



## Chemical and mechanical weed management for increased yield of French bean

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### ABSTRACT

Field experiments were conducted during *Kharif* 2010 and 2011 to study the effect of weed management practices on French bean in temperate region of Kashmir, India. Among different weed control treatments, pre-plant incorporation and pre-emergence application of fluchloralin and pendimethalin 1.00 kg/ha significantly reduced the population of different weeds than weedy check and other herbicide treatments. These resulted in significant increase in growth and yield attributes, viz. plant height, number of branches, dry matter accumulation, seed and straw yield of French bean. Maximum seed yield was obtained with fluchloralin 1.00 kg/ha and pendimethalin 1.00 kg/ha treatments with a corresponding value 1.11 and 1.10 t/ha. These also increased the nutrient uptake by French bean crop at various crop growth stages over weedy check and other treatments during both the years. Application of fluchloralin 1.00 kg/ha and pendimethalin 1.00 kg/ha significantly increased the net return over weedy check, with B:C ratio of 1.18 and 1.12 during two cropping seasons.

**Key words:** Chemical control, Cropping system, Economics, French bean, Mechanical control, N uptake, Weed management

French bean (*Phaseolus vulgaris* L.) is an important and highly profitable among pulse crop in hilly tracts of Jammu & Kashmir, Himachal Pradesh, Uttar Pradesh and parts of Maharashtra in *Kharif* season due to its specific adaption to a cool and long growing season (Tripathi *et al.* 1986 and Sood *et al.* 2003). In India, French bean covers an area of 1.1 million hectares with production of 4.8 MT. In spite of its popularity, its productivity in India is very low being only 450.9 kg/ha as compared to the world average of 777.4 kg/ha (Anonymous 2010). The initial growth rate of French bean is very slow and the interspaces are infested with many weeds. It has been estimated that losses due to weeds alone can reduce the seed yield upto 20 - 60 per cent (Anonymous 2009). Keeping in view the above facts in mind, the present study was undertaken to improve the seed yield of French bean by effective chemical weed control.

### MATERIALS AND METHODS

Field experiment was conducted at the experimental farm of KVK, Pulwama during *Kharif* 2010 and 2011. The soil of the location was silty clay loam, neutral in reaction (pH 7.07) having organic carbon (10.02 g/kg), available N (248.6 kg/ha), P (14.7 kg/ha) and K (250.3 kg/ha). French bean '*Selection-3*'

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was sown in 30 cm inter-row and 10 cm intra-row spacing in first fortnight of April during both the years of experimentation using 120 kg seed/ha. Recommended dose of 120 kg N, 60 kg P and 50 kg K were uniformly applied to all the treatments. Full dose of P and K and half dose of N were applied as basal at the time of sowing and rest half of the N total as per treatment was applied before second irrigation at 47 DAS. Twelve treatments comprising of weedy check, hand weeding at 30 DAS, weed free, fluchloralin 0.75 kg/ha, fluchloralin 1.00 kg/ha, fluchloralin 0.75 kg/ha + hand weeding at 30 DAS, pendimethalin 0.75 kg/ha, pendimethalin 1.00 kg/ha, pendimethalin 0.75 kg/ha + hand weeding at 30 DAS, oxyfluorfen 0.15 kg/ha, oxyfluorfen 0.20 kg/ha, oxyfluorfen 0.15 kg/ha + hand weeding 30 DAS were tested in randomized block design with three replications. All the herbicide treatments were applied pre-planting and pre-emergence with the help of knapsack sprayer fitted with flat fan T-jet nozzle at a spray volume of 500 litre/ha. In weed free plots, weeds were removed manually as and when required with the help of khurpi (hand tool to remove weeds). Observations were recorded on the dry matter of weeds (g/m<sup>2</sup>), weed control efficiency (%), seed yield (t/ha), plant height (cm), number of branches/plant, dry matter accumulation/plant (g/m<sup>2</sup>), straw yield (t/ha), total N-uptake (kg/ha) and relative economics of the crop was also calculated. The data were statistically analyzed following standard procedure.

## RESULTS AND DISCUSSION

## Weed growth

The dominant weeds in French bean were *Euphorbia prostrata*, *Cyprus esculentus*, *Cyprus rotundus*, *Anagallis arvensis*, *Trifolium* spp. and *Phalaris minor*.

## Weed biomass

The dry weight of weeds was significantly affected in French bean by different weed management practices. During first year, fluchloralin 1.00 kg/ha and pendimethalin 1.00 kg/ha were comparable for weed dry weight over weedy check and hand weeding at 30 DAS. Dry matter of weeds was minimum (3.84 g/m<sup>2</sup>) with fluchloralin 1.00 kg/ha and had higher weed control efficiency (80.48 %). But during second year, fluchloralin 1.00 kg/ha (3.34 g/m<sup>2</sup>) was closely followed by pendimethalin 1.00 kg/ha in ascending order, respectively (Table 1). All other treatments were also significantly superior to weedy check and had higher weed control efficiencies.

