

RESEARCH ARTICLE

EVALUATION OF DIFFERENT RATES OF COMPOST MINERAL FERTILIZER ON THE GROWTH AND YIELD OF TOMATO

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ARTICLE DETAILS

Article History:

Received 15 July 2023
Revised 18 August 2023
Accepted 22 September 2023
Available online 27 September 2023

ABSTRACT

Compost – mineral fertilizer has dual effects; improving soil nutrient status and organic matter content which results to increase in yield of cultivated crops. A field experiment was carried out at the Ambrose Alli University Teaching and Research Farm, Ekpoma, Edo State, Nigeria to evaluate the effect of different rates of compost-mineral fertilizer and compost on the growth and yield of tomato. The experimental design was a Randomized Complete Block Design (RCBD) with seven treatments replicated thrice. The treatments were; control, recommended 10 tonnes of compost, 1, 2, 4, 6 and 8 tonnes/hectare (t/ha) of compost-mineral fertilizer. The initial soil analysis showed low nutrients status and the application of fertilizer was necessary to boost its fertility. Parameters taken were; plant height, stem girth, number of branches, number of flowers at 50% flowering, number of fruits and fresh weight of fruits. From the results, the application of 4, 6 and 8t/ha compost-mineral fertilizer significantly ($p \leq 0.05$) increased the growth and yield of tomato compared to other treatments. The yield of tomato obtained from the application of 4, 6 and 8 tonnes of compost-mineral fertilizer (252.50, 272.00 and 294.50 t / ha) were not significantly ($p \leq 0.05$) different from each other but significantly ($p \leq 0.05$) higher compared to other treatments. Therefore, the application of 6 t / ha of compost-mineral fertilizer can be adopted by farmers for tomato production in the study area.

KEYWORDS

compost, compost – mineral fertilizer, growth, tomato and yield

1. INTRODUCTION

Tomato (*Lycopersicon esculentum* Mill) is the most consumed and popular vegetable in the world and it plays a very important role in human diet. In Nigeria, tomato is an important and widely used vegetable and about 25,000 tonnes of fresh tomatoes are produced annually as reported by (Ric et al., 2001). Tomato is grown for its fruit which is found to contain high amount of vitamin C. Low yield of tomato in Nigeria of about 3.91 tonnes/ha have been reported by FAO and PWC in 2018. The use of old seedlings varieties, invasion by weed and pest and low soil fertility have contributed to the low yield of tomato in Nigeria. Henao and Baanante reported that decrease in crop yield and food production globally occurs due to soil nutrient depletion which results from soil degradation (Henao and Baanante, 2006). For better crop production, it is necessary to improve soil quality by the application of fertilizer.

One natural and ecological way of improving soil fertility for improved crop growth is through the use of compost (Ouedraogo et al., 2001). Compost is a mixture of ingredients used to fertilize and improve the soil. It is commonly prepared by decomposing plant and animal wastes and the resulting mixture is rich in plant nutrients and beneficial organisms. Compost helps to stabilize soil aggregates thereby improving soil structure, porosity and density. According to Ebenezar and Blankson, compost applied at different levels in the soil influence growth and yield of crops significantly (Ebenezar and Blankson, 2017). Compost manure treatments have also been reported to increase the growth and yield parameters of tomato compared to the use of only NPK fertilizer (Tsado, 2014).

Mineral fertilizer has been a promising input of improving soil fertility as well as crop yield, this has significantly ($p \leq 0.05$) increased the yield of tomato. The use of mineral fertilizer alone cannot sustain the nutrient and the organic matter content of the soil. Also, inorganic fertilizers are sometimes unavailable and very expensive and therefore its application in balance amount cannot be possible for most farmers. According to continuous application of mineral fertilizers over time affects the soil physical properties resulting to low yield of crops (Zia et al., 2000).

It is therefore necessary to combine the beneficial effects of compost and mineral fertilizer to enhance soil nutrient status, organic matter content and crop yields. Compost-mineral fertilizer is a combination of compost and inorganic fertilizer. For maximum production of tomato, there must be a proper supply of nutrients in balance amount. The integration of inorganic and organic fertilizers is very important as it plays a key role in sustaining soil fertility, organic matter content and maximum yield of tomato (Islan et al., 2013; Manop et al., 2012; Kumar and Sharma, 2004; Khan et al., 2017). There is little information on the integrated use of organic and inorganic fertilizer on the production of tomato in Nigeria, therefore, this present study was carried out to evaluate the effects of different levels of compost- mineral fertilizer application on the growth and yield of tomato.

