EFFECT OF PLANTING DENSITY AND VARYING RATES OF ORGANOMINERAL FERTILIZER ON GROWTH, YIELD AND NUTRITIONAL QUALITY OF TOMATO (*Solanum lycopersicum* L.)

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Abstract
Tomato, one of the most important vegetables cultivated and consumed worldwide plays a significant role in human nutrition. Low soil fertility and inappropriate planting density are major constraints to its production in the Southern Guinea Savanna ecology of Nigeria. Field trials were conducted during the cropping seasons of 2016 and 2017 at the Faculty of Agriculture Teaching and Research Farm (Vegetable Field), University of Ilorin, Ilorin, Nigeria to evaluate the response of tomato to plant population density and different regimes of organomineral fertilizer (OMF) application. The experiment was a split-plot arrangement laid down in Randomized Complete Block Design. The main plot comprised of three population densities (66,000 plants/ha, 50,000 plants/ha and 40,000 plants/ha) and four rates of organomineral fertilizer (0kgN/ha, 50kgN/ha, 100kgN/ha and 150kgN/ha) as sub-plot in three replicates. Data collected on plant height, number of leaves and branches, yield and yield components and phytochemical parameters were subjected to Analysis of Variance and significant means were separated using Least Significant Differences (P<0.05). The results from the study showed that there was significant effect (p<0.05) of plant population and rates of organomineral fertilizer(OMF) on plant height, number of leaves/plant, number of branches/plant, number of days to 50% flowering, yield/plant and yield/hectare. Fruit quality parameters such as B-Carotene, vitamins A and C and Total Soluble Solid were also affected significantly by the interaction effect of plant density and OMF application rate. The study concluded that planting density of 50,000 plants/ha and application of OMF at 100 kgN/ha which favoured high fruit yield and nutritive value was most suitable for optimum production of tomato in the study area.

Key words: Tomato, population, Organic fertilizer, soil fertility, carotenoids

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INTRODUCTION

Tomato (Solanum lycopersicum (L.) H. Karst) is one of the most versatile, popular, and widely grown vegetable throughout the world (Usman and Bakari, 2013). Tomato belongs to the nightshade family of *Solanaceae* along with other well- known species such as eggplants, potato and hot pepper (Tuan and Mao, 2015). It plays a significant role in human nutrition as an important ingredient in many dishes, sauces, salads, soups, stews, garnish and drinks. Tomato is rich in various antioxidants, in particular, lycopene) one of the most powerful natural antioxidant (Preedy and Watson, 2008). It is also rich in minerals and vitamins such as iron, potassium, ascorbic acid and vitamins A and C which promote eye health, prevents urinary tract infections, hypertension and skin ailments (Anon, 2011). The fruit could be eaten raw or mixed with some other vegetables such as chilli pepper and onion for the preparation of soup (Siddiq *et al.*, 2009). Tomato is cultivated in most part of the world due to its wide adaptation to different agro-climatic conditions. According to FAO (2010), global tomato production amounted to 141 million tonnes in 2009, about a quarter of which was from China, United States of America (U.S.A.) and Turkey. In 2010, Nigeria annual production of tomato was estimated at 1.86 million tonnes which were 1/7th of that of the U.S.A for that year (FAO, 2010).

The major constraints of tomato production in most developing tropical countries like Nigeria include low soil fertility, poor soil structure and inadequate cultural management practices among others (Shiyam and Binang, 2013). Tomato is considered as a high nutrient demanding crop for successful growth, fruit yield and fruit quality (Ayeni and Ezeh, 2017). In Nigeria, nutrient requirements for tomato production have often times been met using conventional mineral fertilizer or poultry manure. However, resource-poor farmers who produced the bulk of the tomato in Nigeria encounter difficulties in terms of availability and affordability of mineral fertilizers which consequently affects the provision of adequate nutrient supply for the crop. At times when mineral fertilizers are available, farmers lack the financial capacity to supply plants with the nutrient in the recommended quantities and balanced proportion (Babatola and Olawoyin, 2002; Oyedeji et al., 2014). Also, continuous use of mineral fertilizers has shown a depressive effect on fruit yield and quality, coupled with an associated environmental hazard such as soil degradation, loss of nutrients through leaching and erosion, de-nitrification and accumulation of heavy metals in plant tissues which compromised fruit quality (Marzouk and Kassem, 2011).

