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GROWTH RESPONSE OF MUSK MELON (*Cucumis melo* L.) VARIETIES TO INTRA-ROW SPACING AND POULTRY MANURE RATE IN NIGERIAN SAVANNA

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ABSTRACT

A two-location trial was conducted during the 2023 wet season in Dutsin-Ma, Sudan Savanna ecological zone, and Malumfashi, Northern Guinea Savanna ecological zone, Nigeria, to evaluate the growth performance of Musk melon (*Cucumis melo* L.) varieties as influenced by intra-row spacing and rates of poultry manure application. The treatments consisted 2x3x4 factorial combinations of two varieties of musk melon (NEPTUNE F1 and URANUS F1), three different intra-row spacing (25cm, 50cm and 75cm) and four poultry manure rates (0, 5, 10 and 15 tons per hectare). The experiment was laid out in a Randomised Complete Block Design (RCBD) and replicated three times. Variety was only significant ($P<0.05$) on shoot dry weight and net assimilation rate, where NEPTUNE F1 produced significantly ($P<0.05$) higher shoot dry weight and net assimilation rate than URANUS F1. Intra row spacing significantly ($P<0.05$) increased growth parameters, where sowing musk melon at 50cm produced significantly ($P<0.05$) higher shoot dry weight, relative growth rate and net assimilation rate than other intra row spacings, but 75cm intra row spacing showed better performance on number of leaves and vine length than other intra row spacings in both locations. Application of poultry manure significantly ($P<0.05$) increased growth parameters, where applying 15 t poultry manure ha^{-1} produced significantly ($P<0.05$) higher values than most of the measured growth parameters. In conclusion, sowing NEPTUNE F1 at an intra-row spacing of 50 cm with the application of 15 t poultry manure ha^{-1} produced better growth performance of musk melon in the study area.

Keywords: Musk melon, growth, variety, poultry manure, intra-row spacing.

INTRODUCTION

Musk melon (*Cucumis melon*) belongs to the family Cucurbitaceae. It is an annual plant with a trailing vine growth. Musk melon is a fruit vegetable rich in bioactive compounds such as phenolic, flavonoids and vitamins, as well as carbohydrates and minerals (especially potassium) and contains dietary fibre in a huge amount. Despite the usefulness of this crop, the yield remains low due to large-scale under-cultivation and poor agronomic practices, including incorrect spacing, infertile soil, pest and disease infestation, and over-reliance on inorganic fertilisers, among others. Excessive reliance on mineral fertilizers has been associated with environmental and economic problems during the past decades (CAKMAK, 2002). Thus, organic farming has emerged as a sustainable economic, environmental, and social measure (Pacini *et. al.,* 2003). Recent studies have shown that the yield of organically grown melon crops can be similar to or higher than that of conventionally grown melons (Ewulo et *al.,* 2008). Using organic-sourced fertilizer is becoming common among farmers because of the high cost of mineral fertilisers. It has been reported that the high organic matter content in organic fertilizers enables them to gradually release their embedded soil nutrients, increase the population of soil microbes, and enhance soil quality (Adesoji, 2015).

Poultry manure is an excellent soil amendment that provides nutrients for crop growth and improves soil quality when applied judiciously, owing to its high organic matter content and nutrient availability for plant growth (Oyedeji *et al*., 2014). At present, there are no recommended standards for the rate of poultry manure to enhance muskmelon yield in the study area. Determination of the lowest plant population required for optimal yield, a major agronomic goal, has been conducted for many crops, such as watermelon (Adeyeye *et al.,* 2017). Reports are scanty on the effect of planting spacing on the growth and yield of sweet melon in the study area. Therefore, the study was designed to determine the growth performance of Musk melon varieties as influenced by intra-row spacing and poultry manure application rates.

MATERIALS AND METHODS

A bi-location trial was conducted during the 2023 rainy season at the Teaching and Research Farm, Faculty of Agriculture, Federal University Dutsin-Ma Permanent Site, (Lat. 12°17 'N Long. 07°27'E and 605m above sea level), in the Sudan Savanna and at the Faculty of Agriculture Farm, Umaru Musa Yar'adua University (Layin Minister) Malumfashi (Lat. 11°41' N, long. 7°30'E and 858m above sea level) in the northern Guinea Savanna of Nigeria. The treatments consisted of 2x3x4 factorial combinations of two varieties (NEPTUNE F1F1 and URANUS F1F1), three intra-row spacing treatments (25, 50, and 75cm), and four poultry manure rates (0, 5, 10, and 15 t ha^{-1}). The experiment was laid out using a Randomized Complete Block Design (RCBD) and replicated three times. The gross plot size was 4.5m x 3 m (13.5 m^2) and the net plot was 4.5m x 1.5m (6.75 m^2).