## Seed yield and growth characters

The weed control measures exhibited significant variation in yield and growth parameters. Maximum yield (1.11 t/ha and 0.97 t/ha) was recorded in the fluchloralin 1.00 kg/ha in both the years which was statistically at par with pendimethalin 1.00 kg/ha and minimum yield was recorded in weedy check. Fluchloralin 1.00 kg/ha produced taller (26.83 cm) plants which was closely followed by pendimethalin 1.00 kg/ha (26.64 cm). The superiority of fluchloralin 1.00 kg/ha and pendimethalin 1.00 kg/ha at 90 DAS stage in term of shoot height might have accrued to better weed control (Table 2). Mishra *et al.* (1998) also reported similar results while working with few similar herbicides on French Bean. The maximum dry matter (10.01 g) in the first year was recorded under fluchloralin (1.00 kg/ha) which was statistically at par with fluchloralin (0.75 kg/ha + HW 30 DAS), pendimethalin (1.00 kg/ha) and pendimethalin (0.75 kg/ha + HW 30 DAS), however, in the second year the maximum dry matter (9.93 g/m<sup>2</sup>) was registered by pendimethalin (1.00 kg/ha), which was closely fol-

Table 1. Effect of various treatments on dry matter of weeds in French bean at 60 DAS and seed yield

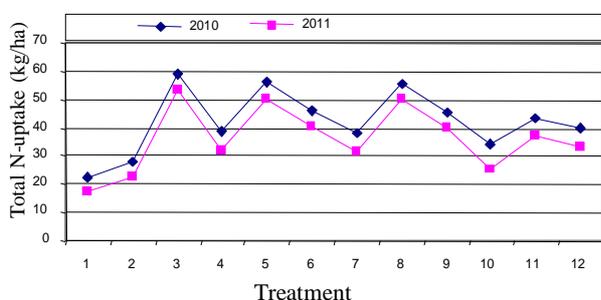
Treatment	Dry matter of weeds (g/m <sup>2</sup> )		WCE (%)	Seed yield (t/ha)	
	2010	2011		2010	2011
Fluchloralin (0.75 kg/ha)	6.98 (2.73)	5.92 (2.53)	63.21	0.86	0.65
Fluchloralin (1.00 kg/ha)	3.84 (2.08)	3.34 (1.88)	80.48	1.11	0.97
Fluchloralin (0.75 kg/ha + HW 30 DAS)	4.98 (2.34)	4.16 (2.16)	73.93	0.95	0.78
Pendimethalin (0.75 kg/ha)	7.62 (2.85)	6.13 (2.57)	60.78	0.85	0.65
Pendimethalin (1.00 kg/ha)	4.03 (2.13)	3.55(2.01)	78.38	1.10	0.96
Pendimethalin (0.75 kg/ha + HW 30 DAS)	5.65 (2.48)	4.78 (2.30)	70.25	0.94	0.77
Oxyfluorfen (0.15 kg/ha)	8.84 (3.06)	7.08 (2.75)	54.59	0.69	0.50
Oxyfluorfen (0.20 kg/ha)	5.89 (2.53)	5.14 (2.37)	68.54	0.91	0.72
Oxyfluorfen (0.15 kg/ha + HW 30 DAS)	6.38 (2.62)	5.61 (2.47)	65.80	0.86	0.65
Weedy check	18.4 (4.36)	16.5 (4.13)		0.64	0.43
Hand weeding at 30 DAS	14.2 (3.84)	12.2 (3.56)	24.56	0.67	0.49
Weed free	0.00 (0.71)	0.0 (0.71)	100.00	1.13	0.99
LSD(P=0.05)	0.20	0.31	4.27	1.08	0.78

Table 2. Growth attributes of French bean at 90 DAS as influenced by various herbicides

