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Original Article

Effects of Different Rates of Poultry Manure on Early Seedling Development and Productivity of Solanum lycoperscium

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This study was carried out to ascertain the effects of different rates of poultry manure on early seedling development and productivity of Solanum lycopersicum (tomato). The experiment was carried out at Nnamdi Azikwe University Awka. Randomized Complete Block Design was used for the study. 25kg of sandy loam soil was used and different concentrations of organic manure (poultry waste) 5kg, 10kg, 15kg and 20kg was used to treat the soil. Growth parameters such as changes in length, girth, leaf area and number of leaves were measured on weekly bases and recorded accordingly. The physicochemical properties of the soil sample and poultry manure is shown in Table 1. The table revealed that the soil sample contained higher composition of sand than silt and clay. The poultry manure contained higher pH, organic carbon, available phosphorus, potassium ion and calcium ion than the soil samples. The effect of different rates of poultry manure on percentage germination of Solanum lycopersicum was shown in Table 2. The table revealed that the rate of 20 kgha-1 gave the highest percentage germination of Solanum lycopersicum (85.44±4.915 %) while the control (0 kgha-1) gave the lowest percentage germination of Solanum lycopersicum. The table 3 revealed that the rate of 20 kgha-1gave the highest height increase from 7.23±0.252 cm in week 2 to 40.27±1.736 cm in week 6, while the control (0 kgha-1) gave the lowest height increase from 3.60±0.458 cm in week 2 to 11.48±1.283 cm in week 6. The effect of different rates of poultry manure on the weekly leaf area of Solanum lycopersicum revealed that the rate of 20 kgha-1 gave highest leaf area increase from 8.62±0.352 cm2 in week 2 to 34.95±2.242 cm2 in week 6, while the control (0 kgha-1) gave lowest leaf area from 4.27±0.202 cm2 in week 2 to 12.67±1.190 cm2 in week 6. Table 5 revealed that the rate of 20 kgha-1 gave the highest girth increase from 0.83±0.029 cm in week 2 to 2.26±0.185 cm in week 6, while the control (0 kgha-1) gave the lowest girth increase from 0.65±0.050 cm in week 2 to 1.31±0.056 cm in week 6. The rate of 20 kgha-1 manure gave the highest number of branches from 1.33±0.577 in week 2 to 4.67±0.577 in week 6, while the control (0 kgha-1) gave the lowest number of branches from 1.00±0.000 in week 2 to 2.00±1.000 in week 6. The rate of 20 kgha-1 also gave highest number of trusses (27.37±0.058), flowers (109.12±0.069), fruits (21.28±0.023), fruit weight (8634.43±0.075 g ha-1) and seed weight (20.65±0.033 g ha-1), while the rate of 0 kgha-1 gave lowest number of trusses (14.08±0.002), flowers (65.58±0.040), fruits (12.58±0.063), fruit weight (3813.33±0.044 g ha-1) and seed weight (14.66±0.029 g ha-1). This study has demonstrated that poultry manure can be used to enhance the growth and yield of tomato in low nutrient soil. The study showed that the rate of 20 kgha-1showed a significant improvement on the growth and yield of S. lycopersicum over 0, 5, 10 and 15 kgha-1.

Keywords: Tomato, Manure, Poultry, Organic, Seedling, Development, Productivity, Solanum lycopersicum

INTRODUCTION

Solanum is a dicot genus of the family Solanaceae; with about 2, 000 species, ranging from food crops, such as the potato and the tomato, to various ornamentals and medicinal species [1]. The family Solanaceae contains both annuals to perennials with everything from vine, subshrub, shrub and even small tree habits. Tomato plants are vines, initially decumbent, typically growing 180 cm (6 ft) or more above the ground if supported, although erect bush varieties have been bred, generally 100 cm (3 ft) tall or shorter. Tomato vines are typically pubescent, meaning covered with fine short hairs. These hairs facilitate the vining process, turning into roots wherever the plant is in contact with the ground and moisture, especially if the vine's connection to its original root has been damaged or severed [2]. Most tomato plants have compound leaves, and are called regular leaf (RL) plants, but some cultivars have simple leaves known as potato leaf (PL) style because of their resemblance to that particular relative. The leaves are 10–25 cm (4–10 in) long, odd pinnate, with five to 9 leaflets on petioles [3], each leaflet up to 8 cm (3 inch) long, with a serrated margin; both the stem and leaves are densely glandular-hairy [4].

