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Short Note

Response of different levels, methods and sources of potassium on the green pea production

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Pea is an important leguminous cool season vegetable crop being grown in Himachal Pradesh covering an area of 9,830 hectares with a total production of 94,170 metric tonnes (Anonymous, 2003). It is very palatable and nutritious for human consumption viz., fresh, canned, frozen or in dehydrated forms. It is a rich source of digestible proteins, carbohydrates, vitamins and minerals. The productivity can be enhanced by better crop management practices. Among the major nutrients, potassium is required for carbohydrate metabolism and translocation, protein synthesis, water regulation and enzyme activation. Potassium has also been reported to impart tolerance to plants to environmental stresses viz., drought, frost, wind, high and low temperature. It also increases resistance of plant to diseases and insects pests and is considered essential for grain development. Increase in yield by the application of potassium has earlier been reported by Pershak and Tischenko (1987), Gill and Kataria (1989) and Rastogi (1995), but not much work has been done regarding its methods and sources of application.

Keeping these objectives in mind a field experiment was laid out at Vegetable Research Farm, Dr. Y.S. Parmar University of Horticulture and Forestry, Nauni, Solan (H.P.) during the winter season of 2001-2002 on a well drained soil, neutral in reaction (pH= 7.02), rich in organic matter (1.01) and medium in available nitrogen (329.2 kg/ha) and potassium (234.17 kg/ha) an high in available phosphorus (51.30 kg/ha). There were 16 treatment combinations comprising 4 levels of potassium (K_1-32.5 kg K_2 O/ ha, K_2- 65 kg K_2 O/ha, K_3-97.5 kg K_2 O/ha and K_4-130 kg K_2 O/ha), two methods of potassium application (M_1-whole applied as a basal dose, M_2-50% applied as basal dose and 50% top dressed and two sources of potassium (S_1- potassium chloride and S_2- potassium sulphate). The trial was laid out in a randomized block design in a plot size of 2.25 x 2.0 m at a spacing 45 x 7.5 cm on the cultivar Arkel. The seeds of cultivar Arkel were sown on 27.12.2001. The observations were recorded on plant height, pod length and pod width, number of green pods per plant, number of pod clusters per plant, number of green peas per pod, green pod yield per plot and per hectare, green biological yield per plot and per hectare, harvest index for green pea production and available potassium in the soil after crop harvest. The results from the following finding are head-wise presented as under and discussed suitably in the light of the available literature.

Effect of level of potassium

Different levels of potassium significantly affected plant height which was recorded the maximum (42.96 cm) at 97.5 kg K_2O/ha (Table 1). The possible reasons may be that potassium plays a role in increasing the plant height (Zimmermann, 1978). Similar results have been reported by Shekhar and Sharma (1991).

The length and width of green pods did not increase with increasing level of potassium application (Table 1). These findings are also similar to those of Naik (1989) and Kohli *et al.* (1992) who did not find any appreciable response of potassium application.

The number of green pods and pod clusters per plant were significantly affected by individual level of potassium application resulting in the highest number at 97.5 kg K_2 O /ha (Table 1). This may be because of the reason that potassium helps in establishing better root system which ultimately leads to luxuriant plant growth. Similar results have been obtained by Adams *et al.* (1973), Besford and Maw (1975) and Mehta and Saini (1986).

Green pod yield per plot and per hectare was significantly affected by increasing level of potassium

Table 1. Effect of different levels, methods of application and fertilizer sources of potassium on growth characters of pea

Treatment	Plant Height (cm)	Green pod length (cm)	Green pod width (cm)	Number of green pods per plant	Number of pod clusters per plant	Number of green peas per pod
Levels of potassium kg/ha (K_2O)						
32.5 (K_1)	42.06	7.81	1.25	8.01	3.10	5.39
65.0 (K_2)	42.90	7.88	1.26	9.08	3.39	5.58
97.5 (K_3)	42.96	7.90	1.25	9.12	3.37	5.60
S.E.±	0.30	0.11	0.02	0.09	0.10	0.12
CD (P=0.05)	0.61	NS	NS	0.19	0.21	NS
Methods of application						
Whole as basal (M_1)	42.50	7.87	1.25	8.71	3.26	5.54
50% basal + 50% Top dress (M_2)	42.84	7.89	1.27	8.97	3.37	5.55
S.E. ±	0.22	0..08	0.13	0.06	0.07	0.09
CD (P=0.05)	NS	NS	NS	0.13	NS	NS
Sources of potassium						
Potassium chloride(S_1)	42.54	7.78	1.25	8.80	3.31	5.54
Potassium sulphate S_2)	42.80	7.88	1.27	8.87	3.34	5.55
S.E. ±	0.21	0.08	0.13	0.06	0.07	0.09
CD (P=0.05)	NS	NS	NS	NS	NS	NS

application and maximum yield was obtained at 97.5 kg K_2O /ha (Table 2) which was at par with K_2 and K_4. The yield increased by 11.47, 13.90 and 13.38 per cent over K_1 by K_2, K_3 and K_4, respectively. The maximum pod length, pod width, number of pods per plant, number of green seeds per pod obtained at 97.5 kg K_2O /ha might have contributed to the highest yield at his level. Potassium is involved in regulation of enzyme system, photosynthesis, respiration, protein synthesis and translocation of food materials thereby increases yield of crop plants. Similar were the research findings of Pershak and Tischenko (1987), Gill and Kataris (1989), Usherwood (1993) and Rastogi (1995).

