International Journal of Innovative Research and Advanced Studies (IJIRAS)
Volume 3 Issue 3, March 2016

ISSN: 2394-4404

Effects Of Urea And Poultry Manure On Growth And Yield Attributes Of Tomatoes (Lycopersicon Esculentum Mill) And Soil Chemical Composition

Ewulo, B. S.

Department of Crop, Soil and Pest Management, Federal University of Technology,
Akure, Ondo State Nigeria

Eleduma, A. F.

Department of Agricultural Technology, Rufus Giwa Polytechnic, Owo, Ondo State Nigeria

Sanni, K. O.

Department of Crop Production and Horticulture, Lagos State Polytechnic, Ikorodu, Lagos State, Nigeria

Abstract: ***A field experiment to investigate the effects of urea and poultry manure (PM) on tomatoes' growth yield parameters and soil chemical properties. The study involves three levels of both Urea and poultry manure, resulting in nine-treatment combinations, viz: (i) 0 U kg/ha^{-1} + 0t PM/ ha^{-1} (ii) 0 U kg/ha^{-1} + 4t PM/ ha^{-1} (iii) 0 U kg/ha^{-1} + 8t PM/ ha^{-1} (iv) 50U kg/ha^{-1} + 0t PM/ ha^{-1} (v) 50U kg/ha^{-1} + 4t PM/ ha^{-1} (vi) 50U kg/ha^{-1} + 8t PM/ ha^{-1} (vii) 100U kg/ha^{-1} + 0t PM/ ha^{-1} (viii) 100U kg/ha^{-1} + 4t PM/ ha^{-1} (ix) 100U kg/ha^{-1} + 8t PM/ ha^{-1}. Treatments were assigned in Randomized Complete Block Design (RCBD) with three replicates. Growth data (plant height, number of branches, number of leaves and stem girth) were collected fortnightly starting from 2 weeks after treatment application (WAT). At harvest, fruit weight and fruit number were recorded. Soil samples were collected before and during experimentation for routine soil analysis. Data were subjected to statistical analysis using SPSS statistical software package and mean separated with Duncan Multiple Range Test. The results of the study showed that the combine use of PM and urea at 50U + 8ton and 100U + 4 ton is very good for cultivation of tomato and maintenance of soil properties.***

Keywords: Growth parameters, Poultry manure, Tomatoes, Soil properties, Urea, Soil properties

I. INTRODUCTION

Decrease in soil fertility after few years of cropping is a major limitation in sustaining crop productivity and ensuring food security. This due to the fact that most tropical soils are composed of low activity clays characterized by low nutrient content, low pH, low organic matter content and high susceptibility to erosion.

Soil nutrients are commonly being exported in nutrient mining (harvested crops from the field) and this problem increases with increases yield from new crops and improved varieties. This is quite severe in Sub-Saharan Africa. An average of 10kg of nitrogen, 4kg of phosphorus per hectare per year are lost from the soil. A good percentage of the agricultural soils in Nigeria are low in productivity because they are alfisol and ultisols which are low in organic matter and have low acidity clays (USDA, 1975; Sambo and Odion, 2010).

Currently application of inorganic fertilizers constitutes a practice by farmers in attempt to correct the deficiencies of nutrient elements. However, extensive use of inorganic fertilizers has a depressing effect on yield. This causes reduction in number of fruits, delays and reduces fruit setting, which subsequently delays ripening, and leads to heavy vegetative growth (Aliyu *et al* 2003; John *et al.*, 2004).

Poultry manures are rich in organic matter and their use as organic fertilizers enhances soil productivity but they have their own limitations that hinder optimum production of food that can guarantee the teaming population. However, the huge amount of these organic wastes required for field crop production and handling problem also make them not suitable as substitute to mineral fertilizers. Organic manures vary in

ISSN: 2394-4404

nutrient composition depending on the source and handling procedure; although they supply mainly N, P, K, Zn, Fe, Cu, Mn and B, large quantities of animal manures would be required to produce large nutrient inputs to the soil.

