

Response of french bean (*Phaseolus vulgaris*) to irrigation and weed management in Calciotrents of north Bihar

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ABSTRACT

An experiment was conducted during the winter seasons of 1995–96 and 1996–97 to study the response of french bean (*Phaseolus vulgaris* L.) to moisture regimes and weed management at Pusa, Bihar. Weed counts and weed dry weight increased with increment in irrigation levels, but values were non-significant. Hand-weeding proved its superiority by lowering these values, followed by dichlofop and pendimethalin. Plant height, leaf-area index and branches/plant increased with increment in irrigation level. These values were significantly higher in hand-weeded condition. Both the herbicides were statistically at par to hand-weeding but significantly superior to weedy check. All the yield attributes as well as yields of french bean increased with increment in irrigation levels. The same were highest in case of hand-weeding, while lowest under weedy condition. Both the herbicides being at par with each other were also at par with hand-weeding except the seed and straw yields obtained during 1996–97.

Key words : French bean, Irrigation, Weed management, Dichlofop, Pendimethalin

Among several factors responsible for higher production, moisture is the key factor in promoting the growth of the french bean. Being a pulse crop, it does not require more irrigations, and both low and high moisture levels are detrimental to crop plants. Weed interference is the another major constraint which results in severe yield loss. Because of its slow early growth and short stature, it becomes the victim of intense weed competition right from very early stage. Due to high labour cost and their non-availability at the right time,

suitable herbicide could be more convenient, economical and efficient alternative to hand-weeding. An information is very meagre, particularly in north Bihar regarding optimum moisture and weed-management practices. Hence present investigation was planned.

MATERIALS AND METHODS

The field experiment was carried out during the winter seasons of 1995–96 and 1996–97 at Pusa, Bihar, with 12 treatment combinations, comprising 3 levels of

irrigation each of 6 cm depth by subtracting the rainfall in main plots (I_1 , 1 irrigation at 30 days after sowing; I_2 , irrigations at 30 and 60 days; and I_3 , 3 irrigations at 30, 55 and 75 days, with 4 weed-management practices in subplots, viz. T_1 , weedy check; T_2 , hand-weeding at 30 days; T_3 , pendimethalin @ 1.0 kg/ha as pre-emergence; and T_4 , dichlofop @ 0.75 kg/ha as pre-emergence. in split-plot design, replicated thrice. The soil of the experimental plot was sandy loam, calcareous, having pH 8.4, organic carbon 0.30%, available nitrogen 198.30 kg/ha, available phosphorus 19.80 kg/ha and available potassium 111.50 kg/ha having field capacity of 21.7%, permanent wilting point 9.5% and bulk density 1.50. The total rainfall during the crop period was 23.9 and 15.4 mm in 1995–96 and 1996–97 respectively.

The french bean variety 'PDR 14' was sown on 5 and 7 November 1995 and 1996, and harvested on 20 and 28 February 1996 and 1997 respectively. The recommended dose of fertilizer, i.e. 80 kg N, 40 kg P_2O_5 and 20 kg K_2O /ha, were applied. Half dose of the nitrogen and full dose of phosphorus and potash were applied as basal in the form of urea, single superphosphate and muriate of potash respectively. Remaining nitrogen was applied 40 days after sowing. Other agronomic package of practices were followed uniformly. The data on weeds and crop were collected.

RESULTS AND DISCUSSION

Weeds

The weed flora observed in the experimental plot were *Cyperus rotundus* L. among sedges; *Cynodon dactylon* (L.)

Pers. and *Dactyloctenium aegyptium* among grasses; and *Chenopodium album*, *Anagallis arvensis* L., *Melilotus alba*, *M. indica*, *Launea pinnatifida* and *Leucas aspera* among broad-leaved weeds.

Increasing irrigation level increased weed count and weed dry weight, but values were non-significant. Among weed-management practices, hand-weeding proved its superiority by significantly lowering weed count and weed dry weight and scored higher weed-control efficiency. However, somewhat higher weed-control efficiency was noticed under dichlofop but it was statistically on a par with pendimethalin for weed count and weed dry weight. Better control of weeds following pre-emergence application of herbicides not only helped in reducing their number but also reduced their dry-matter accumulation. This is in agreement with the results of Mishra *et al.* (1995) and Kumar *et al.* (1996).

Growth attributes

Increment in moisture regimes increased growth attributes like plant height, leaf-area index and branches/plant with higher values at 3 irrigations (I_3); however, the plant height and branches/plant at 2 and 3 irrigations were at par to each other (Table 1).