The experimental field was ploughed and harrowed to achieve a fine tilth and ridges of 75 cm were made. Musk melon seeds were planted at 4 seeds per hole, and the intra-row spacing was based on the treatment, with ridges 75cm apart. The musk melon seedlings were thinned to two seedlings per hill. Poultry manure, according to the treatments, was applied during land preparation two weeks prior to sowing at rates of 0, 5, 10, and 15 t ha^{-1}. Weeds were controlled manually using a hand hoe at 3 and 6 WAS. Cypermethrin (10% E.C) was applied against the incidence of insect pests at the rate of 4L ha^{-1} at one-week intervals starting from flowering to harvest.

Data were collected on the number of leaves, vine length, shoot dry weight, relative growth rate and net assimilation rate at 4, 6 and 8 weeks after sowing (WAS). The collected data were subjected to analysis of variance (ANOVA) as described by Gomez and Gomez (1984) using SAS version 9.0 (SAS, 2002). The differences among treatment means were analysed using Duncan's Multiple Range Test (DMRT) (Duncan, 1955). Effects were considered statistically significant at a 5% level of probability.

RESULTS

Soil Physical and Chemical Properties and Poultry Manure Chemical Properties

Table 1 presents data on the physical and chemical characteristics of the soils at the experimental sites during the 2023 wet season at Dutsin-Ma and Malumfashi. The results indicate that soil texture at the experimental sites is loamy sand in Dutsin-Ma and sandy loam in Malumfashi (Table 1). The soil in Dutsin-Ma was slightly alkaline (pH 7.45) and had a moderate available phosphorus content (15.60 mg kg^{-1}). However, the soil in Malumfashi was acidic (pH 5.37) and had a moderate available phosphorus content (16.80 mg kg^{-1}). The percentage of organic carbon was high (12.61 and 14.10) in both locations, with a higher value in Malumfashi. Total nitrogen was low in Dutsin-Ma (1.65) but higher in Malumfashi (1.86). The exchangeable bases Mg content was slightly high, and Na content was moderate in both locations, while Ca and K were medium in Dutsin-Ma and high in Malumfashi, respectively. The effective cation exchange capacity (4.06 and 4.18) was moderate in Dutsin-Ma and Malumfashi, respectively. The chemical characteristics of poultry manure used in the experiment during the 2023 wet season at Dutsin-Ma and Malumfashi are shown in Table 1. The analysis showed that the total nitrogen was 23.60 g kg^{-1}. The exchangeable bases Mg content was 3.96, while Ca and K were 6.40 and 13.20, respectively (Table 1).

Number of Leaves

The effect of varieties, intra-row spacing and varying poultry manure rates on musk melon in respect of the number of leaves at Dutsin-Ma and Malumfashi is shown in Table 2. Variety had no significant ($P>0.05$) effect on the number of leaves throughout the sampling period at both locations (Table 2). The influence of intra-row spacing on musk melon varieties was only significant ($P<0.05$) on number of leaves only at Dutsin-Ma at all the sampling dates, where intra row spacing of 75cm significantly ($P<0.05$) recorded the higher number of leaves than intra row spacing of 25 and 50cm though at 8 WAS intra row spacing of 50cm were at par (Table 2). Application of poultry manure have shown significant ($P<0.05$) effect on number of leaves per plant where application of 15t ha^{-1} significantly ($P<0.05$) produced higher number of leaves than other rates in all the sampling stages at the two locations, but applying 5 and 10 t ha^{-1} were statistically similar at 4 and 6 WAS in Dutsin-Ma and at 6 and 8 WAS in Malumfashi, while no poultry manure and 5 t ha^{-1} were statistically similar only at 8 WAS in Dutsin-Ma and at 4 and 8 WAS only in Malumfashi (Table 2).

Analysed at the Department of Agronomy, Ahmadu Bello University, Zaria

The interaction between intra-row spacing and poultry manure rate on the number of leaves of Musk melon was found to be significant ($P<0.05$) only at 6 and 8 WAS at Dutsin-Ma, as presented in Table 3. The interaction of intra-row spacing and poultry manure rates on the number of leaves per plant of musk melon was significant ($p<0.05$) at 6 and 8 WAS, only at Dutsin-Ma, where increasing the poultry manure rate from 0 to 15 t $ha^{-1,}$ irrespective of intra-row spacing adopted, significantly ($P<0.05$) increased the number of leaves. Furthermore, increasing the intra-row spacing from 25 to 75 cm, irrespective of the poultry manure applied, increased the number of leaves per plant. However, application of 15 t ha^{-1} in conjunction with 75 cm intra-row spacing significantly ($P<0.05$) gave the highest Number of leaves per plant (Table 3).