2. MATERIALS AND METHODS

2.1 Experimental Site

The field experiment was carried out at the Teaching and Research Farm, Ambrose Alli University, Ekpoma, Edo State, Nigeria. The research farm is located on Latitude 6°46'24.31"N and Longitude 6°8'29.79"E of the equator

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Website:
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DOI:
10.26480/jwbm.02.2023.73.75

with a mean annual rainfall of 1500mm and temperature of about 15°C-34°C.

2.2 Experimental Design

The experimental design was a Randomized Complete Block Design (RCBD) comprising of six treatments and the control plot, replicated three times. The treatments were; control, 10 tonnes of compost, 1, 2, 4, 6 and 8 tonnes/hectare (t/ha) of compost-mineral fertilizer

2.2 Cultural Practices

The site was selected, cleared, packed and mapped into plot sizes of 2x2m. Flat beds were made in each plot. Tomato seeds obtained from local market were raised in the nursery for 4 weeks before transplanting the seedlings to the field. The seedlings were planted at a spacing of 30cm x 30cm, 1 seedling per stand. The various organic substances such as pig dung, sawdust, poultry manure and rice bran were composted while NPK 15-15-15 was to fortified the compost (compost-mineral fertilizer). The compost and compost-mineral fertilizers were applied two week after transplanting using ring method. The compost- mineral fertilizer was applied at different rates, 1, 2, 4, 6, and 8 tonnes/ha and the compost was applied at 10 tonnes / hectare. Weeding was done thrice manually before harvest.

2.3 Soil Samples Collection and Laboratory Analyses.

Soil samples were collected from the experimental site prior to planting to know the nutrient status of the soil at the experimental site and this was done using soil auger. The samples were air dried, crushed and sieved with 2 mm sieve. Particle analysis was determined using the hydrometer method (Boyoucos, 1962). pH of the soil was determined using pH meter (Maclean, 1982). Organic carbon, total nitrogen, available phosphorus, exchangeable bases and exchangeable acidity were determined by the standard procedures (Enwezor et al., 1989). ECEC was determined by the summation of exchangeable bases and exchangeable acidity.

2.4 Collection of Data

Collection of data commenced two weeks after fertilizer application from randomly selected three plants tagged per plot. Growth parameters measured were plant height (cm), stem girth (mm) and number of branches at 4 and 6 weeks after transplanting (WAT). Yield parameters measured were number of flowers at 50% flowering, number of fruits and weight of fresh fruits at harvest.

2.5 Statistical Analyses

Data collected were analyzed using analysis of variance and the means were separated using least significant difference (LSD) Test at 5% level of probability (SAS, 2005).

3. RESULTS AND DISCUSSION

3.1 Physical Chemical Properties of The Soil Prior to Planting

The soil was sandy loam in texture. The pH of the soil was moderately acidic. Organic carbon and nitrogen were slightly above the critical levels while phosphorus was deficient in the soil. (Table 1)

3.2 Effects of Compost and Compost -Mineral Fertilizer on The Growth of Tomato At 4 And 6 Weeks After Transplanting (WAT)

It was observed that plant height, stem girth and number of branches at 4 and 6 WAT were significantly enhanced as shown in table 2. The different levels of compost- mineral fertilizer and compost treatment significantly increased the height of tomato compared to the control. The enhanced growth of the tomato plant could have resulted from the increase in the nutrient availability and soil microbial activity from the fertilizers that were applied which resulted in more nutrient uptake. 6t/ha Compost mineral treatment recorded the maximum height of 52cm and 102.43cm at 4 and 6 WAT while untreated plot had the least height (19.53cm and 35.26cm). Although 6t/ha treatment performed better than other treatments but values were not significantly different from 4 and 8t/ha treatment. Similarly, stem girth also increased significantly with 4, 6 and 8 t/ha performing better than other treatments. The application of compost alone was not significantly better than 1 and 2 t/ha treatment but did better than the untreated plot. A group researcher reported that inorganic fertilizer supplies nutrients to the soil and crops while organic fertilizers improves the physical condition of the soil and also support good crop growth and development (Vanlauwe et al., 2001).

A significant difference was observed between the numbers of branches. At 4WAT, 2, 4 6 and 8t/ha compost mineral fertilizer and compost were significantly enhanced. 8t/ha was significantly higher but it was not significantly better than 2, 4 and 6 t/ha compost-mineral fertilizer and single compost. Control recorded the least number of branches. Also, 4, 6 and 8 t/ha were significantly higher than other treatments at 6WAT. This result agrees with the findings of El – Tantawy, who reported a significant increase in the number of branches with increasing maturity of plant (El – Tantawy, 2009).

