EVALUATION OF THE PERFORMANCE OF DIFFERENT VARIETIES OF CUCUMBER (*Cucumis sativus* L.) IN OWERRI AREA OF SOUTHEASTERN NIGERIA.

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Abstract
Four different cultivars of cucumber viz (CU999, OHE/CU, MURANOF$_1$ and AOA/CU) were evaluated for their performance under the agro-climatic conditions of Owerri- area, South-eastern, Nigeria. The experiment was carried out at the Teaching and Research Farm of Federal University of Technology Owerri (FUTO), Imo State. The experiment was laid out in Randomized Complete Block Design (RCBD) with three replications. Data on emergence parameters, vegetative growth and yield parameters were collected and analyzed using Analysis of Variance (ANOVA) for Randomized Complete Block Design (RCBD). The treatment means were separated using least significant difference at 5% probability level. The results showed that there were significant differences (p<0.05) among the cultivars in day emerged, emergence percentage, days to male flower initiation, days to female flower initiation(42.66), number of pistillate flower per plant (8.33), number of branches eight weeks after planting(4.26), vine length eight weeks after planting(216.13cm), number of leaves eight weeks after planting(54.06), leaf length(20.90cm) and leaf width(24.50cm) while the cultivars showed no significant differences (p<0.05) in days to 50 percent emergence and leaf area index. The CU999 cultivar was also significantly (p<0.05) superior to other cultivars as regard to fruit length (37.66cm), fruit diameter (11.30cm), weight of a fresh fruit (0.35kg), fresh fruit weight per plant(2.62kg) and in fresh fruit yield per hectare. The CU999 cultivar therefore performed better than the other three cultivars evaluated in the study area and could be recommended to farmers for improved production of cucumber.

Keywords: Cucumber Cultivars; Productivity; Evaluation; Genotype; Humid Environment

INTRODUCTION

Cucumis sativus Linn. is one of the most important and popular vegetable crops grown extensively throughout the tropical and subtropical region of the world. It is a thermophillic and frost-susceptible horticultural crop usually cultivated in fields during spring-summer period (Bacci *et al*., 2006) or in greenhouse in different seasons. It performs well in a temperature between 25 to 29°C with plenty of sunlight. Cucumber closely resembles the wild form *Cucumis hardwicki* which is a native of Himalayas and originated in India. It is believed to have been domesticated in India for 3000 years and in Eastern Iran and China probably for 2000 years (Harlan, 1975). Now it is grown all around the world and is thought to be one of the oldest vegetable crops being grown for at least five thousand years (Shetty and Wehner, 2002). Cucumber is the second most important cucurbits in terms of world total production after water melon(*Citrullus lanatus* L.) and melon (*Cucumis melon* L.) and fourth most important vegetable after tomato, cabbage and onion in Asia (Tatilogu,1993) and the second important vegetable crop after tomato in Western Europe (Phu, 1997). The world's largest cucumber producer is China with 48,000 million kilograms which is 73% of total global production, The Food and Agriculture Organization of the United Nations Russia is second largest producer with 1,742 million kg (2.68%) followed by Turkey, with a production of 1,600 million kg (2.46%). Spain is in the seventh place with a production of 713 million kilograms of cucumber, which is 1.09% of this vegetables' global production. (FAO, 2016), reported that world cucumber production in 2012 surpassed 65,000 million kg for the first time, reaching 65,134.08million kilogrammes. As a vegetable crop, *Cucumis sativus* has great economic importance (Plader *et al*., 2007). In addition, cucumber is cultivated because its extract has soothing, cleansing and softening properties which are important for the cosmetics industry(Wang *et al*.,2007a). It is a very good source of phytonutrients such as flavonoid, beta-carotene, triterpene, lycopene, lignin vitamins A, C, K, B6, potassium and also provides dietary fibers, pantothemic acid, magnesium, phosphorus, copper and manganese (Vimala *et al*., 1999). It contains ascorbic acid and caffeic acid both of which helps to smoothen skin irritation and reduces swelling in skin. Its juice is often recommended as a source of silicon to improve the complexion and health of the skin (Duke, 1997). It helps in healing diseases of urinary bladder and kidney; digestive problems like heartburn, acidity, gastritis and ulcer (Garcia-Closes *et al*., 2004). The ascorbic acid and caffeic acid contained in cucumber help to reduce skin irritation and swollen (Okonmah, 2011). It requires a stable warm temperature for good yield (Cobeil and Gosselin, 1990). It develops rapidly, with a shorter time from planting to harvest than for most crops (Wehner and Guner, 2004). It is an all year round out door vegetable in the tropic and an important greenhouse vegetable especially in Northern Europe and North America (Mingboa, 1991). Phu (1997) stated that cucumber could be cultivated in the field during the summer and winter in greenhouses using artificial heating. There exist three main varieties of cucumber; slicing, plickling and burpless. Within these varieties, several different cultivars have emerged. Many cultivars of cucumber exist with varying shapes, skin colours and carotene content (Simon, 1992). Cucumber cultivars have distinctive characteristics/ traits which make them suitable for a particular environment or condition in terms of tolerances to drought, disease resistance, early maturing and yield. The variation in performance of cucumber cultivars has been widely documented by many scholars (Mingboa, 1991; Manyvong, 1997; Sharma *et al*., 2000; Odeleye and Odeleye, 2001; Hamid *et al*. 2002; Maqsood *et al*., 2004; Ojeifo *et al*., 2008) which could be as a result of environmental factors and genetic composition.

