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Effect of Various Levels of Nitrogen, Phosphorus and Potash on the Yield of French Bean

Muhammad Shahid Ahmad Abbas Malik Adil Rehman Muhammad Shirin Khan Zakaria
Agricultural Research Station Baffa, Mansehra-Pakistan,PO # 21110, Mansehra, Pakistan
Email: msswati001@yahoo.com

Abstract
The experiment was conducted at the farm of Agricultural Research Station, Baffa (Mansehra) during August 2014 to monitor the effect of various levels of fertilizer treatments on plant height, number of branches plant^{-1}, pod length, pod weight and pod yield of French bean variety (paulista). The experimental results revealed that that all the fertilizer treatments increased the plant height, number of branches plant^{-1}, pod length, pod weight and pod yield of French bean significantly over control treatment. Maximum plant height (39.03 cm), number of branches plant^{-1}(18.25), pod length (14.10 cm), pod weight (5.37 gm) and pod yield (8.26 t ha^{-1}) were recorded in the treatment receiving 120 kg N, 90 kg P_2O_5 and 90 kg K_2O ha^{-1}. The economics of fertilizers were also worked out on the basis of current market prices and it was found that use of fertilizer was profitable. The cost benefit ratio ranged between 4.90. to 6.05.

1. INTRODUCTION

French bean (*Phaseolus vulgaris L.*) belongs to the family leguminoseae and is a prominent vegetable of Hazara Division. It is grown twice during a year, once as a full-season crop in the month of March and secondly as a off-season crop in the month of August. Its green pods are cooked as a vegetable, being rich in protein and vitamins, calcium and iron. Islam et *al* (2004) reported that application of potassium exerted a beneficial effect on plant growth characteristics and also on the yield of bush beans. Projapoti *et al* (2004) recorded higher pod yield of French bean from 120 kg N ha^{-1}. Begum et *al* (2003) found that the highest fertilizer treatment (90-50-120) resulted in the highest pod length (15.76 cm), pod weight (82.33 gm plant^{-1}) and pod yield (13.99 q ha^{-1}) of French bean. Sharma (2001) recorded maximum plant height, the number of branches plant^{-1} and green pod yield of French bean ha^{-1} with 120 kg N ha^{-1}. He also recorded maximum plant height and the number of branches plant^{-1} with 60 kg P ha^{-1}. The interaction effect between N and P was significant. Highest pod yield was obtained at a treatment combination of 120 kg N and 60 kg P ha^{-1}. Dhanjal *et al* (2001) found significantly higher branches plant^{-1} at 120 kg N ha^{-1}. Singh (2000) got maximum pod length form the application of 125 kg N ha^{-1}. Singh and Singh (2000) reported that the yield and yield component values of French bean increased with increasing N rates, but were generally highest with 80 kg P ha^{-1}. Srinivas and Naik (1998) reported that nitrogen and phosphorus fertilization of French bean resulted in increased pod yield. Sangakkra (1996) found that the vegetative growth and most yield components of French bean increased significantly upto 100 kg K_2O ha^{-1}. Neuvel et *al* (1994) found that pod yield of snap beans were 12.9, 13.9, 15.0 and 15.8 ton ha^{-1} with 0, 50, 100 and 150 kg N ha^{-1} respectively. Chandra et *al* (1987) found that the plant growth and yield of French bean increased with the increasing rates of nitrogen and phosphorus. Ivanove *et al* (1987) reported that the pod yield of French bean was increased with the increase N levels upto 150 kg ha^{-1}.

Continuous cropping without the proper application of plant nutrients to the soil causes a substantial decrease in crop yield. Supply of plant nutrients, especially nitrogen, phosphorus and potash through fertilizer application is one of the best methods to increase the French bean growth and yield. The present study was, therefore conducted to monitor the effect of various levels of nitrogen, phosphorus and potash on the growth parameters and green pod yield of French bean and also to furnish economically sound fertilizer recommendations for French bean production in District Mansehra.

2. MATERIALS AND METHODS

The experiment was conducted at the farm of Agricultural Research Station, Baffa (Mansehra) during August 2014. The soil under test was silt loam, having 0.82% organic matter, 0.041% nitrogen, 9 mg kg^{-1} available phosphorus, 115 mg kg^{-1} available potassium, 2.2% $CaCO_3$ and pH of 7.2. The design of the experiment was randomized complete block with 4 replications. There were 6 treatments in the experiment (Table-1). Each plot (10.8 m^2) consisted of 6 rows, each 3 meter long and 60 cm apart. Plant to plant distance was 20 cm.

2.1 land preparation

Before sowing of crop, the land was prepared thoroughly and nitrogen, phosphorus, and potash were applied in the form of urea, triple super phosphate and potassium sulphate respectively. All phosphorus, potash and ½ nitrogen was applied at the time of sowing while remaining ½ nitrogen was applied after one month of sowing. The variety used was paulista. Sowing was done on 26.08.2014. All the recommended cultural practices were done uniformly in all the treatments. During the course of experiment, the data was recorded on plant height (cm) at maturity, number of branches plant^{-1}, pod length (cm), pod weight (gm) and pod yield t ha^{-1}. The data were statistically analyzed using analysis of variance technique, Least Significant Difference (LSD) test was used to compare the treatment means at 5% level of significance.

