

Original Research Article

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Effect of Nitrogen and Potash Levels on Green Pod Yield, Quality and Post-harvest Soil Nutrient Status of Okra (*Abelmoschus esculentus* L. Moench) during *kharif* Season under Middle Gujarat Conditions

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ABSTRACT

The field experiment was conducted at Main Vegetable Research Station, Anand Agricultural University, Anand to study the “Effect of nitrogen and potash levels on growth and green pod yield of okra (*Abelmoschus esculentus* L. Moench) during *kharif* season under middle Gujarat conditions” during the year 2015. The soil of experimental field was loamy sand in texture having good drainage and 7.7 pH at 0-15 cm soil depth. The experiment was laid out in RBD with factorial concept in three replications. The treatment comprised of four nitrogen levels (75, 100, 125 and 150 kg N/ha) and five levels of potash (25, 50, 75, 25as basal + 25 at 45 DAS and 37.5 as basal + 37.5 at 45 DAS kg K₂O/ ha). There were total twenty treatment combinations of different levels of nitrogen and potash. The crop was fertilized as per respective nitrogen @ 75,100,125 and 150 kg N/ha and potash @ 25, 50, 75, 50 and 75 kg K₂O/ha in the respective plots as per treatments. Results revealed that application of 150 kg N/ha recorded significantly higher green pod yield, available nitrogen and nitrogen content. Application of potash in two equal split (37.5 kg K₂O/ha at basal + 37.5 kg K₂O/ha at 45 DAS) treatment recorded higher green pod yield as well as various quality parameters, available potash in soil and potash content in green fruit. In case of cost of cultivation, result revealed that application of 125 kg N/ha with two equal split of 25 kg K₂O/ha at basal + 25 kg K₂O /ha at 45 day treatment combination recorded higher benefit cost ratio. In case of individual treatment on economics, application of 150 kg N/ha and potash application (37.5 kg K₂O/ha at basal + 37.5 kg K₂O/ha at 45 DAS) was recorded higher benefit cost ratio.

Keywords

Green pod yield,
Nitrogen, Potash
and protein

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Introduction

Okra (*Abelmoschus esculentus* L. Moench) is a member under Malvaceae family and is also known as Lady’s finger. It is an annual vegetable crop grown from seed in tropical and sub-tropical parts of the world.

Okra produces fruit for a longer time and

needs a balanced and sufficient supply of nutrients for higher yield and better quality. Vegetables and vegetable based cropping system show that vegetable crops are well responsive to nutrient supply through organic manures and chemical fertilizers. It is well proved that growth, yield and quality of plants are greatly influenced by availability of a

wide range of nutrients in the soil. Nitrogen is an essential macronutrient which has great significance in growth, development and metabolism of plants. Phosphorus is a constituent of nucleic acid, phospholipids and several enzymes which are of great importance in the transformation of energy within the plant system, metabolism and also in respiration in plants. It has beneficial effect on root development, growth and also hastens maturity as well as improves quality of crop produce. Potassium is one of the three major nutrient elements (N, P and K) required by plants. Potassium imparts vigour and disease resistance to the plant and plays an important role in crop productivity. Plant health at field is also responsible for lower productivity and need to look for other means in production system management which could help in achieving high yield and productivity.

Little information is available on the interaction effect of nitrogen and potash on green pod yield and quality of okra, Hence keeping in view and importance of nitrogen and potash such experiment “Effect of nitrogen and potash levels on growth and green pod yield of okra (*Abelmoschus esculentus* L. Moench)” was carried out Anand Agricultural University, Anand.

Materials and Methods

The field experiment was conducted at Main Vegetable Research Station, Anand Agricultural University, Anand to study the “Effect of nitrogen and potash levels on growth and green pod yield of okra (*Abelmoschus esculentus* L. Moench) during *kharif* season under middle Gujarat conditions” during the year 2015. The soil of experimental field was loamy sand in texture having good drainage and 7.7 pH at 0-15 cm soil depth. The treatment comprised of four nitrogen levels (75, 100, 125 and 150 kg N/ha) and five levels of potash (25, 50, 75, 25

