

**EFFECTS OF APPLIED POULTRY MANURE ON THE AGRONOMIC
PERFORMANCE OF FLUTED PUMPKIN (*Telfairia occidentalis* Hook.F) IN
A NUTRIENT-DEPLETED SOIL IN UNIVERSITY OF BENIN**

BY

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FACULTY OF AGRICULTURE
UNIVERSITY OF BENIN**

NOVEMBER, 2025

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**A PROJECT SUBMITTED TO THE DEPARTMENT OF SOIL SCIENCE AND
LAND MANAGEMENT, FACULTY OF AGRICULTURE, UNIVERSITY OF
BENIN, BENIN CITY, IN PARTIAL FULFILLMENT OF THE REQUIREMENT
FOR THE AWARD OF THE DEGREE OF BACHELOR OF AGRICULTURE
(B.AGRIC SOIL SCIENCE)**

NOVEMBER, 2025

CERTIFICATION

This is to certify that this project work titled “**EFFECTS OF APPLIED POULTRY MANURE ON THE AGRONOMIC PERFORMANCE OF FRUITED PUMPKIN (*Telfairia occidentalis* HOOK. F) IN A NUTRIENT DEPLETED SOIL IN UNIVERSITY OF BENIN**” was carried out by **Fatoba Desola Patience** with Matriculation number **AGR2004414** of the Department of Soil Science and Land Management, Faculty of Agriculture, University of Benin, Benin city, Edo state, Nigeria.

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DATE

DEDICATION

This work is dedicated to God Almighty for the life and grace given to me throughout my course of study in the University of Benin, and to my lovely father and mother for their financial and emotional support as well as their prayers and advice throughout the years and also to my elder sister Ayobami.

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With a grateful heart, I acknowledge God Almighty, whose unfailing grace and the blessings of life, strength, and sound health saw me through the concluding stage of my undergraduate journey

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ABSTRACT

This study evaluated the effectiveness of poultry manure (PM) as a low-cost soil amendment for improving growth and yield of fluted pumpkin (*Telfairia occidentalis*) on nutrient-depleted soil. The study was carried out in 2025 at the Experimental Field of the Faculty of Agriculture, University of Benin, Benin City. This experiment was laid out on a Randomized complete block design (RCBD) with four different treatments and three replicates. The treatment rates were control(0), 5tonnes, 10tonnes and 15tonnes/ha.

The treatments were four levels of poultry manure; control(0) 5tonnes, 10tonnes and 15tonnes/ha. The plant parameters measured were; vine length, number of leaves and stem girth. The growth parameters were recorded 4 WAP, 6 WAP and 8 weeks after planting, while soil properties (pH, organic carbon, total N, available P and exchangeable K) were taken before planting. The initial experiment showed the pH of the soil was moderately acidic (5.45), the textural class before the experiment was sand and low in total nitrogen (0.35g) indicating generally low fertility.

The least value of Number of leaf was recorded in control plot (32.3 leaves) at 4 WAP which was lower than the rest treatment levels at different weeks observed, while the highest value of number of leaves was recorded in soil treated with 15tonnes poultry manure (322 leaves) at 8 WAP and was significantly higher to other weeks observed in each treatment. The control plots recorded the lowest vine length value of 103.3cm at 4 WAP for fluted pumpkin. While the highest vine length was recorded at 15tonnes 388.7cm at 8 WAP. This means, application of poultry manure significantly ($P>0.05$) enhanced growth performance of fluted pumpkin on the degraded soil and application of 15 tonnes poultry manure had significant ($P>0.05$) increased the yield of *Telfairia occidentalis*. Therefore,15 tonnes poultry manure application significantly ($P>0.05$) increased the growth and marketable leaf yield of *Telfairia occidentalis*.

CHAPTER ONE

1.0

INTRODUCTION

1.1 Fluted pumpkin (*Telfairia occidentalis*)

Fluted pumpkin (*Telfairia occidentalis* Hook. F.) a member of the family Cucurbitaceae, is an important leaf and seed vegetable indigenous to southeastern Nigeria and widely cultivated across the warm regions of the world (Godonu *et al.*, 2023). It is known for its nutritional and economic value. The leaves, rich in proteins, iron, and vitamins, are a staple in local diets and serve as a source of income for smallholder farmers (Okon *et al.*, 2022). However, the cultivation of fluted pumpkin in nutrient-depleted soils poses a challenge to farmers, leading to reduced yields and sub-optimal growth (Onuoha *et al.*, 2011). The application of organic fertilizers, particularly poultry manure, has been shown to enhance soil fertility and improve the growth and yield of fluted pumpkin (Nwite *et al.*, 2013).

Poultry manure is a major waste that can be collected from poultry enterprises and can be used as soil amendment input; it enhances soil chemical characteristics, soil tilt, and biological activities.

Poultry manure typically has some of the greatest levels of N, P and K compared to other livestock manures. It also provides a wide range of plant nutrients. When used and managed correctly, it can help meet a lot of crop nutritional needs. (Fulhage and Pfof, 2002)

1.2 Objectives of the study

The main objective of this study was to evaluate the effect of applied poultry manure on the agronomic performance of fluted pumpkin in a nutrient-depleted soil in Uniben. While the specific objectives were to determine:

- i. the growth parameters (Stem girth, number of leaves, Vine length) of fluted pumpkin.
- ii. the appropriate application rates of poultry manure for enhancing the growth performance of fluted pumpkin in nutrient-depleted soil.

