RESEARCH PAPER International Journal of Agricultural Sciences, June to December, 2009, Vol. 5 Issue 2 : 549-551

Growth and yield of french bean (*Phaseolus vulgaris* L.) as influenced by different levels of row spacing, seed rate and nitrogen

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ABSTRACT

A field experiment was conducted during the winter seasons of 1992-93 and 1993-94 at Kanpur (U.P.) to study the effect of row spacing, seed rate and nitrogen levels on growth and yield of french bean (Phaseolus vulgaris). The row spacings of 30 and 40 cm being at par produced significantly higher grain yield of french bean than 20 cm row spacing. Among seed rates, 150 kg/ ha seed produced significantly highest grain yield of 26.18 q/ha against 25.54 and 24.28 q/ha at 125 and 100 kg seed/ha, respectively. In case of nitrogen, grain yield showed significant increase upto 160 kg N/ha. The optimum economic dose computed from quadratic response equation was found 152.5 kg N/ha with estimated grain yield of 29.15 q/ha. Stover yield also behaved in almost similar manner under different treatments.

Key words : French bean, Row spacing, Seed rate, Grain yield.

INTRODUCTION

French bean which is also known as 'Rajmash' is an important legume crop. It is used both as dry seeds or as green pod vegetable. Its demand is increasing day by day throughout the country. In plains of Uttar Pradesh, it is a new introduction as commercial crop. Hence, limited agronomical informations are available for its cultivation. It is said to be very inefficient in biological nitrogen fixation owing to poor nodulation (Ram Gopal *et al*., 2005). It requires higher dose of nitrogen fertilizer for enhanced productivity particularly in plains. In view of these, the present experiment was conducted to assess the effect of row spacings, seed rates and nitrogen levels on the performance of french bean.

MATERIALS AND METHODS

A field experiment was carried out at Vegetable Research Farm, Kalyanpur of C.S. Azad University of Agriculture and Technology, Kanpur during winter season of 1992-93 and 1993-94. The soil of experimental fields was silty loam in texture, low in available nitrogen (0.32 and 0.30% O.C.), medium in available phosphorus (14.70 and 13.90 kg P_2O_5 / ha) and medium also in available potassium (168.2 and 163.0 kg K_2O /ha) having 7.4 and 7.6 pH during 1992-93 and 1993-94, respectively. Twenty seven treatment combinations consisting of 3 row spacings (20, 30, 40 cm), 3 seed rates (100, 125, 150 kg/ha) and 3 nitrogen levels (0, 60, 120 kg/ha) were laid out in split plot design with 3 replications keeping the combination of row spacing and seed rates in main plots and nitrogen levels in sub plots. Uniform dose of 60 kg P_2O^5 and 60 kg K_2O/ ha was applied in whole experimental area as basal through single superphosphate and muriate of potash, respectively. Nitrogen as per treatment was applied through urea, half at sowing and half at first irrigation. french bean variety PDR – 14 was sown in furrows behind plough on 2-11-92 and 8-11-93 in two years. Sowing was done after pre-sowing irrigation and later on 3 irrigations were given to the crop during each year. One weeding and hoeing was done with hand khurpi after first irrigation. Experimental crop was harvested at full grain maturity on 22-3-1993 and 24-3-1994 during two years. To evaluate the effect of treatments on crop, various growth and yield attributes and yields of french bean were recorded.

RESULTS AND DISCUSSION

Growth attritutes :

Number of plants per unit area were influenced significantly only by seed rates, 150 kg seed / ha maintained significantly maximum plants and 100 kg seed / ha maintained significantly minimum plant population (Table 1). These are attributed directly to the number of seeds sown per unit area with varied seed rates. Saxena and Verma (1992) also reported the similar effects. Plant height was affected significantly only by increasing levels of nitrogen where 80 and 160 kg N being at par produced taller plants than control. Number of branches / plant and dry weight / plant were influenced significantly by all the three treatment factors. Among row spacings, 40 cm, among seed rates, 100 kg/ha and among N levels, 160 kg /ha attained maximum values of both branches and dry weight/plant. Significantly minimum values of branches and dry weight/plant were recorded at 20 cm row spacing, 150 kg seed /ha or without N application. Better

Table 1 : Growth and yield attributes of French bean as influenced by row spacing, seed rate and nitrogen levels (pooled 2 years)

Treatment	No. of plants (000/cm)	Plant height (cm)	Dry weight per plant (g)	No. of branches per plant	No. of pods/ plant	No. of grains/ pod	No. of grains/ plant	Grain wt./ plant (g)
Row spacing								
20 cm	233.11	39.53	18.40	13.87	10.24	6.81	62.90	12.58
30 cm	233.48	38.68	18.94	14.55	11.35	7.24	65.68	12.96
40 cm	233.75	37.54	19.59	15.04	12.20	7.30	64.62	12.71
S.E.±	1.44	1.07	0.14	0.34	0.30	0.27	1.01	0.22
C.D. (P=0.05)	N.S.	N.S.	0.29	0.69	0.61	N.S.	2.03	N.S.
Seed rate								
100 kg/ha	188.26	37.95	19.44	15.00	11.59	7.32	72.46	14.99
120 kg/ha	233.08	38.52	18.96	14.62	11.23	7.19	63.96	12.43
150 kg/ha	279.00	39.28	18.53	13.83	10.96	6.84	56.77	10.83
S.E.±	1.44	1.07	0.14	0.34	0.30	0.27	1.01	0.22
C.D. (P=0.05)	2.94	N.S.	0.29	0.69	N.S.	N.S.	2.03	0.45
Nitrogen								
Control	234.98	32.79	17.28	12.22	8.95	5.72	57.39	10.13
80 kg/ha	233.39	41.22	19.13	15.16	12.06	7.57	65.24	13.38
160 kg/ha	231.97	41.73	20.52	16.07	12.78	8.07	70.56	14.74
S.E.±	2.03	0.86	0.71	0.68	0.47	0.37	1.20	0.42
C.D. (P=0.05)	N.S.	1.71	1.39	1.35	0.93	0.75	2.39	0.86

