



## Weed control in fenugreek with pendimethalin and imazethapyr

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Received: 2 May 2016; Revised: 25 May 2016

**Key words:** Fenugreek, Imazethapyr, Pendimethalin, Weed management

Fenugreek (*Trigonella foenum-graecum* L.) locally known as 'Methi' in Hindi, is an important multiuse spice crop of arid and semi-arid regions of India. Fenugreek is an annual herb with trifoliolate leaves and it can grow to be about two feet tall belongs to family Fabaceae. India is the largest producer of fenugreek in the world where Rajasthan, Gujarat, Uttaranchal, Uttar Pradesh, Madhya Pradesh, Haryana and Punjab are the major fenugreek producing states. Rajasthan produces the lion's share of India's production, accounting for over 80% of the total fenugreek output (Anonymous 2012). In Haryana, the crop is sown in an area of 4978 ha with seed production of 13,973 tonnes (Anonymous 2009). Growth of fenugreek is very slow in the initial stage and it does not form a canopy that can suppress weed growth until several weeks after sowing. Therefore, the crop faces severe competition from weeds causing yield reductions from 14.2 to 69.0% depending upon density and duration of competition.

Manual weeding for weed control in fenugreek is generally not accomplished at critical period of crop weed competition due to non-availability of labour. In earlier studies, pendimethalin 0.75 kg/ha and fluchloralin 0.75 kg/ha were reported effective chemicals to control weeds in fenugreek. In the present study imazethapyr and a few other herbicides have been evaluated to control weeds in this important crop.

Field experiment was conducted on sandy loam soil of KVK farm, Jind (Haryana) during *Rabi* season of 2011-12. The soil of the experimental field was sandy loam in texture with low in organic carbon (0.23%) and available N (210 kg/ha), medium in P (13 kg/ha) and high available K (556 kg/ha) with slightly alkaline pH (8.3) and EC 1.13 dS/m. The experiment was laid out in randomized block design with three replications. There were 14 weed control treatments *viz.* weedy check, weed free, two hoeing at 25 and 50 DAS, pendimethalin 1.0 kg/ha, trifluralin 1.0 kg/ha and three doses (35, 45 and 55 g/ha) of imazethapyr

each applied as PPI, PRE and at 2-4 trifoliolate leaf stage replicated thrice making a total of 42 experimental units, each measuring 6 x 6 m<sup>2</sup>. The required quantity of herbicides was worked out and was mixed with water and sprayed uniformly at different stages of crop growth with knapsack sprayer fitted with flat fan nozzle at a spray volume of 500 l/ha. Category-wise weed density (no./m<sup>2</sup>) and biomass of weeds (g/m<sup>2</sup>) were recorded by putting a quadrat (50 x 50 cm<sup>2</sup>) at two random spots in each plot at 25, 50, 75, 100 DAS and at harvest. Fenugreek cultivar 'HM-103' was sown in lines 30 cm apart during last week of November in each experimental unit. All the recommended package of practices was followed to raise the crop. The crop was harvested during last week of April, 2012. Data on weed density and biomass of weeds were transformed using  $\sqrt{x+1}$  before subjected to statistical analysis and weed control efficiency (WCE) was calculated based on the biomass accumulated by the weeds.

### Effect on weeds

The experimental field was infested with broad-leaved weeds comprised of *Chenopodium album*, *Chenopodium murale*, *Melilotus indica* and *Rumex dentatus*.

All weed control treatments significantly reduced the total population and dry matter accumulation by weeds than weedy check (Table 1). Trifluralin as PPI, pendimethalin as pre-emergence (PRE) and imazethapyr 55 g/ha either applied as PPI or PRE provided excellent control of weeds up to 25 DAS. At 100 DAS and at harvest, post-emergence application of imazethapyr (55 g/ha) significantly reduced the weed population over other herbicidal treatments. Excellent efficacy of this herbicide against broad-leaved weeds was also reported by Sikkema *et al.* (2005).

