Agronomic performance and correlation studies in five genotypes of cucumber (*Cucumissativus*)

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Abstract
A field experiment was conducted at Ekorinim, Calabar, from April- June 2023 to study the agronomic performance and correlation between yield and yield- related traits of cucumber (*Cucumis sativus*). The genotypes used were; micu_1002, Market more, Marketer, Saira F_1 and a landrace (Odukpani local).The experiment was laid out in a Randomized Complete Block Design (RCBD) with 3 replications. Data were collected on emergence percentage, number of leaves, number of branches, vine length, number of days to 50% flowering, days to male flower initiation, days to female flower initiation, days to first fruit maturity, number of fruits, fruit length and fruit weight. The data collected were subjected to analysis of variance (ANOVA) and significant means were separated using Duncan Multiple Range Test (DMRT) at 5% level of significance. The cucumber genotypes varied significantly across all the traits ($P<0.05$) except number of branches, first harvest fruit length, first harvest fruit weight, second harvest number of fruits and second harvest fruit weight ($P>0.05$). Pearson correlation coefficient was estimated to determine the association between yield and yield- related traits. Saira F_1 and Micu_1002 were significantly better in number of leaves, number of branches, vine length, number of fruits per plant, fruit weight and fruit length, days to female flower initiation, days to first fruit initiation and days to first fruit maturity than the other genotypes. These genotypes are therefore recommended for further evaluation in this agro-ecology.

Keywords: Association, selection, traits, agro-ecology, growth

Introduction

Cucumber (*Cucumis sativus)* belongs to the Cucurbitaceae family. The Cucurbitaceae, also called cucurbits or the gourd family, are a plant family consisting of about 965 species and 95 genera (Christenhusz and Byng, 2016). Cucumber fruit is described as oval shaped, approximately 6 cm in diameter and 10 cm in length with sharp prominent spines. The immature fruit is reportedly dark green with gray specks, ripening to bright orange (Staeck, 2022). Cucumber is a creeping vine that roots in the ground and grows on support frames; the plant has large leaves that often shade over the fruit (Kumar *et al.*,2014). Depending on the species, cucumbers are set to yield 50 to

70 days once planted, and depending on their use, cucumbers are picked by size, and taste good when collected immature, thus should not reach the yellowish phase as they become bitter with age (Ortas, 2022; Babla *et al.*,2022). Cucumber is cultivated in all agro- ecology in Nigeria. This cuts across the rainforest to the savannah zones of Nigeria, with the production pattern and volume varying from place to place (Adeoye and Balogun, 2016). The five (5) highest cucumber producing states in Nigeria are Plateau, Kaduna, Katsina, Kano and Benue, others with high production capacity are Enugu, Ebonyi, Akwa Ibom, Oyo, Cross River, Rivers and Nassarawa (Bernard and Japhet, 2021).

Yield is a prominent objective in most breeding programmmes, and is affected by many component traits directly or indirectly. It is important to know the contributions of each of the traits that affect yield in order to carry out improvement programmes of such traits. Understanding the relationship between yield and its component traits is of great importance to a plant breeder in selecting desirable genotypes for yield improvement programmes (Islam *et al.*, 1993; Kumar and Shukla 2002).

The efficiency of selection in a breeding programme depends on the knowledge of association of the traits investigated. Correlation of characters is a measure of the strength of relationship between various traits for effective selection. The importance of correlation in designing an effective breeding strategy was presented by Johnson *et al.*(1955). Correlation studies are therefore useful in disclosing the magnitude and direction of these relationships between the different characters and yield.

Although cucumber is one of the main vegetable crops in Nigeria, its yield is quite low due to non-accessibility of improved varieties well suited for specific agro-ecological zones. Cucumber production in Nigeria can be increased by cultivating superior varieties suitable for a particular production zone. Therefore, this study evaluated the agronomic performance as well as ascertained the relationship between yield and yield – related traits in the cucumber genotypes investigated in order to select genotypes suitable for this agro-ecological zone.

