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ORGANIC FERTILIZER RATE ON GROWTH AND YIELD OF CUCUMBER VARIETIES

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ABSTRACT

Appropriate crop variety and organic fertilizer rate are factors that impact growth and yield of cucumber (Cucumis sativus L). Two field trials were conducted between April and December, 2015 at the Federal University of Agriculture, Abeokuta, Nigeria in the tropical rainforest-savannah transition zone of south-western Nigeria, to determine optimum rate of an organic fertilizer on three varieties of cucumber. There were four organic manure rate treatments comprising 0, 5, 10, and 15 $t.ha^{-1}$ of Gateway Organic Fertilizer brand. The three cucumber varieties investigated were: Marketmore, Poinsett and Marketer. Treatments were arranged in a split - plot arrangement fitted into Randomized Complete Block Design (RCBD) with 4 replicates. Data collected on growth and yield parameters were subjected to analysis of variance using GENSTAT discovery. Gateway Organic Fertilizer application had positive influence on growth and fruit yield of cucumber. Number of leaves, number of branches and vine length increased with increasing organic fertilizer rate. Yield was increased up to 53.63 %, 64.74 % and 51.65 % with Marketmore, Poinsett and Marketer varieties, respectively. Among the varieties, Poinsett variety was best for optimum growth and yield. Application of 10 $t.ha^{-1}$ Gateway Organic Fertilizer was optimum for fruit yield of cucumber.

Keywords: Gateway organic fertilizer, Poinsett, Marketmore, Marketer

INTRODUCTION

Cucumber (*Cucumis sativus* L) is a monoecious annual crop in the Cucurbitaceae family that has been cultivated by man for over 3,000 years (Adetula and Denton, 2003; Okonmah, 2011).

It is usually propagated by seed. Economically, it ranks fourth after tomatoes, cabbage and onion in Asia and second after tomato in Western Europe (Eifediyi and Remison, 2010). However, its place is yet to be ranked in tropical Africa because of limited use. Cucumber fruits can be used as a low income source of vitamins and minerals that are lacking in most diets. It can be eaten in salads or sliced into stew, as in the tropical regions. The ascorbic acid and caffeic acid

contained in cucumber helps in reducing skin irritation (Okonmah, 2011). Cultivar selection is one of the most important decisions made during the crop production process. Desirable traits required for local cultivars include high productivity, high fruit crispness and firmness, as well as resistance to pests and diseases. Cucumber varieties are majorly three types: slicing, pickling, and burpless. Within each variety, several different cultivars have emerged with varying shapes, sizes, skin colour and carotene content (Tahir *et al*., 2019). Cucumber yields in the tropics are generally often low due to low soil fertility. The soils are poor in organic matter content and available nutrients; hence productivity and sustainability decline over time (Zingore *et al*., 2003). This is due to continuous cultivation of the tropical soils leading to mining of the soil nutrients which need to be replenished in order to reverse loss of nutrients and maintain productivity. Replenishment of nutrients and enhanced quality of tropical soil may be achieved either from organic sources, inorganic fertilizers or from both (Shangakkara *et al*., 2004). Use of chemical fertilizers alone to sustain high crop yields has not been successful, due to enhancement of soil acidity, nutrient leaching and degradation of soil physical and organic matter status (Nottidge *et al*., 2005). Adediran *et al*., (1999) reported that when organic fertilizers are applied at a rate that supplies equivalent amounts of N, P and K in mineral fertilizer, it has same effects as inorganic fertilizer. There is the need to study the effects of manure rates on cucumber. This experiment was conducted to determine the optimum rate of an organic fertilizer (Gateway Organic Fertilizer) on three cucumber varieties (Marketmore, Poinsett and Marketer).

MATERIALS AND METHODS

The experiment was conducted at the research farm of the Federal University of Agriculture Abeokuta in the tropical rainforest-savannah transitional zone of south-western Nigeria, latitude 7°15'N; longitude 3°25'E. Pre-planting soil samples were taken randomly up to 15 cm depth from 5 locations, using a soil auger and bulked to have a composite sample that was air dried and analyzed to determine soil nutrient status. The first season (Early season) field trial was conducted from April to July, while the second season (Late season) field trial was conducted from September to December, 2015.

