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Effects of Planting Time and Manure Types on The Performance of Five Tomato Cultivars

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ABSTRACT
Field experiment was carried out to determine the effects of cultivars, planting time and manure types on the growth and yield of five cultivars of tomatoes. The research was conducted at Kabba college of Agriculture, Kogi state of Nigeria in the months of July, august and September 2018 and repeated the same time in 2019. Three manure types were used for the research. Pre soil testing was done. Seedlings were raised in the nursery from the selected cultivars for each month mentioned above and transplanted to the field four weeks after planting. The experimental design was spit- split design laid in a randomized complete block design with each treatment replicated three times. Data obtained for growth and yield parameters were subjected to analysis of variance using FLSD at 5% probability level. The result showed that significant differences were observed across the cultivars, months of planting and manure types. Rio grande, Boomerang and cobra recorded significantly higher yield amongst the tested cultivars. The yield was higher in the month of July while poultry manure recorded the highest yield across the cultivars.

INTRODUCTION
Tomato, *Solanum lycopersicum* L.is a very important vegetable crop worldwide. Tomato gives a high yield and it is economically and nutritionally attractive. Tomato can grow under a wide range of temperature however; fruit set is limited in a narrow range. Relatively low or high temperature lead to poor fruit set. The critical factor in tomato fruit setting is the night temperature, the optimal range being 15-20°C (Le, 2013), Abou-Shleel and El-Shirbeny (2014)).

The performance of tomato crop at any stage of its development is influenced by its hereditary make up and the prevailing weather

condition. In Nigeria, commercial tomato production relies mostly on exotic introductions, the production of which is essentially restricted to the northern Guinea savanna and the Sudan ecologies due to favorable climatic conditions, particularly high insolation and low relative humidity (Olaoye et al, 2014). Similarly (Bodunde, Erinle, and Eruotors 1996) stated that large scale tomato production is found in the northern Guinea and Sudan Savannah zones of Nigeria, where relatively high yields are realized by planting between June and December. Small scale productions are prevalent in family gardens and small neighborhood farms in the Southern Guinea Savannah and Rain Forest regions of Nigeria. The country is with a population of over 170 million people, an estimated national population growth rate of 5.7% per annum, and an average economic growth rate of 3.5% per annum in the past five years (Ugonna *et al.*2015). In recent time climate change has become a major threat for crop production and mankind (Datta, 2013). The significant impact of the phenomena cannot be underestimated as it has the propensity to affect the output of most agricultural crops, including vegetables (Le et al., 2013). The implication is that, if the climate keeps changing without the development of cutting-edge technologies to respond to the situation, it may cause food insecurity.

Developing cultivars tolerant to heat, salinity stress and resistant to flood, change in the sowing date, use of efficient technologies like drip irrigation, soil and moisture conservations measures, fertilizers management through fertigation, use of grafting techniques, use of plant regulators, protected cultivation, improving pest management are the effective adaptations strategies for reducing the impact of climate change (Pushparani *et al.*, 2017). At present, a significant percentage of processed tomato products used in Nigeria are imported, resulting in unnecessary pressure on foreign exchange reserve. It is therefore necessary to increase the production of tomato. The need to explore more areas with potential for large scale production thereby expanding the scope of production necessitated the study with the following specific objectives:

1. evaluate the planting time that is most appropriate for growing tomato in study area to meet the urgent need of the country.
2. identify the best variety of tomato amongst the tested varieties suitable for the study area.

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MATERIALS AND METHODS

Experimental site

The experiment will be carried out at the Research Site of Horticultural Section, College of Agriculture, Kabba. The site is located at latitude of 07° 35' N and longitude of 06° 08' E and is 1000 m above sea level, in Southern Guinea Savanna Agro Ecological Zone of Nigeria, where the dry seasons are dry and hot while, wet seasons are cool. The rainfall spans between months of April to November with peak in June. The dry season extends from December to March. The mean annual rainfall is 1570mm per annum with an annual temperature range of 18°C - 32°C. The mean relative humidity (RH) is 60% (Babalola, 2010). The major soil order within the experimental site is Gleysol (Higgins, 1957; **Babalola**, 2010). Soil samples (0-15 cm) was randomly collected from fifteen different points on the experimental site in zig-zag pattern with soil auger; the soil samples were analyzed for physical and chemical composition. The organic carbon content of the soil was determined using dichromate wet oxidation method (Nelson and Sommer 1996); Nitogen N by the micro-Kjeldahl method (Bremner, 1996) and Phosphorus extract using Bray-1 solution and determined by molybdenum blue colometry (Frank *et al.*, 1998). Exchangeable K, Ca, Mg were extracted using ammonium acetate, K level was determined using a flame photometer and Ca and Mg by the EDTA titration method (Herdershot and Lalande, 1993). Soil pH was determined by a soil-water medium at a ratio of 1:2 using the digital electronic pH meter (Ibitoye, 2006).

