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Weed management in Indian mustard (*Brassica juncea*)

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ABSTRACT

A field experiment conducted during winter (*rabi*) seasons of 1998 and 1999 at Research Farm, College of Agriculture, Gwalior, Madhya Pradesh, revealed that the application of oxyfluorfen at 0.25 kg/ha as pre-emergence, fluchloralin 1.0 kg/ha as pre-plant application and 2 hand-weedings (25 and 40 DAS) in Indian mustard [*Brassica juncea* (L.) Czernj. & Cosson] drastically reduced weed density, weed biomass and increased the seed yield. Two hand-weedings were next to weed-free in giving higher seed yield (17.55 and 17.59 q/ha during 1998 and 1999 respectively), followed by oxyfluorfen 0.25 kg/ha as pre-emergence in both the years. However, oxyfluorfen at 0.25 kg/ha was on a par with fluchloralin 1.0 kg/ha as pre-plant application and pendimethalin 0.75 kg/ha as pre-emergence.

Key words : Weed management, Mustard, Cultural practices, Herbicides

Weed competition in Indian Mustard is more serious in early stage, because crop growth during winter (*rabi*) season remains slow during the first 4–6 weeks after sowing. However, during later stage it grows vigorously and has suppressing effect on weeds. As this crop is grown in poor soil with poor management practices, weed infestation is one of the major causes of low productivity. Among the factors responsible for the low productivity of the Indian mustard, weeds alone cause 20–30% yield reduction, which may go up to 62% (Singh, 1992). At present, hand-hoeing is the only method employed for controlling weeds in this crop. Due to rise in labour wages and their non-availability at peak season, herbicides could be a more economical and efficient alternative to hand-weeding for checking early competition (Gill *et al.,* 1984). Therefore, present investigation was carried out to study the effect of weed-management practices in Indian mustard.

MATERIALS AND METHODS

The field experiment was conducted during the winter (*rabi*) seasons of 1998 and 1999 at the Research Farm, College of Agriculture, Gwalior, on alluvial soils (Inceptisol), having organic matter, available nitrogen, phosphorus and potash content of 0.39%, 1.31, 13.9 and 231 kg/ha, respectively, and pH 7.6. The experiment was conducted in randomized block design with 12 treatments replicated 4 times. The treatments consisted of pendimethalin at 0.75, oxyfluorfen at 0.25, oxadiazon at 1.0 kg/ha as pre-emergence, fluchloralin at 1.0 kg/ha as pre-plant incorporation, isoproturon at 1.0 kg/ha as pre-emergence, 1 hand-weeding 25 days after sowing, 2 hand-weedings (25 and 40 days after sowing), 1 hoeing 20 days after sowing, 2 hoeing at 20 and 30 days after sowing, weed-free, 1-weeding 25 days after sowing + 1 hoeing 30 days after sowing and weedy check (control). Indian mustard variety 'Pusa Bold' was sown with the seed rate of 5 kg/ha in rows at 30 cm apart. The fertilizers were applied @ 80 kg N, 40 kg P_2O_5 and 20 kg K_2O/ha. The half dose of N, full dose of P_2O_5 and K_2O were applied as basal dose. The remaining nitrogen was top-dressed after first irrigation, i.e. 30 days after sowing. Sowing was done on 18 October 1998 and 19 October 1999 and harvesting on 21 February 1999 and 23 February 2000. Weed population was counted in 1 m^2 and weed dry weight from the same area was recorded at flower-initiation stage of the weeds.

RESULTS AND DISCUSSION

Effect of crop

Different weed-control treatments significantly affected branches/plant, siliquae/plant and seed yield. Seed/siliqua in both the years was not affected by any of the treatments. All the herbicidal treatments as well as hand-weeding treatments resulted in more branches/plant, siliquae/plant, seeds/siliqua and seed yield over the weedy check (control) (Table 2). However, the maximum yield-attributing traits were recorded in weed-free and 2 hand-weedings (25 and 40 days after sowing) and the lowest in weedy check (control). The herbicidal treatments, viz. oxyfluorfen,

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Table 1. Effect of weed-control treatments on yield attributes, seed yield, net returns and benefit : cost ratio of Indian mustard

Treatment	Dose (kg/ha)	Time of application	Branches/plant				Siliquae/plant		Seeds/siliqua		Seed yield (q/ha)		Mean net returns (Rs/ha)	Mean benefit : cost ratio
			Primary		Secondary		1998	1999	1998	1999	1998	1999		
			1998	1999	1998	1999								
Pendimethalin	0.75	PE	4.4	4.4	11.6	11.6	189.4	178.5	13.6	13.4	16.45	16.44	9,192	2.24
Oxyfluorfen	0.25	PE	4.9	5.0	12.9	12.9	251.6	239.4	13.2	13.8	17.32	17.26	9,429	2.17
Oxadiazon	1.0	PE	4.1	4.3	10.2	10.1	161.7	141.3	13.9	13.1	14.75	14.79	7,180	1.92
Fluchloralin	1.0	PPI	4.6	4.8	12.9	12.9	226.6	226.6	14.4	14.2	16.65	16.66	9,382	2.26
Isoproturon	1.0	PE	4.0	4.3	10.1	10.4	159.6	170.2	13.9	13.7	14.35	15.81	8,178	2.17
Hand-weeding		25 DAS	4.2	4.4	10.5	10.6	187.1	174.8	123.9	13.5	16.40	16.39	9,669	2.38
Hand-weeding		25 and 40 DAS	5.0	5.0	12.9	13.0	268.7	243.7	13.3	13.6	17.55	17.59	10,094	2.31
Hoeing		20 DAS	3.8	4.1	9.4	9.5	134.6	134.6	13.8	13.4	13.10	13.32	6,752	2.00
Hoeing		20 and 30 DAS	3.9	4.2	9.9	9.9	139.6	139.7	13.7	13.4	13.40	13.96	6,822	1.97
Weed-free			5.1	5.2	13.7	13.7	409.2	307.5	14.2	14.1	20.10	21.88	12,484	2.44
Weeding and hoeing		Weeding 25 DAS and Hoeing 30 DAS	4.5	4.5	12.8	12.8	197.0	196.1	13.9	13.6	16.60	16.54	9,381	2.26
Weedy check			3.4	3.7	9.0	9.1	97.5	118.8	13.7	13.2	10.10	11.79	4,833	1.77
CD (P=0.05)			0.6	0.6	2.5	2.1	116.5	91.1	NS	NS	4.66	2.82		

