

EFFECT OF NPK FERTILIZERS ON GROWTH, YIELD AND YIELD ATTRIBUTES OF OKRA (*ABELMOSCHUS ESCULENTUS* (L.) MOENCH.)

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Abstract

Five different doses of NPK fertilizers, viz. T₀ (ONOP0K), T₁ (1N1P1K), T₂ (0N1P1K), T₃ (1N0P1K) and T₄ (1N1P0K) were applied and the growth, yield and yield attributes of okra were studied. The length of main stem, number of nodes and leaves were maximum at T₁. The fresh weight, length, circumference, diameter per fruit and yield per plant were the highest at T₁. The carotenoid content of leaves and vitamin C contents of fruits were maximum at T₁. The total NPK concentration of both plants and fruits were the highest at T₃.

Introduction

Okra is a popular vegetable crop grown from seed. It is mainly cultivated in *Kharif* season in Bangladesh. Okra is a poor yielder of about 3.0 t/ha (BBS 2000), which is very low compared to other neighboring country like India (6.12 t/ha) and other developing countries (7.12 t/ha) of the world (Yamaguchi 1998).

The low yield of okra in Bangladesh may be due to improper use of fertilizers and poor management practices. Some workers used NPK fertilizers for the increase of growth, yield and yield attributes of okra. Significant increase in the growth and yield of okra was observed after the application of N and or NPK (Katung *et al.* 1996). Firoz (2009) reported that the highest yield (16.73 t/ha) was obtained after the application of 100 kg N/ha which was statistically identical to 120 kg N/ha. He also obtained the highest yield (15.77 t/ha) from 120 kg P₂O₅/ha. Philip *et al.* (2010) reported that spacing of 90 × 30 cm and application of NPK fertilizers 150 kg/ha (22.5 kg N, 22.5 kg P₂O₅ and 22.5 kg K₂O₅) gave the highest yield of okra.

Reports on the effect of NPK fertilizers on the growth, yield and yield components of okra are rare in Bangladesh. Hence, in the present investigation the effect of different doses of NPK fertilizers on growth, yield and yield attributes of okra was studied.

Materials and Methods

Seeds of okra (*Abelmoschus esculentus* (L.) Moench.) var. ARKA ANAMIKA were collected from local nursery and sown in the experimental field. The field was ploughed, cross ploughed and leveled properly and divided into 15 plots, each measuring 2 × 1 m with 50 cm space between two plots. Each plot contained three rows and every row contained four hills. The spacing between row to row and hill to hill was 60 cm and 45 cm, respectively. The field design was maintained tri-replicated Randomized Complete Block Design (RCBD).

Different doses of fertilizers applied per plot are as follows: T₀ (ONOP0K) - two kg cow-dung were applied during land preparation. T₁ (1N1P1K) - (a) 2 kg cow-dung, 65 g urea, 150 g TSP and 105 g MP were applied during land preparation, (b) 65 g urea were applied after 25 days of sowing. T₂ (0N1P1K) - 2 kg cow-dung, 150 g TSP and 105 g MP were applied during land preparation, T₃ (1N0P1K) - (a) 2 kg cow-dung, 65 g urea and 105 g MP were applied during land

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preparation, (b) 65 g urea were applied after 25 days of sowing. T₄ (1N1P0K) - (a) 2 kg cow-dung, 65 g urea and 150 g TSP were applied during land preparation, (b) 65 g urea were applied after 25 days of sowing.

Two seeds were sown per hill. After germination one uniform seedling was kept in each hill and rests were thinned out. Total number of seedlings per plot was 12. Watering, weeding, mulching and other cultural practices were done as and when required. The length of main stem, number of nodes and leaves and number of branches were recorded at the opening of first flower and continued at 15 days interval till final harvest. The final data (addition of all counts) were used in the tables. The fruits of okra of all the treatments were harvested at marketable stage. Before harvesting the number of fruits per plant was recorded. The number of fruits per plant, fresh weight, length, circumference and diameter of fruits of each treatment were recorded just immediately after harvest. The yield per plant was calculated by multiplying the number of fruits per plant and fresh weight per fruit.

The plants were finally harvested after five months of sowing. After harvesting the fresh weight of whole plant (stem and leaf) was weighed. Then the plants were chopped and dried in an oven at 65°C till a constant dry weight was obtained. For chemical analysis 100 g of fresh plant (stem and leaf) and fruit samples were dried in an oven at 65°C. Then ground in an electric grinder and made into powder (60 meshed sieves) and stored in air-tight containers. Dried powder of plant and fruit samples was digested following modified micro-Kjeldahl method. N, P and K were determined as described by Jackson (1973). Chlorophyll *a*, *b* and carotenoid contents of fresh leaves of okra at the onset of flowering were determined spectrophotometrically and calculated following Wettstein (1957). Vitamin C of fresh fruit sample was determined following Pleshkov (1976).

Results and Discussion

The length, number of branches and length of branches increased significantly in almost all the treatments from T₀ and the highest values were in T₁, T₄ and T₁, respectively (Table 1). The number of nodes and leaves of main vine and branches and total number of nodes and leaves per plant also increased significantly in all the treatments from T₀ and maximum values were in T₁, T₃ and T₁, respectively (Table 1).

Table 1. Effect of different doses of NPK fertilizers on length per plant, number of branches per plant, length per branch, and number of nodes and leaves per plant of okra.