The challenges associated with the use of inorganic fertilizers has generated renewed interest in the use of organic manure as a source of nutrient for crop cultivation. The use of poultry manure, cow dung, urban waste and other agricultural residues which are easily available, cheap and environmentally friendly are more desirable in crop production (Okunlola et al., 2011). However, the bulkiness and slow nutrient release from these organic sources often discourage the farmers from using it solely (Ayeni et al., 2010, Etukudo et al, 2015). Consequently, John et al. (2004) advocated the use of organic manure together with mineral fertilizer for the supply of adequate quantities and timely release of nutrient required to sustain maximum crop productivity on tropical soils. Complimentary use of organic manure and inorganic chemical fertilizer has proved to be a good soil management practice (Law-Ogbomo, et al., 2011). Formulation of organomineral fertilizer through a strategic combination of organic waste fortified by mineral fertilizer was effective at replenishing soil fertility and enhancing plant nutrient uptake, thus improved crop yield (Ayeni and Ezeh, 2017). The use of OMF for crop production is a low-cost input technology for improving the poor nutritional status of tropical soils for sustainable crop production (Olowoake, 2014). It improves soil by enhancing cation exchange capacity of the soil thus making available nutrients for plant use and increasing microbial activity which helps faster decomposition of organic matter to available form. This reduces the need for chemical fertilizer which lead to reduced production cost and higher income for farmers, thus promoting higher plant growth with better fruit yield and quality (Makinde et al., 2010).

Appropriate fertilization of tomato is greatly affected by planting density, variety and other cultural practices. Proper plant population or density is crucial to allow light penetration to lower parts of the plant, production of healthy plants and high-quality fruits. An appropriate population can mitigate disease development and dissemination (Getahun and Bikis, 2015). Cultural methods such as crop intensification require adequate knowledge of inter and intraspecific competition for soil nutrient, light and space among others (Adani et al., 1998). In this wise, Abdel-Mawgoud et al. (2007) suggested that a good combination of planting density and fertilizer application are important practices that greatly influence tomato yield and fruit quality. Therefore the present study assessed the growth, yield and nutritional value of tomato under different planting density and varying rates of OMF and determined the optimum planting density and rate of OMF for improved yield, fruit quality and sustainable production of tomato in Nigeria.

MATERIALS AND METHODS

The field experiment was conducted during the 2016 and 2017 cropping seasons at the Faculty of Agriculture Teaching and Research Vegetable Farm, University of Ilorin (Latitude 80 29' North and Longitude 40 35' East), North Central, Nigeria within southern Guinea savanna ecological zone. The annual rainfall in

Ilorin is between 1000-1240 mm and a mean temperature range of 19 - 33 OC.

The experiment was a split-plot laid out as randomised complete block design comprised of the main plot which was the three planting densities; 66,000, 50,000, 40,000 plants/ha while the four rates of application of OMF were subplots (0 KgN/ha, 50 KgN/ha, 100 KgN/ha and 150 KgN/ha). A total land area of 450 m^2 was ploughed, harrowed and ridged with soil prepared to a fine tilt. The experimental field was divided into three main blocks and each block consists of twelve (12) subplots giving a total of thirty-six plots. The net plot size was 4 x 3 m. The pre-planting composite soil sample was collected from a depth of 0 - 30 cm randomly within the experimental area. The soil was air-dried and sieved using 2 mm mesh sieve and analyzed for physical and chemical properties using standard laboratory procedure (AOAC, 1990) which include particle size by hydrometer method, pH was determined at 1: 2.5 in water and KCl respectively using pH meter. Organic carbon was determined by dichromate oxidation, exchangeable bases (Ca^{2+}, Mg^{2+}, K^{+}, and Na^{+}) were extracted with 1 N ammonium acetate. Potassium (K^{+}) and sodium (Na^{+}) were determined by flame photometer while Ca^{2+} and Mg^{2+} were determined by AAS (Analyst 200, Perkin Elmer, Waltham, MA). Total nitrogen was determined by Microkjedahl wet oxidation method and phosphorus by Bray P -1 method. Besides, the tomato fruits were evaluated for nutritional quality. Phytochemical constituents such as lycopene and Beta carotene were determined from the dried methanolic extract as described by Kumara et al. (2011). Ascorbic acid (vitamin C) content was determined by the method of Ayekyaw (1978), Vitamin A was determined by spectrophotometric procedure (Parrish, 1977) Total soluble solid (°Brix) was determined by refractometer at 20°C as described by Kasim and Kasim, (2015)Conductivity(Xi et al., 2007) Organomineral fertilizer (Aleshinloye Grade A) a commercial organic fertilizer product was purchased from Aleshinloye fertilizer plant, Ibadan, Oyo State, Nigeria. A tomato variety (Roma vf) was used for the study. Seedlings were raised in the nursery before transplanting using 10 litres capacity buckets filled with heat-sterilized soil. Healthy, vigorous and uniform size seedlings were selected and transplanted to the field four weeks after sowing. Organomineral fertilizer was applied a week after transplanting as a single application. Weeding was done at when due to keep the plots clean throughout the study while insect pests were controlled at flowering period using Cypermethrin (1000 EC) at the rate of 25 ml/10 litres of water. Plants were staked to keep the vines and fruit off the ground from the time of transplanting till harvesting period.

