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Effect of different doses of NPK fertilizers on growth of okra (*Abelmoschus esculentus* (L) Moench)

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Abstract

The study was conducted at Vegetable Seed Production Farm Quetta to investigate the effect of different doses of NPK fertilizers on growth of okra. The experiment was Randomized Complete Block Design. There were five treatments and four replications. Total experimental units were 20 (including control in which there was no fertilizer application). Data regarding height of plant revealed that M_5 had significant superiority over other means. M_5 was at the top position and M_1 was at the bottom because there was no application of fertilizers. Analysis of variance regarding number of flowers per plant indicated highly significant results for fertilizer treatments for this factor of study. It was also noted from that with increase of fertilizer applications, number of flower increased accordingly while results expressed the more the fertilizer better length of green pods. K is needed for good quality of yield.

Keywords: NPK fertilizers, effect, growth, okra, Quetta.

Introduction

Okra (*Abelmoscus esculentus* (L) Moench) is one of the most important summer vegetable crops. It belongs to the family Malvaceae and is semi-cross pollinated in nature. It is quite palatable and liked equally good by the poor and rich in the world. It brings remunerative income to the growers in the Punjab and Sindh provinces of Pakistan. The total area in growing season 2008-09 under Okra cultivation in Pakistan was 15.081 thousand ha with total production of 114.657 thousand tons (MINFA, 2009 and Sajid *et al*., 2012) while in Balochistan, cultivated area is 2737 hectares and production 6822 tons in 2007-08 (Government of Balochistan, 2008).

Okra as vegetables are important protective foods for the maintenance of health and prevention of disease. It contains valuable food ingredients, which can be successfully utilized to build up and repair the body (Bakhru, 2003 and Edet & Etim, 2007). The nutritional constituents of okra include calcium, protein, oil and carbohydrates; others are iron, magnesium and phosphorus. Most okra is eaten in cooked or processed form. Young fruits may be eaten raw. The oil in the seed could be as high as in poultry eggs and soybean (Akinfasoye & Nwanguma, 2005 and Omotoso & Shittu, 2007). Okra is recommended for consumption by World Health Organization due to

its ability to fight diseases. Okra has been found to be a rich source of vitamins A and C, calcium, thiamine and riboflavin. It is also rich in iron and is used as a medicine in the treatment of the peptic ulcer (Uka *et al*., 2013).

Chemical fertilizers are inorganic fertilizers which are most important to increase growth and yield of Okra. They are formulated in appropriate concentrations and combinations which supply three main nutrients: nitrogen, phosphorus and potassium (N.P.K) for various crops and growing conditions. Nitrogen (N) promotes leaf growth and forms proteins and chlorophyll. Phosphorus (P) contributes to root, flower and fruit development. Potassium (K) contributes to stem and root growth and the synthesis of proteins ((Jayaweera & Mikkelsen, 1991 and Ginindza *et al*., 2015). Keeping these in view, an experiment was conducted at the vegetable seed production farm Quetta, to see the effect of varying levels of Nitrogen, Phosphorus and Potassium on growth of okra.

Materials and Methods

This research study was carried out at the Vegetable Seed Production Farm Quetta and Materials for this study were consisted of Okra cultivar's cv. "Pusa Green" and the fertilizers used for the crop were Nitrogenous, Phosphorus and Potassium. These were combined in different proportions. The experiment was Randomized Complete Block Design. There were five treatments and four replications. Total experimental units were 20 (including control in which there was no fertilizer application). Detailed accounts of the various combinations are as follows:

Table 1: Lay out plan design, treatments:

R1	**T0** **Control**	**T3** 100kg N/hac 100kg P/hac	**T1** 60kg N/hac 60kg P/hac	**T2** 100kg N/hac 80kg P/hac 60kg K/hac	**T4** 140kg N/hac 100kg P/hac 60kg K/hac
R2	**T4** 140kg N/hac 100kg P/hac 60kg K/hac	**T2** 100kg N/hac 80kg P/hac 60kg K/hac	**T1** 60kg N/hac 60kg P/hac	**T0** **Control**	**T3** 100kg N/hac 100kg P/hac
R3	**T2** 100kg N/hac 80kg P/hac 60kg K/hac	**T1** 60kg N/hac 60kg P/hac	**T4** 140kg N/hac 100kg P/hac 60kg K/hac	**T3** 100kg N/hac 100kg P/hac	**T0** **Control**
R4	**T4** 140kg N/hac 100kg P/hac 60kg K/hac	**T3** 100kg N/hac 100kg P/hac	**T1** 60kg N/hac 60kg P/hac	**T0** **Control**	**T2** 100kg N/hac 80kg P/hac 60kg K/hac

Half of Nitrogen, full doses of Phosphorus and potassium were applied at the time of bed preparation. The remaining half nitrogen was applied 30 days after sowing of Okra crop.

Data recorded

Germination percentage

The germinated plants were counted and recorded after one week of sowing and second count was recorded after two weeks of sowing._Mean values of these two counts were calculated. Data were analyzed by Randomized Complete Block Design (RCBD) and Duncan's Multiple Range Test (DMRT).

Height of plant (cm)

The plant height was measured with the help of measuring tape. First measurement was recorded at the time of first flowering and second after four weeks and third after two months of the first flowering. Mean values of these three readings were taken and calculated.

Number of flowers per plant

The Data were taken from marked plants. First observation was taken at first flowering stage and later on after every six days, numbers of flowers were counted. In this way seven times data situation with each other. Mean values were calculated and analyzed.

Length of green pod (cm)

The Data were recorded by measuring length of all green Pods individually per plant with the help of measuring tape. This procedure was done with those marked ten plants for different treatments. Mean values of these observations were calculated.

Statistical analysis

Data for experimental study were subjected to statistical analysis and given in table termed as analysis of variance (Steel & Torrie, 1980), which would indicate significance level on the treatment differences. Mean values for the treatments indicating significant differences were compared for achieving appropriate result.

Results and Discussion

Germination percentage

Data collected on this Parameter of study is presented in **Table 2.** Mean value for the various treatments are given for comparative studies.

Table 2: Mean for Germination Percentage

Original Order	Ranked Order
Mean 1= 75.88 E	Mean 5= 79.55 A
Mean 2= 77.63 D	Mean 3= 78.60 B
Mean 3= 78.60 B	Mean 4= 78.44 C
Mean 4= 78.44 C	Mean 2= 77.63 D
Mean 5= 79.55 A	Mean 1= 75.88 E

Analysis of variance depicted significant results for various treatments of fertilizers. These results offered precarious situation. It seemed that even the application of fertilizer failed to produce any difference for treatments. Okra plants have been observed positively responsive to the application of fertilizers. This is particularly true for the application of N. It may be pointed out that rest half of N was applied after one month of sowing of plants. It could be conceived that perhaps the plants would express responses to the application of the fertilizer in their initial development. This called initial advantage of development of plant in technical term. Results of Zanin & Kimoto (1980) and Rastogi *et al.* (1987) favoured these results that there was no effect of fertilizer on germination percentage of Okra.

Height of plant (cm)

Date regarding the factor of study revealed highly significant results for fertilizer treatments. Mean values indicted that M_5 and M_3 stood at per and likewise M_4 and M_2 behaved significantly alike. M_5 had significant superiority over other means. M_5 was at the top position and M_1 was at the bottom. These means followed a sequence of M_5, M_3, M_4, M_2 and M_1. This situation indicated that by increasing fertilizer especially N, height of plant was increased. M_1 stood at bottom because there was no application of fertilizers.