The weed-management practices exhibited marked effect on growth attributes of french bean. Significantly lower values of all the growth attributes were recorded under weedy check (T_1), while it was the highest under hand-weeding (T_2). Both the herbicides were found to be at par with each other for plant height, leaf-area index

Table 1. Effect of moisture regimes and weed management on associated weeds and growth attributes of french bean during 1995–96 and 1996–97

Treatment	Weed count (no./m ²)		Weed dry weight (g/m ²)		Weed-control efficiency (%)		Plant height (cm)		Leaf-area index		Branches/ plant	
	1995– 96	1996– 97	1995– 96	1996– 97	1995– 96	1996– 97	1995– 96	1996– 97	1995– 96	1996– 97	1995– 96	1996– 97
<i>Irrigation</i>												
I ₁ (1 irrigation)	5.8	5.3	4.1	3.7			23.4	22.7	3.5	3.4	5.0	4.7
I ₂ (2 irrigations)	6.5	5.8	4.2	3.9			25.5	25.1	4.0	3.8	5.6	5.3
I ₃ (3 irrigations)	6.6	5.9	4.3	4.1			26.0	25.6	4.4	4.3	5.8	5.6
CD (P=0.05)	NS	NS	NS	NS			1.7	1.6	0.14	0.12	0.3	0.3
<i>Weed management</i>												
T ₁ (weedy check)	16.1	14.3	10.7	9.9			22.7	22.3	3.2	3.0	4.5	4.3
T ₂ (hand-weeding)	2.0	1.3	1.3	0.9	87.6	90.9	26.2	25.8	4.3	4.2	6.0	5.8
T ₃ (pendimethalin)	4.1	3.8	2.7	2.6	74.8	73.7	25.2	24.7	4.1	4.0	5.5	5.2
T ₄ (dichlofop)	3.2	3.3	2.1	2.3	80.3	76.8	25.8	25.1	4.2	4.1	5.8	5.5
CD (P = 0.05)	1.8	1.3	1.0	0.9			1.7	1.8	0.15	0.14	0.4	0.4

Table 2. Effect of moisture regimes and weed management on yield attributes and yield of french bean during 1995–96 and 1996–97

Treatment	Pods/ plant		Pod length (cm)		Seeds/ pod		1,000-seed weight (g)		Seed yield (q/ha)		Haulm yield (q/ha)	
	1995– 96	1996– 97	1995– 96	1996– 97	1995– 96	1996– 97	1995– 96	1996– 97	1995– 96	1996– 97	1995– 96	1996– 97
<i>Irrigation</i>												
I ₁ (1 irrigation)	10.4	10.2	8.6	8.4	3.2	3.0	358.7	348.8	16.0	13.2	22.2	18.3
I ₂ (2 irrigations)	12.4	12.0	9.0	8.8	3.4	3.2	410.2	401.3	18.4	15.2	25.1	20.7
I ₃ (3 irrigations)	13.6	13.1	9.4	9.1	3.7	3.4	398.0	387.9	19.3	16.6	27.4	23.6
CD (P = 0.05)	1.0	0.8	NS	NS	0.24	0.20	26.7	25.3	2.3	1.6	2.7	2.5
<i>Weed management</i>												
T ₁ (weedy, check)	8.7	8.3	8.5	8.5	2.7	2.3	355.3	346.7	15.0	12.6	20.8	17.5
T ₂ (hand-weeding)	14.3	13.7	9.6	9.3	3.9	3.8	415.2	404.9	19.0	17.0	27.9	23.6
T ₃ (pendimethalin)	12.4	11.9	8.9	8.6	3.5	3.3	390.7	380.2	18.1	15.1	25.5	20.9
T ₄ (dichlofop)	13.1	13.2	9.0	8.7	3.6	3.4	394.5	385.3	18.5	15.3	26.0	21.2
CD (P = 0.05)	1.2	1.1	NS	NS	0.33	0.28	37.2	35.7	2.0	1.4	2.3	2.2

and branches/plant. These herbicides were also at par with hand-weeding. Better environment and lesser crop-weed competition right from early stage of crop may be attributed to this. Singh *et al.* (1984) also reported similar findings.

Yield attributes

Pods/plant, pod length, seeds/pod and 1,000-seed weight increased with increment in irrigation levels except 1,000-seed weight which was found to be reduced under 3 irrigations (I_3). The 1,000-seed weight was highest in 1995-96 and 1996-97 under 2 irrigations (I_2), followed by I_3 and I_1 . Samadi and Sapaskhan (1994), also reported decrease in test weight at higher frequency of irrigation.

Weed-management practices significantly affected the yield attributes of french bean. Maximum values of all the yield attributes were recorded under hand-weeded plot, followed by dichlofop and pendimethalin and the minimum under weedy-check condition. The weed-free situation under hand-weeding and herbicides-treated plots created a favourable condition and better crop efficiency for translocation of nutrient and ultimately increased the yield attributes. The findings confirm those of Kumar *et al.*, (1996).

Yield

Crop yield is the resultant of growth and yield attributes which are outcome of crop efficiency and management factors. Both the seed and straw yields of french bean were affected by the levels of irrigation. Significant increase in straw yield was noticed up to 3 irrigations (I_3). In case of

seed yield, the values obtained at 3 irrigations were however, at par with those obtained with 2 irrigations. There was marked effect of weed management on seed and straw yields. The higher seed and straw yields were obtained under hand-weeded plots, followed by dichlofop and pendimethalin. The lower biological yield was noticed in case of weedy condition. The severe crop-weed competition and harsh environment in weedy check condition reduced the yields, while under hand-weeding as well as in herbicide-treated plots, plants made use of the applied resource yielded high. Similar findings were made by Ali and Lal (1991).

Interaction effect was found to be non-significant.

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