Data were collected on parameters which include plant height, number of branches, number of leaves, number of days to 50% flowering, fruit yield and yield parameters and phytochemical contents such as lycopene, carotene, vitamins A and C. The data collected for the two years (2016 and 2017) were pooled and subjected to analysis of variance (ANOVA) using Genstat Release (17th edition) statistical software. Significant means were separated using Fisher's protected least significant difference (LSD) at 5% probability.

RESULTS AND DISCUSSION

Results of physical and chemical properties of soil of the study area before planting were shown in Table 1. The textural class of the soil was sandy loam and slightly acidic towards neutral (pH of 6.40 – 7.20) which is good for vegetable production. Exchangeable ions (Ca^{2+}, Mg^{2+}, Na^{+} and K^{+}) were moderately adequate. The soil was low in organic matter, total nitrogen and phosphorus. This showed that the soil fertility status was poor and there was a need for soil amendment to meet the crop requirements. The nutrient composition of the OMF used according to the manufacturer showed 5.1, 4.4 and 1.8 % for N, P, and K respectively.

Table 1: Physico-chemical properties of the soil of the experimental site before planting

Physical properties	**Value***
Clay (%)	6.60±0.36
Silt (%)	8.08±0.44
Sand (%)	85.22±4.26
Textural class (USDA)	Sandy loam
Chemical properties	
pH in H_2O	7.20±0.40
pH in KCl	6.40±0.30
Available P (mg/Kg)	0.22±0.02
Total Nitrogen (%)	0.28±0.03
Organic carbon (%)	0.77±0.04
Organic matter (%)	1.34±0.07
Exchangeable cations	
Ca^{2+} (mg/Kg)	7.30±0.37
Mg^{2+} (mg/Kg)	3.42±0.17
Na^{+} (mg/Kg)	1.20±0.06
K^{+} (mg/Kg)	3.30±0.17
Exchangeable H^{+}(Cmol/Kg)	0.31±0.02

***Values are means of replicated analysis

Table 2: Mean plant height (cm) of tomato as effected by planting density and rates of application of organomineral fertilizer

Plant density	**OMF (Kg)**	**3WAT**	**4WAT**	**5WAT**	**6WAT**
66,000	0	28.0	34.4	44.9	67.7
	50	29.9	36.6	49.8	71.9
	100	35.6	45.7	58.2	73.8
	150	36.2	45.9	60.8	82.7
50,000	0	29.1	34.2	46.8	64.8
	50	32.5	39.3	51.4	74.9
	100	33.5	41.5	58.6	78.6
	150	33.9	43.5	57.8	75.8
40,000	0	31.6	38.4	49.7	72.4
	50	31.8	40.2	51.2	73.6
	100	32.8	41.5	51.5	80.9
	150	32.9	43.2	56.8	79.8
LSD $_{(0.05)}$					
PP		4.36^{ns}	4.43^{ns}	3.30^{ns}	2.77^{ns}
OMF		4.01^{ns}	4.92^{ns}	2.64^{ns}	2.53^{ns}
PP*OMF		7.21^{*}	8.31*	14.84^{ns}	13.48^{ns}

*Means along column do differ significantly at 0.05 level of probability ns = Not significant, *, PP= planting densities, OMF= organomineral fertilizer.