CHAPTER TWO

2.0

LITERATURE REVIEW

2.1 Overview of Fluted Pumpkin (*Telfairia occidentalis*)

Fluted pumpkin (*Telfairia occidentalis* Hook F.) is a major tropical vegetable cultivated for its leaf and edible seeds. It belongs to the family Cucurbitaceae with creeping vines and elongated tendrils (Ndor *et al.*, 2013). The vegetable develops long twisting tendrils that usually creep and spread on the surface of the ground if left unattended to and coiled through stakes (Bationo *et al.*, 2018). Report showed that fluted pumpkin has an annual yield of 8.29 Mt·ha⁻¹ (leaves 5.52 Mt·ha⁻¹ and seeds 2.08 Mt·ha⁻¹) and harvesting took place 120 - 150 days after sowing (Ayanwale and Abiola, 2008). According to Ayanwale and Abiola (2008), it was documented that fluted pumpkin contains 39% crude protein, which is 9.5%, 18.11% and 8.2% higher than the available crude protein in *Amaranthus sp.*, *Talinum triangulate (Jacq.)* and *Solanum macrocarpon (L.)* and also richer in iron. The oil obtained from the fluted pumpkin is considered suitable for human consumption than palm oil because it has a lower saponification value (Ayanwale and Abiola, 2008). The leaves supply essential vitamins and minerals (Ndor *et al.*, 2013), and are widely used for cooking soups, yam, and vegetables and even used for medicinal purposes. (Jiofack *et al.*, 2008; Kayode and Kayode, 2011). Pumpkins could be consumed in combination with other foodstuffs like okara, dika nuts, egusi, and others (Fayenu *et al.*, 2016). The seeds are rich in fats and proteins, highly beneficial to human health and can be eaten whole, ground into powder for another kind of soup, such as egusi soup (Idris, 2011). The seeds are also potential raw materials for local industries, especially in the Oleo chemical and animal feed industries (Adenike *et al.*, 2014). There has been an overwhelming increase in the consumption

of fluted pumpkin leaves, seeds and shoots over the past years due to all the nutritive benefits obtainable from them (Fayenu *et al.*, 2016).

2.2 Nutrient Depletion in Soils

Nutrient depletion in soils is a significant concern for agricultural productivity, particularly in tropical regions where continuous cropping and poor soil management practices have led to the degradation of soil quality (Bado and Bationo, 2018). Nutrient-depleted soils typically have low soil organic matter, weaker water retention, and reduced microbial activity, all of which depress plant growth and yield (Lehmann *et al.*, 2020; Abdallah *et al.*, 2021). The restoration of soil fertility through the application of organic amendments is crucial for sustainable agricultural practices.

2.2.1 An overview of soil nutrients depletion in Nigeria

Soil nutrient depletion is one of the major challenges facing agricultural productivity in Nigeria. It refers to the gradual loss of essential plant nutrients such as nitrogen (N), phosphorus (P), and potassium (K) from the soil, often resulting from unsustainable land-use practices, erosion, and insufficient nutrient replenishment. This issue significantly contributes to land degradation, low crop yields, and food insecurity across the country (IFDC, 2010; Chude *et al.*, 2011).

2.2.2 Determinants of Soil Nutrient Decline in Nigeria

- 1. Soil Erosion and Leaching:** Erosion by wind and water, especially in southern and central Nigeria, removes nutrient-rich topsoil.
- 2. Deforestation and Bush Burning:** Clearing for cultivation and fuelwood reduces organic-matter inputs and exposes soil to erosion; bush burning further accelerates nutrient losses through volatilisation (notably nitrogen and some sulphur) and oxidation of soil organic matter (Nkonya *et al.*, 2015).

3. Poor organic matter management

The application of compost, green manure, and animal manure is often limited by farmers' lack of awareness/technical support, the labour-intensive nature of handling organic inputs, and transportation/availability constraints, reducing nutrient returns to the soil (Oluwatosin, W. L., and Ogunkanmi, A. (2020); Bello *et al.*, 2024).

2.2.3 Addressing Soil Nutrients Depletion

1. Application of Organic Amendments

-Compost and manure: Poultry manure, cow dung, and compost help replenish soil organic matter and supply nutrients like nitrogen and phosphorus. Poultry manure has been shown to improve the agronomic performance of fluted pumpkin in Nigeria's nutrient-depleted soils (Awodun, 2007; Nwite *et al.*, 2014).

-Green manuring: Incorporating leguminous crops (e.g., mucuna or sunn hemp) improves soil nitrogen through biological nitrogen fixation.

2. Use of Inorganic Fertilizers

Applying balanced chemical fertilizers (e.g., NPK) based on soil test recommendations ensures that nutrient needs are met without overapplication.

Micronutrient supplementation (like zinc and boron) is also necessary, especially where deficiencies have been identified.