Materials and methods

This research work was carried out at Aqua Edem street, Ekorinim, Calabar, with latitude N 4°59'58.22628 and longitude E 8°19'21.42228. Five genotypes of cucumber were used for this experiment; four exotic genotypes; Market more, Marketer, Micu-1002 and Saira (F_1) were obtained from Technism seed company Calabar, and a local landrace (Odukpani local) was sourced from local farmers. The experiment was laid out in a Randomized Complete Block Design (RCBD) with 3 replications. Two seeds each of the cucumber genotypes were sown per hole and later thinned to one. Each experimental unit measured 2m ×2m with an alley way of 0.5m. The planting distance was 50cm × 50cm giving plant population of 40,000 per hectare, manual weeding was carried out at 2 weeks after sowing and whenever weeds were found in the plot. Data were collected on the following traits; emergence percentage (%) , number of leaves per plant , number of branches , vine

length (cm) , number of days to 50% flowering, days to male flower initiation , days to female flower initiation ,days to fruit initiation, days to first fruit maturity, number of fruits per plant ,fruit length (cm) and fruit weight (g).

The data collected were subjected to analysis of variance (ANOVA) using the Statistical Tool for Agricultural Research (STAR) version 4.1. Pearson correlation coefficient was also estimated to determine the relationship between traits.

Results and discussion

The results of the growth and yield traits of the (5) five genotypes of cucumber are presented in Tables 1 and 2. The cucumber genotypes varied significantly across all the growth and yield traits ($P<0.05$) except number of branches, first harvest fruit length, first harvest fruit weight , second harvest number of fruits and second harvest fruit weight ($P>0.05$). The mean emergence percentage was 66.67%. Saira F_1 had the highest emergence percentage of (94.33%), while local had the least (43.67%).

The mean number of leaves was 34.47. Saira F_1 had the highest number of leaves (51.67), while marketer had the least (12.00) number of leaves. There was no significant difference in the number of branches ($P>0.05$). The mean number of branches was 2.80. Saira F_1 had the highest number of branches (3.67), followed by local (3.33), marketer (2.67), micu-1002 (2.33) and market more (2.00). Saira F_1 had the longest vine (160.00 cm), while micu-1002 had the shortest (31.67 cm).

The mean days to male flower initiation was 41 days. Odukpani local took longer days to initiate male flowers (54 days), followed by Market more (50 days), Micu-1002 took (37 days), while Saira F_1 and Marketer took 33 days and 31days to initiate male flowers respectively.

The mean days to female flower initiation was 51days.Odukpani local took longer days to initiate female flowers (66days), followed by Market more (64 days), Marketer (45 days), Micu-1002 and Saira F_1 took 42 and 38 days respectively to initiate female flowers.

The mean days to 50% flowering were 43 days. Marketer had the shortest days (33 days) to 50% flowering, followed by Saira F_1 (36 days), Micu-1002 took 41days, Odukpani local took 52 days while Market more took 56 days to 50% flowering.

The mean days to first fruit initiation was 50 days. It took Odukpani local (58 days) to initiate fruits, followed by Marketer (58 days), Market more (56days), Micu -1002 and Saira F_1 took 46 days and 35 days respectively. The mean days to first fruit maturity was 59 days. Saira F_1 had the shortest days to first fruit maturity (40.7 days), followed by Micu -1002 (52 days), market more took (66 days) to first fruit maturity while Odukpani local and Marketer took 59 and 69 days to first fruit maturity respectively.

