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Response of onion (*Allium cepa*) to potassium application

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ABSTRACT

A field experiment was conducted during 1992–94 to study the response of onion (*Allium cepa* L.) to doses, sources and methods of potassium application. The bulb yield increased significantly up to 120 kg K_2O/ha. Sulphate of potash (SOP) resulted in higher bulb yield than muriate of potash (MOP). The bulb yield significantly increased with split application of K_2O, being the highest with 3 splits. Uptake of N and K increased with increasing levels of K_2O up to 120 kg/ha. Application of SOP increased the utilization of N, Ca and Mg compared with MOP. Split application of K increased the utilization of N, K, Ca and Mg compared with its basal application. Uptake of N increased up to 3 splits of K. Increasing levels of K_2O up to 120 kg/ha increased the carbohydrate content in bulb. The pungency also increased by application of K. Bulbs receiving SOP were more pungent than bulbs receiving MOP.

Key words : Onion, Potassium, Sources, Methods of application

Next to nitrogen and phosphorus, potassium is a limiting fertilizer element in Indian soils (Sekhon and Ghosh, 1982). The vegetables often remove more potassium than other crops. Both total requirement (quantity) and rate of supply or K requirement per unit of time (intensity), are equally important in assessing fertilizer need of a crop. Generally, short-duration crops and crop varieties, which depend to a greater extent on the external supplies of nutrients, are more responsive to K than long-duration crops (Sekhon and Ghosh, 1982). In intensive cultivation and fertilizer use, the form and methods of nutrient application needs special attention. For some vegetables, sulphate of potash (SOP). which also meets the sulphur requirement of plant has lower salt index than muriate of potash (MOP) and is free of chlorine, is recommended. As there is a lack of information regarding the sources as well as methods of application of K for cultivation of onion, the present investigation was carried out.

MATERIALS AND METHODS

An experiment was conducted at Lakhaoti, Bulandshahr (28.4° N, 77.1° E with an altitude of 207.3 m above the mean sea-level) during 1992–94 to study the effect of levels, methods of application and sources of K on onion crop. The soil was sandy

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Table 1. Effect of doses, sources and method of potassium application on yield, dry-matter yield, total soluble solids (T.S.S.), carbohydrate content and pungency of onion bulbs

Treatment	Bulb yield (tonnes/ha)		Dry-matter yield (q/ha)		T.S.S. (%)		Carbohydrate content (%)		Pungency (mg volatile S/100 g)	
	1992–93	1993–94	1992–93	1993–94	1992–93	1993–94	1992–93	1993–94	1992–93	1993–94
K_2O (kg/ha)										
0	21.58	21.67	22.34	22.42	12.2	12.2	7.55	7.60	45.00	45.17
40	22.53	22.80	24.26	23.66	12.1	12.0	9.00	9.10	45.14	45.50
80	24.22	24.60	25.48	24.86	12.0	12.1	9.47	9.55	45.55	45.88
120	25.26	25.77	25.52	25.01	12.1	12.2	9.80	9.82	45.87	46.20
160	25.50	25.95	26.02	25.22	12.1	12.1	10.00	10.05	46.13	46.50
CD (P=0.05)	0.86	1.02	1.02	1.18	NS	NS	0.32	0.26	0.12	1.24
K_2O sources										
Muriate of potash	22.31	22.50	24.46	24.02	12.1	12.0	9.12	9.19	42.30	42.45
Sulphate of potash	25.34	25.83	24.98	24.43	12.2	12.1	9.20	9.25	49.05	49.22
CD (P = 0.05)	0.26	0.18	NS	NS	NS	NS	NS	NS	0.10	1.12
Mathods of K_2O application										
Full basal	23.24	23.58	23.70	24.16	12.1	12.0	9.08	9.11	45.20	45.55
½ basal + ½ 1 MAT	23.72	23.98	24.63	24.20	12.1	12.1	9.17	9.22	45.62	45.55
½ basal + ½ 2 MAT	24.02	24.39	24.72	24.22	12.2	12.2	9.19	9.27	45.55	45.88
⅓ basal + ⅓ 1 MAT + ⅓ 2 MAT	24.43	24.60	24.82	24.34	12.2	12.1	9.20	9.28	45.76	46.02
CD (P=0.05)	0.28	0.20	NS	NS	NS	NS	NS	NS	NS	NS

MAT, Month after transplanting

Table 2. Effect of doses, sources and method of potassium application on uptake of nutrients by onion bulbs