The Oxic Paleudulf soil (Adetunji, 1991) was mechanically ploughed and harrowed after 2 weeks. The entire field was demarcated into 48 plots of 3.0 x 2.0 m each, separated by 1.0 m path-ways. Main plot was cucumber variety (Marketmore, Poinsett and Marketer) while sub plot treatment was organic fertilizer rate at 0, 5, 10 and 15 $t.ha^{-1}$ in a split - plot arrangement fitted into Randomized Complete Block Design (RCBD) with 4 replicates.

Gateway Organic Fertilizer (a commercial brand of organic fertilizer produced in Ogun State, Nigeria**)** was applied in a single dose at 2 weeks before planting at the rate of 5, 10 and 15 $t.ha^{-1}$ while unfertilized plots served as control. Three cultivars of cucumber used for the experiment were: 'Marketmore', (open pollinated variety that is resistant to cucumber scab and cucumber mosaic virus); Poinsett (open pollinated variety that is resistant to angular leaf spot, anthracnose, downy mildew and powdery mildew) and Marketer (open pollinated variety that is resistant to downy and powdery mildew) variety. Planting was done at two weeks after organic fertilizer application. Two seeds of cu-

cumber were planted on flat beds at a spacing of 1.0 x 0.5 m. Manual weeding was at 3 weeks interval prior to flowering and fruiting. Pest control was done organically using a bio-pesticide formulation that composed of 200 g of neem shoot biomass, 100 g of pawpaw leaves, 100 g of jatropha leaves, 100 g of lemon grass, boiled in 10 litres of water. The extract was allowed to cool and foliar application was done using hand sprayer at 2 and 4 weeks after planting.

At each sampling, four cucumber plants were sampled from middle rows to determine vine length, number of leaves/plant, and number of branches. Vine length was measured from the root collar to the growing tip of the main vine. Fully-expanded leaves and branches were counted. Number of days to first and 50% flowering were determined. Healthy and mature fruits were harvested; number of fruits per plant; average fruit weight, and fruit yield were estimated.

Data were subjected to analysis of variance using GENSTAT discovery (12th ed., VSN International, Hemel Hempstead, UK), with cucumber variety and organic fertilizer rates as factors. The interactions were majorly significant and so were used to explain results, and were separated using DMRT at $P \leq 0.05$.

RESULTS

Soil characters of the sandy loam soil varied between seasons (Table1). pH values in both seasons were near neutral. Organic matter composition was higher in the early season cropping (4.3%) which translated to higher nitrogen content; values in late season cropping were higher for available phosphorus, magnesium, calcium and zinc than in early season cropping (Table 1).

Table 1: Pre-cropping Soil and Organic Fertilizer Analysis

Parameter	Early season	Late season	Organic fertilizer
Chemical Composition			
pH	7.20	7.30	6.50
O.M (%)	4.32	1.55	12.32
Total N (%)	0.15	0.08	2.14
Avail. P ($mg.kg^{-1}$)	12.58	18.2	43.12
Exch. Bases			
Mg ($cmol.kg^{-1}$)	0.37	2.51	2.86
K ($cmol.kg^{-1}$)	0.61	0.5	1.50
Na ($cmol.kg^{-1}$)	0.52	0.39	1.48
Ca ($cmol.kg^{-1}$)	0.21	0.63	6.10
Zn($mg.kg^{-1}$)	0.10	0.11	2.11
Fe ($mg.kg^{-1}$)	0.41	0.32	2.02
Physical			
Sand %	52.67	70.2	
Slit %	31.00	14.00	
Clay %	16.00	15.8	
Soil Textural Class	sandy loam	sandy loam	

Total rainfall during the early cropping season with sunshine hour was greater than in the late cropping season (Table 2). During the experimental period, total rainfall and rainfall during the vegetative phase were higher in the late season than in the early season. However, during the reproductive phase, rainfall was higher in the early season than in the late season. Mean temperatures were higher during the vegetative phase but lower during the reproductive phase in early cropping season while in the late cropping season, mean temperatures were lower during the vegetative phase but higher during the reproductive phase (Table 2).