The mean number of fruits at first harvest was 2.53, Saira F_1 had (6.67) number of fruits, Micu -1002 (2.33), Marketer (1.67), Odukpani local and Market more had (1.33) and (0.67) number of fruits respectively. At third harvest, the mean number of fruits was 0.4667. Saira F_1had (1.33), Micu-1002 (1.00), while Odukpani local, Marketer and Market more had no fruits. At fourth harvest,

the mean number of fruits was 0.800.Micu-1002 had (2.67) number of fruits, Saira F_1 (1.33), while Odukpani local ,Marketer and Market more had no fruits. At fifth harvest, the mean number of fruits was 0.800. Micu-1002 had (3 fruits), Saira F_1 had one (1) fruit while Odukpani local, Marketer and Market more had no fruits.

There was significant difference in the fruit length of the five genotypes of cucumber ($P<0.05$), except in the first, second and third harvests ($P>0.05$). At fourth harvest, the mean fruit length was 5.47 cm. Micu-1002 had the longest fruits (15.00 cm), Saira F_1 (12.33 cm), while Odukpani local, Marketer and Market more had no fruits. At fifth harvest, the mean fruit length was 5.07cm. Micu-1002 had the longest fruits (14.33 cm), Saira F_1 (11.00 cm), Odukpani local, Market more and Marketer had no fruits.

The fruit weight of the genotypes were not significantly different ($P>0.05$) at first and second harvest. At third harvest, the mean fruit weight was (53.52 g). Micu-1002 had a weight of (164.17 g), Saira F_1 had a weight of (103.41 g), while Odukpani local, Market more and Marketer had no fruits. At fourth harvest, the mean fruit weight was (73.75 g). Micu-1002 had a weight of (274.54 g), followed by Saira F_1 (94.21 g), Odukpani local, Marketer and Market more had no fruits. At fifth harvest, the mean fruit weight was (50.97g). Micu-1002 had a fruit weight of(168.94g), Saira F_1had fruit weight of (85.89g),Odukpani local, Marketer and Market more had no fruits.

Correlation Analysis

The results from correlation analysis are presented in Table 3. Emergence percentage had a negative and significant correlation with days to male flower initiation (r=-0.7418***), days to female flower initiation (r=-0.7381***) and days to first fruit maturity (r=-0.5865*). Number of leaves had a weak negative and significant correlation with days to first fruit maturity (r=-0.4254*). Days to 50% flowering had a strong positive and significant correlation with days to male flower initiation (r=0.9556***), days to female flower initiation (r=0.8868***) and a weak negative and significant correlation with number of fruits (r=-0.4971*). Days to male flower initiation had a strong positive and significant correlation with days to female flower initiation (r= 0.9078***), but negative and significant correlation with number of fruits (r= -0.5289). Days to female flower initiation had a negative and significant correlation with number of fruits (r=-0.6557**). Days to first fruit maturity had a positive and significant correlation with number of fruits (r=0.6794***).

Discussion

The results from the analysis of variance (ANOVA) showed that the variation in cucumber genotypes was significant for some traits while others like number of branches, days to first fruit initiation, first harvest fruit length, first harvest fruit weight, second harvest number of fruits and second harvest fruit weight were not significant.

The genotypes Saira F_1 and Marketer had higher percentages of emergence (94%) and (83%) compared to the other genotypes, this variation in emergence could be due to

variation in seed coat. These results are in accordance with the findings of (Hamid *et al*., 2002). Saira F_1 and Market more had better performance in number of leaves, compared to Micu-1002, Marketer and Odukpanilocal. The high number of leaves was formed because of the greater vine length. The significant higher values obtained in Saira F_1 and Market more in terms of number of leaves over the other cucumber genotypes investigated could be attributed to the superiority of the genotypes with respect to vegetative growth and suitability of the genotypes to the agro-climatic conditions of the study area. Pal *et al*. (2017), Khan *et al*.(2015) and Ranjian *et al*. (2015), also reported that number of leaves varies significantly among cucumber accessions due to genetic variation. A good leaf cover is essential for producing high quality fruits. Poor leaf cover will expose fruits to high levels of radiation and cause excessive heating of the fruit surface. This can lead to a variety of disorders including sunburn, sun-scald, fruit yellowing, fruit cracking and shriveled fruit. Saira F_1 and Odukpani local had the highest vine length. Generally more vigorous vine growth brings about better yields in cucumber. Similar assessments were reported by Pal *et al*. (2017), Veena *et al*. (2012) and Shukla *et al*.(2010). The vines allow the plants to raise themselves up towards sunlight and hold tightly to structures such as trellises.

