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EFFECT OF ORGANIC MANURE COMBINATION ON THE GROWTH AND YIELD OF TOMATOES *(LYCOPERSICUM ESCULENTUM MILL)*

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ABSTRACT
A field experiment was carried out in Umunze in Anambra State Nigeria, during the season, 2019 to evaluate the growth and yield of tomatoes as affected by different organic manure. The experiment was a randomized complete block design with three replications. The experiment comprises of eight treatment combinations which are represented by T1, T2, T3, T4, T5, T6, T7, and T8. The results showed that T7 with organic manure combination of 2kg cow dung, 2kg goat dung and 2kg poultry manure significantly (at P <0.05) increased tomato growth and yield compared to control treatment with no manure application. In general, it is seen that the use of organic manure especially in combination T7 had positive effect on soil health and fertility, which generally increase the growth and yield of tomato.

KEYWORDS: Growth, Yield, Tomatoes, Organic manure.

INTRODUCTION

In sub Saharan Africa, the maintenance of soil productivity remains an issue because of poor cultural practices, poor organic matter and available nutrient status of soil (Nottidge *et al* 2005, Agbede and Ojeniyi 2009). Bationo *et al* (2006) describe soil fertility depletion as the single most important constraint to food availabilty in West Africa.

According to Yadav and Prasad (1992) the tendency to supply all plant nutrients through synthetic fertilizers should be avoided as this has deleterious effect on long term soil productivity.

Use of organic fertilizers that are cheap, sustainable, edaphologically suitable, economically viable, culturally acceptable, environmentally friendly and compatible is considered a major method of increasing tomato yield. Organic manures are known to be effective in the maintenance of an adequate supply of organic matter into soil, with attendant improvement in soil physical and chemical conditions and enhanced crop performance (Ikpe and Powel 2003; Ano and Agwu 2005).

Tomato (*Lycopersicum esculentum Mill*) is a crop with high nutritional requirements and its production is greatly influenced by the availability of nutrients (Ferreira *et al*., 2003). These nutritional requirements are met through the use of nutrient sources which vary depending on the cultural practices adopted by the farmer. In developing countries like Nigeria, tomato is becoming more important part of the food basket; hence the farmers aim to increase quality of the produce (Ugonna *et al* 2013).

To achieve sustained soil productivity and subsequent increase in crop growth and yield, there is need for the exploitation of varied alternative sources of soil fertility improvement and management strategies. Soil fertility replenishing strategies that are conventionally employed are the application of nutrients in the form of organic manure (Ojeniyi 2000).

The objective of this work is to evaluate growth and yield of tomatoes as affected by different organic manure application

MATERIALS AND METHODS

The methodologies applied for this research are discussed under the following headings:

Study Site

The experiment was conducted at Umunze, Orumba South Local Government Area of Anambra state Nigeria.

Experimental Design

The experiment is a randomized block design, with 3 replications. The treatments include:
T1: GD: 6kg of Goat dung + 30kg soil
T2: 6kg of Poultry manure + 30kg of soil
T3: 6kg of Cow dung + 30kg of soil

T4: GD + PM: 3kg of Cow dung + 3kg of poultry manure + 30kg soil
T5: GD + CD: 3kg of Goat dung + 3kg of cow dung + 30kg soil
T6: CD +PM: 3kg of Cow dung + 3kg of poultry manure +30kg soil
T7: GD+PM +CD: 2kg of Goat dung + 2kg of poultry manure + 2kg of cow dung + 30kg soil
T8: Control: 30kg of soil without organic manure

Measurement of plant growth parameters
Growth parameters like plant height, stem diameter, number of leaves per plant, leaf area were evaluated. The plant height was measured from the soil level to the tip of the shoot and expressed in cm.

Measurement of yield parameters
Measured yield parameters included number of fruits per plant and fruit diameter. The different biometric observations for both growth and yield were recorded for a duration of 10 weeks.

Statistical analysis
The data was subjected to a one-way Analysis of Variance (ANOVA) to determine the influence of organic manure combination for the various treatments. Duncan multiple range test was used to separate sample means.

RESULTS
In the present study, the organic manures had significant influence on the plant growth and yield of tomato verities and the results are presented in Table Nos. 1-6.

Table 1 showed there was a significant difference in the plant height among the treatments (P<0.05). The result in Table 1 revealed that T7 (66.62±57.933 cm) recorded the highest plant height followed by T2 (56.67±52.107 cm) while T8 (17.74±12.809 cm) had the least.

The result in Table 2 revealed that T7 (87.78±61.301) recorded the highest number of leaves followed by T2 (73.67±51.504) while T8 (39.89±34.744) had the least. There was a significant difference in the number of leaves among the treatments (P<0.05).

