PERFORMANCE OF OKRA VARIETIES IN RELATION TO FERTILIZER APPLICATION

THESIS

Submitted to the

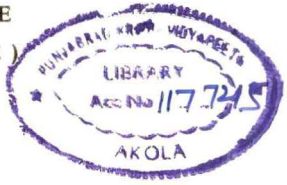
Punjabrao Krishi Vidyapeeth, Akola
in partial fulfilment of the requirements
for the Degree of

MASTER OF SCIENCE

IN

AGRICULTURE

(HORTICULTURE)



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1990

DECLARATION OF STUDENT

I hereby declare that the experimental work and its interpretation of the thesis entitled "PERFORMANCE OF OKRA VARIETIES IN RELATION TO FERTILIZER APPLICATION" or part thereof has not been submitted for any other degree or diploma of any University, nor the data have been derived from any thesis/publication of any University or scientific organisation. The sources of materials used and all assistance received during the course of investigation have been duly acknowledged.

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CERTIFICATE

This is to certify that the thesis entitled "PERFORMANCE OF OKRA VARIETIES IN RELATION TO FERTILIZER APPLICATION" submitted in partial fulfilment of the requirements for the degree of Master of Science in Agriculture of the Punjabrao Krishi Vidyapeeth, Akola, is a record of bonafide research work carried out by Shri Girish Prabhakarrao Choudhary under my guidance and supervision. The subject of the thesis has been approved by the student's advisory Committee.

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THESIS APPROVED BY THE STUDENT'S ALVISORY COMMITTEE INCLUDING EXTERNAL EXAMINER (AFTER VIVA VOCE).

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ACKNOWLEDGEMENT

I feel immense pleasure to express heartful sense of gratitude to my honourable chairman Dr.K.G. Mahakal, M.Sc. (Agri.), Ph.D., Asstt. Professor of Horticulture, College of Agriculture, Punjabrao Krishi Vidyapeeth, Akola for his valuable, talented and inspiring guidance, constructive criticism, constant encouragement throughout the course of investigation and for the pains he has taken in finalizing the manuscript of this dissertation.

I am extremely grateful to the members of the Advisory Committee, Dr.D.V. Diware, M.Sc. (Agri.),Ph.D., Asstt. Prof. in Horticulture, Shri S.G. Thote, Asstt. Prof. in Statistics and Shri V.N. Ingle, Associate Professor in Agronomy, P.K.V., Akola for their valuable advice during the course of this investigation.

With a deep sense of gratitude, I extend my sincere thanks to Dr.P.P. Deshmukh, M.Sc. (Agri), Ph.D., Head, University Department of Horticulture, P.K.V., Akola for providing me with the facilities for the research work.

I wish to record my thanks to Dr.P.D. Wangikar, Associate Dean, Post Graduate Institute, Punjabrao Krishi Vidyapeeth, Akola for providing me all the necessary facilities for carrying out research.

I also express my sincere thanks to Dr.S.U. Gondane, M.Sc. (Agri.), Ph.D., Head, Department of Horticulture, College of Agriculture, P.K.V., Akola for his valuable and kind co-operation.

I express my sincere thanks to the staff members of Department of Horticulture and Statistics, P.K.V., Akola.

I wish to acknowledge my special thanks to my colleagues and friends Shri S.K. Anade, M.Sc. (Agri.), K.M. Kende, K.G. Thakur, D.K. Nirwan who have helped me during the course of investigation.

Last but not least, I wish to record my deep feelings of love, affection and gratitude to my parents, uncle Shri A.A. Choudhary, Prof. of Agril. Engineering, P.K.V., Akola, brother Shri P.R. Choudhary, Asstt. Professor, College of Agriculture, Akola, uncle Shri C.V. Jawarkar, whose blessings and constant encouragement could lead me to accomplish my studies.

Choudhary

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Date: 30-6-90

(G.P. Choudhary)

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LIST OF ABBREVIATIONS

cm	: Centimetre
C.D.	: Critical difference
^{o}C	: Degree centigrade
et al.	: et alia (and others)
Fig.	: Figure
g	: Grams
ha	: Hectare
Kg	: Kilograms
viz.	: Namely
N	: Nitrogen
N.S.	: Non-significant
P	: Phosphorus
%	: Per cent
/	: Per
K	: Potash
q	: Quintal
Sig.	: Significant

CHAPTER I

INTRODUCTION

Vegetables play an important role in human nutrition. During recent years, the interest in vegetable production has increased rapidly as a result of greater appreciation of the food values and the place of vegetables in the nation's food requirement.

Okra (Abelmoschus esculentus L. Moench) is rich in Vitamins, Calcium, Potassium and other mineral matter. The composition of bhendi fruit (Per 100 g of edible portion) is, Moisture 89.6 g, Carbohydrate 6.4 g, Protein 1.9 g, Fat 0.2 g, Fibre 1.2 g, Mineral 0.7 g, Calcium 66 mg, Magnesium 43 mg, Oxalic acid 8 mg, Phosphorus 56 mg, Iron 1.5 mg, Sodium 6.9 mg, Potassium 10.3 mg, Copper 0.19 mg, Sulphur 30 mg, Vit. A-88 I.U. Thiamine 0.07 mg, Riboflovin 0.10 mg, Nicotinic acid 0.60 mg and Vit.C 13 mg (Aykroyd, 1963).

The cultivated okra belongs to the Abyssinian centre of origin. Okra is an annual vegetable crop grown in the tropics and subtropics of the world. It is grown throughout the country particularly during early spring and autumn in the South and Central India. While in Northern Plains, spring Summer and the Kharif are the main growing seasons.

The vitamin and mineral rich okra is prized vegetable cultivated for its immature fruits in the Indian Subcontinent.

The roots and stems are used as clarifier in the manufacture of jaggery. It has also some industrial importance i.e. extraction of fibre and in paper industry.

In Indian teritory, it is grown in all parts of the States. In Maharashtra, the area under okra cultivation was 3,900 hectares in 1969-70. It is further increased to 4,300 hectares in 1978-79. The area again increased from 4300 ha to 4600 ha in 1979-80 by 7 per cent over the year 1978-79 (Annual Season and Crop Report, 1979-80). Vidarbha region stands second in acerage (1400 ha) in Maharashtra State (Season and Crop Report of Maharashtra State, 1974).

The demand of vegetables like okra has a great potentiality of export both in fresh and processed from mainly to Gulf markets. Among the vegetables exported, the principal one is okra (Chadha, 1989). Therefore, there is good scope for increasing area under cultivation and also for boosting the quality production of okra to earn maximum profit in the export.

Performance of variety Selection 2-2 was studied and it was recommended for cultivation in Vidarbha region. Recently some new varieties of okra have been developed which are resistant to yellow vein mosaic virus. Performance of these varieties was studied under local

conditions and the variety Parbhani Kranti was found to be promising (Dhakare, 1989 and Somkuwar, 1989). Therefore, this variety was included in the present investigation.

Judicious manuring is one of the most important concepts, which helps to bring up a radical change in the present pattern of agricultural production. Under most conditions use of fertilizers affords the quickest method of achieving the objective of high yield. The object of fertilization is to improve the nutritional status of soil, specially nutritional environment of the plant, so that it can take to its need to produce a maximum possible yields.

Nitrogen encourages the vegetative development of the plants. It also controls to some extent, the efficient utilization of phosphorus and potassium which helps to increase the production. Phosphorus influences the vigour of the plants and improves quality of crops. It promotes growth and maturation of the crop. It also increases resistance to diseases. Potassium enhances the ability of the plants to resist diseases, insect attacks and cold and other adverse conditions. It plays an essential part in the formation of starch and in the production and translocation of sugars.

Taking into consideration the above, the present investigation was undertaken on "Performance of okra varieties in relation to fertilizer application" in kharif season 1989 with following objectives.

1. To find the suitable variety under local conditions.

2. To study the effect of nitrogen alone and in combination with phosphate and potash on growth and yield of okra.

* * * * *

CHAPTER II

REVIEW OF LITERATURE

The present investigation was undertaken to study "Performance of okra varieties in relation to fertilizer application". The findings of research work on the above aspects in respect of okra are reviewed in this chapter.

2.1 Effect of Nitrogen, Phosphorus and Potassium on Vegetative Growth

Vegetative growth and plant vigour determine the yield of okra. The growth of plants mostly depends on the nutritional supply of plant particularly, nitrogen, phosphorus and potash of which nitrogen is most important.

Chhonkar and Singh (1963) observed the growth of okra cultivar Harichikni-R with the application of nitrogen at 0, 21, 210, 630 or 1050 ppm, phosphorus at 0, 3, 93, 237 or 547 ppm and potash at 0, 8, 78, 704 or 1408 ppm. Plant height was significantly increased by nitrogen and phosphorus, but not by potash. Maximum plant growth was obtained with a combination of nitrogen 210 ppm, phosphorus 257 ppm and potash 78 ppm and the optimum ratio of nitrogen, phosphorus and potash in the plant tissue for the best growth was approximately 4.5 : 1 : 5.5.

Randhawa and Pannum (1969) observed that maximum height, maximum number of leaves and branches were produced with the application of 66 kg nitrogen/ha.