3. Soil Testing and Fertility Mapping

Regular soil testing helps identify nutrient deficiencies and informs fertilizer application.

Fertility maps help farmers apply nutrients site-specifically, improving efficiency and reducing costs.

4. Crop Rotation and Intercropping

Rotating cereals with legumes help naturally replenish nitrogen.

Intercropping reduces the risk of complete nutrient exhaustion from monocropping and can improve nutrient cycling.

2.3 The Role of Poultry Manure

Poultry manure is widely known for its high nutrient content and its ability to improve soil fertility (Ojo *et al.*, 2015; Agbede *et al.*, 2024). It contains essential macronutrients nitrogen (N), phosphorus (P), and potassium (K) as well as micronutrients vital for plant growth (Olajide *et al.*, 2023; Rasool *et al.*, 2023). The organic matter in poultry manure improves soil aggregation/structure and water-holding capacity and stimulates microbial activity, which together enhance nutrient availability (Adeyemo *et al.*, 2019; Agbede, 2021; Yan *et al.*, 2023). Studies have shown that applying poultry manure significantly enhances the growth and yield of crops, including vegetables (Awodun, 2007; Rasool *et al.*, 2023).

2.4 Effects of Poultry Manure on Soil Properties

Many studies have shown that poultry manure significantly improves both the physical and chemical properties of soils. Applications of poultry manure have been linked to improve soil moisture retention and physical structure (Ewulo *et al.*, 2008), alongside gains in soil organic matter (Adeyemo *et al.*, 2019). Additionally, poultry manure helps reduce soil bulk density and improves porosity, which enhances root penetration and aeration (Adeleye *et al.*, 2010) However, excessive application can lead to issues like soil acidification and potential pollution.

2.5 Agronomic Performance of Fluted Pumpkin Under Organic Amendment

Fluted pumpkin is a fast-growing vine that performs best on moist, well-drained, fertile soils with adequate moisture and nutrients (NIHORT, 2020) Research shows that applying poultry manure increases plant height (vine length), leaf area, and yield in fluted pumpkin (Awodun, 2007). The effectiveness of poultry manure in fluted pumpkin improves when the application

schedule is timed to crop demand: split applications enhanced fresh shoot yield, indicating better synchrony between nutrient supply and plant uptake (Akintoye *et al.*, 2023; Adekiya *et al.*, 2020).

2.6 Previous Studies on Poultry Manure and Crop Performance

Numerous researches have proven the beneficial effects of poultry manure on crop performance. For instance, a number of studies show that applying poultry manure significantly increases okra growth and yield (Mornya and Mansaray, 2022), found that in maize-groundnut relay intercropping at Akure, applying 5 t ha⁻¹ of poultry manure significantly improved growth and yield, leading them to recommend it in place of 200 kg ha⁻¹ NPK fertilizer. These findings highlight the significance of exploring the effects of poultry manure on crops.

2.7 Challenges and Considerations in Using Poultry Manure

Despite its benefits, the use of poultry manure comes with challenges:

- i. Nutrient variability based on source and management: It refers to the inconsistent levels of plant nutrients due to the differences in sources (type of poultry) and management (storage, handling, and application method).
- ii. Potential for weed seed contamination: Poultry manure can carry weed seeds if the poultry feed contains unprocessed grains, or from feeds not properly digested.
- iii. Risk of excess application leading to nutrient leaching: Excess application can lead to nutrient toxicity and environmental pollution including water.
- iv. Odour and Air pollution: Fresh poultry manure emits strong odours and ammonia gas, which can be offensive and harmful to farm workers and nearby residents. But effective curing of the manure can eliminate or reduce this menace.

Proper composting, using appropriate application rates/timing, and integrating poultry manure within broader soil-fertility practices (ISFM) are essential to mitigate risks and maximize

benefits (Vanlauwe *et al.*, 2010; Chen *et al.*, 2014; Adekiya *et al.*, 2020; Umunnakwe *et al.*, 2022).

2.8 Effect of organic fertilizers on fluted pumpkin (*Telfairia occidentalis*)

Reports have shown the effect of organic fertilizers on the physical and biological properties of fluted pumpkin (Ebuka *et al.*, 2021). In a report fluted pumpkin was treated with poultry manure, cow manure and pig manure, although there was significant effect made by the cow manure and pig manure, poultry manure performed highest. (Ebuka *et al.*, 2021). It was suggested that Organic manure releases enough nutrient elements which are required for maximum growth and yield of fluted pumpkin and they are recommended as soil amendment for soil productivity and high crop yield (Ebuka *et al.*, 2021). Organic manure had a significant effect on the vine length, fresh weight of leaves and leaf yield. Raised platform staking constantly performed better with higher values than the other staking methods except in number of vines (Umekwe *et al.*, 2013).