Table 1: Physical and chemical properties of soils at the experimental sites and poultry manure used during the 2023 rainy season

Soil Characteristics	**Soil depth (0-30cm)**	
Experimental Sites	Dutsin-Ma	Malumfashi
Particle Size Distribution (%)		
Sand (%)	800	540
Silt (%)	120	360
Clay (%)	80	100
Textural Class	Loamy Sand	Sandy Loam
Chemical Composition		
pH in H_2O (1:2.5)	7.45	5.37
pH in 0.01M $CaCl_2$ (1:2.5)	6.55	6.46
Organic Carbon (g kg^{-1})	12.61	14.10
Total Nitrogen (g kg^{-1})	1.65	1.86
Available Phosphorus (g kg^{-1})	15.60	16.80
Exchangeable Bases (Cmol kg^{-1})		
Calcium (Ca)	2.98	3.01
Magnesium (Mg)	0.54	0.48
Potassium (K)	0.20	0.22
Sodium (Na)	0.14	0.17
Aluminium and Hydrogen (Al^{3+} H^+)	0.2	0.3
ECEC	4.06	4.18
Poultry Manure nutrient composition (g kg^{-1})		
Total Nitrogen	23.60	
Calcium (Ca^{2+})	6.40	
Magnesium (Mg^{2+})	3.96	
Potassium (K^+)	13.20	

Table 2: Effect of varieties, intra-row spacing and poultry manure rate on number of leaves of Musk melon at Dutsin-Ma and Malumfashi during 2023 rainy season

	Number of leaves					
	Dutsinma			Malumfashi		
Treatment	4WAS	6WAT	8WAS	4WAS	6WAT	8WAS
Variety (V)						
URANUS F1	9.47	33.86	91.42	11.00	36.08	95.89
NEPTUNE F1	11.25	32.81	87.67	13.00	33.00	86.69
SE±	0.339	1.008	2.798	0.419	1.221	3.170
Intra Raw Spacing (S) (cm)						
25	9.54^b	30.29^b	88.29^{ab}	12.00	32.67	91.42
50	9.50^b	30.42^b	78.92^b	12.17	37.42	100.7
75	12.04^a	39.29^a	101.42^a	11.83	33.54	81.75
SE±	0.508	1.512	4.197	0.628	1.832	4.755
Poultry Manure (P) (t ha^{-1})						
0	5.00^c	16.78^c	49.56^c	7.06^c	18.89^c	49.56^c
5	8.67^b	28.06^b	69.78^c	$9.89b^c$	29.56^b	72.22^{bc}
10	11.17^b	34.22^b	92.89^b	12.67^b	36.00^b	95.33^b
15	16.61^a	54.28^a	145.94^a	18.39^a	53.72^a	148.16^a
SE±	0.678	2.016	5.596	0.837	2.442	6.340
Interaction						
V*S	NS	NS	NS	NS	NS	NS
V*P	NS	NS	NS	NS	NS	NS
S*P	NS	*	*	NS	NS	NS
V*S*P	NS	NS	NS	NS	NS	NS

Vine Length (cm)

Vine length, as influenced by varieties, intra-row spacing, >and poultry manure rates, on musk melon at Dutsin-Ma and Malumfashi, was presented in Table 4. The results, consistent across both locations, revealed that the influence of musk melon varieties on vine length was not significant (P>0.05) throughout the sampling period (Table 4). However, the influence of intra-row spacing on vine length of musk melon varieties was significant (P<0.05), where intra-row spacing of 75cm produced longer vines than all other spacing only at 6 and 8 WAS at both locations, but 25 and

Means followed by the same letters within column in each treatment group are not significantly different at 5% probability level using the Duncan Multiple Range Test (DMRT). WAS = Week after sowing. NS = Not Significant at 5% level of probability. >* = Significant at 5% level of probability, SE± = Standard error

Table 3: Interaction between intra row spacing and poultry manure rate on number of leaves in Musk melon at 6 WAS during 2023 wet season at Dutsin-Ma.