Tomato is an important vegetable grown commercially in large scale because it is a cheap source of vitamin C. Tomato ranks number one in their contribution to the diet, hence consumed in large quantities. Fresh tomato provides half the recommended dietary allowance of vitamin C for an adult for a day [5]. The fruit may be eaten raw with salad or more frequently cooked into stew, savoury dishes, made into pure sauce juice and ketchup [6]. They are refreshing in beverages and are especially good as flavorings for soup. Tomato can be used to give colour and make green salads more inviting [7].

Medicinally, tomato and tomato products have a health promoting power because it is rich in folic acid, vitamin C, potassium and oxalic acid [8]. In the human diet, it is an important source of micronutrients; certain minerals (notably potassium) and carboxylic acids, including ascorbic, citric, malic, fumaric and oxalic acids [9]. Tomatoes and tomato products are rich in food components that are antioxidant and considered to be a source of carotenoids, in particular lycopene and phenolic compounds [10], but low in fat and calories, as well as being cholesterol-free. Most importantly, tomato consumption has been shown to reduce the risks of cardiovascular disease and certain types of cancer, such as cancers of prostate, lung and stomach [11]. The health promoting benefits of tomatoes and tomato products have been attributed mostly to the significant amount of lycopene contained. The results of various studies suggest that lycopene plays a role in the prevention of different health issues, cardiovascular disorders, digestive tract tumors and in inhibiting prostate carcinoma cell proliferation in humans [12].

As a potent antioxidant, lycopene is presently marketed as a fortified nutritional supplement [13]. Tomato seeds, which contain 24% oil, are also of medicinal value. According to Chassy *et al*. [14], they promote gastric secretion, act as blood purifier and keep intestines in good condition. The despite the immense importance of tomato, the yield in Nigeria, especially in Southern eastern part is very low, when compared to other parts. There is widespread of soil degradation which is brought about by loss of organic matter, which consequently results in soil acidity, nutrient imbalance and low crop yields [15].

Solanum lycoperscum is known to be a low management crop that can grow in poor soils but studies have shown that its yields could be improved by application of fertilizers and manures [16]. Cvetkovic and Markovic [17] reported that like any other crop, *S. lycoperscum* responds well to

good soil fertility and organic matter. Some of the problems encountered by tomato growers include decreasing soil fertility and quantity of compost required for optimum crop productivity [18, 19].

The use of organic manure is a more practical way of improving and maintaining soil fertility status. It is more economical, and has a long lasting effect on the soil, when decomposed totally or partially by soil microbes and is also environmental friendly [20]. This is because nutrients contained inorganic manures are released more slowly and are stored for a longer time in soil, thereby ensuring a long residual effect [21]. In many tropical soils, organic manure has been reported to be the major sources of nitrogen, phosphorus, potassium, calcium as well as magnesium [22]. Organic manure when properly applied has the potentials of improving soil infiltration capacity, as well as impact beneficial effects on the structure of the soil [23].

Poultry manure, sometimes called chicken manure, is an excellent soil amendment that provides nutrients for plant growth. The chemical composition of poultry manure varies with factors such as source of manure, feed on the birds, age, and condition of the birds, storage, handling of manure, and litter used. Poultry waste consists of droppings, wasted feed and broken egg. It also includes the dead birds and hatchery waste which all contain high amount of protein and calcium [24].