Hence, neither mineral fertilizer nor organic manure is a panacea to soil fertility management (Agboola and Unamena, 1989). Both mineral fertilizers and organic manures have their own roles to play in soil fertility management but none can solely supply all the nutrients and other conditions of growth for producing crops that can feed the teeming population (Uyobisere and Elemo, 2000). The common problems associated with both chemical fertilizer and organic manure when singly applied could be eliminated by integrating the good qualities in each material in order to achieve a better interaction effects (Kulkarne and Kulkarne, 1982). The complementary use of organic and inorganic fertilizers has been recommended for sustenance of long term cropping in the tropics (Ipimoroti *et al.*, 2002). Fuchs *et al.* (1970) reported that nutrients from mineral fertilizers enhance the establishment of crops while those from mineralization of organic manures promote yield when both fertilizers are combined. Adeniyan and Ojeniyi (2005) reported that application of 300 kg ha^{-1} NPK, 7 t ha^{-1} poultry manure and six combinations of reduced level of NPK showed that maize performed better when organic and mineral fertilizers were combined at a reduced quantity. Therefore, the objectives of this study are to determine the optimum urea fertilizer and poultry manure requirements for the maximum tomato cultivation and its effects on soil chemical properties in south western Nigeria.

II. MATERIALS AND METHODS

The experiment was carried out at the Teaching and Research Farms of Federal University of Technology, Akure, Ondo State, Nigeria (7° 16' N, 7° 12' E). The site has been fallowed for a year and with predominant weeds such as: *Aspilia Africana, Euphobia heterophylium, Talinum triangulare.* The land was cleared and manually tilled. Raised seed beds (2 m x 2 m) were prepared. Poultry manure obtained from livestock unit of the Teaching and Research Farms of the University was applied to each plot in ring form 2 weeks after planting (WAP) based on the treatment. The physico-chemical properties of the soil at the experimental site revealed that the soils were sandy loam in texture. Soil reaction was slightly acidic (pH 5.02), moderate in organic carbon, moderately low total N content, very low in available phosphorus and an adequate exchangeable K and Mg (Table 1).

Treatment consisted of factorial combinations of three rates of urea fertilizer (0, 50 and 100 kg ha^{-1}) and three levels of poultry manure (0, 4 and 6 t ha^{-1}) laid out in randomized complete block design with three replicates per treatment resulting in 9 treatment combinations viz: (i) 0 U kg/ha^{-1} + 0t PM/ ha^{-1} (ii) 0 U kg/ha^{-1} + 4t PM/ ha^{-1} (iii) 0 U kg/ha^{-1} + 8t PM/ ha^{-1} (iv) 50U kg/ha^{-1} + 0t PM/ ha^{-1} (v) 50U kg/ha^{-1} + 4t PM/ ha^{-1} (vi) 50U kg/ha^{-1} + 8t PM/ ha^{-1} (vii) 100U kg/ha^{-1} + 0t PM/ ha^{-1} (viii) 100U kg/ha^{-1} + 4t PM/ ha^{-1} (ix) 100U kg/ha^{-1} + 8t PM/ ha^{-1}.

Roma VF, an early maturing and yellow patch virus resistant seeds were sourced from National Horticultural Institute (NIHORT), Ibadan. The seeds were raised in a well-prepared nursery to ensure steady supply of tomato seedlings for transplant. Seedlings were ready for transplanting 4 weeks after sowing at a 90 x 60cm. All necessary routine management operations were carried out as at when due.

Data was collected on plant height using meter rule, number of branches and leaves was visually counted while stem girth was determined using digital vernier caliper. Number of fruits per plant and fresh fruit weight was determined at harvest. Data collected was subjected to the analysis of variance (ANOVA). Significant differences in the treatments were further separated using Duncans' Multiple Range Tests (DMRT).

III. RESULTS AND DISCUSSION

A. PRE-COPPING SOIL STATUS

The pre-cropping soil analysis revealed that the soil at the experimental site is below the critical level of organic carbon, N, P, K. Ca and Mg. Akinrinde Obigbesan (2000), revealed that the critical level of organic carbon, N, P, K. Ca and Mg for crop production in Southwest Nigeria is 1.74g/kg, 0.20%, 10.0mg/kg, 0.16 – 0.20 cmol/kg, 2.0 cmol/kg and 0.40 cmol/kg respectively. Thus for sustainable crop production on the experimental soil, there is need for soil amendment with either organic or inorganic fertilizers.

B. THE EFFECTS OF UREA AND POULTRY MANURE ON GROWTH PARAMETERS

Table (2) shows the effects of urea and poultry manure (PM) on tomato growth parameters of tomatoes. There were significant ($p<0.05$) effects of urea and PM on tomato plant height. Plants treated with 0U + 4 ton PM gave the highest plant height of 73. 82cm, while the least plant height (40.26cm) was from 50U + 4 ton PM. There were significant increase in the plant height of tomato plant with increase in urea and poultry manure rate from 4-8 weeks after transplanting (WAT). This agrees with report by Oyinlola and Jinadu, (2012) that increase in N rates leads to increases in tomato plant height from 2-12 weeks after transplanting. Brown *et al.*, 1995 also stated in their findings that plant growth was markedly influenced by application of poultry manure, inorganic N fertilizer and their combinations as observed from the better plant height and number of leaves compared to the control. The low response of tomatoes to mineral Urea in this trial as compared to combined application of poultry manure and Urea fertilizers is in agreement with the response patterns reported by other researchers on various food crops (Akanbi *et al.*, 2005).