	Poultry manure rates (P) t ha^{-1}			
Treatment	0	5	10	15
Intra row spacing (S) cm				
		6 WAS		
25	12.17^{g}	26.00^{def}	34.50^{cd}	48.50^{b}
50	17.50^{fg}	26.33^{def}	38.17^{bc}	39.67^{bc}
75	20.67^{efg}	31.83^{cd}	30.00^{cde}	74.67^{a}
SE±		4.831		
		8 WAS		
25	41.00^{f}	70.00^{de}	100.17^{c}	142.00^{b}
50	48.67^{ef}	56.50^{edf}	108.00^{c}	102.50^{c}
75	59.00^{edf}	82.83^{cd}	70.50^{de}	193.33^{a}
SE±		12.756		

Means followed by the same letters are not significant different at 5% probability level using Duncan Multiple Range Test (DMRT)

Table 4: Effect of varieties, intra-row spacing and poultry manure rate on vine length (cm) of musk melon at Dutsin-Ma and Malumfashi during 2023 rainy season

	Vine length (cm)					
	Dutsin-Ma			Malumfashi		
Treatment	4WAS	6WAS	8WAS	4WAS	6WAS	8WAS
Variety (V)						
URANUS F1	19.99	45.99	111.7	25.80	63.72	150.1
NEPTUNE F1	18.76	50.45	122.1	25.40	70.35	164.7
SE±	0.607	1.351	2.757	0.716	1.431	3.106
Intra Row Spacing (S) (cm)						
25	17.45	43.95b	104.6b	25.42	60.02b	139.2b
50	20.22	45.38b	111.5b	24.45	63.61b	152.5b
75	20.46	55.33a	134.6a	29.93	77.47a	180.5a
SE±	0.910	2.026	4.136	1.074	2.146	4.660
Poultry Manure (P) (t ha^{-1})						
0	8.94c	16.17c	41.99c	14.77c	29.06c	72.28c
5	14.77b	29.06b	72.28b	25.94b	70.82b	172.3b
10	25.94a	70.82a	172.3a	27.85b	76.84b	181.0ab
15	27.85a	76.84a	181.0a	33.83a	91.43a	204.0a
SE±	1.213	2.701	5.515	1.433	2.862	6.213
Interaction						
V*S	NS	NS	NS	NS	NS	NS
V*P	NS	NS	NS	NS	NS	NS
S*P	NS	NS	NS	NS	NS	NS
V*S*P	NS	NS	NS	NS	NS	NS

Means followed by the same letters within a column in each treatment group are not significantly different at 5% probability level using Duncan Multiple Range Test (DMRT). WAS = Week after sowing. NS= Not Significant at 5% level of probability. SE± = Standard error

50cm were statistically similar, though 50cm was at par (Table 4). Application of poultry manure had significant (P<0.05) effect on vine length, where application of 15 t ha^{-1} produced significantly (P<0.05) longer vines than other rates at all sampling periods at both locations, but 15 and 10 t ha^{-1} were statistically similar at all growth stages at Dutsin-Ma and at 8 WAS only at Malumfashi, though 10 t ha^{-1} was at par (Table 4). The interactions were not significant (P > 0.05) for vine length across sampling periods in both locations

Shoot Dry Weight (g)

The influence of varieties, intra-row spacing and varying rate of poultry manure on shoot dry weight of musk melon at Dutsin-Ma and Malumfashi during the 2023 rainy season is shown in Table 5. Variety had significantly (P<0.05) influenced musk melon at all sampling periods in both locations, with variety NEPTUNE F1 significantly (P<0.05) showing superiority over URANUS F1 (Table 5). Intra-row spacing significantly (P<0.05) influenced shoot dry weight at all sampling periods in both locations. Musk melon grown with an intra-row spacing of 75cm significantly (p<0.05) accumulated heavier shoot dry weight relative to musk melon grown on intra-row spacing of 50 and 25cm, while 25cm intra-row spacing recorded the least shoot dry weight, though 50cm was at par at both the study sites (Table 5). Differences in Musk melon shoot dry weight across poultry manure rates were significant (P< 0.05) throughout the sampling periods. Application of 5, 10 or 15 t ha^{-1} poultry manure significantly (P<0.05) increased musk melon shoot dry weight over the untreated control in all the sampling dates in both the study sites. Application of poultry manure at 15 t ha^{-1} produced heavier shoot dry weight, while the untreated control of 0 t ha^{-1} recorded the least shoot dry weight throughout the sampling period at both locations (Table 5). The interactions were not significant (P>0.05) for shoot dry weight across sampling periods in both locations.

Relative Growth Rate (RGR)

The effect of musk melon varieties, intra-row spacing and varying rates of poultry manure on the relative growth rate (RGR) of musk melon at Dutsin-Ma and Malumfashi during 2023 is shown in Table 6. The variety had no significant effect (P>0.05) on the RGR of musk melon across sampling dates at both locations (Table 6). The effect of intra row spacing significantly (P<0.05) affect relative growth rate of musk melon at all the sampling period, at both locations, at 4-6 WAS, when musk melon grown with 25cm intra row spacing was significantly (P<0.05) superior with respect to RGR than all other intra row spacing, while 50 and 75cm where statistically similar in both locations. However, at 6-8 WAS musk melon grown with 50cm intra row spacing was significantly (p<0.05) superior with respect to RGR, though 75cm intra row spacing was at par at both locations

