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Effect of farmyard manure, fertilizer levels and plant density on the performance of garden pea (*Pisum sativum* L.) in high hill dry temperate conditions

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Abstract

A field experiment was conducted during summer season of 2002 and 2003 in Lahaul valley under high hill dry temperate zone of Himachal Pradesh to study the effect of farmyard manure, fertilizer levels and planting density on yield attributing characters and pod yield of garden pea (*Pisum sativum* L.). The two levels of farmyard manure (0 and 20 t/ha), and 3 levels of fertilizers (50, 100 and 150 % of recommended dose of 20:60:30 kg N, P_2O_5 and K_2O /ha, respectively) and 3 row spacing (30, 45 and 60 cm) were evaluated in split plot design with three replications. The application of farmyard manure significantly increased the pod yield alongwith the yield attributing traits. An application of 150% NPK significantly out yielded the other two fertilizer combinations of 100 and 50% for green pod yield and other plant characters *viz.*, plant height, pods per plant, shelling (%) and straw yield. Low density plantation significantly increased pod yield and related characters. It can be concluded that application of farmyard manure @ 20 t/ha, 30:90:45 kg N, P_2O_5 and K_2O t/ha and close row spacing of 30 cm significantly increased the pod yield of garden pea.

Key words: Garden pea, farmyard manure, fertilizers, planting density and economics.

Introduction

Garden pea (*Pisum sativum* L.) is an important off-season vegetable crop grown in the high hill dry temperate conditions of Himachal Pradesh. The green pods available in summer months find ready market in the plains bringing high economic returns to the poor tribes particularly of Lahaul valley. Moreover, due to heavy snowfall and far sub zero temperature in these tribal areas, no crop can be raised and area remains cut off from the rest of world during winter. Hence, its successful off season cultivation provides employment and boost the income of poor tribes. The yield of pea is influenced by numerous agronomical, ecological and edaphic factors like environment, fertility of the soil and cultural practices. Among these, the fertility of the soil and planting geometry are the prime considerations for increasing crop yield. With this background, a field experiment was conducted to study the effect of farmyard manure, fertilizer levels and plant density on the productivity and profitability of garden pea.

Material and Methods

A field experiment was conducted during summer 2002 and 2003 at Experimental Farm of High Land Agricultural Research and Extension Centre, Kukumseri, in Lahaul and Spiti district of Himachal Pradesh. The centre is situated at an elevation of 2672m above mean sea level in a dry temperate zone in North Western Himalayas. Lahaul valley is characterized by the sloppy mountains with short snowless growing season of six months during April to September. The soil of experimental field was sandy loam in texture having pH 6.9, organic carbon 0.62% and 190, 39 and 156 kg N,P and K/ha, respectively. The experiment was laid out in split plot design with 3 replications and 18 treatment combinations. The main plots consisted of combination of two levels of farmyard manure (0 and 20 t/ha) and 3 levels of fertilizers (50, 100, 150 per cent of the recommended dose of 20:60:30 kg N, P_2O_5 and K_2O /ha, respectively), while sub plot treatments consisted of 3 planting geometries (30 cm x 10 cm, 45cm x 10 cm and 60cm x 10 cm). "Azad P-1" garden pea was sown in plot size of 2.7 m x 2.4 m at the respective spacings. Full dose of farmyard manure, N, P_2O_5 and K_2O as per treatments were applied at the time sowing. The data were recorded on randomly selected five plants for plant height (cm), pods per plant, seeds per pod and shelling (%). The green pod yield and straw yield were recorded on plot basis and were converted to quintals per hectare. The data for each individual year were statistically analyzed as per the standard procedure. Economics was calculated on the basis of prevalent market prices of inputs and outputs.

Results and Discussion

Effect of farmyard manure

The application of farmyard manure @ 20 t/ha significantly increased the plant height, shelling (%), green pod yield and straw yield compared with the control in both the years of study (Table 1), while pods per plant and seeds per pod increased significantly in 2002 only. The application of farmyard manure increased the green pod yield significantly by 7.1 per cent at 20 tonnes per hectare over control in both the years. The beneficial effect of organic manure on yield and its attributing characters might be because of additional supply of plant nutrients as well as improvement in physical and biological properties of the soil (Majumdar *et al.*, 2002). The additional improvement in pod yield because of farmyard manure application might be due to cumulative effect of improvement in vegetative growth and yield attributes. The net returns were also high with the application of farmyard manure.

