



EFFECTS OF CHICKEN WASTE ON VEGETATIVE PERFORMANCE OF AFRICAN EGG PLANT (*SOLANUM MACROCARPON* L.)

¹Aderemi, A. M., ²Aderemi, F. T., ²Aluko, A. K., ¹Elesho, R. O., ²Majekodunmi, O. A.,
¹Roberts, E. A., ¹Afolabi, R. T., ¹Adenuga, D. A. and Adesida, A. O.

¹Agricultural Extension and Management Department,
Federal College of Forestry, Ibadan, Nigeria.

²Horticulture and Landscape Technology Department,
Federal College of Forestry, Ibadan, Nigeria.

Corresponding Author's Email: aderemi.am@frin.gov.ng,
GSM: 08035637542, 08079713340

ABSTRACT

The study was carried out at Horticultural Garden Federal College of Forestry Jericho Ibadan during the rainy season of 2022 to investigate the effect of poultry manure on leaf production of *Solanum macrocarpon* Linn. The treatments consisted of four (4) levels of poultry manure (0, 1.5, 2.0 and 2.5t/ha) designated as T₁, T₂, T₃ and T₀ as control. The experiment was laid out in a Completely Randomized Design (CRD) replicated five (5) times. Data were collected weekly on plant height, number of leaves, leaf area, stem diameter and fresh weight at harvest. All data collected were subjected to analysis of variance (ANOVA) and Duncan's Multiple Range Test (DMRT) was adopted in separating the means. The result obtained revealed a significant ($P \leq 0.05$) among the treatments used on all the parameters assessed and the seedlings were positively influenced. The result further indicated that, seedlings that received 2.5t of poultry manure significantly ($P \leq 0.05$) produced the widest leaves, higher number of leaves and tallest plants while seedlings that received 2.0t of poultry manure did well in terms of stem diameter and fresh harvest weight. Based on the result of this study, 2.0 t/ha of poultry manure is recommended for optimum leaf production of *solanum macrocarpon* L. in the study area.

Keywords: Poultry, Manure, Eggplant and Garden.

INTRODUCTION

Solanum macrocarpon L. otherwise known as the African eggplant, or gboma is a plant of the Solanaceae family. *S. macrocarpon* is a tropical perennial plant that is closely related to the eggplant (Obboh *et al.*, 2015). African eggplant originated from West Africa, but is now widely distributed in Central and Caribbean, South America, and some parts of Southeast Asia (Bukanya, 1980). *S. macrocarpon* is widely cultivated for its use as a food, its medicinal purposes, and as an ornamental plant (Bonso *et al* 1998), erect, branched, herbaceous, plant reaching up to 1.5 m with blackish-violet stem that is woody at the base. It has an alternate leaf pattern with the blade width of 4-15 cm and a height of 10-30 cm. The shapes of the leaves are oval and lobed with a wavy margin. Both sides of the leaves are hairy with stellate or simple hairs. Prickles may or may not be present on the leaves depending on the cultivar. When prickles are present they are found more along the midrib and lateral veins. The prickles are straight and can grow up to a length of 13 mm. The seeds have a length of 3-4.5 mm, a width of 2-3.5 mm, and are shaped in an obivoid or reniform (Bonso, *et al* 1998). The flowers have a diameter of 3-8 cm and are located on short stalked inflorescence that can contain 2 to 7 flowers. The lower portion of the plant carries bisexual flowers while the upper



portion contains male flowers. The flowers are 2-3.5cm in length and usually have a purple or pale purple colour, on rare occasions there are white flowers, they are complete, actinomorphic and perfect. Anthesis occurs at about 5-8 a.m. (Schipper, 2000).

