



Original Research Article

Effect of Nitrogen and Phosphorous levels on growth, yield attributing characters, yield and economics of French bean (*Phaseolus vulgaris* L.)

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ABSTRACT

Keywords

Nitrogen,
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A 3- year field experiment was conducted during 2003-04, 2004-05 and 2005-06 with four levels of nitrogen (0,50,100 and150 kg/ha)and four levels of phosphorus (0,25,50 and 75 kg P₂O₅ ha⁻¹) to study their impact on growth, yield attributes, yield and economics of French bean (*Phaseolus vulgaris* L.) grown under medium deep Vertisol soil in Marawada region. Higher dose of nitrogen (150 kg/ha) and phosphorus (75 kg/ha)resulted significantly highest grain & straw yield of French bean and show at par result with crop receiving 100 kg N & 50 kg P₂O₅ ha⁻¹which was found more profitable.

Introduction

Cultivation of pulses is gaining importance all over the country due their increasing demand and high markets value. Among such , *rajmash*, commonly known as kidney bean, is being popular with the farmers due to its higher productivity and consequently higher profit in comparison to other pulses. Being shy nodulation legume, it requires fairly large quantity of Nitrogenous fertilizer (Sharma, *et al.*, 1976). It is almost unable to fix atmospheric nitrogen symbiotically, hence responds well to N application. French bean productivity is low in Maharashtra due inadequate use of fertilizers is one of the most important reasons of its low productively under situation of Marathwada, where the block soils (Vertisol) are deficient in both nitrogen & phosphorus. Potassium is sufficient in this

soils. Therefore, nitrogen & phosphorus are considered to be necessary in increasing grain yield and improve quality of French bean .Nitrogen is necessary for development of vegetative and reproductive plant parts. French bean responds well to application of phosphorus (Ahlawat, Sharma, 1989) .The present investigation was , therefore, carried out to find the influence of N & P levels on growth & yield attributing characters, yield & economics of French bean.

Materials and Methods

The field experiment was carried out at the department of Agronomy Marathwada Krishi Vidyapeeth , Parbhani during the year 2003-04,2004-05&2005-06 on French bean. The soil was medium deep Vertisols having PH 8.3 and available Phosphorous 18.23

kg/ha, Potassium 365.76 kg/ha and Nitrogen 147.4 kg/ha respectively. French bean cv. HPR-35 was tested with combination of four levels of nitrogen (0,50,100,150 kg/ha) and four levels of phosphorus (0,25,50,75Kg P₂O₅/ha) in completely split plot design with three replications. Half dose of N (60 kg/ha), full dose of P₂O₅ (60kg/ha) & K₂O (60 kg/ha) was applied as basal and remaining half dose of N (60 kg/ha) was top dressed at 30DAS.

Result and Discussion

The data presented in tables (1&2) showed significant impact of N& P₂O₅ on growth attributes viz, plant height, No .of branches per plant, No of functional leaves per plant, leaf area & total dry matter per plant, as well as yield attributes viz. No of pods per plant, pod dry wt/plant, No of seeds /plant, 100 seed weight& seed yield / plant .The maximum values of these parameters were recorded where higher dose of N& P₂O₅ was applied & minimum under the control this could be attributed to the fact that , application of N increased the vegetative growth at initial stages (plant height & branches / plant) & finally led to higher number of pods & seeds weight. Application of P significantly increased these parameters Phosphorus is important in root development & translocation of photosynthetic & being the constituents of nucleic acid, phytin & phospholipids, its application increases growth & yield attributing parameters (Verma & Saxena, 1995)

A critical examination of the data presented in table 3 revealed that Nitrogen applied @ 150(N₃) kg/ha recorded significantly higher pod, seed, straw biological yield (kg/ha), & protein content (%) than nitrogen applied @ 50 kg/ha (N₂) & No nitrogen control which showed at par result with application of 100 kg N/ha.

As N levels increases from control to 150 kg /ha the growth and yield attributing parameters showed maximum result due to increase in photo synthetically active area and it's efficiency to utilize solar radiation might have been the possible causes for higher dry mater accumulation with increased N availability response to such high dose of N may be because of poor nodulation in the crop (Ali & kushwaha,1987)

The phosphorous application was also found to be effective increasing the yield & yield attributing up to 75 kg/ha, which was significantly superior over rest of P₂O₅ levels except crop receiving 50 kg P₂O₅ ha⁻¹ (table3). As P plays a vital role in crop nutrition as a component of many bio-molecules (ribonucleic acid, deoxyribonucleic acid, sugar phosphate etc) involved in photo synthesis, respiration, root growth & other metabolic processes, the improvement in above mentioned yield attributes is expected. Increase in yield attributes due of to P application has been reported earlier by Verma & Saxena(1993), Parmar *et.al* (1990) & Rana *et.al* ((2001)