Establishment and Materials

Five cultivars of tomato (Ishaze, Dan karufi, Cobra, Boomerang and Rio grande) were selected. Three manure types were used namely NPK fertilizer, poultry manure and organo mineral fertilizer. The poultry manure was applied 2 weeks before transplanting at 10 tonnes per hectare. The organo mineral and the NPK fertilizer were applied 2 weeks after transplanting at 2 tonnes per hectare and 150kg per hectare respectively. The experiment was conducted in three consecutive months namely July, August and September. Weeding and earthling-up were done at third and sixth weeks after transplanting. Plants were staked at three weeks after transplanting (WAT).

Experimental design

The experiment was laid out as a randomized complete block design (RCBD) in a split- split plot arrangement. Planting dates was assign to the main plot, cultivars in the sub-plot and manures in the sub - sub plot, replicated three times. The land was ploughed, harrowed and made into unit plot size with dimension (6x2.5) m^2. This was subdivided into sub-plot measuring 1m x 2.5m with a separation distance of 0.50m. This design was followed in the establishment of the field for the three consecutive months. Cultural practices and data collection was carried out accordingly.

Data Analysis

The data collected was subjected to analysis of variance (ANOVA) and treatment means will be compared using the Fisher least significant difference (F-LSD) at 5% probability level as stipulated by (Obi, 2002). Statistical analysis was done using (GENSTAT, 2007) Discovery Edition 3.

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Results

Table 1:Physical and chemical properties of poultry manure, Organo mineral and soil

	Mg/kg Na	Mg/kg K	Mg/100g Ca	Mg/100g Mg	P(Ppm)	PH in H_2O	% OC	% OM	% N	% Particle size
OMF	3.85	13.10	12.20	4.48	68.21	6.40	2.21	3.82	0.61N	
Poultry	2.25	13.60	11.20	4.55	61.01	6.90	3.87	6.74	0.59N	
Soil	1.28	0.26	2.16	1.60	1.13	5.57	1.88	3.20	0.10N	Silt-10.00 Clay-3.88 Sand-86.12

OMF: Organo mineral fertilizer, Na: Sodium, K: Potassium, Ca: Calcium, Mg: Magnesium, H_2O, OC: Organic Carbon, OM: Organic matter, N: Nitrogen

Table 2 Effects of cultivars, manure and planting time on the plant height of tomato

Cultivars	PH6	PH8	PH10	PH12
C1 Ishaze	12.28	24.97	33.45	44.97
C2Dan karufi	11.60	27.52	40.10	47.07
C3Cobra	12.68	28.35	40.12	49.30
C4Boomerang	11.56	27.36	40.02	49.17
C5Rio grande	9.95	22.15	30.72	40.72
LSD(0.05)	1.37	3.96	3.96	4.44
fertilizer 1poutry	12.64	27.84	38.23	48.41
2organo	11.54	26.64	37.97	46.66
3 NPK	10.67	23.73	34.50	43.67
LSD (0.05)	0.57	3.55	6.86	3.97
Month 1July	13.07	26.12	39.67	46.82
2August	11.54	20.91	29.96	44.51
3September	10.24	31.18	41.08	47.41
LSD (0.05)	0.63	3.07	3.07	3.54
Cultivars C	Ns	**	**	NS
Fertilizer F	*	*	NS	NS
Month M	**	**	**	NS
C x F	*	NS	NS	NS
C x M	NS	**	**	*
M x F	NS	NS	NS	NS
C x F x M	*	NS	NS	NS

PH: plant height

Table3: Effect of cultivars, manure types and planting time on the number of leaves