Solanum macrocarpon L. has a large variety of cultivars. It grows in areas of high rainfall found in the tropical and humid regions of West and Central Africa, South-East Asia, South America and the Caribbean. Some cultivars can be found in the savanna and semi-arid region of Northern Ghana, Burkina Faso and their neighboring countries. The cultivars grown there consist of plants with small leaves and fruit. The fruit cultivars are only able to grow in humid coastal areas. *S. macrocarpon* can occasionally be found at higher altitudes but have a slower growth rate and are more robust. Optimal temperature ranges for the crop are 23-35 °C (day) and 18-25 °C (night) and it grows on a wide range of well-drained soils with an optimal soil pH range between 5.5 and 6.8. *S. macrocarpon* reproduces mostly by self-pollination. Out crossing occurs by bees and other insects, but at low frequencies. Germination typically begins a week after sowing. Flowering does not occur until 2-3 months after germination (Olet, 2014). *Solanum macrocarpon* L. known in southwestern Nigeria as (Igbagba), is considerably high in calcium, iron and potassium. It contributes substantially to the people's diet as source of soup, stew and widely grown for both consumption and sales due to its potential leaf production (Ojo and Olufolaji, 2000). The fresh and tender leaves of Igbagba are cooked and consumed as vegetables. It contains vitamins and minerals including vitamin A, C, E, folic acid, niacin and Potassium, riboflavin that contribute to growth and maintenance of good health. (Fasuyi, 2006). In Nigeria, the fruit is used as laxative, and as a means to treat cardiac diseases (Bello and Muhammed, 2005). In Kenya the roots are boiled and the juice is then consumed to kill any hookworms in the stomach. The root is also used for bronchitis, body aches, asthma, and it speeds up the process of healing wounds. The seeds of *S. macrocarpon* are crushed to treat toothache (Sanchez, 2011). *Solanum macrocarpon* is traditionally processed (boiling or squeeze washing with or without salt) before it is used in vegetable stew preparation (Ihekoronye and Ngoddy, 2005). Poultry manure is the faeces of chickens used as organic fertilizer. Of all animal manures, it has the highest amount of nitrogen, phosphorus and potassium. Fresh chicken manure contains 0.8% Potassium, 0.4% to 0.5% Phosphorus and 0.9% to 1.5% Nitrogen (Chiefz, *et al.*, 1996). The present investigation is, therefore carried out to study the effects of chicken waste on plant vegetative performance, leaf number, plant height, fresh harvest weight, and leaf area (width and length) of *S. macrocarpon* L.

Garden egg (*S. macrocarpon* L.) is a leafy vegetable widely consumed in several countries of West Africa and South America. Despite the importance of *S. macrocarpon* in Africa, this plant is still neglected and underutilized. The interest in this leafy vegetable could be explained by the fact that many consumers of all ages like it. *S. macrocarpon* is rich in protein, fiber, calcium, iron, potassium, magnesium, phosphorus and sodium (Agoreyo, 2012), but less than 40% of people know the usefulness of this vegetable. The attention of scientists and policymakers has been focused on potato, tomato and peppers. Information on other regionally important *Solanum* crops is lacking. Emphasis is now placed on use of organic manures instead of inorganic sources of nutrients because of the need to take pure foods devoid of chemical elements that are easily absorbed from inorganic sources of nutrients (Hossain, 2017). The specific objectives of this study are; to assess the growth performance of *Solanum macrocarpon* L. to different rates of poultry manure, to evaluate the yield of *Solanum macrocarpon* L in terms of leaf production, to recommend the optimum application rate for the leaf production of *Solanum macrocarpon* L. Virtually no research has been done



to enhance the germ plasm potential or to study its agronomic requirements. Consequently, cultivated varieties are still landraces and their cultivation is in drastic decline due to pest and diseases pressures, poor yield and small fruit sizes.

Cultivation for improved production is no longer an option, but a dire need to meet the requirements of both farmers and consumers in Africa. The knowledge of diversity and characteristics of existing landraces, and farmers' selection criterion are a pre-requisite for designing a concrete breeding programme (Adoukonou-Sagbadija *et al.* 2006). Lack of this information places *Solanum macrocarpon* in danger of continued genetic erosion and disappearance. Propagation by seed enhanced with organic manure will help to bring back the vegetable to be more readily available in the market and for consumption.

METHODOLOGY

Experimental Site

The experiment was carried out within the premises of Federal College of Forestry Jericho Ibadan, situated at Jericho hill under Ibadan South West local government area of Oyo State.. The area is situated in the rainforest agro ecological zone of Nigeria and lies on latitude 7°54'N and longitude 3°34' E above sea level.. The average annual rainfall ranges from 1300mm-1400mm.and the average temperature is about 26°C with the average humidity of 75-80% with two district season of wet (April-October) and dry (November - March). (FRIN Meteorological Station, 2018).