Effects of urea and PM on number of branches were significant ($p<0.05$). Tomato plants treated with 50U+ 8ton PM gave the highest number of branches of 17.58 while those treated with 100U + 8ton PM gave the lowest number of branches (9.89). Iqbal *et al.*, 2011 reports that the number of

branches per plant was highly significant for tomato with 60:00, 60:90 and 60:130 kg/ ha urea and potash.

Number of leaves of tomato plants amended with urea and poultry manure was significantly ($p<0.05$) differ, compared to control. Plant treated with 50U+ 8ton PM gave the highest number of leaves (9.53) and the plant treated with 50U+4ton pm gave the lowest number of leaves of (6.60). Adekiya and Agbede (2010) stated that NPK fertilizer + poultry manure mostly enhanced the growth parameters such as plant height, number of leaves and leaf area. In a related development, application of urea and poultry manure application significantly ($p<0.05$) influenced tomato stem girth; with tomato planted on plots ammended with 100U+4ton pm gave the highest stem girth of 1.01. While the plant from 50U+4ton PM plot, gave the lowest stem girth of 0.70

Soil Properties	Values
Chemical properties	
pH (water)	5.02
P (mg/kg)	0.10
O.C (g/kg)	1.34
N (%)	0.11
Ca (cmol/kg)	2.10
Mg (cmol/kg)	0.90
Na (cmol/kg)	0.17
K (cmol/kg)	0.54
Al (cmol/kg)	1.67
CEC (meq/kg)	5.35
BS (%)	3.71
Physical properties	
Sand (%)	63.8
Silt (%)	25.0
Clay (%)	11.2
Textural class	Sandy loam

Table 1: Initial characteristics of the soil used for the experiment

Treatment	Number of leaves	Plant height (cm)	Number of branches	Stem girth (cm)
100u + 4tons PM	9.27ab	70.60ab	14.68b	1.01a
50u + 4tons PM	6.60e	40.26f	10.75cd	0.70d
50u + 8tons PM	9.53a	73.01a	17.58a	0.90abc
0u + 8tons PM	8.93abc	63.21bc	14.38b	0.73cd
0u + 4tons PM	8.88abc	73.82a	11.37cd	0.90abc
100u + 8tons PM	6.59e	45.58ef	9.89d	0.77bcd
0u + 0tons PM	8.42bcd	68.72abc	13.49bc	0.95ab
100u + 0tons PM	7.57de	51.47de	14.53b	0.86abcd
50u + 0tons Pm	7.91cd	59.89cd	12.74bc	0.82bcd

Table 2: Effects of urea and poultry manure on tomato growth parameters

C. THE EFFECTS OF UREA AND POULTRY MANURE ON YIELD PARAMETERS

The results obtained for number of harvested fresh fruits per plot with the different rates of urea and PM show that the treatments significantly influenced the number of harvested fresh fruits (Table 3). The highest mean fruit number of 29.13 was harvested from the plots amended with 100U+4ton PM, while the least fruit number of 13.13 was recorded from control treatment. The results are in agreement with Arya *et al.* (1999) and Ahmed and Butt (1999), who both reported that number of fruits per plant increased with increase in N level. Also, this result is similar to those obtained by Akanbi *et al.* (2005), who observed a great increase in yield of tomato when N fertilizer was combined with compost manure.

Effects of urea and PM on mean weight of fruit was significant (Table 3). The highest fruit of 724.24g was obtained at 100U+4ton pm. Adekiya and Agbede, (2010) stated that NPK fertilizer + poultry manure increases the number of fruits per plant and fruit weight.

Treatments	No of Fruits	Weight of Fruits (g)
100u + 4tonPM	29.13a	724.24a
50u + 4tonPM	15.80d	300.57de
50u + 8tonPM	22.30c	477.57c
0u + 8tonPM	26.30b	449.91cd
0u + 4tonPM	26.80ab	547.24b
100u + 8tonPM	17.13d	369.74d
0u + 0tonPM	20.30cd	514.91bc
100u + 0tonPM	25.80bc	626.07ab
50u + 0tonPM	13.13e	299.07e