3.3 Effects of compost-mineral fertilizer and compost on the yield of tomato

The effect of compost –mineral fertilizer and compost on the yield of tomato is shown in table 3. There was a significant difference in the number of flowers at 50% flowering, number of fruits and fresh fruit weight. All the levels of compost mineral fertilizer and compost significantly enhanced the number of flowers, number of fruits and fresh fruit weight with the highest values recorded in plots treated with 8t/ha compost mineral fertilizer. The values obtained were not significantly higher than that of 4 and 6t/ha treatment while untreated plots had the least values. The application of sole compost also significantly increased the yield of tomato but values were not significantly better than 1 and 2 t/ha compost mineral treatment.

Tomato number of flowers, number of fruits and weight of fresh fruit yield were best enhanced with the application of 8t/ha to the tune of 34.00, 5.89 millions/ha and 294.5t/ha respectively which is comparable with 4 and 6t/ha while the least productivity was from the control plot. The findings from this study is in line with the report of where they stated that the combined application of inorganic and organic fertilizer significantly ($p \leq 0.05$) increased the yield of crops compared to either the application of inorganic and organic alone (Markinde et al., 2001). Adeniyi and Ojeniyi have also reported that a balanced plant nutrition and enhanced crop production are ensured with the use of organo- mineral fertilizer (Adeniyi and Ojeniyi, 2003).

Table 1: Initial Physical Properties of The Soil at the Experimental Site

Parameter	Soil
pH (1:1) H ₂ O	5.68
OC (g/kg)	15.56
N (g/kg)	1.51
P (mg/kg)	9.55
Exchangeable Bases (cmol/kg)	
Ca ²⁺	4.324
Mg ²⁺	1.830
K ⁺	0.095
Na ⁺	0.277
Exchangeable Acidity (cmol/kg)	0.24
Al ³⁺	0.00
ECEC	6.765
Particle size distribution (g/kg)	
Sand	932.00
Silt	18.00
Clay	50.00
Textural class	Sandy Loam

Table 2: Effect of Compost and Compost-Mineral Fertilizer on The Growth of Tomato at 4 And 6 Weeks After Transplanting (WAT)

Treatment (t/ha)	Plant height (cm)		Stem Girth		Number of Branches	
	4	6	4	6	4	6
0	19.53d	35.26d	16.00d	16.96d	6.85c	11.03e
1	37.00c	67.56c	17.56cd	20.44bc	13.89b	32.78cd
2	41.44bc	81.27bc	18.56bcd	21.51bc	15.72ab	44.67bc
4	48.00ab	80.18bc	19.67abc	21.60b	16.44ab	53.83ab
6	52.00a	102.43a	22.11a	25.78a	17.11ab	64.52a
8	48.56ab	90.49ab	20.78ab	24.97a	18.06a	64.96a
Compost	36.33c	66.80c	17.39cd	19.47c	16.00ab	30.00d
LSD (0.05)	9.04	16.18	2.465	1.272	3.698	12.76

The mean values with the same letter in the vertical column are not significantly ($p \leq 0.05$) different using LSD.

Table 3: Yield of Tomato as Affected by Compost and Compost-Mineral Fertilizer

Treatment (t/ha)	Number of flowers At 50% flowering.	Number of fruits (million/ha)	Weight of fresh fruit (t/ha)
0	4.00d	1.10d	55.00d 15
1	14.00c	3.33c	166.50c 126
2	18.00bc	3.99bc	199.50bc154
4	22.00b	4.89ab	255.50ab215
6	32.33a	5.44a	272.00a232
8	34.00a	5.89a	294.50a254
Compost	16.50bc	3.33c	166.50c126
LSD (0.05)	6.506	1.053	50.00

The mean values with the same letter in the vertical column are not significantly ($p \leq 0.05$)

4. CONCLUSION

Based on the findings of this study, the growth and yield of tomato increased significantly with the use of compost and compost-mineral fertilizer. 8t/ha had the highest number of branches, flowers, fruits and fresh fruit weight but was not significantly better than 4 and 6t/ha compost-mineral treatment. Application of compost alone was beneficial for the growth and yield of tomato but best results were obtained from 4, 6 and 8t/ha compost- mineral fertilizer.

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