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Nitrogen and phosphorus nutrition of Frenchbean (*Phaseolus vulgaris* L.) grown in eastern Uttar Pradesh under late-sown condition

N.B. SINGH AND V. VERMA

Zonal Agricultural Research Sub-Station, Narendra Dev University of Agriculture and Technology, Bari-Bagh, Ghazipur, Uttar Pradesh 233 001

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ABSTRACT

A 2-year experiment was conducted during 1995-96 and 1996-97 with 5 nitrogen (0, 30, 60, 90 and 120 kg/ha) and 3 phosphorus levels (0, 30 and 60 kg/ha) to study their impact on growth, yield attributes, yield and economics of Frenchbean *(Phaseolus vulgaris* L.) grown under late-sown condition of eastern Uttar Pradesh. Higher dose of nitrogen (120 kg/ha) and phosphorus (60 kg/ha) resulted in higher yield and was found more profitable.

Key words : Nitrogen, Phosphorus, Frenchbean, Yield

Frenchbean is gaining importance in Gangetic belt of eastern Uttar Pradesh, owing to its wide adaptability to growing season. Being a shy nodulated crop, its fertilizer requirement particularly of nitrogen is like that of cereals. Therefore, study on requirement of nitrogen fertilizer for this crop for this particular area is of prime importance. Frenchbean responds well to application of phosphorus (Ahlawat and Sharma, 1989). Judicious combination of N and P may bring considerable yield increase owing to their complementary effects. The present investigation was, therefore, carried out to find the optimum requirement of N and P for Frenchbean under late-sown condition in plains of eastern Uttar Pradesh.

MATERIALS AND METHODS

The field experiment was carried out at Zonal Agricultural Research Sub-Station Bari-Bagh, Ghazipur, during winter seasons of 1995-96 and 1996-97 on Frenchbean. The soil was sandy loam, having pH 7.5 and organic carbon 0.27%. Available P, K and total N were 11.4, 145.70 and 254.63 kg/ha respectively. The treatments consisted of combinations of 5 levels of nitrogen (0, 30, 60, 90 and 120 kg/ha) and 3 levels of phosphorus (0, 30 and 60 kg/ha). These were tested in completely randomized block design with 3 replications. Half dose of N and full dose of P were dressed basal and remaining N was top-dressed in 2 equal splits after the

irrigation. Frenchbean var. 'PDR 14' was sown on 17 November 1995 and 19 November 1996 in rows, 30 cm apart using 150 kg seed/ha. Uniform distance of 10 cm was maintained between the plants by thinning and gap-filling at 15 days after sowing. Besides, pre-soaking irrigation, four irrigations were applied to the experimental crop. Essential agronomic and crop-saving practices like disease and insect-control measures were followed as per requirement of the crop.

RESULTS AND DISCUSSION

Significant impact of N and P_2O_5 was observed on growth and yield attributes, viz. plant height, branches/plant, pods/plant, seeds/plant and 100-seed weight (Table 1), barring the plant height and 100-seed weight owing to application of P. The maximum values of these parameters were recorded where higher dose of N and P_2O_5 was applied and minimum under the control. This could be attributed to the fact that application of N increased the vegetative growth at initial stages (plant height and branches/plant) and finally led to higher number of pods and seed weight. Application of P significantly increased these parameters. Phosphorus is important in root development and translocation of photosynthates and, being the constituent of nucleic acid, phytin and phospholipids, its application increases growth and yield-attributing parameters (Verma and Saxena, 1995). Nitrogen caused a marked variation in grain and straw yields during both the years (Table 2). A linear increase in grain yield was recorded with increase in levels of N to 120 kg/ha. Frenchbean crop with little or no nodulation required large amount of N from applied or soil source and hence shows high response to nitrogen (Ali and Shankar, 1991). Further, the yield increase was mainly owing to improvement in yield-attributing characters at higher dose

Table 1. Growth and yield attributes of Frenchbean as affected by nitrogen and phosphorus application

Treatment	Plant height (cm)		Branches/plant		Pods/plant		Seeds/pod		100-seed weight (g)	
	1995–96	1996–97	1995–96	1996–97	1995–96	1996–97	1995–96	1996–97	1995–96	1996–97
Nitrogen (kg/ha)										
0	29.05	29.74	2.68	2.77	5.77	6.28	2.50	2.66	24.39	25.16
30	33.98	34.80	2.98	3.23	6.34	6.88	2.72	2.87	27.39	28.38
60	37.11	39.28	3.36	3.52	8.61	9.71	2.95	3.23	29.37	30.36
90	39.78	41.92	3.85	3.95	9.58	11.47	3.29	3.60	32.21	33.80
120	42.22	43.21	4.25	4.36	11.22	12.63	3.83	4.11	32.70	33.80
CD (P=005)	2.27	1.98	0.18	0.16	0.48	0.49	0.13	0.14	0.98	1.14
Phosphorus (kg/ha)										
0	35.85	37.38	3.34	3.48	7.99	9.11	3.00	3.20	29.14	30.12
30	36.52	37.78	3.44	3.57	8.33	9.40	3.07	3.32	29.22	30.22
60	36.91	38.20	3.50	3.65	8.59	9.66	3.10	3.36	29.27	30.25
CD (P=0.05)	NS	NS	0.14	0.13	0.36	0.37	0.09	0.11	NS	NS

Table 2. Yield and economics of Frenchbean as affected by nitrogen and phosphorus application