Binoy *et al.* [25] reported that addition of poultry and cattle manure to soil lead to increase in soil PH, Organic Carbon, Nitrogen, Phosphorus, Calcium, Potassium, Magnesium, Sodium and CEC. The hazardous environmental consequences and high cost of inorganic fertilizers make them not only undesirable but also uneconomical and out of reach of the poor farmers who still dominate the Nigerian agricultural sector [26]. This has led to increased use of organic manure, a readily available alternative, which proves more environmentally friendly [27].In recent times, attention has been directed towards organic manure because of the rising cost of inorganic fertilizers coupled with their inability to give the soil the desired sound health. This study was carried out to compare the productivity of *Solanum lycopersicum* treated with different rates of organic manure (Poultry manure).

MATERIALS AND METHOD

Experimental Location

The field study was conducted at Nnamdi Azikiwe University Awka, Nigeria; geographically located within latitude 6.21° North 7.07° East longitude and 136 meters elevation above the sea level. Total annual rainfall ranges between 1828mm – 2000mm per year with average temperature of 27°C.

Source of Materials

Seedlings of *Solanum lycopersicum* used in this work were obtained under special arrangement from a farmer from Nibo Village, in Awka South Local Government Area, of Anambra State in 2017. The plant seeds were authenticated by Prof. C.U. Okeke, a plant taxonomist in the Department of Botany, Nnamdi Azikiwe University. Organic manure (the poultry manure) was obtained from Arroma poultry farm. Sandy loamy soil obtained from within the University premises was used while thirty nylon bags which was perforated at the base to allow for adequate water drainage was bought in a nearby market.

Materials used

- *Solanum lycopersicum* seeds
- Organic manure (poultry manure).
- A record book for keeping experimental data during the course of the experiment

- Weighing balance was used for weighing the soil and organic manure.
- Ruler and measuring tape was used for measurements.
- Thread was used for measuring the girth of the plant.
- Cutlass was used for clearing the mapped area.
- Marker was used for marking inscription

Masking tape was used for marking and identifying the different treatments and their replicates.
Polythene bags were used for planting the *Solanum lycopersicum*

Experimental design

Prior to seed sowing, the soil was measured (25kg) with a weighing balance and mixed uniformly with poultry manure at different rates and was filled in perforated polythene bags. These treatments include poultry manure and control without any treatment. Each of these treatments was replicated thrice making a total of 15 perforated polythene bags.

For treatments with poultry manure the soil was mixed uniformly with 5kg, 10kg, 15kg, and 20kg of poultry manure respectively in each perforated bag. The polythene bags were arranged vertically according to each treatment at different rates and finally the non treated bags which serve as control.

Cultural practices

The cultural practices adopted during the experiment include the following:

- Weeding: this was done weekly by hand picking.
- Watering: this was done once a week since rainfall at the time of the experiment was heavy and continuous.

Data collection

Data collection on plant height, stem girth, number of leaves and leaf area was started at 1 week after planting and the plants were harvested 6 weeks after planting. The leaf growth parameters were measured on all the leaves on each plant and the average was obtained and used for data analysis. The leaf area was measured by multiplying the leaf length by the leaf width. Plant height was measured using a measuring tape to determine the distance from the soil surface at the base of the leaf to the apex of the leaf, while stem girth was determined using thread and meter rule. The number of leaves was measured quantitatively by counting.

Statistical Analysis

Data collected were analyzed using one way analysis of variance and mean separation by Duncan Multiple Range Test (DMRT) and LSD using Statistical Package for social sciences (SPSS) version 21. All statistical analysis was carried out at 0.05 level of significance.

