler and Ibrahim (2018) who investigated the effect of fertilizers and cutting frequency on fluted pumpkin (*Telfairia occidentalis* Hook F.) and observed that significant difference exist between the treatment means for the different fertilizer types and cutting frequency, poultry dropping exerted higher effect on the number of leaves, vine length, leaf area, total fresh weight and total dry weight while NPK exerted more effect on the number of branches. Therefore, urea and NPK15:15:15 fertigation method of application of fertilizers enhances number of branches of fluted pumpkin.

Conclusion

Urea and NPK15:15:15 fertigation on the growth and yield of fluted pumpkin in Uyo, Nigeria. The results indicated that the application of urea and NPK15:15:15 through fertigation significantly improved the growth parameters of fluted pumpkin in terms of vine length and number of branches but with urea fertigation showing high significant difference from other categories. The application of these fertilizers through fertigation system enhanced nutrient use efficiency and reduced nutrient losses, leading to improved overall crop performance.

Recommendations

Based on the findings of the study, the following recommendations are made:

- i. Vegetable farmers should adopt urea and NPK15:15:15 fertigation methods to apply to fluted pumpkin enhance length of vine and optimizing number of leaves.
- ii. Akwa Ibom State Ministry of Agriculture and extension agents should use the findings of this research in planning capacity-building initiatives in collaboration with vegetable farmers to educate them on the use of urea and NPK fertilizers through fertigation as it improve the parameters of fluted pumpkin production.

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