Table 3: The effects of urea and poultry manure on yield parameters

D. THE EFFECTS OF UREA AND POULTRY MANURE ON SOIL CHEMICAL PROPERTIES

Table (4) shows the effects of urea and PM on the soil chemical properties. The effect of urea and PM on the soil chemical properties was significant ($p<0.05$) for pH, P, OM, K, Na, Mg, Ca, Al, H, CEC, BS. There was a slight increase in the soil PH in the entire fertilizer rate after harvesting. The highest soil pH was obtained in 0U+4ton pm (6.02 H_20) slightly acidic, while the lowest was obtained in 100U+4ton pm (5.28 moderately acidic) compared to 5.02 pH recorded at the beginning of the experiment. Adekiya and Agbede (2010) in their study observed that Soil pH tended to reduce with a rise in the amount of poultry manure, suggesting that poultry manure led to increased acidity in the soil. This finding however did not agree with the findings of this study. This may be as a result of the complementary use of poultry manure and urea. Report by Ewulo *et al.*, 2008 that excess N in the soil and soil acidity could cause nutrient imbalance in tomato crop and a reduction in the uptake of certain nutrients is true as soil acidity of 100u + 4tonPM was found to be the highest (5.28).

ISSN: 2394-4404

The highest soil P was recorded in 5Ou+8ton pm (0.93mg/kg) which was very low, while the lowest was recorded in 100U+0ton pm (0.044mg/kg) and 0U+0pm (0.067mg/kg) respectively compared with (0.10mg/kg) at the beginning of the experiment. The soil P did not change at 50U+0ton pm application rate. Report by Ewulo *et al.*, 2009 agrees with the observation of this study that urea increases soil OM, N, P, K, Ca and Mg. This could be due to enhanced microbial activity (due to surge in N availability) that led to enhanced production and mineralization of organic matter from natural (native) source in soil.

The soil organic matter increased after the experiment at all application rates. It was very high in 100U+8ton pm (3.25g/kg) and lowest in 0U+8ton pm (2.17g/kg) compared to the 1.34g/kg soil organic carbon at the beginning of the experiment which was moderate. The soil K in the entire fertilizer rate after the experiment decreased from 0.54cmol/kg to a range of 0.49 in 50U+8ton pm and 0.31cmol/kg in 50U+4tonpm.

IV. CONCLUSION

This study shows that poultry manure and urea applications are both essential for enhancing soil nutrient status and increasing crop yield. The 50U + 8ton PM improved the vegetative characteristics of tomatoes while 100U + 4ton PM produce the highest number of fruits and yield of tomato. The highest soil pH was recorded with 0U + 8ton pm. Organic matter was highest with the combined use of 100U + 8tonPM. Soil chemical properties were best influenced by 50U + 8tonPM. Observations from the results show that the combined use of poultry manure and urea is very good for tomato growth, yield and maintenance of soil physical, chemical and biological properties.

Treatments	PH (H_2O)	O.C (g/kg)	N (%)	P (mg/kg)	K (cmol/kg)	Na (cmol/kg)	Ca (cmol/kg)	Mg (cmol/kg)	Al (cmol/kg)	H (cmol/kg)	CEC (meq/kg)	BS (%)
100u+ 4tonPM	5.28h	2.79d	0.17e	0.13e	0.46b	0.17h	3.20d	1.10e	1.20d	0.56g	5.49h	4.93h
50u+ 4tonPM	5.55f	2.57h	0.14h	0.10f	0.31h	0.22e	2.30f	1.10e	1.16e	0.60f	4.53i	3.93i
50u+ 8tonPM	5.71c	2.69f	0.25a	0.93a	0.49a	0.26c	4.70a	2.20a	1.36b	1.52b	9.17a	7.65b
0u+ 8tonPM	5.96b	2.17i	0.20c	0.50b	0.45c	0.35a	4.70a	2.20a	1.00f	0.48h	8.18b	7.70a
0u+ 4tonPM	6.02a	2.61g	0.12i	0.43d	0.33g	0.28b	3.10e	1.60d	1.04e	1.00d	6.31g	5.31g
100u+ 8tonPM	5.53g	3.25a	0.23b	0.10f	0.44d	0.20f	3.10e	1.60d	2.88a	2.40a	7.74c	5.34f
0u+ 0tonPM	5.61e	2.73e	0.15g	0.07g	0.33g	0.20f	3.80b	2.00b	0.96g	0.76e	7.09f	6.33d
100u+ 0tonPM	5.66d	3.19b	0.19d	0.44c	0.34f	0.18g	4.70a	1.60d	1.28c	0.76e	7.58d	6.82c
50u+ 0tonPM	5.66d	2.81c	0.16f	0.10f	0.42e	0.24d	3.70c	1.90c	0.60h	1.08c	7.34e	6.26e

Table 4: The effect of urea and poultry manure on the soil chemical properties

REFERENCES

[1] Adekiya, A.O. & Agbede, T.M. (2010). Growth and yield of tomato (*Lycopersicon esculentum* Mill) as influenced by poultry manure and NPK fertilizer. Emirate Journal of Food and Agriculture, 21 (1), pp. 10-20.