as basal + 25 at 45 DAS and 37.5 as basal + 37.5 at 45 DAS kg K₂O/ ha). Experiment laid down in Randomized Block Design with three replication. There were total twenty treatment combinations of levels of nitrogen and potash. The crop was fertilized as per respective nitrogen @ 75, 100, 125 and 150 kg N/ha and potash @ 25, 50, 75, 50 and 75 kg K₂O/ha in the respective plots as per treatments. The 25% quantity of nitrogen was given as a basal dose at the time of preparation of land and remaining quantities was applied as top dressing at around 30, 45 and 60 days after sowing. Entire quantity of phosphorus (50 kg/ha) were applied as a common basal dose in furrow to all the plots in form of single super phosphate. The furrows were lightly covered with soil. The seeds of GAO-5 variety of okra were dibbled in previously opened furrows at a distance of 60 cm between and 30 cm within the row. The biometric observations were recorded from five randomly selected plants tagged in each net plot. The details of various growth parameters, yield attributes and chemical parameters studied during the course of investigation. The soil samples were collected after completion of crop. The chemical analysis for pod and soil samples carried out by various standard methods of chemical analyses.

An analysis of available nitrogen by (Alkaline Permanganate method) available phosphorus by (Colorimetric method) and Estimation of potassium was made from acid extract by Flame photometer method as described by Jackson (1973).

The data were analyzed individually as per the standard analysis of variance ANOVA technique using the Randomized Block Design (Factorial). The treatment comparisons were made using t test at P=0.05 level of significance.

Results and Discussion

Effect of nitrogen

The results in respect of green pod yield (Table-1) revealed that nitrogen levels had pronounced effect on green pod yield. Nitrogen application @ 150 kg/ha (N_4) produced significantly higher green pod yield (147.31 q/ha). The lowest green pod yield (73.02 q/ha) was recorded under application of 75 kg N/ha (N_1). The increase in green pod yield was recorded under treatment N_4 was 64.15 per cent over treatment N_1 . More green pod yield at higher dose of nitrogen was due to more vegetative growth resulting from efficient utilization of nutrients, water, radiation and increased metabolic activities followed by increased translocation toward yield contributing characters. These results are in conformity with findings of those reported by Shanke *et al.*, (2003), Suthar *et al.*, (2009), Singh *et al.*, (2012) and Deepika *et al.*, (2015).

In the study, different nitrogen levels do not showed their significant influence on moisture and mucilage content (Table-1) in okra fruit but the total chlorophyll content in okra fruit remained significant (Table-1). Significantly higher total chlorophyll content (1.67 mg/g) in okra fruit was recorded under treatment N_4 (150 kg N ha⁻¹) as compared to rest of the treatments. It might be due to nitrogen as the constitute of chlorophyll content and the synthesis of amino acid, protein and chlorophyll is accelerated with the greater nitrogen supply. These results are in conformity with the findings of Paliwal *et al.*, (1999).

Different nitrogen levels do not showed their significant influence on organic carbon, available phosphorus and potassium status (Table 1) in soil after harvesting of crop but the available nitrogen in soil after harvesting

of crop remained significant. (Table-1). An application of nitrogen brought out non-significant variation in phosphorus and potash content in plant (Table-1) but the nitrogen content in plant remained significant (Table-1). The significantly the higher nitrogen content (275.96 kg/ha) in plant was recorded under the treatment N_4 (150 kg/ha). However, it was at par with treatment N_3 (125 kg/ha). Increase in nitrogen content under treatment N_4 could be due to more quantity of nitrogen application enhanced green fruit yield and ultimately helped in increase of nitrogen content in plant.

Effect of potash

Significantly the higher green pod yield of okra was recorded under treatment K_5 (37.5 kg K₂O/ha at basal + 37.5 kg K₂O/ha at 45 DAS). (Table-1) However, it was at par with treatment K_4 (25 kg K₂O/ha at basal + 25 kg K₂O/ha at 45 DAS) and treatment K_3 (75 kg K₂O/ha) in different picking. Treatment K_1 registered significantly the lowest green pod yield (101.54 q ha⁻¹). This show that there was a significant improvement in growth and yield attributes due to split application potash was probably due to better translocation and partitioning of assimilates toward the sink at proper doses of potash. In fact potash application is known to improve the physiological and metabolic processes and translocation resulted in increased growth and yield attributes and there by increased green pod yield. The finding on higher green pod yields due to different levels of potash were also reported by Khan *et al.*, (2014), Mushtaq *et al.*, (2014) and Pushpavalli *et al.*, (2014).