The effect of planting density and rates of application of organomineral fertilizer on plant height of the tomato variety is presented in Table 2. It was observed that plant height increases with an increase in planting density and rates of OMF application. However, significant treatment effect ($p<0.05$) was only observed on plant height at 2 and 4 weeks after transplanting (WAT) where the highest plant height was observed for tomato planted at 66,000 plants/ha and 150 KgN/ha organomineral fertilizer. The plant population density was reported to have a significant impact on plant height especially crops with dense population tends to grow taller to compete for the light which is an important raw material for photosynthesis (Adani et al., 1998). The significant treatment effect was limited to 2 and 4 WAT probably due to the onset of flowering and fruiting processes which takes most of the assimilate. At 5 – 6 WAT, there was a switch from vegetative growth to the production of fruits which reduces plant elongation and channel most of the photosynthate toward flowering and fruit set. This finding concurred to the earlier report of Abdel-Mawgoud et al. (2007), who also noted that the plant population per unit area affects growth and performance of crop plants.

The significant proportional interaction between the planting density and organomineral fertilizer (OMF) regimes showed that the OMF positively impacts on the growth of the tomato in term of plant height. The results of the present study was concurrent to the earlier workers' observation and further reinforced the claims of Makinde et al. (2010) and Ayeni and Ezeh (2017). The interaction effect of planting density and rates of organonomineral fertilizer application on leaf formation in tomato varied across the weeks of evaluation and mean number of leaves differ significantly ($p<0.05$) between treatments throughout observation (Table 3). The highest mean number of leaves / plant was observed in plants at the medium planting density (50,000 plants/ha) and 100 kgN /ha OMF application while the least was found among the control (0 KgN OMF) at all the planting densities. These showed that the plants even at medium density were able to utilize the organic amendment efficiently thus produced higher number of leaves/plant than the other treatments (Abdel-Mawgoud et al., 2007).

Table 3: Mean number of leaves of tomato as effected by Plant density and rate of application of organomineral fertilizer

Plant density	OMF (Kg)	3WAT	4WAT	5WAT	6WAT
66,000	0	83.0	106.3	147.0	300.0
	50	94.8	126.5	156.0	352.3
	100	99.5	130.5	165.0	380.3
	150	107.7	123.5	163.0	380.3
50,000	0	76.8	96.8	124.8	243.5
	50	94.7	106.0	135.5	322.8
	100	103.8	144.0	205.5	444.3
	150	104.5	121.7	173.5	322.8
40,000	0	84.8	96.3	136.7	279.1
	50	89.3	96.3	140.5	279.3
	100	98.0	109.5	140.5	333.8
	150	107.2	128.7	155.8	328.3
$LSD_{(0,5)}$					
PP		9.13^{ns}	18.96^{ns}	29.18^{ns}	73.8^{ns}
OMF		10.64^{ns}	15.64^{ns}	23.58^{ns}	64.8^{ns}
PP*OMF		17.75**	28.73**	43.64**	116.5*

*Means along column do differ significantly at 0.05 level of probability
ns = Not significant, *, Significant, PP= planting densities, OMF= organomineral fertilizer.

Table 4: Mean number of branches of tomato plant as effected by plant density and rate of application of organomineral fertilizer

Plant density	OMF (Kg)	3WAT	4WAT	5WAT	6WAT
66,000	0	8.3	10.3	13.2	22.7
	50	9.7	12.0	14.3	26.8
	100	9.7	12.3	14.3	26.8
	150	10.3	11.8	15.2	31.0
50,000	0	7.8	9.3	11.7	21.8
	50	9.7	10.0	12.8	29.2
	100	10.5	12.2	18.8	30.7
	150	10.0	11.8	16.5	30.5
40,000	0	8.2	9.2	12.8	26.8
	50	8.3	9.2	12.8	24.2
	100	8.5	10.3	13.2	25.3
	150	10.2	13.7	14.3	34.5
LSD $_{(0.05)}$					
PP		0.852^{ns}	1.737^{ns}	2.746^{ns}	6.57^{ns}
OMF		0.944^{ns}	1.418^{ns}	2.120^{ns}	5.94^{ns}
PP*OMF		1.592**	2.614**	3.994**	10.58*

*Means along column do not differ significantly at 0.05 level of probability
ns = Not significant, PP= planting densities, OMF= organomineral fertilizer.