In an experiment significant difference was observed in plots treated with treatment and control where poultry manure performed highest in fluted pumpkin with the highest number of vine length, weight of leaves and leaf yield (Umekwe *et al.*, 2018). Application of different levels of poultry manure (PM) significantly increased soil pH, available phosphorus (P) of the soil (Iren *et al.*, 2015). There was significant increase in the fresh yield of fluted pumpkin across all stages of growth with higher yield obtained at higher levels of poultry manure application when compared with the control. Poultry manure best supports the performance of fluted pumpkin in this degraded Ultisol (Iren *et al.*, 2015). A trial was aimed at assessing the soil properties and vegetative growth of fluted pumpkin as affected by application of compost amended fertilizer which increased the vine length, number of branches, number of leaves, fresh shoot marketable yield and shoot dry weight of pumpkin (Adebayo *et al.*, 2020). Field trials on effect of fertilizer

types on the growth, yield and nutritional composition of fluted pumpkin (*Telfairia occidentalis*) shows that the parameters of fluted pumpkin increased significantly when treated with poultry manure (Olaniyi and Oyerele 2012). Poultry manure increased fresh shoot weight of fluted pumpkin, while plants in control plots performed lesser (Akintoye *et al.*, 2023). Pumpkin (*Telfairia occidentalis*) growth parameters using two organic manure sources were investigated with respect to different prevailing wind directions and heights Using different organic manure and at wind heights for pumpkin affect its performances via yield components and cumulative yields (Lamidi *et al.*, 2021).

Research showed that Application of poultry manure and irrigation produced significantly higher values of all the growth parameters than the control which produced the maximum leaf area, the best result in terms of vine length, number of leaves (Manuel *et al.*, 2013). In a study conducted to evaluate the possible uses of fish pond effluent (FPE) as soil amendment in the production of fluted pumpkin showed increase in the growth and yield indices evaluated with various levels of treatment (Ojobor, 2019).

A field experiments were conducted on neem leaf and poultry manures soil amendment to assess the growth and yields of *Telfairia occidentalis* between 2013 and 2014 cropping seasons. The findings showed that number of leaves, vine length, leaf area and number of branches increased significantly compared to control (Ekanem and Akpheokhai 2019). Growth and yield of vegetable was lowest in control treatments as against the organic manures (poultry manure) which positively influenced the performance and yield of vegetable (Tiamiyu *et al.*, 2012).

2.9 Growth Parameters of Fluted Pumpkin (*Telfairia occidentalis*)

Growth parameters are crucial measures for assessing fluted pumpkin performance under various cultural and management practices. These parameters offer insights into the crop's potential yield,

physiological response, and vegetative vigor. Vine length, leaf count, stem girth, leaf area, and biomass accumulation are frequently measured growth parameters (Odiaka *et al.*, 2008). Each of these parameters shows a different part of how the plant grows and how much it produces.

2.9.1 Vine Length

In fluted pumpkins, vine length is a key factor in determining the vegetation expansion and canopy spread. Fayeun, (2016) found vine length and leaf area impart significant direct effects on marketable leaf yield. In the WSB/PM trial at Ikorodu, vine length increased significantly from 6 WAP under WSB, PM, and their combinations; the 5-t ha⁻¹ WSB + 2.5 t ha⁻¹ PM and 7.5 t ha⁻¹ WSB treatments ranked highest by 8 WAP, as reported by (Godonu *et al.*, 2023).

2.9.2 Number of Leaves

The number of leaves directly influences the marketable yield of fluted pumpkin, as leaves are the main economic part harvested. In a recent field experiment at Ikorodu, Lagos, testing wood-shavings biochar (WSB), poultry manure (PM), and WSB+PM, Godonu *et al.*, (2023) reported that leaf counts at 8 WAP were highest under 5 t ha⁻¹ WSB + 2.5 t ha⁻¹ PM and 7.5 t ha⁻¹ WSB, both significantly above control, stand-alone PM also outperformed the control.

2.9.3 Stem Girth

Stem girth indicates the plant's ability to support vigorous vegetative growth. Thicker stems allow better nutrient and water translocation within the plant. In a comparative trial (poultry droppings, cow dung, goat droppings, pig dung), poultry droppings (PD) and cow dung (CD) consistently produced, higher stem girth on fluted pumpkin than the other organic treatments, especially from 6–12 WAP (Agadaigho, Odjegba, and Igbunu, 2024). In a recent factorial field experiment report also indicated that stem girth at 6 WAP was significantly greater under WSB+PM combinations relative to the control, with the 5t ha⁻¹ WSB + 2.5 t ha⁻¹ PM and 7.5 t

ha⁻¹ WSB treatments among the top performers (Godonu *et al.*, 2023). (By 8 WAP some differences narrowed statistically.)

2.9.4 Leaf Area

Leaf area (LA) is a critical morphological trait in plants because it determines the photosynthetic surface, transpiration, and ultimately biomass accumulation. In leafy vegetables such as fluted pumpkin (*Telfairia occidentalis*), LA directly contributes to marketable yield (Pérez-Harguindeguy *et al.*, 2013).

Akoroda (1993) developed a non-destructive regression for *Telfairia occidentalis* in which leaf area is predicted from leaflet length and width, while explicitly addressing variation in leaf-lamina shape. Many studies in fluted pumpkin cite the equation proposed by him:

$$LA = 0.9467 + 0.2475LW + 0.9724LW$$

Where, LA is the leaf lamina area; L is the length of the central leaflet; W is the maximum width of the central leaflet and N is the number of leaflets in a leaf. This study remains a foundational reference for subsequent pumpkin leaf area research. Similarly, Schrader *et al.*, (2021) demonstrated that applying species-specific shape correction factors in length × width estimations significantly improved accuracy across different plant species.