Treatment	Uptake of nutrients (kg/ha)							
	N		K		Ca		Mg	
	1992–93	1993–94	1992–93	1993–94	1992–93	1993–94	1992–93	1993–94
K_2O (kg/ha)								
0	24.60	24.27	14.89	14.30	6.47	6.28	4.75	4.55
40	27.71	27.82	19.38	18.47	6.53	6.61	4.73	4.56
80	31.24	31.49	27.13	26.32	6.30	6.15	4.60	4.18
120	34.10	34.53	31.83	30.67	6.06	5.70	4.54	3.67
160	33.15	33.22	33.66	33.48	5.36	4.67	3.57	3.11
CD (P=0.05)	2.80	3.02	4.24	4.02	0.06	0.32	1.10	1.24
K_2O source								
Muriate of potash	26.77	26.55	24.54	23.63	5.58	5.40	3.57	3.38
Sulphate of potash	33.45	33.84	25.34	24.80	6.84	6.72	5.07	4.91
CD (P=0.05)	1.48	2.12	NS	NS	0.03	0.28	0.64	0.82
Mathods of K_2O application								
Full basal	27.89	28.82	22.31	21.93	6.04	5.66	4.18	4.24
½ basal + ½ 1 MAT	29.89	29.89	24.91	24.22	6.17	6.23	4.27	4.08
½ basal + ½ 2 MAT	30.23	30.46	25.94	25.12	6.49	6.10	4.56	4.39
⅓ basal + ⅓ 1 MAT + ⅓ 2 MAT	32.00	32.98	26.87	26.32	6.35	6.39	4.64	4.94
CD (P=0.05)	1.68	2.24	2.43	2.13	0.04	0.30	0.64	0.68

MAT, Month after transplanting

loam with pH 8.3, having available N 186.0 and 190.0 kg/ha, available P 6.6 and 7.0 kg/ha and available K 149.8 and 150.50 kg/ha during 1992 and 1993 respectively. The treatments consisted of 2 sources of K (MOP and SOP), 5 levels of K_2O (0,40, 80, 120 and 160 kg/ha) and 4 methods of K application [full basal, ½ basal and ½ at 1 month after transplanting (MAT) ½ basal and ½ at 2 MAT, ⅓ basal, ⅓ at 1 MAT and the remaining ⅓ at 2 MAT]. The experiment was laid out in split-plot design with methods of application and sources of K in main plots and levels of K_2O in subplots, replicated thrice.

RESULTS AND DISCUSSION

Yield

Application of K significantly affected the yield and dry-matter yield of bulbs, but had no effect on TSS. The bulb and dry-matter yields markedly increased with each increasing level of K up to 120 and 80 kg K_2O/ha respectively (Table 1). It might be attributed to soil deficient in available K. The SOP resulted in significantly higher bulb yield than MOP. The greater response to SOP might be ascribed to increased availability of S in soil which was deficient in it (9 kg/ha available). Split application of K was superior to its basal application. The yield of bulbs increased with more number of split application (Table 1). This might be due to the fact that application of K in splits facilitated uniform supply of K throughout the growth period of crop. The leaching losses could be higher with single dose. These results are in agreement with those of Sharma (1994).

Quality of onion bulb

The increasing level of K_2O up to 120 kg/ha markedly increased the carbohydrate content in bulb (Table 1). The pungency increased markedly with every increase in level of K up to 160 kg K_2O/ha in 1992–93. However, in 1993–94, the increase was noticed with the highest level of 160 kg K_2O/ha only. The bulbs receiving SOP were more pungent than those receiving MOP. This may be due to greater availability of S in soil with application of SOP. These results are in agreement with those of Rathore (1991). Carbohydrate content and pungency were not affected by methods of K application.

Uptake of nutrients

The uptake of N and K increased with every increase in the level of K_2O up to 120 kg/ha. Utilization of Ca decreased for each increase in the level of K_2O beyond 40 kg/ha. The uptake of Mg decreased at the highest level of 160 kg K_2O/ha. Application of SOP increased utilization of N, Ca and Mg than that of MOP. Split application of K increased the utilization of N, K, Ca and Mg compared with its basal application. Uptake of N with 3 splits of K was greater than that with its 2 splits (Table 2). Singh and Singh (1975) also reported similar results. Potassium-use efficiency of the crop was the highest at 80 kg K_2O/ha.

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