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Effect of nitrogen, phosphorus and potash on growth, yield and quality of onion (*Allium cepa* L.) raised from onion sets

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ABSTRACT

A field experiment was conducted during *Kharif* season of 2004-05 and 2005-06, to study the effect of nitrogen, phosphorus and potassium application raised from onion sets on growth, yield and quality characters. In a trial with cv. AGRI found Dark Red, different levels of nitrogen, phosphorus and potassium significantly affected the growth characters of onion, but yield characters was found non-significantly except total yield. The application of nitrogen significantly increased total yield of onion. Application of 150kg N + 80kg P_2O_5 + 80 kg K_2O per ha. was most appropriate combination of nutrients with respect to growth and yield of the rainy season onion crops raised from seedlings.

Key words : Variability, Heritability, Genetic advance, Line × tester, Okra.

INTRODUCTION

Rainy season onion crop is raised mostly from seedling, instead of onion set. The crop raised from seedling require 150-165 days, while from onion set takes 105-145 days. The crop from onion set is successfully grown in Gujarat and Maharashtra states and its cultivation under North India is limited to Alwar, Bharatpur in Rajasthan. Therefore, an investigation was carried out to determine the requirement of nitrogen, phosphorus and potassium of rainy season onion raised from onion set at district Farrukhabad.

Lack of adequate nutrients supply is one of the main factors which limits the yield of bulb onions. The nitrogen application was almost universally reported to have increased the growth and yield of onion in India. The recommendation for the rainy season crop for nitrogen application varies from 50 to 200 kg/ha (Purewal and Dargan, 1962, Chopra and Kanwar, 1966).

MATERIALS AND METHODS

Investigations was carried out at Krishi Vidgyan Kendra, Farrukhabad with the cv. AGRI found Dark Red during 2004-2005 and 2005-2006. The soil of experimental site was sandy loam having uniform fertility level. The soil analysis report indicated that it had a pH of 8.1, available organic carbon 0.31 per cent, nitrogen 136.8 kg/ha phosphorus 19.36 kg/ha and potassium 230.68 kg/ha with sandy loam texture. Three levels of nitrogen (50, 100 and 150 kg/ha), two levels of phosphorus (40 and 80 kg/ha) and two levels of potassium (50 and 100 kg/ha), 12 treatments combinations were laid out in Randomized Block Design with three replications. The source of nitrogen, phosphorus and potassium was urea, single super phosphate and muriate of potash, respectively. Half of the nitrogen and full doses of phosphorus and potassium were broadcasted and mixed in soil before planting. The remaining half of nitrogen was applied in two split doses, one month and two month after transplanting. The uniform onion sets were transplanted in 1.5 x 1.0 m plots during the IInd week of July. The crop was harvested during the month of December. The data were recorded on growth, yield and quality characters and analysed statistically as suggested

RESULTS AND DISCUSSION

The effect of nitrogen, phosphorus and potassium on different characters is presented in Table 1.

Effect of nitrogen:

The effect of nitrogen, phosphorus and potassium on different characters is presented in Table 1. The differences among the treatments were found significant except T.S.S. of bulb. The data indicates that the plant height, leaves per plant, fresh weight of plant and bulb as well as dry weight of plant and bulb increased linearly with increasing levels of nitrogen and age of the plant. The diameter of bulb was not affected by different levels of nitrogen. The reason perhaps for significant increase in the above growth characters due to increasing levels of nitrogen might be because of more vegetative growth, more chlorophyll formation and thus more carbohydrate formation in onion plants. Similar results have also been reported by Nandpuri *et al.* (1968), Singh and Kumar (1969). The higher levels of nitrogen reduced the T.S.S.

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Table 1 : Effect of N, P and K on diameter, T.S.S., bolting Neck thickness and total yield

Treatments	Diameter of bulb (cm)	T.S.S. (%)	Doubles (%)	Botting (%)	Neck-thickness (cm)	Total yield
Nitrogen levels						
N_{50}	4.31	12.7	9.5	2.6	1.1	207.3
N_{100}	4.88	11.8	11.2	2.0	1.3	296.2
N_{150}	5.07	11.1	15.0	1.6	1.6	355.4
L.S.D. at 0.05	NS	1.01	1.14	0.28	0.14	8.4
Phosphorus levels						
P_{40}	4.66	12.1	10.7	1.4	1.3	269.2
P_{80}	4.85	11.6	15.1	2.0	1.4	303.3
L.S.D. at 0.05	NS	NS	2.66	NS	NS	6.8
Potash levels						
K_{50}	4.72	12.1	11.5	1.5	1.4	277.4
K_{100}	4.79	11.7	12.4	2.0	1.3	295.2
L.S.D. at 0.05	NS	NS	NS	NS	NS	NS
Interaction						
N x P	NS	NS	NS	NS	NS	NS
N x K	NS	NS	NS	NS	NS	NS
P x K	NS	NS	NS	NS	NS	NS
N x P x K	NS	NS	NS	NS	NS	NS

NS-Non significant

and bolting percentage where as the jointed bulb, neck-thickness and yield increased significantly with each increasing levels of nitrogen. The higher dose of nitrogen is essential for building up of protoplasm and proteins which induce cell-division and initiate meristmatic activity.

Effect of phosphorus:

An application of 80 kg phosphorus per hectare significantly increased the plant height, leaves per plant, fresh weight of plant and bulb as well as dry weight of plant and bulb, while it has not produced any significant effect on diameter of bulb. It is evident that phosphorus plays on important role in plant metabolism associated with meristematic activities. Increment in various growth characters of onion plants, therefore, appears to be the consequence of increased rate of cell division induced by application of phophorus. These results find support with the findings of Islam and Haque (1977). Phosphorus application did not exhibit any significant improvement on the T.S.S., bolting and neck-thickness of bulbs, however, percentage of jointed bulb (doubles) were obtained significantly Singh and Batra (1972) reported that maximum protein content in bulb was found with the 50 kg P_2O_5/ha. The higher dose of P_2O_5 application perhaps caused more jointed bulbs.