Digital image analysis has become increasingly popular for calibrating such models. Schneider *et al.*, (2012) described ImageJ as a reliable software platform for measuring “true area” from scanned or photographed leaves, which researchers now commonly use to validate length–width estimations. In line with this, Poorter *et al.* (2009) highlighted the importance of accurate LA measurement in ecological and agronomic studies, linking it to variation in leaf mass per area (LMA) and specific leaf area (SLA), which are directly correlated with plant growth rates. For compound-leaf species like fluted pumpkin, it is essential to measure and sum the areas of

individual leaflets rather than relying on only the central leaflet. Akoroda (1993) emphasized this approach, and later works applying his framework reaffirmed its reliability for trifoliate leaves.

2.9.5 Biomass Accumulation

Biomass accumulation usually known as fresh shoot marketable yield and shoot dry weight shows how well vegetative traits (leaf area, vine length, branching) convert into harvestable matter. In fluted pumpkin, organo-mineral fertilisation has delivered clear gains: in an Ibadan field trial, Organic Fertilizer Plus (OFP) at 4 t ha⁻¹ produced the highest fresh shoot marketable yield (2.22t ha⁻¹) and shoot dry weight (240.0 kg ha⁻¹), compared with the unfertilized control (494.4 kg ha⁻¹ fresh; 130.0 kg ha⁻¹ dry) (Olowoake and Adeyemo, 2020).

CHAPTER THREE

3.0 MATERIALS AND METHODS

3.1 Study Area

The experiment was carried out in the Experimental Field of Faculty of Agriculture, University of Benin, Benin City. The area lies between latitude $6^{\circ} 23' 55.9''$ to $6^{\circ} 24' 1.2''$ North and longitude and $5^{\circ} 37' 33.1''$ to $5^{\circ} 37' 45.7''$ East. It is in the rainforest ecological zone of Nigeria (Illoba and Ekraene, 2008) which is characterized by two distinct seasons: dry (November–March) and wet (April–October). It has a mean annual rainfall of 1900 mm and average temperature of 27°C . The topography of the land is a gentle slope, which falls eastwards. The soils in the area are ultisols; which are derived from recent coastal plain sands known as Benin formation (Umwani, 2007). The vegetation of the area includes weeds such as: *Panicum maximum*, *Mimosa pudica*, *Eleusine indica*, *Sida acuta*, *Sporobolus pyramidalis* etc.

3.2 Planting Materials

Fluted pumpkin seeds were sourced in Benin City. Polypot was obtained from a farmer's shop in Benin city. Poultry manure was obtained from the University of Benin farm project, Faculty of Agriculture, Animal farm. The seeds and polypot were bought from local markets in Benin City.

3.3 Cultural Practices

3.3.1 Nursery preparation

Seedlings were raised in soil-filled nursery bags. The bags were placed on the experimental field after sowing the seeds

3.3.2 Land preparation

The land was cleared manually using cutlass and hoes. Soil was collected, properly mixed, and filled into the bags. Seeds were sown directly into the poly pots, and the seedlings were transplanted into the field two weeks after sowing.

3.3.3 Transplanting

The seedlings were transplanted into the prepared field, two weeks after sowing.

3.3.4 Watering

After transplanting, the seedlings were watered 2 days in a week to avoid seed drought

3.4 Experimental Design and layout

This experiment was carried out as a Randomized Complete Block Design (RCBD) with three replicates. The plot size was measured 3m x 3m, between two plants was 1m, between two rows was 1m. Four treatments were applied. The four treatments applied using ring method to pumpkin were 0, 5, 10, 15tonnes/ha of poultry manure. Treatments were replicated 3 times at each plot using a randomized complete block design (RCBD). This resulted in an average of 16 stands for each block resulting in 48 stands for each treatment level with a plant population of 144 stands. Poultry manure was stacked under a shed and was air dried before application by ring method two weeks after transplanting.

3.5 Weeding

Weeding was done manually with the use of hoes every two weeks consecutively after transplanting.

3.6 Parameters measured

Growth parameters were taken at 4th week, 6th week and 8th weeks after treatment application. Data on vine length, number of leaves, and stem girth were taken with measuring tape and recorded using 3 selected plants per treatment.

3.7 Soil analysis

Soil sample was collected at a depth of 0-15cm using a core sampler. The soil properties of the sample were analyzed before planting.

3.7.1 Physical and chemical Analysis

The soil samples were air dried for 3 days at room temperature and passed through 2mm sieve before analysis.

3.7.2 Soil Particle size determination (HYDROMETER METHOD)

The particle size distribution was determined by the hydrometer method (Boyouscos, 1951) as modified by Gee and Bauder (1986).

51g of air-dried soil was weighed into shaking bottles and 50 ml of 5% calgon solution (sodium hexametaphosphate) was added to soil. Then 100ml distilled water was added to the mixture, stirred and left standing for 30minutes. The sample was transferred quantitatively into a 1000ml measuring cylinder and made up to mark with distilled water. The first reading was taken when the cylinder was dropped on the platform within 40 seconds, the percentage silt + clay was determined within the 40 seconds.