*Chenopodium album* and *C. murale* accumulated more dry weight and were real culprit in crop-weed competition. Pendimethalin and trifluralin at 1.0 kg/ha caused significant reduction in weed dry weight recorded at 25 and 50 DAS. Efficient control

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**Table 1. Weed flora as influenced by weed management practices at different crop growth stages**

Treatment	Weed population (no/m <sup>2</sup> )				Biomass of weeds (g/m <sup>2</sup> )				WCE (%)
	25 DAS	50 DAS	100 DAS	Harvest	25 DAS	50 DAS	100 DAS	Harvest	
Imazethapyr (35 g/ha) PPI	8.7 (75)	12.0 (122)	12.2 (147)	11.4 (128)	6.6	43.4	108.1	110.4	40
Imazethapyr (45 g/ha) PPI	7.9 (62)	10.4 (107)	11.5 (132)	10.8 (115)	5.0	36.4	99.6	101.6	45
Imazethapyr (55 g/ha) PPI	6.2 (37)	7.5 (56)	9.6 (91)	9.1 (81)	3.0	20.9	72.7	77.2	58
Imazethapyr (35 g/ha) PRE	8.7 (74)	11.0 (120)	11.9 (140)	11.2 (125)	6.9	41.9	104.5	105.9	42
Imazethapyr (45 g/ha) PRE	7.9 (61)	10.2 (103)	11.2 (125)	10.4 (107)	4.8	32.8	97.4	98.0	47
Imazethapyr (55 g/ha) PRE	5.8 (33)	7.4 (53)	9.2 (83)	8.4 (69)	2.6	21.1	70.1	75.7	59
Imazethapyr (35 g/ha) 2-4 trifoliolate leaf stage	10.3(105)	8.0 (63)	9.5 (90)	9.1 (81)	8.6	29.4	90.0	82.7	55
Imazethapyr (45 g/ha) 2-4 trifoliolate leaf stage	9.8 (95)	7.2 (51)	8.7 (75)	8.3 (67)	6.5	26.1	77.6	73.0	60
Imazethapyr (55 g/ha) 2-4 trifoliolate leaf stage	9.1 (81)	5.5 (29)	7.0 (48)	6.2 (37)	5.6	15.0	53.1	58.3	69
Trifluralin (1000 g/ha) PPI	6.2 (38)	8.7 (75)	9.4 (88)	8.7 (75)	2.8	23.9	80.3	92.5	50
Pendimethalin (1000 g/ha) PRE	5.6 (30)	8.3 (68)	8.9 (78)	8.1 (65)	2.7	22.5	77.0	87.6	52
Two hoeing 25 and 50 DAS	11.5(131)	1.0 (0)	4.0 (15)	3.5 (11)	11.0	0.0	11.5	18.3	90
Weed free	1.0 (0)	1.0 (0)	1.0 (0)	0 (0)	0	0	0	0	100
Weedy check	12.0 (142)	14.9 (221)	16.82(282)	16.1(258)	15.7	75.2	181.7	184.2	0
LSD (P=0.05)	0.5	0.3	0.3	0.31	1.3	2.5	4.7	5.3	-

DAS- Days after sowing; PE - Pre-emergence; PPI - Pre plant incorporation

of weeds in fenugreek by pendimethalin applied as pre-emergence at 750-1000 g/ha has been reported earlier (Narender *et al.* 2014). At 100 DAS and at harvest, pendimethalin showed slightly better control of weeds over trifluralin and imazethapyr (55 g/ha) applied as pre-plant incorporation or pre-emergence. Two hand hoeings proved very effective in minimizing density of all weeds at all the stages of crop growth. Maximum weed control efficiency (69%) was achieved with post-emergence use of imazethapyr (55 g/ha) which was higher than trifluralin and pendimethalin.

### Effect on crop

Effect of different weed control treatments was also observed on yields attributing character *viz.* pods per plant, seeds per pod, test weight, grain yield per plant and grain yield. Significantly lower values of pods per plant, seeds per pod, test weight and seed yield were recorded under weedy check and highest values of these were recorded in weed free and two hoeing. The yield attributes in plots treated with pendimethalin at 1.0 kg/ha were statistically at par with post-emergence application of imazethapyr at 55 g/ha. Among herbicidal treatments maximum grain yield (kg/ha) was recorded with post-emergence use of imazethapyr at 55 g/ha which was significantly higher than all other herbicidal treatments. Number of seeds per pod and grain yield per plant in trifluralin treated plots was significantly less as compared to post-emergence use of imazethapyr at 55 g/ha.