The result in Table 3 revealed that T7 (36.24±19.805) recorded the highest area of leaves followed by T2 (35.22±20.11) while T8 (17.38±9.941) had the least. There was a significant difference in the area of leaves among the treatments. The results on the effect of organic manure on stem girth of the plants are given in table 4. It is seen that T7 had the best effect on stem girth and the control had the least effect on stem diameter. The result in Table 5 revealed that T7 (2.94±0.639) recorded the highest plant vigor followed by T6 (2.89±0.323) while T8 (0.11±0.323) had the least. There was a significant difference in the plant vigor among the treatments (P<0.05).

According to the experimental results of the present study, a combination of poultry manure, cow dung and goat dung (2kg poultry +2kg cowdung+2kg goat dung+30kg top soil) was the most influential treatment in plant height, number of leaves, stem girth, and number of leaves. It may be due to the high content of nitrogen present in the organic manure compared to others. During growth phase, the soil can be amended with a combination of poultry manure, cow dung and goat dung for best growth of tomatoes plants.

Results obtained on the effect of organic manure treatments on the yield of Tomato from Table 6 revealed that T7 (24.67±4.844) recorded the highest number of fruits followed by T6 (23.50±4.930) while T8 (8.00±2.098) had the least. There was a significant difference in the number of fruitsamong the treatments (P<0.05).

The results of the present study also in accordance with the previous studies on tomato (Shao *et al* 2010; Shi *et al* 2004 and Li *et al* 2009).

Table 1: Performance of different soil treatments (organic manure) on the plant height of tomato.

Treatment	Weekly plant height of tomatoes (cm) ±SD						Mean plant heights (cm) ±SD
	Week 1	Week 2	Week 4	Week 6	Week 8	Week 10	
T1	4.20^{b}±0.000	8.33^{b}±0.153	19.00^{b}±2.000	46.33^{b}±2.082	92.67^{b}±4.726	123.33^{c}±0.577	48.98^{b}±46.058
T2	4.90^{d}±0.173	8.87^{c}±0.252	20.93^{d}±0.404	64.67^{e}±1.155	98.33^{b}±2.517	142.33^{e}±0.577	56.67^{d}±52.107
T3	4.63^{c}±0.153	8.13^{b}±0.058	17.48^{b}±1.397	54.67^{c}±4.163	91.00^{b}±7.550	125.00^{c}±1.000	50.15^{b}±46.49
T4	5.13^{d}±0.153	9.33^{d}±0.208	18.97^{b}±0.681	63.33^{e}±0.577	91.00^{b}±4.359	132.67^{d}±2.517	53.41^{c}±48.392
T5	4.20^{b}±0.100	8.43^{b}±0.058	20.77^{d}±0.681	58.67^{d}±1.155	92.67^{b}±3.215	115.67^{b}±0.577	50.07^{b}±43.85
T6	5.47^{e}±0.252	10.13^{e}±0.153	25.33^{e}±0.577	72.00^{f}±0. 000	95.00^{b}±3.000	116.67^{b}±1.155	54.10^{c}±44.14
T7	5.93^{f}±0.153	10.63^{f}±0.208	28.13^{f}±0.231	95.67^{g}±1.155	98.67^{b}±2.082	160.67^{f}±1.155	66.62^{e}±57.933
T8	3.07^{a}±0.058	7.40^{a}±0.200	12.67^{a}±1.155	17.33^{a}±2.309	25.67^{a}±1.155	40.33^{a}±2.082	17.74^{a}±12.809
P-value	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**

Columns sharing similar superscripts are not significantly different P>0.05

Table 2: Performance of different soil treatments (organic manure) on the number of leaves of tomato.

Treatment	Biweekly number of leaves of tomatoes ±SD						Mean number of leaves ±SD
	Week 1	Week 2	Week 4	Week 6	Week 8	Week 10	
T1	4.00^{a}±0.000	15.67^{bc}±1.528	30.33^{ab}±7.572	68.67^{b}±2.082	85.67^{b}±6.110	104.33^{ab}±4.163	51.44^{b}±38.319
T2	4.00^{a}±0.000	17.00^{bcd}±1.732	41.67^{b}±10.116	80.67^{b}±4.726	94.00^{bc}±4.000	114.33^{bc}±5.132	58.61^{c}±41.92
T3	4.00^{a}±0.000	15.00^{bc}±2.000	28.00^{ab}±1.000	69.00^{b}±7.000	98.00^{cd}±4.000	120.33^{cd}±12.014	55.72^{bc}±44.82
T4	4.00^{a}±0.000	16.67^{bcd}±1.528	35.33^{b}±8.505	76.33^{b}±10.599	111.33^{ef}±6.658	127.67^{de}±3.512	61.89^{c}±48.344
T5	5.67^{b}±0.577	15.00^{b}±1.732	29.67^{bc}±0.577	85.00^{b}±15.100	105.33^{de}±5.508	128.00^{de}±5.568	61.44^{c}±48.599
T6	5.67^{b}±0.577	19.00^{cd}±2.000	56.33^{c}±4.726	106.67^{c}±12.741	119.00^{f}±6.245	135.33^{e}±5.508	73.67^{d}±51.504
T7	5.67^{b}±0.577	20.00^{d}±2.646	78.67^{d}±13.577	118.67^{c}±6.658	136.33^{g}±7.024	167.33^{f}±8.145	87.78^{e}±61.301
T8	4.67^{a}±0.577	10.33^{a}±1.155	20.00^{a}±2.000	41.33^{a}±2.517	61.67^{a}±5.508	101.33^{a}±8.737	39.89^{a}±34.744
P- value	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**