[2] Adeniyan, O.N. and Ojeniyi, S.O. (2005): Effect of poultry manure, NPK 15-15-15 and combination of their reduced levels on maize growth and soil chemical properties. Nigerian Journal of Soil Science, 15, pp. 34-41.

[3] Agboola, A.A. & Unamena, R.P.A. (1989). Maintenance of soil fertility under traditional farming systems. Proceedings of the National Seminar on Organic Fertilizer, July 25-28, 1989, Kaduna.

[4] Ahmed, C.M.S. & Butt, S.J. (1999) Effect of NPK on some yield components of tomato. Anadolu. 9(1), pp. 56-62.

[5] Akanbi W.B., Akande, M.O. & Adediran, J.A. (2005). Suitability of composted maize straw and mineral N fertilizer for tomato production. Journal of Vegetable Science, 11(1), pp. 57-65.

[6] Akinrinde, E.A. & Obigbesan. G.O. (2000). Evaluation of the fertility status of selected soils for crop production in five ecological zones of Nigeria. Proceedings 26th Annual Conference of Soil Science Society of Nigeria, Ibadan, Nigeria. pp. 279-288.

[7] Aliyu, L., Karikari, S.K. & Ahmed, M.K. (2003). Yield and yield components of eggplant (*Solanium nigro* L.) as affected by date of transplanting, intra row spacing and nitrogen fertilization. Journal of Agricultural Science and Technology, 2(1), pp. 7-12.

[8] Arya, P., Vidyasagar, S. & Singh, S.R. (1999). Effect of N, P and K on tomato seed production. Sci. Hort. 6:89-91.

[9] Ayeni, L.S. (2011). Integrated Plant Nutrition Management: A Panacea for Sustainable Crop Production in Nigeria. International Journal of Soil Science, 6, pp. 19-24.

[10] Brown, J.E. (1995). Comparison of broiler litter and commercial fertilizer on production of tomato. Journal of Vegetable Crop Production, 1(1), pp. 53-62.

[11] Fuchs, W., Rauch, K. & Wiche, H.J. (1970). Effect of organic fertilizer and organo mineral fertilizing on development and yield of cereals. Abrecht-Thaerach, 14, pp. 359-366.

[12] Iqbal, M., Niamatullah, M., Yousaf, I., Munir, M. & Khan, M. Z. (2011). Effect of nitrogen and potassium on growth, economical yield and yield components of tomato. Sarhad Journal of Agriculture, 27(4), pp. 545-548.

[13] Ipimoroti, R.R., Daniel, M.A. & Obatolu, C.R. (2002), Effect of organic mineral fertilizer on tea growth at Kusuku Mabila Plateau Nigeria. Moor Journal of Agricultural Research, 3, pp. 180-183.

[14] John, L.W., Jamer, D.B., Samuel, L.T. & Waner, L.W. (2004). Soil fertility and fertilizer: an introduction to nutrient management. pp. 106-153, Pearson Education. India.

[15] Kulkarne, R.K. & M. Kurlkarne, (1982). Complementary use of farm yard manure and chemical fertilizers in intensive crop production. Bioresoures Technology, 169, pp. 17-36.

[16] Oyinlola, E.Y. & Jinadu, S.A., (2012). Growth, yield and nutrient concentrations of tomato as affected by soil textures and nitrogen. Asian Journal of Agricultural Research, 6, pp. 39-45.

[17] Sambo, B.E. & Odion, E.C. (2010). A Case for Conservation Agriculture: Panacea for Sustainable Agricultural Productivity, Soil Fertility and Economic Growth Improvements under Innovative Cowpea Clipping Management in Degraded Savannah Regions. Sustainable Development and Environmental Protection -

ISSN: 2394-4404

Strategies for Developing Nations. Published by Bell University, Nigeria Pp 13 -15.

[18] Uyobisere, E.O. & Elemo, K.A. (2000). Effect of inorganic fertilizer and foliage of *Azadirachta and Parkia* species on the productivity of maize. Nigerian Journal of Soil Research, 1, pp. 17-22.

[19] Zake, J.Y.L. (1993). Overcoming soil constraints of crop production in sustaining soil productivity intensive. Proceedings of the seminar African agriculture Wageingeen CTA, Nov. 15-19, Accra, Ghana, Pp: 55-66.