Table 4 showed the effect of planting density and rates of organomineral fertilizer on the number of branches of tomato. It was observed that the number of branches significantly increased with lower plant population (40,000 plants/ha) and the highest rate of organomineral fertilizer. The number of branches/ plant differs significantly ($p<0.05$) throughout the assessment. Planting density of 40,00 plants/ha and 150 KgN OMF had the highest mean at 4, 5 and 6 WAT which could be as a result of a reduction in competition for light, space, nutrient and moisture thereby allowing the plant to have more branches than others (Olaniyi and Ajibola, 2008).

Generally, the number of days to 50% flowering decreased with lower planting density and increased rate of organomineral fertilizer application (Table 5).

Table 5: Yield and yield parameters of tomato as effected by plant density and rate of organomineral fertilizer application

Plant density	OMF (Kg)	50%FA	No. of Fruit/Plant	Mean Fruit Weight(g)	Fruit weight/plant (g)	Yield/ha (tonnes)
66,000	0	37.17	7.5	10.38	111.0	5.55
	50	34.00	8.2	14.06	149.3	6.59
	100	34.67	9.5	14.30	153.5	7.41
	150	34.50	10.7	14.64	150.6	6.85
50,000	0	37.00	7.2	13.64	110.0	8.69
	50	35.33	7.7	14.83	131.5	9.94
	100	33.67	8.5	17.46	185.8	12.39
	150	34.00	9.2	13.62	137.0	10.24
40,000	0	33.83	7.2	11.10	62.2	2.49
	50	35.50	7.0	11.23	122.5	3.27
	100	34.50	9.0	15.03	139.7	5.37
	150	34.17	8.7	12.89	134.2	4.91
LSD $_{(0.05)}$						
PP		1.574^{ns}	1.621^{*}	2.791^{ns}	44.32*	2.286***
OMF		1.113**	1.716*	2.998^{ns}	25.19*	1.21*
PM*OMF		2.176*	2.926^{ns}	5.093^{ns}	41.51*	3.120*

*Means along column do differ significantly at 0.05 level of probability
ns = Not significant, PP= planting densities, OMF= organomineral fertilizer, 50%FA= 50 %flowering

Although, it differs significantly from one another and control. However, 50,000 plants/ha and 100 KgN OMF produced early flowering and consequently early maturing plants. Number of fruit per plant was significantly influenced by the main effects of planting density and rates of organomineral fertilizer at $p<0.05$. Results showed that number of fruit/ plant increases
with a reduction in planting density. Also, higher rate of OMF increases number of fruit /plant among the tomato plants. The plants treated with 100 KgN and 150 kgN OMF were not significantly different in terms of number of fruit/plant at $p<0.05$. The highest value was observed in 40, 000 plants/ha and 150 kgN OMF. This finding agreed with the report of Olaniyi and Ajibola (2008). Meanwhile, the present study revealed that there were no significant differences among the treatment combinations for mean fruit weight which may be attributed to the genetic composition of tomato. The fruit weight/plant differ significantly at $p<0.05$ among treatments. Also, the interaction effect of planting density and rate of OMF significantly affected fruit weight/plant. It was observed that 50,000 plants /ha combined with 100 KgN OMF had the highest value while the least was obtained from 66,000 plants/ha and 0 KgN OMF. The treatment means for yield/ ha differ significantly at $p<0.05$ and it was observed that 50,000 plants/ha combined with application of 100 KgN OMF produced the highest yield/ha which was significantly better than other treatment combinations. The least yield/ha was obtained from control-0 KgN/ha and 40,000 plants/ha.

It was demonstrated that the right proportion of OMF and moderate planting density would increase the biological and agronomical yield of crop plants as reported by Law-Ogbomo and Egharevb, (2009). This study revealed that fruit yield of tomato could be increased through higher planting density provided the soil fertility is amended to provide adequately for nutrient uptake by plants. High planting density without fertilizer application resulted in lower vegetative growth such as height, number of leaves and branches than those treated with organomineral fertilizer as they had to rely on the native soil fertility which, from the result of the chemical analysis was deficient in those nutrients.

