

Effect of nitrogen, phosphorus and potassium on the growth and yield of Frenchbean (*Phaseolus vulgaris*)

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Received: July 1993

ABSTRACT

A field trial was carried during the winter seasons of 1989–90 and 1990–91 to study the effect of nitrogen, phosphorus and potassium on the growth and yield of 'PDR 14' Frenchbean (*Phaseolus vulgaris* L.). Three factors, viz. nitrogen, phosphorus and potassium, each at 3 levels (0, 60 and 120 kg/ha) were compared in a 3³-confounding design replicated 3 times. Nitrogen affected all the growth attributes, viz. height, leaves, leaf area, fresh weight, dry weight, branches at harvest and yield, significantly up to the 120 kg N/ha in both the years, whereas effect of phosphorus was noticed up to 60 kg/ha on leaves/plant in the first year, leaf area in the second year and on grain yield in both the years. Potassium, however, failed to exert any significant influence in any year on any of the characters. Interactive effect of nitrogen and phosphorus was noticed in leaves/plant only in the second year and 120 kg N/ha and 120 kg P₂O₅/ha produced maximum leaves/plant (43.5). All the growth attributes were found positively and significantly correlated with the grain yield.

Since Frenchbean (*Phaseolus vulgaris* L.) is a new introduced crop, limited technology for its cultivation is available at present. However, the crop has ability to produce with so far available technologies. As this is a non-nodule-forming crop, the scope for boosting up production of this crop by selecting optimum requirement of 3 major nutrients of fertility—nitrogen, phosphorus and potassium—needs no emphasis. The present investigation was therefore planned and carried out to investigate the effect of nitrogen, phosphorus and potassium on the growth and yield of Frenchbean.

MATERIALS AND METHODS

The experiment was conducted during the winter seasons of 1989–90 and 1990–91 at Vegetable Research Farm, Kalyanpur

(Kanpur) in a silty-loam soil. The soil was poor (0.27% organic carbon) in nitrogen and medium (219 kg/ha) in available phosphorus and available potassium (219 kg/ha). The treatments comprised 3 factors, viz. N, P and K, each at 3 levels (0, 60 and 120 kg/ha) in a 3³-confounding design, replicated 3 times. Soil reaction was neutral in both the years (pH 7.2–7.5). Commonly grown variety of 'PDR 14' Frenchbean was sown on 4 November in the first year and on 26 October in the second year in rows 30 cm apart, with a seed rate of 150 kg/ha. Plant distance of 10 cm was maintained 15 days after germination by thinning, ensuring equal plant stand. In addition to pre-soaking irrigation, 3 additional irrigations in each year were given to the crop. One-third N and full dose of P and K were applied at sowing as basal soil applications, whereas

Table 1. Growth attributes and yield of Frenchbean at harvest (120 days after sowing)

Treatment	Plant height (cm)		Leaves/plant		Leaf area (cm ²)		Fresh weight (g)		Dry weight (g)		Branches/plant		Yield (q/ha)	
	Y ₁	Y ₂	Y ₁	Y ₂	Y ₁	Y ₂	Y ₁	Y ₂	Y ₁	Y ₂	Y ₁	Y ₂	Y ₁	Y ₂
<i>N</i> (kg/ha)														
0	30.6	42.5	35.5	35.9	59.6	65.2	82.3	81.2	17.3	17.1	11.4	10.1	17.7	21.4
60	35.2	45.8	39.6	39.8	63.6	79.9	86.3	87.5	18.2	18.7	15.4	13.3	23.2	28.0
120	41.1	49.2	43.1	3.6	66.9	85.7	101.1	101.7	20.7	21.6	17.5	14.6	26.0	31.5
CD (P = 0.05)	1.8	2.9	0.6	2.7	3.6	3.2	4.7	3.1	1.0	1.5	1.2	1.2	0.9	1.3
<i>P</i> ₂ <i>O</i> ₅ (kg/ha)														
0	35.3	44.9	37.7	38.8	62.3	72.7	88.9	90.3	18.6	18.8	14.3	12.1	20.5	24.1
60	36.1	46.7	39.5	39.1	62.3	77.7	89.0	88.7	18.5	19.2	14.8	13.1	22.8	27.7
120	35.6	45.8	40.9	41.5	64.4	80.6	91.8	91.3	19.1	19.3	15.2	12.8	23.6	29.0
CD (P = 0.05)	NS	NS	0.6	NS	NS	3.2	NS	NS	NS	NS	NS	NS	0.9	1.3
<i>K</i> ₂ <i>O</i> (kg/ha)														
0	35.9	45.2	38.6	38.7	62.8	72.1	87.9	88.6	18.3	18.6	14.8	12.4	22.3	20.7
60	35.6	45.9	39.6	40.3	63.4	77.9	90.0	90.1	18.9	19.4	14.9	12.7	22.5	27.1
120	35.4	46.4	39.8	40.3	63.6	90.6	91.8	91.7	18.9	19.4	14.6	12.8	22.1	27.0
CD (P = 0.05)	NS	NS	0.6	NS	NS	3.2	NS	NS	NS	NS	NS	NS	NS	NS

