Critical Age Of Sweet Pepper (*Capsicum Annum* L.) Response To Npk Fertilizer For Improved Growth And Yield

By

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Abstract

Potted experiments were conducted at the experimental site of the Department of plant Science of Ekiti State University, Ado-Ekiti to examine the critical age of sweet pepper response to NPK fertilizer for improved growth and yield. NPK fertilizer was applied either at 1,2,3 or 4 weeks after transplanting (WAT) to determine its effect on the following performance variables: plant height, stem girth, days to flower, number of fruits and fruit weight per plant. NPK fertilizer application within the first three weeks after transplanting resulted to taller plant than the 4WAT application. The result of the study also showed that Application of NPK fertilizer within the first two weeks after transplanting produced higher number of leaves, early flowering time and subsequently produced the highest fruit yield of pepper. It is concluded that early application of fertilizer to pepper after transplanting will result to fast and improved growth as well as increase yield of sweet pepper.

Key words: Sweet pepper, NPK fertilizer, application time, growth and yield.

Introduction

In Nigeria, peasant farmers have been growing pepper for many years and they produce low yield which ranged between 500,000 and 600,000 metric tons in 1980's and it increase slightly above 630,000 metric tons in the 1990's (Tisdale and Helson, 1997). This low yield resulted from low soil fertility, diseases and pests, and low yielding varieties (Akintoye 2003). The growing plant requires nutrients like Nitrogen, Phosphorus, Potassium, etc. which have their special functions and should be supplied to the plant at the right time and right quantity (Fagbayide, 1997). Application of NPK fertilizer has been reported to increase vegetative growth, yield and quality attributes (Faraq and Damranyi 1994). Height and leaf number increase have been reported with the application of nitrogen fertilizer (Akanbi and Adeniran, 2010). However, fertilizer plays a catalytic part in protein synthesis, chlorophyll formation, carbon assimilation and acceleration of enzymatic actions (Hedge, 2001). Efficient use of fertilizer is necessary to balance and maintain the optimum levels at which fertilizer could be used without being detrimental to the soil. Nitrogen is involved in the synthesis of protein, nucleic

acids and hormones; a deficiency of nitrogen in plants is marked by reduced growth and yellowing of leaves (Lynn and Aleksande, 2005). Apart from NPK involvement in active metabolism, it also increases the ability of plants to resist bacteria and fungi attack (Vanlauwe *etal*, 2002).
Different rates of NPK fertilizer application have been studied at various locations to ascertain the appropriate quantity required for optimum yield in pepper (Dwivedi, 1993) but little attention has been paid to the appropriate time of application. Adeniyi (2001) had opined the necessity to study how yield of pepper is affected by time of application of organic and inorganic fertilizers. The present study therefore aimed at determining the appropriate age of the pepper plant that NPK fertilizer would be best utilized for proper growth and best yield.

Materials and Methods

The experiment was carried out in the experimental site of the Department of plant science, Ekiti State University, Ado-Ekiti. Ado Ekiti is located on Latitude 7^0,40^0N and Longitude5^0, 15^0E with a bimodal rainfall pattern of about1450mm and a mean daily Temperature of 27^0c. Top soil was collected from fallowed land previously planted with maize. The soil was air dried, sieved and later filled into horticultural pots with 15L capacity and a depth of 28cm. Pepper seedlings of three weeks old were transplanted into the pots for the purpose of the NPK regimes application. Thirty soil filled pots were divided into five and the treatments allotted to them. NPK was applied at 1, 2, 3and4 weeks after transplanting to make four treatments while the last was the control experiment. These five treatments were replicated six times. NPK fertilizer was applied at the rate of $100kg^{ha-1}$ field equivalent (Osumah and Tijani Eniola 2010) to each pot using the ring method.

At six weeks after transplanting, data on number of leaves per plant, plant height and stem girth was collected. Days to flower, number of fruits per plant and fruit weight per plant was also assessed. All data collected were subjected to statistical analysis of variance and means separated using the Fisher's least significant difference.

Results

The results of the effect of critical age of NPK fertilizer application on pepper height and stem girth in the two seasons are presented in table1. The heights recorded 1, 2 and 3 weeks after planting NPK applications were not significantly different but higher than those of 4WAT and the control. The shortest plants were recorded in the control experiment which gave significant shorter plants than the 4WAT NPK applications.

Stem girths observed in the 1WAT and 2WAT NPK fertilizer applications were not significantly different but highest when compared to the other treatments. The 2WAT NPK application gave higher stem girth figures than the 4WAT NPK fertilizer applications in both seasons. The control showed the least performance in terms of stem girth measurement.

Table 2 shows the results of the critical age of NPK fertilizer on the number of leaves per plant and days to flowering on *Capsicum annum*. The highest number of leaves was recorded in the 1WAT NPK application but not significantly different from the 2WAT NPK fertilizer

application. The number of leaves recorded for the 3WAT and 4WAT were identical but significantly higher than those of the control in both trials.

The pepper plants in the 2WAT NPK fertilizer applications were the earliest to flower but not significantly different from the 1WAT NPK fertilizer application. While there were no significant differences among the 3WAT, 4WAT and the control in terms of days to flower in 2008, the plants in the 3WAT NPK pots flower earlier than either the 4WAT or the control.