The following materials are used for this study; Top soil, *Solanum macrocarpon* seeds, Poultry manure, Polythene pots, Hoe, Weighing balance, Sieve or Perforated bowl, Watering can, Vernier caliper, Measuring Ruler, Hand glove, Hand trowel, Paper tape, Measuring tape, Recording book and pen, Sensitive scale, Graph book. The seeds of *Solanum macrocarpon* L. was gotten from NIHORT (National Institute of Horticulture and Research), top soil from the college and other materials were collected from the Horticultural garden of Federal College of Forestry, Ibadan.

The experiment was laid out in a completely randomized design (CRD), the seeds of *Solanum macrocarpon* was raised in a germination bowl for two weeks using top soil. The soil sample was collected and sieved to separate all unwanted materials contained in the soil sample. 2kg of soil were measured into a polythene pot and there were three treatments replicated five times making a total of fifteen samples. Treatment application started two weeks after transplanting.

The treatments in the experiment were as follows;

To = (control) 2kg of topsoil equivalent to 0t/ha

T1 = 2kg of topsoil+ 30g of poultry manure equivalent to 1.5t/ha

T2 = 2kg of topsoil + 40g of poultry manure equivalent to 2t/ha

T3 = 2kg of topsoil + 50g of poultry manure equivalent to 2.5t/ha

The sensitive scale was used to measure the air dried manure and was mixed together with the top soil with the use of hand trowel inside the polythene pot. The mixture was watered for complete two weeks so that the poultry manure will be able to decay into the soil, two weeks old *Solanum macrocarpon* L. seedlings were transplanted after two weeks of emergence and data were taken on the following parameters;

a. Plant Height; each plant height was measured by the use of measuring rule graduated in centimeters.

b. Number of Leaves; the leaf number was taken by counting the leaves



c. Leaf Area (cm²); leaf width and length was determined destructively using the graph method.

This was done by counting the number of squares covered by the leaf and multiplying it by the number of the graph unit.

d. Stem diameter; the diameter of the stem was determined using vernier calliper

e. Fresh Harvest Weight; the fresh weight of leaf (vegetables) harvested was taken using sensitive scale.

The physio-chemical analysis of the soil used for planting and chemical analysis of poultry manure used was carried out at the Bio-Science Laboratory, Forestry Research Institute of Nigeria (FRIN) and the result is presented in Table 1 and 2 respectively. All the data collected were subjected to Analysis of Variance (ANOVA) and means were separated using Duncan's Multiple Range Test (DMRT).

Table 1: Physico-chemical Properties of Soil Used for the Experiment

Parameters	Properties
PH (H ₂ O)	6.27
Organic Carbon (O.C) %	1.48
Organic Mineral (OM) %	2.55
Total Nitrogen (TN) %	0.8
K (Cmol/kg)	0.8
Na (Cmol/kg)	1.16
Ca (Cmol/kg)	0.18
Mg (Cmol/kg)	0.82
Mn (mg/kg)	192
Cu (mg/kg)	2.46
Zn (mg/kg)	15.5
Fe (mg/kg)	260
P (mg/kg)	8.84
% Sand	61.5
% Clay	14.0
% Silt	24.5

Source: Bio- Science Department, Forestry Research Institute of Nigeria (FRIN)

Table 2: Chemical Analysis of the Poultry Manure Used for the Experiment

Parameters	Properties
Ca%	7.663
Mg%	1.088
Na%	0.313
K%	0.313
Mn%	0.003
Fe%	0.125
Cu%	0.004
Zn%	6.340
P%	0.410
T.N%	12.00
O.C	13.40
O.M	23.10

Source: Bio-Science Department, Forestry Research Institute of Nigeria (FRIN)