Columns sharing similar superscripts are not significantly different P>0.05

Table 3: Performance of different soil treatments (organic manure) on the area of leaves of tomato.

Treatment	Biweekly area of leaves of tomatoes ±SD						Mean area of leaves ± SD
	Week 1	Week 2	Week 4	Week 6	Week 8	Week 10	
T1	3.34^{b}±0.357	7.26^{a}±0.093	28.67^{b}±7.095	41.00^{ab}±13.528	40.00^{b}±0.000	40.17^{b}±0.289	26.74^{b}±17.043
T2	3.41^{b}±0.220	7.55^{a}±0.316	28.67^{b}±5.033	47.50^{b}±7.500	47.50^{c}±0.500	45.50^{c}±0.500	30.02^{b}±19.343
T3	3.29^{b}±0.060	7.60^{a}±0.346	29.17^{b}±2.021	43.50^{b}±9.260	57.73^{e}±0.643	56.67^{f}±1.155	32.99^{cd}±22.567
T4	3.48^{b}±0.293	9.11^{c}±0.311	32.17^{bc}±4.010	38.83^{a}±2.466	42.00^{b}±1.000	44.00^{c}±1.000	28.26^{b}±16.597
T5	3.33^{b}±0.151	8.32^{b}±0.115	34.17^{bc}±3.175	51.00^{b}±9.179	48.00^{c}±1.000	52.00^{e}±1.000	32.80^{c}±20.856
T6	5.39^{c}±0.235	11.43^{d}±0.076	52.00^{d}±3.464	52.17^{b}±7.522	42.33^{b}±3.215	48.00^{d}±1.000	35.22^{d}±20.11
T7	7.62^{d}±0.558	14.00^{e}±0.656	39.17^{c}±6.602	46.67^{b}±7.638	52.00^{d}±1.000	58.00^{f}±1.000	36.24^{d}±19.805
T8	2.37^{a}±0.042	7.23^{a}±0.153	18.33^{a}±2.517	26.33^{a}±4.041	22.00^{a}±1.000	28.00^{a}±1.000	17.38^{a}±9.941
P-value	**0.00**	**0.00**	**0.03**	**0.00**	**0.00**	**0.00**	**0.00**

Columns sharing similar superscripts are not significantly different P>0.05

Table 4: Performance of different soil treatments (organic manure) on the Stem girth of tomato.

Treatments	Biweekly Stem girth of tomatoes ±SD						Mean stem girth ±SD
	Week 1	Week 2	Week 4	Week 6	Week 8	Week 10	
T1	0.40^{b}±0.000	0.50^{b}±0.000	1.93^{ab}±0.115	4.07^{d}±0.115	4.67^{c}±0.115	5.30^{bc}±0.608	2.81^{b}±2.033
T2	1.43^{e}±0.058	1.73^{f}±0.115	2.37^{c}±0.153	3.87^{c}±0.115	4.23^{b}±0.058	5.87^{c}±0.231	3.25^{d}±1.608
T3	0.73^{c}±0.115	1.00^{c}±0.000	2.53^{cd}±0.231	3.20^{c}±0.000	4.73^{c}±0.115	5.00^{b}±0.000	2.87^{b}±1.698
T4	0.87^{c}±0.208	1.23^{d}±0.058	2.70^{d}±0.265	3.80^{c}±0.000	4.27^{b}±0.115	5.43^{bc}±0.603	3.05^{c}±1.693
T5	1.20^{a}±0.000	1.33^{d}±0.115	2.07^{b}±0.115	3.80^{c}±0.000	4.20^{b}±0.000	5.47^{bc}±0.503	3.01^{e}±1.64
T6	1.30^{d}±0.173	1.60^{e}±0.000	3.33^{e} ±0.058	4.40^{e}±0.000	5.33^{d}±0.115	5.87^{c}±0.115	3.64^{e}±1.791
T7	1.60^{f}±0.000	1.90^{g}±0.1.00	3.57^{e}±0.115	5.00^{f}±0.000	6.27^{e}±0.115	7.47^{d}±0.503	4.30^{f}±2.229
T8	0.20^{a}±0.000	0.30^{a}±0.000	1.70^{a}±0.173	1.93^{a}±0.115	2.03^{a}±0.058	2.10^{a}±0.1.00	1.38^{a}±0.835
P-value	**0.00**	**0.00**	**0.00**	**1.00**	**0.00**	**0.00**	**0.00**

Columns sharing similar superscripts are not significantly different P>0.05

Table 5: Performance of different soil treatments (organic manure) on the plant vigorof tomato.

