RESEARCH COMMUNICATION

EFFECT OF WEED MANAGEMENT ON INDIAN MUSTARD (*BRASSICA JUNCEA* L.) CULTIVARS

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Abstract: A field experiment was conducted at Banaras Hindu University, Varanasi (U.P.) during winter (*rabi*) seasons of 2011-12 and 2012-13 to develop weed management practices for popular Indian mustard (*Brassica juncea* L.) cultivars, *viz.*, 'Kranti', 'Pusa bold' and 'Varuna' with pre-emergence application of alachlor 0.75 kg/ha, pendimethalin 0.75 kg/ha and metolachlor 0.75 kg/ha alone or their integration with hand weeding after one month of sowing. Pre-emergence application of alachlor 0.75 kg/ha, pendimethalin 0.75 kg/ha and metolachlor 0.75 kg/ha with one hand weeding at 30 days after sowing (DAS) were the most effective in minimizing weed population and their dry weight in mustard. These treatments recorded maximum seed yields (19.71, 19.06 and 18.94 q/ha) and increase 47.76%, 42.77% and 41.87% over weedy check, respectively. No significant difference was seen in mustard cultivars with respect to weed management. The maximum seed yield was obtained with 'Kranti'. The net return was maximum in alachlor 0.75 kg/ha applied along with hand weeding over other treatments. Unchecked weeds caused 32.27% seed yield loss with minimum net return.

Keywords: Cultivars, Herbicides, Hand weeding, Indian mustard, Weed, Yield

INTRODUCTION

Indian mustard (*Brassica juncea* (L.) Czernj and Cosson) is one of the most important winter oilseed crops of India. India occupies third position in rapeseed-mustard production in the world after China and Canada. In India, during 2013-14, the rapeseed-mustard crop had production of about 7.96 million tonnes from an area of 6.70 million hectares with an average productivity of 1188 kg ha^{-1}. Weeds were of major importance and accounted for the major losses among the various environmental and other constraints responsible for low productivity of mustard. Yield losses due to weeds varied from 25 to 45% depending on the type of weed flora and their intensity, stage and duration of crop-weed competition (Singh *et al.,* 2013). Therefore, the management of weeds is more important for achieving higher yields of Indian mustard. The use of herbicides is found effective and economic for controlling weeds in Indian mustard, but the use of herbicides alone is not enough to provide weed free environment (Yadav, 2004). Nowadays, there is also renewed interest in the development of research programmes that consider the potential for the development of crop varieties that interfere with the development of weeds. Therefore, the present investigation was undertaken to study the weed management practices on Indian mustard cultivars.

MATERIAL AND METHOD

The field experiment was conducted during *rabi* (winter) seasons of 2011-12 and 2012-13 at Agricultural Research Farm, Institute of Agricultural Sciences, Banaras Hindu University, Varanasi (25°18′ N latitude, 83°03′E longitude and altitude of 129 m above mean sea level), Uttar Pradesh, India on a sandy loam soil with pH 7.4, organic carbon 0.38%, available N, P and K 195.0, 18.8, 218.0 kg/ha, respectively. Mean minimum and maximum temperature during crop seasons ranged from 5.8 to 22.1°C and 17.1 to 39.2°C, respectively. During the years, weather conditions were extremely favourable for both crop and weed growth. The field experiment was conducted in factorial randomized block design with three replications, having 24 treatment combinations consisting of eight weed control treatments (*i.e.* alachlor 0.75 kg/ha, pendimethalin 0.75 kg/ha, metolachlor 0.75 kg/ha, alachlor 0.75 kg/ha + hand weeding (HW), pendimethalin 0.75 kg/ha + HW, metolachlor 0.75 kg/ha + HW, HW and weedy check) and three Indian mustard cultivars (*i.e.* 'Kranti', 'Pusa bold' and 'Varuna'). Mustard crop was sown in rows at 30 cm apart on 16 and 20 October during 2011 and 2012, respectively. Herbicides alachlor, pendimethalin and metolachlor are applied at 2 DAS using volume spray of 600 litres/ha with a knapsack sprayer fitted with flat-fan nozzle, whereas hand weeding was given at 30 DAS. Recommended package of practices were adopted to raise the experimental crop. A uniform dose of diammonium phosphate (100 kg/ha) was drilled at the time of sowing and 150 kg/ha urea was applied in two equal splits, half at sowing and the remaining after first irrigation at 35 DAS as top dressing. Observation on weed population (No./m^2) and weed

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dry matter production (g/m^2) were recorded at 45 DAS and 90 DAS. Data related to yield attributes and seed yield were recorded at harvest. Net return (` ha^{-1}) of the treatments was computed based on the prevalent market prices.