The highest Net returns were obtained with crop receiving 100 kg N/ha. (Table3). Similarly, the monetary grains in terms of gross return and net return increased consistently and significantly with varying levels of P up to 75 kg P₂O₅/ha. Where net return/rupee invested increased up to 100 kg N/ha and 50 kg P₂O₅ ha⁻¹. Further increase in N levels and P levels reduced the returns. Where as maximum harvest index of French bean were recorded by crop receiving 100 kg N/ha and 75 kg P₂O₅ ha⁻¹, respectively. The interaction of N and P was not found significant in influencing the pod, seeds Straw, biological yield (kg ha⁻¹), gross and Net monetary returns, B:C ratio and protein content (%).

Table.1 Growth attributes of French bean as influenced by different nitrogen and phosphorus levels (2003-06)

Treatments	Plant height (cm) at harvest			No. of branches/plant at harvest			No. of fun. leavs/plant at 60 DAS			Leaf area (dm ²)			Total dry matter (g/plant) at harvest		
	03-04	04-05	05-06	03-04	04-05	05-06	03-04	04-05	05-06	03-04	04-05	05-06	03-04	04-05	05-06
Nitrogen levels															
N ₀ : 00 kg N/ha	26.21	27.96	26.07	5.02	4.02	3.94	8.86	9.96	8.73	10.45	12.05	10.56	15.58	13.36	12.67
N ₁ : 50 kg N/ha	28.13	30.27	28.28	5.53	5.16	4.84	11.71	11.43	11.64	13.93	14.17	14.43	19.10	14.91	15.04
N ₂ : 100 kg N/ha	30.07	32.76	30.31	6.21	5.87	5.32	13.23	12.71	12.38	15.74	16.14	15.72	22.25	16.10	16.23
N ₃ : 150 kg N/ha	30.88	32.93	30.44	6.49	6.06	5.40	13.41	13.02	12.53	16.05	16.67	16.04	22.82	16.35	16.31
SE ±	0.34	0.19	0.28	0.02	0.13	0.08	0.01	0.34	0.23	0.02	0.39	0.25	0.37	0.05	0.07
CD at 5%	0.99	0.56	0.84	0.05	0.37	0.24	0.04	1.01	0.69	0.06	1.15	0.75	1.09	0.14	0.21
Phosphorus levels															
P ₀ : 00 kg P ₂ O ₅ /ha	27.11	28.56	26.90	5.28	4.66	4.23	10.49	10.04	9.96	12.22	12.58	12.48	17.32	13.51	13.23
P ₁ : 25 kg P ₂ O ₅ /ha	28.62	30.64	28.22	5.64	5.27	4.90	11.80	11.63	11.37	13.98	14.57	14.24	19.34	14.76	14.95
P ₂ : 50 kg P ₂ O ₅ /ha	29.52	32.22	29.80	6.10	5.54	5.15	12.33	12.59	11.91	14.85	15.77	14.92	21.30	16.08	15.98
P ₃ : 75 kg P ₂ O ₅ /ha	30.04	32.49	30.15	6.23	5.64	5.20	12.59	12.87	12.02	15.12	16.12	15.06	21.79	16.36	16.07
SE ±	0.41	0.54	0.47	0.16	0.31	0.19	0.24	0.38	0.35	0.26	0.40	0.35	0.31	0.23	0.19
CD at 5%	1.19	1.59	1.41	0.46	NS	0.57	0.72	1.14	1.05	0.75	1.16	1.05	0.90	0.67	0.57
Interaction (N x P)															
SE ±	0.82	1.09	0.79	0.32	0.63	0.24	0.49	0.78	0.54	0.51	0.81	0.67	0.57	0.46	0.39
CD at 5%	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
G. mean	28.82	30.98	28.77	5.81	5.28	4.87	11.80	11.78	11.32	14.04	14.76	14.18	19.94	15.18	15.06

Table.2 Yield attributes of French bean as influenced by different nitrogen and phosphorus levels (2003-06)