	NL6	NL8	NL10	NL12
C1 Ishaze	5.69	9.02	12.59	14.88
C2Dan karufi	5.34	9.24	12.99	15.21
C3Cobra	5.57	9.45	12.91	15.71
C4Boomerang	4.68	7.85	10.95	13.40
C5Rio grande	5.19	7.98	10.63	14.38
LSD (0.05)	0.70	1.16	1.43	1.93
fertilizer 1poutry	5.92	8.23	11.99	14.45
2organo	5.25	9.24	12.66	15.18
3 NPK	4.71	7.96	11.39	14.52
LSD (0.05)	0.63	1.04	1.28	1.73
Month 1July	5.69	9.02	12.59	14.88
2August	5.34	9.24	12.99	15.21
3September	5.57	9.45	12.91	15.71
LSD (0.05)	0.54	0.90	1.11	1.45
Cultivars C	NS	*	*	NS
Fertilizer F	**	*	NS	NS
Month M	NS	**	**	**
C x F	NS	NS	*	NS
C x M	NS	**	*	*
M x F	NS	NS	NS	NS
C x F x M	.	.	*	NS

Table 4: Effect of cultivars, manure types and planting time on the average Fruit length, fruit circumference, number of fruit per plant and fruits weight per plant.

	AFRL	AFRC	ASFRW	AFRWP
C1 Ishaze	7.45	10.24	34.08	530.89
C2Dan karufi	6.42	11.46	32.78	552.25
C3Cobra	6.94	12.98	33.28	785.56
C4Boomerang	6.46	11.61	32.80	774.47
C5Rio grande	6.66	11.58	38.38	809.42
FLSD(0.05)	0.12	0.07	5.76	191.20
fertilizer 1poutry	6.81	11.53	36.73	742.20
2organo	6.79	11.60	74.81	692.08
3 NPK	6.76	11.56	31.25	637.27
FLSD(0.05)	0.10	0.07	5.15	171.00
Month 1	7.36	12.17	38.25	1067.77
2	6.95	12.33	35.78	579.58
3	6.05	10.25	28.77	424.20
FLSD(0.05)	0.09	0.06	4.46	178.10
Cultivars C	**	**	Ns	**
Fertilizer F	NS	NS	*	NS
Month M	**	**	**	**
C x F	NS	NS	**	NS
C x M	**	**	**	*

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M x F	NSS	NS	**	*
C x F x M	NS	NS	*	NS

AFRL: Average Fruit length, AFRC Average fruit circumference, ASFRW: Average single fruit weight, AFRWP: Average fruits weight per plant,

The physical and chemical properties of poultry manure, organo mineral and soil revealed that organo mineral is rich in Potassium (13.10g), Calcium (12.12g), Nitrogen (0.61N). The PH is almost slightly acidic (6.40). The soil texture is sandy loam with low Mg (1.28g), K (0.26g), and N (0.10N). The soil is acidic with a PH (5.57). The effect of cultivars, manure and planting time on the plant height of tomato recorded a significance difference on cultivars from 6 – 8WAP. The highest height was recorded on cobra (49.30cm) and was statically similar to the height recorded on boomerang (49.17 cm). Significant differences were recorded across the manure types; at 12 WAP poultry manure has the highest height (46.66cm). Significant difference was observed on the time effects. The highest height was recorded in the month of September. Interaction between cultivars and manure types shows significant difference at 6 and 8 WAP. A highly significant difference was observed between cultivars and planting time from 8 – 10 WAP. There was no significant difference on the interaction between planting time and manure from 6 – 12 WAP. The effect of cultivars, manure and planting time on the number of tomato leaves showed significant difference from 8 – 10 WAP. The cultivar cobra at 12 WAP had the highest number of leaves (15.71) while the manure types revealed a significant difference at 12WAP with organo mineral having the highest number of leaves (15.18). Interaction between manure types and cultivars show no significant difference.

The effect of cultivars, manures and planting time on the yield of tomato indicated a highly significant difference on the fruit length and fruit circumference in terms of cultivars. Cultivars effect revealed a significant difference on fruit length, fruit circumference and average fruit yield per plant. Ishaze cultivar had the longest average fruit length(7.45 cm).Cobra tomato fruit had the widest average fruit circumference (12.48cm).The highest average fruit weight per plant was observed on Rio grande cultivar (809.42g). Planting time showed a highly significant differences

on fruit size and yield, the month of July had the highest average fruit yield per plant(1067.77g) The effect of manure types was significant on average number of fruit per planting. The interaction between cultivars and manure revealed a significant difference on fruit size and yield likewise the interactions of other factors.