In the study, different potash levels showed their significant influence on total chlorophyll content and mucilage content (Table 1) in okra fruit. Significantly higher total chlorophyll content and mucilage content in okra fruit was recorded under treatment

K₅(37.5 kg K₂O/ha at basal + 37.5 kg K₂O/ha at 45 DAS). However, it was at par with treatment K₄ (25 kg K₂O/ha at basal + 25 kg K₂O/ha at 45 DAS). It might be due to potash increase the photosynthesis and enzymatic activities in plant. The results are confirmed by finding of Deepika *et al.*, (2015).

In the study, different levels of potash did not show any significant influence on organic carbon, available nitrogen and available phosphorus in soil after harvest of okra. While, significant influence due to potash application on K status of soil after the harvesting of crop. Significantly the highest K status of soil (260.20 kg/ha) after harvest was recorded under the treatment K₅(37.5 kg K₂O/ha at basal + 37.5 kg K₂O/ha at 45 DAS). Potash content in plant (Table-1) was influence significantly due to potash levels. Increase in potash content under treatment K₅ could be due to split application of potash enhanced potash availability at later stage of growth and ultimately increased green fruit yield (Table-1) and helped in increase of potash content in plant.

Interaction effect

The results presented in Table-2 revealed that significantly higher green pod yield was recorded under treatment combination N₄K₅(167.45q/ha) as compared to rest of the treatment combinations but it was at par with treatment combinations N₄K₄, N₄K₃, N₃K₅, N₃K₄ and N₃K₃. The higher green pod yield under treatment combination N₄K₅ might be due to synergic interactive effect of nitrogen and potash levels. This might be due to interactive effect of nitrogen and potash levels of greener pod yield at higher dose of nitrogen and potash was due to more vegetative growth resulting from efficient utilization of nutrient, water, radiation and increased metabolic activities followed by increased translocation toward yield

contribution characteristics. Also potash application improve physiological and metabolic process and translocation resulted in increased growth and yield attributes and there by increased green pod yield in okra were also reported by Mani and Ramanathan (1980).

Economics

Effect of nitrogen levels

The results pertaining to benefit: cost analysis of the crop as influenced by nitrogen levels (Table-3) indicated that increased net realization with increase nitrogen levels. Application of 150 kg N/ha (N₄) registered maximum net realization (232731/ha) with BCR value of 3.76, application of 125 kg N/ha (N₃) recorded 227137/ha net profit with the BCR of 3.69. The lowest net realization 85130/ha was noticed under application of 75 kg N/ha (N₁) with 1.39 BCR value. The increased net realization with increasing levels of nitrogen was due to increased growth and yield attributing characters and ultimately green pod yield (Table-4). The similar results were reported by Firoz (2009) and Suthar (2009).

Effect of potash levels

Data presented in Table 3 revealed that maximum net realization was occurred under treatment K₅ (37.5 kg K₂O/ha at basal + 37.5 kg K₂O/ha at 45 DAS). (203149/ha) with the highest BCR value of 3.27 followed by K₄ treatment with 199915/ ha net realization and 3.25 BCR value.

The lowest net realization (142442/ha) was recorded under the treatment K₁ with 2.35 BCR value. The higher net realization under treatment K₅ was only due to higher green pod yield.

Table.1 Yield, quality, soil and pod nutrient status as influenced by different treatments