In Nigeria, cucumber production has not been ranked; it is grown mainly in Jos, Plateau State, and there was a general belief that cucumber can only be grown in the northern part of the country. Been of recent introduction in southeast agroecology, its cultivation in southeast Nigeria has been found to be achievable under moderate rainfall and in dry season using irrigation facilities (Enujeke, 2013a). Although Cucumber is one of the crop that is grown round the year , its yield is quiet low due to (i) non accessibility of varieties well suited for specific production zones, (ii) diseases caused due to low struggle to biotic and biotic stresses, (iii) lack of appropriate cultural practices (Fertilization, irrigation and hoeing etc.). Among these, the most common cause of little productivity is the agriculture of low varieties (Miano *et al*., 1991). Cucumber production can be increased by adopting superior varieties. Iken and Anusa (2004) reported that because of the differences in yield potential of different ecological zones, testing of new crop varieties across the country becomes an established practice in plant breeding. Varietal differences affect or determine the growth and yield of crops. Majanbu *et al*. (1996) and Sajjan *et al*., (2002) reported that growth characters of crops such as plant height, vine length, leaf area, member of leaves or branches, and fruit production were influenced by genetic factors of the different varieties. Ibrahim *et al*, (2000) reported that the differences in growth indices of crops are normally attributed to their genetic constitution. Akinfoesoya *et al*. (1997) and; Odeleye and Odeleye (2001) indicated that growth characters, yield and its component differed among crop varieties. Ray and Sinclair (1997) attributed differences between the growth characters of crop genotypes to photosynthetic activity of leaves that is, internal factors and the differences in high distribution on leaf surface of the crop canopy, leaf arrangement, differences in chlorophyll content, activity photosynthetic enzymes and differences in stomatal conductance values. Costa and Campos (1990), Gardner *et al*. (1990) and Zaki *et al*. (1999) attributed yield differences in crop cultivars to stomatal conductance value and to differences between genotypes in partitioning of photosynthetic materials towards economic yield. *Clark et al*. (1997) reported that the genotypes differences in yield and its components may be due to variations in genetic structure, mineral concentration and potentials to transport photosynthetic materials within plants. Evaluations of different cucumber cultivars have been conducted in various countries. Shetty and Wehner (1998) studied 18 cucumber cultivars on trellis and flat beds and concluded that the best cultivars for marketable yield were Summer Top and Rusty Blight, while best overall cultivars on flat beds were Poinsett-76 and Spring-440. Resende (1999) conducted a trail on ten cultivars of cucumber and observed that Indaial, Score, Colonia and Ginga AG-77 gave the highest yield, best growth performance with longest fruits and highest commercial value. Sharma *et al*. (2000) studied the performance of various cucumber cultivars under field and greenhouse conditions and observed that the yield under field condition was higher than greenhouse conditions and cultivars Poinsett-76 and K-75 had higher yields than other cultivars, which could be attributed to greater fruit length, weight and yield per plant. Hamid *et al*., (2002) performed a field trail on six cucumber cultivars under agro-climatic conditions of Swat and found that cultivar PARC-1 was the best among all the cultivars studied. Umeh and Onovo (2015) compared the germination and morphological characteristics of four cucumber genotypes in Keffi, Nasarawa State, Nigeria their findigs revealed that Nandini 732F_1 and Poinsett 76 were promising among the cucumber genotypes studied. Ojeifo *et al*., (2008) also revealed that Marketmore and Centriolo marketer were promising among all the cucumber varieties they studied in southern Nigeria. Adinde *et al*., 2016 also assessed the performance of four cucumber cultivars in Iwollo, South-Eastern Nigeria and found that poinsett 76 had higher yields than other cultivars.