The second reading was taken after 2 hours. The percentage clay was determined after 2 hours.

3.7.3 Soil PH

The pH of the air-dried soil was determined using a glass electrode pH meter of ratio 1:1 and (20 g soil to 20 ml distilled water) and in 1N KCl solution at a ratio of 1:2 soil to water suspension..

20 g of air-dried soil was weighed into 100 ml beaker, 20 ml of distilled water was added and the mixture was stirred intermittently for 30 minutes with a stirring rod. The pH meter was standardized with buffer pH 4.0 and 7.0, before the pH of the soil was taken. The reading was taken by dipping the electrode into the liquid part of the mixture and the reading recorded.

3.7.4 Soil Organic Carbon

This was determined by the chromic acid wet oxidation procedure of Walkley and Black as described by (Black 1986).

reaction chamber and 10 ml of 40% NaOH solution added followed by distillation. The distillate was collected in 2.0% boric acid and was titrated with 0.02 N HCl using bromocresol green as indicator. A blank distillation and titration was also carried out to take care of the traces of nitrogen in the reagents as well as the water used. The total nitrogen (% nitrogen in the sample) was calculated as:

$$\% \text{ N} = \text{N} \times (\text{a} - \text{b}) \times 1.4 \times \text{mcf}$$

where:

N = concentration of HCl used in titration

a = ml HCl used in sample titration

b = ml HCl used in blank titration

w = weight of air-dry soil sample

mcf = moisture correcting factor (100% + % moisture) / 100)

1.4 = $14 \times 0.001 \times 100\%$ (14 = atomic weight of N)

3.7.6 Available Phosphorus Determination

The available phosphorus was extracted with Bray's No.1 extracting solution (0.03 M NH_4F and 0.025 M HCl) as described by Bray and Kurtz (1945). Phosphorus in the extract was determined by the blue ammonium molybdate blue method with ascorbic acid as the reducing agent and read using a spectrophotometer.

A 3 g soil sample was weighed into a shaking bottle (50 ml) and 30 ml of extracting solution of Bray's No.1 added. The mixture was shaken for 10 minutes on a reciprocating shaker and filtered through a Whatman No. 42 filter paper. An aliquot of 5 ml of the blank, the extract, and 10 ml of the colouring reagent (ammonium molybdate and tartrate solution) were pipetted into a test tube and uniformly mixed. The solution was allowed to stand for 15 minutes for the blue

colour to develop to its maximum. The absorbance was measured on a spectronic 21D spectrophotometer (Cecil 3021 from England) at a wavelength of 660 nm at medium sensitivity. A standard solution of 0, 1, 2, 3, 4 and 5 mg P. l⁻¹ was prepared from 20 mg ml⁻¹ phosphorus stock solution.

Calculation:

$$\mathbf{P \text{ (mg kg}^{-1} \text{ soil)} = (a - b) \times 35 \times 15 \times mcfw}$$

where:

a = mg l⁻¹ P in sample extract

b = mg l⁻¹ P in blank

mcf = moisture correcting factor

35 = ml extracting solution

w = sample weight in gram.

3.7.7 Available potassium

Potassium in soil exists as water soluble, exchangeable and fixed (lattice-K). The first two forms constitute only small part (not more than 1 %) and are considered to be easily available to plant. These forms are determined by ammonium acetate method (Njukeng *et al.*, 2013). A 5 g soil sample was weighed into a 100 ml conical flask. Twenty-five (25) ml of 1 N ammonium acetate solution was added and the mixture shaken for 5 minutes. The solution obtained was filtered through Whatman No.1 filter paper and K concentration in the filtrate measured using flame photometer.

Calculation:

$$\text{Available K (mg kg}^{-1} \text{ soil)} = C \times 25$$

Sample weight (g) × mcf

where:

C = Concentration of potassium in filtrate.

Mcf = Moisture correction factor.

25 = Volume of ammonium acetate.

3.8 Statistical analysis

Data collected were subjected to statistical analysis using GenStat version 12 (2012) and Duncan New Multiple Range Test to separate the means at 5% level of probability.

CHAPTER FOUR

4.0

RESULTS AND DISCUSSION

4.1 Physical and Chemical Properties of the Soil used in the experiment before Planting

The result shows that the soil was moderately acidic (5.45). The textural class is sand with 910 gkg^{-1} sand, 30 gkg^{-1} silt and 60 gkg^{-1} clay content. The organic carbon content and available phosphorus were moderate and low (10.3 gkg^{-1} and 11.0 gkg^{-1} respectively). The total nitrogen was low (0.35 gkg^{-1}) and the available potassium was moderate (11.94 cmolkg^{-1})

The fertility status of the soil before the experiment shows that it was moderate in organic carbon and low total nitrogen contents. It also has moderate phosphorus and very high potassium content and this indicates very high potassium content far above the optimum for fluted pumpkin. The low fertility status may be due to weathering, leaching and extensive cultivation of the soil (Akanbi *et al.*, 2010). The pH of the soil which was strongly acidic may be attributed to the high rainfall in the area which makes the soil susceptible to erosion and leaching of highly mobile basic cations, leaving sesquioxides that contribute to the acidity of the soil (Juo *et al.*, 1995).

