*Agr. Foo. Nat. Res. J. Volume 3, Issue 2, Page 296 - 301*
**e-ISSN: 1597-7153 | p-ISSN: 3043-5420**

**Agriculture, Food and Natural Resources Journal**
***The Official Journal of the Faculty of Agriculture, Nnamdi Azikiwe University, Awka, Nigeria***

Journal homepage: https://journals.unizik.edu.ng/afnrj

**Original Article**

# Effect of urea and organic manure on growth and yield of *Telfaria occidentalis* in Abeokuta, Nigeria

OPEN ACCESS

Abosede Obafunke BELLO* & Olagoke Ayobami OLANIYI

*Federal College of Education, Abeokuta in affiliation with University of Ibadan, Nigeria*

**DOI:** https://www.doi.org/10.5281/zenodo.14253999

***Editor:*** *Dr Onyekachi Chukwu, Nnamdi Azikiwe University, NIGERIA*

***Received:*** *June 11, 2024*
***Accepted:*** *August 27, 2024*
***Available online:*** *September 30, 2024*

***Peer-review:*** *Externally peer-reviewed*



**Conflict of Interest:** The authors have no conflicts of interest to declare

***Financial Disclosure:*** *The authors declared that this study has received no financial support*

**ABSTRACT**

Fluted pumpkin (*Telfairia occidentalis*) is cultivated for its edible leaves and seeds, which are high in protein, fat, potassium, and iron, contributing to a balanced diet. The variability in the nutritional content of agricultural soil necessitates amendments to enhance soil quality and crop yields. This study compared the effects of urea fertilizer and organic manure (cow dung, poultry droppings) on the growth and yield of the leaves of fluted pumpkin under field conditions (singly and in combinations) at the botanical garden of the Federal College of Education, Abeokuta. The study employed a randomized block design with replicates and measurements of 10 g and 5 g amendments. Findings revealed that control plants exhibited the lowest growth parameters, indicating nutrient deficiency. Urea amendment showed the highest number of leaves (41.87), leaf breadth (10.43 cm), and stalk diameter (1.97 cm). The longest leaves (13.43 cm) and stalks (54.70 cm) occurred in plants grown in soil amended with a combination of 10 g cow dung and poultry droppings, while the highest branching (24.67) was observed in the urea and poultry droppings combination. The leaves had a dark-green colouration characteristic of healthy plants in the experimental plants. Applying 10 g of urea or a combination of nutrient sources can significantly enhance the plant's performance, suggesting both methods are beneficial for crop improvement. The study recommends that organic manure, especially when combined with urea, is vital for optimizing the growth of fluted pumpkins, thereby providing insights for sustainable agriculture.

KEYWORDS: *Crop, Organic, Productivity, Uptake, Yield*

## INTRODUCTION

*Telfairia occidentalis*, commonly known as the fluted gourd or fluted pumpkin, is a tropical climbing plant native to West Africa, where it is cultivated for its edible leaves and seeds. It is cultivated primarily for its leaves and edible seeds in various West African countries, especially Nigeria. The seeds are high in protein and fat, contributing to a balanced diet. The plant is drought-resistant and usually grown on trellises. The shoots are rich in potassium and iron, while the seeds contain significant protein and fat content (Aiyelagbe, 2012).

In a system involving continuous cropping, which is commonly employed by Nigerian farmers, maintenance of soil fertility and productivity can only be ensured via the use of soil amendments. Several researchers have recommended and advocated for the integrated use of organic and inorganic fertilizers (Kakar *et al.*, 2020; Iren *et al*., 2012; Adeniyan & Ojeniyi 2003, 2005; Lombin *et al*., 1991). Inorganic fertilizers, which contain essential

*Corresponding author: drbelloabosede@gmail.com

nutrients like nitrogen, phosphorus, and potassium, are often used to supplement natural soil fertility (Ishaker, 2000). Poultry litter, a mixture of poultry waste and bedding materials, serves as a valuable source of nutrients and soil amendment (Altunga, 2007). Urea is a widely used nitrogen fertilizer, known for its high solubility and efficiency (Messen & Petterson, 2005).