The literature indicates that the performance of the cultivars evaluated varies depending upon the climatic conditions. Selecting high yielding and disease resistance cultivar suitable for south-east agro-climatic condition can help to increase cucumber production in the area. At present, no cultivar of cucumber has been identified to be best in yield which is suitable for Owerri area, southeastern Nigeria. The objective of the study was therefore to evaluate the performance of four cucumber (*Cucumis sativus* L.) cultivars under the agroecological conditions of Owerri area, South-Eastern Nigeria.

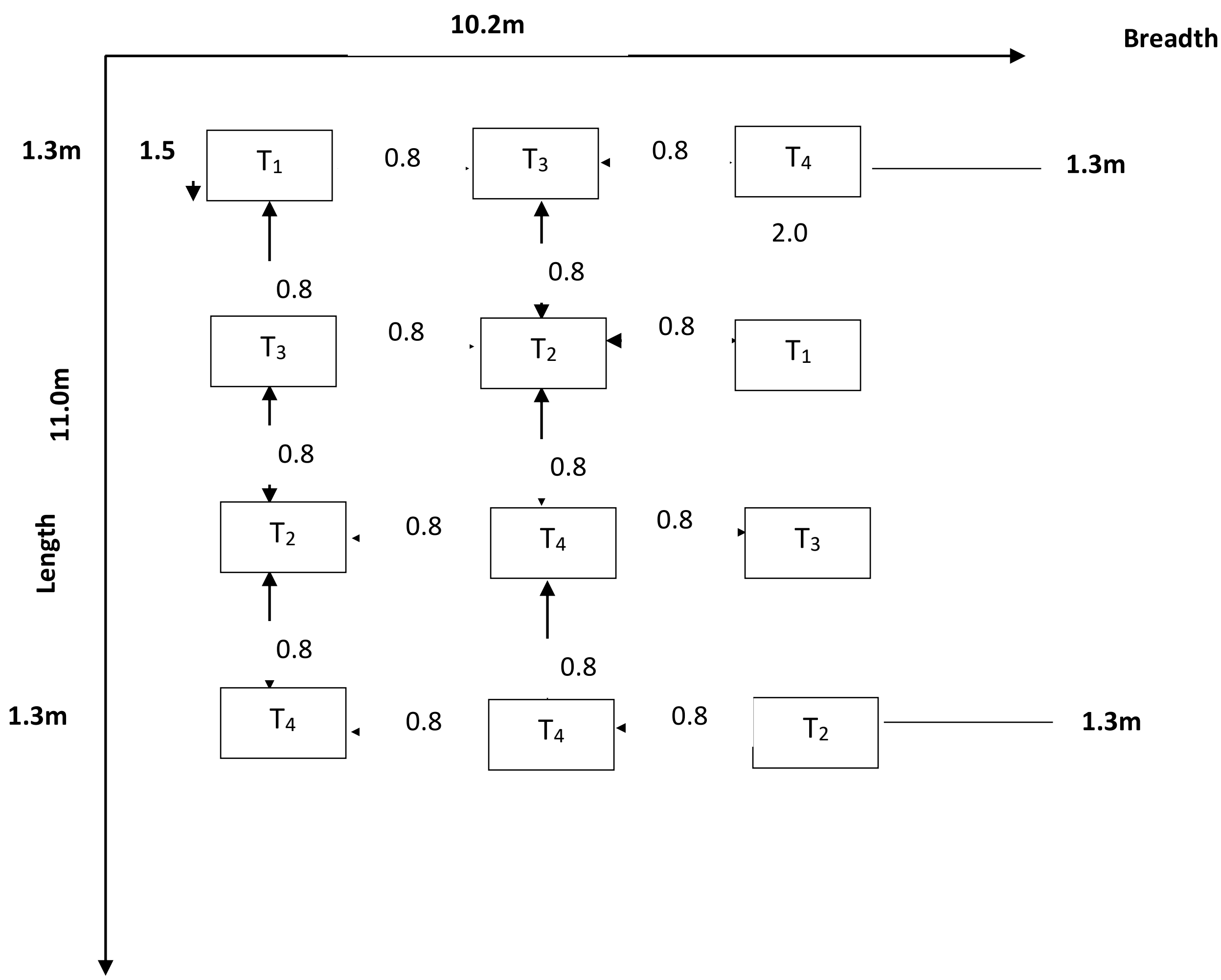
MATERIALS AND METHODS

Experimental site The experiment was conducted at the Teaching and Research Farm of Federal University of Technology Owerri (FUTO), Imo State. The study was carried out between March –May, 2018. The study area is located in South- East Nigeria, on latitude $5^0$23'8.7" North and Longitude $6^0$39'39.4" East at an altitude of 55mm above sea level, with a mean annual temperature and rainfall of 20-30^0c and 2500mm respectively, 89-93% relative humidity (Nwosu and Adeniyi, 1980).The rainfall pattern is bimodal; with peales at july and September every year.

Source of seeds Seeds of the cucumber cultivar used CU999 and $MURANOF_1$ were sourced from the National Horticultural Research Institute, Imo State, while two cultivars OHE/CU and AOA/CU of *Cucumis sativus* L. were collected from Ohaji/ Egbema and Akokwa where the crop is commonly cultivated in Imo State, Nigeria.

Experimental design The experiment was laid out in Randomized Complete Block Design (RCBD) with three replications. Four cultivars of cucumber (*Cucumis sativus*) were sown as treatments.
The treatments were:

T1 – CU999
T2 – OHE/CU
T3 – $MURANOF_1$
T4 – AOA/CU