3. RESULTS AND DISCUSSION

3.1 Growth and Yield Parameters

The data presented in (Table-2) show the effect of various fertilizer treatments on the plant height, number of branches plant^{-1}, pod length, pod weight and pod yield ha^{-1}. It is evident from the data that all the fertilizer treatments increased the plant height, number of branches plant^{-1}, pod length, pod weight and pod yield ha^{-1}significantly over control treatment. By comparing the various fertilizer treatments with one another, maximum plant height of 39.03 cm was observed in T6 (120-90-90), followed by 37.75 cm in T4 (90-90-60). These results are in agreement with the findings of Sharma (2001). Maximum number of branches plant^{-1}i.e.18.25 and 17.50 were found in T6 (120-90-90) and T4 (90-90-60) respectively. These results are in conformity with the findings of Sharma (2001) and Dhanjal *et a*l. (2001). Maximum pod length of 14.10 cm was observed in T6 (120-90-90), followed by 13.78 cm in T4 (90-90-60). These results are in agreement with the findings of Begum *et al* (2003) and Singh (2000). Similarly maximum pod weight (5.37 gm) was recorded in T6 (120-90-90), followed by (5.26 gm) in T4 (90-90-60). The highest pod yield of 8.26 t ha^{-1} was recorded in T6 (120-90-90), followed by T4 (90-90-60), wherein pod yield was 7.82 t ha^{-1}. These results can be attributed to the fact that the French bean responded well to the enhanced doses of fertilizers. These increases in the yield component may be the result of better utilization of NPK which resulted in increased biosynthesis of the photosynthates and ultimately the yield. These results are in consonance with the findings of Prajapoti *et al* (2004), Begum et *al* (2003), Sharma (2001), Singh and Singh (2000), Sangakkra (1996), Neuval et *al* (1994), Ivanov *et al* (1987) and Chandra (1987).

3.2 ECONOMICS OF FERTILIZER PRACTICES

Economic feasibility of the fertilizer practices should be an essential element of studies aimed at improving crop productivity. Basically, the farmer is an economist and he adopts only those improved practices which are more paying and easily workable. On the basis of current market prices of fertilizer and French bean, the obtainable income from the additional yield were worked out. Table-3 reflects the comparative economics of various fertilizer levels on French bean. Evidently, there could be no additional income from the control treatment which received no fertilizer. The cost benefit ratio from different fertilizer application varied between 1:4.90 to1:6.05. All the fertilizer levels were found profitable over control, indicating that the use of fertilizer in judicious amounts will always remain a profitable proposition for the French bean growers. Treatment-4 showed the highest cost benefit ratio (1:6.05), followed by T3 (1:5.95).

All the fertilizer treatments have shown marked yield increase. However, the better and economically sound response was given by T4, receiving 90 kg N plus 90 kg P_2O_5 and 60 kg K_2O ha^{-1} under the soil conditions prevailing in Mansehra District.

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Table-1. Fertilizer treatments used in the experiment.

Treatments	N	P_2O_5 kg ha^{-1}	K_2O
T1	0	0	0
T2	60	60	60
T3	90	60	60
T4	90	90	60
T5	90	60	90
T6	120	90	90

Table-2 Effect of various fertilizer treatments on the growth and yield of French bean.
(Figures are average of 4-replications)

S.No.	N-P_2O_5-K_2O Kg ha^{-1}	Plant height (cm)	Number of branches $plant^{-1}$	Pod length (cm)	Pod weight (gm)	Pod yield (t ha^{-1})
T1	0-0-0	33.90 d	14.25 c	10.85 c	3.79 d	4.41 d
T2	60-60-60	36.33 c	16.00 b	13.08 b	4.80 c	6.59 c
T3	90-60-60	36.90 c	17.00 ab	13.53 ab	5.13 b	7.34 bc
T4	90-90-60	37.75 b	17.50 a	13.78 ab	5.26 ab	7.82 ab
T5	90-60-90	37.58 b	17.25 ab	13.65 ab	5.19 ab	7.50 ab
T6	120-90-90	39.03 a	18.25 a	14.10 a	5.37 a	8.26 a
L.S.D at 5%		0.82	1.28	0.69	1.89	0.80

Means followed by the same letter (s) do not differ significantly from one another at 5% probability level, using LSD test.

Table-3 Comparative economics of various fertilizer treatments on French bean.

Treatments N-P_2O_5-K_2O kg ha^{-1}	Cost of Fertilizer (Rs)	Average Yield (t ha^{-1})	Additional yield over control (t ha^{-1})	value of Add. Yield @Rs 15000 t^{-1}	Cost benefit ratio
T1 (0-0-0)	…..	4.41	…..	…..	
T2 (60-60-60)	6668	6.59	2.18	32700	1:4.90
T3 (90-60-60)	7385	7.34	2.93	43950	1:5.95
T4 (90-90-60)	8442	7.82	3.41	51150	1:6.05
T5 (90-60-90)	8945	7.50	3.09	46350	1:5.18
T6 (120-90-90)	10719	8.26	3.85	57750	1:5.39

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