Table 2: Meteorological data of the experimental site in 2015

	Rainfall (mm)	Sunshine (hr)	Maximum temperature (^oC)	Minimum temperature (^oC)
January	0.00	6.10	35.40	20.50
February	17.10	2.10	33.10	24.60
March	149.00	5.60	35.30	25.10
April	87.20	6.10	33.80	24.10
May	113.80	6.70	33.10	23.80
June	116.50	4.20	31.00	22.80
July	90.70	3.60	23.50	28.30
August	92.70	2.40	22.90	22.90
September	160.00	2.80	30.40	22.50
October	205.90	5.90	31.60	23.00
November	17.60	6.30	33.50	23.80
December	0.00	5.90	33.50	19.30

There were significant differences in the number of leaves of cucumber as influenced by interaction of variety and organic fertilizer rate (Table 3). In the early season cropping, Marketmore variety cultivated with 10 $t.ha^{-1}$ organic fertilizer produced more leaves significantly higher when compared with other interactions at 4 WAP. At 6 WAP, Marketmore variety cultivated with 10 and 15 $t.ha^{-1}$ organic fertilizer produced more leaves but similar when compared with Poinsett cultivated with 5, 10 and 15 $t.ha^{-1}$ and Marketer at 10 and 15 $t.ha^{-1}$ organic fertilizer. At 8 WAP, Marketmore cultivated with 5, 10 and 15 $t.ha^{-1}$ organic fertilizer produced more leaves which were significantly higher when compared with other interactions (Table 3).

At 4, 6 and 8 WAP, during the late cropping season, Marketer variety cultivated with 15 $t.ha^{-1}$ organic fertilizer produced more leaves per plant (Table 3).

Table 3: Effects of variety and fertilizer rate interactions on number of cucumber leaves /plant in 2015

Variety	Rate (t.ha^{-1})	4	6	8	4	6	8
		Weeks after planting					
		Early season			Late season		
Marketmore	0	10.75cde	18.00de	17.00bc	6.000h	15.00h	6.00c
	5	18.00b	34.00abc	30.00a	10.00ef	31.00de	13.00b
	10	27.75a	41.00a	26.00a	12.00 cde	31.00de	12.00b
	15	19.75b	34.00abc	30.00a	15.75 ab	34.00c	12.00 b
Poinsett	0	7.25e	21.00cde	10.00cd	7.00 gh	18.00g	10.00 b
	5	9.75de	33.00abc	18.00b	11.00def	34.00c	18.00a
	10	10.75cde	32.00abcd	17.00bc	12.00cde	34.00c	17.00a
	15	10.25de	30.00abcd	17.00bc	15.00ab	37.00b	17.00a
Marketer	0	6.88e	14.00e	10.00d	9.00fg	23.00f	11.00b
	5	9.63de	22.00bcde	10.00d	14.00bc	39.00b	11.00b
	10	14.88bcd	28.00abcd	14.00bcd	14.00bc	39.00b	17.00a
	15	17 .1bc	36.00ab	17.00b	16.00a	42.00a	18.00a

Means with the same letter(s) under the same column are not significantly different ($P < 0.05$) using Duncan Multiple Range Test (DMRT).

Number of cucumber branches was significantly influenced by interaction of variety and organic fertilizer rate (Table 4). In the early season cropping, Marketmore variety cultivated with 10 and 15 t.ha^{-1} organic fertilizer produced more branches which were significantly higher when compared with other interactions at 4 WAP. At 6 WAP, Marketer cultivated with 15 t.ha^{-1} organic fertilizer produced more branches that were similar when compared with Marketmore and Poinsett cultivated with 5, 10 and 15 t.ha^{-1} organic fertilizer but significantly higher when compared with other interactions. At 8 WAP, Poinsett cultivated with 5, 10 and 15 t.ha^{-1} organic fertilizer produced more branches which was similar compared with Marketmore and Marketer cultivated with 15 t.ha^{-1} organic fertilizer but significantly higher compared with other interactions (Table 4). During the late cropping season, Marketer variety cultivated with 15 t.ha^{-1} organic fertilizer had plants with more branches across the weeks but similar when compared with Marketer variety cultivated with 10 t.ha^{-1} organic fertilizer (Table 4).

Table 4: Effects of variety and fertilizer rate interaction on number of branches / plant in 2015

