



COMPARATIVE EFFECT OF ORGANIC AND IN-ORGANIC FERTILIZER TREATMENT ON THE GROWTH AND TUBERYIELD OF SWEET POTATO (*Ipomea batata* L)

Adeyeye, A.S.[†] — Akanbi W.B² — Sobola, O.O³ — Lamidi, W.A⁴ — Olalekan, K.K⁵

^{1,5}Federal University Wukari, Taraba State Nigeria

²Ladoke Akintola University of Technology, Ogbomoso Oyo State, Nigeria

^{4,5} Osun State University, Osogbo, Osun State, Nigeria

ABSTRACT

The experiment was conducted at the teaching and Research farm of the Federal University Wukari Taraba State, Nigeria to assess, evaluate and compare the effect of organic fertilizers such as poultry manure, cow dung, organic manure and in-organic fertilizers such as NPK and urea on the growth and tuber yield of sweet potato. The recommended rates of cow dung (10t/ha) poultry manure (10t/ha), organic manure (10t/ha) NPK15:15:15 (400kg/ha) and urea (200kgN/ha) were applied as treatment to sweet potato with a control at (0kg/ha). These were arranged in a randomized complete block design with three replications. Measurement were taken on the growth and tuber yield at harvest such as the length of primary vein, number of secondary vein number of leaves, number of tuber and tuber weight. Data collected were analyzed using (ANOVA) and the significant means separated using Duncan multiple difference at 5% probability level. The result revealed or showed that numbers of leaves were significant in all the treatments. Application of urea fertilizer produced the highest number of tuber per plant, while tuber weight was not significantly different, but poultry manure application had the higher mean value of (2.34kg). It was concluding that application of poultry manure as organic fertilizer are better and can compare readily with inorganic fertilizer (urea) in the production of sweet potato.

Keywords: Sweet potato, Organic, Mineral fertilizer, Yield.

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Contribution/ Originality

Sweet potato is one of the most important field crop in the world and many studies have been carried out on the growth, productivity and nutritional properties including the effect of organic and inorganic fertilizers applications. The study therefore compares the effectiveness of available organic and inorganic fertilizer on the growth and tuber yield of the crop.

1. INTRODUCTION

Sweet potato (*Ipomea batata*) is one of the major food crops in the world, and it rank second to yam in Nigeria as a major important tuber crop, contributing to the people food requirement. Karam *et al.* (2009). It is consumed locally at it serve as famine relief crop at the end of rainy season and it has increase the income of the farmers through its exportation as a result of it high demand internationally (Karam *et al.*, 2009). Despite it important as a food crop, the productivity of these crops is becoming low mainly due to poor soil fertility of the most arable field. Fertilizer is one of the most important inputs either as organic or inorganic of increasing the productivity of crops (Anonymous, 1997; Ali *et al.*, 2009). Leytem and Westermann (2005) reported the important effects of fertilizer on

[†] Corresponding author

the yield of potatoes. Also that potato is highly responsive to N-fertilization and that N is usually the most limiting essential nutrient for potatoes growth and development (Errebhi *et al.*, 1998). Although inorganic fertilizer when applied to crop usually has a quick- released formula making nutrient rapidly available to plants, but because of the high cost and its long time adverse effect on soil chemical properties, organic fertilizer are recommended for use, organic fertilizer are environmentally friendly and it supply both macro and micro nutrients to the soil (Negassa *et al.*, 2001; Tirol-padre *et al.*, 2007) and also improve the physio-chemical properties of the soil.

Among the conventional fertilizers, urea, and NPK fertilizers are mostly used by farmer to produce vegetable, while among the organic fertilizer are, poultry manure, cow dung and organic manure which are popularly used for vegetable production in Nigeria. Hence there is a need to compare their effectiveness and usefulness in potatoes production. Therefore the objective of this study was to compare the effect of mineral and organic fertilizer on the growth and tuber yield components of (sweet potatoes).

2. MATERIALS AND METHODS

The experiment was carried out at the teaching and Research farm of the Federal University Wukari Taraba State, Nigeria. Taraba state lie between latitude 6°30, 8° 30N of the equator and between longitude 9° and 12°E of the Greenwich meridian with a land mass of 54.426km². It shared borders with Bauchi and Gombe State in the North, Adamawa State in the East and Cameroon republic in the south west. The state has a tropical wet – dry climate, well drained alluvial soils and has both savannah and Rain forest vegetation. The rainfall ranges between 100mm to 250mm per annum in the north with the driest and wettest season lasting from December to February and July to September respectively. The soil physical chemical properties are as in table 1. The materials for the experiment such as the organic manures were collected at the animal farm of the university, while the mineral fertilizer was purchase from open market in Wukari. Organic fertilizers used in the study were also taken for the laboratory analysis.

