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Research Note

EFFECT OF PLANT SPACING AND NITROGEN FERTILIZER ON THE GROWTH AND YIELD OF PEPPER (*Capsicum annum L.)*

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ABSTRACT

A field trial on pepper (capsicum annum L. var Nsukka yellow pepper) was conducted at the Ebonyi State University, Faculty of Agriculture experimental farm during the 1999 cropping season. Four nitrogen rates (0,50, 100 and 150kgN/ha) and three plant spacings (30cm x 75cm, 45cm x 75cm, 60cm x 75cm) were evaluated in a 4x3 factorial laid out in Randomized Complete Block Design (RCBD) with three replications. Results obtained showed that 150kgN/ha produced the tallest plants. Similarly,150KgN/ha produced plants with the highest number of branches, leaves, fruits and fruit diameter. There was an increase in plant height and number of branches as the spacing increased from 30cm x 75cm to 60cm x 75cm while the number of fruits and diameter of fruits decreased as the spacing increased. Nitrogen, plant spacing and their interaction had no significant effect on the weight of fruits produced. From this study, 150kgN/ha was sufficient for the growth of Nsukka yellow pepper in Abakaliki agroecological zone. Plant spacing of 30cm x 60cm is recommended for optimum yield.

Key words: Nsukka yellow pepper, nitrogen, plant spacing, growth, yield.

INTRODUCTION

Pepper is an important vegetable crop that is cultivated in Nigeria. It is cultivated outdoors as either a rainfed or irrigated crop. In 1980, Nigeria produced 627,000 metric tonnesof pepper, which accounted for about 50% of the African production (Anon, 1980). Pepper constitutes about 40% of the vegetables consumed locally (Denton and Swarug, 1981). It contains vitamins A, C and E and it is used as flavour for soup and stew. Although pepper is cultivated throughout Nigeria, yields obtained by peasant farmers are often very low due to various production constraints such as lack of information on fertilizer application, proper plant spacing and non- availability of fertilizers. As a result of these, low yields are obtained, leading to the exhorbitant prices per unit weight of the fruit (Uzo, 1984). Plant spacing is one of the agronomic practices that influence crop growth and development (Yayock, 1978). Aliyu *et al* (1990) reported that reducing the intra-row spacing of two pepper varieties from 50cm to 40cm significantly decreased plant height, number of fruits and diameter of fruits while total fruit yield per hectare was conversely increased. They also asserted that 180kgN/ha significantly increased number of branches, diameter of fruits and total fruit yield when compared with 60kgN/ha. Quinn (1980) suggested that closer spacing will optimize the yields of some recently introduced more compact tomato cultivars. Ahmed (1981) found

that closer plant spacing and 150kgN/ha produced the highest fruit yield of pepper in Zaria. He noted that neither intra-row spacing nor nitrogen application had any significant effect on the weight of fruits, plant height, number of branches and leaves. Nagdy *et al* (1979) observed that varying plant spacings and rates of nitrogen application increased plant height, number of branches and leaves.Amans (1987) reported that reducing plant spacing increased tomato fruit yield and significantly reduced the percentage of rotted fruits. Nitrogen rates of 0, 80, 160 and 240kgN/ha resulted in yield responses of 18, 73, 100 and 92% for each respective nitrogen rate (Abregts, 1971). Locasio and Fiskell (1977) obtained relative yield responses of 100% and 89% with nitrogen rates of 200kgN/ha and 275kgN/ha respectively. They recommended 200kgN/ha for optimum production of pepper in Louisiana. Abregts and Howard (1973) reported that the relative yield responses of pepper to 160 and 212kgN/ha were 92% and 100%, respectively. It is expected that pepper crop transplanted at the appropriate plant spacing with adequate fertilizer application should not only result in higher yield but it will also reduce the price per unit weight of the fruit. The objective of this study was therefore to evaluate the effect of plant spacing and nitrogen fertilizer on the growth and yield of Nsukka yellow pepper.

MATERIALS AND METHODS

A field trial was conducted at the Faculty of Agriculture experimental farm to evaluate the effect of nitrogen fertilizer and plant spacing on the growth and yield of Nsukka yellow pepper. The field measured 20m x 15m, giving a total plot size of 300m^2. Raised field beds were manually cultivated and they were divided into three equal blocks.

Each block consisted of 16 plots, giving a total of 48 test plots. Each plot measured 2m x 2m with 0.5m between adjacent rows.