Field operation The experimental field size of 10.2m x 11.0m ($112.2m^2$) (0.01122ha) was marked out using measuring tape, rope and peg. Land clearing was done using cutlass. The debris was packed using rake. The soil was tilled to fine tilth. The field was demarcated into 3 blocks each block containing 4 plots. 12 plots of 1.5m x 2.0m ($3m^2$) each was prepared using hoe. 0.8m and 0.8m alleys separated adjacent blocks and plots respectively. Poultry droppings at the rate of 15tons/ha (dry weight) was incorporated into the soil. Four cucumber seed cultivars (treatments) were sown on the plots at 3 seeds per hill at a depth of 2.5cm, using spacing of 0.5m x 0.5m. A total of 18 seeds were sown in each plot. Insect pests were controlled using Knockoff (*Lamda cyhalothrin*) insecticide. Fungal disease was controlled using Ridomil (*Metalaxyl*) fungicide. Regular weeding was done every two weekly interval using hoe.

Data collection Eight middle stands from each plot were tagged and used as sample plants upon which data collection was made. Data were collected on day emerged, days to 50 percent emergence, emergence percentage, days to male flower initiation, days to female flower initiation, number of pistillate flower per plant, number of branches eight weeks after planting, vine length eight weeks after planting, number of leaves eight weeks after planting, leaf length, leaf width, leaf area index, fruit length, fruit diameter, number of fruits per plant, fruit weight, fruit weight per plant, fruit yield per hectare.

Day emerged Day emerged was determined by counting the days from planting to the date a seed emerged.

Days to 50% emergence Days to 50% emergence was determined by counting the days from the date of planting to the date up to half of the sown seeds emerged.

Emergence percentage

Data on emergence percentage was obtained 10 days after sowing by counting the number of seedlings emerged and dividing by the number of seeds sown then multiplied by 100.

$$\text{Emergence percentage} = \frac{\text{Total seeds emerged}}{\text{Total seeds sown}} \times 100$$

Vine length Vine length was measured with measuring tape from the base to the growing tip of the main vine.