DISCUSSION

The importance of the combinations of planting the appropriate cultivar of tomato at the right time and with manure cannot be overemphasized as it has direct effect on the growth and yield of tomato. The research by Hossain *et al.,* (2013) revealed that the yield of tomato was significantly affected by different sowing dates and tomato genotypes. Increased productivity is attained only when tomato is grown adopting improved varieties and agro techniques. Isah *et al.* (2014) recorded significant differences in plant height by tomato cultivars (47.60-110.50 cm). The tallness, shortness and other morphological differences recorded are varietal characteristics, which are controlled and expressed by certain genes. Fayaz *et al.,* (2007) discovered that days to first picking indicate significant differences among 11 tomato cultivars. They found that cultivar Rio grande gave the earliest days to first picking (82.40) after transplanting followed by Liger-87 and Roma with 83.07 and 85.33 days respectively, while cultivar Local round recorded maximum days to first picking (96.04) followed by Shalkot (95.25 days). They concluded that the early or late maturity is attributed to genotypic character and somewhat influenced by the environmental factors of any particular growing area. Zahedi and Ansari (2012) found significant variation in yield of tomato genotypes and attributed it to seasonal variability, whose impact on plant growth and yield was different for different genotypes. Meseret et al. (2012), found variations in the performance of tomato cultivars and heirloom varieties under tropical conditions. Their results indicated that the hybrid varieties all produced higher yields than the heirloom varieties. Koray and Nihat (2012) observed that tomato yields significantly differed according to the time of planting (early, normal or late). Mahmoud *et al,* (2014) observed significant difference at $P<0.05$ between means due to sowing date. They concluded that tomato grown on poultry manure and sown at the right time performed better in terms of the height of the plant than the other sources of organic manure and sowing date. Poultry

manure application improves soil retention and uptake of plant nutrients. It increases the number and diversity of soil microorganisms, particularly in sandy conditions. This effect enhances crop health by increasing water and nutrient availability, as well as suppressing harmful levels of plant parasitic nematodes, fungi and bacteria (Abolusoro *et al.*, 2012). The results from the study carried out by (Dimitrios et al., 2008) indicated that effect of organic and inorganic fertilization on growth and fruit yield was significant, in turn gave value higher than the control. In other comparative studies no significant differences in fruit yield has been found between organic fertilization (Bocek et al 2008., Murmu et al., 2013). M.Asharfu et al, 2017 reported an increase in the growth and yield of tomato using both organic and inorganic fertilizer.

CONCLUSION

All the manure types used significantly enhance growth and yield of tomato. It was observed that poultry manure significantly increase numbers of leaves, plant height, and stem girth and fruit yield of tomato relative to other manure. Though NPK yielded the lowest compared to yields among the manure treatment considered under this study, this might be due to leaching of the nutrient since the research was carried out during the raining season when soil in the study area was prone to erosion and leaching. The observed increase in tomato yield with application of NPK compared with the control demonstrated that it makes a significant contribution to improve crop performance. The month of July seem to be more favorable in the growth of tomato in the study area as it out performed other months used in the research. The yield of three cultivars of tomato (Boomerang, Cobra and Rio-grande) amongst the tested cultivars was significantly higher than that of other cultivars and are therefore recommended to farmers wishing to key into tomato production in the area while the month of july is recommended as the best period for growing tomato in the study areas.

REFERENCES

Abolusoro, S.A and Abolusoro, P.F (2012).Effects of the organic manure types on the growth, yield as well as soil and root population of root knot nematode Meloidogyne incognita. *World journal of Agricultural Research* 1(5) 138-144.

Abou-Shleel S.M. and El-Shirbeny M.A.(2014) GIS Assessment of Climate Change Impacts on Tomato Crop in Egypt. *Global Journal of Environmental Research,* 8 (2): 26-34.

Asharful I, Sumiya I, Ayasha A, Mdhahabibur R. and Dilip N.(2017) Effect of organic and inorganic fertilizer on soil properties and growth, yield and quality of tomato in Mymensingh, Bangladesh. Agriculture, 2017, 7, 18; doi: 10.3390/agriculture7030018.

Babalola T.S (2010). Land evaluation studies of two wetland soil in Nigeria. An MSc thesis submitted to the department of crop, soil and environmental sciences, University of Ado- Ekiti. Pp 141.

Bocek,S, Mayl I and Patockova S (2008) yield and quality of bush processing tomato fertilized with dried organic and organo mineral fertilizer. Acta univ. Agric, Silvic Mendel. Brun 56(2) 31-38

Bodunde, J.G., Erinle, I.D , Eruotor, P.G. ,and Amans, E.B. (1993). "Recommendation for the release of four heat tolerant Tomato varieties". *Paper approved by the Professional and Academic Board,* IFRA, ABU, Zaria, Nigeria. Pp 165

Bremner, J. M. (1996). Nitrogen- Total. In: Sparks, D. I. (Ed.), pp. 1085-1121. Methods of Soil Analysis. Part3. Chemical Methods. 2nd edition.