Treatments	No. of pods/plant			Pod dry wt./plant (g)			No. of seed/pods			100 seed weight (g)			Seed yield/plant (g)		
	03-04	04-05	05-06	03-04	04-05	05-06	03-04	04-05	05-06	03-04	04-05	05-06	03-04	04-05	05-06
Nitrogen levels															
N ₀ : 00 kg N/ha	9.09	7.48	6.42	12.85	10.87	10.85	2.04	2.61	1.95	38.69	30.89	30.41	8.44	7.72	7.00
N ₁ : 50 kg N/ha	10.33	8.74	7.26	15.8	12.32	12.02	2.86	2.98	2.47	41.62	32.76	31.73	10.37	9.16	7.61
N ₂ : 100 kg N/ha	11.27	9.35	7.95	18.48	13.41	13.26	3.85	3.32	2.96	42.43	33.9	32.89	11.76	10.05	8.50
N ₃ : 150 kg N/ha	11.44	9.47	8.12	18.84	13.56	13.53	4.02	3.41	3.11	42.63	34.01	33.17	11.93	10.17	8.72
SE ±	0.01	0.05	0.07	0.38	0.03	0.12	0.04	0.13	0.06	0.55	0.09	0.11	0.06	0.1	0.08
CD at 5%	0.02	0.16	0.21	1.1	0.1	0.36	0.12	0.39	0.18	1.59	0.28	0.32	0.19	0.31	0.23
Phosphorus levels															
P ₀ : 00 kg P ₂ O ₅ /ha	9.22	7.7	6.96	14.29	11.12	11.10	2.02	2.72	2.01	39.45	31.44	30.54	9.28	8.2	7.21
P ₁ : 25 kg P ₂ O ₅ /ha	10.49	8.25	7.01	15.99	12.16	11.94	2.84	2.91	2.59	41.11	32.7	31.52	10.57	8.82	7.50
P ₂ : 50 kg P ₂ O ₅ /ha	11.15	9.45	7.92	17.69	13.33	13.22	3.92	3.32	2.88	42.2	33.48	33.05	11.22	9.98	8.52
P ₃ : 75 kg P ₂ O ₅ /ha	11.27	9.64	7.88	17.99	13.56	13.41	3.99	3.37	3.01	42.59	33.93	33.07	11.43	10.09	8.60
SE ±	0.16	0.43	0.13	0.31	0.41	0.24	0.13	0.16	0.19	0.47	0.29	0.16	0.16	0.39	0.21
CD at 5%	0.46	1.26	0.39	0.92	1.21	0.72	0.39	0.48	0.57	1.36	0.85	0.48	0.47	1.14	0.64
Interaction (N x P)															
SE ±	0.31	0.86	0.26	0.63	0.83	0.46	0.27	0.31	0.31	0.49	0.58	0.29	0.32	0.79	0.41
CD at 5%	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
G. mean	10.53	8.76	7.44	16.49	12.54	12.42	3.19	3.08	2.62	41.34	32.89	32.05	10.63	9.28	7.96

Table.3 Pooled mean of the yield (kg/ha) of French bean as influenced by different nitrogen and phosphorus levels (2003-06)

Treatments	Pooled yield (kg/ha)	Seed yield (kg/ha)	Straw yield (kg/ha)	Biological yield (kg/ha)	Harvest index (%)	Protein contnt (%)	GMR (Rs/ha)	NMR (Rs/ha)	Benefit:Cost ratio
Nitrogen levels									
N ₀ : 00 kg N/ha	1507	976	1254	2230	43.77	17.06	20431	7014	1.52
N ₁ : 50 kg N/ha	1978	1313	1670	2982	44.03	20.47	27431	13754	2.00
N ₂ : 100 kg N/ha	2285	1534	1836	3369	45.53	22.49	32015	17557	2.21
N ₃ : 150 kg N/ha	2334	1572	1898	3469	45.32	22.86	32819	17058	2.08
SE ±	61	45	55	107	--	0.22	829	829	0.054
CD at 5%	182	125	163	320	--	0.65	2296	2296	0.151
Phosphorus levels									
P ₀ : 00 kg P ₂ O ₅ /ha	1581	1026	1384	2409	42.59	17.70	21494	7713	1.55
P ₁ : 25 kg P ₂ O ₅ /ha	1974	1299	1655	2954	43.97	20.23	27151	13213	1.94
P ₂ : 50 kg P ₂ O ₅ /ha	2251	1515	1800	3315	45.70	22.24	31615	17208	2.18
P ₃ : 75 kg P ₂ O ₅ /ha	2297	1555	1817	3372	46.12	22.72	32436	17249	2.12
SE ±	32	21	33	74	--	10.4	387	387	0.025
CD at 5%	96	58	98	221	--	3.12	1071	1071	0.069
Interaction (N x P)									
SE ±	73	42	69	165	--	0.84	773	773	0.049
CD at 5%	NS	NS	NS	NS	--	NS	NS	NS	NS
G. mean	2026	1349	1664	3013	44.63	20.72	28174	13846	1.95

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