Treatment	Green pod yield (q/ha)	Moisture (%)	Total chlorophyll content (mg/g)	Mucilage (mg/g)	Organic carbon (%)	Available nitrogen (kg/ha)	Available phosphorus (kg/ha)	Available potassium (kg/ha)	N content (%)	P content (%)	K content (%)
Nitrogen level (kg/ha)											
N ₁	73.02	80.07	1.29	232.76	0.46	238.11	42.15	240.41	1.05	0.49	1.35
N ₂	114.80	80.59	1.44	233.65	0.46	256.00	43.93	240.74	1.18	0.50	1.38
N ₃	144.35	81.17	1.61	235.68	0.47	270.08	46.57	246.03	1.42	0.51	1.45
N ₄	147.31	82.07	1.67	236.16	0.47	275.96	46.69	250.45	1.52	0.51	1.49
SEm±	3.41	0.84	0.02	2.28	0.01	6.13	1.58	3.44	0.03	0.01	0.05
CD (P=0.05)	9.77	NS	0.06	NS	NS	17.55	NS	NS	0.11	NS	NS
Potash level (kg/ha)											
K ₁	101.54	79.69	1.37	227.62	0.45	254.46	43.15	232.15	1.22	0.48	1.23
K ₂	108.83	80.35	1.47	229.34	0.46	256.62	43.93	238.15	1.27	0.50	1.32
K ₃	125.79	81.20	1.53	236.01	0.47	261.78	45.10	243.09	1.32	0.51	1.46
K ₄	130.60	81.70	1.54	237.20	0.46	257.77	44.50	242.19	1.30	0.50	1.48
K ₅	132.59	81.93	1.59	242.64	0.47	269.56	46.26	260.20	1.34	0.52	1.59
SEm±	3.82	0.95	0.02	2.55	0.01	6.85	1.76	3.84	0.04	0.008	0.04
CD (P=0.05)	10.92	NS	0.07	7.30	NS	NS	NS	11.00	NS	NS	0.14
N×K	Sig.	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
CV %	11.02	4.06	5.54	3.76	8.66	9.13	13.67	5.45	5.53	5.85	5.54

Table.2 Green pod yield as influenced by Nitrogen X potash interaction

Treatment	Green pod yield (q/ha)				
	Potash levels (kg/ha)				
	K ₁	K ₂	K ₃	K ₄	K ₅
N ₁	65.82	71.01	75.04	74.44	78.76
N ₂	108.50	114.27	115.01	117.41	118.79
N ₃	114.71	123.93	152.59	165.15	165.35
N ₄	117.131	126.08	160.48	165.39	167.45
SEm±	7.63				
CD (P=0.05)	21.84				
CV %	11.02				

Table.3 Economics as influenced by different levels of nitrogen and potash levels

Treatment	Green pod yield (q/ha)	Cost of treatment (Rs/ha)	Common cost (Rs/ha)	Total cost (Rs/ha)	Gross realization (Rs/ha)	Net realization (Rs/ha)	BCR
Nitrogen levels (kg/ha)							
N ₁ = 75	73	1128	59783	60911	146041	85130	1.39
N ₂ = 100	115	1454	59783	61237	229606	168369	2.75
N ₃ = 125	144	1780	59783	61563	288700	227137	3.69
N ₄ = 150	147	2106	59783	61889	294620	232731	3.76
Potash levels (kg/ha)							
K ₁ = 25	102	855	59783	60638	203080	142442	2.34
K ₂ = 50	109	1542	59783	61325	217660	156335	2.54
K ₃ = 75	126	2248	59783	62031	251580	189549	3.05
K ₄ = 25 at basal+ 25 at 45 DAS	131	1542	59783	61325	261240	199915	3.25
K ₅ = 37.5 at basal + 37.5 at 45 DAS	133	2248	59783	62031	265180	203149	3.27

Table.4 Economics of different treatment combinations

Treatment	Green pod yield (q/ha)	Cost of cultivation (Rs/ha)	Gross realization (Rs/ha)	Net realization (Rs/ha)	BCR
N ₁ K ₁	66	61766	131652	69886	1.13
N ₁ K ₂	71	62453	142035	79582	1.27
N ₁ K ₃	75	63159	150095	86936	1.38
N ₁ K ₄	74	62453	148897	86444	1.38
N ₁ K ₅	79	63159	157528	94369	1.49
N ₂ K ₁	109	62092	217010	154918	2.49
N ₂ K ₂	114	62779	228556	165777	2.64
N ₂ K ₃	115	63485	230028	166544	2.62
N ₂ K ₄	117	62779	234839	172061	2.74
N ₂ K ₅	119	63485	237593	1741078	2.74
N ₃ K ₁	115	62418	229420	167002	2.68
N ₃ K ₂	124	63105	247877	184772	2.93
N ₃ K ₃	153	63811	305186	241375	3.78
N ₃ K ₄	165	63105	330300	267195	4.23
N ₃ K ₅	165	63811	330700	266889	4.18
N ₄ K ₁	117	62744	234260	171516	2.73
N ₄ K ₂	126	63431	252171	188741	2.97
N ₄ K ₃	161	64137	320973	256837	4.00
N ₄ K ₄	165	63431	330799	267369	4.21
N ₄ K ₅	167	64137	334909	270772	4.22