Table 1: Physical and Chemical Properties of soil before planting

Parameters	Values
Sand gkg^{-1}	910
Silt gkg^{-1}	30
Clay gkg^{-1}	60
Textural class	Sand
pH (1: 1 in water)	5.45
Organic C (gkg^{-1})	10.3
Total N (gkg^{-1})	0.35
Avail. P (mgkg^{-1})	11.0
K (cmolkg^{-1})	11.94

4.2 Effects of Poultry Manure on Vine Length, Stem Girth, and Number of Leaves of *Telfairia occidentalis*.

4.2.1 Vine Length (cm): Table 2, 3, and 4 respectively shows a consistent increase in vine length with increasing poultry manure application rates across the 4th, 6th, and 8th weeks after planting (WAP). The control plots recorded the lowest vine length value of 103.3cm at 4 WAP for fluted pumpkin. While the highest vine length was recorded in 15tonnes (388.7 cm) at 8 WAP. Statistics show that this result is significant ($P>0.05$). This agrees with the findings of Umekwe *et al.*, (2015). Poultry manure consistently increased vine length relative to the control in field trials.

4.2.2 Stem Girth (cm): According to Table 2, 3, and 4, at 4 WAP, the control recorded the lowest value (0.87 cm), while 10 tonnes treatments had higher values 1.733cm. At 6 WAP, the value of stem girth was recorded lowest in the untreated soil (control) with value number of 0.900cm, while the highest value recorded in the soil treated with 5tonnes pm (2.133cm) and was significantly higher compared to other treatments. At 8 WAP, stem girth also recorded lowest in the untreated soil (control) with a value of 0.967cm, while the highest value recorded in the soil treated with 5tonnes pm (2.633cm) and was significantly higher compared to other treatments. This shows that 5tonnes of poultry manure were effective on the stem girth of fluted pumpkin. Statistics show that this result is significant ($P>0.05$) Similar responses have been reported in previous field trials: poultry manure significantly increased stem girth relative to the control in fluted pumpkin (Awodun, 2007), and poultry droppings produced significantly higher stem girth than the zero-manure treatment from 6–12 WAP in a randomized field experiment (Agadaigho *et al.*, 2024)

4.2.3 Number of Leaves: Leaf production of the *Telfairia occidentalis* also responded positively to poultry manure application. The least number of leaves was recorded in control plot (32.3 leaves) at 4 WAP which was lower than the rest treatment levels at different weeks observed, while the highest value of number of leaves was recorded in soil treated with 15tonnes pm (322 leaves) at 8 WAP and was significantly higher compared to other weeks observed in each treatment. Hence, the application of 15tonnes of pm influences the number of leaves of *Telfairia occidentalis* and statistics show that this result is significant ($P>0.05$) This agrees with the findings of Okoro, (2007) who reported a significant increase in the number of leaves of *Telfairia occidentalis*, this is because almost all vegetables require N for proper shoot growth and P for proper root development and soils rich in organic carbon and organic matter.

Table 2. Effects of poultry manure on Vine length, Number of leaves and Stem girth of *Telfairia occidentalis* after 4th week of poultry manure application.

Treatment (tonnes/ha)	Vine length (Cm)	Number of leaves	Stem girth
Control (0 tonnes)	103.3 ^a	32.3 ^a	0.87 ^a
5tonnes	186.7 ^{ab}	148.3 ^{ac}	1.733 ^b
10tonnes	258.0 ^b	160.7 ^{ac}	1.700 ^{ac}
15tonnes	287.0 ^b	137.7 ^b	1.333 ^b
SEM	18.28	11.43	0.1
C.V%	7.0	5.8	6.3

Means with the same alphabets in the same column are not significantly different at 5% level of significance or ($P>0.05$)

Table 3. Effects of poultry manure on Vine length, Number of leaves and Stem girth of *Telfairia occidentalis* after 6th week of poultry manure application.

Treatment (tonnes/ha)	Vine length (Cm)	Number of leaves	Stem girth
Control (0tonnes)	168.0 ^a	70 ^a	0.900 ^a
5tonnes	242.7 ^b	208.3 ^b	2.133 ^c
10tonnes	314.0 ^c	253 ^c	2.00 ^c
15tonnes	318.0 ^c	252 ^c	1.60 ^b
SEM	60.5	50.43	0.18
C.V%	29.0	42.4	12.9

Means with the same alphabets in the same column are not significantly different at 5% level of significance or ($P>0.05$)

Table 4. Effects of poultry manure on Vine length, Number of leaves and Stem girth of *Telfairia occidentalis* after 8th week of poultry manure application.

