Seed Research Vol. 34(1) 31-34, 2006

Effect of Potassium Levels , Methods and Sources on Seed Yield and Quality of Pea cv. Arkel

S.K. SHARMA, K.S. VERMA AND MANISH KUMAR
Department of Vegetable Crops, Dr. YS Parmar University of Horticulture and Forestry
Nauni, Solan 173230

ABSTRACT The present investigations were carried out at Vegetable Research Farm, Department of Vegetable Crops, Dr. Y.S. Parmar University of Horticulture and Forestry, Nauni, Solan (H.P.) during winter season of 2001-2002. The treatments included four levels of potassium (K : 32.5 kg K_2O/ha, K_2: 65 kg K_2O/ha. K_3 : 97.5 kg K_2O/ha and K_4 : 130 kg K_2O/ha), two methods of potassium application (M_1 : whole applied as a basal dose, M_2 : 50% applied as basal dose and 50% through split dose) and two sources of potassium (S_1 : potassium chloride, S_2 : potassium sulphate). It was observed that application of 65 kg K_2O/ha as 50% basal and 50% split as side dressing at flowering stage through potassium sulphate resulted in a maximum seed yield in pea cv. Ankel.

Keywords: Pea, arkel, potassium, methods of application, sources of potassium and yield, seed quality

Among the macro-nutrients, potassium plays an indispensable role and is considered to be root booster, stalk strengthener, food former, enzyme activator, water stretcher, sugar and starch transporter, protein builder, wilt reducer and disease retarder. Further, it plays a major role in many physico-chemical, biological and histological mechanisms of the plant. It is considered essential for seed development. Efficiency of potassic fertilizer increases when applied in splits over its application as a basal dose [1]. Application of potassium in the form of potassium sulphate has shown increased yield per unit area as compared to potassium chloride. The present studies were initiated with the objective to find out the suitable potassium level, method of application and sources of potassium application in pea seed production.

MATERIALS AND METHODS

The present study was conducted at Vegetable Research Farm, Dr. Y.S. Parmar University of Horticulture and Forestry, Nauni, Solan (H.P.) during winter season of 2001-2002 on a well drained soil. The initial status of the soil was neutral in reaction, rich in organic carbon, medium in nitrogen, potassium and high in phosphorus. Treatments included four levels of potassium (K_1 : 32.5 kg K_2O/ha, K_2 : 65.0 kg K_2O/ha, K_3 : 97.5 kg K_2O/ha and K_4 : 130.0kg K_2O/ha), two methods of potassium application (M_1 : whole applied as a basal dose, M_2 : 50% applied as a basal dose and 50% through split dose) and two sources of potassium (S_1 : potassium chloride, and S_2 : potassium sulphate). Seeds of pea cv. Arkel were sown on 27.12.2001.

In all 16 treatments were laid out in a randomized block design in a plot size 2.25 x 2.0 m at a spacing of 45 x 7.5 cm. Observations were recorded on number of seeds per pod, seed yield per plot, biological yield per plot, harvest index, 100 seed weight, per cent seed germination, seedling length and seed vigour index.

RESULTS AND DISCUSSION

Effect of level of potassium

The percentage increase in yield over K_1 (32.5 kg K_2O/ha) in K_2 (65 kg K_2O/ha), K_3 (97.5 kg K_2O/ha) and K_4 (130 kg K_2O/ha) was 15.8, 16.9 and 16.5 per cent, respectively (Table 1). The increase in

Received Sept., 2003 Revised Oct., 2005 Accepted Feb., 2006

Table 1. Effect of different levels, methods of application and sources of potassium on number of seeds per pod, seed yield biological yield and harvest index in pea seed production.