Inorganic fertilizer provides readily available nutrients for plant uptake and growth; while its organic counterpart besides nutrients supplied to crops, also improves soil physico-chemical condition, thereby increasing soil organic matter content. Soil organic matter has a biological function in that it provides carbons, the energy source for soil microbes, and enhances plant growth, and seed germination (Kumbhar *et al*., 2007). Amendment of organic materials such as, animal manure affects soil organic matter content, soil fertility, soil physical characteristics, augmentation of microbial activities, and amelioration of metal toxicity (Bhuiyan, 2004; Mehesi, 2012; Kakar, 2020).

The fluted pumpkin (*T. occidentalis*), commonly called "Ugu", especially by the Igbo people of eastern Nigeria, is a creeping leafy vegetable with large, lobed leaves and long twisting vine (Ibironke, 2019). The vegetable is grown throughout West Africa's lowland humid tropics and commercially viable with Sierra Leone, Ghana, and Nigeria emerging as the leading producers (Onuguh, 2022). Common factors affecting the productivity of fluted pumpkin in the region include the dependence of farmers majorly on rain for plant growth, (utilizing irrigation), and the low fertility of the soil.

The use of organic manure to improve soil fertility and enhance the vegetative performance of fluted pumpkin has been reported in Nigeria (Muoneke *et al*., 2011; Shiyam & Binang, 2013).

Poultry manure (PM) is very rich in organic carbon which has been reported to improve soil biophysical properties and support optimum crop performance (Idem *et al*., 2012). Generally, the incorporation of PM to the soil increases its organic matter content, reduces erosion, enhances infiltration and retention of soil moisture, promotes the biological activities on the rhizosphere, improves the structure, neutralizes soil pH and makes more nutrients available to the soil.

Numerous studies have indicated that applying animal manure has a profound impact on the microbial communities across various ecosystems, particularly within the rhizosphere. For instance, a short-term fertilization experiment conducted by Jie *et al.* (2021) revealed that the use of organic fertilizers significantly enhances the proliferation of nutrient-rich microorganisms. Additionally, a long-term fertilization study spanning 33 years in arid regions demonstrated that the use of pig manure significantly boosts both microbial diversity and abundance (Sun, 2020). These microorganisms can infiltrate plants via several pathways, particularly through organic fertilizers to the soil.

This study seeks to study the effect of urea and organic manure on growth, fruit yield and postharvest quality of fluted pumpkin under field conditions.

## MATERIALS AND METHOD

### Study Area

The experiment was conducted at the Botanical Garden and Biology Laboratory of Federal College of Education, Abeokuta Ogun State, Nigeria (geographical coordinates are; 7° 9' 39 North, and 3° 21 54 East). With a mean temperature of 28°C Average rainfall ranges between 7.1mm in the month of January to 208. 27 in the month of June. It is located within 100 km North of Lagos, 82 km Southwest of Ibadan, Oyo State (Ogunyemi, *et al.*, 2022)

### Experimental Design

The study employed randomized block design with treatments in replicates for soil amendment and crop planting. The treatments includedT1: Control (no fertilizer); T2: Cow Dung (5%); T3: Poultry Droppings (5%); T4: Urea (5%); T5: Combined Cow Dung and Poultry Droppings (5%); T6: Urea + Cow Dung (5%); T7: Urea + Poultry Droppings (5%). The manure was allowed to cure and mixed with loamy soil for the treatments. The curing is needed to prevent formation of humic acid characteristic of raw poultry droppings which could affect growth performance as described by Khoi *et al.* (2010).. Urea was introduced two weeks after planting according to the specifications of the manufacturer, while control was the soil alone. The control group, consisting solely of soil, allows for comparison against treatments to assess the efficacy of the manure and urea . Wetting and monitoring of plants was ensured to prevent drying out and pest infestation. This is to ensure the plants grow at optimal growth conditions. This method is in line of the study of Azeez, *et al.*, (2023).

### Data Collection and analysis

Data on growth and yield parameters were collected weekly as demonstrated in the study by Azeez, *et al.*, (2023). Records of the leaf lengths and breadths and the number of leaves and branches were taken and subjected to descriptive and inferential statistical analysis.The color of the leaves is also observed to ensure and compare the characteristic dark-green leaves. The data were analyzed using the Statistical Package for Social Sciences (SPSS) version 21.0 package. Descriptive statistics wereused to determine the measures of central tendency. Means were separated using Duncan Multiple Range test. Values with different superscripts down the column at $p < 0.05$ level of significance.