Treatment	Grain yield (q/ha)		Straw yield (q/ha)		Cost of cultivation (Rs/ha)		Gross income (Rs/ha)		Net return (Rs/ha)		Benefit : cost ratio	
	1995–96	1996–97	1995–96	1996–97	1995–96	1996–97	1995–96	1996–97	1995–96	1996–97	1995–96	1996–97
Nitrogen (kg/ha)												
0	11.89	11.92	15.89	16.72	6,577	7,637	13,327	14,750	6,743	7,113	1.02	0.92
30	14.73	15.15	19.18	20.51	6,806	7,866	16,498	18,598	9,392	10,731	1.41	1.36
60	16.16	17.91	22.38	24.35	7,036	8,096	18,610	21,979	11,574	13,882	1.64	1.71
90	17.74	20.20	23.69	26.49	7,257	8,218	19,877	24,798	12,619	16,479	1.73	1.97
120	19.17	21.19	24.79	29.76	7,495	8,556	21,429	26,026	13,934	17,470	1.86	2.03
CD (P=005)	0.92	1.00	1.37	1.41	-	-	-	-	-	-	-	-
Phosphorus (Kg/ha)												
0	15.42	15.55	20.54	22.27	6,612	7,532	17,275	14,750	10,662	11,633	1.59	1.52
30	15.99	17.62	21.24	23.63	7,034	8,095	1,916	14,750	10,882	13,517	1.53	1.64
60	16.65	18.68	21.77	24.76	7,456	8,657	15,681	22,914	11,194	14,256	1.48	1.62
CD (P=0.05)	0.73	0.78	0.96	1.08								

of N application. Response of Frenchbean to N up to 120 kg/ha was reported by Kushwaha (1994) and Dwivedi *et al.* (1994).

Grain and straw yields increased significantly up to 60 kg P_2O_5/ha. Such differential behaviour might have been due to more diversion of phosphates towards the grains under high levels of phosphorus owing to increased utilization of N.

Table 3. Nitrogen content and uptake by Frenchbean as affected by nitrogen application

Treatment	N in grain (%)		N in straw (%)		N uptake by grain (kg/ha)		N uptake by straw (kg/ha)		Total N uptake (kg/ha)	
	1995–96	1996–97	1995–96	1996–97	1995–96	1996–97	1995–96	1996–97	1995–96	1996–97
Nitrogen (kg/ha)										
0	3.63	3.69	0.808	0.830	43.14	43.97	12.84	13.89	55.98	57.86
30	3.67	3.73	0.829	0.842	54.14	56.51	15.86	17.27	70.00	73.78
60	3.73	3.77	0.850	0.869	61.97	67.49	19.02	21.18	80.99	88.67
90	3.78	3.83	0.873	0.905	67.02	77.41	20.68	23.98	87.70	101.39
120	3.82	3.85	0.907	0.941	73.19	81.54	22.50	27.94	95.69	109.48
CD (P=005)	0.08	0.07	0.016	0.017	3.17	3.21	0.93	1.02	3.89	4.34
Phosphorus (kg/ha)										
0	3.71	3.75	0.835	0.859	57.35	58.46	17.29	19.29	74.64	77.75
30	3.73	3.77	0.858	0.880	59.85	66.68	18.33	21.00	78.18	87.68
60	3.74	3.79	0.868	0.891	62.49	71.01	18.96	22.26	81.459	93.27
CD (P=0.05)	NS	NS	0.012	0.013	2.45	2.50	0.72	0.80	2.72	2.96

Table 4. Phosphorus content and uptake by Frenchban as affected by phosphorus application

Treatment	(%) P in grain		(%) P in straw		P uptake by grain (kg/ha)		P uptake by straw (kg/ha)		Total P uptake (kg/ha)	
	1995–96	1996–97	1995–96	1996–97	1995–96	1996–97	1995–96	1996–97	1995–96	1996–97
Nitrogen (kg/ha)										
0	0.500	0.506	0.192	0.195	5.96	6.07	3.04	3.25	9.00	9.32
30	0.510	0.516	0.217	0.217	7.53	7.85	4.17	4.52	11.70	12.37
60	0.523	0.533	0.222	0.225	8.70	9.75	4.97	5.49	13.67	15.24
90	0.556	0.570	0.224	0.228	9.89	11.57	5.32	6.05	15.21	17.62
120	0.573	0.586	0.227	0.230	10.97	12.49	5.64	6.83	16.61	19.32
CD (P=005)	0.20	0.023	0.009	0.010	0.37	0.38	0.19	0.22	0.52	0.59
Phosphorus (kg/ha)										
0	0.486	0.500	0.195	0.198	7.53	7.83	4.04	4.44	11.57	12.27
30	0.544	0.556	0.223	0.225	8.77	9.89	4.78	5.42	13.55	15.31
60	0.568	0.572	0.230	0.233	9.49	10.80	5.06	5.83	14.55	16.63
CD (P=0.05)	0.015	0.018	0.007	0.007	0.29	0.30	0.14	0.17	0.37	0.39

Ahlawat and Sharma (1989) also reported a favourable response of Frenchbean to P application.

The monetary advantage (Table 2) based on 2 years of experimentation indicated that the maximum net return and benefit : cost ratio were obtained with higher dose of N and P. This could be ascribed to higher grain yield obtained owing to application of higher levels of N and P.

Nitrogen content in grain, its accumulation in grain and straw and total uptake by the crop (Table 3) increased significantly up to 120 kg N/ha owing to enhanced N availability. The enhanced N uptake may be owing to cumulative effect of increased N content and dry-matter production. This is in conformity with the results obtained by Rana *et al.* (1998). Similarly, the content in grain and straw increased significantly with increasing levels of P application (Table 4) . Phosphorus status of plant parts might have increased owing to increased availability of phosphorus. Cumulative effect of increase in phosphorus content and dry matter production might have led to significant increase in phosphorus uptake by the crop. Ahlawat and Sharma (1989) also reported a favourable response of phosphorus application to Frenchbean.

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