Test weight, and grain yield were highest in plots kept weed free throughout the crop season. The comparative economics showed that pendimethalin at 1.0 kg/ha was most economical weed control treatment with net returns of ₹ 9712/ha with benefit-cost ratio of 1.99 which was closely followed by post-emergence application of imazethapyr at 55 g/ha (₹ 9609/ha) and benefit-cost ratio of 1.93. Thus for econo-effective weed management in fenugreek, pre-emergence application of pendimethalin at 1.0 kg/ha or post-emergence use of imazethapyr at 55 g/ha may be adopted as an alternative to manual weeding with maximum returns and seed yield. Among herbicidal treatments, the lowest return over weedy check was given by imazethapyr at 35 g/ha applied as pre-plant incorporation.

### Economics

The comparative economics of various weed control treatments is presented in table 2. Data of the present investigation revealed that to raise an economical crop of fenugreek, proper weed management is must. Pendimethalin at 1.0 kg/ha gave the highest return (₹ 8542/ha) over weedy check followed by imazethapyr (55 g/ha) applied at 2-4 trifoliolate leaf stage and pre-emergence. Among herbicidal treatments, the lowest return over weedy check was given by imazethapyr at 35 g/ha applied as pre-plant incorporation.

**Table 2. Yield attributes, yield, net returns and benefit: cost ratio of fenugreek as influenced by herbicides**

Treatment	No. of pods/plant	No. of seeds/pod	Test weight (g)	Grain yield/plant (g)	Grain yield (t/ha)	Net returns (x10 <sup>3</sup> /ha)	B:C
Imazethapyr (35 g/ha) PPI	58.5	15.6	11.3	8.6	1.06	3.98	1.40
Imazethapyr (45 g/ha) PPI	71.2	17.3	11.7	9.9	1.19	5.42	1.53
Imazethapyr (55 g/ha) PPI	92.2	17.9	11.7	11.3	1.44	8.40	1.81
Imazethapyr (35 g/ha) PRE	62.1	15.3	11.5	8.9	1.11	4.56	1.46
Imazethapyr (45 g/ha) PRE	72.2	16.8	11.8	10.4	1.21	5.66	1.56
Imazethapyr (55 g/ha) PRE	94.2	18.2	12.0	11.8	1.48	8.94	1.86
Imazethapyr (35 g/ha) 2-4 trifoliolate leaf stage	62.6	16.2	11.3	8.9	1.11	4.62	1.46
Imazethapyr (45 g/ha) 2-4 trifoliolate leaf stage	84.2	17.2	11.8	10.0	1.23	5.97	1.59
Imazethapyr (55 g/ha) 2-4 trifoliolate leaf stage	95.5	18.4	12.0	11.9	1.53	9.61	1.93
Trifluralin (1000 g/ha) PPI	92.3	17.8	12.0	11.3	1.44	8.87	1.90
Pendimethalin (1000 g/ha) PRE	92.9	18.4	12.1	11.7	1.48	9.71	1.99
Two hoeing 25 and 50 DAS	99.7	18.2	11.9	11.9	1.55	4.97	1.32
Weed free	101.6	19.0	12.3	13.3	1.63	3.66	1.20
Weedy check	51.7	15.1	10.9	7.04	0.79	1.17	1.12
LSD (P=0.05)	3.41	0.59	0.17	0.41	0.05	-	-

DAS- Days after sowing

### SUMMARY

Trifluralin as PPI, pendimethalin as pre-emergence and imazethapyr at 55 g/ha either applied as PPI or PRE provided excellent control of weeds up to 25 DAS. At 100 DAS and at harvest, post-emergence application of imazethapyr (55/ha) significantly reduced the weed population over other herbicidal treatments. Maximum dry matter accumulation by the crop, yield and yield attributes were recorded in weed free plots which was significantly higher over all herbicidal treatments. Maximum weed control efficiency (69%) was observed with post-emergence application of imazethapyr 55 g/ha.

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