Verma et al. (1970) conducted experiment with Pusa Sawani variety of okra under Udaipur conditions with five levels of nitrogen (0, 30, 60, 90 and 120 kg/ha), three levels of phosphorus (0, 60 and 80 kg/ha) and two levels of potassium (0 and 40 kg/ha). Maximum number of leaves was 42 with the application of 90 kg nitrogen and phosphorus 80 kg/ha in combination as compared with those under control.

Chauhan and Gupta (1973) pointed out that, there was no beneficial effect of various levels of phosphorus and potash. It was found that height, number of leaves, girth of plant and yield of green pods were increased as the levels of nitrogen added to the soil were increased from 22.5 kg to 67 kg/ha.

Roy and Chhonkar (1976) conducted experiment in Bihar on okra. They observed significant positive correlation between the number of fruits, number of shoots and fruit yield.

Singh (1979) conducted experiment on Pusa Sawani variety of okra under Banarus condition and found that nitrogen, phosphorus and potash gave positive response in increasing growth parameters such as plant height and number of branches. Significant increase in height, number of branches, number

of fruits, fruit size and yield was not observed with the increase in the level of nitrogen from 75 to 150 kg/ha and potassium from 60 to 120 kg/ha.

Pawar (1980) reported that vegetative growth of okra in respect of height, number of leaves, number of branches and internodes was increased with the application of nitrogen 150 kg/ha. Similarly the plant height and number of branches/plant were increased with the increase in levels of nitrogen up to 120 kg/ha (Zenin and Kimota,1980).

Gupta et al. (1981) reported that the plant height and number of internodes per plant in okra increased with the application of nitrogen and phosphorus.

2.2 Effect of Nitrogen, Phosphorus and Potash on Fruit Number, Fruit size and Yield

Sutton (1963) studied the effect of combinations of nitrogen, phosphorus and potash on okra variety Pusa Sawani and reported that increasing the phosphorus rate from 30 to 90 lb/acre with 23 lb/acre of nitrogen significantly increased the yields of first 5 harvests. The yields of second 5 harvests were increased significantly by increasing the nitrogen level from 23 to 70 lb/acre, with 30 lb/acre of phosphorus. Increasing the levels of potash had no beneficial effect on okra yields.

The trial conducted by Singh and Singh (1965) under Kanpur condition to study the effect of different sources of nitrogen on okra cultivar Pusa Sawani showed that Urea 60 lb/acre produced better plants with highest yield/acre as compared to calcium ammonium nitrate, ammonium sulphate and ammonium chloride.

Sutton (1966) reported that the effect of nitrogen was most significant in increasing the yield. The nitrogen, phosphorus and potash in 1:1.3:1.3 ratio resulted in highest yield of marketable okra fruits.

Ahmad and Tulloch (1968) observed in their study the response of okra to various levels of nitrogen ($0 \overset{\text{to}}{\wedge} 336$ kg/ha), phosphorus ($0 \overset{\text{to}}{\wedge} 280$ kg/ha) and potassium ($0 \overset{\text{to}}{\wedge} 280$ kg/ha). They obtained highest yield with the application of nitrogen 112 kg, phosphorus 168 kg and potassium 280 kg/ha.

Windham (1969) pointed out that application of nitrogen 20 lb, phosphorus 40 lb and potash 40 lb/acre increased the yield of okra by 0.4 ton/acre.

Saimbhi and Padda (1970) reported that in a fertilizer trial with Pusa Sawani variety application of nitrogen 134 kg/ha increased yield of okra. However, higher levels of nitrogen were not beneficial. There were no significant responses to phosphorus application.

The experiment conducted with Pusa Sawani variety of okra under Udaipur conditions during Kharif season showed that the fruit length was increased with increasing levels of nitrogen from 0 to 120 kg/ha, the maximum being 17.60 cm at 120 kg nitrogen as compared with 15.10 cm under control. The fruit diameter increased to a maximum of 2.31 cm with nitrogen 90 kg/ha. Total number of fruits/plant were maximum (11.50) with the application of nitrogen 90 kg/ha which was three times more then control. But nitrogen in combination with 80 kg phosphorus/ha increased the number of fruits to maximum of 13.42/plant. These investigations showed that the application of 90 kg nitrogen and 80 kg phosphorus/ha improved the qualitative and quantitative yield of okra (Verma et al. 1970).

Asif and Greig (1972) from Kansas State University reported that application of nitrogen 120 lb/acre gave maximum yield while phosphorus and potash had no favourable influence on yield. Increased application of nitrogen increased nitrate accumulation in the fruit. The application of phosphorus, potash at 43 and 83 lb/acre respectively increased only phosphorus and potash levels of the plants.

Chauhan and Gupta (1973) conducted experiment at Gwaliar to find out the optimum nutritional requirement of okra on sandy loam soil. They observed that height, number of leaves, girth of plant and yield of green pods were

increased as the level of nitrogen was increased from 22.5 kg to 67 kg/ha. There was no beneficial effect of various levels of phosphorus and potash. However, nitrogen and phosphorus, in combination, increased yield of okra.

Sharma and Shukla (1973) reported under Bangalore conditions that the highest yields of okra were obtained with the application of nitrogen 120 kg, phosphorus 34 to 88 kg and potassium 41.6 kg/ha.

Verma and Rathore (1974) pointed out that the highest yield was obtained with the applications of nitrogen 150 kg/ha in the form of urea applied as foliar and soil application in 3:1 proportion.

Leela et al. (1975) studied the effect of application of nitrogen from 75 to 150 kg/ha and phosphorus 80 or 120 kg/ha on Pusa Sawani variety of okra. The yield was maximum with nitrogen 120 kg/ha. However, the higher rate of phosphorus application had no beneficial effect.

Koay and Chua (1978) compared basal dressing of decomposed chicken manure at 13 ton/ha supplimented or not with a side dressing of nitrogen, phosphorus and potash 10:10:14 kg/ha or 20:20:28 kg/ha respectively. Total number of pods and yield were higher with chicken manure and they were not enhanced by side dressing.

Gupta and Rao (1979) reported about the trial conducted under Bangalore conditions. They observed significant increase in number of fruits/plant with the application of nitrogen up to 100 kg/ha. Further increase in nitrogen application did not increase the number of fruits/plant.

Hooda et al. (1980) observed increase in the number of pods/plant of Pusa Sawani variety with the increase in levels of nitrogen from 40 to 120 kg/ha. The yield obtained was 126.45 q/ha. The response to phosphorus was lower, with yields of 112, 116 and 118 q/ha under control, plot receiving phosphorus at 30 kg and 60 kg/ha respectively.

In a trial on okra with treatment combination of nitrogen 80 kg/ha with potash 30 or 60 kg/ha significant increase in yield (149.2%) was obtained over control (Mani and Ramnathan, 1980).

Singh and Pandita (1981) pointed out that maximum number of pods were produced with the application of nitrogen 120 kg/ha while there was no effect of phosphorus on number of pods produced.

Tomar and Chauhan (1982) obtained highest yield of 152.10 q/ha with the application of nitrogen 75 kg/ha in Pusa Sawani variety of okra.

Reddy and Veeraraghavaiah (1984) conducted a trial with Pusa Sawani variety. The plants received nitrogen at 40 to 120 or phosphorus 30 or 60 kg/ha. Nitrogen alone increased the yield from 58.90 q/ha under control to 97.50 q/ha with application of nitrogen 120 kg/ha whereas phosphorus alone increased the yields to 89.16 q/ha with the application of phosphorus 60 kg/ha. The highest yield (101.46 q/ha) was obtained with nitrogen and phosphorus at highest rates.

Adelana (1985) reported that significant increase in yield was observed with the application of 20 to 40 kg nitrogen 20 kg phosphorus and 20 to 30 kg potash/ha.

Majanbu et al. (1985) studied two okra cultivars i.e. White Velvet and NHAE-47-4 with application of nitrogen at 0, 25, 50 and 100 kg/ha, phosphorus at 0, 13 and 26 kg/ha and showed that nitrogen application significantly increased the green pod yield, diameter of fruits and number of fruits/plant. The two cultivars responded to nitrogen application in respect of green pod yield.

Application of phosphorus also significantly increased green pod yield and number of pods. The two cultivars responded to nitrogen application differentially in respect of green pod yield. For optimum green pod yield

of White Velvet variety application of nitrogen 35 kg/ha is suggested while for NHAE-47-4, nitrogen application can be increased to 70 kg/ha. There was no different response of cultivars to phosphorus fertilization on green pod yield. However, the application of phosphorus 13 kg/ha enhanced the yield of both cultivars.

Ram Singh and Jaglan (1985) reported that all fertilizer treatments (Nitrogen 100 to 500 kg/ha and potash (0-360 kg/ha) gave significantly higher yields as compared with the control but there were no appreciable differences between the treatments.

2.3 Performance of Varieties

The field trial conducted by Teli and Laiya (1981) on 29 cultivars and 7 F_1 hybrids showed that, AE-79, AE-52, Sel-1-1, AE-79 and AE-69 were resistant to fruit and shoot borer.

Kashyap et al. (1983) screened seventy two genotypes of okra against Earis spp. under field conditions and found that less than 10 per cent infestation in Narnaul Special 6(2), Perkins Long Green, Clemson Spineless, White Snow and Bel Round varieties, whereas more than 50 per cent infestation was observed in varieties IC-12933.