(Table 6). Applications of poultry manure had a significant (P<0.05) effect on RGR of musk melon throughout the sampling period at both locations. Where each increase in poultry manure rate from 0 to 5 t ha^{-1} induced a significant (P<0.05) effect in musk melon RGR, however, further increase of poultry manure from 5 to 15 t ha^{-1} had no significant (p>0.05) musk melon RGR at both the growth stages in Dutsin-Ma and at 6-8 WAS only in Malumfashi. However, application of 15 t ha $^{-1}$ significantly (P<0.05) increased RGR throughout the sampling period at both locations, while 10 and 5 t ha $^{-1}$ were at par (Table 6). The interactions were not significant (P>0.05) for RGR across sampling periods in both locations.

Net Assimilation Rate (NAR)

Effect of varieties, intra-row spacing and poultry manure rates on Net assimilation rate (NAR) of musk melon at Dutsin-Ma and Malumfashi during the 2023 is shown in Table 7. Variety influenced the NAR of musk melon significantly (P < 0.05) at both locations throughout the sampling period, with variety NEPTUNE F1 yielding higher NAR values than those from variety URANUS F1

Table 5: Effect of varieties, intra-row spacing and poultry manure rate on shoot dry weight of Musk melon at Dutsin-Ma and Malumfashi during 2023 rainy season

	Shoot Dry Weight (g)					
	Dutsin-Ma			Malumfashi		
Treatment	4WAS	6WAS	8WAS	4WAS	6WAS	8WAS
Variety (V)						
URANUS F1	14.35^{b}	26.64^{b}	52.45^{b}	13.47^{b}	23.94^{b}	50.64^{b}
NEPTUNE F1	16.86^{a}	31.98^{a}	69.67^{a}	16.58^{a}	31.06^{a}	71.37^{a}
SE±	0.313	0.708	2.215	0.357	0.725	2.123
Intra Row Spacing (S) (cm)						
25	12.65^{b}	25.28^{b}	45.03^{b}	12.01^{b}	24.66^{b}	45.10^{b}
50	16.15^{b}	29.72^{ab}	67.43^{a}	15.35^{a}	27.41^{ab}	67.11^{a}
75	17.97^{a}	32.93^{a}	70.72^{a}	17.72^{a}	30.44^{a}	70.82^{a}
SE±	0.470	1.062	3.323	0.535	1.087	3.185
Poultry Manure (P) (t ha^{-1})						
0	9.39^{c}	18.61^{c}	31.88^{c}	9.19^{c}	19.36^{c}	34.99^{c}
5	13.77^{b}	27.78^{b}	56.47^{b}	13.38^{b}	25.04^{bc}	57.51^{b}
10	15.87^{b}	31.22^{b}	65.96^{b}	15.69^{b}	28.61^{b}	63.59^{b}
15	23.37^{a}	39.63^{a}	89.93^{a}	21.84^{a}	37.01^{a}	87.94^{a}
SE±	0.627	1.416	4.430	0.714	1.449	4.247
Interaction						
V*S	NS	NS	NS	NS	NS	NS
V*P	NS	NS	NS	NS	NS	NS
S*P	NS	NS	NS	NS	NS	NS
V*S*P	NS	NS	NS	NS	NS	NS

Means followed by the same letters within a column in each treatment group are not significantly different at the 5% probability level according to the Duncan Multiple Range Test (DMRT). WAS= Week after sowing, NS= Not Significant at 5% level of probability, SE = Standard error

(Table 7). Intra-row spacing significantly (P<0.05) affected musk melon NAR throughout the growth stages at both locations. At 4-6 WAS, musk melon grown with an intra-row spacing of 25cm produced significantly (P<0.05) higher NAR than musk melon grown with 75cm intra-row spacing, though musk melon grown with 50cm was at par at Dutsin-Ma and at Malumfashi, And at 6-8 WAS musk melon NAR were significantly (P<0.05) decreased when grown within 25cm intra-row spacing, however, musk melon grown with 50cm showed significant (P<0.05) superiority with respect to NAR over musk melon grown with 25cm intra-row spacing though statistically similar to 75cm at both the study sites (Table 7). Application of poultry manure was significant (P<0.05) at all sampling stages at Dutsin-Ma, and only at 6-8 WAS at Malumfashi.. At 4-6 WAS, at Dutsin-Ma, NAR of musk melon nourished with 10 t ha^{-1} poultry manure was significantly (P<0.05) higher than the untreated control of 0 t ha-1, which recorded the lowest NAR, though statistically similar to 5 and 15 t ha-1, which were at par. At 6-8 WAS, application of 15 t ha^{-1} poultry manure significantly (P<0.05) enhanced NAR of musk melon over 5 and 0 t ha^{-1} but statistically similar with 10 t ha^{-1}, poultry manure rate of 10 and 5 t ha^{-1} were statistically similar but significantly (P<0.05) gave higher NAR than 0 t ha^{-1}, though 10 t ha^{-1} was at far at both locations of the study (Table 7). The interaction of musk intra-row spacing and poultry manure rates was significant (P<0.05) on net assimilation rate at 4-6 WAS of musk melon in Dutsin-Ma, as shown in Table 8. There was a significant (P<0.05) effect on NAR of musk melon in the increase of poultry manure rate from 0 to 5 t ha^{-1} with 25 and 75cm intra-row spacing. A further increase to 10 t ha^{-1} of poultry manure increased the NAR of musk melon only at plots grown with 50cm intra row spacing, after which no significant (p>0.05) effect was observed at further poultry manure rate increase (Table 8).