Variety	Rate (t.ha^{-1})	4	6	8	4	6	8
		Weeks after planting					
		Early season			Late season		
Marketmore	0	0.75de	3.25bc	2.75gh	1.00 g	3.50h	3.63f
	5	3.25ab	4.87ab	4.13defg	1.00g	5.00efg	5.38de
	10	4.25a	4 25abc	5.63bcde	1.70f	6.00ed	6.63 bc
	15	3.62ab	5 .37ab	5.70abcd	1.85ef	6.75bcd	6.75abc
Poinsett	0	2.75abc	3.25bc	3.50fg	2.00def	4.25gh	4.25ef
	5	2.75abc	5.75ab	7.50a	2.25cde	5.75def	7.50ab
	10	2.50bc	5.00ab	7.50a	2.60abc	6.75bcd	7.25abc
	15	2.50bc	5.00ab	7.25ab	2.85ab	7.50ab	7.50ab
Marketer	0	0. 25e	2.25bc	2.25h	2.00def	4.75gh	5.38de
	5	0.75de	3.87bc	3.87defg	2.45bcd	6.25cd	6.25cd
	10	1.50cde	5.00ab	5.00cdef	2.90ab	7.25abc	7.25abc
	15	2.00bcd	6.75a	6.75abc	3.00a	8.00a	8.00a

Means with the same letter(s) under the same column are not significantly different ($P < 0.05$) using Duncan Multiple Range Test (DMRT)

There were significant differences in the vine length of cucumber plants as affected by the interaction of variety and level of Gateway Organic fertilizer (Table 5). In the early season cropping, Marketmore variety cultivated with 5 and 10 t.ha^{-1} organic fertilizer produced vines significantly longer when compared with other interactions at 4 WAP. At 6 and 8 WAP, Marketmore cultivated with 5, 10 and 15 t.ha^{-1} organic fertilizer produced vines significantly longer when compared with other interactions (Table 5).

During the late cropping season, At 4 WAP, Marketer variety cultivated with 10 and 15 t.ha^{-1} organic fertilizer produced vines significantly longer when compared with other interactions. At 6 and 8 WAP, Marketer variety cultivated with 15 t.ha^{-1} organic fertilizer produced vines significantly longer when compared with other interactions (Table 5).

Table 5: Effects of variety and fertilizer level interactions on vine length (cm) /plant of cucumber

Variety (V)	Rate (t.ha^{-1})	4	6	8	4	6	8
		Weeks after planting					
		Early season			Late season		
Marketmore	0	34.46e	112.29bc	155.19b	23.00h	49.00h	61.35i
	5	100.00ab	175.75a	212.06a	37.38efg	108.75e	131.53g
	10	111.38a	183.79a	208.16a	44.63cde	114.15de	135.32fg
	15	79.44bc	188.35a	220.75a	42.75def	125.9bc	143.95cd
Poinsett	0	26.06e	63.70e	70.01e	31.2gh	54.08h	65.60i
	5	38.25e	116.30bc	144.6bc	51.88 bc	114de	136.53ef
	10	36.25e	104.00cd	131.58bc	45.28 bcde	119.15cd	140.32de
	15	37.75e	112.18bc	122.60bcd	53.78b	130.65b	149.78b
Marketer	0	31.88e	71.88e	71.88e	23.00g	65.63g	78.10h
	5	44.63de	99.08cd	99.08ed	48.75bcd	97.83f	144.03cd
	10	66.38cd	120.60bc	120.60cd	63.50a	127.00bc	146.57bc
	15	77.75bc	143.58b	143.58bc	68.38a	148.33a	163.45a

Means with the same letter(s) under the same column are not significantly different ($P < 0.05$) using Duncan Multiple Range test (DMRT).

Leaf area of cucumber was significantly influenced by the interaction of variety and organic fertilizer rate (Table 6). In the early season cropping, Marketmore variety cultivated with 5, 10 and 15 t.ha^{-1} and Marketer cultivated with 10 and 15 t.ha^{-1} organic fertilizer produced leaves significantly wider when compared with other interactions at 4 WAP. At 6 WAP, Poinsett cultivated with 5 t.ha^{-1} organic fertilizer produced wider leaves which were similar compared with Marketmore cultivated with 5 and 10 t.ha^{-1} , Poinsett at 10 and 15 t.ha^{-1} and Marketer at 15 t.ha^{-1} organic fertilizer. At 8 WAP, Marketmore cultivated with 10 and 15 t.ha^{-1} organic fertilizer produced significantly wider leaves when compared with other interactions (Table 6).