Madav and Dumbre (1985) in their experiment conducted on 14 varieties of okra indicated that AE-75, Pusa Sawani,

Long Green, Indo-American Hybrid and Koparwadi local were resistant to shoot and fruit borer.

Jamble and Nerkar (1986) reported that Parbhani Kranti, Abelmuschus esculentus derived from back cross of A.manihot to the okra Pusa Sawani carries resistance to yellow vein mosaic derived from A.manihot which has a complete resistance to yellow vein mosaic virus.

Thakur (1989) reported that Parbhani Kranti and Punjab-7 have given consistant higher yield at different centres.

Better performance of the variety Parbhani Kranti was observed as compared with Punjab-7 and Selection 2-2 varieties (Thakare, 1989 and Somkuwar, 1989).

The experimental evidences presented above indicate that growth and yield characters of okra were influenced by the nutrients. Responses to varying combinations of nutrients and their levels were observed in different experiments. The differences in soil type and potential for growth and yield characters of the varieties included in different studies may be the cause for such variation in the response to different nutrients.

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CHAPTER III

MATERIALS AND METHODS

The investigation entitled "Performance of okra varieties in relation to fertilizer application" was carried out in the Department of Horticulture, Punjabrao Krishi Vidyapeeth, Akola during kharif season 1989.

Climate and Weather Conditions

Akola is situated in subtropical zone at the latitude of 20°40' N and longitude of 77°02' E. The altitude of the place is 307.4 m from the mean sea level. During the period of investigation i.e. from July to October, 1989 the rainfall received was 583.9 mm. The maximum temperature ranged between 26.6°C to 37.1°C and minimum temperature between 13.6°C to 24.7°C while humidity ranged between 66 per cent to 92 per cent (morning) and 17 per cent to 87 per cent (evening).

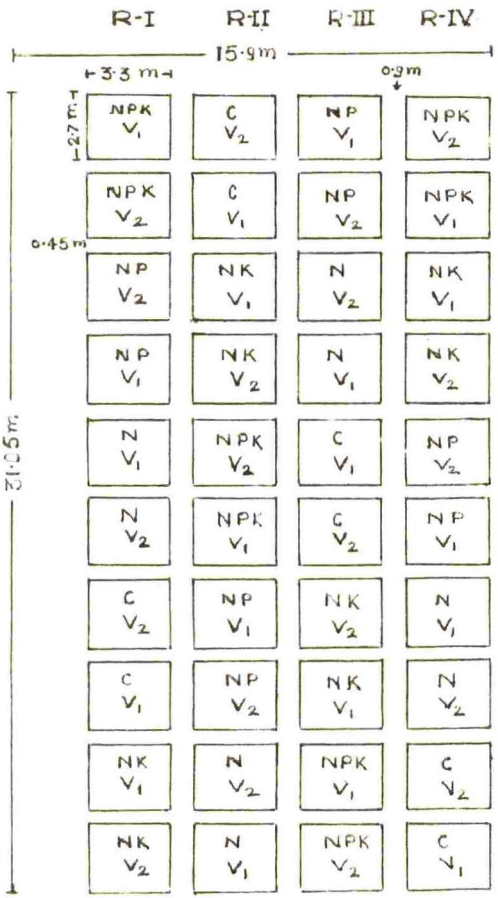
The meteorological data for the period of investigation in respect of rainfall, humidity, minimum and maximum temperature recorded at University Campus during 1989-90 is given (in Appendix 1).

The land used for the experiment was fairly uniform with gentle slope. The soil was medium black with uniform texture having good drainage. The plot was under brinjal crop during Kharif season of previous year.

Experimental Details

The details of the plan and layout were as under -

1.	Design of Experiment	: Split plot
2.	No. of replication	: 4
3.	No. of treatment combinations	: 10
4.	Total no. of plots	: 40
5.	Plot size	: 3.30 X 2.70 m
6.	Spacing	: 45 X 30 cm
7.	Total area under experiment	: 573.99 m^2
8.	Date of sowing	: 11th July, 1989.
9.	Main treatments	Abbreviations
	1. Nitrogen	N
	2. Nitrogen and phosphorus	NP
	3. Nitrogen and potassium	NK
	4. Nitrogen, phosphorus and potassium	NPK
	5. Control (Without N, P and K)	C
	N = 100 kg/ha	
	P = 50 kg/ha	
	K = 50 kg/ha	
10.	Sub treatments	
	Varieties	
	1. Parbhani Kranti	V_1
	2. Selection 2-2	V_2



SCALE:
1cm = 2 m

LEGEND

C - CONTROL

V_1 - PARBHANI KRANTI

V_2 SELECTION 2-2

FIG. 1. PLAN OF LAYOUT

The land selected for experiment was prepared by cross ploughing two months before sowing. Thereafter four harrowings were given in order to bring the land to fine tilth and make the soil loose. Fifty cartloads of farm yard manure per hectare was added and mixed thoroughly by harrowing the field.

The good quality seeds of okra varieties, Parbhani Kranti and Selection 2-2 were obtained from main garden, University Department of Horticulture, Punjabrao Krishi Vidyapeeth, Akola. These seeds were soaked in water for 24 hours before sowing for hastening the germination. The treated seeds were dibbled at the depth of 2-3 cm at 45 x 30 cm spacing. About 2-3 seeds were sown per hill.

The requirements of fertilizers per plot according to treatments were first calculated. The basal dose of P_2O_5 @ 50 kg/ha and K_2O @ 50 kg/ha was given in the form of single super phosphate and murrate of potash respectively. Nitrogen (100 kg/ha) was given in the form of urea in two equal doses. The basal dose was applied at the time of sowing alongwith phosphorus and potash and remaining half quantity of nitrogen was applied 30 days after sowing. Thinning was done 15 days after sowing by keeping single healthy seedling per hill. The necessary cultural operations were carried out as and when required.

Plant Protection Measures

In order to prevent the infestation of jassid and shoot borer, spraying of endosulphan was done upto flowering. Spraying of malathion was done after flowering. The proper sprays of the insecticides (malathion) at proper interval were given.

Observations

From each experimental plot of all replications, 5 plants were selected randomly. The following preharvest and the post-harvest observation were recorded.

Preharvest observations

1. Height of plant.
2. No. of leaves/plant
3. No. of branches/plant.
4. No. of internode/plant.
5. Length of internode.

Post-harvest observations

1. No. of fruits per plant.
2. Length and diameter of fruit.
3. Yield per plot.
4. Plants affected by shoot borer and yellow vein mosaic virus per plot.

Preharvest Observation

Height of plant

Five randomly selected plants were tagged with the label. The height of labelled plants was measured, in centimetre from ground level to the base of terminal leaf. First observation was taken 30 days after sowing. Subsequent observations were recorded at 15 days interval up to 90 days of sowing.

Number of leaves per plant

Total number of leaves per plant were counted on 5 selected plants and recorded at an interval of 15 days from 30 days after sowing.

Number of branches per plant

Number of branches per plant of 5 selected plants were counted at an interval of 15 days from 45 days after sowing.

Number of internodes per plant

Number of internodes formed/plant were recorded on 5 randomly selected plants from 30 days after sowing.

Length of internode

Length of 2nd internode from ground level was recorded at an interval of 15 days from 30 days after sowing.

Post Harvest Observation

Number of fruits per plant

The fruits harvested from five observation plants at each picking were counted and recorded. Average number of fruits per plant was calculated after last picking.

Length and diameter of fruit

Length and diameter of fruits was measured at 5 to 6 days from anthesis.

Yield per hectare

The fruits obtained from each plot were weighed seperately at each picking. Total yield/hectare was calculated from yield/plot.

Plants affected by yellow vein mosaic virus and shoot borer

Number of plants affected by yellow vein mosaic virus and shoot borer were counted from each plot at 75 days after sowing.

Statistical Analysis

The data collected was analysed by the Standard Statistical Method of "Analysis of Variance" (Panse and Sukhatme, 1967). Appropriate standard error to each factor was worked out. To compare treatments mean, the critical difference (C.D.) at 5 per cent level of significance was worked out wherever needed.

* * * * *

CHAPTER IV

EXPERIMENTAL FINDINGS

This chapter deals with the result of an experiment on okra carried out in Kharif season of 1989. The observations were recorded periodically on the growth characters like height of plant, number of leaves, number of branches, number of internodes per plant, length of internode. Yield contributing characters like average length and diameter of fruits, number of fruits per plant and yield per plot were also recorded.

PRE-HARVEST STUDIES

4.1 Effect of Nitrogen, Phosphorus, Potash and Varieties on Plant Height of Okra

The data in respect of height of plant as observed at different stages of growth are presented in Table 1.

4.1.1 Effect of nitrogen, phosphorus and potash

The height of okra plants was significantly increased with the application of nitrogen alone as compared to control at all stages of growth recorded at 15 days interval from 30 days after sowing.

At 30 days the height of the plants was significantly increased with the application of nitrogen alone as compared to control. However the height of okra plants was not significantly increased with the application of phosphorus and potash as compared to those under nitrogen.