RESULTS AND DISCUSSION

Plant Height

Table 3 presented results on the effects of poultry manure on plant height of eggplant. The result shows that there was a significant ($P \leq 0.05$) effect of the treatment on the plant height throughout the study period. The result further indicated that, the treatment application of T_3 (2.5 t/ha of poultry manure) produced the tallest plants even though statistically ($P \leq 0.05$) similar with T_2 (2.0 t/ha) but significantly ($P \leq 0.05$) better than the other rates considered. Control plot (0 t/ha) produced the least plant height though statistically ($P \leq 0.05$) similar with T_1 (1.5 t/ha) except at 3 WAP. The significant difference observed in this study where plant height increased with increase in poultry manure rates revealed the importance of organic fertilizer in eggplant production. The result of this study corroborates the findings of *Agbede et al.*, (2008), and *Ewulo et al.*, (2008) that reported that poultry manure is not only a cheap and an effective source of N for sustainable crop production, but improves soil physical properties by reducing temperature, bulk, density, and increasing total porosity, if higher rates are applied. This result also lend support to the report of *Alarima et al.* (2022) Who reaffirmed that Gateway Organic Fertilizer increased growth and yield of cucumber fruits. This could be as a result of organic fertilizer that established and maintained soil physical condition for plant growth.

Table 3: Effects of Poultry Manure on Plant Height of Eggplant

Weeks after Planting						
Treatments	1	2	3	4	5	6
T_0	3.98 ^b	4.26 ^b	4.60 ^c	5.24 ^b	5.56 ^b	6.30 ^c
T_1	4.78 ^{ab}	5.18 ^{ab}	5.58 ^{ab}	6.00 ^b	6.36 ^b	6.76 ^{bc}
T_2	5.30 ^a	5.54 ^a	6.22 ^{ab}	7.10 ^a	7.42 ^a	7.72 ^{ab}
T_3	5.72 ^a	6.02 ^a	6.68 ^a	7.58 ^a	8.08 ^a	8.48 ^a
LS	*	ns	*	*	*	*
SE \pm	0.38	0.37	0.45	0.53	0.56	0.49

NOTE: LS = Level of significance, SE = Standard error, * = Significant @ 0.05 probability level. Means followed by the same letter in a column are statistically same by DMRT

Number of Leaves

The results on table 4 showed that there was a significant ($P \leq 0.05$) effect of the treatment on the number of leaves among the treatments at 3 to 6 weeks after planting. The result further indicated that, the treatment application of T_2 (40g of poultry manure) produced the highest number of leaves. The T_2 application (40g of poultry manure) produced the highest number of leaves at weeks 3, 4 and 5 while T_3 application (50g of poultry manure) produced the highest at 6 weeks after planting (27.00 leaves) with increase in the rate of poultry manure and was significantly ($P \leq 0.05$) different from T_2 (23.80 leaves). The least number of leaves was recorded in T_0 (16.20 leaves) and was not significantly ($P \leq 0.05$) different from T_1 application (16.30 leaves). The significant difference ($P \leq 0.05$) observed in this study where plant height increased with increase in poultry manure rates revealed the importance of organic fertilizer in eggplant production. This result is in support of the findings of *Pujiastuti, E S, et al.*, (2018), which was also confirmed by *Rego, A.F., et al.*, (2019) that Chicken dung supplies nutrients to the growth of leaf size which increase the leaf area and in turns, increase photosynthesis to give energy to plant to support the plant growth.

Table 4: Effects of Poultry Manure on Number of Leaves of Eggplant

Weeks						
Treatments	1	2	3	4	5	6
T ₀	2.80 ^a	5.20 ^a	6.20 ^c	7.80 ^c	11.60 ^c	16.20 ^b
T ₁	2.60 ^a	4.60 ^a	8.20 ^b	11.60 ^a	13.40 ^{bc}	16.80 ^b
T ₂	3.20 ^a	5.20 ^a	10.80 ^a	16.60 ^a	18.60 ^a	23.80 ^a
T ₃	2.40 ^a	4.60 ^a	10.60 ^a	15.00 ^a	16.40 ^{ab}	27.00 ^a
LS	ns	ns	*	*	*	*
SE±	0.17	0.17	1.09	1.95	1.56	2.65

NOTE: NOTE: LS = Level of significance, SE = Standard error, * = Significant @ 0.05 probability level. Means followed by the same letter in a column are statistically same by DMRT.

Stem Girth

The result obtained from table 5 showed that there were significant ($P \leq 0.05$) differences among the treatments on the stem girth in weeks 1 to 6. The result showed that there was no significant ($P \leq 0.05$) difference in T₂ and T₃ application in weeks 1 to 6 having 5.64 and 5.62 mm respectively.