The genotypes Marketer and Saira F_1 took shorter days to initiate male flowers. The variation in the number of days to male flower initiation might be due to the genetic nature of the different genotypes as the environmental conditions were the same for all genotypes. Similar estimations were reported by Adinde *et al*. (2016). Micu_1002 and Saira F_1 took shorter days to initiate fruits compared to the other genotypes. These variations in the genotypes may be due to the genetic nature of the genotypes. The result of the yield traits of the five genotypes of cucumber showed that number of fruits per plant differed significantly among the five genotypes. Saira F_1 and Micu_1002 had the highest number of fruits per plant compared to others .Number of fruits generally has greater contributions to the final yield.

The correlation analysis from this study showed that most of the traits were significant and positively correlated with each other, which suggests that a selection for an increase in one character will simultaneously lead to an increase in most of the other traits as significant and positive association between two characters indicates. Days to 50% flowering had positive and significant correlation with days to male flower initiation and days to female flower initiation, while its relationship with number of fruits was negative and significant. The positive and significant correlation indicates a strong association of these traits with days to 50% flowering. This implies that as the number of days to male flower initiation increases, there is a corresponding increase in the number of days to female flower initiation. The significant negative correlation between number of fruits and days to 50% flowering (r=-0.4971*), days to male flower initiation (r= -0.5289*) and days to female flower (r=-0.6557**) indicates that increase in these traits will ultimately decrease the number of fruits in

cucumber, also selection for earliness will affect yield negatively, this could be due to the fact that early flowering would mostly result in early maturity such that there was no sufficient time to accumulate or partition enough photosynthates (sink) for higher yields as is the case in late flowering and maturity, where longer duration allows for greater amount of photosynthate partitioning. Early flowering may also lead to inadequate pollination reducing fruit set and yield.Significant negative correlations of traits, makes simultaneous selection and improvement of traits difficult (Adinyeland Oseikita, 2006).

Conclusion and recommendation

The result obtained from this study indicate that Saira F_1 had better performance with respect to various growth and yield characters such as number of leaves, number of branches, vine length, number of fruits per plant, fruit weight and fruit length, days to female flower initiation, days to first fruit initiation and days to first fruit maturity. The correlation analysis from this study showed that most of the traits were significant and positively correlated with each other, whichsuggests that selection for an increase in one character will simultaneously lead to an increase in most of the other traits as significant and positive association between two characters indicates.

Saira F_1 and Micu_1002 had excellent performance in most of the traits, therefore these genotypes are recommended for further evaluation in this agro-ecology.

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Table 1: Mean values of growth and reproductive traits of five (5) genotypes

of cucumber

GENOTYPE	E%	NOL	NOB	VL	MFI	FFI	D50%F	DFFI	DFFM
Odukpani Local	43.67c	29.33b	3.33	74.67b	54.33a	66.33a	56.33a	58.66	69.00a
Marketer	83.00ab	12.00c	2.67	42.00c	31.67b	45.67b	33.33c	58.00	68.3a
Market more	50.33c	49.67a	2.00	74.33b	50.33a	64.67a	52.00a	56.33	66.00a
Micu_1002	62.00bc	29.67b	2.33	31.67c	37.67b	42.33bc	41.00b	46.00	52.00b
Saira F_1	94.33a	51.67a	3.67	160.00a	33.00b	38.00c	36.67bc	35.67	40.67c
			NS						
	66.67	34.47	2.80	76.53	41.40	51.40	43.87	50.93	59.20
Cv %	22.37	19.78	26.08	19.01	8.02	4.92	6.79	3.81	7.84