Number of branches per plant Number of branches per plant was determined by direct counting of the branches per plant.

$$\text{No of branches per plant} = \frac{\text{Total no. of branches on sample plants}}{\text{No. of sample plants}}$$

Number of leaves per plant Number of leaves per plant was determined by direct counting of the leaves per plant.

$$\text{No of leaves per plant} = \frac{\text{Total no. of leaves on sample plants}}{\text{No. of sample plants}}$$

Leaf area index (LAI) Leaf Area Index was determined using direct method as postulated by Breda (2003). This was done by measuring the leaf length and width per plant.

$$\text{LAI} = \frac{\text{Avg. Leaf Length (M)} \times \text{Avg. Leaf Width (M)} \times \text{No. of Leaves} \times \text{Plant density}}{\text{Area of plot (m)}^2}$$

Days to first female flower initiation Days to first female flower initiation was determined by counting the days from the date of sowing to the date first female flower was seen in each plot.

Number of fruits per plant Number of fruits per plant was determined by direct counting of the number of harvested fruits from the sample plants in each plot and dividing by the number of sample plants.

$$\text{No of fruits per plant} = \frac{\text{Total no. of fruits harvested from the sample plants}}{\text{No. of sample plants}}$$

Weight of a fresh fruit (kg) Weight of a fresh fruit was determined using weighing scale to get the total weight of the harvested fruits and dividing by the number of fruits weighed.

$$\text{Weight of a fresh fruit (kg)} = \frac{\text{Total no. of weight of fresh fruits weighed}}{\text{Total no. of fresh fruits weighed}}$$

Fresh fruit weight per plant (kg) Fresh Fruit weight per plant was computed using the number of fruits per plant and weight of a fresh fruit. Fruit weight per plant (kg) = No. of fruit per plant × Weight of a fresh fruit

Fresh fruit yield per hectare (ton) Fresh fruit yield per hectare was computed using fresh fruit weight per plant and plant density per hectare. Fresh fruit yield per ha (ton) = Fresh fruit weight per plant × Plant density (11,901 stands/ha).

Statistical analysis Data collected were subjected to Analysis of Variance (ANOVA) for randomized complete block design (RCBD) using SPSS Release 22.0 software (2011) and significant means separated using least significant difference (LSD) at 0.05 probability level as described by Obi (2002).

Emergence parameters of four cultivars of cucumber (*Cucumis sativus L.*)

The result of analysis of variance on emergence parameters of four cucumber cultivars as presented in Table 2 showed that there was non-significant difference (*P>0.05*) among the treatment means in days to 50% emergence. Whereas there was significant difference (*P>0.05*) among the treatment means in days emerged and emergence percentage.

Table 2. Emergence parameters of four cultivars of cucumber (*Cucumis sativus)*

Cucumber Cultivars	D_Emerged	D50%E	%E.P
CU999	6.50	5.30	77.70
OHE/CU	4.00	6.33	62.90
MURANOF_1	3.30	6.33	92.27
AOA/CU	3.60	6.33	96.27
F-$LSD_{0.05}$	0.214	NS	0.058

LSD= Least Significant Difference; NS=Non Significant; D_Emerged= Day Emerged; D50% E= Days to 50 Percent Emergence; EP=Emergence Percentage.

Vegetative growth of four cucumber cultivars

The results of the vegetative growth parameters of four cucumber cultivars evaluated were shown in Table 3.

Table 3. Vegetative growth parameters of four cultivars of cucumber (*Cucumis sativus* L.)