Dimitrois B, Magdalin K, Loannis R, Panayiota P, Ilias T, Nickolina C and Argyno D (2018) Effect of organic and inorganic fertilization on yield and quality of processing tomato (Lycopersicon esculentum M.). *Folia Horticulture* 30(2); 321-332 Doi:10.2478/hort- 2018-0027.

Frank, K., Beegle, D. and Denning, J.(1998). Phosphorus. In Brown, J. R. (Ed.), pp. 21-26. Recommended Chemical Soil Test Procedures for the North Central Region, North *Central Region Research Publication* No. 221(revised), Missouri Agric. Exp. Stn., Columbia, MO.

Fayaz A, Obedullahi K, Sair S, Aktar H and Sher A (2007). Performance evaluation of tomato cultivars at high aititude. *Sarhad journal of Agriculture* 23(3):581-587 Food and Agricultural Organization. 2010. FAO production year Book, Rome.

Heuvelink, E. (2005). *Tomatoes. Crop Production Science in Horticulture* 13. CABI Publishing. Massachusetts. USA. Pp.339.

Hossain M.F, Ara 1 N, Islam M.R, Hossain J. and Akhter B. (2013) Effect of different dates on yield of tomato genotypes. *International journal of Agricultural Research Innovation and Technology.* 4 (1) 40-43.

Ibitoye, A. A. (2006). *Laboratory Manual Basic Soil Analysis*. 2nd ed. 82. Foladave Publishing Company, Akure, Ondo State, Nigeria.

Isah, A. S., Amans, .E. B, Odion, E. C and Yusuf, A. A. (2014). Growth Rate and Yield of Two Tomato Varieties (Lycopersicon esculentum Mill) under Green Manure and NPK Fertilizer Rate Samaru Northern Guinea Savanna. *International Journal of Agronomy* 2014, Article ID 932759

Koran, K and Nihat, T. (2012) effect of planting time and tomato varieties on broomrape(Phelipanche aegyptiaca) emergence and tomato yield in western Turkey. *Research on crops* 13(3): 1070 - 1077

Lee, N. (2013). Off-season Production of Grafted Tomatoes in Bach Luu. Vinh Phuc Department of Agriculture and Rural Development

Mahmoud B.A, Hamma I. L, Wakili A, Yusuf S. M ,(2014) Performance of tomato as influenced by organic manure and sowing date in Samaru, Zaria. *International Journal of Agronomy and Agricultural Research* (IJAAR) ISSN: 2223-7054 (Print) 2225-3610 (Online) http://www.innspub.net Vol. 5, No. 5, p. 104-110, 2014.

Meseret, D.R., Ali, M. and Kassahun, B. (2012). Evaluation of tomato (Lycopersicon esculentum Mill.) genotypes for yield and yield components. *African Journal of Plant Science and Biotechnology* 6(Special Issue), 45-49.

Murmu K, Ghosh B.C,and Swain D.K (2013) yield and quality of tomato grown under organic and conventional nutrient management *Arch Agro. Soil Sci* 59 (10), 1311-1321

Olaoye, G., Takim, F.O. and Bankole, F. (2014). Fruit Yield and Juice Quality Attributes of Six exotic tomato Introductions under different Cropping Systems In the Southern Guinea Savanna of Nigeria *Nigerian Journal Of Crop Science,* 2. 1: 1-8

Pushparani A.D, Moirangthem S. S, Shubhashree P.D and Jhilki Kj1 (2017) Effect of Climate Change on Vegetable Production- A Review. *International Journal of Current Microbiology and Applied Sciences* 6 (10) 477 – 483. ISSN: 2319-7706.

Went, F.W. 1984. Plant growth under controlled conditions. II. Thermo periodicity in growth and fruiting of the tomato. *American J. Bot.* 31: 135-150.

Ugonna, C. U. Jolaoso M. A. and Onwualu A. P. Tomato Value Chain in Nigeria: Issues, Challenges and Strategies. *Journal of Scientific Research & Reports.* 7(7): 501-515

Zahedi, S.M. and Ansari, N.A. (2012). Comparison in quantity characters (flowering and fruit set) of ten selected tomato (Solanum lycopersicum L.) genotypes under subtropical climate conditions (Ahvaz). *International Research Journal of Applied and Basic Sciences.* Vol., 3 (6), 1192-1197.