Table 1: Mean plant height (cm) at 30, 45, 60, 75 and 90 days after sowing as influenced by Nitrogen, Phosphorus and Potash, and varieties

Treatments	Days after sowing				
	30	45	60	75	90
Nutrients					
C	9.79	20.10	45.26	59.60	63.60
N	12.11	24.66	69.00	86.62	95.31
NP	12.94	26.18	70.20	82.56	93.06
NK	13.27	32.58	61.42	97.22	107.68
NPK	12.01	31.53	72.11	97.97	105.01
'F' test	Sig.	Sig.	Sig.	Sig.	Sig.
S.Em.±	0.39	0.63	3.07	3.65	6.14
C.D. at 5% level	1.21	1.93	9.43	11.23	18.88
Varieties					
Parbhani Kranti	12.65	28.55	66.17	87.39	95.43
Selection 2-2	11.39	25.47	61.03	82.20	90.43
'F' test	Sig.	Sig.	Sig.	N.S.	Sig.
S.Em.±	0.19	0.40	1.39	1.87	1.58
C.D. at 5% level	0.56	1.19	4.06	-	4.74
Interaction					
'F' test	N.S.	N.S.	Sig.	Sig.	N.S.
S.Em.±	0.42	0.89	3.02	4.19	3.53
C.D. at 5% level	-	-	9.09	12.58	-

Table 1(a): Mean plant height (cm) at 60 days after sowing as influenced by Nitrogen, Phosphorus, Potash and Varieties

Variety	C	N	NP	NK	NPK	Mean
Parbhani Kranti	44.97	65.25	77.15	69.00	74.47	66.17
Selection 2-2	45.55	72.75	63.25	53.85	69.75	61.03
Mean	45.26	69.00	70.20	61.42	72.11	

	Nutrients	Varieties	Interaction
'F' test	Sig.	Sig.	Sig.
S.Em.±	3.06	1.39	3.02
C.D. at 5% level	9.42	4.06	9.09

Table 1(b) Mean plant height (cm) at 75 days after sowing as influenced by Nitrogen, Phosphorus, Potash and varieties

Variety	C	N	NP	NK	NPK	Mean
Parbhani Kranti	65.45	89.25	87.82	95.72	98.72	87.39
Selection 2-2	53.75	84.00	77.30	98.72	97.22	82.20
Mean	59.60	86.62	82.56	97.22	97.97	

	Nutrients	Varieties	Interaction
'F' test	Sig.	N.S.	Sig.
S.Em.±	3.65	1.87	4.18
C.D. at 5% level	11.23	-	12.58

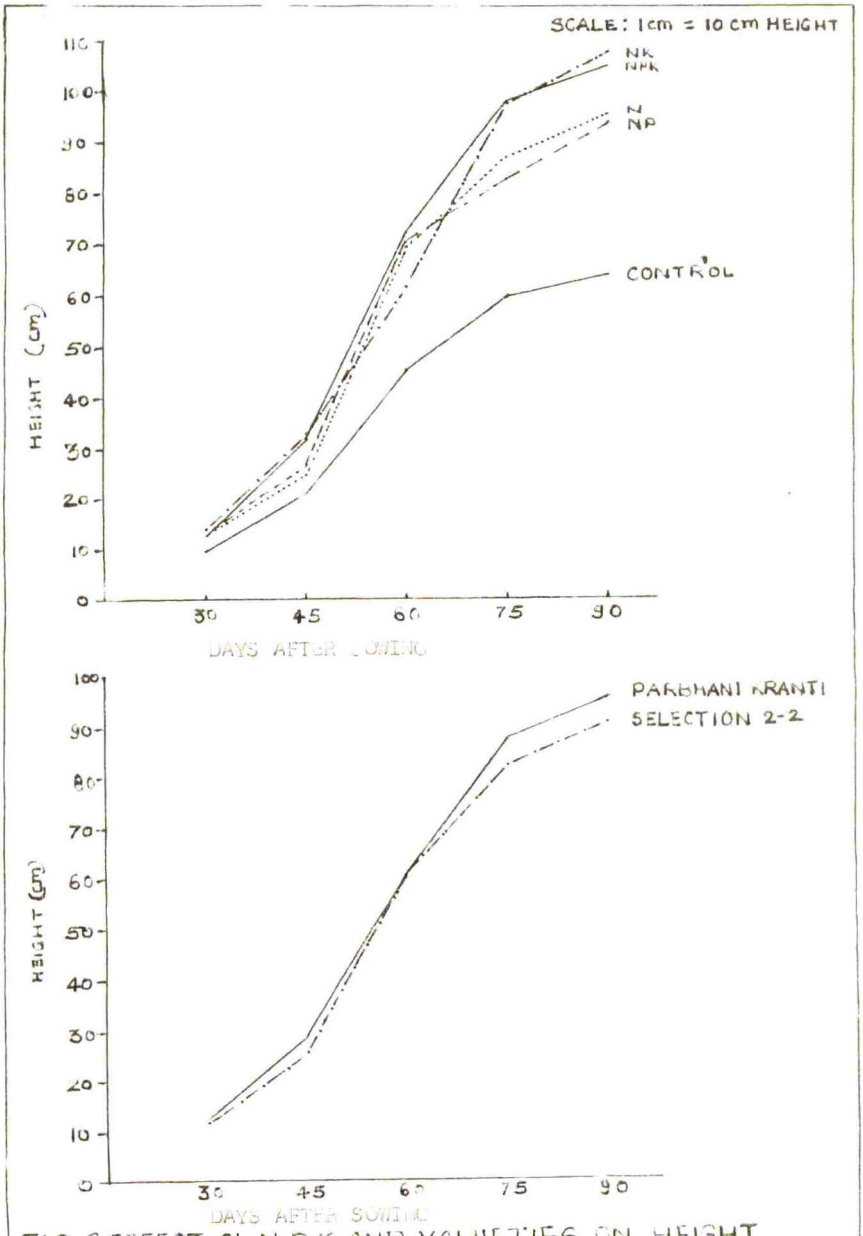


FIG. 2 EFFECT OF N, P, K AND VARIETIES ON HEIGHT

At 45 days after sowing the height of the plants was significantly increased with the application of nitrogen in combination with potash (32.58 cm) as compared with those under nitrogen alone (24.66 cm). Differences in the height of the plants under N and NP as well as NK and NPK were found to be non-significant.

From 60 to 90 days after sowing significant increase in height of the plants was not observed with the application of phosphorus and potash as compared with the application of nitrogen alone. However at 75 days after sowing the height of okra plant was significantly more with the application of NPK in combination as compared to nitrogen alone.

4.1.2 Effect of varieties

The height of the plants of okra variety Parbhani Kranti was found to be significantly more than those of Selection 2-2 variety at all stages of growth from 30 to 90 days after sowing except at 75 days when the difference in the height of the plants of two varieties were non-significant.

4.1.3 Interaction effect

The interaction effect due to different nutrients and varieties was found to be non-significant at 30 days, 45 days and 90 days after sowing but significant at 60 days and 75 days after sowing.

At 60 days after sowing the height of Parbhani Kranti variety was found to be maximum with the application of nitrogen and phosphorus in combination as compared to all other treatments. At 75 days after sowing significant increase in height of Selection 2-2 variety was observed with the application nitrogen and potash in combination than nitrogen alone whereas differences in height of the plants of Parbhani Kranti variety under N, NK and NPK were found to be non-significant.

4.2 Effect of Nitrogen, Phosphorus and Potash On Number of Leaves of Okra

The data regarding number of leaves per plant observed at different stage of crop growth are presented in Table 2 and Figure 3. It is observed that growth rate in terms of increase in number of leaves was maximum between 45 to 75 days after sowing.

4.2.1 Effect of nitrogen, phosphorus and potash

At all stages of crop growth from 30 to 75 days from sowing, significantly higher number of leaves were produced on the plants receiving nitrogen alone as compared to those under control. Whereas the differences in the number of leaves on the plants under the treatments N, NP, NK and NPK were found to be non-significant.