## RESULTS AND DISCUSSION

Results indicated no significant differences in leaf count across treatments in the first three weeks (Table 1). However, significant increases were observed from the fourth week onward, with the highest leaf count found in plants treated with urea and poultry droppings.

**Table 1: Effects of 10g of different nutrientsources on the number of leaves of *Telfaria occidentalis* at various weeks after planting (WAP)**

| Treatments | 1WAP | 2WAP | 3WAP | 4WAP | 5WAP | 6WAP |
|---|---|---|---|---|---|---|
| Control | 9.67±4.66$^{a}$ | 16.00±5.56$^{a}$ | 21.66±5.78$^{a}$ | 26.83±4.76$^{ab}$ | 30.00±3.51$^{ab}$ | 38.16±4.16$^{ab}$ |
| CD | 9.66±1.86$^{a}$ | 15.67±0.33$^{a}$ | 18.33±2.89$^{a}$ | 25.16±3.49$^{ab}$ | 29.16±3.77$^{ab}$ | 36.23±3.88$^{b}$ |
| PD | 14.50±3.88$^{a}$ | 19.50±3.77$^{a}$ | 23.83±3.68$^{a}$ | 29.83±3.22$^{ab}$ | 31.00±3.21$^{ab}$ | 37.33±2.40$^{b}$ |
| Urea | 11.00±2.00$^{a}$ | 15.50±4.48$^{a}$ | 24.67±1.85$^{a}$ | 31.66±1.85$^{ab}$ | 35.93±1.11$^{a}$ | 41.87±1.44$^{b}$ |
| CD+PD | 8.66±1.45$^{a}$ | 14.33±1.09$^{a}$ | 19.00±0.57$^{a}$ | 23.33±0.66$^{ab}$ | 27.03±0.72$^{b}$ | 34.67±1.16$^{b}$ |
| Urea + CD | 6.77±2.14$^{a}$ | 15.33±1.42$^{a}$ | 19.00±1.73$^{a}$ | 23.67±2.02$^{ab}$ | 28.87±1.34$^{b}$ | 34.47±1.25$^{b}$ |
| Urea +PD | 8.50±3.25$^{a}$ | 17.83±3.22$^{a}$ | 18.17±2.62$^{a}$ | 23.83±2.80$^{ab}$ | 28.03±2.62$^{b}$ | 34.37±2.27$^{b}$ |

*Means± standard error followed by different superscripts on the same columns are significantly different ($p< 0.05$) according to Tukey's HSD test at $p <0.05$ KEY:Cow dung= CD, Poultry droppings = PD*

The longest leaf lengths were recorded in plants treated with a mixture of cow dung and poultry droppings (Table 2).The findings highlight that while soils were nutrient-deficient initially, the application of organic and inorganic amendments substantially improved plant growth and yields. This aligns with previous studies advocating for the combined use of fertilizers to maximize crop production (Azeez *et al*, 2023*;* Ayeni, 2008; Iren *et al*., 2012).

**Table 2: Effects of 10g of different nutrientsources on the leaf length of *Telfaria occidentalis* at various weeks after planting (WAP)**

| Treatments | 1WAP | 2WAP | 3WAP | 4WAP | 5WAP | 6WAP |
|---|---|---|---|---|---|---|
| Control | 5.10±1.81$^{a}$ | 8.27±1.58$^{ab}$ | 11.10±1.13$^{ab}$ | 11.53±1.18$^{abc}$ | 13.03±0.64$^{a}$ | 13.70±0.71$^{a}$ |
| CD | 7.07±1.02$^{a}$ | 8.93±.76$^{ab}$ | 7.77±1.79$^{bc}$ | 8.47±0.43$^{c}$ | 9.30±0.49b | 10.30±0.55$^{a}$ |
| PD | 4.86±1.15$^{a}$ | 8.50±.57ab | 8.47±1.32$^{abc}$ | 8.77±0.58$^{bc}$ | 9.40±0.55b | 10.03±0.59$^{a}$ |
| Urea | 3.80±0.10$^{a}$ | 9.60±1.02ab | 11.76±1.13$^{a}$ | 12.20±1.17$^{ab}$ | 12.70±1.11$^{a}$ | 11.43±2.78$^{a}$ |
| CD+PD | 6.96±1.22$^{a}$ | 11.17±1.42a | 11.93±1.05$^{a}$ | 12.40±1.05$^{a}$ | 12.83±0.90$^{a}$ | 13.43±1.20$^{a}$ |
| Urea + CD | 3.37±1.26$^{a}$ | 5.50±1.00b | 7.07±1.48$^{c}$ | 7.96±1.43$^{c}$ | 9.53±1.53b | 10.47±2.58$^{a}$ |
| Urea +PD | 3.13±1.28$^{a}$ | 7.27±1.75ab | 8.27±1.43$^{abc}$ | 9.03±1.29$^{abc}$ | 10.93±0.89ab | 11.80±1.72$^{a}$ |