Interaction effects of different nitrogen and potash levels

Data on economics as influenced by interaction effects between different levels of nitrogen and potash (Table-4) indicated that 125 kg N/ha as well as 25 kg K₂O/ha at basal + 25 kg K₂O/ha at 45 DAS. (N₃K₄) recorded the highest BCR value 4.23 followed by treatment combination N₄K₅, recorded the 4.22 BCR value. The lowest BCR value was noted under the treatment combination N₁K₁ with 1.13. The higher BCR value under treatment combinations (N₃K₄)and N₄K₅ was only due to higher green pod yield and lower total cost than other treatment combinations.

It is concluded that in light of the results obtained from this investigation, it is

concluded that the application of 125 kg N/ha along with 25 kg K₂O/haas basal + 25 kg K₂O/haat 45 DAS to *kharif* okra (*cv.Gujarat Anand Okra-5*), produced higher green pod yield, quality, nutrient content and gave higher BCR value.

References

Cochran, W. G. and Cox, G. M. (1957). Experimental designs, John Willey and Sons. Inc., New York, 546-568.
 Deepika, S. D., Hadimani, H. P., Ganiger, Vasant and Bhuvaneshwari, G. (2015). Response of nitrogen and phosphorus levels on the growth, yield and nutritional quality of okra. *Green Farming*, 6(5): 1010-1014.
 Firoz, Z. A (2009). Impact of nitrogen and

- phosphorus on the growth and yield of okra (*Abelmoschus esculentus* L. Moench.) in hill slope condition. *Bangladesh J. Agril. Res.*, 34(4): 713-722.
- Jackson, M.L. (1973). Soil Chemical Analysis, Indian edition. Prentice - Hall India Pvt. Ltd., New Delhi.
- Khan, A., Shah, S. N., Rab, A., Sajid, M., Ali, K., Ahmed, A. and Faisal, S. (2014). Influence of nitrogen and potassium levels on growth and yield of chillies (*Capsicum annum* L.). *International J. Of Farming and Allied Sciences*, 3(3): 260-264.
- Mani, S. and Ramanathan, K. M. (1980). Effect of nitrogen and potassium on the yield of bhendi fruits. *South Indian Horticulture*, pp.136-138.
- Mushtaq, F., Chattoo, M. A., Afroza, B., Amin, A., Mufti, s. and Nabi, A. (2014). Studies in relation to potassium application for improved growth and yield in chilli cv. Kashmir long-1. *Green Farming*, 5(6): 989-992.
- Paliwal, R., Naruka, I. S. and Yadav, J. K. (1999). Effect of nitrogen and sulphur on growth and yield of okra (*Abelmoschus esculentus* L. Moench). *Progressive Horticulture*, 31 (1-2): 94-97
- Pushpavalli, R., Arulthasan, T. and Kandaswamy, K. G. (2014). Growth, nutrient uptake and yield of okra (*Abelmoschus esculentus* L. Moench) as influenced by organic and inorganic K fertilizers. *Academia J. of Agric. Research*, 2(10): 203-206.
- Shanke, B. R., Jadao, B. J., Ghawade, S. M. and Mahorkar, V. K. (2003). Effect of different levels of N and P on growth and seed yield of okra (var. Parbhani Kranti), under Akola condition. *Orissa J. Horti.*, 31(1): 123-124.
- Singh, P. K., Singh, V. K., Singh, D. R., and Singh, P. N. (2012). Response of different levels of nitrogen, spacing and green fruit picking on growth, fruit yield, seed yield and seed quality of okra (*Abelmoschus esculentus* L. Moench). *Ann. Agric. Res.*, 33 (1-2): 36-39.
- Suthar, J. V., Patel, J. B., Patel, J. R., Doshi, J. S. and Patel, J. A. (2009). Effect of Organic Manures and Nitrogen levels on seed yield and seed quality of okra (*Abelmoschus esculentus* L. Moench) under Middle Gujarat Conditions. *Seed Research*, 37(1-2): 156-158.

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