Table 2: Mean number of leaves at 30, 45, 60 and 75 days after sowing as influenced by Nitrogen, Phosphorus, Potash and Varieties

Treatments	Days after sowing			
	30	45	60	75
Nutrients				
C	6.25	7.27	10.97	20.40
N	7.02	8.40	16.02	24.30
NP	6.75	8.40	16.27	26.27
NK	6.78	8.55	15.45	23.17
NPK	6.70	8.47	15.85	26.45
'F' test	Sig.	Sig.	Sig.	Sig.
S.Em.±	0.12	0.23	0.84	1.24
C.D. at 5% level	0.36	0.72	2.59	3.82
Variety				
Parbhani Kranti	6.74	8.19	15.04	24.45
Selection 2-2	6.66	8.25	14.79	23.79
'F' test	N.S.	N.S.	N.S.	N.S.
S.Em.±	0.10	0.13	0.48	0.73
C.D. at 5% level	-	-	-	-
Interaction				
'F' test	N.S.	N.S.	N.S.	N.S.
S.Em.±	0.22	0.29	1.07	1.65
C.D. at 5% level	-	-	-	-

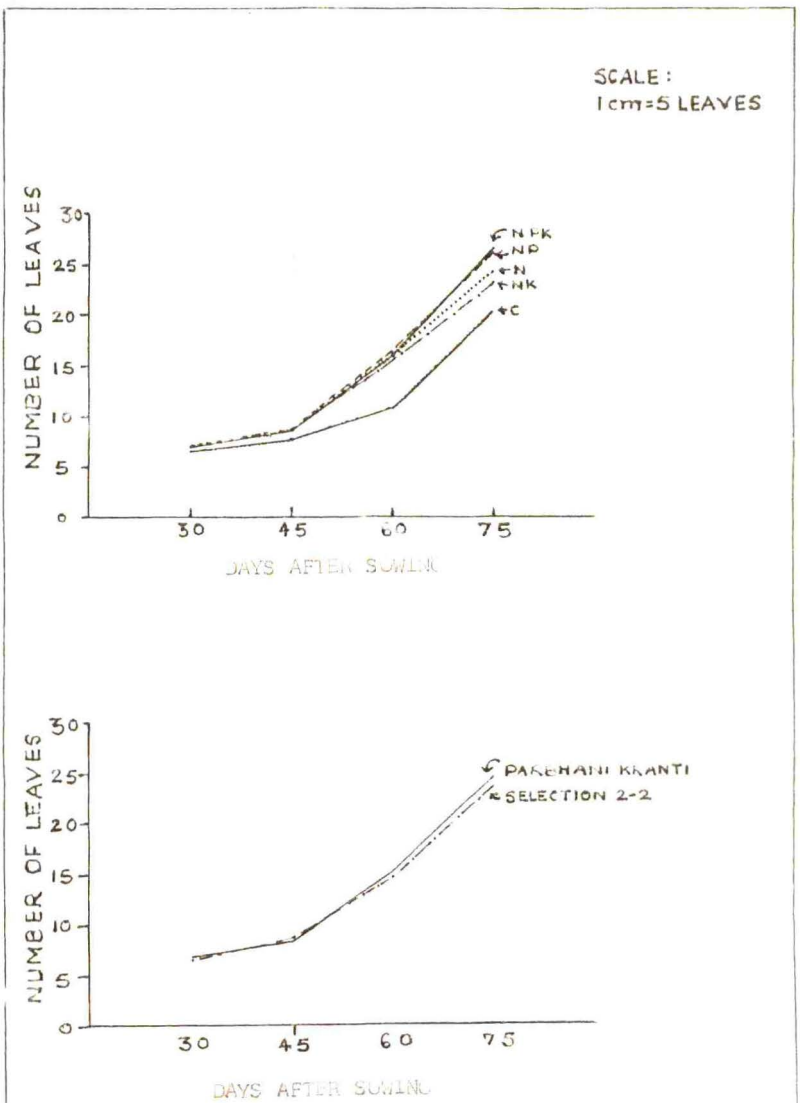


FIG. 3 EFFECT OF N, P, K AND VARIETIES ON NUMBER OF LEAVES

4.2.2 Effect of varieties

The differences in the number of leaves produced by the two varieties was found to be non-significant at all the stages of crop growth.

4.2.3 Interaction effect

The interaction effect due to various nutrient combinations and varieties were found to be non-significant at all stages of crop growth.

4.3 Effect of Nitrogen, Phosphorus and Potash on Number of Branches of Okra Plant

The data in respect of number of branches per plant were recorded at fortnightly interval from 45 days after sowing (Table 3).

4.3.1 Effect of nitrogen, phosphorus and potash

The effects of nutrient combinations were found to be non-significant at all stages of growth except at 60 days after sowing. At this stage, significantly higher number of branches were produced on the plants with the application of nitrogen alone as compare with control. However, the differences in the number of branches produced by the plants under N, NP and NPK as well as NK and NPK were found to be non-significant.

Table 3: Mean number of branches at 45, 60, 75 and 90 days after sowing as influenced by Nitrogen, Phosphorus, Potash and Varieties.

Treatments	Days after sowing			
	45	60	75	90
Nutrients				
C	0.02	0.72	2.42	3.17
N	0.07	1.82	2.55	2.87
NP	0.02	2.20	3.00	3.47
NK	0.02	1.25	2.17	2.77
NPK	0.15	1.65	2.84	3.02
'F' test	N.S.	Sig.	N.S.	N.S.
S.Em.±	0.05	0.21	0.21	0.25
C.D. at 5% level	-	0.64	-	-
Variety				
Parbhani Kranti	0.08	1.65	2.74	3.18
Selection 2-2	0.04	1.41	2.45	2.95
'F' test	N.S.	N.S.	N.S.	N.S.
S.Em.±	0.02	0.14	0.11	0.24
C.D. at 5% level	-	-	-	-
Interaction				
'F' test	N.S.	N.S.	N.S.	N.S.
S.Em.±	0.04	0.31	0.25	0.24
C.D. at 5% level	-	-	-	-

4.3.2 Effect of varieties

The difference in the number of branches produced on the plants of the two varieties included in the study was found to be non-significant at all stages of crop growth. At 90 days after sowing maximum number of branches (3.18) were recorded on Parbhani Kranti followed by Selection 2-2 (2.95).

4.3.3 Interaction effect

The interaction effects due to different nutrient combinations and varieties on number of branches were found to be non-significant at all stages of crop growth.

4.4 Effect of Nitrogen, Phosphorus, Potash and Varieties on Number of Internodes of Okra

The observations in respect of number of internodes per plant recorded at fortnightly interval are presented in Table 4. and in fig 4. It can be seen from the data that, growth rate in terms of number of internodes per plant was higher between the period from 45-75 days after sowing than in the primary or in subsequent period of growth.

4.4.1 Effect of nitrogen, phosphorus and potash

At all stages of growth significantly higher number of internodes were observed on the plants receiving nitrogen

Table 4: Mean number of internodes at 30, 45, 60, 75 and 90 days after sowing as influenced by Nitrogen, Phosphorus, Potash and Varieties

Treatments	Days after sowing				
	30	45	60	75	90
Nutrients					
C	3.57	4.12	10.90	14.32	16.17
N	4.75	4.75	12.97	18.25	19.85
NP	4.75	4.77	13.10	18.27	20.45
NK	4.67	4.72	13.82	19.04	21.47
NPK	4.97	5.00	13.75	19.00	21.22
'F' test	Sig.	Sig.	Sig.	Sig.	Sig.
S.Em.±	0.23	1.08	0.60	0.51	0.69
C.D. at 5% level	0.72	3.13	1.56	1.56	2.13
Variety					
Parbhani Kranti	4.62	4.68	13.05	18.22	20.41
Selection 2-2	4.47	4.67	12.77	17.34	19.26
'F' test	N.S.	N.S.	N.S.	Sig.	Sig.
S.Em.±	0.17	0.08	0.19	0.22	0.30
C.D. at 5% level	-	-	-	0.66	0.90
Interaction					
'F' test	N.S.	N.S.	N.S.	N.S.	N.S.
S.Em.±	0.38	0.19	0.44	0.49	0.67
C.D. at 5% level	-	-	-	-	-

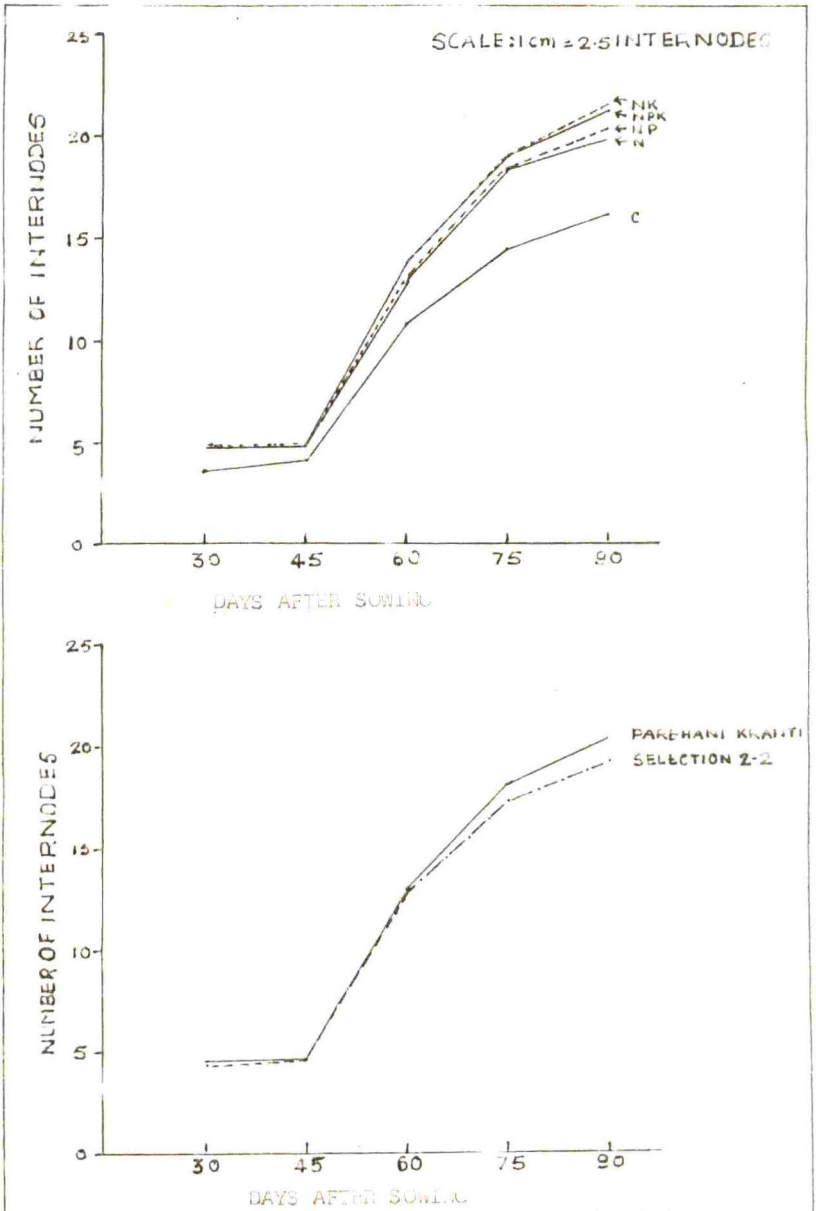


FIG. 4 EFFECT OF N, P, K AND VARIETIES ON NUMBER OF INTERNODES

alone as compared to those under control except at 45 days after sowing. The number of internodes per plant was not significantly increased with the application of phosphorus and potash as compared to nitrogen alone.