*Means± standard error followed by different superscripts on the same columns are significantly different ($p< 0.05$) according to Tukey's HSD test at $p <0.05$. KEY: Cow dung= CD, Poultry droppings = PD*

Results (Table 3) of this study also revealed that the soils used are nutrient deficient as the control experiment had the lowest values of all the parameters measured within 1 Week after planting (WAP) to 6 Weeks after planting (WAP). Soil fertility is degrading day by day due to intensive crop production, heavy fertilization, and mono-cropping (Moe, 2019; Collins , 2013).

**Table 3: Effects of 10g of different nutrientsources on leaf breadth of *Telfaria occidentalis* at various weeks after planting (WAP)**

| Treatments | 1WAP | 2WAP | 3WAP | 4WAP | 5WAP | 6WAP |
|---|---|---|---|---|---|---|
| Control | 1.90±0.21$^{a}$ | 5.83±1.36$^{a}$ | 6.90±.65$^{ab}$ | 7.50±2.25$^{ab}$ | 8.23±0.38$^{ab}$ | 8.86±0.39$^{b}$ |
| CD | 4.07±1.53$^{a}$ | 5.00±.57$^{a}$ | 7.03±1.03$^{ab}$ | 7.76±2.05$^{ab}$ | 8.30±0.70$^{ab}$ | 8.90±0.55$^{b}$ |
| PD | 2.60±0.44$^{a}$ | 5.80±1.60$^{a}$ | 7.37±1.03$^{ab}$ | 7.43±2.57$^{ab}$ | 7.23±0.46$^{ab}$ | 8.33±0.23$^{b}$ |
| Urea | 3.07±1.19$^{a}$ | 7.33±1.45$^{a}$ | 8.10±1.06$^{a}$ | 8.56±3.21$^{a}$ | 8.97±0.97$^{a}$ | 10.43±0.92$^{a}$ |
| CD+PD | 4.33±1.22$^{a}$ | 6.93±0.64$^{a}$ | 7.57±.35$^{ab}$ | 8.03±1.15$^{ab}$ | 8.16±0.26$^{ab}$ | 8.53±0.32$^{b}$ |
| Urea + CD | 1.97±0.56$^{a}$ | 4.87±0.41$^{a}$ | 4.83±.72$^{b}$ | 5.73±3.51b | 7.03±0.76$^{ab}$ | 8.50±0.47$^{b}$ |
| Urea +PD | 2.36±1.56$^{a}$ | 6.76±1.75$^{a}$ | 7.56±1.07$^{ab}$ | 8.03±4.85$^{ab}$ | 8.50±0.86$^{ab}$ | 9.16±0.81$^{ab}$ |

*Means± standard error followed by different superscripts on the same columns are significantly different ($p< 0.05$) according to Tukey's HSD test at $p <0.05$. KEY: Cow dung= CD, Poultry droppings = PD*

Application of urea fertilizer and organic manure in a single or in a combined form improved the fresh yield of fluted pumpkin across all stages of growth when compared with the control (Table 4 and 5). The results obtained from this study agreed with the findings of other researchers (Ayeni, 2008; Iren *et al*., 2012; Adekunle, 2013; Ismael, 2021; Azeez, 2023;) that combined use of inorganic fertilizer and organic manure will support the supply of adequate quantities of plant nutrients required to sustain maximum crop production while minimizing environmental impact from nutrient use (Kakar, 2020). This finding aligns with that of Muhammed *et al*., (2022) who stated that the leaf characteristics; leaf number, length of petiole, leaf area, and leaf dry weight were increased significantly by using poultry dung treatment in their study.