Treatments	Height/ plant (cm)	Number of branches/plant	Length/ branch (cm)	Number of nodes and leaves/plant		
				Main stem	Branch	Total
T ₀	22.83a	1.00a	13.67a	7.67a	5.67a	13.34a
T ₁	63.11e	2.33bc	32.33d	18.00d	11.00b	29.00c
T ₂	40.00b	2.00b	15.00b	10.67b	12.33c	23.00b
T ₃	47.00d	2.67cd	16.25b	10.33b	13.00c	23.33b
T ₄	45.03c	3.00d	23.00c	12.33c	10.00b	22.33b

Mean in a column followed by same letter do not differ significantly at 5% level.

The number of fruits per plant increased highly significantly in all the treatments from T₀ and the highest number of fruits per plant was found in T₂. The fresh weight, length, circumference, diameter of fruit and yield per plant also increased significantly in all the treatments from T₀ and maximum values were obtained in T₁ for all the cases (Table 2). The yield per plant increased with the increase of fresh weight per fruit and a significant positive correlation ($r = 0.91$) was found

between fresh weight per fruit and yield per plant. The increase of yield of okra of the present investigation due to N application was found consistent with the finding of Katung *et al.* (1996), Hooda *et al.* (1980), Mani and Ramanathan (1980), Majanbu *et al.* (1985) and Singh (1995). The increase of yield of okra due to P and NPK application of the investigation corroborates other studies (Sharma and Yadav 1976, Firoz 2009). The combined effect of NPK fertilizers for the increase of yield of okra in the present investigation was found consistent with the findings of Ahmed and Tullock-Reid (1986) and Philip *et al.* (2010).

Table 2. Effect of different doses of NPK fertilizers on number of fruits per plant, fresh weight per fruit, length, circumference, diameter per fruit and yield per plant of okra.

Treatments	Number of fruits/ plant	Fresh wt./ fruit (g)	Length/ fruit (cm)	Circumference/ fruit (cm)	Diameter/ fruit (cm)	Yield/ plant (g)
T ₀	1.80a	5.87a	7.15a	4.20a	1.30a	10.56a
T ₁	6.00d	15.20e	15.20e	6.00e	1.90b	91.20d
T ₂	8.00e	11.59d	11.34d	5.10d	1.67ab	92.72d
T ₃	5.00c	10.10c	9.48c	4.80c	1.53ab	50.50c
T ₄	4.00b	9.89b	8.53b	4.50b	1.47a	39.56b

Mean in a column followed by same letter do not differ significantly at 5% level.

The chlorophyll *a* content of leaves was significantly higher in all the treatments from T₀ except T₂. The highest value was at T₄ followed by T₁, T₃, T₂ and T₀. The chlorophyll *b* contents of leaves increased significantly in all the treatments except T₃ and maximum value was in T₄ (Table 3). Carotenoid contents also increased significantly in all the treatments and the highest carotenoid content was in T₁. The total pigment content was obtained maximum in T₄ followed by T₁, T₃, T₂ and T₀ (Table 3).

Table 3. Effect of different doses of NPK fertilizers on chlorophyll *a*, *b*, carotenoids and total pigment contents of fresh leaves of okra at the onset of flowering.

Treatments	Chlorophyll <i>a</i> (mg/g)	Chlorophyll <i>b</i> (mg/g)	Carotenoid (mg/g)	Total pigment (mg/g)
T ₀	3.06a	1.20a	1.91b	6.17a
T ₁	4.21c	1.89c	2.28d	8.38c
T ₂	3.81b	1.35b	1.71a	6.87a
T ₃	4.15c	1.29b	1.87b	7.31b
T ₄	4.51d	1.90c	2.06c	8.47c

Mean in a column followed by same letter do not differ significantly at 5% level.

The NPK concentration of plants and fruits were found different in different treatments of the present investigation. The N concentration of both plants and fruits were found significantly higher in all the treatments from T₀ and the maximum value was obtained in T₃. The P concentration of plants also increased significantly in all the treatments and the highest P concentration was in T₁ but the P concentration of fruits was found maximum in T₃ and the lowest value was in T₄. The K concentration of plants was found significantly higher in all the treatments except in T₄. The K concentration of fruits though found higher in most of the treatments from control but the differences were not significant. The total NPK concentration of plants and fruits increased significantly from T₀ in all the treatments and highest values were in T₃ (Table 4).

The vitamin C contents of fruits were not found similar in the different treatments. The maximum vitamin C content was obtained in T₁ (26.4 mg/100g) followed by T₂, T₃, T₄ and T₀ (Table 4).

Table 4. Effect of different doses of NPK fertilizers on N, P, K concentrations of plants and fruits and vitamin C contents fruits of okra.

Treatments	N, P and K concentrations (g% of dry weight basis)								Vitamin C (mg/100g)
	N		P		K		Total		
	Plants	Fruits	Plants	Fruits	Plants	Fruits	Plants	Fruits	
T ₀	1.40a	2.00a	1.57a	1.88ab	0.64a	1.40	3.61a	5.28a	20.30a
T ₁	2.03c	2.87c	2.05e	1.93ab	1.16c	1.48	5.24c	6.28c	24.60d
T ₂	1.84b	3.22d	2.00d	2.08b	1.37d	1.40	5.21c	6.70d	23.80c
T ₃	3.08e	3.32e	1.93c	2.16b	1.13c	1.43	6.14d	6.91e	23.80c
T ₄	2.52d	2.66b	1.76b	1.72a	0.75b	1.43	5.03b	5.81b	22.00b

Mean followed by same letter(s) did not differ significantly at 5% level.

From the above discussion it may be concluded that the growth, yield and yield attributes of okra were highest in T₁ where balanced dose of NPK fertilizers was applied. So, T₁ may be recommended for the growers for better yield of okra.

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