Table 6: Effect of varieties, intra-row spacing and poultry manure rate on relative growth rate of Musk melon at Dutsin-Ma and Malumfashi during 2023 rainy season

	Relative growth rate (g m^2wk^{-1})			
	Dutsin-Ma		Malumfashi	
Treatment	4-6WAT	6-8WAS	4-6WAS	6-8WAT
Variety (V)				
URANUS F1	0.135	0.142	0.130	0.160
NEPTUNE F1	0.143	0.154	0.141	0.161
SE±	0.004	0.005	0.004	0.005
Intra Row Spacing (S) (cm)				
25	0.152^{a}	0.125^{b}	0.160^{a}	0.129^{b}
50	0.133^{b}	0.170^{a}	0.127^{b}	0.188^{a}
75	0.131^{b}	0.149^{ab}	0.119^{b}	0.164^{ab}
SE±	0.006	0.007	0.006	0.007
Poultry Manure (P) (t ha^{-1})				
0	0.112^{b}	0.121^{b}	0.111^{c}	0.124^{b}
5	0.149^{a}	0.150^{a}	0.129^{bc}	0.170^{a}
10	0.150^{a}	0.159^{a}	0.136^{b}	0.173^{a}
15	0.144^{a}	0.163^{a}	0.165^{a}	0.175^{a}
SE±	0.007	0.009	0.008	0.010
Interaction				
V*S	NS	NS	NS	NS
V*P	NS	NS	NS	NS
S*P	NS	NS	NS	NS
V*S*P	NS	NS	NS	NS

Means followed by the same letters within column in each treatment group are not significantly different at 5% probability level according to Duncan Multiple Range Test (DMRT). WAS= Week after sowing, NS= Not Significant at 5% level of probability, SE = Standard error

Table 7: Effect of varieties, intra-row spacing and poultry manure rate on net assimilation rate of Musk melon at Dutsin-Ma and Malumfashi during 2023 rainy season

	Net assimilation rate ($g.g^{-1}wk^{-1}$)			
	Dutsin-Ma		Malumfashi	
Treatment	6WAS	8WAS	6WAS	8WAS
Variety (V)				
URANUS F1	12.08^{b}	14.30^{b}	9.36^{b}	14.82^{b}
NEPTUNE F1	14.68^{a}	19.97^{a}	14.61^{a}	21.91^{a}
SE±	0.501	0.809	0.480	0.877
Intra Row Spacing (S) (cm)				
25	15.86^{a}	13.45^{b}	13.90^{a}	13.01^{b}
50	12.94^{ab}	20.90^{a}	11.46^{b}	22.08^{a}
75	11.34^{b}	17.06^{ab}	10.59^{b}	20.02^{a}
SE±	0.751	1.214	0.720	1.315
Poultry Manure (P) (t ha^{-1})				
0	10.55^{b}	9.21^{c}	11.02	10.44^{c}
5	14.04^{ab}	16.55^{b}	11.23	18.63^{b}
10	15.24^{a}	19.28^{ab}	11.85	20.43^{ab}
15	13.69^{ab}	23.50^{a}	13.85	23.97^{a}
SE±	1.001	1.619	0.960	1.754
Interaction				
V*S	NS	NS	NS	NS
V*P	NS	NS	NS	NS
S*P	*	NS	NS	NS
V*S*P	NS	NS	NS	NS

Means followed by the same letters within a column in each treatment group are not significantly different at 5% probability level according to Duncan Multiple Range Test (DMRT). WAS = Week after sowing, NS = Not Significant at 5% level of probability. * = Significant at 5% level of probability, SE = Standard error

Table 8: Interaction between intra-row spacing and poultry manure rate on net assimilation rate in Musk melon at 4-6 WAS during 2023 wet season at Dutsin-Ma.

