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Comparative Effects of Animal Manures and Mineral Fertilizer on Agronomic Parameters of *Telfairia occidentalis* on Luvisol in Lagos Southwestern Nigeria

Okubena-Dipeolu Esther[1], Olalusi Funmilayo[1] and Ayeni Leye Samuel[2]

[1]Department of Botany, Lagos State University, Ojo Lagos, Nigeria

[2]Department of Agricultural Science Adeyemi College of Education, Ondo, Nigeria

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***For Correspondence**

Ayeni Leye Samuel, Department of Agricultural Science Adeyemi College of Education, Ondo, Nigeria, Tel: +234 8112001481

E-mail: leye_sam@yahoo.com

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ABSTRACT

Telfairia occidentalis is a vegetable rich in nutrients and command market value common among the Igbos of eastern part of Nigeria but has not been widely cultivated in other parts of the country except Lagos. Two pot experiments were concurrently conducted at lagos State University to evaluate the effect of blood meal (BM), poultry dung (PM), cattle dung (CD), pig dung (PD) and NPK15:15:15 fertilizer (NPK) on morphological characteristics of *Telfairia occidentalis*. Ten kilogram (10 kg) of soil was weighed and poured into forty two buckets. A concentration of 12.5, 25, 50 and 100 g/10 kg soil of each of the treatments to represent 2.5, 5, 10 and 20 t/ha were individually mixed with 10 kg soil. NPK 15:15:15 fertilizer was applied at the rate of 1.25, 2.5, 3.75 and 5 g to represent 100, 200, 300 and 400 kg/ha respectively. The treatments were arranged on completely randomized design and replicated three times. Application of BM, PM, CD, PD and NPK had significant ($p<0.05$) influence on root, shoot and leaf parameters of *Telfairia occidentalis*. It is concluded that apart from the soil nutrients requirement, the choice of fertilizer in growing *Telfaria occidentalis* need to be depended on the part of the plants that is of interest to the farmer.

INTRODUCTION

Telfairia occidentalis is a leaf vegetable commonly grown in Africa especially in the southern part of Nigeria. It is also popularly grown for its edible seeds. Common names for the plant include Fluted gourd, Fluted pumpkin, and Ugu in Nigeria. It is a member of the curcurbitaceae family and is indigenous to south- East part of Nigeria [1,2]. The fluted gourd is used primarily in preparing soups and herbal medicines. The seeds produced by the gourd are high in protein and fat, and can therefore contribute to a well-balanced diet food trades of the Igbo tribe [1].

The use of animal dungs in increasing crop yield in recent time is more pronounced than the synthetic fertilizers among the Olericulturists. This is because; the synthetic fertilizer is rapidly lost by either volatilization during the dry season or by leaching in drainage water and also causes soil pollution. Continuous use of inorganic fertilizer affects soil structure. Hence, organic manures can serve as alternative to mineral fertilizers for improving soil structure. Therefore, there is the need for increased dependence on the use of organic waste such as farmyard manure, crop residues and poultry manure for crop production. In fact, poultry manure has been adjudged to be one the most and commonest valuable of all manures (Michael and George). Aside from poultry manure, there are other manures like blood meal, cattle dung and pig dung that are also rich in plant nutrients. Fluted pumpkins prefer a loose, fri able and soil rich in plant nutrients. These soil conditions are hardly available in southern guinea savanna agro ecological zone of north central Nigeria where fluted pumpkin is mostly grown. There have not been researches that compare different animal manures on vegetative growth of fluted pumpkin in southwestern Nigeria. Hence, the objective of this study was to compare the effects of organic manures and mineral fertilizer on the vegetative growth of *Telfairia occidentalis*. The leaf has

a high nutritional, medicinal and industrial values being rich in protein 29%, fat 18%, minerals and vitamins 20% (Tindall). Apart from the leaves, the seeds can be cooked /roasted and eaten, or ground and added in soup, contained 20.5 g proteins, 45 g fat, 23 g carbohydrate, 2.2 g fiber and 4.8 g total ash. The oil in the seeds is useful in soap making and in cooking [3,4]. In the recent time, fluted pumpkin had gained medicinal recognition. It has been discovered to be blood purifiers and could therefore be useful in maintenance of good health.

