



Original Research Article

Comparative effect of organic and inorganic fertilizer sources on the growth and fruits yield of tomato (*Lycopersicum esculentum* mill.)

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One of the limiting factors to crop production in Sub-Saharan Africa is due to poor soil fertility and in order to increase the crop yield to meet ever increasing population of this region, fertilizer is required as in the form of organic or inorganic. There seems to be some level of specificity in crop adaptation to the type of fertilizer in order to increase its growth and yield potentials. So the current field experiments were conducted to study the effect of different organic and inorganic fertilizers on the growth and yield of tomatoes during 2015 and 2016 in the raining seasons at the Teaching and Research Farm of Federal University Wukari. The treatments consisted of five different types of fertilizer as inorganic: NPK, and urea, organic: poultry manure, cow dung and organic manure with a control which were applied to tomato variety (NWe- 158) in randomize complete block design replicated three times. Data were collected on the growth and yield parameters and analyzed using (ANOVA) at 5% level of probability. The results showed a significant effect ($P < 0.05$) by the treatments on growth and yield parameters of tomato. The application of poultry manure significantly produced higher number of leaves, nodes, flowers, and fruits. While organic manure treatment gave significant higher plant height. Hence poultry manure produced best result for the production of tomatoes.

Key words: Tomato, poultry manure, urea, organic manure, cow dung, NPK, growth, fruit yield.

INTRODUCTION

Adequate fertilizer is prerequisite way to combat declining in crop yield which has being a major concerned in the crop and vegetable production in Sub-Sahara region of the world. Hence the studies assess the effect of different fertilizer sources on the growth and yield of tomato. Tomato (*Lycopersicon esculenta* mill) is one of the most important edible and nutritious vegetable crops in Nigeria and widely cultivated in tropical, sub-tropical and temperate climates in the world. It is ranks first important fruit vegetables follow by pepper (Olaniyi and Ojetayo, 2010). In Nigeria tomato has been an indispensable part of the daily diet of millions which is used in preparation of soup and stew when cooked with pepper and onions. It is also used in the preparation of salad and as a condiment in

flavor of processed meat. It can also be processed into purees, juices and ketchup (Denton and Swarp, 1983). Tomato is rich in minerals, vitamins, essential amino acid, sugar, and dietary fibers and contains much vitamin B and C iron and phosphorus (Fatimah et al., 2016). One of the limiting factors affecting the production of tomato is due to poor soil fertility of most of the arable farm land due to continuous cropping resulted from land availability. The way out of this problem is the application of fertilizers either as organic or inorganic. Organic fertilizers such as poultry manure, cow dung, compost are been reported to provide significant quantity of nutrients which are supply to the soil in slow rate over a long period which reduce the nitrate losses in drainage water (Addiscot et al., 1991). It

improves the activities of micro organism in the soil as well improves water movement and good aeration of the soil among many other advantages but the quantity, transportation, labor and cost still remain as the challenges of commercial use of organic fertilizers. Inorganic fertilizers are also been used by farmers in the production of crops and vegetables and many researchers have documented reports on the increased yield of various crops through its application (Akanbi, 2007). Among the commonly used inorganic fertilizers by vegetable farmers are the NPK and Urea but the scarcity and high price of these fertilizers remain a challenges facing crop production especially in the this region. There is a little or no information available on the effectiveness and efficacy of these fertilizers in the production of tomato hence this study is design to compare the effect of organic and inorganic fertilizers treatments on the growth and fruit yield of tomato in order to recommends the best fertilizer for the production of this crop in the study area.

MATERIALS AND METHODS

Experiment site

The current studies were carried out at the Teaching and Research Farm of Federal University Wukari, Taraba state, Nigeria during the raining seasons of 2015 and 2016 to study the effect of organic and inorganic fertilizer application on the growth and fruits yield of tomato. Taraba state lies between latitude 6°30', 8° 30'N of the equator and longitude 9° and 12°E of the Greenwich meridian with a land mass of 54.426km². The state has a tropical wet – dry climate, well drained alluvial soils and has both savannah and Rain forest vegetation. The rainfall ranges from 100 mm to 250 mm per annum in the north with the driest and wettest season lasting from December to February and July to September, respectively. Soil sample of the site was collected at 15cm depth using an auger and poultry manure collected was taken for analysis while the land was ploughed and harrowed. The soil was analyzed for P^H, nitrogen, carbon, organic matter and the concentration of phosphorus, calcium and magnesium.ing. The soil P^H was determined using the distilled water in KCL with a soil water ratio of 1:2.5. The suspension was thoroughly stirred and allowed to stand for 30minites after which the P^H was determined using an electronic P^H meter. Total nitrogen was determined by micro Kjeldahl digestion method described by A.O.A.C (1980). The cations (Ca, Mg) were determined by the atomic absorption method as outlined in the Analysis of the official Analytical Chemists (A.O.A.C, 1980).

