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Full Length Research Paper

Interrelationship between yield and yield components in cucumber (*Cucumis sativus*) in Enugu, South-eastern, Nigeria

V. N. Onyia[1]*, T. S. Emavwodia[2], C. O. Mbuka[3] and G. C. Onyishi[3]

[1]Department of Crop Science, University of Nigeria, Nsukka, Enugu State, Nigeria.
[2]Department of Agronomy and Ecological Management, Enugu State University of Science and Technology, Enugu State, Nigeria.
[3]Department of Crop Science and Technology, Federal University of Technology, P. M. B. 1526, Owerri, Imo State, Nigeria.

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The research to determine the interrelationship between yield and different yield components in cucumber (*Cucumis sativus*) using organic and inorganic fertilizers was conducted at the Department of Agronomy and Ecological Management Research farm in Enugu, South-eastern Nigeria. The treatment comprises of zero application of the soil amendment (control), poultry manure, NPK and Urea. They were laid out in a Randomized Complete Block Design (RCBD) and replicated five times. Data were collected on vine length (cm), number of leaves per plant, number of nodes per plant, number of branches per plant, number of flowers per plant, fruit length, fruit weight per plot and fruit yield. Correlation studies were carried out to determine the component that influence fruit yield. Significant differences were recorded for all the agronomic traits evaluated. It was observed that urea gave the longest vine length of 21, 46.4 and 244 cm at 4, 6 and 8 WAP while the control had the least vine length of 17.2, 34 and 108.6 cm at 4, 6 and 8 WAP, respectively. The same trend was of nodes/plant, number of flowers/plant and fruit yield. Correlation analysis showed that in all the stages, plant height was positively and significantly correlated with number of leaves while number of flowers was positively correlated with fruit weight and fruit yield. Based on the results obtained, the use of urea will greatly enhance the production of cucumber more than the use of poultry manure or NPK.

Key words: *Cucumis sativus*, interrelationship, correlation analysis, poultry manure, NPK.

INTRODUCTION

Cucumber (*Cucumis sativus* L.) is a tender annual vegetable vine crop, grown for its fresh fruit. It is used as salads or taken as fresh fruit desserts. The crop is a member of the Cucurbitaceae family, which comprises 90 genera and 750 species. It is thought to have originated from India or China (Harlan, 1975), with domestication occurring later throughout Europe and some parts of Africa including Nigeria. It is thought to be one of the oldest vegetable crops grown for at least five thousand years (Shetty and Wehner, 2002). Despite all the economic potentials of the crop, the full production potentials in South Eastern region of Nigeria have not been realized. Yield obtained by farmers in the region is often very low especially, in intensive cropping areas due to imbalance use of fertilizers and continuous cropping which has led to several nutrients becoming deficient (Mahmood et al., 1999). Reports on the relevance of organic manure and mineral fertilizers in tropical agriculture have been presented by various researchers. Adediran et al. (2005) reported a positive vegetative growth, root development and fruit yield of tomatoes to the complementary application of organic manure with mineral fertilizer. Singh et al. (2003) in their report considered nitrogen as one of the major nutrients required by the plants for growth, development and yield. Premsekhri and Rajashree (2009) also reported a

*Corresponding author. E-mail: onyianduvin@yahoo.com.

significant increase in growth and yield of okra using organic manure (farm yard manure).

Increased fruit yield has been one of the primary breeding objectives in the development of cucumber cultivars (Wehner, 1989). Yield components have been used to study fruit yields in vegetable crops such as cucumber (Abusaleha and Dutta, 1988; Cramer and Wehner, 1998; Prasad and Singh, 1994; Serquen et al., 1997; Solanki and Shah, 1989; Yin and Cui, 1994), blue berry (*Vaccinium corymosum* L) (Siefker and Honcock, 1986), Strawberry (*Fragaria xananassa* Mill) (Hancock et al., 1984) and Tomatoes (*Lycopersicom Lycopersicom*) (McGiffen et al., 1994). In some instances, yield components have been positively correlated with yield and could be selected to improve yield. However, few of those studied involve genetically diverse cucumber populations.

In view of the importance of fertilizer in influencing the different yield components which ultimately culminate in final yield, the present research was undertaken to determine the response of growth and yield of cucumber to different sources of fertilizer and to determine the interrelationship between yield and yield components in cucumber. The results obtained will serve as a prelude for further research into the breeding and improvement of the crop.