4.4.2 Effect of varieties

The difference in number of internodes per plant of the two varieties was found to be non-significant at 30, 45 and 60 days after sowing. However it was found to be significant at 75 days and 90 days. More number of internodes were recorded on the variety Parbhani Kranti (20.41) as compared with Selection 2-2 (19.26) at final observation.

4.4.3 Interaction effect

The interaction effects due to various nutrient combinations and varieties on number of internodes were found to be non-significant.

4.5 Effect of Nitrogen, Phosphorus and Potash and Varieties on Length of Internode

The observations in respect of length of internode recorded at fortnightly interval are presented in Table 5.

Table 5: Mean length (cm) of internodes as influenced by Nitrogen, Phosphorus, Potash and Varieties

Treatments	Days after sowing				
	30	45	60	75	90
Nutrients					
C	1.55	1.69	1.95	2.00	2.00
N	1.76	1.90	2.06	2.19	2.24
NP	1.74	1.92	2.07	2.17	2.21
NK	1.02	1.82	2.18	2.29	2.33
NPK	1.75	1.93	2.13	2.24	2.28
'F' test	N.S.	N.S.	N.S.	N.S.	N.S.
S.Em.±	0.10	0.09	0.09	0.09	0.09
C.D. at 5% level	-	-	-	-	-
Variety					
Parbhani Kranti	1.74	1.90	2.08	2.19	2.23
Selection 2-2	1.71	1.88	2.10	2.15	2.20
'F' test	N.S.	N.S.	N.S.	N.S.	N.S.
S.Em.±	0.03	0.03	0.04	0.03	0.03
C.D.at 5% level	-	-	-	-	-
Interaction					
'F' test	N.S.	N.S.	N.S.	N.S.	N.S.
S.Em.±	0.07	0.07	0.11	0.07	0.07
C.D.at 5% level	-	-	-	-	-

4.5.1 Effect of nitrogen, phosphorus and potash

The effect of nitrogen, phosphorus and potash on the length of internode of two varieties under study was found to be non-significant at all stages of growth.

4.5.2 Effect of varieties

The difference in the length of internode of the two varieties at all stages of growth was found to be non-significant. The maximum length of internode (2.23 cm) was observed in case of Parbhani Kranti variety followed by Selection 2-2 (2.20 cm) at final observation.

4.5.3 Interaction effect

The interaction effects due to nutrient combinations and varieties on the length of internode was found to be non-significant at all stages of crop growth.

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4.6 Effect of Nitrogen, Phosphorus, Potash and Varieties on Number of Fruits Per Plant

The data in respect of number of fruits per plant as influenced by various nutrient combinations and varieties are presented in Table 6.

Table 6: Mean number of fruits per plant as influenced by Nitrogen, Phosphorus, Potash and Varieties

Variety	C	N	NP	NK	NPK	Mean
Parbhani Kranti	9.40	12.70	12.35	13.85	14.00	12.46
Selection 2-2	8.25	12.95	13.45	12.65	13.55	12.17
Mean	8.82	12.82	12.90	13.25	13.77	

	Nutrients	Varieties	Interaction
'F' test	Sig.	N.S.	N.S.
S.Em.±	0.62	0.26	0.59
C.D. at 5% level	1.93	-	-

4.6.1 Effect of nitrogen, phosphorus and potash

Significantly higher number of fruits were produced on the plants with the application of nitrogen alone as compared to those under control. However, significant increase in the number of fruits per plant was not observed with the application of phosphorus and potash as compared to nitrogen alone.

4.6.2 Effect of varieties

The difference in the number of fruits produced on the plants of two varieties of okra was found to be non-

significant. However, higher number of fruits per plant (12.46) was recorded in case of Parbhani Kranti followed by Selection 2-2 variety (12.17).

4.6.3 Interaction effects

The interaction effects due to various nutrient combinations and varieties on the number of fruits per plant were found to be non-significant.

4.7 Effect of Nitrogen, Phosphorus and Varieties on Length of Fruit

The data in respect of length of fruit as influenced by different nutrient combinations are presented in Table 7.

Table 7: Mean length (cm) of fruits as influenced by Nitrogen, Phosphorus, Potash and Varieties

Variety	C	N	NP	NK	NPK	Mean
Parbhani Kranti	6.75	9.36	10.55	10.01	9.98	9.33
Selection 2-2	5.97	8.55	9.94	9.82	9.46	8.74
Mean	6.36	8.95	10.24	9.91	9.72	

	Nutrients	Varieties	Interaction
'F' test	Sig.	Sig.	N.Sig.
S.Em.±	0.24	0.12	0.27
C.D. at 5% level	0.74	0.36	

4.7.1 Effect of nitrogen, phosphorus and potash

The differences in the length of fruits under the various nutrient combinations were found to be significant. The length of fruit was significantly increased with the application of nitrogen alone as compared to control. Significant increase in the length of fruits was also observed with the application of phosphorus and potash when applied in combination with nitrogen than nitrogen alone. However, difference in the length of fruits under NP, NK and NPK were found to be non-significant.

4.7.2 Effect of varieties

The varietal differences in respect of length of fruits were found to be significant. More length of fruit (9.33 cm) was observed in case of Parbhani Kranti as compared with Selection 2-2 variety (8.74 cm).

4.7.3 Interaction effect

The interaction effect due to nutrient combinations and varieties on length of fruit was found to be non-significant.

4.8 Effect of Nitrogen, Phosphorus, Potash and Varieties on the Diameter of Fruits

The data in respect of diameter of fruits as influenced by different nutrient combinations are presented in Table 8.

Table 8: Mean diameter (cm) of fruits as influenced by Nitrogen, Phosphorus, Potash and Varieties

Variety	C	N	NP	NK	NPK	Mean
Parbhani Kranti	1.25	1.44	1.51	1.44	1.43	1.41
Selection 2-2	1.15	1.30	1.46	1.48	1.36	1.35
Mean	1.20	1.37	1.48	1.46	1.39	

	Nutrients	Varieties	Interaction
'F' test	Sig.	Sig.	N.S.
S.Em.±	0.017	0.016	0.036
C.D. at 5% level	0.053	0.048	-

4.8.1 Effect of nitrogen, phosphorus and potash

The differences in respect of diameter of fruits under different nutrient combinations were found to be significant. The diameter of fruits was significantly increased with the application of nitrogen alone as compared to control. However, appreciable increase in diameter of fruits was not observed with application of phosphorus and potash in combination with nitrogen as compared to nitrogen alone.

4.8.2 Effect of varieties

The difference in diameter of fruits of two varieties was found to be significant. More diameter of fruit (1.41 cm) was recorded in Parbhani Kranti variety followed by Selection 2-2 (1.35 cm).

4.8.3 Interaction effect

The interaction effect due to various nutrient combinations and varieties on diameter of okra fruit was found to be non-significant.

4.9 Effect of Nitrogen, Phosphorus, Potash and Varieties on Yield Per Hectare

The observations in respect of yield/ha are presented in Table 9.