Key:
E%: Emergence percentage, N0L: Number of leaves, NOB: Number of branches, VL: Vine Length, MFI: Male flower initiation, FFI : Female flower initiation , D50%F : Days to 50 percent flowering, DFFI:Days to first fruit initiation, DFFM: Days to first fruit maturity

Table 2: Mean values of yield traits of 5 cucumber genotypes

GENOTYPE	FHNOF	SHNOF	THNOF	FHNOF	FTHNOF	FHFL	SHFL	THFL	FHFL	FTHFL	FHFW	SHFW	THFW	FHFW	FTHFW
Odukpani local	1.33b	2.00	0.00b	0.00c	0b	8.00	8.00	0.00c	0.00b	0.00c	117.61	188.65	0.00c	0.00c	0.00c
Marketer	1.67b	0.67	0.00b	0.00c	0b	7.15	11.00	0.00c	0.00b	0.00c	60.91	794.94	0.00c	0.00c	0.00c
Market more	0.67b	1.00	0.00b	0.00c	0b	7.67	8.00	0.00c	0.00b	0.00c	81.57	73.67	0.00c	0.00c	0.00c
MICU 1002	2.33b	2.00	1.00a	2.67a	3a	15.00	14.67	15.33a	15.00a	14.33a	183.20	121.06	164.17a	274.54a	168.94a
Sarai F1	6.67a	2.00	1.33a	1.33b	1b	9.67	9.67	12.33b	12.33a	11.00b	127.57	172.01	103.41b	94.21b	85.89b
		NS				NS	NS	NS			NS	NS			
	2.53	1.53	0.4667	0.8000	0.8000	9.50	10.27	5.53	5.47	5.07	114.17	127.07	53.52	73.75	50.97

Key:

FHNOF: First harvest number of fruits, SHNOF: Second harvest number of fruits, THNOF: Third harvest number of fruits, FHNOF: Fourth harvest number of fruits, FTHNOF:_ Fifth harvest number of fruits, FHFL :First harvest fruit length, SHFL: Second harvest fruit length, THFL: Third harvest fruit length, FHFL: Fourth harvest fruit length, FTHFL: Fifth harvest fruit length, FHFW: First harvest fruit weight, SHFW: Second harvest fruit weight, THFW: Third harvest fruit weight, FHFW: Fourth harvest fruit weight, FTHFW: Fifth harvest fruit weigh

Table 3: Correlation coefficients of yield and yield related traits of five (5) cucumber genotypes

	E%	VL	NOL	NOB	ND50%F	DMF	DFF	DFFM	NOF	FL	FW
E%											
VL	0.4015										
NOL	0.0046	0.6417									
NOB	0.3125	0.4915	0.2359								
D50%F	-0.7169	-0.0662	0.2026	0.1781							
DMF	-0.7418***	-0.0899	0.1762	-0.2321	0.9556***						
DFF	-0.7381***	-0.2146	0.0432	-0.2262	0.8868***	0.9078***					
DFFM	-0.5865*	-0.5667	-0.4254*	-0.2311	0.3827	0.4455	0.6544**				
NOF	0.6135	0.7325	0.4628	0.5637	-0.4971*	-0.5289*	0.6557**	0.6794**			
FL	0.1756	-0.0656	0.1313	0.1482	-0.2102	-0.1890	-0.3202	-0.2601	0.378		
FW	0.0999	0.0302	0.2762	0.3704	-0.1081	-0.0919	-0.2881	-0.2156	0.472	0.826*	

Key:

E% :Emergence percentage, N0L:Number of leaves, NOB :Number of branches, VL: Vine Length, DFM: Male flower initiation, DFF: Female flower initiation, D50%F:Days to 50 percent flowering, DFFI: Days to first fruit initiation, DFFM: Days to first fruit maturity, NOF: Number of Fruits, FL: Fruit Length, FW: Fruit weight