Table 6: Phytochemical properties of Tomato (Roma vf) as affected by plant density and rates of organomineral fertilizer application

Plant population	OMF (Kg)	A-lycopene mg/100g fw.	N-lycopene mg/100g fw	B-Carotene mg/100g fw	Vitamin A mg/100g fw	Vitamin C mg/100g fw
66,000	0	0.045	0.108	0.684	1.441	8.45
	50	0.013	0.108	0.725	1.409	9.05
	100	0.012	0.113	0.731	0.393	10.34
	150	0.018	0.110	0.717	0.429	14.92
50,000	0	0.016	0.109	0.761	0.452	9.69
	50	0.015	0.111	0.893	0.420	16.17
	100	0.014	0.109	0.903	0.468	11.41
	150	0.018	0.109	0.688	0.381	11.72
40,000	0	0.011	0.109	0.601	0.320	10.05
	50	0.012	0.110	0.752	0.358	11.31
	100	0.014	0.106	0.643	0.431	12.75
	150	0.015	0.111	0.623	0.286	15.80
$LSD_{(0.05)}$						
PP		0.063ns	0.580ns	0.596ns	0.501ns	7.363ns
OMF		0.082ns	0.228ns	0.103*	0.101*	0.001*
PP x OMF		0.028^{ns}	0.004^{ns}	0.138*	0.103*	5.540^{*}

*Means followed by the similar letter(s) along column do not differ significantly at 0.05 level of probability
ns = Not significant, *, Significant, PP= planting densities, OMF= organomineral fertilizer.

Some of the Phytochemical attributes of harvested tomato fruits were significantly affected by treatment differences. Treatment combination had no significant effect on alpha and normal lycopene and vitamin C but highly significant for Beta-carotene and vitamin A (Table 6). However, Vitamin C and lycopene had lowest values among the lowest plant density 40,000plants/ha which may be because the Nitrogen available for plants under low density was more and as such used for increased vegetative growth. Ascorbic acid and vitamin C were reported to decrease indirectly under such condition through increased leaf expansion and shading (Preedy and Watson, 2008). β-carotene is a precursor of vitamin A and very ripe tomato tend to have a higher percentage of β-carotene than an unripe or partially ripe tomato as it aids accelerated colour development. High level of bioactive ingredients such as β-carotene and vitamin A have been reported in organically grown tomato and it is linked with the protection of fruits against herbivores, pest and predators in the environment (Kumar et al., 2015). More so, treatment combination differs significantly for pH and Total Soluble Solid (TSS) but Electrical Conductivity were not significantly different (Table 7). The TSS of tomato fruits with higher Brix value correlate positively with level of valuable nutritive components(Kasim and Kasim, 2015). Moderate plant density (50,000/ha) combined with 100 KgN OMF improves the fruit quality of the tomatoes in terms of vitamin C, vitamin A, β-carotene and TSS.

Table 7: Nurtitional parameters of Tomato (Roma vf) as affected by Planting density and Rates of application of organomineral fertilizer

Plant population	OMF (Kg)	pH	TSS (°Brix)	Conductivity
66,000	0	3.9	0.311	885
	50	4.1	0.365	720
	100	4.1	0.487	825
	150	3.9	0.504	790
50,000	0	4.2	0.388	525
	50	3.9	0.724	1140
	100	4.5	0.964	985
	150	4.2	0.415	620
40,000	0	3.9	0.366	790
	50	4.0	0.729	740
	100	3.9	0.518	780
	150	3.9	0.799	700
LSD $_{(0.05)}$				
PP*OMF		0.2722*	0.2393***	434.4^{ns}

*Means followed by the similar letter(s) along column do not differ significantly at 0.05 level of probability
ns = Not significant, *, Significant, PP= planting densities, OMF= organomineral fertilizer.

CONCLUSION

From the result of this study, growth and yield parameters varied significantly with population density and rates of organomineral fertilizer. Growth parameters such as plant height, number of leaves, number of branches and yield parameters such as number of days to produce 50% flowering, yield per plant and yield per hectare shows a positive impact of the combination of plant population density and different rates of organomineral fertilizer on tomato. Plant height, number of leaves/plant and yield /ha were highest at a plant density of 50,000 treated with 100kgN/ha OMF. However, the number of branches and fruit weight/plant were highest at low density. Vitamins A and C and β-carotene were also affected significantly by combined treatments with the highest value in plants treated with 100kgN/ha OMF. Also, the TSS and pH of the fruits were highest in the same treatment combination indicating better aroma, taste and preservation quality. The study concluded that the application of 100 kgN/ha OMF plus 50,000 plants/ha enhanced the growth, yield and nutritional parameters of tomato and is therefore recommended in the study area

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