MATERIAL AND METHODS

Telfairia occidentalis seeds were obtained from National Institute of Horticulture (NIHORT), Ibadan, south-west Nigeria. Loamy soil was obtained from Lagos State University Ojo campus. The soil was air dried for two weeks after which it was sieved to obtain fine sand free from particles. Cow dung, pig manure and poultry manure were air dried with an exception of blood meal which was already dried and in pellet forms. NPK 20:10:10 was purchased from LAISA Company. 10 kg of soil was weighed and poured into forty two buckets. A concentration of 12.5, 25, 50 and 100 g of each of the cow dung, poultry manure, pig manure and bone meal to represent 2.5, 5, 10 and 20 t/ha were individually mixed with 10 kg soil. The treatments were replicated three times and arranged in completely randomized design. The two experiments were concurrently sited at the Lagos state university green-house, Ojo campus. Seeds of *Telfairia occidentalis* were planted by sowing 2 seeds/pot while NPK fertilizer was applied two weeks after planting. Equal volume of water was added to all the treatments two weeks after planting.

Determination of Growth Parameters of *Telfairia occidentalis*

Six weeks after planting *T. occidentalis* were harvested. The whole plant was uprooted from their buckets. Plant height, root length was determined. Fresh weight of the plant in each bucket was carried out using beam balance. The harvested plants were packed in an envelope and oven dried at 55°C till drying was completed. Leaf area (LA) was measured using the formular LA= 0.853 + (leaf blade length X leaf blade breadth) X 8.7440 (Kintomo and Ojo)

Fresh and dry weight of leaves, stem and root were also determined by destructive analytical method in which each plant sample was severed and separated into roots, stems and leaves.

To determine dry weight, the plant parts were placed in an oven and air-dried at 55°C. After drying, they were placed on foil and weighed using an electronic beam balance.

Determination of Chemical Constituents of Inorganic and Organic Fertilizer

NPK Nitrogen (N), phosphorus (P), and potassium (K) with a NPK rating of 20:10:10. This implies that 20% by weight of the fertilizer is nitrogen (N) and that the weight of phosphorus in the fertilizer is the same as it would be if the fertilizer contained in 40% diphosphoruspentoxide (P_2O_5). The amount of potassium in the fertilizer is the same as it would be if the fertilizer were 10% potassium oxide (K_2O). Of the 20% Nitrogen, the package indicated that 8.8% was ammonia nitrogen and the remaining 11.2% was urea nitrogen.

Chemical analysis was carried out on the organic fertilizer to determine the levels of Nitrogen (N), Phosphorus (P), Carbon (C) as well as other selected minerals like Potassium (K), Calcium (Ca), Magnesium (Mg), Sodium (Na), Manganese (Mn), Iron (Fe), Copper (Cu) and Zinc (Zn). The total carbon content of the organic fertilizer was determined according to the Walkley and Black (1934) wet oxidation method [5]. Total nitrogen in the organic fertilizer was determined using the regular Macro Kjedhal method.

A quantity of 0.2 g of the powdered organic materials was digested with nitric, perchloric and sulphuric acid mixture in the ratio 5:1:1 respectively in a 100 ml conical flask. The mixture was heated on a hot plate for about one hour until 1 ml of clear solution was left in the flask. A lot of brownish fume with choking smell was given off. It was allowed to cool and 100 ml of distilled water was added to the clear solution. The solution was filtered through an ash less filter paper (Whatman No.3) into a volumetric flask. Determination of total phosphorus as P_2O_5 in the digested organic waste was done spectrophotometrically, using the Molybdovanadate blue colour method. The K, Ca and Mg contents were read with AAS. The micronutrients were extracted with HCl and determined with ASS.

Moisture content, crude fat, carbohydrate, ash and protein were determined using the methods of Association of Official Analytical Chemist [6]. The crude fibre was determined using fibretec 2021/2023 system. The dried sample (0.875 g) was placed in a Kjeldahl digestion flask and was analyzed as describe by AOAC [6].

DATA ANALYSIS

The means of the data generated from the two experiments were used for statistical analysis. Duncam Multiple Range Test was used to separate the means using SPSS version 17.