Cucumber cultivars	DMFI	DFFI	N0PFPP	N0B8WAP	VL8WAP(cm)	N0L8WAP	LL(cm)	LW(cm)	LAI
CU999	37.66	42.66	8.33	4.26	216.13	54.06	20.90	24.50	0.05
OHE/CU	39.00	44.67	7.33	4.00	133.76	44.50	15.36	19.23	0.30
MURANOF_1	0.00	44.67	14.17	1.23	78.43	27.18	12.72	16.78	0.01
AOA/CU	40.33	45.00	6.67	2.67	140.33	26.13	13.50	17.18	0.01
F-$LSD_{0.05}$	0.05	0.666	0.004	0.091	0.31	0.43	0.03	0.01	Ns

LSD= Least significant difference ($p>0.05$); NS=Non-significant; DMFI=Days to male flower initiation; DFFI= Days to female flower initiation; N0PFPP = Number of pistillate flower per plant; N0B8WAP= Number of branches eight weeks after planting; VL8WAP = Vine length eight weeks after planting; N0L8WAP = Number of leaves eight weeks after planting; LL = Leaf length; LW= Leaf width; LAI= Leaf Area Index.

RESULT

The result showed that there was significant difference ($p>0.05$) among the four cucumber cultivars studied in days to male flower initiation, days to female flower initiation, number of pistillate flower per plant, number of branches eight weeks after planting, vine length eight weeks after planting, number of leaves eight weeks after planting, leaf length and leaf width. Thus the cultivars showed no significant difference ($p>0.05$) in leaf area index. Consequently, there was significant difference ($p<0.05$) in days to male flower initiation and days to female flower initiation among the cucumber cultivars studied. CU999 cultivar showed early flower initiation of both the staminate and pistillate with a mean value of 37.66 and 42.66 respectively while AOA/CU had late flower initiation of staminate and pistillate of 40.33 and 45.00 respectively. However, MuranoF_1 cultivar was found to be pistillate bearing cultivar only without staminate, thus having the highest mean value for the number of pistillate flowers of 14.17 among the three cultivars studied. There was significant difference ($p<0.05$) in number of branches eight weeks after planting for the cultivars evaluated.CU999 had the highest number of branches with a mean value of 4.26, followed by OHE/CU of mean value of 4.00 with MuranoF_1 having the lowest number of branches with mean value of 1.23.CU999 had the highest vine length with a mean value of 216.13cm while MuranoF_1 cultivar had the lowest vine length with mean value of 78.43cm. There was significant difference ($p<0.05$) in number of leaves per plant eight weeks after planting for the cultivars evaluated.CU999 cultivar had the highest number of leaves per plant eight weeks after planting with a mean value of 54.06, while AOA/CU cultivar had the lowest number of leaves per plant with a mean value of 26.13. OHE/CU cultivar attained the second highest position with a mean value of 44.50 but was statistically at par with MuranoF$_1$ and AOA/CU cultivars. The cultivars also differed significantly (*p<0.05*) in leaf length and leaf width. CU999 had the highest mean values for leaf length and leaf width of 20.90 and 24.50 respectively while MuranoF$_1$ had the lowest mean values for leaf length and leaf width of 12.72 and 16.78 respectively.

Yield of four cucumber cultivars (*Cucumis sativus*)

The results of the analysis of variance on yield parameters of four cucumber cultivars studied were presented in Table 4. There were significant differences (*p<0.05*) in all the yield parameters evaluated. In fruit length, fruit diameter, number of fruits per plant, fruit weight, fruit weight per plant, fruit yield per hectare. CU999 cultivar had the highest mean values of 37.66cm, 11.30cm, 0.35kg and 2.62kg respectively, while the lowest values in fruit length, fruit diameter and fruit weight per plant were obtained in AOA/CU cultivar which had mean values of 17.73cm, 5.13cm and 0.79kg respectively. MuranoF$_1$ cultivar was statistically at par with CU999 and OHE/CU cultivars in terms of number of fruits per plant. Similarly, CU999 had the highest mean value (0.35kg) in weight of a fresh fruit which was statistically at par with 0.30kg obtained in OHE/CU. The least mean value of 0.15kg obtained in MuranoF$_1$ was also statistically at par with 0.20kg obtained in AOA/CU cultivar.

Table 4: Yield parameters of four cultivars of cucumber (*Cucumis sativus*).