Green biological yield per plot and per hectare was significantly influenced and the maximum value was obtained at 130 kg K_2O /ha which was at par with K_2 and K_3 attributed to vigorous growth by potassium application (Muthukrishnan *et al.*, 1973). Effects of potassium levels on harvest index for green pea production were non significant. Similar observations were reported by Cutcliffe and Munro (1980).

Significant effect was observed with respect to available potassium in the soil after crop harvest for different potassium levels (Table 2). The maximum value for available K after crop harvest was obtained at 130 kg K_2O /ha which was at par with K_3. It is obvious that after meeting out the plant requirements and fixing capacity of the soil, the unutilized K continues to build up the available potassium of the soil.

Methods of potassium application

Significant effects of methods of potassium

Table 2. Effect of different levels, methods of application and fertilizer sources of potassium on yield, biological yield and harvest index of green pea

Treatment	Green pod yield/plot (kg)	Green pod yield/ha (q)	Green biological yield/plot (kg)	Green biological yield/ha (q)	Harvest index for green pea production	Available potassium in soil (kg K_2O/ha)
Levels of potassium kg /ha (K_2O)						
32.5 (K_1)	2.88	63.94	6.28	139.5	0.458	248.3
65.0 (K_2)	3.20	71.28	6.95	154.4	0.461	261.3
97.5 (K_3)	3.28	72.83	6.98	155.6	0.469	264.3
130.0 (K_4)	3.26	72.50	7.07	157.1	0.469	279.3
S.E±	0.07	1.62	0.18	4.11	0.006	7.97
CD (P=0.05)	0.14	3.32	0.37	8.40	NS	16.29
Methods of application						
Whole as basal (M_1)	3.03	67.53	6.58	146.4	0.461	263.0
50% basal + 50% split (M_2)	3.27	72.75	7.06	156.8	0.464	263.7
S.E. ±	0.05	1.15	0.13	2.90	0.004	5.64
CD (P=0.05)	0.10	2.35	0.26	6.00	NS	NS
Sources of potassium						
Potassium chloride (S_1)	3.14	69.67	6.80	150.9	0.461	264.4
Potassium sulphate (S_2)	3.18	70.61	6.84	152.3	0.464	262.2
S.E. ±	0.05	1.15	0.13	2.90	0.004	5.64
CD (P=0.05)	NS	NS	NS	NS	NS	NS

application were observed for the traits number of green pods/ plant and green pod yield per plot, green pod yield per hectare, biological yield per plot and biological yield per hectare (Table 2) and the maximum values with respect to these characters were obtained when potassium was applied as 50% basal and 50% as top dressed. The per cent increase in yield per hectare at M_2 (50% basal and 50% split) over M_1 (whole as a basal dose) was 7.72 per cent. It may be because efficiency of potassium fertilizer increased when applied in splits over its application as a basal dose as reported by Tandon and Sekhon (1998). Increase in yield by split method of application of potassium has been reported by Singh and Singh (1981) and Rastogi (1995) in pea. The results with respect to other traits were found non – significant.

Sources of Potassium

Both the sources of potassium viz., Potassium Sulphate and Potassium Chloride were found at par. Similar results were reported by Loch and Petho (1991) as well.The interaction effects between levels, methods and sources of potassium application were found non- significant.

The maximum cost benefit 1:1.04 was obtained at $K_3M_2S_2$ (97.5 kg K_2O /ha applied as 50% basal and 50 % top dress through potassium sulphate) and $K_2M_2S_2$ (65 kg K_2O /ha applied as 50 % basal and 50 % top dress through potassium sulphate) treatment combinations (Table 3).

Table 3. Economics of green pea (Arkel) production during 2001-2002

Treatment combinations	Seed yield (q/ha)	Gross returns* (Rs.)	Expenditure per treatment (Rs.)	Net returns (Rs.)	Benefit : cost ratio
$K_1M_1S_1$	62.00	62000	36180	25820	0.71
$K_1M_1S_2$	62.67	62670	36280	26390	0.73
K_1M2S_1	63.78	63780	36420	27360	0.75
$K_1M_2S_1$	67.33	37330	36520	30810	0.84
$K_2M_1S_1$	67.11	37110	36421	30687	0.84
$K_2M_1S_2$	68.44	38440	36621	31819	0.87
$K_2M_2S_1$	74.22	74220	36661	37599	1.03
$K_2M_2S_2$	75.33	75330	36861	38469	1.04
$K_3M_1S_1$	70.00	70000	36862	33338	0.91
$K_3M_1S_2$	70.22	70220	36962	33260	0.89
$K_3M_2S_1$	75.33	75330	36902	38428	1.04
$K_3M_2S_2$	75.78	75780	37202	38578	1.04
$K_4M_1S_1$	69.78	69780	36903	32578	0.89
$K_4M_1S_2$	70.00	70000	37304	32696	0.87
$K_4M_2S_1$	75.11	75110	37143	37967	1.02
$K_4M_2S_2$	75.11	75110	37544	37566	1.00

* Sale rate of green pods @ Rs. 1000/q

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