Effect of fertilizers

The pod yield and related attributes significantly increased with increase in fertilizer dose (Table 1). The highest pod yield (98.6 and 97.0 q/ha during 2002 and 2003, respectively) was recorded with 150 per cent N, P and K. The higher yield could be attributed to increased growth and yield parameters owing to accumulation of more photosynthates in sink. The highest dose of N, P and K increased yield by 4.45 and 3.97 per cent over recommended and by 26.09 and 25.81 per cent over 50% in 2002 and 2003, respectively. The finding is in consonance with Naik (1989) and Bahadur and Singh (1990).

The increase in pod yield due to the application of N, P and K may be attributed to the fact that these nutrients being important constituents of nucleotides, proteins, chlorophyll and enzymes involved in various metabolic processes, which have direct impact on vegetative and reproductive phases of plants (Mengel and Kirkby, 1996). The net returns were also increased at 150% to the tune of around Rs. 4,000 and Rs.3,500 during the first and second year, respectively over the recommended fertilizer application (Table 2).

Planting density

High density plantation significantly increased plant height, green pod yield and straw yield over low density during both the years.However, yield attributing characters *viz.*, number of pods per plant, number of seeds per pod and shelling per centage were significantly increased with the lower planting densities. The closer spacing (30 cm x 10 cm) significantly increased yield by 5.4 and 5.3 % over 45 cm and 8.3 and 8.2 per cent over 60 cm in 2002 and 2003, respectively. Similar results were also reported by Naik (1989), Saimbhi *et al.* (1990) and Yadav *et al.* (1990).The closer spacing gave higher net returns of Rs.88,530 and Rs.85,073 in the first and second year, respectively as compared to wider spacings.

Table 1. Effect of levels of farmyard manure, recommended dose of fertilizers and plant density on the growth and yield of garden pea

Treatment	Plant height (cm)		No. of pods per plant		No. of seeds per pod		Shelling (%)		Green pod yield (q/ha)		Straw yield (q/ha)	
	2002	2003	2002	2003	2002	2003	2002	2003	2002	2003	2002	2003
FYM levels (t/ha)												
0	55.9	55.6	10.9	10.6	9.4	9.2	61.2	60.7	87.3	86.1	10.5	10.3
20	57.8	57.6	11.2	10.9	9.5	9.3	62.3	61.8	93.5	92.2	11.6	11.3
CD (P=0.05)	0.69	0.47	0.15	NS	0.10	NS	0.37	0.28	0.77	0.61	0.15	0.24
Fertility levels ($N:P_2O_5:K_2O$ /ha of the recommended)												
50%	55.4	55.1	10.5	10.3	8.9	8.8	60.5	60.0	78.2	77.1	9.3	9.0
100%	57.0	56.8	11.2	10.8	9.3	9.1	61.6	61.2	94.4	93.3	11.7	11.5
150%	58.1	58.0	11.5	11.1	10.1	9.9	63.1	62.6	98.6	97.0	12.2	11.9
CD (P=0.05)	0.52	0.42	0.40	0.25	0.14	0.39	0.63	0.23	0.80	1.42	0.16	0.31
Spacing (cm)												
30X10	57.6	57.2	10.6	10.3	8.9	8.8	60.8	60.3	94.4	93.1	11.8	11.4
45 X10	56.7	56.6	11.2	10.8	9.5	9.4	61.9	61.5	89.6	88.4	10.9	10.7
60 X10	56.4	56.1	11.4	11.1	9.8	9.7	62.5	62.1	87.2	86.0	10.5	10.3
CD (P=0.05)	0.61	0.64	0.32	0.24	0.18	0.17	0.49	0.38	1.84	1.28	0.38	0.35

Table 2. Effect of levels of farmyard manure, recommended dose of fertilizers and plant density in garden pea

Treatment	Gross returns (Rs./ha)		Expenditure (Rs./ha)		Net returns (Rs./ha)	
	2002	2003	2002	2003	2002	2003
FYM levels (t/ha)						
0	106335	104865	19270	21108	87065	83757
20	113940	112335	25270	27108	88670	85227
Fertility levels ($N:P_2O_5:K_2O$ /ha of the recommended)						
50 %	95235	93870	24185	26023	71050	67847
100 %	115035	113685	25270	27108	89765	86577
150%	120150	118185	26355	28193	93795	89992
Spacing (cm)						
30 x 10	115050	113430	26520	28358	88530	85072
45 x 10	109155	107685	25270	27108	83885	80577
60 x 10	106215	104745	24020	25858	82195	78887

It can be concluded from the present study that an application of 20 t/ha farmyard manure, 30:90:45 kg N, P_2O_5 and K_2O /ha and closer spacing of 30 cm x 10 cm significantly increased the green pod yield and also provide increased net returns per hectare.

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