Table 6: Effects of variety and fertilizer rate interactions on leaf area /plant

Variety	Rate (t.ha^{-1})	4	6	8	4	6	8
		Weeks after planting					
		Early season			Late season		
Marketmore	0	703.10de	1418.00e	984.50d	353.50ef	1227.90d	199.80 cd
	5	1744.40abc	5021.00abcd	2451.60bc	984.40cde	4399.80c	681.30bcd
	10	2577.60a	5942.00ab	2834.60ab	1359.60 bc	4571.80c	816.70ab
	15	2325.40ab	4600.00bcd	3226.80a	1860.80 ab	4668.70c	706.50abc
Poinsett	0	599.10e	2983.00de	636.30d	161.50 f	2093.40 d	160.30d
	5	1078.20cde	7720.00a	1977.90e	959.40 cde	7786.70a	623.70bcd
	10	1562.50bcd	7046.00ab	2224.20bc	1029.90 cd	7455.20a	434.60bcd
	15	1216,00cde	6252.00ab	2127.50bc	1310.40bc	7183.2ab	532.30bcd
Marketer	0	757.50de	1443.00e	757.50d	663.70def	2407.6d	468.7bcd
	5	933.50cde	2929.00de	933.50d	1417.50bc	4999.5c	900.20ab
	10	1784.20ab	4215.00cd	1784.50c	1679.5 ab	5795.2bc	935.40ab
	15	2430.80ab	5905.00abc	2430.80bc	2280.60a	6927.4ab	1231.80a

Means with the same letter(s) under the same column are not significantly different ($P < 0.05$) using Duncan Multiple Range test (DMRT).

During the late cropping season, Marketer variety cultivated with 10 and 15 t.ha^{-1} organic fertilizer at 4, 6 and 8 WAP, produced wider leaves (Table 6).

The number of days to first flower, 50% flowering and days to first harvest was significantly influenced by the interaction of variety and organic fertilizer rate (Table 7). During the early cropping season, Marketmore variety not fertilized flowered earlier when compared with other interactions and also produced 50% of its flower earlier which was similar compared with Marketer at 0. 5, 10 and 15 t.ha^{-1} organic fertilizer. Unfertilized Marketmore, Poinsett and Marketer varieties produced fruits which were ready for harvest earlier when compared with the fertilized (Table 7). In the late cropping season, there were no significant differences in the days to first flowering while the days to 50% flowering and first harvest were significantly different (Table 7). Fertilized Marketmore variety attained 50% flowering earlier, similar with Poinsett and Marketer cultivated with organic fertilizer. Fertilized Marketmore, Poinsett and Marketer varieties produced fruits ready for harvest earlier when compared with unfertilized plants (Table 7).

The number of fruits harvested across the weeks as influenced by the interaction of variety and organic fertilizer rates was signifi-

cantly different (Table 8). During the early cropping season, Poinsett cultivated with 10 and 15 t.ha^{-1} organic fertilizer produced more fruits significantly higher compared with other interactions at 1st harvest. However, at 2nd and 3rd harvests, Poinsett and Marketer cultivated with 15 t.ha^{-1} had more fruits compared with other interactions while at 4th harvest, Marketer variety cultivated with 15 t.ha^{-1} produced more fruits which were significantly higher compared with other interactions (Table 8).

Table 7: Effect of variety and organic fertilizer rate interactions on number of days to first flowering, 50% flowering and first harvest of cucumber variety

		Early season			Late season		
Variety	**Rate (t.ha^{-1})**	**1st flowering**	**50% flowering**	**1st Harvest**	**1st flowering**	**50% flowering**	**1st Harvest**
Marketmore	0	32. 00a	38.00ab	50.00a	34.00a	44.00a	53.00a
	5	28.00de	36.00bc	45.00bc	31.00a	42.00bc	51.00b
	10	28.00de	35.00c	45.00bc	30.00a	41.00cd	49.00cd
	15	30.00bc	36.00bc	45.00bc	31.00a	41.00cd	49.00cd
Poinsett	0	30.00bc	38.00ab	50.00a	33.00a	43.00a	52.75a
	5	27.00e	35.00c	45.00bc	30.00a	39.00ef	50.00bc
	10	28.00de	36.00bc	44.00c	29.00a	38.00f	48.00d
	15	27.00e	36.00bc	44.00c	29.00a	38.00f	48.00d
Marketer	0	31.00ab	39.50a	50.00a	34.00a	44.00a	54.00a
	5	28.00de	39.00a	46.00b	32.00a	41.00cd	50.00bc
	10	29.00cd	38.00ab	46.00b	31.00a	40.00de	48.00d
	15	29.00cd	38.00ab	46.00b	31.00a	40.00de	48.00d

Means with the same letter(s) under the same column are not significantly different ($P < 0.05$) using Duncan Multiple Range test (DMRT)

Table 8: Effect of variety and organic fertilizer rate interactions on number of fruits produced by 3 cucumber varieties in 2015 early cropping season