MATERIALS AND METHODS

These studies were conducted at the Department of Agronomy and Ecological Management Experimental Farm in Enugu South Eastern Nigeria. Four treatments were used: Zero application of soil amendment (control), poultry manure (Pm), NPK 15:15:15 (NPK) and Urea and were replicated five times. The experiment was laid out in a randomized complete block design (RCBD). The plot size was 2 × 2 m given a total of 20 plots and total land area of 133 m^2. Three seeds were planted per hole at a plant spacing of 80 × 50 cm and were later thinned down to one plant/stand 14days after planting (DAP). Staking was done 21 DAP when the vine tendrils appeared. The fertilizers were applied at the rates of 200 kg/ha of Pm, 100 kg/ha of NPK and 100 kg/ha of Urea. Weeding was done thrice at 14, 28 and 42 DAP with the aid of a hand held Africa hoe. Data on vine length, number of nodes per plant, number of branches per plant, number of flowers per plant, fruit length, fruit weight per plot and fruit yield per plot were collected. The analysis of variance (ANOVA) was carried out using the procedure outlined by Steel and Torrie (1984) and detection of statistical differences among treatment means were done as outlined by Obi (2002). Correlation coefficients between yield and yield components were also determined

RESULTS AND DISCUSSION

The results obtained from the research showed significant differences among the different treatments at various stages of plant growth. No significant difference was noticed in the vine lengths among the treatments at 2 WAP. However, significant differences were observed at 4, 6 and 8 WAP. The differences became more apparent at 6 and 8 WAP where the use of Urea gave the longest vine lengths of 46.4 and 244 cm respectively while the control gave the lowest vine length of 34 and 108.6 cm respectively. Wehner and Cramer (1996) had earlier reported that the increase in mean number of plant height can be attributed to the fertilizer used. As nitrogen level decreased, vine length also decreased and plots receiving no nitrogen produced minimum cucumber vine length as shown in the lengths of 2 WAP. Phu (1996) also observed an increase in cucumber vine length when 100 kg of nitrogen was applied. There was an increase in the number of leaves in treatments that had high nitrogen levels. There was no significant difference in the plots treated with PM, NPK and Urea at 2, 4 and 6 WAP. Significant differences were only noticed at 8 WAP where plots treated with PM, NPK and Urea had 196, 213 and 247 leaves/plant respectively. This may be attributed to the fact that plants require nitrogen for production of vegetative parts especially, leaves according to Standhill (1981). Crop physiologists have established that high yields in modern crop production by adapted cultivars can largely be explained by increased solar interception achieved by larger and longer living canopies. From the study conducted by Ding et al. (1991), the longer a crop is allowed to grow in a particular site in a season, the greater is its biomass production in that site. This increase in biomass production with longer duration growth reflects not only the opportunity for more prolonged interception of photosynthetically active radiation by the crop, but also the greater opportunity for uptake of nitrogen and other nutrients especially in low input condition (Yoshida, 1993). Significantly higher number of nodes and number of branches was recorded in plots treated with urea at 6 and 8 WAP as shown in Table 1.

The highest number of nodes of 61 was obtained in plots treated with urea at 8 WAP while the lowest number of nodes (36) was obtained in the control plots. Similar trend was observed in the number of branches/plant. Number of flowers per vine was significantly affected by the different treatments. The maximum number of flowers was produced in plots treated with urea compared to the other plots while the control plot produced a total of 28 flowers per plant at 8 WAP plots treated with urea producing a maximum of 47 flowers per vine within the same period. The data once again showed the need for nitrogen for both vegetative and reproductive growth of cucumber plant. Also, similar results were observed by Baker et al. (2006), who obtained more number of fruits per plant in cucumber from 80 kg N per hectare. The results showed that nitrogen had significant effect on fruit weight and fruit weight and fruit yield. Significant increase in fruit weight was observed in plots treated with urea (156 g) while the control had fruit weight of 123.7 g per plot ($p = 0.05$). The same trend was also observed in fruit yield tons per ha. These results agree with the findings of Ahmad et al. (2007) that fruit weight of cucumber increased linearly due to increase in nitrogen fertilizer use.

In majority of the correlations, it was observed that vine

Table 1. Mean effects of plant height (cm), number of leaves/plant, number of nodes/plants, number of branches/plan, number of flowers/plants, fruit weight/plot and fruit yield/plot at different growth stages.