The least mean was obtained in the control (3.85) and was not significantly different from T₁ application (4.81). The effect of organic fertilizer on the stem girth of eggplant. This result was supported by Mpanga *et al.*, (2021) and stated that Poultry manure had positive effects on growth and yield of garden egg and this could be attributed to the fact that poultry manure contained essential nutrient elements associated with high photosynthetic activities and thus promotes roots and vegetative growth.

Table 5: Effects of Poultry Manure on Stem Girth of Eggplant

Weeks						
Treatments	1	2	3	4	5	6
T ₀	0.40 ^c	0.94 ^b	1.21 ^c	1.88 ^b	2.75 ^b	3.85 ^b
T ₁	0.79 ^{bc}	1.66 ^a	2.01 ^b	2.43 ^b	3.99 ^a	4.81 ^{ab}
T ₂	1.35 ^{ab}	2.08 ^a	2.81 ^a	3.16 ^a	4.80 ^a	5.64 ^a
T ₃	1.03 ^{ab}	1.64 ^a	2.32 ^{ab}	3.51 ^a	4.83 ^a	5.62 ^a
LS	*	*	*	*	ns	ns
SE±	0.20	0.24	0.34	0.37	0.49	0.42

NOTE: LS = Level of significance, SE = Standard error, * = Significant @ 0.05 probability level. Means followed by the same letter in a column are statistically same by DMRT.

Leaf Area

Table 6 showed that there were significant ($P \leq 0.05$) difference among the treatments at weeks 3 to 6 after transplanting. The study of the result showed that T₃ application had the highest leaf area and was not significantly ($P \leq 0.05$) different from T₃. T₃ and T₂ application having 111.06 mm² and 100.43 mm² respectively at 6 weeks after planting while the least leaf area was obtained in the control (T₀) having 36.78 mm². This result supports the result of Rego, *et al.*, (2019) and Pujiastuti, *et al.*, (2018) that stated that, the high concentration of nitrogen in chicken dung helps for the formation of large cells and causes plant leaves to form larger such as being wider as well as vigorous. Nitrogen also helps in formation of chlorophyll where addition of chicken dung makes plant leaves become greener.

Table 6: Effects of Poultry Manure on Leaf Area of Eggplant

Weeks						
Treatments	1	2	3	4	5	6
T ₀	4.52 ^a	7.78 ^a	10.57 ^b	13.81 ^b	25.61 ^c	36.78 ^c
T ₁	10.12a ^b	13.45 ^a	19.87 ^b	30.32 ^b	50.76 ^b	74.18 ^b
T ₂	11.89 ^a	15.65 ^a	37.45 ^a	61.27 ^a	79.98 ^a	100.43 ^a
T ₃	8.29 ^{ab}	13.59 ^a	33.52 ^a	59.46 ^a	82.07 ^a	111.06 ^{ab}
LS	ns	ns	*	*	*	*
SE±	1.58	1.69	6.20	11.56	13.40	16.54

NOTE: LS = Level of significance, SE = Standard error, * = Significant @ 0.05 probability level. Means followed by the same letter in a column are statistically same by DMRT.

Fresh Weight

The fresh harvest weight result obtained showed that there were significant ($P \leq 0.05$) differences among the treatments at 1 to 3 weeks after maturity. The highest fresh weight was obtained in T₂ application at week 3 (23.80g), followed by T₃ application (15.87g) in week 2, and T₁ application (13.46g) which was not significantly ($P \leq 0.05$) different from T₂ application (15.65g) and the least result was obtained in the control (3.24g).

Table 7: Effects of Poultry Manure on Fresh Harvest Weight of Eggplant

Weeks			
Treatments	1	2	3
T ₀	3.24a	5.20a	8.48b
T ₁	7.18b	9.25b	13.46ab
T ₂	11.22a	15.65a	23.80a
T ₃	14.30a	15.87a	8.48b
LS	*	*	*
SE±	2.41	2.60	3.61

NOTE: LS = Level of significance, SE = Standard error, * = Significant @ 0.05 probability level. Means followed by the same letter in a column are statistically same by DMRT.

CONCLUSION AND RECOMMENDATION

Based on the result obtained from this study, it is therefore concluded and recommended that T₃ which is (2.5t/ha of poultry manure) is encouraged for growth in terms of plant height, number of leaves, and leaf area while T₂ which is (2.0t/ha of poultry manure) is optimum for highest leaf production and larger stem diameter in the study area.

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