Table 9: Mean yield (q/ha) as influenced by Nitrogen, Phosphorus, Potash and Varieties

Variety	C	N	NP	NK	NPK	Mean
Parbhani Kranti	39.50	85.97	87.00	87.76	93.60	78.76
Selection 2-2	32.88	73.85	78.11	84.51	83.38	70.54
Mean	36.19	79.91	82.55	86.13	88.49	

	Nutrients	Varieties	Interaction
'F' test	Sig.	Sig.	N.S.
S.Em.±	5.08	1.29	2.89
C.D. at 5% level	15.61	3.88	-

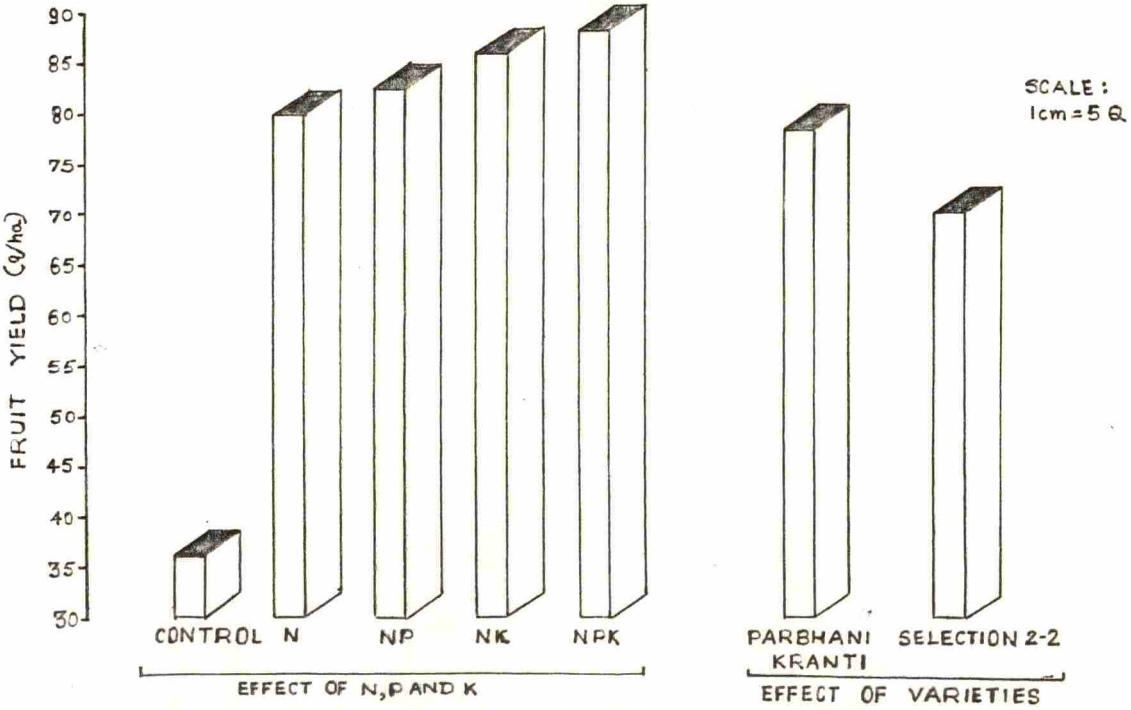
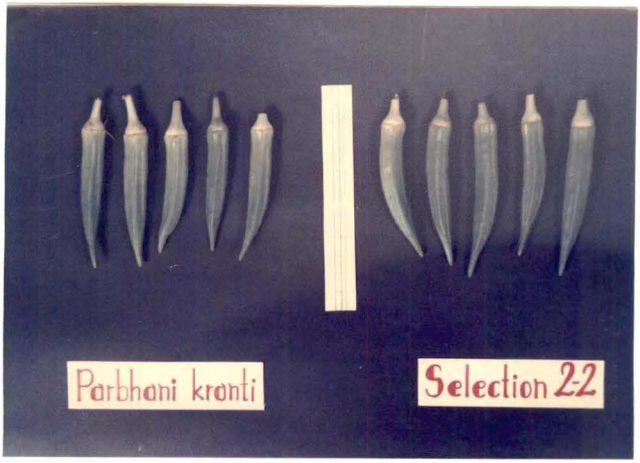


FIG. 5 AVERAGE FRUIT YIELD (q/ha)



Fruits of Okra Varieties harvested
5-6 days after anthesis

4.9.1 Effect of nitrogen, phosphorus and potash

Significant increase in yield of okra was observed with the application of nitrogen alone as compared to control. Increase in yield was also observed with the application of phosphorus and potash alongwith nitrogen. However, the differences in the yield under N, NP, NK and NPK were found to be non-significant.

4.9.2 Effect of varieties

The difference in the yield of two varieties was found to be significant. The variety Parbhani Kranti gave higher yield (78.76 q/ha) as compared with Selection 2-2 (70.54 q/ha).

4.9.3 Interaction effect

The interaction effect due to nutrient combinations and varieties was found to be non-significant.

4.10 Percentage of Plants Affected by Yellow Vein Mosaic Virus

The data in respect of plants affected by yellow vein mosaic virus as influenced by different nutrient combinations and varieties are presented in Table 10.

Table 10: Mean per cent of plants affected by yellow vein mosaic virus as influenced by Nitrogen, Phosphorus, Potash and Varieties

Variety	C	N	NP	NK	NPK	Mean
Parbhani Kranti	2.90 (9.81)	6.00 (14.18)	4.21 (11.85)	8.95 (17.41)	3.99 (11.53)	5.21 (12.95)
Selection 2-2	3.54 (10.86)	5.41 (13.46)	3.97 (11.50)	6.28 (14.52)	3.24 (10.38)	4.48 (12.14)
Mean	3.22 (10.33)	5.70 (13.82)	4.09 (11.67)	7.56 (15.96)	3.60 (10.95)	

Figures in parenthesis are arcsin values.

	Nutrients	Varieties	Interaction
'F' test	N.S.	N.S.	N.S.
S.Em.±	3.08	0.84	1.88
C.D. at 5% level	-	-	-

4.10.1 Effect of nitrogen, phosphorus and potash

From the data, it can be seen that significant differences were not observed in the percentage of okra plants affected by yellow vein mosaic virus with the application of nitrogen, phosphorus and potash as compared to control.

4.10.2 Effect of varieties

The varietal differences in respect of incidence of yellow vein mosaic virus were found to be non-significant.

4.10.3 Interaction effects

Interaction effect due to various nutrient combinations and varieties on plants affected by yellow vein mosaic virus was found to be non-significant.

4.11 Percentage of Plants Affected by Shoot Borer

The data in respect of plants affected by shoot borer as influenced by different nutrient combinations and varieties are presented in Table 11.

Table 11: Mean per cent of plants affected by shoot borer as influenced by Nitrogen, Phosphorus, Potash and Varieties

Variety	C	N	NP	NK	NPK	Mean
Parbhani Kranti	0.37 (3.52)	4.78 (12.64)	5.18 (13.16)	3.39 (10.61)	3.24 (10.38)	3.05 (10.06)
Selection 2-2	1.38 (6.75)	2.18 (8.51)	3.71 (11.11)	3.66 (11.03)	6.99 (15.34)	3.35 (10.55)
Mean	0.87 (5.13)	3.48 (10.59)	4.44 (12.13)	3.52 (10.82)	5.11 (12.86)	

Figures in parenthesis are arcsin values

	Nutrients	Varieties	Interaction
'F' test	Sig.	N.S.	Sig.
S.Em.±	1.42	0.62	1.38
C.D. at 5% level	3.51	-	4.16

4.11.1 Effect of nitrogen, phosphorus and potash

The data showed that minimum incidence of shoot borer was recorded under the control. The incidence of shoot borer was observed to be significantly higher with the application of nitrogen alone. However the differences in the incidence of the pest under N, NP, NK and NPK were found to be non-significant.

4.11.2 Effect of varieties

The varietal differences in respect of incidence of shoot borer were found to be non-significant. Minimum plants were affected by shoot borer in variety Parbhani Kranti (3.05%) followed by Selection 2-2 (3.35%).

4.11.3 Interaction effect

Interaction effect due to various nutrient combinations and varieties on percentage of plants affected by shoot borer was found to be significant.

Least incidence of shoot borer was observed under control in case of both the varieties of okra. There were no significant differences in the incidence of shoot borer under different combinations of nutrients in case of Parbhani Kranti variety. However, more incidence of the

pest was observed under NPK as compared to other treatments. The differences in the incidence of the pest under control and nitrogen as well as N, NP and NK were found to be non-significant.

* * * * *

CHAPTER V

DISCUSSION

The investigations on "Performance of okra varieties in relation to fertilizer application" were carried out during Kharif season 1989-90. Many researchers have stressed the need of optimum fertilizer and improved varieties for an intensive cultivation. Specially in case of vegetables still the practices followed are quite indigenous and traditional and adequate recommendations regarding the optimum nutrients and improved varieties are lacking for many of the crops. The object of this investigation was to see the performance of okra varieties and to ascertain the potentiality of okra varieties to produce higher yield in relation to fertilizer application. Most of fertilization aspects for production of okra have been studied by many workers for increasing total fruit yield. But studies on responses of new varieties of okra to varying combinations of nutrients are lacking. The results of the experiment which have been given in the preceeding chapter are discussed here to evaluate the performance of some new high yielding okra varieties under varying combinations of nutrients.

5.1 Effect of Nitrogen, Phosphorus, Potash and Varieties in Vegetative Growth of Okra

The growth of okra is best represented by height of plant, number of leaves, branches and internodes

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5.1 Effect of Nitrogen, Phosphorus, Potash and Varieties in Vegetative Growth of Okra

The growth of okra is best represented by height of plant, number of leaves, branches and internodes

produced on the plants. The vegetative growth of the plant depends on the abundent supply of moisture and nutrients present in the soil. The different combinations of nutrients influenced the various growth characteristics of different varieties under study. Okra is short duration crop. The edible portion is green succulent fruit, which emerges in the axil ofthe leaf. The height as well as number of leaves increase continuously throughout its duration and hence, fruiting attains continuously in okra. The meteorological data recorded during the course of experiment (Appendix I) show suitability of climate for cultivation of okra in the Kharif season.