Treatments	Vine length (cm)				Number of leaves per plant				Number of nodes per plant			Number of branches per plant			Number of flowers per plant		Fruit weight per plot	Fruit yield tons per ha
	W	A	P		W	A	P		W	A	P	W	A	P	W	A	P	
	2	4	6	8	2	4	6	8	4	6	8	4	6	8	6	8		
Control (zero application)	6.4	17.2	34	108.6	3	10	36	91	3	19	36	2	6	32	5	28	123.7	7.02
P.M.	6.6	18.2	38.8	199.6	4	10	39	196	4	23	41	3	7	35	5	30	131.0	9.52
NPIC	6.8	19.8	43.4	211	5	11	43	213	5	24	49	4	9	46	6	35	143.66	12.26
Urea	6.6	21	46.4	244	5	12	45	247	5	26	61	5	12	52	7	47	156.24	14.92
F-LSD (P=0.05)	ns	2.392	5.957	54.23	0.677	2.37	6.617	72.619	0.128	4.007	5.739	12.845	3.18	4.75	3.318	4.409	4.172	6.23

Table 2. Correlation coefficients and interrelationship between yield and yield components in the four treatments used-control, PM, NPIK and Urea.

Trait Control	Vine length	No of leaves	No of nodes	No of branches	No of flowers at 6 WAP	No of flowers at 8WAP	No of Fruits/plot	Fruit yield
Vine length		0.992**	0.907	0.750	-0.679	-0.979*	-0.659	0.150
No of leaves			0.899	-0.827	-0.585	0.969*	-0.560	-0.270
No of nodes				0.745	-0.505	-0.803	-0.506	-0.603**
No of branches					0.972	-0.694	0.002	-0.661
No of flowers at 6 WAP						0.729	0.998**	0.449
No of flowers at 8 WAP							0.700	0.200**
No of fruits/plot								0.500**
Fruit yield								
Poultry manure								
Vine length		0.992**	0.634	0.684	-0.728	0.093	0.093	0.093
No of leaves			0.642	0.702	-0.710	0.129*	0.129	0.129
No of nodes				0.937	0.005	0.417	0.417	-0.417**
No of branches					0.002	0.656	0.656	0.656
No of flowers at 6 WAP						0.500	0.500*	0.500
No of flowers at 8 WAP							1.000**	1.000**
No of fruits/plot								1.000**
Fruit yield								
NPK								
Vine length		0.999**	0.659	0.690	-0.725	0.096	-0.725	0.096

Table 2. count'd.

No of leaves		0.669	0.709	-0.706	0.134*	-0.706	0.134
No of nodes			0.960*	0.000	0.476	-0.000	-0.476**
No of branches				-0.002	0.658	-0.002	0.658
No of flowers at 6 WAP					0.500	1.000**	0.500
No of flowers at 8 WAP						0.500	1.000**
No of fruits/plot							0.500
Fruit yield							
Urea							
Vine length	0.998**	0.665	0.684	0.727	0.094	-0.094	-0.094
No of leaves		0.616	0.641	0.764	0.067*	-0.067	-0.067
No of nodes			0.981*	-0.001	0.514	-0.514	-0.514**
No of branches				-0.002	0.639	-0.639	-0.645
No of flowers at 6 WAP					-0.500	0.500*	0.521
No of flowers at 8 WAP						1.000**	1.000**
No of fruits/plot							1.000**
Fruit yield							

*Correlation is significant at 0.01; **Correlation is significant at 0.05.

length is positively and significantly correlated with number of leaves. It also shows that number of leaves is positively and significantly correlated with number of flowers at 8 WAP (Table 2). The result also indicates that number of flowers at 6 WAP is positively and significantly correlated with fruit weight. The same trend was also observed in the other treatments as shown in Table 2.

A negative association between the percentages of pistillate nodes and the percentage of fruit set for the treatments was observed. This negative association could be explained by the phenomenon of fruit inhibition observed for cucurbits. With first fruit inhibition, the development of the other fruit was limited by the development of the first pollinated fruit (McCollum, 1934). Selection for an increased percentage of pistillate nodes in this population may have promise for increasing the number of fruit produced per plant. This selection may result in more gain in yield than direct selection for yield *per se* of heritability for the percentage of pistillate nodes is higher than heritability for yield.

Conclusion

Nitrogen had a positive and significant effect on the growth and yield of cucumber as it enhanced cucumber production. The use of Urea which is almost 100% nitrogen based performed best among all the other treatments that were used. Correlation studies showed that traits such as number of leaves, vine length number of flowers per plant which are regarded among the yield components were significantly in correlation with yield and could be considered in breeding for yield improvement in cucumber production.

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