**Table 4: Effects of 10g of different nutrientsources on number of branches of Telfaria occidentalis at various weeks after planting (WAP)**

| Treatments | 1WAP | 2WAP | 3WAP | 4WAP | 5WAP | 6WAP |
|---|---|---|---|---|---|---|
| Control | 5.00±0.57$^{b}$ | 8.17±0.93$^{bc}$ | 11.17±1.16$^{b}$ | 17.33±3.88$^{a}$ | 15.93±0.52$^{c}$ | 19.17±0.72$^{e}$ |
| CD | 5.33±0.60$^{ab}$ | 7.66±0.66$^{bc}$ | 12.00±1.73$^{ab}$ | 15.67±1.45$^{a}$ | 18.00±0.57$^{abc}$ | 22.66±1.20$^{abc}$ |
| PD | 7.66±1.69$^{a}$ | 13.00±1.00$^{a}$ | 14.66±0.66$^{a}$ | 17.83±0.88$^{a}$ | 15.50±1.61$^{c}$ | 20.83±0.73$^{bcd}$ |
| Urea | 5.00±0.29$^{b}$ | 8.00±0.28$^{bc}$ | 12.33±0.60$^{ab}$ | 15.00±0.57$^{a}$ | 16.30±0.58$^{bc}$ | 23.16±0.44$^{ab}$ |
| CD+PD | 5.33±0.33$^{ab}$ | 8.50±1.04$^{bc}$ | 10.50±1.76$^{b}$ | 12.17±0.60$^{a}$ | 14.77±0.95$^{c}$ | 20.50±0.76$^{cd}$ |
| Urea + CD | 6.00±0.57$^{ab}$ | 10.67±0.88$^{ab}$ | 13.17±0.44$^{ab}$ | 15.00±0.57$^{a}$ | 19.37±1.28$^{ab}$ | 19.00±0.57$^{e}$ |
| Urea +PD | 5.66±0.44$^{ab}$ | 10.33±0.88$^{abc}$ | 14.33±0.44$^{a}$ | 17.33±0.88$^{a}$ | 19.60±0.80$^{a}$ | 24.67±0.44$^{a}$ |

*Means± standard error followed by different superscripts on the same columns are significantly different (p< 0.05) according to Tukey's HSD test at p <0.05. KEY: Cow dung= CD, Poultry droppings = PD*

**Table 5: Effects of 10g of different nutrient sources on stalk length of *Telfaria occidentalis* at various weeks after planting (WAP)**

| Treatments | 1WAP | 2WAP | 3WAP | 4WAP | 5WAP | 6WAP |
|---|---|---|---|---|---|---|
| Control | 20.86±3.74$^{a}$ | 32.00±3.79$^{a}$ | 42.10±4.86$^{a}$ | 26.86±3.49$^{c}$ | 34.03±3.13$^{b}$ | 39.60±2.95$^{a}$ |
| CD | 17.93±2.08$^{a}$ | 27.57±1.79$^{a}$ | 26.60±6.46$^{ab}$ | 29.26±10.62$^{a}$ | 37.76±5.64$^{ab}$ | 44.46±6.62$^{ab}$ |
| PD | 19.33±4.31$^{a}$ | 28.33±7.26$^{a}$ | 26.73±1.67$^{ab}$ | 43.87±5.53$^{ab}$ | 47.13±3.46$^{ab}$ | 51.47±3.25$^{ab}$ |
| Urea | 10.66±1.57$^{a}$ | 24.33±3.06$^{a}$ | 35.43±5.12$^{ab}$ | 39.17±4.42$^{b}$ | 41.13±4.09$^{ab}$ | 42.27±6.52$^{ab}$ |
| CD+PD | 23.80±3.95$^{a}$ | 36.00±4.85$^{a}$ | 34.80±2.68$^{ab}$ | 48.10±4.86$^{a}$ | 49.93±4.12a | 54.70±2.81$^{a}$ |
| Urea + CD | 10.63±3.03$^{a}$ | 15.50±4.35$^{a}$ | 21.83±3.94$^{b}$ | 39.13±1.74$^{b}$ | 41.63±1.60$^{ab}$ | 44.33±.29$^{ab}$ |
| Urea +PD | 22.76±4.44$^{a}$ | 26.17±2.96$^{a}$ | 33.43±4.04$^{ab}$ | 38.80±8.77$^{ab}$ | 43.36±5.92$^{ab}$ | 49.53±5.14$^{ab}$ |