		1st Harvest	2nd harvest	3rd Harvest	4th Harvest
Variety x rate (t.ha^{-1}**)**					
Marketmore	0	0.00d	1.75de	1.62f	0.38ef
	5	2.50bc	3.75bc	2.88e	1.12def
	10	1.75c	4.50bc	3.00e	1.00def
	15	2.25bc	4.12bc	2.75ef	0.25f
Poinsett	0	0.25d	1.75de	2.75ef	1.25de
	5	2.75bc	3.75bc	4.50cd	1.50d
	10	4.00a	3.50bc	4.50cd	1.75d
	15	3.12ab	6.50a	6.00ab	2.75d
Marketer	0	0.00d	0.75e	2.75ef	2.75c
	5	0.00d	1.75de	3.50de	3.50c
	10	0.00d	3.75bc	5.13bc	5.13b
	15	0.00d	5.50ab	7.00a	7.00a

Means with the same letter(s) under the same column are not significantly different ($P < 0.05$) using Duncan Multiple Range test (DMRT)

During the late cropping season, Poinsett cultivated with 10 and15 t.ha^{-1} organic fertilizer produced more fruits which were significantly higher compared with other interactions at 1st harvest while at 2nd harvest, Poinsett cultivated with 10 organic fertilizer produced more fruits which were significantly higher compared with other interactions. At 3rd harvest, Poinsett and Marketer cultivated with 10 t.ha^{-1} had significantly more fruits while at 4th harvests, marketer cultivated with 10 t.ha^{-1} produced more fruits which were similar compared with Marketmore (Table 9).

Table 9: Effect of variety and organic fertilizer rate interactions on number of fruits per plant in 2015 late cropping season

		1st harvest	2nd harvest	3rd harvest	4th harvest
Variety x rate (t.ha^{-1}**)**					
Marketmore	0	0.00f	1.00h	1.15j	3.50bc
	5	1.00f	2.75g	4.50h	4.50bc
	10	2.00cd	5.00d	6.45g	4.75abc
	15	1.50de	4.25e	6.80f	3.00c
Poinsett	0	0.00f	1.00h	2.75i	3.25c
	5	3.50b	5.50cd	9.75d	4.75abc
	10	4.00ab	8.35a	11.50a	5.62ab
	15	4.50a	7.43b	11.45b	3.87bc
Marketer	0	0.00f	1.25h	1.14k	3.500bc
	5	1.50de	3.50cd	6.86e	4.75abc
	10	2.50c	5.30cd	9.75a	6.75a
	15	2.50c	5.76c	10.14c	3.00c

Means with the same letter(s) under the same column are not significantly different ($P < 0.05$) using Duncan Multiple Range test (DMRT).

There were significant differences in the fruit yield of cucumber as influenced by interaction of variety and organic fertilizer rate in the early season cropping (Table 10). Marketmore and Poinsett cultivated with 10 and 15 t.ha^{-1} organic fertilizer produced yields significantly higher when compared with other interactions (Table 10). During the late cropping season, Poinsett variety cultivated with 10 t.ha^{-1} organic fertilizer produced higher yield when compared with other interactions (Table 10).

Table 10: Effect of variety and organic fertilizer rate interaction on total fruit yield (t.ha^{-1})

		Early season	Late seasons
Variety x rate (t.ha^{-1}**)**			
Marketmore	0	27.72gh	20.16j
	5	40.32e	49.56h
	10	69.72a	83.16f
	15	73.92ab	72.24g
Poinsett	0	29.40g	25.20i
	5	73.00b	99.96d
	10	73.92ab	111.72a
	15	75.60a	108.36b
Marketer	0	27.72gh	21.00j
	5	37.80f	72.24g
	10	39.48ef	94.92e
	15	40.32e	101.64c

Means with the same letter(s) under the same column are not significantly different ($P < 0.05$)
using Duncan Multiple Range Test (DMRT)

DISCUSSION

The soil used for the experiment was sandy loam in texture and low in fertility. This could adversely affect the performance and productivity of cucumber plant due to the low water and nutrient retention ability of such soil. Hence, soil amendment using organic fertilizer could improve such soil.

