

Effect of nitrogen and irrigation levels on yield and water use of french bean (*Phaseolus vulgaris*)

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ABSTRACT

An experiment was conducted at Akola during winter (*rabi*) seasons of 1990–91 and 1991–92 to study the effect of nitrogen and irrigation on french bean (*Phaseolus vulgaris* L.). Irrigation at an IW : CPE ratio of 1.2 amounting to 6 irrigations yielded the highest. Irrigating the crop at lower ratios reduced the grain yield consistently. Significant response to nitrogen application was recorded up to 90 kg/ha. Highest water-use efficiency was recorded with irrigation at 1.2 and 1.0 IW : CPE ratios during first and second years respectively. Significantly highest interaction effect on grain yield was recorded, when crop was irrigated at 1.2 IW : CPE ratio with an application of 90 kg N/ha.

French bean or *rajmash* (*Phaseolus vulgaris* L.) is an important nutritive legume, having 22–25% protein in its dry seeds and 1–2.4% in green pods (Singh and Singh, 1987). Of late the crop is getting a place in cropping systems of Vidarbha region. Therefore an experiment was conducted during winter season (*rabi*) of 1990–91 and 1991–92 to study the response of french bean to nitrogen and irrigation levels.

MATERIALS AND METHODS

The experiment was conducted during 1990–91 and 1991–92 in a 3-time replicated split-plot design allocating 4 irrigation regimes (irrigation at 1.2, 1.0, 0.8 and 0.6 IW : CPE ratios) to main plots and 5 nitrogen levels (0, 30, 60, 90 and 120 kg/ha) to subplot. The soil of the experimental plot was clay loam with 0.82% organic carbon, 15.32 kg/ha of available P_2O_5 and 212.8 kg/ha available K_2O . Field capacity and permanent wilting point were 32.4 and

17.6% respectively. The crop was sown on 1 November 1990 and 1 November 1991 during first and second years respectively. Seeds (2–3) of variety 'HUR 15' were dibbled at 30 cm × 10 cm distance after pre-soaking irrigation and 1 seedling/hill was kept after thinning. Half nitrogen as per treatment and uniform dose of 60 kg P_2O_5 /ha were drilled 8–10 cm deep at sowing time. Remaining nitrogen was top-dressed a month later. Irrigation treatments were superimposed after uniform irrigation to obtain an even crop stand. Crop was irrigated with 6 cm irrigation water every time. In all 6, 5, 4 and 3 irrigations were given in case of 1.2, 1.0, 0.8 and 0.6 IW : CPE ratios respectively during both the years. The gross and net plot size were 3 m × 5 m and 2.4 m × 3.5 m respectively. Harvesting was done on 2 February 1991 and 1 February 1992 during first and second years respectively. There was no rainfall during the period of experimentation.

Table 1. Grain yield and yield attributes of french bean as influenced by irrigation regimes and nitrogen levels

Treatment	Grain yield (q/ha)			Pods/plant		100-seed weight (g)		Consumptive use (mm)		Water-use efficiency (kg/mm/ha)	
	Y ₁	Y ₂	Pooled	Y ₁	Y ₂	Y ₁	Y ₂	Y ₁	Y ₂	Y ₁	Y ₂
<i>Irrigation regimes</i>											
I ₁ (1.2 IW : CPE)	9.19	5.94	7.57	9.80	8.81	21.33	22.34	267.22	366.38	3.44	1.62
I ₂ (1.0 IW : CPE)	7.64	5.29	6.47	8.58	8.14	20.73	20.09	228.54	306.38	3.34	1.94
I ₃ (0.8 IW : CPE)	5.75	4.16	4.96	7.34	7.44	20.66	19.61	203.93	278.52	2.81	1.49
I ₄ (0.6 IW : CPE)	3.75	3.51	3.63	6.83	5.37	20.03	19.05	168.76	232.10	2.22	1.51
CD (P = 0.05)	0.93	1.45	NS	NS	0.31	NS	NS				
<i>Nitrogen (kg/ha)</i>											
0	3.06	2.92	2.99	5.78	6.19	20.00	17.93	180.15	242.31	1.69	1.20
30	5.55	4.07	4.84	7.57	6.88	20.00	19.33	196.36	281.63	2.82	1.44
60	6.85	4.93	5.89	8.77	7.48	20.00	20.69	219.28	312.54	3.12	1.57
90	8.71	5.64	7.18	8.86	8.06	20.71	21.55	233.14	324.69	3.73	1.73
120	8.77	6.00	7.39	9.73	8.58	20.95	21.86	235.51	338.15	3.72	1.77
CD (P = 0.05)	1.01	0.84	2.28	1.49	0.58	NS	2.35				

Y₁, 1990–91; Y₂, 1991–92

NS, Non significant

Table 2. Effect of interaction between irrigation regimes and nitrogen levels on grain yield

Treatment	N ₀	N ₃₀	N ₆₀	N ₉₀	N ₁₂₀	Mean
I ₁	3.80	5.75	7.70	10.00	10.59	7.57
I ₂	3.37	5.81	6.90	8.11	8.13	6.47
I ₃	2.74	4.39	5.04	6.26	6.37	4.96
I ₄	2.04	3.39	3.93	4.35	4.46	3.69
Mean	2.99	4.84	5.89	7.18	7.39	
CD (P = 0.05)	1.13					

Details of irrigation treatments are given in Table 1

RESULTS AND DISCUSSION

Effect of irrigation regimes

Irrigation scheduling of 1.2 IW : CPE ratio accounting to 6 irrigations gave significantly higher grain yield during first year (Table 1). At lower ratios grain yield was reduced consistently. During the second year, although the highest yield was recorded with irrigation at 1.2 IW : CPE ratio, the differences in grain yield between 1.2, 1.0 and 0.8 IW : CPE ratios were not significant. Pooled data also indicated similar results, although not significantly. Irrigations at 1.2 IW : CPE ratio recorded the maximum number of pods/plant and 100-seed weight which might have augmented the grain yield.

In the first year highest consumptive use and water-use efficiency were recorded under irrigation at 1.2 IW : CPE ratio. However, during the second year although highest consumptive use was recorded under 1.2 IW : CPE ratio, the highest water-use efficiency was noticed under 1.0 IW : CPE ratio. This may be due to less difference in the grain yield between 1.2 and 1.0 IW : CPE ratio.

Effect of nitrogen

Nitrogen fertilization increased the grain

yield significantly during both the years. Application of 120 kg N/ha yielded the highest, but significant response was noticed only up to 90 kg N/ha in the first year and 60 kg N/ha in the second year. Pooled data indicated more or less similar trend. The difference in grain yield between 30 and 60 kg N/ha was not significant but both were found superior to the control. Similarly, 90 and 120 kg N/ha recorded significantly more yield than 30 kg N/ha, but were at par with 60 kg N/ha. Grain yield/plant and 100-seed weight were significantly enhanced due to nitrogen fertilization, which might have helped in boosting the grain yield. Parthibhan and Thamburaj (1991) also reported similar results.

Interaction effect

Pooled interaction between irrigation and nitrogen levels (Table 2) indicated that significantly highest grain yield was recorded with 90 kg N/ha coupled with irrigation at 1.2 IW : CPE ratio. The data further revealed that application of 90 kg N/ha gave significantly highest yield over lower levels, even if the irrigations were scheduled at 1.0 and 0.8 IW : CPE ratios. Increase in the grain yield due to 120 kg N/ha over 90 kg N/ha was not significant at above irrigation re-

gimes. This confirmed the findings of Srinivas and Rao (1984).

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