*Means± standard error followed by different superscripts on the same columns are significantly different (p< 0.05) according to Tukey's HSD test at p <0.05. KEY: Cow dung= CD, Poultry droppings = PD*

Plants treated with poultry droppings, cow dung, or their combination had an equal number of branches (Table 6). These findings align with Noosheen *et al.* (2021), who found that the highest number of branches was recorded with a combination of Urea and poultry dung. The treatment with urea at 90 kg ha-1 combined with PM at 30 kg ha-1 maximized seedling survival, number of branches, plant height, and number of leaves. Agbo-Adediran *et al*., (2020) also stated that crops grown on cow dung amended soil had the highest value for stalk diameter, followed by poultry droppings.

**Table 6: Effects of 10g of different nutrientsources on stalk diameter of *Telfaria occidentalis* at various weeks after planting**

| Treatments | 1WAP | 2WAP | 3WAP | 4WAP | 5WAP | 6WAP |
|---|---|---|---|---|---|---|
| Control | 0.53±0.09$^{a}$ | 0.93±.06$^{a}$ | 1.50±0.10$^{ab}$ | 1.63±0.06$^{ab}$ | 1.70±0.05$^{ab}$ | 1.83±0.12$^{a}$ |
| CD | 0.56±0.07$^{a}$ | 0.83±.20$^{a}$ | 1.10±0.23$^{b}$ | 1.53±0.12$^{ab}$ | 1.70±0.12$^{ab}$ | 1.93±0.03$^{a}$ |
| PD | 0.57±0.06$^{a}$ | 0.60±.10$^{a}$ | 1.37±0.13$^{ab}$ | 1.47±0.21$^{ab}$ | 1.73±0.12$^{ab}$ | 1.93±0.03$^{a}$ |
| Urea | 0.56±0.06$^{a}$ | 1.00±.12$^{a}$ | 1.83±0.17$^{a}$ | 1.77±0.13$^{a}$ | 1.87±0.08$^{a}$ | 1.97±0.03$^{a}$ |
| CD+PD | 0.67±0.09$^{a}$ | 1.00±.25$^{a}$ | 1.57±0.23$^{ab}$ | 1.67±0.17$^{ab}$ | 1.73±0.13$^{ab}$ | 1.90±0.05$^{a}$ |
| Urea + CD | 0.56±0.07$^{a}$ | 0.83±.09$^{a}$ | 1.16±0.27$^{b}$ | 1.53±0.19$^{ab}$ | 1.73±0.09$^{ab}$ | 1.83±0.09$^{a}$ |
| Urea +PD | 0.67±0.08$^{a}$ | 0.73±.12$^{a}$ | 1.33±0.13$^{ab}$ | 1.63±0.13$^{a}$ | 1.77±0.09$^{ab}$ | 1.93±0.03$^{a}$ |

*Means± standard error followed by different superscripts on the same columns are significantly different (p< 0.05) according to Tukey's HSD test at p <0.05. KEY: Cow dung= CD, Poultry droppings = PD*

## CONCLUSION AND RECOMMENDATION

From the findings of the research, we concluded that organic manure at a moderate quantity of about 10 g per plant is better for the growth of fluted pumpkins while urea can be an option as a fertilizer, it is better to mix it with poultry droppings as it improves growth of fluted pumpkin optimally. It is recommended that the use of organic manure should be maximized to reduce dependence on chemical alternative into cultivation of *T. occidentalis;* and advised that Urea and Poultry droppings are mixed to further boost the growth of fluted pumpkin.

### Acknowledgements

The authors hereby acknowledge all authors whose work were cited. Also, the efforts of those who assisted in the manuscript preparation are appreciated.

### Authors' Contributions

BAO managed data collection, interpretation of data, writing of manuscript, material support, and review of manuscripts and wrote the first draft of the manuscript. OOOmanaged the literature searches, development of methodology, data analysis, and the development of the model. All authors read and approved the final manuscript.