3. EXPERIMENTAL DESIGN AND TREATMENT

The experiment was laid out in a randomized complete block design (RCBD) with three replications. The treatments consist of three organic fertilizers and their rates as poultry manure (10/ha) cow dung (10/ha) and organic manure (10/ha), two mineral fertilizer as NPK at (400kg/ha) and urea at (200kg/ha) with the control at (0kg/ha). The potato stem cutting were planted on a bed of 2mx2m with a spacing of 50cm x 100cm with the total number of 18 plots. The organic fertilizers were applied by thoroughly incorporated into the soil two weeks before planting while mineral fertilizer were applied a week after planting. Weeding was done manually at two weeks after planting and as when necessary. There was no severe pest infestation during the experiment. The plants were allowed to grow, developed till maturity.

4. DATA COLLECTION AND ANALYSIS

Data were collected on the growth and tuber yield component at harvest. The Data collected were: Length of the primary vein, Number of leaves, Number of secondary Vein, Number of tuber per plant, weight of tuber per plant and tuber yield. Of Data collection was statistically analyzed using analysis variance (ANOVA) and the treatment means were separated using Duncan multiple Range Test (DMRT) at 5% probability level.

5. RESULT

The parameters measured at harvest were all influence by the application of fertilizer either as organic or inorganic. The numbers of leaves were affected by the fertilizer application and it was significantly different from the control (0kg/ha). There was no significant difference between the fertilizer applied with the respect to length of primary vein, number of leaves and number of secondary vein. But with number of secondary vein, poultry manure

produced the highest means value of (10.83) which was followed by cow dung and urea and the last mean value of (5.52) from NPK fertilizer treatment. (Table 2). Number of tuber per plant showed a significant difference and the highest number of tuber followed the order: poultry manure, NPK, organic manure and cow dung and the least from control plant (Table). There was no significant difference between the weight of tuber and tuber yield in the study, but application of urea produced higher mean value of (4000kg/ha) of tuber yield followed by poultry and cow dung and the least mean value from the control application (0kg/ha) (Table 3). During the study, the parameters assessed on sweet potato increased for all fertilizer treatments and it is better when compared to the control or non fertilized plant. This support the work of [Djilani and Senoussi \(2013\)](#) that fertilizers either organic or inorganic provide adequate plant nutrient for optimum growth and development. Also [Havlin et al. \(2005\)](#) reported that an adequate supply nutrient to plant release N which is associated with vigorous seedling emergence, vegetative growth and yield. The tuber number of the crop was also significantly influence by the fertilizer application, where the plant that received urea has significantly higher number of tuber. This may be due to the fact that urea influence vegetative growth of the plant especially production of many leaves which now produced enough photosynthetate that are stored in the tuber. This is line with the work of [Errebhi et al. \(1998\)](#) that potato is highly responsive to N-fertilization and that N is usually the most limiting essential nutrient for potatoes growth and development. Although urea application effect was not different significantly from the poultry manure, poultry manure is preferred to urea in the study because of its ability to improve soil structure through the increased activities of micro organism in the soil. It is therefore concluded that poultry manure application where ever is available is the best for the production of sweet potato.

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Table-1. The soil chemical and physical analysis of the Teaching and d Research Farm, Federal University, Wukari

Properties	Values
pH(H ₂ o)	5.75
Organic carbon (%)	1.36
Organic Matter (%)	2.35
Total N (%)	0.98
Available P (MgL ⁻¹)	0.52
Exchangeable K (mol/kg)	1.6
Exchangeable Na (mol/kg)	2.1
Exchangeable Ca (mol/kg)	3.8
Exchangeable Mg (mol/kg)	1.8
Exchangeable Acidity (mol/kg)	1.10
TEB	9.3
CEC	10.4
Base Saturation (%)	89.4
Sand (g/kg)	76.80
Clay (g/kg)	15.20
Silt(g/kg)	8.0
Textural Class	Sandy soil

Source: Univesity of Agriculture ,Makudi ,Benue State ,Nigeria

Table-2. Effects of organic and inorganic fertilizers on the growth parameters of sweet potato at harvest.

Treatments	Length of primary vein (cm)	Number of leaves	Number of secondary vein	Number of tuber per plant
NPK	1.89 a	2.23 a	5.92 a	2.50 ab
Urea	1.92 a	2.35 a	9.08 a	2.83 a
Poultry Manure	1.72 a	2.34 a	10.83 a	2.58 ab
Cow Dung	1.68 a	2.24 a	9.58 a	2.17 ab
Organic Manure	1.94 a	2.32 a	6.83 a	2.25 ab
Control (0kg/ha)	1.44 a	1.96 b	6.00 a	1.33 b
LSD (5%)	0.47	0.22	4.79	1.36

Source: Adeyeye et al,Federal University Wukari Taraba State,Nigeria

Table-3. Effects of organic and inorganic fertilizers on the tuber weight and yield of sweet potato at harvest.

Treatments	NPK	UREA	Poultry manure	Cow Dung	Organic manure	Control	LSD (5%)
Tuber weight kg.	2.15 a	2.32 a	2.34 a	2.34 a	2.24 a	1.86 a	0.51
Tuber Yield kg/ha.	0.36a	0.40a	0.39a	0.39a	0.37a	0.31a	0.17

Source: Adeyeye et al,Federal University Wukari,Taraba State Nigeria

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