Table 3: Mean for height of plant (cm)

Original Order	Ranked Order
Mean 1= 80.5 E	Mean 5= 94.75 A
Mean 2= 80.90 D	Mean 3= 91.25 B
Mean 3= 91.25 B	Mean 4= 86.55 C
Mean 4= 86.55 C	Mean 2= 80.90 D
Mean 5= 94.75 A	Mean 1= 80.5 E

Number of flowers

Results suggested significant superiority of M_5 over all other means. M_5 and M_3 had significant difference whereas M_3 was superior to M_2 on difference below.

M_5 secured the highest and M_1 got the lowest positions. The means followed as sequence of M_5, M_3, M_4, M_2 and M_1 in a descending order respectively. Analysis of variance indicated highly significant results for fertilizer treatments for this factor of study.

Table 4: Mean for number of flowers/plant

Original Order	Ranked Order
Mean 1= 13.75 E	Mean 5= 16.25 A
Mean 2= 14.00 D	Mean 3= 15.5 B
Mean 3= 15.5 B	Mean 4= 15.00 C
Mean 4= 15.00 C	Mean 2= 14.00 D
Mean 5= 16.25 A	Mean 1= 13.75 E

It was noted from results that with increase of fertilizer applications, number of flower increased accordingly, number of flowers depicted in the presence of NPK fertilizers. Present research studies have indicated good situations to the effect that result turn out highly significant. It has been observed that Okra plants continue flowering and vegetation growth simultaneously. Similar results were also observed by Randhawa & Punnum (1970) for the factor.

Length of green pod (cm)

In the results, it was appeared that M_5 occupied the highest position significantly. Difference between M_3 over M_4 and M_2 over M_1 were non-significant. M_1 occupied the lowest position. These followed the sequence of M_5, M_3, M_4, M_2, and M_1 descending order respectively.

Table 5: Mean for number of flowers/plant

Original Order	Ranked Order
Mean 1= 9.25 E	Mean 5= 10.85 A
Mean 2= 9.45 D	Mean 3= 9.80 B
Mean 3= 9.80 B	Mean 4= 9.55 C
Mean 4= 9.55 C	Mean 2= 9.45 D
Mean 5= 10.85 A	Mean 1= 9.25 E

Analysis of variance indicated highly significant results for fertilizers treatment for this factor of study. It expressed the more the fertilizer better length of green pods. K is needed for good quality of yield.

Conclusion

From the results of the study it is concluded that data regarding germination percentage precarious situation while height of plant gave highly significant results for various treatments of fertilizers. It indicated that with the increase of fertilizer application especially N, height of plant increased. The data further shows that number of flowers depicted significant results for fertilizers. Number of flowers increased in the presence of NPK fertilizers at increasing rate. Data regarding length of green pod expressed highly significant results for fertilizers while higher doses of fertilizers produced better yield.

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Appendices

Table 2a: Analysis of variance for germination percentage

S.O.V	D.F	S.S	M.S	F. CAL	PROB.
Rep	3	7.0466	2.3488	2.85	0.9982
Fertilizer	4	30.7517	7.6879	9.36	0.0011
Error	12	9.8591	0.8215		
Total	19	47.6574			

* = Significant

Table 3a: Analysis of variance for height of plant

S.O.V	D.F	S.S	M.S	F. CAL	PROB.
Rep	3	15.052	5.052	3.25	0.5273
Fertilizer	4	653.56	163.39	105.16	0.0000
Error	12	18.644	1.554		
Total	19	687.256			

** = Highly Significant

Table 4a: Analysis of variance for number of flowers/plant

S.O.V	D.F	S.S	M.S	F. CAL	PROB.
Rep	3	6.55	2.1833	3.63	0.4901
Fertilizer	4	15.20000	3.8	6.33	0.0056
Error	12	7.20000	0.600		
Total	19	28.9500			

* = Significant

Table 5a: Analysis of variance for length of green pod (cm)

S.O.V	D.F	S.S	M.S	F. CAL	PROB.
Rep	3	0.13200	0.044	1	0.0050
Fertilizer	4	6.35200	1.588	36.09	0.0000
Error	12	0.52800	0.0440		
Total	19	7.01200			

** = Highly Significant

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