The experiment was conducted as a 4x3 factorial laid out in Randomized Complete Block Design (RCBD) with three replications. Three plant spacings (30cm x 75cm, 45cm x 75cm and 60cm x 75cm) and four nitrogen rates (0, 50, 100 and 150kgN/ha) were the treatments used. Six weeks old pepper seedlings were transplanted into the plots and nitrogen fertilizer (urea) was applied two weeks after transplanting using the band placement method. Potassium and phosphorus fertilizer were applied as blanket treatment at the rate of 60kgK/ha and 90kgP/ha respectively. The plots were manually weeded using hand hoes.

The parameters evaluated were plant height, number of branches, number of leaves and fruits, diameter and weight of fruits. Harvesting of the ripe fruits by hand picking commenced on 10th September, 1999. All data obtained during the experiment were subjected to statistical analysis using the procedure outlined by Steel and Torrie (1980) for a factorial experiment in Randomized Complete Block Design(RCBD) and separation of treatment means for significant effect was by the use of Least Significant Difference as described by Obi (1986).

RESULTS

Nitrogen fertilizer rate of 150kgN/ha produced plants with more number of leaves than other treatments and was significantly higher than 0kgN/ha (Table 1). However, the number of leaves at 100kgN/ha and 150kgN/ha were statistically similar.

The number of leaves increased as the plant spacing increased from 30cm x 75cm to 45cm x75cm. The closest plant spacing (30cm x 75cm) produced the least number of leaves while 45cm x 75cm produced the highest number of leaves and they differed significantly. The number of leaves at 30cm x75cm and 60cm x75cm differed significantly among themselves (Table 1).

Plots that received 0kgN/ha and plant spacing of 45cm x 75cm had significantly more vegetative growth than all other treatment combinations except 150kgN/ha and 45cm x 75cm (Table 1). Nitrogen fertilizer application significantly ($p= 0.05$) improved plant height and the number of branches over the control. The tallest and the most profusely branched plants were produced at 150kgN/ha while the

shortest and the least branched plants were at 0kgN/ha. Plant height at 50, 100 and 150kgN/ha did not differ among themselves (Table 2). Plant height and the number of branches increased as the spacing increased from 30cm x 75cm to 60cm x 75cm (Table 2). The widest plant spacing (60cm x 75cm) produced the tallest plants and the highest number of branches while the closest plant spacing (30cm x75cm) produced the shortest and the least branched plants and they differed significantly (Table 2). Nitrogen x Spacing interaction was significant at (P = 0.05). The plant height of plots that received 0kgN/ha and 60cm x75cm, 50kgN/ha and 45cm x 75cm, 150kgN/ha and 60cm x 75cm were statistically similar. However, plants that received 0kgN/ha and 60cm x 75cm were significantly taller than all other treatment combinations (Table 2).

Table 1: Effect of nitrogen fertilizer and plant spacing on the number of leaves.

	N-rate (kg/ha)				
Spacing (cm)	**0**	**50**	**100**	**150**	**Mean**
30 x 75	95.33	104.67	122.33	107.33	107.41
45 x 75	159.00	107.33	136.67	157.00	140.00
60 x 75	112.67	118.00	136.00	147.00	128.42
Mean	122.33	110.00	131.67	137.11	

F-LSD (P = 0.05)

Nitrogen = 12.1

Spacing = 10.5

Nitrogen x spacing = 6.06

Table 2. Effect of nitrogen fertilizer and plant spacing on plant height and number of branches.

		N-rate (kg/ha)				
	Spacing (cm)	**0**	**50**	**100**	**150**	**Mean**
Plant Height (cm)	30 x 75	28.00	43.33	52.33	59.33	45.75
	45 x 75	43.00	61.67	57.33	57.00	54.75
	60 x 75	63.00	56.67	59.67	56.00	58.84
	Mean	44.67	53.89	56.44	57.44	
Number of branches	30 x 75	5.00	11.67	13.67	26.67	14.25
	45 x 75	8.33	15.33	18.33	24.00	16. 50
	60 x 75	8.67	18.33	20.33	30.00	19.33
	Mean	7.33	15.11	17.44	26.89	

F-LSD (P=0.05) (plant height)
Nitrogen = 7.08
Spacing = 6.20
Nitrogen x spacing = 3.50

F-LSD (P=0.05) (Number of branches)
Nitrogen = 4.58
Spacing = 3.96
Nitrogen x spacing = NS

The application of nitrogen fertilizer significantly increased the number and diameter of the fruits over the control (Table 3). There was an increase in the number and diameter of fruits as the nitrogen rate increased from 0kgN/ha to 150kgN/ha. The number and diameter of fruits were highest at 150kgN/ha and least where no nitrogen was applied. The number, diameter and weight of fruits decreased as the plant spacing increased from 30cm x 75cm to 60cm x75cm but not beyond 45cm x75cm in the weight of fruits. Plant spacing, nitrogen and their interaction had no significant effect on the weight of fruits (Table 3).