RESULT

Physicochemical properties of the soil sample and poultry manure

The physicochemical properties of the soil sample and poultry manure is shown in Table 1. The table revealed that the soil sample contained higher composition of sand (82.20 %) than silt (10.90 %) and clay (6.90 %). The pH of the soil is fairly acidic (5.90) with low organic carbon (0.58 mg kg^{-1}) and total nitrogen content (0.46 mg kg^{-1}). The poultry manure contained higher pH (7.20), organic carbon (8.30 mg kg^{-1}), total nitrogen (1.26 mg kg^{-1}), available phosphorus (6.90 mg kg^{-1}), potassium ion (8.03 $Cmolkg^{-1}$) and calcium ion (3.08 $Cmolkg^{-1}$) than the soil samples.

Table 1: Physicochemical properties of soil sample and poultry manure

Properties	Soil sample	Poultry manure
Sand	82.20	-
Silt	10.90	-
Clay	6.90	-
pH (H_2O)	5.90	7.20
Organic carbon (mg kg^{-1})	0.58	8.30
Total nitrogen (mg kg^{-1})	0.46	1.26
Av. phosphorus ($mgkg^{-1}$)	6.75	6.90
Exchangeable base ($Cmolkg^{-1}$)		
Na^+	0.16	0.12
K^+	0.17	8.03
Ca^{2+}	0.92	3.08
Mg^{2+}	1.50	0.45
CH	3.75	-

Effect of different rates of poultry manure on percentage germination of *Solanum lycopersicum* in the first week

The effect of different rates of poultry manure on percentage germination of *Solanum lycopersicum* is shown in Table 2. The table revealed that the rate of 20 $kgha^{-1}$ gave the highest percentage germination of *Solanum lycopersicum* (85.44±4.915 %) while the control (0 $kgha^{-1}$) gave the lowest percentage germination of *Solanum lycopersicum*. There was a significant difference in the percentage germination of *S. lycopersicum* between the different rates of poultry manure ($p<0.05$) (Table 2).

Table 2: Effect of different rates of poultry manure on percentage germination of *Solanum lycopersicum*

Treatment (kgha^{-1})	**Percentage Germination**
0.00	43.94±3.787^{a}
5.00	50.33±2.517^{b}
10.00	55.28±4.112^{b}
15.00	77.00±9.042^{c}
20.00	85.44±4.915^{c}
LSD	**3.544**

Results are in Mean ± Standard Deviation
Means with the same letter in a column is not significantly different (p>0.05)

Effect of different rates of poultry manure on weekly height (cm) of *Solanum lycopersicum*

The table 3 revealed that the rate of 20 kgha^{-1}gave the highest height increase from 7.23±0.252 cm in week 2 to 40.27±1.736 cm in week 6, while the control (0 kgha^{-1}) gave the lowest height increase from 3.60±0.458 cm in week 2 to 11.48±1.283 cm in week 6. There was a significant difference in the weekly height of *S. lycopersicum* between the different rates of poultry manure ($p<0.05$) (Table 3).

Table 3: Effect of different rates of poultry manure on the weekly height (cm) of *Solanum lycopersicum*

Treatment (kgha^{-1})	**Week 2**	**Week 3**	**Week 4**	**Week 5**	**Week 6**
0.00	3.60±0.458^{a}	4.06±0.907^{a}	6.83±0.965^{a}	11.06±1.097^{a}	11.48±1.283^{a}
5.00	4.07±0.252^{ab}	4.55±0.732^{a}	7.58±0.177^{a}	11.90±0.306^{a}	12.42±0.071^{a}
10.00	4.43±0.351^{b}	7.20±1.127^{b}	8.00±0.297^{a}	14.83±0.689^{b}	15.39±1.119^{b}
15.00	5.76±0.458^{c}	7.75±1.795^{b}	13.18±0.753^{b}	22.55±0.783^{c}	23.97±1.603^{c}
20.00	7.23±0.252^{d}	9.02±0.283^{b}	24.24±1.043^{b}	38.74±1.089^{d}	40.27±1.736^{d}
LSD	0.242	0.721	0.487	0.559	0.862

Results are in Mean ± Standard Deviation
Means with the same letter in a column is not significantly different (p>0.05)