Treatment	Number of seeds/ pod	Seed yield/ plot(g)	Seed yield/ ha (q)	Biological yield/ha (q)	Harvest index	100 seed weight (g)	Germination (%)	Seed vigour index
Levels of potassium (Kg K_2O/ha)								
32.5 (K_1)	5.1	419	9.32	51.00	0.182	16.57	88.9	1953
65.0 (K_2)	5.3	485	10.77	53.55	0.202	16.66	90.5	2047
97.5 (K_3)	5.3	490	10.88	50.98	0.214	16.68	89.7	2029
130.0 (K_4)	5.3	488	10.85	54.00	0.201	16.68	89.3	2023
S.E. ±	0.09	4.62	0.10	0.61	0.002	0.07	1.61	47
$CD_{0.05}$	0.18	9.43	0.21	1.25	0.004	NS	NS	NS
Methods of application								
Whole as basal (M_1)	5.2	452	10.04	50.55	0.20	16.63	88.5	1955
50% basal + 50% split (M_2)	5.3	489	10.87	53.40	0.20	16.66	90.6	2072
S.E. ±	0.06	3.26	0.07	0.43	0.001	0.05	1.14	33
$CD_{0.05}$	NS	6.67	0.15	0.88	NS	NS	NS	68
Sources of potassium								
Potassium chloride (S_1)	5.2	462	10.25	51.63	0.198	16.64	89.5	1995
Potassium sulphate (S_2)	5.3	479	10.65	53.04	0.201	16.65	89.7	2032
S.E. ±	0.06	3.26	0.07	0.43	0.001	0.05	1.14	33
$CD_{0.05}$	NS	6.67	0.15	0.88	0.002	NS	NS	NS

potassium level above 65 kg/ha did not show any significant improvement in seed yield. Similar situation existed for biological yield (Table 1). However, harvest index was maximum at 97.5 kg K_2O/ha being significantly superior over 32.5 kg K_2O/ha. The possible increase in yield and yield contributing characters by the application of potassium may be because it is directly or indirectly involved in major plant processes, metabolism of carbohydrates and source sink ratio. Further potassium also helps in better growth because of its role in cell division and cell elongation. Similar results have also been reported by other workers [3-6].

Different levels of potassium could not exert significant influence on 100 seed weight (Table 1). These findings are in line with those of Akulov [7] who reported that genotypes were predominant in determining 100 seed weight. Potassium application also could not exert significant effect on per cent seed germination, seedling length and seed vigour index. Similar results were also obtained by Hadavizadeh [8] who reported that potassium levels have no effect on seed quality characters of pea.

Methods of potassium application

Maximum seed yield per plot and per hectare, biological yield per plot and per hectare were obtained when potassium was applied as 50% basal and 50% split at the flowering stage. Per cent increase in seed yield in M_2 (50% basal and 50% split) over M_1 (whole as basal dose) was 8.19 per

Table 2. Interaction between levels and methods of potassium application on seed yield of pea.

Treatment ($Kg\ K_2O$/ha)	Seed yield/plot (g)		Seed yield/ha (q)	
	Whole as basal (M_1)	50% as basal and 50% split (M_2)	Whole as basal (M_1)	50% as basal and 50% split (M_3)
32.5 (K_1)	404	435	8.98	9.66
65 (K_2)	465	505	10.33	11.21
97.5 (K_3)	470	509	10.44	11.31
130 (K_4)	469	508	10.41	11.29
SE ±	6.53	6.53	0.15	0.15
C.D.=0.05	13.31	13.31	0.30	0.30

Table 3. Interaction between levels and methods of potassium application on seed yield of pea.

Methods of application	Seed yield/plot (g)		Seed yield/hactare (q)		Biological yield/plot (kg)		Biological yield/ha (q)	
	Potassium chloride	Potassium sulphate	Potassium chloride	Potassium sulphate	Potassium chloride	Potassium sulphate	Potassium chloride	Potassium sulphate
	(S_1)	(S_2)	(S_1)	(S_2)	(S_1)	(S_2)	(S_1)	(S_2)
Whole as basal (M_1)	437	467	9.71	10.37	2.20	2.30	49.01	51.17
50% basal ± 50% split (M_2)	486	492	10.80	10.93	2.44	2.45	54.24	54.91
S.E. ±	4.62	4.62	0.10	0.10	0.02	0.02	0.61	0.61
C.D.0.05	9.41	9.41	0.20	0.20	0.05	0.05	1.24	1.24

cent. Increase in yield by split method of potassium application may be because of the reason that the potassium uptake continues upto the later stage of the crop growth and thus the over all process of split method of application may be associated with rapid plant metabolism within a very short time rather than whole method of application at the time of sowing. Increase in yield by split method of application of potassium has been reported by Singh and Singh [9], Sud and Grewal [10] and Rastogi and Sharma [11] in pea. Methods of potassium application could not exert significant effect on harvest index.

Amongst the seed quality characters, methods of application did not show significant effect with respect to 100 seed weight and per cent seed germination (Table 1). These results are in line with those of Akulov [7]. Seedling length and seed vigour index was maximum at M_2 (50% applied as basal and 50% split) having significant differences over M_1. The possible reasons for higher vigour index at split method of potassium application may be its association with rapid metabolism resulting in quick cell division and elongation.