Treatment	Biweekly plant vigor of tomatoes ±SD						Mean plant vigor ±SD
	Week 1	Week 2	Week 4	Week 6	Week 8	Week 10	
T1	1.00^{b}±0.000	1.00^{b}±0.000	1.00^{b}±0.000	3.00±0.000	2.00^{b}±1.000	2.33^{b}±0.577	1.72^{b}±0.895
T2	1.33^{b}±0.577	1.33^{b}±0.577	2.00^{c}±0.000	2.00^{a}±0.000	2.67^{b}±0.577	2.67^{b}±0.577	2.00^{b}±0.686
T3	1.00^{b}±0.000	1.00^{b}±0.000	1.00^{b}±0.000	3.00^{a}±0.000	2.00^{b}±0.000	2.00±0.000	1.67^{b}±0.767
T4	2.00^{c}±0.000	1.33^{b}±0.577	2.00^{c}±0.000	2.00^{a}±0.000	2.33^{b}±0.577	2.33±0.577	2.00^{b}±0.485
T5	1.00^{b}±0.000	1.00^{b}±0.000	1.67^{c}±0.577	2.00^{a}±0.000	2.67^{b}±0.577	2.67^{b}±0.577	1.83^{b}±0.786
T6	3.00^{d}±0.000	3.00^{c}±0.000	3.00^{d}±0.000	3.00^{a}±0.000	2.67^{b}±0.577	2.67^{b}±0.577	2.89^{c}±0.323
T7	3.00^{d}±0.000	2.67^{c}±0.577	3.00^{d}±0.000	4.00^{a}±0.000	2.67^{b}±0.577	2.33^{b}±0.577	2.94^{c}±0.639
T8	0.00^{a}±0.000	0.00^{a}±0.000	0.00^{a}±0.000	0.00^{a}±0.000	0.33^{a}±0.577	0.33^{a}±0.577	0.11^{a}±0.323
Total	**0.00**	**0.00**	**0.00**	**1.00**	**0.00**	**0.00**	**0.00**

Columns sharing similar superscripts are not significantly different P>0.05

Table 6: Effect of different soil treatments (organic manure) on the Weekly Mean number of fruits of tomato.

Treatments	Weekly Mean number of fruits ± SD		Overall Mean number of fruits ±SD
	Week 10	Week 12	
T1	12.00^{bc}±3.000	18.33^{b}±2.517	15.17^{b}±4.262
T2	16.00^{cd}±2.646	19.00^{b}±2.000	17.50^{b}±2.665
T3	11.33^{b}±0.577	17.33^{b}±1.155	14.33^{b} ±3.386
T4	15.33^{bc}±2.517	19.33^{b}±5.686	17.33^{b} ±4.502
T5	14.33^{bc}±2.082	18.67^{b}±1.528	16.50^{b}±2.881
T6	20.00^{de}±1.732	27.00^{c}±4.583	23.50^{c}±4.930
T7	21.00^{e}±3.606	28.33^{c}±2.309	24.67^{c}±4.844
T8	7.00^{a}±2.000	9.00^{a}±2.000	8.00^{a}±2.098
P-value	**0.00**	**0.00**	**0.00**

CONCLUSION

This study shows that organic manure application improves soil nutrient balance and thus increases tomato growth and yield. Results generally revealed that organic manures are a suitable source of nutrients for improving soil fertility and yield of tomato.

Growth in tomato is highly influenced by organic manure combination than single organic manure treatments. The result obtained in this study revealed that Tomato responded well to application of organic manure in combination. The study recorded higher values in all growth parameters measured under organic manure treatment combination than control treatments.

The highest number of leaves was recorded in tomato plants grown with combination T7(2kg cow dung,2kg goat dung and 2kg poultry manure) while the lowest was recorded in the T8 (control without any treatment). Other growth parameters recorded similar effect. This finding indicates that organic manure combination had a strong effect on growth of tomato.

All yield parameters measured were higher with organic manure application in combination T7 (2kg cow dung, 2kg goat dung and 2kg poultry manure). Tomato planted without any kind of treatment resulted in lower yields.

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