### Ethical Statement

Not applicable

## REFERENCES

Agbo-Adediran O. A., Adenuga, D.A., Odeyale, O.C., Musa, F.B. & Agboola, F.O. (2020). Effect of Poultry Manure and Cow Dung on the Growth of *Entandrophragma angolense*. *Journal of Research in Forestry, Wildlife and Environment*. 12;3.279-283 https://www.ajol.info/index.php/jrfwe/article/view/200836

Amanullah, H. (2016) Influence of organic and inorganic nitrogen on grain yield and yield components of hybrid rice in Northwestern Pakistan. *Rice Science. 23*, 326–333. https://doi.org/10.1016/j.rsci.2016.02.003.

Ayeni L.S., Adeleye E.O. & Adejumo J.O. (2012). Comparative effect of organic, organo-mineral and mineral fertilizers on soil properties, nutrient uptake, growth and yield of maize (*Zea mays*),'' *International Research Journal of Agricultural Science and Soil Science*, 2 (11); 493-497.

Ayeni, L. S., & Ezeh, O. S. (2017). Comparative effect of NPK 20:10:10, organic and organo-mineral fertilizers on soil chemical properties, nutrient uptake and yield of tomato (*Lycopersiconesculentum*). *Applied Tropical Agriculture*, 22(1), 111–116.

Azeez, M.O., Ogunseiju, J.O., Oyetunji, O. & Adesanwo, O.O. (2023) Comparative Effects of Urea Intercalated with Poultry Manure on Soil Properties, Growth Parameters, Nitrogen Contents and Grain Yield of Rice. *Tanzania Journal of Agricultural Sciences* 22(1); 68-77.

Bello, W. B. & I. O. Adekunle (2013). Evaluation of integrated application ofurea and animal manures. *Nigerian Journal of Soil Science*, 23 (1): 52- 55

Collins, J.L. (2013). Soil Nitrogen Dynamics and Mineralization. Oklahoma State University 2:4-11.

Fawole, O.B., Alori, E.T., & Ojo, O. (2016). Evaluation of two compost for the improvement of crop yield using tomato (*Lycopersicon esculentum*) as test crop. *Hans Journals of Agricultural sciences*, 61(1),37-44.

Ghanbarian D, Youneji S, Fallah S & Farhadi A., (2008). Effect of broiler litter on physical properties, growth and yield of two cultivars of cantaloupe (*Cucumis melo* L.). *International Journal Agricultural and Biological sciences* 10: 697–700.

Ibironke, S.I.; Owotomo, I. (2019). Haematology and Comparative Study of Fluted Pumpkin Leave Vegetable and Seed Nutrients (*Telfairia occidentalis*). *Archives of Nutrition and Public Health1*; 1–6.

Iren, O. B., John, N. M. & Imuk, E. A. (2014). Effects of sole and combined applications of organic manures and Urea on soil properties and yield of fluted pumpkin (*Telfairia occidentalis* Hook F). *Nigerian Journal of Soil Science*.24: 125– 133.

Isherwood, K.F. (2000). Mineral Fertilizer Use and the Environment IFA, UNEP, Revised edition, Paris, France. https://www.fertilizer.org/resource/mineral-fertilizer-use-and-the-environment

Ismael, F., Ndayiragije, A. & Fangueiro, D (2021). New Fertilizer Strategies Combining Manure and Urea for Improved Rice Growth in Mozambique *Agronomy* , *11*(4), 783; https://doi.org/10.3390/agronomy11040783

Kakar, K., Xuan, T.D., Noori, Z., Aryan, S., Gulab, G. (2020). Effects of organic and inorganic fertilizer application on growth, yield, and grain quality of rice. *Agriculture*, 10,544. https://doi.org/10.3390/agriculture10120544

Karki, S., Poudel, N.S., Bhusal, G., Simkhada, S.; Regmi, B.R.; Adhikari, B. & Poudel, S. (2018). Growth parameter and yield attributes of rice (*Oryza sativa*) as influenced by different combination of nitrogen sources. *World Journal of Agricultural Resources* 6; 58–64. https://doi.org/10.20546/wjar.2018.601.006

Khoi, M.C., Guong, V.T., Trung, M.N. and Nilsson, S.I. (2010). Effects of compost and lime amendment on soil acidity and N availability in acid sulfate soil. 19th World Congress of Soil Science, Soil Solutions for a Changing World, Australia. pp 1-6.