Sources of potassium

Per cent increase in seed yield per hectare at S_2 (potassium sulphate) over S_1 (potassium chloride) was 3.7 per cent. The possible reason for higher yield was that the potassium sulphate adds sulphur to the soil which might have increased the yield. Similar observations have been made by Loch and Petho [12]. Both sources of potassium application found to be non-significant with respect to number of seeds per pod, 100 seed weight, per cent seed germination, seedling length and vigour index (Table 1).

Interaction effect between level x method of potassium application was found significant (Table 2). It was because in both (as basal or split dose), there was no significant increase in yield beyond 65kg/ha potassium application. Interaction between method x source of potassium application showed significant effect. It was due to the fact that as a basal dose potassium sulphate was significantly superior but at the split dose both (K_2SO_4 & KCl) salts were equally effective for seed yield/biological yield (Table 3). This may be possible due to the fact that efficiency of potassic fertilizer increases when applied in splits over its application as a basal dose [13] and better transportation of K_2SO_4 as compared to KCl.

The interaction between level x method x source could not have a significant effect on seed yield per plot and per hectare although maximum cost benefit ratio was obtained at $K_2M_2S_2$ (65 k_2O/ha applied as 50% basal and 50% split through potassium sulphate) treatment combination. This may possible because that potassium is involved in metabolism of carbohydrates essential for seed development. Further, its application through split is also associated with rapid plant metabolism resulting in higher plant yield.

REFERENCES

1. TANDON, H.L.S. & G.S. SEKHON (1988). Twenty years of research in soil and fertilizer potassium in India - some highlights. *Fert. News.* 33 (10) : 21-33.
2. MUTHUKRISHNAN, C.R., A. SHANMUGAM & C. SRINIVASAN, (1973). Potassium needs of major vegetables in Tamil Nadu. *Potash Newsletter.* 8(1): 24-27.
3. PERSHAK, I.T. & L.D. TISHCHENKO (1987). Effectiveness of applying fertilizers to peas under conditions of Ukrainian forest steppe. *Agrokhimiya.* 3: 48-50.
4. PACHAURI, D.C., P.C. THAKUR & T.S. VERMA (1988). Effect of different levels of nitrogen, phosphorus and potash on seed yield of peas. *Prog. Hor.* 22(1-2) :58-62.
5. MINAR, J. & J. ZEHNALEK (1989). The effect of increasing doses of potassium and nitrogen on the growth, chlorophyll content and accumulation of mineral nutrients in pea (*Pisum sativum* cv. Liliput). *Scripta Facultatis Scientarum Naturalium Universitatis Purkynianae Brunensis.* 19(1-2): 3-22 : 51.
6. MICHALOJC, Z. (1997). Effect of nitrogen-potassium fertilizer application on the yield and chemical composition of pea. *Annales Universities Marial Curie Sklodowska Sectio Horticultura,* 5 : 179-188.
7. AKULOV, A.S. (1986). Variation in certain quantitative traits in peas grown under different conditions, *Nauchno-Technicheskii Byulleten Vsesoyuznogo Nauchno Issledovatel skogo Instituta Zernobobovykh Nauchno Krupyanykh Kul'tur.* 35 : 38-39.
8. HADAVIZADEH, A (1989). The effect of mother plant nutrition on seed yield, quality and vigour in peas. *Dissertation Abstr. Intern. B. Sci. & Engineering.* 50(3): 1698.
9. SINGH, O.N. & R.P. SINGH (1981). Response of potassium fertilizer application in pea. *Pulse Crop News Letter,* 1(2): 58.
10. SUD, K.C. & J.S. GREWAL (1991). Evaluation of methods of potassium application in potato production on acidic soils of Shimla. *J. Potassium Res.* 8 (2) : 137-143.
11. RASTOGI, K.B. & D.P. SHARMA (1999). On-farm trials on the response of vegetables to fertilizer application, potash and phosphatic. Institute of Canada, India Programme, Gurgaon. India.
12. LOCH, J. & F. PETHO (1991). Effect of potassium sulphate on the yield and quality of vegetables. *Pot. Rev.* 3 : 45-47.
13. TANDON, H.L.S. & G.S. SEKHON (1988). Potassium Research and Agricultural Production in India. FDCO. New Delhi.