	Poultry manure rate (P) t ha^{-1}			
Treatment	0	5	10	15
Intra row spacing (S) cm				
25	12.52^{abc}	18.36^{a}	18.41^{a}	14.14^{a-d}
50	10.35^{cd}	7.91^{d}	17.60^{ab}	15.89^{abc}
75	8.78^{d}	15.85^{abc}	9.70^{cd}	11.04^{bcd}
SE±		2.452		

Means followed by the same letters are not significant different at 5% probability level according to Duncan Multiple Range Test (DMRT)

DISCUSSION

Varieties significantly responded to treatments (poultry manure and intra-raw spacing) in terms of sweet melon growth and development. The results obtained revealed that variety NEPTUNE F1 significantly outperformed variety URANUS F1 in both locations. This could be attributed to genetic composition, which might have been responsible for the performance difference observed between the varieties. This corroborates with Ibrahim *et al.* (2001), Bidein *et al.* (2017), and Aliyu *et al*. (2023), who opined that differences in growth rate and yield characters of vegetable crops are normally attributed to their genetic make-up.

The intra-row spacing adopted during the experiment significantly influenced the performance of musk melon in terms of growth and development. It was observed that the 50 cm intra-row spacing showed superior performance in the evaluated musk melon growth characters compared with other intra-row spacings. This could be due to adequate spacing in plant production, which caused the observed increases in crop growth. This agrees with the reports of Dean *et al*. (2004) and Mangala and Mausia (2006), who observed that vegetative parameters increased with melon spacing. The rapid ground cover by the sweet melon vines and leaves also served as a living mulch, reducing moisture loss through soil evaporation, maintaining relatively cool soil temperature, reducing N volatilisation, and smothering weeds, which is beneficial to the crop, as it did not have to compete for growth resources alongside more aggressive and adaptive weeds during the various stages of the crop's growth and development. Takim and Fadayomi (2008) reported that low-growing cover crops, such as egusi melon (*Cucumeropsis mannii*), which has the same morphological characteristics as sweet melon, could reduce weed pressure in intercropped small-holder farms, hence increasing crop yield.

The application of poultry manure significantly enhanced the growth and development of sweet melon. Each increase in poultry manure rate from 5 to 10 and 15 t ha^{-1} significantly enhanced most of the evaluated characters. This could be attributed to the manifold advantages of manure, including physical, chemical, and biological benefits for soil properties and, by extension, crop performance in terms of growth and development (Haruna, 2023). It appears that 15 t ha^{-1} of poultry manure supplied sufficient nutrients to meet crop needs. Thus, the marked increases in sweet melon to the applied 15 t ha^{-1} of poultry manure could have necessitated significant growth responses. This is consistent with the findings of Dauda *et al*. (2008), who attributed the vigorous growth and fruit yield observed in watermelon to an increased nutrient supply from higher rates of poultry manure application. The untreated control plots (0 t ha^{-1}) of poultry manure recorded the lowest values for the crop's growth characters during the experiment. The poor performance of plots that received no poultry manure might be due to nutrient stress, leading to reduced plant growth, as exemplified by poor growth of sweet melon. This agrees with the findings of Aujla *et al.* (2007) and Akanbi *et al*. (2007). The interaction of intra-row spacing and poultry manure on the growth of musk melon (Number of leaves) was observed in the experiment. It revealed that, within 75cm intra-row spacing and application of 15 t ha^{-1} of poultry manure, the crop recorded superior performance during the experiments relative to the 25 or 50cm intra-row spacing and the other poultry manure treatments evaluated. This could be as a result of the crop possessing morphological characteristics of a crawling sweet melon which has an ability to position its vines and leaves towards the response of light (phototropism) to harnessing adequate amount lights, and the development of roots (rhizosphere) in the soil to harness nutrient to avoid of water or nutrient competition, utilizing abundant amount of nutrient present in the soil from the application of up to 15 t ha^{-1} of poultry manure which was sufficient for the growth and development of the crop (Hamma *et al*., 2012).

CONCLUSION

In conclusion, varieties significantly enhanced musk melon growth. Variety NEPTUNE F1 recorded significantly higher values for the number of leaves, number of vines, vine length, shoot dry weight, crop growth rate, relative growth rate, and net assimilation rate than URANUS F1. Intra-row spacing significantly influenced the growth of musk melon, with musk melon grown at 50 cm intra-row spacing showing superior performance compared with other intra-row spacings. Poultry manure significantly increased musk melon growth characters, such as the number of leaves, vine length, shoot dry weight, relative growth rate, and net assimilation rate, with an application rate of 15 t ha^{-1} appearing to be the most appropriate for musk melon production in the study area.