performance of these growth characters at lower seed rate and wider row spacing might be due to the availability of more space per plant which utilized the environment more efficiently compared to densely populated plants. At higher plant densities, plants tended to compete more for basic resources, thus performed poor. It confirms the findings of Helepayat and Ali (1991). Better growth response of crop at increased N application might be attributed to poor N status of soil and lack of nodule forming ability of the crop. Similar results were also reported by Saxena and Verma (1995).

Yield attributes :

Different row spacings could affect the number of pods/plant and grains/plant significantly (Table 1). Maximum pods/plant were recorded significantly under 40 cm row spacing while grains/plant were counted at par under 30 and 40 cm spacing. The 20 cm row spacing performed poorest in all cases perhaps due to lesser inter row spacing where individual plants could not well utilized the basic resources. All yield attributes showed reduction with each increase in seed rate upto highest of 150 kg/ha. However, rate of reduction was significant only in cases of grains/plant and grain wt./plant. Availability of more space to individual plant at lower seed rate may improve the of yield attributes by using production resources more efficiently which leads to higher assimilation of photosynthates. These results are supported by the findings of Ali (1991). All yield attributes significantly responded to N application and in cases of grains/plant and grain wt./plant, response was significant upto highest N dose of 160 kg/ha. Kushwaha (1991) reported significant increase in yield attributes of french bean upto 120 kg N/ha the highest tried in his study.

Yields:

The row spacing of 30 cm being at par with 20 cm produced significantly higher grain yield over 40 cm row spacing (Table 2). These yields were attributed mainly to number of grains/plant and grain weight/plant (Table 1). Saxena and Verma (1992) also observed 30 cm row spacing as optimum for french bean. In case of seed rates, 150 kg/ha yielded significantly highest grain and it was attributed mainly to higher plant population per unit area. Though individual plants performed better in all yield attributes at lower seed rate of 100 kg/ha but it could not compete in yield due to lesser plant stand per unit area. These results are in accordance to those of Saxena and Verma (1992). Grain yield increased significantly with increasing rate of N upto 160 kg/ha. It was attributed to number of grains/plant and grain weight/plant which also showed significant increase upto 160 kg N/ha. To work out the maximum and optimum dose of N following quadratic regression equation was generated using the pooled data over years:

$$Y = 20.03 + 0.1144\ X - 0.000358X^2$$

Table 2 : Growth and yield (q/ha) of French bean as influenced by row spacing, seed rate and nitrogen levels

Treatment	Grain yield (q/ha)			Stover yield (q/ha)		
	1992-93	1993-94	Pooled	1992-93	1993-94	Pooled
Row spacing						
20 cm	25.78	25.03	25.41	37.76	36.42	37.09
30 cm	26.35	25.12	25.74	41.30	39.05	40.18
40 cm	25.14	24.56	24.85	40.47	38.52	39.50
S.E.±	0.45	0.38	0.29	1.19	0.98	0.77
C.D. (P=0.05)	0.96	N.S.	0.60	2.52	2.08	1.56
Seed rate						
100 kg/ha	24.66	23.90	24.28	37.79	36.56	37.18
120 kg/ha	26.02	25.06	25.54	40.49	38.37	39.43
150 kg/ha	26.59	25.76	26.18	41.25	39.07	40.17
S.E.±	0.45	0.38	0.29	1.19	0.98	0.77
C.D. (P=0.05)	0.96	0.80	0.60	2.52	2.08	1.56
Nitrogen						
Control	20.43	19.62	20.03	34.06	32.53	33.30
80 kg/ha	27.31	26.43	26.87	41.94	39.57	40.76
160 kg/ha	29.53	28.67	29.10	43.52	41.89	42.71
S.E.±	0.76	0.52	0.40	1.80	1.99	1.44
C.D. (P=0.05)	1.54	1.05	0.82	3.64	4.03	2.82

With the help of this equation, maximum and optimum doses of N were worked out as 158.7 and 152.5 kg/ha with yield estimates of 29.17 and 29.15 q/ha, respectively. Ram Gopal *et al*. (2005) also reported significant increase in grain yield of french bean upto the application of 150 kg N/ha.

Stover yield was also influenced significantly by all the treatment factors. Row spacing of 30 and 40 cm being at par produced significantly higher stover than 20 cm row spacing. The seed rates of 125 and 150 kg/ha being at par produced significantly more stover than 100 kg seed/ha. Similarly, 160 and 80 kg N/ha remained at par but both yielded significantly higher stover than control. Such higher stover yields are attributed mainly to dry weight/plant and number of branches/plant in case of row spacing and nitrogen levels but in case of seed rates, higher plant stand was mainly responsible for higher stover yield.

Interaction effect between treatment factors were not found significant on grain or stover yields in any case of study.

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Received : February, 2009; Accepted : May, 2009