Experimental design and treatments

The experimental design used for the study was a complete randomized design with three replications. The treatments consisted of five different fertilizers comprising of inorganic

as Urea at 200kg/ha, NPK (15:15:15) at 400kg/ha, organic as, poultry manure (10t/ha), cow dung (10t/ha), organic manure (10t/ha) with a control, 0kg/ha which were applied to tomatoes (NWe-158) variety. The organic manures were applied to the plots at two weeks before transplanting while inorganic fertilizers are applied a week after transplanting.

Land preparation

Tomato seeds were purchased from the seed seller at wukari in Taraba state Nigeria. The seed were planted at the nursery for four weeks before transplanting. The healthy, vigorous and uniform size seedlings were selected and transplanted after 4weeks and the size of the plot used was 2m by 2m with the plant spacing of 25cm by 50cm. The total number of plot used is 18. The organic fertilizer as cow dung , poultry and organic manure were thoroughly incorporated into the soil two weeks before transplanting and the mineral fertilizer as urea and NPK was applied a week after transplanting. Weeding was done manually at two weeks after transplanting and as when necessary other cultural practices were also carried out as spraying with the use of cypermethrine at the rate of 2ml per 1liter of water starting from two weeks after planting and as when necessary to control insect pest and staking of the plant were also carried out to prevent logging especially during fruiting.

Data collection

Data were collected from the three tag plants (3 plants per plot) which were randomly selected from the net plot while the growth and yield parameters such as plant height, number of nodes, number of flowers, and number of fruits per plant were taken starting from two weeks after transplanting and continue fortnightly till the harvest.

Data analysis

The data collected were subjected to analysis of variance (ANOVA) at 5% level of probability and the mean were separated using Duncan multiple range test (DMRT).

RESULTS

Table 1 showed the result of the pre-planting soil analysis of the experiment site as loamy sand and well drain, having low nutrient and this infers that the soil needs amendment. Also the result of organic fertilizers was shown in (Table 2)

The result obtained from the study shows that application of different fertilizer improved the growth and development of the crop. The number of leave was significantly affected by the treatments applied and the poultry treatments and the poultry treatment produced significantly highest leave number followed by NPK fertilizer. The NPK fertilizer treatment result does not

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

pH	5.75
Organic carbon (%)	1.36
Organic Matter (%)	2.35
Total N (%)	0.98
Available P (mg/kg)	0.52
Exchangeable K (mol/kg ⁻¹)	1.60
Exchangeable Na (mol/kg ⁻¹)	2.10
Exchangeable Ca (mol/kg ⁻¹)	3.80
Exchangeable Mg (mol/kg ⁻¹)	1.80
Exchangeable Acidity (mol/kg ⁻¹)	1.10
TEB	9.30
CEC(c mol/kg ⁻¹)	10.4
Base Saturation (%)	89.4
Sand (g/kg)	76.80
Clay (g/kg)	15.20
Silt(g/kg)	8.00
Textural Class	Sandy loam

Table 2. The nutrient compositions of the organic fertilizers used in the study

Treatment	P ^H	%C	%N	P	K	Ca	Mg	Na
Poultry Manure	7.50	8.50	5.74	1.79	0.38	2.62	1.76	0.02
Cow Dung	7.90	8.90	5.60	0.56	3.57	3.10	1.34	0.02
Organic Manure (compost)	7.80	7.48	4.76	0.84	0.96	0.26	0.28	0.01

Table 3. Effect of organic and inorganic fertilizers on the growth parameters of Tomato at two week after transplanting

Treatment	Plant Height	Number of Leaves	Number of Nodes	Number of Branches
NPK	21.49 a	11.83 ab	11.44 ab	1.22 a
Urea	22.53 a	10.00 b	11.00 ab	1.44 a
Poultry	19.70 a	17.56 a	14.44 a	2.56 a
Cow Dung	15.59 a	10.89 ab	9.56 ab	1.56 a
ORG. Manure	22.33 a	11.67 ab	10.22 ab	4.56 a
Control	14.94 a	8.67 b	7.33 b	1.67 a
SD	2.81	2.35	1.86	1.14
LSD	8.35	6.97	5.54	3.38

Values with different letters along column are significantly different using DMRT at 5% probability level

different significantly from the result obtained from cow dung and organic manure treatments. The least number of leaves came from control treatment. The above trend was observed with number of nodes taken in the study. Table 3 plant height and the number of branches show no significant different among the other growth parameters measured.