RESULTS

Information obtained from the analyzed organic fertilizers indicated that the fertilizers have different nutrients composition. Blood meal has majority 13.2, 1.02 and 0.4 % for N, P and K respectively, pig dung has 4.0, 0.7, 2.0, 7.9 and 1.6% for N, P, K,Ca

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and Mg respectively while poultry dung has 7.3, 1.36, 4.5, 3.9, 2.8 and 0.99%. Cattle dung has OC, N, P, K, Ca, Mg and Na for 36.3, 1.3, 0.36, 0.44, 2.4, 0.56 and 0.2% respectively. NPK15:15:15 fertilizer was used as mineral fertilizer. The result of the nutrient composition of the organic materials used for the conduct of the experiment showed that blood meal had the highest N followed by pig dung while cattle recorded the lowest N. poultry manure had the highest total P while poultry manure had the highest K. The variation in the chemical composition of the organic materials would affect the agronomic performance of *Telfairia ria occidentalis* **(Table 1).**

Table 1. Pre Field Chemical Soil Analysis on LASU soil.

Parameters	MEAN ± SD
Nitrogen %	0.16
K+ (mg/Kg)	314
Mg++ (mg/Kg)	122
Ca++ (mg/Kg)	1885
Fe++ (mg/Kg)	6.5
Cu++ (mg/Kg)	1.5
P as PO4--- (mg/Kg)	391
Carbon %	5.6
C: N Ratio	35:01:00
Total Organic Matter (mg/Kg)	11.8

Agronomic Parameters

Compared with control, all NPK fertilizer rates, cow dung and blood meal rates significantly increased root length of *Telfairia occidentialis*. Among the NPK rates, application of 200 and 400 kg/ha fertilizer recorded the highest root length, 5 and 10 t/ha of CD had the highest root length, 10 and 20 t/ha blood meal had the highest root length, 2.5 t/ha PD had the highest root length while root length increased as the level of PM increased. In over all, 20 t/ha PM recorded the highest root length.

Compared with control, all CD, BM, PD and PM rates significantly increased shoot fresh weight. Only 200 kg/ha of NPKF, 5 and 10 t/ha CD significantly increased fresh shoot weight of *Telfairia occidentialis*. Relative to control, all NPKF (except 400 kg/ha NPKF), CD, PD and PM significantly increased shoot dry matter of *Telfaria-ria occidentialis*. All NPKF rates, CD, BM, PD and PM significantly increased root fresh weight of *Telfairia occidentialis*. Akanbi et al., observed similar result. All CD rates, 5 t/ha blood meal, all PD increased dry matter (except 20 t/ha CD) and 5 t and 10 t/ha significantly increased the number of leaves [7]. This finding is in agreement with the observation of Spreeth et al., that poultry manure increased the agronomic parameters of amaranthus, cowpea and bambara. Idem et al., affirmed that poultry manure and NPK fertilizer increased agronomic parameters of fluted pumpkin in an experiment conducted to show the effect of poultry manure and NPK fertilizer on growth and yield of pumpkin in south eastern Nigeria [8,9].

Compared with control, all the treatments significantly increased the leaf area of *Telfiria occidentialis*. Among the soil samples fertilized with NPK fertilizer rates, 400 kg/ha had the highest root length, fresh and dry root weights. The soil fertilized with 200 kg/ha NPK fertilizer recorded the highest fresh and dry shoot weights as well as leaf area while the soil fertilized with 300 kg/ha had the highest leaf area.

Among the CD treatments, the soil samples manured with 5 t/ha CD, had the highest root length, fresh and dry root weights, 10 t/ha CD had the highest number of leaves while 20 t/ha recorded the highest fresh and dry shoot weights.

Compared blood meal treatments rates, 2.5 t/ha had the highest root, number of leaves and leaf area. Application of 10 t/ha blood meal recorded the highest fresh and dry shoot weights while 5 t/ha BM had the highest fresh and dry root weights.

Among pig dung treatments, application of 2.5 t/ha pig dung had the highest root length, fresh and dry shoot weights, 5 t/ha PD had the highest fresh and dry root weights while 20 t/ha PD recorded the highest leaf area **(Table 2).**

Table 2. Compared Blood Meal Treatments Rates, 2.5 t/Ha Had The Highest Root, Number of Leaves and Leaf Area. Application of 10 t/Ha Blood Meal Recorded the Highest Fresh and Dry Shoot Weights While 5 t/Ha BM Had the Highest Fresh and Dry Root Weights.