Cucumber Cultivars	FL	FD	NFP	FW	FWP	FYH
CU999	37.66	11.30	7.40	0.35	2.62	18840
OHE/CU	31.36	8.80	5.70	0.30	1.72	12384
MURANOF$_1$	20.37	5.26	9.30	0.15	1.41	10128
AOA/CU	17.73	5.13	4.00	0.20	0.79	5664
F-LSD$_{0.05}$	0.004	0.027	0.019	0.038	0.037	0.037

LSD= LEAST SIGNIFICANT DIFFERENCE (*P*>0.05). FL= Fruit length; FD =Fruit diameter; NFP= Number of fruits per plant; FW= Fruit weight; FWP= Fruit weight per plant; FYH =Fruit yield per hectare.

Table 5. Correlation analysis of cucumber cultivars.

	N0B8WAP	VL8WAP	NOL8WAP	NFP	FL	FD	FW	Y ton/ha
N0B8WAP	1							
VL8WAP	0.720*	1						
NOL8WAP	0.814**	0.786**	1					
NFP	-0.387ns	-0.254ns	0.062ns	1				
FL	0.797**	0.686*	0.930**	0.161ns	1			
FD	0.821**	0.760**	0.914**	0.078ns	0.982**	1		
FW	0.868**	0.781**	0.862**	-0.136ns	0.905**	0.791**	1	
Y ton/ha	0.551ns	0.608*	0.814**	0.474ns	0.890**	0.781**	0.791**	1

Note: **= Correlation is significant at the 0.01 level, *= Correlation is significant at the 0.05 level, ns = Non significant, N0B8WAP= Number of branches eight weeks after planting; VL8WAP = Vine length eight weeks after planting; N0L8WAP = Number of leaves eight weeks after planting; NFP= Number of fruits per plant; FL= Fruit length; FD =Fruit diameter; FW= Fruit weight; Y ton/ha = Yield tons per hectare.

Number of Branches Eight Weeks after Planting

Number of branches eight weeks after planting showed positive correlation with vine length eight weeks after planting(0.720* P≤0.05), number of leaves eight weeks after planting(0.814** P≤0.01), fruit length(0.797** P≤0.01),fruit diameter(0.821** P≤0.01), fruit weight(0.868** P≤0.01), non significant correlation with number of fruits per plant and yield tons per hectare.

Vine Length (cm)

Vine length eight weeks after planting positively correlated with number of branches eight weeks after planting (0.720* P≤0.05), number of leaves eight weeks after planting (0.786** P≤0.01), fruit length (0.686* P≤0.05), fruit diameter (0.760** P≤0.01), fruit weight (0.781** P≤0.01) and yield tons per hectare (0.608* P≤0.05) whereas vine length showed non significant correlation with number of fruits per plant.

Number of Leaves Eight Weeks after Planting

Number of leaves eight weeks after planting had positive correlation with fruit length (0.930** P≤0.01), fruit diameter (0.914** P≤0.01), fruit weight(0.862** P≤0.01) and yield tons per hectare (0.814** P≤0.01) whereas number of leaves eight weeks after planting had no significant correlation with number of fruits per plant.

Fruit Length (cm) and Fruit Width (cm)

A strong positive correlation was present between fruit length and fruit diameter (0.597** P≤0.01). Fruit length (0.905** P≤0.01) and fruit diameter (0.791** P≤0.01) are also positively correlated with fruit weight. However, fruit length (0.890** P≤0.01) and fruit diameter (0.781** P≤0.01) showed positive correlation with yield tons/ha and fruit weight (0.791** P≤0.01) also had strong positive correlation with yield tons/ha.

DISCUSSION

It is evident from the results presented in Table 2 and 3 that there were non-significant differences in days to 50% emergence, and leaf area index among CU999, OHE/CU, MuranoF_1 and AOA/CU cultivars evaluated. Table 3 showed that CU999 cultivar had superior values in terms of number of branches per plant eight weeks after planting, vine length eight weeks after planting and number of leaves per plant. The findings are similar with that of Abusaleha and Dutta, (1990) who also studied vegetative traits such as vine length and found great variations in them. This variability shows that a great genetic diversity is present among cucumber cultivars.

