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Response of Nitrogen, Phosphorus and Potash on Growth, Yield and Quality of Onion Bulbs during Kharif Season

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ABSTRACT

A field experiment was conducted during Kharif season of 2015 and 2016 at Krishi Vigyan Kendra, Rohtas district of Bihar with cv. Agri found Dark Red to study the effect of different combinations of N, P and K application on growth, yield and quality characters of Kharif onion. In this experiment, different levels of Nitrogen, Phosphorus and Potassium significantly affected the growth, yield and quality of onion significantly. The application of N, P2O5 and K2O significantly increased total onion yield with the combination of 120 kg, 80 kg and 60 kg/ha, respectively and it was found most appropriate combination of nutrients with respect to growth and yield of the Kharif season onion.

Key Words: Bulb, Fertilizers, Growth, Nitrogen, Phosphorus, Potash, Quality, Onion, Yield.

INTRODUCTION

Onion (*Allium cepa* L.) is one of the most important commercial bulb vegetable crop of Rabi and Kharif seasons. Lack of adequate nutrients supply is one of the main factors which limit the yield of bulb onions. The nitrogen application was almost universally reported to have increased growth and yield of onion in India. Therefore an investigation was carried out to determine the requirement of nitrogen, phosphorus and potassium of rainy season onion raised from set at Rohtas district.

The onion develops distinct bulb. According to the variety these bulbs vary in size (small, medium and large) colour (white, yellow and red); shape (flattened round or globular); texture (fine, coarse and pungency). The crop is grown for consumption in green state and as mature bulbs. In India, almost all spicy dishes contain onion as one of the important ingredient used for culinary purposes. Experience has shown that there is always shortage of onion in India and Bihar at Kharif season. This could be attributed to fewer yields per unit area coupled with increase in population. This is due to cultivation of onion due improper cultivation of fertilizers and growing unsuitable varieties condition of an area in Bihar. Optimum fertilizers application for onion and cultivation of suitable varieties in specific environment are necessary for obtaining good yield of onion. The essential nutrients especially the primary macro nutrients nitrogen, phosphorus and potassium (NPK) are necessary for plant growth development and yield.

Kumar *et al* (1998) reported that N at 150 kg/ha gave the best result. It has been observed that combined application of N and P at higher rates produced excellent performance. Singh and Mohanty (1998) recommended rate for 160:80:60. Singh et al (2000) concluded that onion productivity could be enhanced considerably by application of 100:40 Kg. P: 83 kg/ha. According to Ghaffar et al (2003) with application of NPK 130:100:50 NPK kg/ha were showing best result. Onion productivity could be increased substantially through use of improved cultivars and optimum use of fertilizers (Shaheen, 2007). Nitrogen application in onion significantly influences the flavour development and availability of bulb (Randle, 2000). Several researcher have reported higher level of N considerably improved the production of onion over low level of N

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(Mohercy *et al*, 2007; Yaso *et al*, 2007; Nemat *et al*, 2011; Dhital *et al*, 2015).

MATERIALS AND METHODS

The study was conducted during Kharif 2015 and 2016 at Krishi Vigyan Kendra, Rohtas under BAU, Sabour, Bhagalpur with cv. Agrifound Dark Red. The soil sample was obtained and analysed that it has pH 6.2, organic carbon 0.58 per cent, nitrogen 268.8 kg/ha; phosphorus 40.42 kg/ha and potassium 210.46 kg/ha with clay loam texture. Eighteen different combination of nitrogen (80, 100 and 120 kg/ha), phosphorus (40, 60 and 80 kg/ha) and potassium (40 and 60 kg/ha) 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 set were transplanted in 3.0 × 1.0 m plots during the 3rd week of July. The crop was harvested during the month of last November and December. The data were recorded on growth, yield and quality characters and analysed statistically.

RESULT AND DISCUSSION

Effect of Nitrogen

The data (Table 2) indicated that the plant height, leaves per plant, polar diameter, fresh weight of plant and bulb as well as dry weight of plant and bulb increased linearly with increasing level of nitrogen and age of plant. The thickness was not affected by different levels of nitrogen. The reason perhaps for significant increase in the growth characters was due to increasing levels of nitrogen because of more vegetative growth, more chlorophyll and carbohydrates formation in onion plants. Nitrogen performs a critical rate during photosynthesis and also an indispensable part of protein. It is vital for many physiological and trio chemical reactions of plant metabolism. Nitrogen management efficiency assumes greater importance in salt affected soils. Under most agro ecological conditions, nitrogen has been reported as one of the most yield limiting nutrients for crop production and its effective use is imperative for the economic sustainability of cropping system yield increased significantly with each increasing level of nitrogen. The higher dose of nitrogen is essential for built up protoplasm and proteins which induce the cell division and initiate meristematic activity.