Effect of potassium :

Incase of potassium, higher dose (100 kg/ha) is marked increased in growth characters of rainy season onion. While the diameter of bulb was found non-significant. Potassium helps in the photosynthesis, translocation and utilization of synthesized carbohydrates. The above findings are in agreement with the observations of Deshmukh *et al.* (1984) and Anonymous (1989-90). Application of potassium at both the levels *i.e.* 50 and 100 kg/ha significantly influence the total yield. Lowest dose of potassium application showed non-significant T.S.S. and neck-thickness as well as doubles and bolting percentage. The same finding have been reported by Anonymous (1989-90) in case of rainy season onion from Nasik.

Effect of NPK Interactions :

The N x P, N x K and P x K interactions produced significant results in respect of the growth characters of rainy season onion set crop. The interaction of N3P2, N3K2 and P2K2 combinations gave the best results in enhancing the growth characters. The maximum increase in the growth, yield and quality characters was observed with N3P2K2 combination but it caused determination in quality parameters.

Conclusion:

In a trial with cultivar Agrifound Dark Red, different

Table 2 : Effect of N, P and K on plant height (cm), Number of leaves and fresh wt./plant

Treatments	Plant height (cm)			Number of leaves			Fresh wt. of plant (g)		
	60 DAT	100 DAT	140 DAT	60 DAT	100 DAT	140 DAT	60 DAT	100 DAT	140 DAT
Nitrogen levels									
N_{50}	36.25	60.94	57.57	4.6	8.2	8.9	7.71	61.33	167.95
N_{100}	38.30	65.10	63.14	5.0	8.9	10.2	9.50	70.83	211.20
N_{150}	40.30	67.68	66.60	5.2	9.5	11.7	11.83	91.41	260.41
L.S.D. at 0.05	0.90	1.07	2.38	0.35	0.43	0.35	0.38	2.19	3.85
Phosphorus levels									
P_{40}	37.72	63.62	60.88	4.9	8.6	9.8	9.03	70.50	195.44
P_{80}	38.80	65.52	63.59	5.0	9.1	10.7	10.33	78.55	230.94
L.S.D. at 0.05	0.74	0.87	1.94	NS	0.35	0.30	0.31	1.78	3.14
Potash levels									
K_{50}	37.97	63.51	60.95	4.9	8.8	10.0	9.20	72.38	204.19
K_{100}	38.57	65.63	63.52	5.0	8.9	10.5	10.16	76.66	222.19
L.S.D. at 0.05	NS	0.87	1.94	NS	NS	0.3	0.31	1.78	3.14
Interaction									
N x P	NS	Sig	NS	NS	NS	NS	Sig	Sig	Sig
N x K	NS	Sig	Sig	NS	NS	NS	Sig	NS	NS
P x K	NS	NS	NS	NS	NS	NS	NS	Sig	Sig
N x P x K	NS	NS	NS	NS	NS	NS	NS	NS	NS

NS- Non significant

Table 3 : Effect of N, P and K on dry weight of plant (g), fresh wt. of bulb (g) and dry wt. of bulb (g)

Treatments	Dry Wt. of plant (g)			Fresh Wt. of bulb (g)			Dry Wt. of bulb (g)		
	60 DAT	100 DAT	140 DAT	60 DAT	100 DAT	140 DAT	60 DAT	100 DAT	140 DAT
Nitrogen levels									
N_{50}	1.35	11.22	29.75	1.48	28.66	93.87	0.26	4.95	15.97
N_{100}	1.69	12.68	35.04	1.66	33.83	120.25	0.29	5.63	20.46
N_{150}	2.27	16.14	42.12	2.36	44.83	159.45	0.39	7.58	25.73
L.S.D. at 0.05	0.07	0.50	1.39	0.25	1.73	5.63	0.04	0.27	2.14
Phosphorus levels									
P_{40}	1.62	12.57	33.52	1.64	32.94	117.16	0.28	5.56	19.64
P_{80}	1.92	14.12	37.76	2.03	38.61	131.88	0.34	6.54	31.79
L.S.D. at 0.05	0.06	1.20	1.14	0.20	1.41	4.60	0.03	0.22	1.74
Potash levels									
K_{50}	1.95	13.01	34.69	1.71	34.33	119.50	0.30	5.82	19.93
K_{100}	1.89	13.68	36.58	1.96	37.22	119.53	0.33	6.29	21.50
L.S.D. at 0.05	0.06	1.20	1.14	0.20	1.41	4.60	0.05	0.22	NS
Interaction									
N x P	NS	Sig	Sig	NS	Sig	Sig	Sig	Sig	NS
N x K	Sig	Sig	Sig	Sig	Sig	Sig	Sig	Sig	NS
P x K	NS	NS	NS	NS	NS	NS	NS	Sig	Sig
N x P x K	NS	NS	NS	NS	NS	NS	NS	NS	NS

NS-Non significant

levels of nitrogen, phosphorus and potassium significantly affected the growth characters of onion, but yield characters were found non-significant, Except total yield. The application of nitrogen significantly increased total yield of onion. An application of 150 kg N + 80 kg P_2O_5 + 50 kg K_2O per hectare was most appropriate combination

of nutrients with respect to growth and yield of the rainy season onion crop raised from seedling.

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