Table 1. Effect of treatments on weed population and dry matter production of weeds

Treatment	Weed population*(No./m^2)				Weed dry matter production*(g/m^2)			
	2011-12		2012-13		2011-12		2012-13	
	45 DAS	90 DAS	45 DAS	90 DAS	45 DAS	90 DAS	45 DAS	90 DAS
Weed management practice								
Alachlor 0.75 kg ha^{-1}	48	24	48	30	20.70	14.58	24.20	16.50
Pendimethalin 0.75 kg ha^{-1}	54	28	50	36	25.41	16.00	27.11	17.10
Metolachlor 0.75 kg ha^{-1}	56	31	54	39	27.21	18.31	28.32	18.60
Alachlor 0.75 kg ha^{-1} + hand weeding (30 DAS)	30	15	41	19	13.11	8.80	15.71	11.21
Pendimethalin 0.75 kg ha^{-1} + hand weeding (30 DAS)	36	16	42	22	14.10	9.10	17.00	14.91
Metolachlor 0.75 kg ha^{-1} + hand weeding (30 DAS)	38	19	45	23	15.18	10.12	18.88	15.50
Hand weeding (30 DAS)	47	22	51	27	18.16	15.10	25.41	74.11
Weedy check	99	81	88	64	71.50	47.50	65.50	38.50
CD (P=0.05)	8.23	5.32	7.37	6.34	3.82	4.60	5.31	4.71
Cultivar								
Kranti	50	30	48	31	24.40	17.5	27.50	19.12
Pusa bold	51	34	49	33	25.00	18.00	28.20	19.20
Varuna	53	34	53	36	25.38	18.12	28.80	19.24
CD (P=0.05)	NS	NS	NS	NS	NS	NS	NS	NS

*Data is transformed to $\sqrt{x+1}$; NS: Non-significant

Table 2. Effect of treatments on siliquae/plant, seeds/siliqua, seed yield and net return (Mean of two years)

Treatment	Siliquae/plant	Seeds/siliqua	Seed yield (kg/ha)	Net return* (`/ha)
Weed management practice				
Alachlor 0.75 kg ha^{-1}	217.68	17.11	1680	35,700
Pendimethalin 0.75 kg ha^{-1}	207.35	16.96	1611	34,030
Metolachlor 0.75 kg ha^{-1}	202.68	11.68	1549	32,070
Alachlor 0.75 kg ha^{-1} + hand weeding (30 DAS)	242.68	17.68	1971	39,530
Pendimethalin 0.75 kg ha^{-1} + hand weeding (30 DAS)	232.18	17.36	1906	37,780
Metolachlor 0.75 kg ha^{-1} + hand weeding (30 DAS)	226.32	17.10	1894	37,620
Hand weeding (30 DAS)	213.52	17.06	1660	31,300
Weedy check	156.35	16.48	1335	26,550
CD (P=0.05)	17.72	0.61	162	-
Cultivar				
Kranti	232.39	17.14	1826	38,780
Pusa bold	217.56	16.69	1734	36,020
Varuna	217.56	16.64	1523	29,690
CD (P=0.05)	17.70	0.48	167	-

*Price of mustard seeds: `30/kg; Common Cost of Cultivation: `12,500/ha.

RESULT AND DISCUSSION

The most dominant weed species at experimental site were *Chenopodium album, Anagallis arvensis, Melilotus indica, Fumaria parviflora, Vicia sativa, Rumex spinosus, Melilotus alba, Cynodon dactylon* and *Cyperus rotundus.*

Weed population and dry matter production of weeds were significantly minimized by application of different weed control treatments as compared to weedy check (Table 1). Pre-emergence application of alachlor, pendimethalin or metolachlor each at 0.75 kg/ha along with one hand weeding at 30 DAS being at par, caused maximum reduction in weed population and dry weight of weeds during both the years. Chauhan *et al.* (2005) reported similar effects of pendimethalin and hand weeding. Application of alachlor, pendimethalin and metolachlor alone was significantly inferior to integrated weed management treatments.

There was a significant difference in the siliquae/plant and seeds/siliqua as these recorded values were more in the treated plots than in weedy check (Table 2). No significant differences in yield attributes was observed among the alachlor 0.75 kg/ha, pendimethalin 0.75 kg/ha, metolachlor 0.75 kg/ha and one hand weeding at 30 DAS. However, integration of these herbicides that is alachlor 0.75 kg/ha, pendimethalin 0.75 kg/ha, metolachlor 0.75 kg/ha along with one hand weeding at 30 DAS resulted in maximum siliquae/plant and maximum seeds/siliqua. The highest seed yields (19.71, 19.06 and 18.94 q/ha) were recorded with application of alachlor, pendimethalin and metolachlor each at 0.75 kg/ha supplemented by one hand weeding at 30 DAS and estimated 47.76%, 42.77% and 41.87% higher yield over weedy check, respectively. All the weed control practices significantly increased the seed yield over weedy check. The increase in seed yield over with weed control practices is believed to be an indirect expression of reduction in crop-weed competition which significantly helped in increasing the yield components and the seed yield of crop.

Mustard cultivars did not have significant influence on population and dry matter production of weeds during both the years. However, a significant increase in siliquae/plant and seeds/siliqua was observed due to different cultivars. The increase in seed yield was recorded 19.89% and 13.85% with 'Kranti' and 'Pusa bold', respectively over 'Varuna'. More seed yield in 'Kranti' and 'Pusa bold' were mainly due to maximum expression of yield attributes like siliquae/plant and seeds/siliqua. Similar finding was reported by Sharma and Mishra (1997). Net return followed the same pattern as seed yield and the highest net return was obtained with mustard cultivar 'Kranti'. Among weed management practices, net return was maximum in alachlor, pendimethalin and metolachlor integration with one hand weeding at 30 DAS and this was to be `39,530, 37,780 and 37,620/ha, respectively. Hand weeding was costly, therefore, all herbicidal treatments were superior to it in influencing net return due to weed control.

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