Effect of Phosphorus

An application of 80 kg/ha phosphorus significantly increased the plant height levels, fresh weight of plant and bulb weight as well as marketable yield while it was non-significant of Neck thickness equatorial diameter. It was evident that phosphorus plays an important role in plant metabolism associated with meristematic activities appears to be the consequence of increased rate of cell division induced by application of phosphorus. This result was supported by Sharma *et al* (2006). The higher dose of P2O5 application caused more jointed bulbs. The application of 75 kg P gave the best seedling survival reported by Ajay et al (2000) and Rahim (2000) reported that application of P2O5 increased marketable yield.

Effect of Potassium

In case the of potassium higher dose (60 kg/ha) was significantly different for plant height, fresh weight of bulb, growth characters of rainy season onion. Potassium helps in the photosynthesis, translocation and utilization of synthesized carbonates. Potassium is involved in the production and transport of carbohydrate and sugars to the bulb enzyme activation and synthesis of proteins. It also maintains the ionic balance and water status within the plant thereby improving resistance to cold injury and drought. It promotes strong early growth and ensures continued growth and development. Maximize dry matter of sugar accumulation as well as quality. Singh and Mohanty (1998) reported higher yield of better quality of onion with K application.

Table1. Effect of nitrogen, phosphorus and potassium on growth of onion.

Treatment	Days to sprouting	Per cent sprouting of bulb	Plant height (cm)	No. of leaves	Neck thickness (cm)	Polar diameter (cm)
Nitrogen levels (kg/ha)						
N80	7.92	88.05	49.88	8.67	1.57	4.34
N100	7.96	88.00	59.69	10.72	1.65	5.14
N120	8.24	88.92	63.12	11.75	1.64	5.12
CD	NS	NS	1.97	0.52	NS	0.17
Phosphorus level (kg/ha)						
P40	8.02	88.24	55.79	8.60	1.61	4.74
P60	8.02	88.45	58.82	9.40	1.64	4.92
P80	8.11	88.82	58.42	10.52	1.63	4.75
CD	NS	NS	1.97	0.40	NS	0.17
Potassium level (kg/ha)						
K40	8.14	8834	60.41	10.0	1.4	4.82
K60	8.16	88.78	64.53	10.5	1.5	5.02
CD	NS	NS	0.84	0.3	NS	0.17
N×P	NS	NS	SG	SG	NS	SG
N×K	NS	NS	SG	SG	NS	SG
P×K	NS	NS	NS	SG	NS	NS
N×P×K	NS	NS	SG	SG	NS	SG

Effect of NPK Interaction

The interaction of N X P, N X K and P X K produced significant result in respect of the growth characters of Kharif season onion crop. The interaction of N3P3, N3K2 and P3K2 combination gave the best results in enhancing the growth characters. The maximum increase in the growth, yield and quality was observed with N3P3K2 combination. Singh *et al* (2000) concluded that onion productivity could be enhanced considerably by application of 100:80:60 NPK/ha.

CONCLUSION

It was concluded that the different levels of nitrogen, phosphorus and potassium significantly affected the growth characters of onion, in yield characters, bulb weight and marketable yield. An application of 120 kg N + 80 kg P2O5 and 60 kg of K2O per hectare was most appropriate combination of nutrients with respect to growth and yield of the Kharif season.

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Table 2. Effect of nitrogen, phosphorus and potassium on yield and quality of onion.

Treatment	Equatorial diameter (cm)	Bulb weight (g)	Marketable yield (q/ha)	Dry weight of bulb (g)	Total yield
Nitrogen levels (kg/ha)					
N80	5.91	49.48	138.9	15.87	208.4
N100	6.04	63.75	179.2	20.56	294.3
N120	6.17	64.52	185.4	25.76	352.4
CD	0.16	2.34	9.42	2.14	8.3
Phosphorus level (Kg/ha)					
P40	5.99	56.08	150.8	19.65	265.4
P60	6.88	59.56	168.2	25.78	305.6
P80	6.14	61.18	174.3	32.75	350.3
CD	0.16	2.84	9.32	1.74	6.6
Potassium level (kg/ha)					
K40	5.82	58.48	164.5	19.93	256.4
K60	6.04	60.42	182.4	26.48	304.6
CD	0.14	2.14	9.24	1.64	6.8
N×P	NS	SG	SG	SG	NS
N×K	SG	NS	SG	SG	NS
P×K	NS	NS	NS	NS	NS
N×P×K	NS	NS	NS	SG	NS

* NS = Not Significant; SG = Significant

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