Treatment	Plant height (cm)		No. of branches /plant		Dry matter accumulation/plant (g)		Stover yield (t/ha)	
	2010	2011	2010	2011	2010	2011	2010	2011
Fluchloralin (0.75 kg/ha)	24.4	24.4	5.14	5.00	7.56	7.20	1.26	1.22
Fluchloralin (1.00 kg/ha)	26.8	26.6	6.11	6.05	10.0	9.92	1.58	1.56
Fluchloralin (0.75 kg/ha + HW 30 DAS)	25.0	25.4	5.62	5.89	9.69	9.55	1.50	1.49
Pendimethalin (0.75 kg/ha)	24.6	24.7	5.27	5.53	8.31	7.90	1.26	1.22
Pendimethalin (1.00 kg/ha)	25.6	26.2	6.05	5.98	9.99	9.93	1.58	1.56
Pendimethalin (0.75 kg/ha + HW 30 DAS)	24.9	25.3	5.58	5.78	9.71	9.58	1.50	1.49
Oxyfluorfen (0.15 kg/ha)	23.0	24.4	5.47	5.47	7.52	7.14	1.18	1.13
Oxyfluorfen (0.20 kg/ha)	24.9	25.1	5.44	5.55	8.52	8.14	1.48	1.46
Oxyfluorfen (0.15 kg/ha + HW 30 DAS)	23.2	25.1	5.35	5.47	8.56	8.16	1.29	1.26
Weedy check	20.6	19.5	4.19	4.00	7.16	6.86	1.09	1.03
Hand weeding at 30 DAS	23.1	22.2	4.83	4.75	7.36	7.02	1.13	1.12
Weed free	27.5	27.1	6.53	6.44	10.0	9.97	1.60	1.58
LSD (P=0.05)	1.86	1.28	0.54	0.32	0.98	1.05	0.94	0.92

**Table 3. Relative economics of different weed control treatments in French bean**

Treatment	2010			2011		
	Cost of cultivation (x10 <sup>3</sup> /ha)	Net returns (x10 <sup>3</sup> /ha)	B:C ratio	Cost of cultivation (x10 <sup>3</sup> /ha)	Net returns (x10 <sup>3</sup> /ha)	B:C ratio
Fluchloralin (0.75 kg/ha)	22.69	15.82	0.70	22.69	11.89	0.52
Fluchloralin (1.00 kg/ha)	22.94	27.09	1.18	22.94	25.77	1.12
Fluchloralin (0.75 kg/ha + HW 30 DAS)	23.74	18.91	0.80	23.74	16.47	0.69
Pendimethalin (0.75 kg/ha)	23.08	15.25	0.66	23.08	11.41	0.49
Pendimethalin (1.00 kg/ha)	23.43	26.43	1.13	23.43	25.11	1.07
Pendimethalin (0.75 kg/ha + HW 30 DAS)	24.13	18.34	0.76	24.13	15.67	0.65
Oxyfluorfen (0.15 kg/ha)	23.14	8.00	0.34	23.14	4.88	0.21
Oxyfluorfen (0.20 kg/ha)	23.19	17.84	0.73	23.19	13.63	0.59
Oxyfluorfen (0.15 kg/ha + HW 30 DAS)	24.19	14.69	0.61	24.19	10.58	0.44
Weedy check	22.09	6.61	0.30	22.09	2.55	0.11
Hand weeding at 30 DAS	23.14	6.96	0.30	23.14	3.97	0.17
Weed free	26.29	24.37	0.93	26.29	23.59	0.90

**Fig. 1. Total N uptake of French bean as influenced by various herbicides at harvest stage**

lowed by fluchloralin (1.00 kg/ha), pendimethalin (0.75 kg/ha + HW 30 DAS) and fluchloralin (0.75 kg/ha + HW 30 DAS). The minimum dry matter was recorded under weedy check. Fluchloralin (1.00 kg/ha) registered maximum number of branches (6.11 and 6.05) in both the years which were statistically at par with pendimethalin (1.00 kg/ha) in the first year and pendimethalin (1.00 kg/ha), fluchloralin (0.75 kg/ha + HW 30 DAS) and pendimethalin (0.75 kg/ha + HW 30 DAS) in the second year. Maximum straw yield (1.58 t/ha and 1.56 t/ha) was obtained in fluchloralin (1.00 kg/ha) which was closely followed by pendimethalin (1.00 kg/ha) in both the years of study. Less competition among weeds thereby results in more photosynthesis and hence better translocation of photosynthates besides larger sink and stronger reproductive in weed control treatments (Dhanpal *et al.* 1989, Rao *et al.* 1997).

Due to least crop-weed competition and higher growth, development and yield, fluchloralin 1.00 kg/ha and pendimethalin 1.00 kg/ha had resulted significantly higher total nitrogen uptake (55.95 and 49.95 kg/ha) in 2010 and 2011 (55.32 and 49.72 kg/ha) in French bean, responsibility. (Fig 1).

## Economics

Economic returns as a function of seed yield and sale price varied during different years. More returns during 2008 were obtained due to high sale price and higher seed yield. The maximum gross returns of ` 50,040 and ` 49,860 per hectare and net returns of ` 27,095 and ` 26,432 per hectare and B:C ratio of 1.18 and 1.13 were recorded with fluchloralin 1.00 kg/ha and pendimethalin 1.00 kg/ha, respectively. (Table 3).

Thus, the results of two year study clearly indicated that fluchloralin 1.00 kg/ha and pendimethalin 1.00 kg/ha were the effective treatments for satisfactory weed control and higher productivity and profitability in French bean cultivation.

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