DISCUSSION

Significant differences in plant height, number of leaves and the number of branches were observed among the nitrogen and spacing treatments. Plant height and the number of branches increased as the nitrogen rates increased from 0kgN/ha to 150kgN/ha and as the plant spacing increased from 30cm x 75cm to 60cm x 75cm. The two higher plant spacings (45cm x 75cm and 60cm x 75cm) produced similar and significantly taller plants than the least spacing of 30cm x 75cm. The increase in vegetative growth as the nitrogen rate increased could be attributed to an increase in cell division in the plant tissues, leading to the production of more photosynthetic surface and subsequent accumulation of photosynthates for more vegetative growth. Aliyu *et al*. (1990) reported that the number of branches and leaves increased as the nitrogen rate increased to 180kgN/ha. Nagdy *et al.* (1979) observed that varying plant spacings and rates of nitrogen application increased plant height, number of branches and leaves. The number of leaves was highest at 150kgN/ha and it increased as the plant spacing increased but not beyond 45cm x75cm. Aliyu *et al.* (1990) found that reducing intra-row spacing from 50cm to 40cm significantly decreased plant height but increased the number of leaves.

Table 3. Effect of nitrogen and plant spacing on the number, diameter and weight of fruits

Spacing (cm)		N-rate (kg/ha) 0	50	100	150	Mean
Number of fruits	30 x 75	23.33	27.00	24.00	56.00	32.58
	45 x 75	21.67	26.33	26.00	39.33	28.33
	60 x 75	10.33	21.67	27.33	37.33	24.17
	Mean	18.44	25.00	25.78	44.22	
Diameter of fruits (cm)	30 x 75	34.61	37.15	42.53	43.33	39.41
	45 x 75	31.33	35.20	41.83	43.87	38. 06
	60 x 75	18.53	32.10	40.07	44.23	33.73
	Mean	28.16	34.82	41.48	43.81	
Weight of fruits (kg)	30 x 75	0.15	0.18	0.15	0.88	0.34
	45 x 75	0.23	0.23	0.25	0.28	0.25
	60 x75	0.25	0.20	0.37	0.33	0.29
	Mean	0.21	0.20	0.26	0.50	

F-LSD (P=0.05) (Number of fruits)
Nitrogen =8.84
Spacing = NS
Nitrogen x spacing = NS

F-LSD (P-=0.05) (Weight of fruits)
Nitrogen = NS
Spacing = NS
Nitrogen x spacing = NS

F-LSD (P-=0.05) (Diameter of fruits)
Nitrogen = 3.04
Spacing = 3.60
Nitrogen x spacing = 1.50

The number and diameter of fruits increased as the nitrogen rate increased from 0kgN/ha to 150kgN/ha. This could be attributed to a higher number of fruiting buds which may have resulted to increased fruit production at the higher nitrogen rates. Abregts and Howard (1973) reported that yield responses increased as the nitrogen rate increased from 160kgN/ha to 212kgN/ha.

The number and the diameter of fruits at the plant spacing of 30cm x 75cm was higher than those produced at the wider spacings. This could be attributed to better and early canopy formation which may have checked weed growth and reduced competition for plant nutrients from weeds. It could also be as a result of higher population density observed at 30cm x75cm. Amans (1987) noted that reducing plant spacing increased tomato fruit yield and significantly reduced the percentage of rotted fruits. Similarly, Ahmed (1981) obtained the highest fruit yield at a closer plant spacing and nitrogen application. Quinn (1980) similarly recommended closer spacing to optimize the yields of some recently introduced compact tomato cultivar. Nitrogen, plant spacings and their interaction had no significant effect on the weight of fruit. This result is similar to that of Ahmed (1981) who reported that neither intra-row spacing nor nitrogen had any significant effect on the weight of pepper fruit.

CONCLUSION

This research has shown that in Abakaliki agroecological zone, nitrogen rate of 150kgN/ha was sufficient for the production of Nsukka yellow pepper. Closer plant spacing of 30cm x 75cm is also recommended for optimum yield.

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