Treatment	root length (cm)	shoot fresh weight (g)	shoot dry weight (g)	root fresh weight (g)	root dry weight (g)	No of leaves	leaf area (cm^2)
Control	46b	28.16e	3.15c	4.37c	0.33	48ab	489.87h
NPK (kg/ha) 100	50b	29.68e	4.17b	5.31c	0.43	45b	857.59g
200	60a	56.53d	7.9a	9.94b	0.74b	23c	44068.9a
300	47b	28.71e	4.68bc	8.05b	0.59bc	46b	865.13g
400	60a	29e	3.04b	15a	0.8b	18d	917.55f
Cow dung (t/ha) 2.5	57a	32.22e	4.1b	6.2c	0.59bc	8.0e	918.89f

5	58a	45.02d	6.25a	17.64a	1.47a	55a	1312.16d
10	38c	48.66d	5.85b	9.77b	0.7b	65a	943.4f
20	57a	71.8b	8.15a	12.64b	0.82b	60a	766.45g
Blood meal (t/ha) 2. 5	58a	44.9d	5.34b	9.06b	0.73b	64a	988.58f
5	38c	44.43d	8.15a	10.22b	0.85b	63a	994.95f
10	57a	27.45e	3.12c	5.12c	0.48c	48ab	728.72g
20	57a	43.67d	4.25b	8.23b	0.6b	38c	794.86g
Pig dung (t/ha) 2.5	53b	67.51c	7.75a	13.97b	0.83b	55a	1039.68e
5	52b	64.35b	6.64a	15.96a	1.1a	54a	884.48g
10	36.5	49.63d	6.22a	14.81b	1.1a	52a	1081.22f
20	36c	53.66d	5.88ab	11.87b	0.93ab	47b	1514.04d
Poultry dung (t/ha) 2.5	39c	60.77c	6.7a	13.42b	0.93ab	47b	1784.48c
5	47b	85.87a	6.9a	11.82b	0.7b	58a	1174.13d
10	59a	63.68c	7.2a	17.26a	1.15ab	44b	2341.24c
20	66a	63.71c	6.5a	6.57c	0.48c	59a	3221.90b

Means with the same letter are not significantly different at 5% using Duncam multiple range test

The results obtained from this experiment showed that the treatments released plant nutrients to the soil at different rates and different times. One could not specifically say which treatment most increased the growth and yield of *T. occidentalis*. The fact there is that. all the treatments increased agronomic parameters of the test crop. NPK fertilizer did not significantly performed better than the animal manures despite the fact that it has the highest three essential major nutrients required by all crops. This might be as a result of the deficient of other nutrients in NPK fertilizer. Some of the treatments such as pig dung increased the growth and yield of Telfaria at low rate of their application (2.5 t/ha) while poultry manure increased it at higher rates especially at 10 t/ha. Cow dung and blood meal performed better at 5 t/ha. This might be as a result of differences in their C/N ratios as well as differences in nutrients composition. Carbon nitrogen ratio in animal dung is known to either cause immobilization of nutrients at high level or mineralization at low rate [10,11]. The organic manures also influenced the agronomic parameters in different ways. The wide C/N ratio of the initial soil might also affect the nutrients that would be released for Telfaria uptake. For example, 10 t/ha of cow dung recorded the lowest root length while the same 10 t/ha recorded the highest number of leaves. This indicated that the choice of organic fertilizer by farmers would also depend on which part of the plant is paramount or of interest to the farmers. Ayeni et al., emphasised that, one of the major problems that hinder the use of organic maures is their inconsistence in releasing plant nutrients to the soil which may lead to increase in yield of crops [12]. The experiment performed by Ayeni et al., showed that application of 20 t/ha of poultry manure increased soil exchangeable K in the first experiment while 30 t /ha poultry manure increased exchangeable K in the late season compared with control in an experiment conducted to show comparative effect of poultry manure and NPK fertilizer on performance of tomato in derived savannah transition zone of Southwest Nigeria [12].

CONCLUSION

Field experiment was conducted to evaluate the performance of organic and mineral fertilizers on growth and yield of *Tefairia occidentalis* in Lagos southwestern Nigeria. Cow dung, pig dung, blood meal, poultry manure and NPK fertilizer increased the growth and yield of *Telfairia occidentalis* at different rates and according to the parameters. It is concluded that the choice of fertilizer in growing *Telfaria occidentale* will also depend on the part of the plants that is of interest to the farmer or buyer.

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