The significantly higher values obtained in CU999 cultivar in both vegetative and yield parameters as presented in the tables above, over the other cucumber cultivars tested could be attributed to superiority in its genetic constitution with respect to vegetative growth and suitability of the cultivar to the growing conditions of the study area. The result was similar to the findings of Majanbu *et al*. (1996); and Ibrahim *et al*. (2000) who reported that genetic constitution of crop varieties influences their growth characters. Genetic nature of a cultivar enables it to adapt well to the given climatic condition. Ray and Sinclair (1997); Maqsood *et al*. (2004) and Enujeke (2013b and 2013c) attributed the differences between the growth characters of crop varieties to photosynthetic activities of leaves, differences in distribution of leaf surface and crop canopy, leaf arrangement, differences in chlorophyll content and activity of photosynthetic enzymes. The superiority of CU999 cultivar in vegetative growth over other cultivars was probably because it was able to effectively exhibit its good genetic make-up to exploit the newly found favourable agro-climatic conditions of the study area for rapid growth and branching. This is in harmony with the reports of Akinfoesoye *et al*. (1997) and Ray and Sinclair (1997) who attributed the growth characters of crop species not only to genetic constitution of the crop but also to the suitable agro-ecological zone where they can express their full genetic resources for growth and yield enhancement. The cultivar AOA/CU took longer mean time (40.33 and 45.00days) to produce male and female flowers and differed significantly with other cultivars. CU999 took shortest mean time (37.66 and 42.66 days) to produce male and female flowers but was statistically as par with OHE/CU and MuranoF_1. Early female flower initiation is desirable and is an indication of early maturing.

In terms of yield, it is evident from Table 4 that MuranoF_1 cultivar produced significant higher small number of fruits per plant being a female bearing cultivar than other cultivars which are monoecious but produced no significant value for weight of fruit; fruit weight per plant and fruit yield per hectare. However, Cu999 cultivar produced significant value for weight of fruit; fruit weight per plant and fruit yield per hectare compared to OHE/CU, MuranoF_1 and AOA cultivars. These results were against to the results of Resende (1999), who found that in case of number of fruits per plant cultivars; Indaial, Colonia, Ginga AG-77, Score and Tamor showed the best performance by producing more number of fruits per plant as compared to other cultivars evaluated. The results could be compared with those of Stolk and Cools (1980), who reported that the cultivar Bright had a higher average fruit weight but the cultivar K-8499, produce many small fruits. Clark *et al*. (1997) reported similar results and attributed the differences in yield and its components between crop genotypes to variations in genetic structure, mineral concentration and potentials to transport photosynthetic materials within plants.

It is clear from the results of the correlation analysis presented in Table 5; that vine length eight weeks after planting positively correlated with number of branches eight weeks after planting (0.720* P≤0.05), number of leaves eight weeks after planting (0.786** P≤0.01), fruit length (0.686* P≤0.05), fruit diameter (0.760** P≤0.01), fruit weight (0.781** P≤0.01) and yield tons per hectare (0.608* P≤0.05) whereas vine length showed no significant correlation with number of fruits per plant. This result is against with the findings of Abusaleha and Dutta (1988) who represented that vine length have positive significant correlation with fruit width and total number of fruit per plant. This is because if the length of vine increases there will be increase in number of branches and number of leaves which lead to increase in fruit length, fruit diameter and shows its manifestation in the weight and yield of the fruit.

Result of the correlation analysis represents that yield was positively correlated with vine length. Lawal (2000) reported very high positive correlation between fruit length and cucumber fruit yield. Moreover Eifediyi *et al*., (2011) found no significant positive correlation between fruit diameter and fruit yield. Fruit length (0.890** P≤0.01) and fruit diameter (0.781** P≤0.01) showed positive correlation with yield tons/ha. The findings are similar with the results of Abusaleha and Dutta (1988) who found no relationship between fruit diameter and number of fruit per plant. These variations are due to the differences in environmental conditions, the genetic diversity of genotypes, or the presence of available nutrients.

Thus, CU999 appeared to have the best cultivar and environmental interaction (G × E) in producing superior yield in Owerri over OHE/CU, MuranoF_1 and AOA/CU.

CONCLUSION

The results obtained from the study showed that CU999 significantly performed better than OHE/CU, MuranoF_1 and AOA/CU and equally showed great adaptability to the climatic conditions of Owerri area. Based on the findings, CU999 could be recommended to farmers for improved cucumber production in Owerri area, South-Eastern Nigeria.

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