Selling price: Grain Rs 950/q, rate of herbicides : Pendimethalin Rs 315/kg, oxyfluorfen Rs 1,310/kg oxadiazon Rs 285/kg, fluchloralin Rs 350/kg and isoproturon Rs 320/kg
PE, Pre-emergence, PPI, pre-plant incorporation; DAS, days after sowing

Table 2. Effect of weed-control treatments on weed population, weed dry matter and weed-control efficiency in Indian mustard

Treatment	Dose (kg/ha)	Time application	Weed population (No./m²)		Weed dry matter (g/m²)		Weed-control efficiency (%)	
			1998	1999	1998	1999	1998	1999
Pendimethalin	0.75	PE	49.5	47.5	15.4	7.8	71.7	71.9
Oxyfluorfen	0.25	PE	30.7	31.7	11.1	5.6	79.7	79.6
Oxadiazon	1.0	PE	62.0	69.0	20.6	11.2	62.3	59.6
Fluchloralin	1.0	PPI	34.2	35.2	12.7	6.6	76.6	76.3
Isoprotron	1.0	PE	69.0	62.0	21.7	10.5	60.2	62.2
Hand-weeding		25 DAS	51.0	54.2	16.8	8.7	69.2	68.8
Hand-weeding		25 and 40 DAS	27.2	29.7	9.8	5.0	82.0	81.8
Hoeing		20 DAS	78.2	79.0	28.3	14.5	48.1	47.9
Hoeing		20 and 30 DAS	73.0	72.5	25.6	12.9	53.1	53.8
Weed free			19.2	18.7	2.7	1.3	94.9	95.0
Weeding and hoeing		Weeding at 25 DAS and hoeing at 30 DAS	39.0	38.2	13.8	7.0	74.6	74.9
Weedy check			102.5	112.5	54.7	27.9		
CD (P=0.05)			12.0	14.9	9.4	4.4		

PE, Pre-emergence; PPI, pre-plant incorporation; DAS, days after sowing

fluchloralin and pendimethalin, as well as 2 hand-weedings (25 and 40 days after sowing) were at par among themselves for seed yield (q/ha). The maximum seed yield (q/ha) was recorded in weed-free treatment followed by 2 hand-weedings (25 and 40 days after sowing), oxyfluorfen 0.25 kg/ha as pre-emergence, fluchloralin 1.0 kg/ha as pre-plant application and pendimethalin 0.75 kg/ha as pre-emergence. However, the lowest yield was registered under weedy check (control). The results confirm the findings of Singh *et al.* (1989). The higher yield under 2 hand-weedings may be attributed to lower dry-matter accumulation by weeds and decrease in their population that helped in increasing the yield attributes which ultimately led to higher yield. The superiority of the 2 hand-weedings (25 and 40 days after sowing) may be attributed to better weed control and better aeration to crop. Similar results were also reported by Yadav *et al.* (1999).

Effect on weeds

The weeds flora of the experiment field during both the years comprised *Chenopodium album* L., *Convolvulus arvensis* L., *Asphodelus tenufolius* L., *Melilotus indica* L., *Anagallis arvensis* L., *Avena fatua* L., *Cynodon dactylon* (L.) Pers. and *Phalaris minor* Retz. The dicot weeds were more dominating in the field.

The of population and dry weed weight were significantly affected by different treatments. The lowest weed population and weed dry weight were recorded in the weed-free treatment which was found to be significantly lower than all other treatments except 2 hand-weedings (25 and 40 days after sowing) and oxyfluorfen 0.25 kg/ha. The highest population and dry weight of weeds was found under weedy check (control), being statistically inferior to all other treatments in controlling weeds (Table 2). These results confirm the findings of Tomar and Namdeo (1991). The weed-control efficiency was maximum under weed-free treatment and it was followed by 2-hand weedings (25 and 40 days after sowing) and oxyfluorfen 0.25 kg/ha (Table 2).

Economic viability

All the treatments for weed control had better economics over the weed check (control). The weed-free treatment gave the maximum net returns. The treatment of 2 hand-weedings (25 and 40 days after sowing) was most economical (Table 1). Thus use of herbicides (oxyfluorfen 0.25 kg/ha, fluchloralin 1.0 kg/ha and pendimethalin 0.75 kg/ha) could be one of the viable options to control the weeds in Indian mustard.

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