Table 4 showed the growth and development parameters measured at two weeks after transplanting. Application of NPK fertilizer gave significant plant height followed by poultry manure which does not differ significantly from urea organic manure and low dung treatments. Application of poultry manure result in a significant increase in number of leaves of the crop when compared to the control. Furthermore an increase in number of nodes also observed through the application of poultry manure follow by applied NPK fertilizer treatment. on the other hand,

number of branches and fruit number per plant does not show any significant differences in respect to fertilizer treatments applied (Table 4).Table 5 showed the measurement taken at 3 weeks after transplanting and the results showed that there was a significant differences in all the parameters taken with the application of different fertilizers treatments except for the number of nodes and branches that showed no significant relationship , poultry manure and organic manure gave the best mean values when compared to other fertilizer treatment in the study (Table 5).

DISCUSSION AND CONCLUSION

Application of fertilizer irrespective of the source generally improved the growth and development of tomato crop in

Table 4. Effect of organic and inorganic fertilizer on the growth parameters of Tomato at four weeks after transplanting

Treatment	Plant Height	Number of leaves	Number of Nodes	Number of Branches	Number of fruits
NPK	45.89 a	46.33 ab	49.44 ab	4.89 a	0.009 a
Urea	41.22 ab	44.44 ab	46.89 ab	2.67 a	0.89 a
Poultry	41.44 ab	51.33 a	53.89a	4.89 a	0.11 a
Cow Dung	34.56 ab	31.67 bc	33.33 bc	2.67 a	0.00 a
ORG. Manure	37.22 ab	35.00 abc	38.33 bc	2.44 a	0.78 a
Control	28.33 b	24.33 c	24.22 c	2.33 a	0.44 a
SD	4.67	6.47	6.31	0.99	0.43
LSD	13.88	19.24	18.76	2.91	1.28

Values with different letters along column are significantly different using DMRT at 5% probability level

Table 5. Effect of organic and inorganic fertilizers on the growth parameters and fruit yield of Tomato at six week after transplanting

Treatment	Plant Height	No of Leaves	No of Nodes	No of Branches	No of Flowers	No of Fruits
NPK	60.83 a	47.89 a	5.44 a	5.44 a	14.89 ab	12.44 ab
Urea	56.11 ab	44.11 ab	5.00 a	5.00 a	7.67 b	7.78 b
Poultry	61.33 a	64.78 a	7.77 a	7.78 a	19.67 a	18.56 a
Cow Dung	58.11 a	44.22 ab	4.89 a	4.89 a	9.67 b	8.11 b
ORG. Manure	64.96 a	47.78 ab	7.44 a	7.44 a	12.22 ab	8.22 b
Control	36.78 b	22.56 b	5.00 a	5.64	7.56 b	4.11 b
SD	7.14	8.54	1.38	1.34	2.76	3.42
LSD	21.22	25.40	4.10	3.99	8.21	10.16

Values with different letters along column are significantly different using DMRT at 5% probability level

the study. The best results obtained for the growth parameters measured came from poultry manure treatment applied especially on the number of leaves and nodes this might be attributed to the improvement of the physical condition of the soil and nutrient supplied by the poultry manure which in line with the work of Akinfasoye and Akanbi (2005) which concluded that the use of organic manure cannot be over emphasized because of its usefulness in the improvement of physical soil condition as well as microbial properties and the nutrient it supplies for crop productivity. The number of flowers and the fruits of the crop are also improved in the study through the application of poultry manure followed by organic and cow dung. This confirm the ability of organic fertilizers to supply the required nutrients (Alabi, 2006)

It furthermore conforms and agreed with the work of Frank (2000) that there is a general increase in the vegetative growth when organic manure are applied to plants, furthermore poultry manure is rank best among the manure because it is known to be rich in N, P and K with other micro nutrients that when decomposed add nutrients to soil which will result in better growth and yield. Others researchers such as (Nicholson et al., 1999; Ajayi et al., 2009 and Dauda et al., 2005a,b) reported significant response in yield to different organic manure treatments.

CONCLUSION

The result of the experiment generally shows and suggest that application of poultry manure improve the growth and

yield of tomato when compares to other fertilizer treatment in the study. Therefore poultry manure is recommended for the production of tomato for optimum yield.

Conflict of interests

The authors declare that they have no conflicting interests

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