Treatments (tonnes/ha)	Vine length (Cm)	Number of leaves	Stem girth
Control (0tonnes)	218.7 ^a	94 ^a	0.967 ^a
5tonnes	257.8 ^a	251.3 ^b	2.633 ^b
10tonnes	342.0 ^a	284.3 ^b	2.433 ^b
15tonnes	388.7 ^a	322.0 ^b	2.167 ^b
SEM	76.7	51.1	0.52
C.V%	25.4	21.5	25.4

Means with the same alphabets in the same column are not significantly different at 5% level of significance or ($P>0.05$)

CHAPTER FIVE

5.0 CONCLUSION AND RECOMMENDATION

5.1 Conclusion

The soil before planting was moderately acidic (pH 5.45), sand, and low in total nitrogen (0.35 g kg⁻¹), indicating generally low fertility. Poultry manure improved the vegetative growth of *Telfairia occidentalis* compared to the control at 4, 6, and 8 WAP. Vine length was highest in the manure-treated plots, while the control remained lowest. Stem girth also increased significantly with manure, especially at 5tonnes, which produced the thickest stems at 6–8 WAP. The number of leaves was highest at 8 WAP in the 15tonnes poultry manure treatment and the result was significant ($P>0.05$). This means that the application of poultry manure significantly enhanced growth performance of fluted pumpkin on the degraded soil.

5.2 Recommendation

Application of 15tonnes poultry manure per plot had significant effect on the yield of *Telfairia occidentalis*. Therefore, for maximum vine growth and leaf production, 15t/ha poultry manure per plot is recommended.

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APPENDIX

Field layout

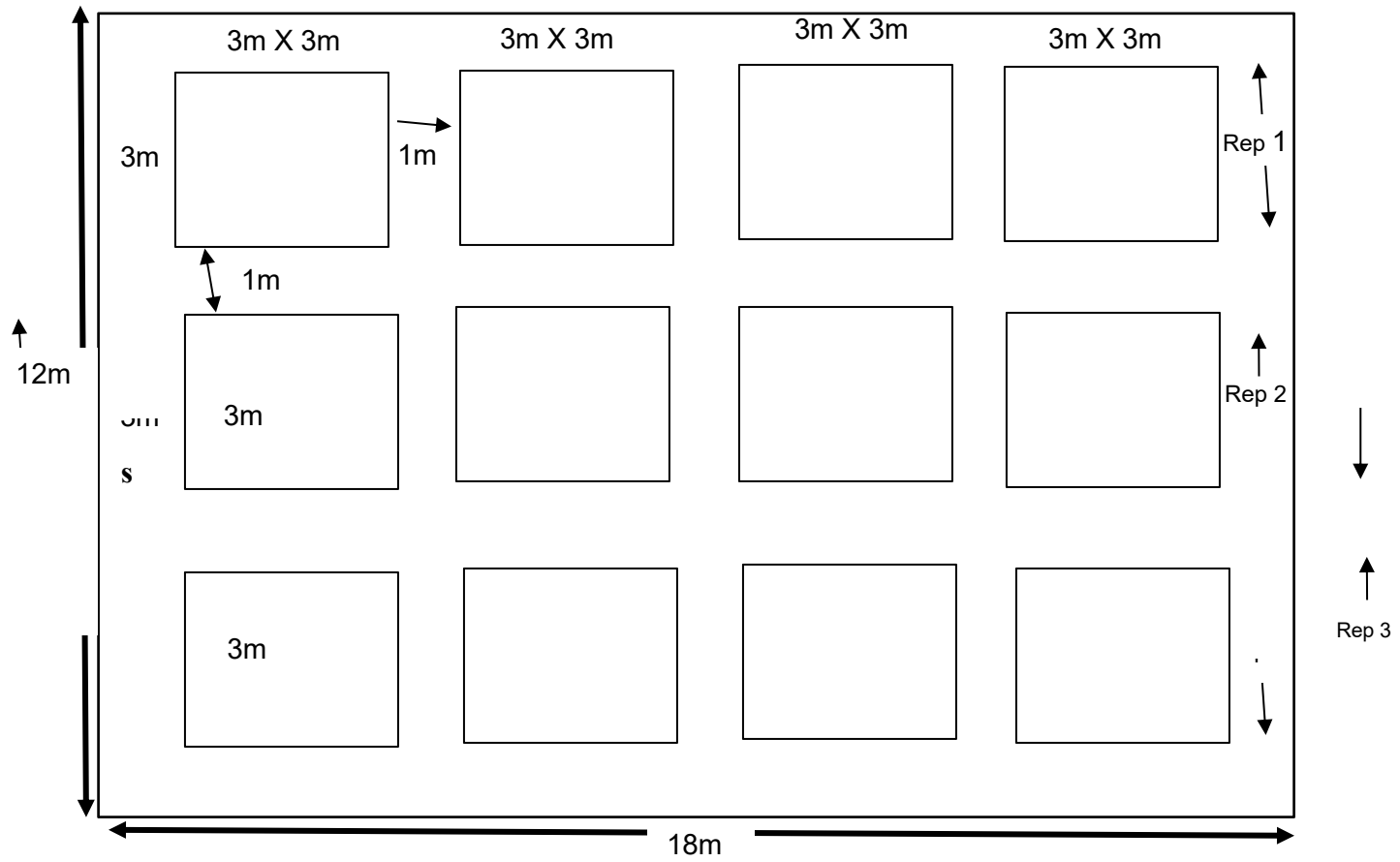


Fig 1. Experimental design/ plot layout