REFERENCES

Adesoji, A. G. (2015). Potentials and Challenges of Inorganic and Organic Fertilizers in Nutrient Management. In: Sinha, S, Pant, S. S., Bajpai, S. and Govil, J. N. (eds). Fertilizer Technology I Synthesis. Studium Press LLC, Houston, TX, USA, pp. 77-100.

Adeyeye A.S, Akanbi, W.B, Olalekan, K.K, Lamidi, W.A, Othman, H.J, and Ishaku, M.A (2017). The Growth and Yield Performance of Sweet Melon as Affected by Planting Spacing in North East Nigeria. *International Journal of Research in Agriculture and Forestry* Volume 4, Issue 8, 2017, PP 17-21 ISSN 2394-5907 (Print) & ISSN 2394-5915 (Online)

Akanbi W.B., Togun A.O., Olaniran O.A., Akinfasoye J.O., Tairu F.M., (2007) Physico-chemical properties of eggplant (*Solanum melongena* L.) fruit in response to nitrogen fertilizer and fruit size. *Agriculture Journal.* 2(1):140-148.

Aliyu, L., Musa, H., and Yakubu, M. (2023). Constraints and opportunities in muskmelon production in Nigeria. *Nigerian Journal of Agricultural Sciences,* 35(1), 22–30.

Aujla M.S., Thind H.S., Buttar G.S., (2007) Fruit yield and water use efficiency of eggplant (*Solanum* melongena L.) as influenced by different quantities of nitrogen and water applied through drip and furrow irrigation. *Journal of Science and. Horticulture*. 112:142– 148.

Bidein, T., Lale, N.E.S and Zakka, U. (2017) Efficacy of Combining Varietal Resistance with Organic Fertilizer Application in Reducing Infestation of Cucumber *(Cucumis Sativus* L.) By Insect Pests in the Niger Delta. *European Journal of Agriculture and Forestry Research* Vol.5, No.1, Pp.49-63.

Dauda, S.N., Ajayi, F.A. and Ndor E. (2008). Growth and Yield of Watermelon (*Citrullus lanatus*) as Affected by Poultry Manure Application. *Journal of Agriculture & Social Sciences*.;121– 124. http://www.fspublishers.org (accessed 2009 November 10).

Dean, B, Milijana, G and Borsic, J. (2004) Plant spacing and cultivar effect on melon growth and yield component. *Procedings of American Society of Horticultural Science* 2004; 109: 238- 243.

Ewulo, B. S. Ojeniyi, S. O. and Akanni, D. A. (2008). Effect of poultry manure on selected soil physical and chemical properties, growth, yield and nutrient status of tomato. *African Journal of Agricultural Research* Vol. 3 (9), pp. 612-616,. **http://www.academicjournals.org/AJAR** (accessed 2009 November 10).

Hamma, I. L., Ibrahim, U. and Haruna, M. (2012). Effect of poultry manure on the growth and yield of cucumber (Cucumis sativum l.) in Samaru, Zaria. Nigerian Journal of Agriculture, Food and Environment. 8(1):94-98.

Haruna, A. O., (2023) Response of varieties of sweet melon (*Cucumis melo* L.) intercropped with eggplant (*Solanum melongena*) as influenced by varying rates of organic manure and crop arrangement. Unpublished DISSERTATION Submitted to School of Postgraduate Studies, AHMADU BELLO UNIVERSITY.

Ibrahim, R. Amans, E.B. Ahmed A. and Abubakar, I.U. (2001). Growth and yield of tomato(*Lycopersicum esculentus* Mill) varieties influenced by crop spacing St Samaru, Northern Nigeria. *Nigeria Journal of Horticultural Society*. 5:52-57.

Cakmak, I., (2002). Plant Nutrition Research: Priorities to Meet Human Needs for Food in Sustainable Ways. Plant and Soil. Vol. 247, NO. 1 Progress in Plant Nutrition: Plenary Lectures of the XIV International Plant Nutrition Colloquium. Springer publishers, Pp:3-24

Mangala, R and Mausia, S. (2006). *Handbook of Agriculture* 2006; pp 169.

Oyedeji, Stephen, Animasaun, David Adedayo, Bello, Abdullahi Ajibola, Agboola, Oludare Oladipo. (2014). Effect of NPK and Poultry Manure on Growth, Yield, and Proximate Composition of Three Amaranths, *Journal of Botany*, vol. 2014 (1-6).

Pacini. C., Wossink, A., Giesen, G., Vazzana, C., Huirne, R. (2003). Evaluation of sustainability of organic, integrated and conventional farming systems: A farm and field-scale analysis. *Agriculture, Ecosystems & Environment* 95:273-288.

Takim, F.O. and Fadayomi, O. (2008). Influence of tillage operations and cropping systems on field emergency of weeds in a Southern Guinea savanna zone, 36th *Annual Conference of Weed.*