Effect of different rates of poultry manure on the weekly leaf area (cm^2) of *Solanum lycopersicum*

The effect of different rates of poultry manure on the weekly leaf area of *Solanum lycopersicum* is shown in Table 4. The table revealed that the rate of 20 $kgha^{-1}$ gave highest leaf area increase from 8.62±0.352 cm^2 in week 2 to 34.95±2.242 cm^2 in week 6, while the control (0 $kgha^{-1}$) gave lowest leaf area from 4.27±0.202 cm^2 in week 2 to 12.67±1.190 cm^2 in week 6. There was a significant difference in the weekly leaf area of *S. lycopersicum* between the different rates of poultry manure ($p<0.05$) (Table 4).

Table 4: Effect of different rates of poultry manure on the weekly leaf area (cm^2) of *Solanum lycopersicum*

Treatment ($kgha^{-1}$)	Week 2	Week 3	Week 4	Week 5	Week 6
0.00	4.27±0.202^{a}	7.53±3.281^{a}	7.96±0.571^{a}	12.19±1.125^{a}	12.67±1.190^{a}
5.00	5.21±0.408^{b}	6.92±1.169^{a}	10.35±3.252^{ab}	17.12±6.899^{ab}	18.63±6.600^{ab}
10.00	6.04±0.056^{c}	9.17±2.087^{a}	13.27±5.367^{bc}	22.07±8.908^{bc}	23.43±9.400^{bc}
15.00	6.60±0.201^{d}	7.96±0.277^{a}	16.74±4.657^{bc}	28.20±7.174^{bc}	30.23±7.574^{bc}
20.00	8.62±0.352^{e}	16.13±0.658^{b}	19.69±1.091^{c}	33.29±3.673^{c}	34.95±2.242^{c}
LSD	0.181	1.220	2.341	4.113	4.140

Results are in Mean ± Standard Deviation

Means with the same letter in a column is not significantly different ($p>0.05$)

Effect of different rates of poultry manure on the weekly stem girth (cm) of *Solanum lycopersicum*

Table 5 revealed that the rate of 20 $kgha^{-1}$ gave the highest girth increase from 0.83±0.029 cm in week 2 to 2.26±0.185 cm in week 6, while the control (0 $kgha^{-1}$) gave the lowest girth increase from 0.65±0.050 cm in week 2 to 1.31±0.056 cm in week 6. There was a significant difference in the weekly stem girth of *S. lycopersicum* between the different rates of poultry manure ($p<0.05$) (Table 5).

Table 5: Effect of different rates of poultry manure on the weekly stem girth (cm) of *Solanum lycopersicum*

Treatment ($kgha^{-1}$)	Week 2	Week 3	Week 4	Week 5	Week 6
0.00	0.65 ± 0.050^{a}	0.88 ± 0.060^{a}	1.18 ± 0.071^{a}	1.23 ± 0.068^{a}	1.31 ± 0.056^{a}
5.00	0.72 ± 0.029^{ab}	0.99 ± 0.087^{a}	1.32 ± 0.070^{a}	1.38 ± 0.069^{a}	1.49 ± 0.045^{a}
10.00	0.73 ± 0.050^{bc}	0.98 ± 0.067^{ab}	1.68 ± 0.153^{b}	1.82 ± 0.165^{b}	1.94 ± 0.170^{b}
15.00	0.80 ± 0.023^{c}	1.11 ± 0.081^{b}	1.89 ± 0.147^{c}	2.04 ± 0.156^{c}	2.23 ± 0.101^{c}
20.00	0.83 ± 0.029^{c}	1.48 ± 0.032^{c}	2.17 ± 0.09^{d}	2.21 ± 0.095^{c}	2.26 ± 0.185^{c}
LSD	**0.021**	**0.047**	**0.075**	**0.078**	**0.084**