Kumbhar, A. M., Buriro U.A., Oad F.C. and Chachar, Q.I. (2007). Yield Parameters and N uptake of wheat under different fertility levels in legume rotation. *Journal of Agricultural Technology*. 3 (2): 323 – 333.

Lombin, L. G.; Adepetu, J. A. & Ayotade, K. A. (1991). Complementary Use of Organic manures and inorganic fertilizers in arable crop production. In Proceedings National Organic Fertilizer Seminar, Kaduna, pp.146 – 162.

Mehesi, T.A., Siddique, M.A. & Shahid, S.B. (2012). Effect of Urea and Cow Dung on Growth and Yield of Carrot. *Journal of Bangladesh Agricultural University*, 10;9-13. https://doi.org/10.3329/jbau.v10i1.12012

Messen, M., & Petterson, J. (2005). Urea as a nitrogen fertilizer: Properties and efficiency. *Journal of Agricultural Science*, *143*(4), 421-429.

Moe, K., Htwe, A.Z., Thu, T.T.P., Kajihara, Y. & Yamakawa, T. (2019). Effects on NPK status, growth, dry matter and yield of rice (*Oryza sativa*) by organic fertilizers applied in field condition. *Agriculture* 9, 109. https://doi.org/10.3390/agriculture9050109

Mohammad, H. A., Aroiee, H., Hamide, F., Atefe, A., & Sajede, K. (2010). Response of eggplant (*Solanum melongena* L) to different rates of nitrogen under field conditions. *Journal of Central European Agriculture*, *11*(4), 8-14. https://doi.org/10.5513/JCEA01/11.4.863

Noosheen Z. A., Muhammad J. A., Majid M. T., M. M., Syed Z. A., S. J. H., Abdul K., & Muhammad I.R. (2021). Integrated effect of urea and poultry manure on growth, yield and postharvest quality of cucumber (*Cucumis sativus* L.). *Asian Journal Agric and Biological sciences.* 2(4):30-35

Ogunyemi, A., Oguntoke, O., Adeofun, C., & Akingbade, A.O. (2022). Spatial-temporal changes and anthropogenic impacts in the floodplain wetlands of Lower Ogun River Basin, SouthWest, Nigeria.

Ojo, M.O., Akoun, J., Aderounmu, A.F., Adeniji, R.A. & Adekola, P.J. (2009). Response of *Adansonia digitata* L. to organic and inorganic fertilizers. *Proceedings of the Annual Conference of IRDI Science and Technology Forum.* May 5-8, 2009, Conference Centre, University of Lagos, Nigeria P. 207.

Oke, O. F. (2015). Vegetative growth, nutrient uptake and yield of pumpkin underliquid organic manures in a tropical agroecosystem. *Journal of Agriculture and Veterinary Science*, *8*(12), 1-4. https://doi.org/10.9790/2380-081220104

Oludele, O. E., Ogundele, D. T., Odeniyi, K., & Shoyode, O. (2019). Crude oil polluted soil remediation using poultry dung (chicken manure). *African Journal of Environmental Science and Technology*, *13*(10), 402-409. https://doi.org/10.5897/ajest2019.2669

Owoloja, O. A., & Oyewo, I. O. (2019). Comparative effects of cow dung and poultry manure on the germination and growth of *Zingiber officinale* (Ginger) William Roscoe Production. *Asian Journal of Agricultural and Horticultural Research*, *4*(3), 1-7. https://doi.org/10.9734/ajahr/2019/v4i330022

Umunnakwe, O.C., Akpan, J.F. & Aberagi, F. V. (2022). Foliage yield of fluted pumpkin (*Telfairia occidentalis* hook f.) as influenced by organic manure and cutting frequencies on soil of Calabar, Nigeria. *Global Journal of Agricultural Sciences* 21: 79-84 DOI: https://dx.doi.org/10.4314/gjass.v21i1.10C

United States Department of Agriculture (2022). USDA.gov. *https://www.usda.gov*