Y₁, 1989–90; Y₂, 1990–91

remaining N was top-dressed in 2 splits. Almost equal precipitation (49.8 mm in the first year and 49.1 mm in the second year) was received in the whole span of crop. Other agronomic practices were followed as per requirements of the crop. Weather parameters showed a normal trend in the study period.

RESULTS AND DISCUSSION

Effect of N

Nitrogen @ 120 kg/ha affected all the growth attributes and yield significantly up to 120 kg/ha. An application of 60 kg N/ha over the control and 120 kg N/ha over 60 kg N/ha was found significantly superior in both the years in terms of plant height, leaves/plant, leaf area, and branches/plant and grain yield. Similar trend was observed in fresh and dry weights in the second year only, and in the first year though a dose of 120 kg N/ha was significantly superior to the rest 2 doses, but 60 kg N/ha was statistically at par with the control for fresh and dry weights/plant (Table 1). Good response to N in the present study may be attributed to poor N in soil and to lack of nodule-forming ability of the crop. Similar favourable response of N on Frenchbean was also reported by Ali and Kushwaha (1987).

Effect of P

Effect of phosphorus was noticed only in leaves/plant in the first year, leaf area in the second year and grain yield in both the years (Table 1). This may be due to the medium status of P in the experimental soil. A significant increasing trend was observed for leaves/plant in the first year with the increasing doses of P up to 120 kg/ha. For leaf area in the second year, application of 60 or 120 kg P_2O_5 /ha, however, was significantly superior to the control but were at par to

each other. The grain yield in both the years was increased up to 120 kg P_2O_5 /ha, but a dose of 60 kg P_2O_5 /ha was statistically at par with highest dose (120 kg P_2O_5 /ha) and both being significantly superior to the control. The yield levels under 60 kg and 120 kg P_2O_5 /ha were 22.8 and 23.6 q/ha in the first year and 27.7 and 29.0 q/ha in the second year respectively. Ahlawat and Sharma (1989) also reported response of Frenchbean to phosphorus.

Effect of K

Potassium influenced only leaves/plant in the first year and leaf area in the second year significantly. An application of 60 kg K_2O /ha was statistically at par with 120 kg K_2O /ha, but both were significantly superior to the control for leaves/plant in the first year. However, 60 kg K_2O /ha was superior for leaf area in the second year over the control and 120 kg K_2O /ha was significantly superior to 60 kg K_2O /ha. Potassium, however, failed to establish any significant effect on grain yield perhaps due to medium K content of the experimental soil.

Effect of N $\times$ P interaction

Interaction of N and P was observed only for leaves/plant in the second year (Table 2). The control and 60 kg N/ha under

Table 2. Leaves/plant of Frenchbean as influenced by interaction of nitrogen and phosphorus (1990-91)

N (kg/ha)	P_2O_5 (kg/ha)		
	0	60	120
0	32.1	36.2	38.2
60	38.2	39.4	41.1
120	42.8	42.9	43.5
CD (P = 0.05)	1.1		

Table 3. Correlation of growth attributes at harvest with grain yield of Frenchbean

Growth attribute	Correlation coefficient (r) with grain yield	
	1989-90	1990-91
Plant height (cm)	0.8478**	0.8358**
Leaves/plant	0.9149**	0.8479**
Leaf area (cm ²)	0.9378**	0.8686**
Fresh weight/plant (g)	0.7246**	0.7527**
Dry weight/plant (g)	0.7022**	0.8219**
Branches/plant	0.8902**	0.9157**

*P = 0.05; ** P = 0.01

all P levels showed a significant difference for leaves/plant, whereas there was no significant difference among P levels under N 120 kg/ha. However, the maximum leaves/

plant were recorded under 120 kg N/ha + 120 kg P/ha (43.5), which were at par with those recorded with 0 and 60 kg P₂O₅/ha under 120 kg N/ha level, but significantly superior to 0 and 60 kg N/ha under all P levels.

Correlation

Correlation of growth characters at harvest was worked out with grain yield in terms of correlation coefficient (r) (Table 3). All the growth attributes were found positively correlated with grain yield during both the years.

REFERENCES

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