Results are in Mean ± Standard Deviation
Means with the same letter in a column is not significantly different (p>0.05)

Effect of different rates of poultry manure on the weekly number of branches of *Solanum lycopersicum*

The table revealed that the rate of 20 $kgha^{-1}$ manure gave the highest number of branches from 1.33±0.577 in week 2 to 4.67±0.577 in week 6, while the control (0 $kgha^{-1}$) gave the lowest number of branches from 1.00±0.000 in week 2 to 2.00±1.000 in week 6. There was a significant difference in the number of branches of *S. lycopersicum* between the different rates of poultry manure at the fifth week ($p<0.05$) (Table 6).

Table 6: Effect of different rates of poultry manure on weekly number of branches of *Solanum lycopersicum*

Treatment ($kgha^{-1}$)	Week 2	Week 3	Week 4	Week 5	Week 6
0.00	1.00 ± 0.000^{a}	1.00 ± 0.000^{a}	1.67 ± 0.577^{a}	1.67 ± 0.577^{a}	2.00 ± 1.000^{a}
5.00	1.33 ± 0.577^{a}	1.33 ± 0.577^{a}	2.00 ± 1.000^{b}	2.00 ± 1.000^{a}	2.33 ± 0.577^{a}
10.00	1.00 ± 0.000^{a}	1.33 ± 0.577^{a}	2.00 ± 1.000^{b}	2.00 ± 1.000^{a}	2.67 ± 0.577^{a}
15.00	1.00 ± 0.000^{a}	2.33 ± 0.577^{a}	3.67 ± 0.577^{b}	4.33 ± 0.577^{b}	4.33 ± 1.155^{b}
20.00	1.33 ± 0.577^{a}	2.00 ± 1.000^{b}	3.33 ± 1.528^{b}	4.00 ± 1.000^{b}	4.67 ± 0.577^{b}
LSD	**0.241**	**0.418**	**0.074**	**0.079**	**0.085**

Results are in Mean ± Standard Deviation
Means with the same letter in a column is not significantly different (p>0.05)

Effect of different rates of poultry manure on the productivity of *Solanum lycopersicum* at 10 weeks after planting

Table 7 revealed that the rate of 20 kgha^{-1} gave highest number of trusses (27.37±0.058), flowers (109.12±0.069), fruits (21.28±0.023), fruit weight (8634.43±0.075 g ha^{-1}) and seed weight (20.65±0.033 g ha^{-1}), while the rate of 0 kgha^{-1} gave lowest number of trusses (14.08±0.002), flowers (65.58±0.040), fruits (12.58±0.063), fruit weight (3813.33±0.044 g ha^{-1}) and seed weight (14.66±0.029 g ha^{-1}). There was a significant difference in all productivity parameters of *S. lycopersicum* between the different rates of poultry manure ($p<0.05$) (Table 7).

Table 7: Effect of different rates of poultry manure on the productivity of *Solanum lycopersicum* at 10 weeks

Treatment (kgha^{-1})	No. of trusses	No. of flowers	No. of fruits	Fruit weight (gha^{-1})	Seed weight (gha^{-1})
0.00	14.08±0.002^{a}	65.58±0.040^{a}	12.58±0.063^{a}	3813.33±0.044^{a}	14.66±0.029^{a}
5.00	19.83±0.043^{b}	89.75±0.015^{b}	15.33±0.008^{b}	6920.00±0.075^{b}	14.80±0.018^{b}
10.00	20.75±0.012^{c}	98.00±0.028^{c}	17.50±0.045^{c}	7413.33±0.003^{c}	18.13±0.068^{c}
15.00	23.18±0.011^{d}	101.20±0.053^{d}	18.08±0.033^{d}	8570.66±0.081^{d}	18.53±0.075^{d}
20.00	27.37±0.058^{e}	109.12±0.069^{e}	21.28±0.023^{e}	8634.43±0.075^{e}	20.65±0.033^{e}
LSD	**0.021**	**0.030**	**0.030**	**0.042**	**0.036**