The data presented in Figures 2, 3 and 4 showed that the growth rate of okra in terms of height of the plants, number of leaves, branches, internodes per plant and length of internode under various nutrient combinations was found to be continuous and more or less constant from 45 to 75 days after sowing. The growth rate was slow afterwards.

Vegetative growth as indicated by the height of plants, number of leaves, internodes of okra plants was significantly increased with the application of nitrogen alone as compared to control recorded at all stages of growth. In general, appreciable increase in growth of

plants was not observed with the application of phosphorus and potash in combination with nitrogen as compared with nitrogen alone. However, at 45 days after sowing significant increase in height of plants was observed with the application of potash and at 75 days after sowing with the application of phosphorus and potash in combination with nitrogen as compared with nitrogen alone. Several workers have reported the effect of major nutrients singly or in combination on the growth and yield of okra. It has been established that nitrogen nutrition plays a dominant role in influencing the growth and yield of okra. Application of nitrogen 100 kg/ha stimulated shoot elongation, the increase in growth of okra plants may be due to the property of nitrogen to enhance the vegetative growth and capacity of plants to utilize greater amount of nitrogen. Increase in growth of okra plants with the application of nitrogen has also been reported by Chhonkar and Singh (1963), Saimbhi and Padda (1970) and Verma et al. (1970).

The production of large number of leaves is considered to be an important aspect in the vegetative growth of plants as they are the site of the photosynthetic activities. Application of nitrogen had favourable influence on the number of leaves produced on the plants at various stages

of crop growth. These findings are in close agreement with those of Chauhan and Gupta (1973), Randhawa and Pannum (1969) and Pawar (1980).

The varietal difference in respect of growth of the plants was observed at 15 days interval. The plants of variety Parbhani Kranti were found to be vigorous as measured by height of the plant, number of leaves, branches and internodes/per plant than those of Selection 2-2 variety. Similar findings in respect of growth of plants of these two varieties have been reported by Somkuwar (1989) and Dhakare (1989).

5.2 Effect of Nitrogen, Phosphorus, Potash and Varieties on Yield and Yield Contributing Characters of Okra

The yield of okra is largely dependent on the vegetative growth of the plants which determines the number of fruits per plant, the size of fruits and yield.

The data presented in Table 6, indicated that significantly higher number of fruits were produced on the plants with the application of nitrogen alone as compared to those under control. The increase in number of fruits per plant with the supply of nitrogen may be due to increased amount of food manufactured by the foliage. As explained by Randhawa and Pannum (1969), the synthesis of amino

acids, proteins and chlorophyll was accelerated with the nitrogen supply. As a result of beneficial effects of nitrogen application on growth, better fruiting was obtained.

The varietal difference in respect of number of fruits per plant was found to be non-significant. However, relatively more number of fruits were produced on the plants of variety Parbhani Kranti as compared to those of Selection 2-2.

Significant increase in yield of okra was observed with the application of nitrogen alone as compared to control. Slight increase in yield was observed with the application of phosphorus and potash alongwith nitrogen as compared with nitrogen alone. However the differences in the yields obtained under different nutrient combinations were found to be non-significant. As explained earlier application of nitrogen has helped in more vegetative growth or more photosynthetic area and higher quantities of metabolites which resulted in more number of fruits and ultimately higher yield. The increase in the yield of okra with the application of nitrogen has also been reported by Singh and Singh (1965). Randhawa and Pannum (1969), Verma et al. (1970), Saimbhi and Padda (1970).

The varietal differences in respect of fruit yield were significant. The variety Parbhani Kranti was found

to be high yielding (78.76 q/ha) as compared with Selection 2-2 (70.54 q/ha). The increase in fruit yield may be due to more number of branches and height of the plants of Parbhani Kranti variety. Similar observations regarding better performance of Parbhani Kranti variety have also been reported by Thakur (1989), Dhakare (1989) and Somkuwar (1989).

Significant differences in the incidence of yellow vein mosaic virus were not observed with the application of nitrogen alone and in combination with phosphorus and potash. The varietal difference was also found to be non-significant in respect of incidence of yellow vein mosaic virus.

The incidence of shoot borer was minimum (0.87%) under control as compared to that under nitrogen alone and in combination with phosphorus and potash. However, the differences in the incidence of the pest under different combinations of nutrients were found to be non-significant. The varietal difference in respect of incidence of shoot borer was observed to be non-significant.

Considering the vegetative growth and yield characteristics of okra, in general response to the application of nitrogen was observed. Among the varieties included in the study, Parbhani Kranti exhibited better vegetative growth and yield potential.

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CHAPTER VI

SUMMARY AND CONCLUSION

The present investigations "Perfonmance of okra varieties in relation to fertilizer application" was undertaken during kharif season of 1989 in the Department of Horticulture, Punjabrao Krishi Vidyapeeth, Akola.

Design of the experiment adopted was split plot with 4 replications. The treatments included were as under.

Main treatments - Fertilizers

1.	Nitrogen	N
2.	Nitrogen and Phosphorus	NP
3.	Nitrogen and Potassium	NK
4.	Nitrogen, Phosphorus, Potassium	NPK
5.	Control (without N, P and K)	C

Sub treatments - Varieties

1.	Parbhani Kranti	V_1
2.	Selection 2-2	V_2

The observations recorded in respect of vegetative growth and yield of okra are summarised below.

The growth of the plants upto 90 days after sowing in respect of height, number of leaves, branches and

internodes per plant was found to be increased with the application of nitrogen alone as compared with those under control. The vegetative growth of okra in respect of height, number of leaves, branches and internodes per plant was observed to be more in variety Parbhani Kranti as compared with Selection 2-2 variety.

The number of fruits per plant and yield per hectare were found to be increased with the application of nitrogen. The variety Parbhani Kranti was found to be high yielding followed by Selection 2-2.

The incidence of yellow vein mosaic virus was more or less similar under different combinations of nutrients and control. However, incidence of shoot borer was found to be low under control as compared with that under different combinations of nutrients. The varietal differences in respect of incidence of yellow vein mosaic virus as well as incidence of shoot borer were found to be non-significant.

Conclusion

From the findings of present study, it may be concluded that,

1. The maximum vegetative growth of the plants, number of fruits per plant and higher fruit yield per hectare were obtained with the application of nitrogen.
2. Among the two varieties included in the study, maximum vegetative growth and yield per hectare were observed in case of the variety Parbhani Kranti as compared with Selection 2-2.

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*Originals not seen.

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APPENDIX-I

Meteorological data for the experimental period during the year 1989 recorded at Agril. Meteorology Observatory, P.K.V., Akola

Met. Week	Date	Temperature (°C)		Humidity (%)		Rain-fall (mm)	Rainy days
		Maxi-mum	Minimum	Morn-ing	Even-ing		
26	25- 1 July	32.5	24.0	85	65	79.8	2
27	2- 8 July	31.9	23.7	83	65	46.2	2
28	9-15 July	33.9	24.7	78	50	0.0	NIL
29	16-22 July	33.1	24.3	84	64	45.4	3
30	23-29 July	30.8	23.5	87	67	38.3	4
31	30- 5 August	31.7	23.0	79	52	0.0	NIL
32	6-12 August	26.6	22.2	92	87	49.2	5
33	13-19 August	28.7	23.1	89	75	88.0	2
34	20-26 August	28.7	23.3	90	80	61.8	3
35	27- 2 Sept.	29.0	22.4	88	72	40.0	4
36	3- 9 Sept.	31.9	22.2	84	53	0.0	NIL
37	10-16 Sept.	33.2	23.1	83	50	8.6	1
38	17-23 Sept.	34.8	23.1	85	52	69.8	3
39	24-30 Sept.	33.2	23.0	86	52	22.2	1
40	1- 7 Oct.	35.2	19.3	79	36	2.5	NIL
41	8-14 Oct.	37.1	15.8	70	21	0.0	NIL

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VITA

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THESIS ABSTRACT

(a) Title of the thesis	:"PERFORMANCE OF OKRA VARIETIES IN RELATION TO FERTILIZER APPLICATION"
(b) Full name of student	: Girish Prabhakarrao Choudhary
(c) Name and address of Major Advisor	: Dr.A.G.Mahakal, Asstt.Prof. in Horticulture, P.K.V.,Akola
(d) Degree to be awarded	: M.Sc.(Agri.)
(e) Year of award of degree	: 1990
(f) Major subject	: Horticulture
(g) Total number of pages in thesis	: 59
(h) Number of words in thesis abstract	: 231
(i) Signature of student	: Choudhary
(j) Signature, name and address of forwarding authority	:

ABSTRACT

The investigations were carried out on performance of two okra varieties viz. Parbhani Kranti and Selection 2-2 in relation to application of different combinations(viz. N, NP, NK, NPK andcontrol) of nitrogen, phosphorus and potash during Kharif season 1989 in the Department of Horticulture, P.K.V.,Akola. Design of the experiment was split plot with four replications.

The growth of the plants upto 90 daysafter sowing in respect of height, number of leaves, branches and internodes per plant was found to be increased with the application of nitrogen alone as compared with those under control. The vegetative growth of okra in respect of height

number of leaves, branches and internodes per plant was observed to be more in variety Parbhani Kranti as compared with Selection 2-2 variety.

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