The results of this study showed that there were significant differences among varieties in vegetative growth in both experiments, namely: Vine length, number of branches, leaf area, number of leaves and yield characters such as days to 1st flowering and 50 % flowering, number of fruits per plant, fruit weight per plant and total yield. Marketmore variety produced significantly longer vines,

more leaves, larger leaves and more branches than other varieties, showing greater genetic potentials for vegetative growth. The excessive vegetative growth in Marketmore variety in the early cropping season and similar trend observed in the late cropping season resulted in lower yield while less vegetative growth observed in Poinsett variety resulted in higher yield. This is an indication of vegetative growth at the expense of fruit yields. This contradicts the general belief that larger leaf area increases the photosynthetic activity and result in higher yield. It also negates the findings of Reddy et al., (2018) that vine growth and tuber yield are directly related. The consistent significant yield response exhibited by Poinsett variety in both trials could be attributed to innate quality of the variety and this agrees with the findings of Eifediyi and Remison (2010) that the differences in vegetative and yield characters could also be attributed to genetic composition of the varieties used.

Significant increase observed in vegetative growth and reproductive development with application of 15 t.ha^{-1} organic fertilizer could be as a result of organic fertilizer application that increased the water holding capacity and thereby making more nutrients available and was similar to the findings of Ewulo *et al.,* (2008) and Enujeke (2013) that higher rate of manure improved moisture availability and enhanced release of more nutrients for plant growth.

Earliness in days to 1st and 50 % flowering, as well as days to maturity that was observed in fertilized plants, than unfertilized plant is in line with the findings of Aiyelaagbe *et al (*2007) that application of 20 t.ha^{-1} or 4.2 kg NPK +Mg enhanced early flowering better than other rates of fertilizer application and no fertilizer in cucumber production.

Higher yield was observed in fertilized plants, irrespective of the rates of fertilizer application than unfertilized plants in the early cropping season, while in the late cropping season, effects of 10 and 15 t.ha^{-1} applications were similar, probably because the nutrient stocks of the 5 t.ha^{-1} application had been utilized in the early season. This is consistent with Soretire *et al*., 2013 that 15 t.ha^{-1} Gateway Organic Fertilizer application resulted in higher growth and grain yield of soyabean.

Higher yield that was observed with application of 10 and 15 t.ha^{-1} Gateway Organic fertilizer than other rates in both seasons could be due to higher rates of manure improving the soil conditions for crop establishment and also release of adequate nutrient elements for yield enhancement. This is in harmony with the reports of Aliyu (2000), Mangila *et al.,* (2007), and Agbede *et al.,* (2008) that higher rates of manure increase crop yield.

The yield response of cucumber to organic fertilizer that was higher in the late season than the early season trial observed could be due to the slow nutrient release pattern of organic fertilizer which made the period of its nutrient release coincide with that of the plants' demand for fruit formation. Similar observation has been reported on Egusi melon (Makinde et al, 2021).

The relatively good performance of Poinsett variety fertilized with 10 t.ha^{-1} organic fertilizer in both early and late cropping seasons compared to other treatment combinations, confirms the findings that varieties of crops can differ in response to fertilizer, as reported by Anderson *et al* (2007) and Nedunchezhiyan *et al* (2010) that potato varieties are differently - fertilizer responsive. It could also imply that cucumber uses nutri-

ents efficiently when sourced from organic fertilizers.

In this study, it was observed that Gateway Organic Fertilizer increased growth and yield of cucumber fruits. This could be as a result of organic fertilizer that established and maintained soil physical condition for plant growth. This corroborates the studies of Agbede *et al.,* (2008), and Ewulo *et al.,* (2008) that poultry manure is not only a cheap and an effective source of N for sustainable crop production, but improves soil physical properties by reducing temperature, bulk, density, and increasing total porosity, if higher rates are applied.

CONCLUSION

This study has shown that Gateway Organic Fertilizer application had positive influence on the growth and fruit yield of cucumber.

Among the varieties, Poinsett variety is the best for optimum growth and yield.

Application of 10 $t.ha^{-1}$ Gateway Organic Fertilizer was optimum for fresh growth and fruit yield of cucumber.

REFERENCES

Adediran, J. A., Akande, M. O., Taiwo, L. B., Sobulo, R. A. 1999. Comparative effectiveness of organic based fertilizer with mineral fertilizer on crop yield. In: Proceedings of the 25th Annual Conference of Soil Science Society of Nigeria, 21st–25th November, Benin City, Edo State, Nigeria, Pp. 91–95.

Adetula, O., Denton L. 2003 Performance of vegetative and yield accessions of cucumber (*Cucumis sativus* L.) Horticultural Society of Nigeria (HORTSON) Proceedings of 21st Annual Conference 10-13 Nov, 2003.