The highest number of fruits was recorded on the plants receiving NPK fertilizer application at 2WAT, but this was not significantly different from either the 1WAT or 3WAT NPK fertilizer applications (Table3). The fruit numbers were in the order: 8.4, 8.0 and 7.8; and 10.0, 9.7 and 9.5 for 2 WAT, 1WAT and 3WAT in the 2008 and 2009 seasons respectively. While the number of fruits in the 3WAT and 4 WAT NPK fertilizer applied pots were not significantly different in the 2008 season, the number was significantly lower in 3 WAT than the 4 WAT in 2009 season. The control recorded the lowest number of fruits per plant.

In both seasons, the highest fruit weight was recorded in the pots receiving NPK fertilizer at 2WAT but this was not significantly different from those that received NPK at 1WAT. Fruit weight was higher in the 2WAT than either the 3 or 4 WAT NPK applications. The fruits weight in the 3 WAT was significantly higher than the 4 WAT NPK fertilizer applications. The least fruit weight was however observed in the control experiment.

Table1. Effects of treatments on plant height (cm) and stem girth (mm) at 6 weeks after transplanting (WAT)

Treatments	Plant height (cm)		Stem girth (mm)	
	2008	2009	2008	2009
NPK at 1WAT	14.7a	15.2a	28.1a	27.5a
NPK at 2WAT	13.3a	15.6a	28.0a	28.2a
NPK at 3WAT	12.9a	16.1a	23.2b	24.6b
NPK at 4WAT	8.8b	12.4b	17.2c	20.8c
Control	6.7c	9.3c	14.0d	13.4d
LSD	1.9	2.4	2.3	3.1

Means with the same letter within column are not significantly different (P=0.05)

Table2. Effect of treatments on number of leaves per plant and days to flower

Treatments	Number of leaves per plant		Days to flower	
	2008	2009	2008	2009
NPK at 1WAT	31.3a	26.8a	82.3b	80.2b
NPK at 2WAT	33.3a	28.4a	80.7b	78.4b
NPK at 3WAT	25.8b	23.1b	93.0a	82.0b
NPK at 4WAT	23.1b	21.3b	94.2a	89.5a
1Control	11.7c	12.5c	97.3a	91.2a
LSD	3.4	2.6	5.9	6.1

Means with the same letter within column are not significantly different (P=0.05)

Table3. Effect of treatment on number fruits per plant and fruit yield per plant (g)

Treatments	Number of fruits per plant		Fruit yield per plant (g)	
	2008	2009	2008	2009
NPK at 1WAT	8.0a	9.7a	285.3ab	301.3ab
NPK at 2WAT	8.4a	10.0a	300.8a	321.6a
NPK at 3WAT	7.8ab	9.5a	266.5b	286.2b
NPK at 4WAT	6.5b	7.0b	205.2c	233.2c
Control	3.3c	4.2c	155.7d	172.0d
LSD	1.6	2.4	25.9	31.2

Means with the same letter within column are not significantly different (P=0.05)

Discussion

The results from these trials clearly show that the age of pepper plant at which NPK fertilizer was applied had significant influence on both the vegetative and reproductive growth of the plant. It is revealed here that pepper responded to early fertilizer application than late application. This was evident in the higher number of leaves, taller plants, higher stem girths as well as earlier days to flower in both the 1WAT and 2WAT. The higher vegetative growth observed at early age (1WAT and 2WAT) in this study could be attributed to early utilization of absorbed nutrients provided by early NPK fertilizer application. The increase in vegetative growth had been attributed to increase synthesis of carbohydrates as a result of fertilizer application (Malik *etal*, 2011).

In the present study, it is apparent that NPK fertilizer applied at older age of pepper plant (4weeks after planting) resulted to shorter and thinner plants than those applied at early ages of between 1 and 3 weeks after transplanting. Also, higher numbers of leaves were produced at early ages of 1 and 2 weeks after transplanting when NPK fertilizer was applied than when application was delayed till 3 or 4 weeks after transplanting. The reduction in these growth parameters at older age of NPK fertilizer application (3 or 4 WAT) might also have resulted into delay in flowering at these ages than those of early ages of application (1 or 2 WAT). NPK fertilizer application at 4 weeks after transplanting showed no significant difference from those in which no fertilizer was applied. This implies that the (4WAT) age at which NPK fertilizer had no effect again on earliness of pepper to flower. The first two weeks after transplanting might therefore be the critical age at which pepper will respond very well to efficient NPK fertilizer utilization. It had been reported that a deficiency of nitrogen in plants is marked by reduced growth and yellowing of leaves (Lynn and Aleksande, 2005). The delay in application of NPK fertilizer in the present study might therefore have resulted into poor growth parameters consequently observed.

Fruit number and fruit weight were highest in the 2WAT fertilizer application while the least was recorded in the control. 4WAT NPK fertilizer application resulted to lower pepper yield when compared with the earlier application of fertilizer. The result obtained here clearly emphasised fertilizer use as a key factor in soil fertility management and yield increase in crop production (Akinrinde, 2006). While the 2WAT NPK fertilizer application produced higher pepper yield than the 3 and 4 WAT applications, the 1WAT and 3 WAT applications were not significantly different in terms of pepper fruit yield. This yield result clearly indicates that optimum pepper yield could be achieved when NPK fertilizer is applied at two weeks after transplanting.

Conclusion

Since yield and growth performance of pepper under the 4WAT NPK fertilizer application was comparably lower than those of 1, 2 and 3WAT, it is concluded that early NPK fertilizer application will be of great advantage in increasing the growth and yield of pepper. More importantly it is conclusive here that NPK fertilizer application should be delayed till 2 weeks

after transplanting but should not be delayed for more than 3 weeks after transplanting in pepper production if optimum yield is to be achieved.

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