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Influences of Various Organic Fertilizer on the Vegetative Growth of Pumpkin (*Telefairia occidentalis*) in Anyigba, Kogi State, Nigeria

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Abstract

The experiment was conducted in an open field in front of the green house of the Faculty of Agriculture Kogi State University, Anyigba. The main objectives are to evaluate the effect of types of organic manure on the growth and yield of fluted pumpkin (*Telfaria occidentalis*). The experimental plots was measured at 14.5 m × 15 m. A Randomized Complete Block Design (RCBD) with eight (8) treatments and three (3) replicates making a total of 24 plots and rates were Poultry Manure (20 t/ha), cow dung (20 t/ha), Goat droppings (20 t/ha) and Palm Bunch (20 t/ha), respectively The parameter measured were vine length (cm), Number of leaf, Number of branches, Stem girth (cm) and fresh weight of leaves (g). The results revealed that cow dung showed the best performance by producing the highest although the vegetative growth of fluted pumpkin (*Telfaria occidentalis*) longest vines with mean value of 94.00 cm, 153.00 cm and 156.50 cm. highest number of branches, with mean value of 20.50, 28.00 and 27.50, highest number of leaves with mean value of 86.00, 94.00 and 95.00, wildest stem girth with mean value of 1.03 cm 1.01 cm and 1.04 cm Cow dung exhibited the highest fresh weight of leaves with mean value of 96.15 g while Goat Manure and control plots displayed the least mean values. The results clearly demonstrate a significant variance between treatments with cow dung manure being the most productive among those investigated. Hence it is highly recommended for farmers in Anyigba.

Keywords: *Vegetable, Organic, Nutrient, Sources and Soil*

1. Introduction

The fluted pumpkin (*T. occidentalis*), also referred to as "Ugwu" by the Igbo people of eastern Nigeria, is a creeping leafy vegetable with huge lobed leaves and long twisting tendrils (Ibironke and Owotomo, 2019). The vegetable is commercially lucrative and grown throughout West Africa's lowland humid tropics (Sierra Leone, Ghana, and Nigeria being the leading producers) (Duling *et al.,* 2019). In Nigeria, the leaves, flowers and seeds are consumed locally as vegetables by humans and fodder for livestock (Idem *et al.,* 2012) Nitrogen is necessary for healthy vegetation and is best provided as manure (Hasnain *et al.,* 2020). Fluted pumpkins are harvested 120-150 days after planting (Annih *et al.,* 2020). *T. occidentalis* seeds and leaves are consumed because they are healthy sources of lipids, vitamins, fiber, and

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minerals such as iron, potassium, phosphorus, and mineral salt (Obembe *et al.,* 2021). Additionally, *T. occidentalis* bio accumulates a few secondary metabolites, including phytate, oxalate, nitrate, and cyanogenic glycoside, which, in high concentrations, can be toxic to humans and animals (Parwez *et al.,* 2022). For instance, the chelators oxalate and phytate decrease the bioavailability of various mineral elements. Kidney stones are caused by oxalate in combination with calcium (Petroski and Minich, 2020).

Organic nutrient sources are specifically derived from plant and animal origins (FAO, 2006). They include plant residues, animal wastes and bio fertilizers. In this era where climate change and the Covid-19 pandemic has impacted agricultural production and the financial capabilities of all workforces including farmers, farmers could use organic fertilizers available to them for soil fertility purposes because they are cheaper and more environmentally friendly when they are locally available (Adejobi *et al*., 2013). Organic fertilizers include poultry manure, cattle manure, green manure (often legumes), field crop residues, palm kernel cake, among others. Bio fertilizers are products containing single micro-organisms or combinations of them which when applied help fix atmospheric N, solubilize nutrients, mobilize nutrients, or secrete growth promoting substances to aid crop growth. These products do not supply nutrients themselves but enhance the activities of soil microbes to make more nutrients available to crops. They are categorized into N-fixing bio fertilizers, phosphorus solubilizing bio fertilizers, composting accelerators and plant growth promoting rhizobacteria (FAO, 2006). Most of the plant and animal residues are often by-products and nuisance to the environment. Using them as nutrient sources would help reduce waste and greenhouse gas emission. In line with the foregoing an alternative source of crop nutrition such as by the use of organic manure can be considered to restore and maintain the soil nutrient status for improved crop productivity organic manure application can be considered as an option provided it is applied at the right rate and time. Thus, the research will determine the growth and yield of fluted pumpkin (*Telfaria occidentalis)* as influenced by organic fertilizers.