Adetunji, M. T. 1991. An evaluation of the soil nutrient status for maize production in south western Nigeria. *Samara Journal of Agricultural Research*. 8:101-113

Agbede, T.M., Ojeniyi, S.O., Adeyemo, A.J. 2008. Effect of Poultry Manure on Soil physical and chemical properties, growth and grain yield of sorghum in Southwest, Nigeria. *American-Eurasian Journal of Sustainable Agriculture*. 2(1): 72-77.

Aiyelaagbe, I.O.O., Adegbite, I.A., Adedokun, T.A. 2007**.** Response of cucumber to composted city refuse in South-Western Nigeria. African Crop Science Conference Proceedings Vol. 8:333-337,

Aliyu, L. 2000. Effect of organic and mineral fertilizers on growth, yield and composition of pepper. *Biological Agriculture and Horticulture*. 18(1): 29-36

Anderson, P., Kapinga, R., Zhang, D., Hermann, M. 2007. Vitamin A forAfrica (VITAA): An entry point for promoting orange-fleshed sweet potato to combat vitamin A-deficiency in sub-Saharan Africa. Proceedings of the 13th ISTRC Symposium, Arusha, Tanzania,November, 2003. Pp. 711-720.

Eifediyi, E. K., Remison, S. U. 2010. Growth and yield of cucumber (*Cucumis sativum* L) as influenced by farm yard manure and inorganic fertilizer. *Journal of Plant Breeding and Crop Science* 2(7): 216-220.

Enujeke E.C. 2013. Growth and yield responses of cucumber to five different rates of poultry manure in Asaba area of Delta state, Nigeria International *Research Journal of Agricultural Science and Soil Science*. 3(11): 369-375

Ewulo B.S, Ojeniyi S.O, 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*. 3 (9): 612-616,

Makinde E. A., Odeyemi, O. M., Odedina J. N., Ayeni, O. S., Olajide A. A., Okparaojiego, C. J. 2021. Evaluation of post-manure application planting time and poultry manure rate on growth, seed yield and yield components of Egusi melon. *Nigerian Agricultural Journal*. 52(3): 1-9.

Mangila, E., Tabiliran, F.P., Naguit, M.R.A., Malate, R. 2007. Effects of Organic Fertilizer on the Yield of Watermelon. Threshold 2. January- December, 2007, pp 27-35.

Nedunchezhiyan, M., G. Byju., S.N. Dash. 2010. Effects of organic production of orange fleshed sweetpotato (*Ipomoea batatas* L.) on root yield, quality and soil biological health**.** *International Research Journal of Plant Science*. 1(6): 136-143.

Nottidge, D. O., Ojeniyi, S .O., Asawalam, D. O., 2005. Comparative effects of plant residues and NPK fertilizer on soil properties in a humid Ultisol. *Nigerian Journal of Soil Science* 15: 9–13.

Okonmah L.U. 2011. Effects of different types of staking and their cost effectiveness on the growth, yield and yield components of cucumber (Cumumis sativa L). *International Journal of Agricultural Science*.1 (5): 290- 295.

Reddy, R., Soibam, H., Ayam, V.S., Panja, P., Mitr, S. 2018. Morphological characterization of sweet potato cultivars during growth,development and harvesting. *Indian Journal of Agricultural Resources*. 52 (1): 46-50.

Shangakkara, W. R. M., Liedgens, Soldal A., Stamp, P. 2004. Root and shoot growth of maize (*Zea mays* L.) as affected by incorporation of Crotalaria, Juncea and *Tithonia diversifolia* as green manure. *Journal of Agronomy and Crop Science*. 190: 139–146.

Soretire, A. A., Olayinka, A. 2013. Response of soybean to cow dung and wood ash application in tropical acid soils of southwestern Nigeria. Nigerian Journal of Soil Science. 23(2): 103-113

Tahir, S.M., Kabir, A. M., Ibrahim, H., Sufiyanu, S. 2019. Studies on the performance of organic and inorganic fertilizer on the growth and yield of cucumber (cucumis sativus L.). *Science World Journal*. 14(1): 156-163

Zingore, S., Mafongoya, P, Myamngafata., K. F. Giller. 2003. Nitrogen mineralization and maize yields following applications of tree pruning to a sandy soil in Zimbabwe. *Agroforestry Systems*. 57:199-21.

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