Results are in Mean ± Standard Deviation
Means with the same letter in a column is not significantly different ($p>0.05$)

DISCUSSION

The result indicated that the experimental soil sample was fairly acidic and low in total nitrogen and organic carbon. This is in agreement with the study of Heeb [22] who showed that due to poor fertility management most African soils has continued to be poor in nutrient and decline in productivity. Moreover, poultry manure was found to contain appreciable higher composition of pH, organic carbon, total nitrogen and available phosphorus in comparison to the soil sample. This supports the study of Akande and Adediran [28] that poultry manure contains essential nutrients which make it suitable for the growth of many crops.

The result on effect of different rates of poultry manure on percentage germination of *S. lycopersicum* revealed that percentage germination of *S. lycopersicum* increased with rate of poultry manure application with the rate of 20kgha $^{-1}$ giving the highest percentage germination. The result may due to the fact that the higher rate of poultry manure increased the soil organic matter, macronutrient status and micronutrient qualities which are necessary for optimum germination of the crop [28, 29].

Similarly, the growth of *S. lycopersicum* assessed by height, stem girth, number of branches and leaf area increased with rate of poultry manure application, 20 $kgha^{-1}$ gave the highest growth. The increased in growth of *S. lycopersicum* with increasing rate of poultry manure all agrees with the work of Zhang *et al.* [30] who found that the number of branches significantly increases with increasing level of poultry dropping probably due to higher release of nitrogen, phosphorus and potassium. Adediran *et al*. [29] also found that poultry manure at 20 t ha^{-1} had highest nutrient contents and mostly increased yield of tomato and soil macro and micronutrients content. Caris *et al.* [23] concluded that aside from improving macronutrient availability, higher rate of poultry manure reduced soil bulk density and enhanced its moisture content. According to Adediran *et al*. [29], these improvements in soil parameters had led to significant increases in growth of tomato.
The higher stem height and girth reported by the rates of 20$kgha^{-1}$ is an indication that it will support higher competitiveness of *S. lycopersicum*. Adeniyan *et al.* [31] showed that stem height and girth increase are necessary for competition and survival. The higher number of branches and leaf area as reported by the rate of 20$kgha^{-1}$ also implies that it will support higher phytosynthetic activity and yield *S. lycopersicum* [31].
Additionally, the result of the study revealed that the productivity of *S. lycopersicum* increased with rate of poultry manure application with 20$kgha^{-1}$ giving the highest productivity as measured by trusses, number of flowers, number of fruits, fruit weight and seed weight. This agrees with the findings of Adekiya and Agbede [32], who found that increase in the concentration of poultry manure litters resulted in better yield of tomato. Increase in the number of flowers is in line with the work of Adediran [29], who found that number of flowers significantly increased with increase in the concentration of poultry droppings. Also, increase in the number fruit weight and seed weight are in agreement with the findings of Fatimah *et al.*[33] which show that tomato fruit weight increased with increasing manure concentration. Increase in the number of trusses and fruits in this study are supported by the findings of Adekiya and Agbede [32] who noted that poultry manure improves available nutrients and water holding capacity of the soil which are the prime factors for the increased in trusses and fruit yield of tomato.

CONCLUSION

Among the factors that contribute to low tomato yield in Nigeria is low soil fertility and unfavourable soil physical properties such as bulk density. This study has demonstrated that poultry manure can be used to enhance the growth and yield of tomato in low nutrient soil. The study showed that the rate of 20 $kgha^{-1}$showed a significant improvement on the growth and yield of *S. lycopersicum* over 0, 5, 10 and 15 $kgha^{-1}$. Hence, poultry manure at the rate of 20 $kgha^{-1}$ is recommended for farmers for higher growth and productivity of *S. lycopersicum*.

CONFLICT OF INTEREST

Authors declare no conflict of interest.

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