2. Materials and Methods

2.1. Experimental Site

The experiment was conducted in an open field in front of the green house of the faculty of Agriculture, Prince Abubakar Audu University, Anyigba, The location is at Latitude 7˚6 N and Longitude7˚43 E. The field experiment consists of a variety of fluted pumpkin (*Telfaria occidentalis)* was gotten from Agricultural Development Project (ADP) Anyigba, Kogi State. The organic manures poultry manure, cow dung, Goat droppings and Palm Bunch was obtained from the Animal Research Farm Prince Abubakar Audu University

2.2. Treatments and Experimental Design

The experimental plots was measured at 14.5 m × 15 m. A Randomized Complete Block Design (RCBD) with eight (8) treatments and three (3) replicates making a total of 24 plots was obtained for the experiment and treatments was applied per plots by means of randomization to avoid bias. Rates were Poultry Manure (20 t/ha), cow dung (20 t/ha), Goat droppings (20 t/ha) and Palm Bunch (20 t/ha), respectively.

2.3. Soil Analysis

The composite soil samples was collected to a depth of 0-15 cm was air dried, crushed and sieved with 2 mm mesh in order to assess the physico-chemical properties of the soil.

2.4. Cultural Practices

All organic manure was incorporated two weeks prior to sowing to allow for proper decomposition in the soil. The fluted pumpkin (*Telfaria occidentalis)* seed was sown directly on the plots. Watering was done with the help of a watering can in the absence of rainfall for good and robust production till harvesting period. Weeding was done manually using hand at two weeks intervals on the experimental plot throughout the period of the experiment. Staking was done by setting up series of twine between to keep all of the leaves of the ground. Harvesting was done by cutting off the Leaves from the allocated plots of the matured state and labeling was done for ease of identification

Data was collected from five (5) plants for the vegetative parameters respectively.

2.5. Parameters

Vine Length (cm): This was carried out three (3) times at 6, 9 and 12 Weeks after planting with the aid of a measuring tape. The length of the vines in all the treatments was measured and tabulated against the different replications for which they represented

Number of Branches per Plant: Number of branches per plant was determined by physical counting at 6, 9 and 12 weeks after planting.

Number of Leaves per Plant: Number of leaves per plant was determined by counting the number of leaves per plant at 6, 9 and 12 weeks after planting.

Stem Girth (cm): The girth of each stem was measured per plant with a Verneer caliper and recorded at 3 weeks interval to maturity stage at 6, 9 and 12 weeks after planting

Fresh Weight of Leaves: This was determined by weighing each of the bulked harvested leaves per plot using the sensitive scale (electronic scale machine) in the laboratory at 12 weeks after planting.

2.6. Data Analysis

Data collected was subjected to analysis of variance (ANOVA) for Randomized Complete Block Design (RCBD) and significantly different means were separated using FSLD at $p > 0.005$ using Statistical Tools for Agricultural Research (STAR, 2013).

3. Results and Discussion

3.1. Physico-Chemical Analysis Results

Based on the result presented in Table 1, it can be inferred that the soil possesses both chemical and physical properties. The utilization of a textural triangle reveals that this soil is classified as sandy loam. Additionally, with total nitrogen of 0.069%, organic carbon 1.38 while, organic matter is 2.379. pH in H_2O suggests slight acidity with mean value of (5.10) an advantageous quality for cultivating vegetable crops.

Table 1: Physico-chemical Properties of Soil

Properties	Depth 0-15 cm
Percentage Total Nitrogen	0.069
Percentage Organic Carbon	1.38
Percentage Organic Matter	2.379
pH in KCl	4..60
pH in H_2O	5.10
P (Mg/Kg)	5.11
Na (Mg/Kg)	0.31
Mg (Mg/Kg)	2.27
Ca (Mg/Kg)	4.36
TEB	8.88
Ex Acidity (t)	1.02
EcEc (Cmol/Kg)	9.90
Percentage Silt	3.88
Percentage Clay	12.64
Percentage Sand	83.48
Textural Class	Loamy Sand

Source: Field Analysis 2023

3.2. Result of Fertilizer Analysis

Table 2 reveals that poultry manure exhibits a superior nitrogen content in comparison to other organic fertilizers, with a percentage composition of Total Nitrogen (%N) and Available phosphorous (ppm) (1.98 and 3.12). Notably, palm bunch boasts the highest potassium content among the studied organic fertilizers at 3.82%.

Table 2: Result of Organic Fertilizer Analysis

Sample	N (%)	P (%)	K (%)
Cow Dung	1.56	1.90	1.06
Poultry Manure	1.98	3.12	1.11
Goat Manure	1.72	1.06	2.01
Palm Bunch	1.08	1.00	3.82

Source: Lab Analysis 2023

*3.2.1. Influence of Various Organic Fertilizer on the Vine Length (cm) and Number of Branches of Fluted Pumpkins (*Telfaria occidentalis)

Table 3 indicates that the utilization of organic manure had a significant effect (p<0.05) on vine length at 6, 9, and 12 WAP. Specifically, plants treated with cow dung exhibited the longest vines with mean value of 94.00 cm, 153.00 cm, and 156.50 cm; however, this was not significantly different from the vine length of those treated with poultry manure with mean value of 92.50 cm, 126.50 cm and 145.00 cm. Throughout the experiment period (i.e., at 6, 9, and 12 WAP), Notably, while control plots produced plants with shorter vines after 6 weeks after planting of growth than other treatments did with mean value of 38.75 cm; goat manure resulted in shorter vine lengths at both 9 and 12 week weeks after planting with mean value of 84.00 cm and 93.00 cm marks.

Table 3: Influence of Various Organic Fertilizer on the Vine Length (cm) and Number of Branches of Fluted Pumpkins (*Telfaria occidentalis)*

Treatments	Vine Length (cm)			Number of Branches		
	6 WAP	9 WAP	12 WAP	6 WAP	9 WAP	12 WAP
Palm Bunch (PB)	71.75^{a}	111.50^{b}	124.00^{b}	13.00^{b}	20.50^{b}	20.50^{c}
Cow Dung (CD)	94.00^{a}	153.00^{a}	156.50^{a}	20.50^{a}	28.00^{a}	27.50^{a}
Poultry Manure (PM)	92.50^{a}	126.50^{ab}	145.00^{ab}	17.50^{ab}	23.00^{ab}	24.50^{b}
Goat Manure (GM)	44.75^{b}	84.00^{b}	93.00^{b}	11.50^{b}	20.50^{b}	18.00^{c}
Control (C)	38.75^{b}	89.00^{b}	114.00^{b}	12.50^{b}	18.50^{b}	18.50^{c}
$LSD_{(0.05)}$	24.96	38.33	32.02	4.82	5.33	2.98
CV (%)	23.70	22.05	16.43	20.87	15.66	8.86

Note: WAP-Weeks after planting; LSD- Least significant Difference; means with different letters in same column are significantly different at 5% level of probability, otherwise are not significant; and CV: Coefficient of Variations.

Table 3 reveals that the application of organic manure had a significant (p<0.05) impact on the number of branches in pumpkin leaves at 6, 9, and 12 WAP. Plots treated with Cow dung produced plants with the highest number of branches, with mean value of 20.50, 28.00 and 27.50. However was not significantly different from those treated with Poultry Manure at 6 and 9 WAP with mean value of 17.50 and 23.00. Notably, the lowest number of branches occurred in plots treated with Goat Manure at both 6 and 12WAP with mean value of 11.50 and 18.00. While control plots exhibited their lowest branch count at only 12 WAP with mean value of 18.50.

*3.2.2. Influence of Various Organic Fertilizer on the Numbers of Leaves and Stem Girth (cm) of Fluted Pumpkin (*Telfaria occidentalis)

Table 4 shows the quantity of pumpkin leaves was significantly impacted by organic manure application, based on the results obtained at 6, 9 and 12 weeks after planting (WAP). Plots treated with Cow dung yielded with the highest number of leaves with mean value of 86.00, 94.00 and 95.00, however differed significantly from all other treatments except Poultry Manure at 6 WAP. The control plots had plants with the lowest number of leaves at 6 WAP, with mean value of 30.50 while plots treated with Goat Manure produced plants with a lower number of leaves compared to others at both 9 and 12 WAP with mean value of 53.50 and 61.00 respectively

The results from Table 4 indicate that the stem girth of pumpkin leaf was significantly influenced ($p< 0.05$) by the use of organic manure at 6, 9 and 12WAP. Specifically, plots treated with Cow dung exhibited the highest stem girth diameter with mean value of 1.03 cm 1.01 cm and 1.04 cm at week 6 9 and 12 WAP. Meanwhile, plants grown in plots treated with Goat Manure and control plots displayed the smallest plant girth diameter at both 6 and 9 WAP with mean value of 0.86 cm and 0.86 cm periods; however, control plots produced plants with the least plant girth diameter only at the final measurement point of 12 WAP with mean value of 0.86 cm.

Table 4: Influence of Various Organic Fertilizer on the Numbers of Leaves and Stem Girth (cm) of Fluted Pumpkin (*Telfaria occidentalis)*

	Numbers of leaves			Stem Girth (cm)		
Treatments	**6 WAP**	**9 WAP**	**12 WAP**	**6 WAP**	**9 WAP**	**12 WAP**
Palm Bunch (PB)	42 ·00^{b}	63.00^{c}	68.50^{bc}	0.88^{bc}	0.87^{bc}	0.95^{b}
Cow Dung (CD)	86.00^{a}	94.00^{a}	99.50^{a}	1.03^{a}	1.01^{a}	1.04^{a}
Poultry Manure (PM)	59.50^{a}	75.50^{b}	80.50^{b}	0.93^{b}	0.93^{b}	0.96^{b}
Goat Manure (GM)	38.00^{b}	53.50^{c}	61.00^{c}	0.86^{c}	0.86^{c}	0.88 ^{b}
Control (C)	30.50^{b}	62.50^{c}	66.00^{c}	0.86^{c}	0.86^{c}	0.86 ^{b}
$LSD_{(0.05)}$	14.36	10.92	12.14	0.06	0.07	0.06
CV (%)	19.58	10.17	10.49	4.52	4.91	3.88

Note: WAP-Weeks after planting; LSD- Least significant Difference; means with different letters in same column are significantly different at 5% level of probability, otherwise are not significant; and CV: Coefficient of Variations.

*3.2.3. Influence of Various Organic Fertilizer on Fresh Weight of Leaves of Fluted Pumpkin (*Telfaria occidentalis)

Table 5 illustrates that organic manure has a significant ($p<0.05$) impact on the fresh weight of pumpkin leaves, as observed at 12 weeks after planting. Notably, plots treated with Cow dung exhibited the highest fresh weight of leaves with mean value of 96.15 g, while those treated with Poultry Manure did not exhibit a statistically significant difference

Table 5: Influence of Various Organic Fertilizer on the Numbers of Leaves and Stem Girth (cm) of Fluted Pumpkin (*Telfaria occidentalis)*

Treatments	**Fresh Weight (g)**
Palm Bunch (PB)	47.71^{b}
Cow Dung (CD)	96.15^{a}
Poultry Manure (PM)	54.57^{ab}
Goat Manure (GM)	30.42^{b}
Control (C)	46.81^{b}

Table 5 (Cont.)

Treatments	Fresh Weight (g)
$LSD_{(0.05)}$	31.68
CV (%)	37.81

Note: LSD- Least significant Difference; means with different letters in same; Column are significantly different at 5% level of probability, otherwise are not significant; and CV: Coefficient of Variations.

from plots treated with Palm bunch. However, it is worth noting goat manure gave the least mean value of 30.42 g and was not statistically differ between the three sets of Manure-treated plots.

4. Discussion

Pre-planting soil analysis showed that the soil at the experimental site had a low soil nutrient status. The total value of nitrogen, phosphorus and potassium present in the test soil is a recorded level, which requires the application of soil amendments in the form of organic fertilizers. The increase in vine length, the number of branches and the number of leaves and a significant increase compared to the applied organic fertilizers (cattle, sheep and livestock manure) can be related to the increase in the N content of the applied fertilizers. Cow manure increases cell activity, increases cell proliferation, and increases vegetative growth. This result is in line with the results of Aderi *et al.* (2011) who found a significant effect of organic fertilizer level on some quantitative parameters of pumpkin. Similarly, Eifediyi and Remison (2013) observed that organic fertilizers can support the cropping system with better nutrition, which leads to the increase and yield of plants. Aslo, Olowoake and Ojo (2014) confirmed the increase in growth parameters and different types of fertilizers which may be due to the efficiency of the use of fertilizers applied to plants, increasing the presence of other nutrients such as P in applied fertilizers. Adapted from N, Olowoake (2017) the improvement of growth parameters with the application of organic fertilizers confirms the results of Aminifard *et al.* (2010) and Agbo *et al.* (2012) observed a significant increase in the growth and yield of *T. occidentalis* and other vegetables with organic fertilizers applied. In addition to releasing nutrients to the soil, organic fertilizers have been shown to improve other soil chemistry and physical properties that increase plant growth and development Olowoake (2014). Nitrogen is the main component of nucleic acids and chlorophyll, while phosphorus is involved in many metabolic processes necessary for normal growth, such as photosynthesis. Potassium is also necessary for photosynthesis because it activates many enzymes involved in the photosynthesis process. These elements affect the stability of chlorophyll molecules, and these nutrients are also present in cattle and are released slowly during the growing season. Frank *et al.* (2020) reported that pumpkin and Tshilangane *et al.* (2022) reported similar findings.

5. Conclusion and Recommendations

The primary reason for applying organic manure to soil is to enhance its organic matter amendment and provide nutrients to crops. Organic manure remains a strong and effective option due to its non-harmful nature towards soil health, making it ideal in today's polluted world where long-lasting effects are crucial for sustainability purposes. Therefore, this study aimed at determining the yield of fluted pumpkin (*Telfaria occidentalis)* as influenced by organic fertilizers which showed that cow dung significantly improved nutrient levels, as well as growth of *Telferia spp*. Among all treatments applied, cow dung (organic manure) showed the best performance by producing the highest vegetative growth. The results clearly demonstrate a significant variance between treatments with 20 tons/ha of cow dung manure being the most productive among those investigated. Cow dung manure proves to be an efficient source of NPK and organic matter for telfaria production, hence it is highly recommended for farmers in Anyigba.

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