INTEGRATED WEED MANAGEMENT IN MUSTARD [*Brassica juncea* (L.) CZERN AND COSS.]

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ABSTRACT

An experiment entitled "Integrated weed management studies in mustard [Brassica juncea (L.) Czern and Coss.]" was conducted at Agronomy Instructional Farm, Chimanbhai Patel College of Agriculture, Sardarkrushinagar Dantiwada Agricultural University, Sardarkrushinagar (Gujarat) during rabi 2011-12. Besides weed free condition, Pendimethalin @ 0.5 kg/ha PE + 1 HW at 25 DAS, was found more effective in reducing the weed population (viz., grassy, broad leaved and sedges) resulted into less dry weight of weeds (147.67 kg/ha), higher weed control efficiency (74.50 %) as well as lower weed index (2.03 %). Oxadiargyl @ 75 g/ha PE + 1 HW at 25 DAS was found equally effective with this respect. Except weed free condition, Pendimethalin @ 0.5 kg/ha PE + 1 HW at 25 DAS recorded significantly higher seed and (1702 kg/ha), stover yield (4875 kg/ha) and maximum net realization (Rs 46,277 per ha) than rest of the treatments.

KEY WORDS: Mustard, Brassica juncea, weed

INTRODUCTION

Mustard is one of the major *rabi* oilseed crop of India. It occupies a prominent place being next to groundnut both in area and production. India is one of the largest producers of mustard in the world. India's contribution in the world production is 11.00 per cent with forth position in the world, next to China, Canada and Germany. Among the different oilseeds, mustard occupies an area of 6.18 million hectares with 7.36 million tonnes of total production and productivity of 1190 kg/ha (Anonymous, 2010). In Gujarat, area under mustard crop is about 2.23 lakh hectares with 3.49 lakh tonnes of total production with productivity of 1568 kg/ha (Anonymous, 2010-11).

Among the various factors, which influence the crop production, weed flora a single negative factor and serious menace, which plays key role for achieving high yield potential in any crop. The weeds cause substantial losses to agricultural production. Estimates showed that in India, weeds cause an annual monetary loss of ₹ 1980 million (Mukhopadhyay, 1992). Weed problem is one of the major barriers which responsible for low productivity of mustard because yields. Weeds compete with the crop for light, nutrient, water and carbon dioxide. Rao (2000) reported that reduction in crop yield has a direct correlation with weed competition. Presence of weeds reduces the photosynthetic efficiency, dry matter production and distribute of photosynthesis to economical parts and

thereby, adversely affecting source and sink relationship resulting in reduction of mustard yield besides these, they increase production cost, create the pests and plant disease problem and decrease the quality of farm produce as well as value of the land.

The use of herbicide has revolutionized in weed control, reducing the cost of cultivation and has resulted in the revolution of many conventional weed control practices. Unfortunately till now, majority of the farmers are ignorant about the proper rate of herbicide, their time and method of application and their economics. Practically, inadequate information is available to evaluate new herbicides for the weed control in Indian mustard. Therefore, there is a need to have more emphasis on these aspects. Keeping these considerations in view, an investigation was planned.

MATERIALS AND METHODS

An experiment entitled "Integrated weed management in mustard [*Brassica juncea* (L.) Czern and Coss.]"was conducted at Agronomy Instructional Farm, Chimanbhai Patel College of Agriculture, Sardarkrushinagar Dantiwada Agricultural University, Sardarkrushinagar (Gujarat) during *rabi* season of 2011-12. The soil of experimental plot was loamy sand in texture, low in organic carbon and available nitrogen, medium in available phosphorous and rich in available potassium status. The experiment comprising of twelve treatments *viz.*, weedy check, Interculturing + 1 HW at 25 DAS, Pendimethalin @ 0.5 and 0.75 kg/ha PE alone & along with HW at 25 DAS with each levels, Oxadiargyl @ 75 and 90 g/ha PE alone & along with HW at 25 DAS with each levels, Oxyfluorfen @ 100 g/ha as PE and weed free was evaluated in a randomized block design with three replications. Mustard variety GM 3 was sown on 20th October 2011 keeping row to spacing of 45 cm in all the treatments. A uniform basal dose of NPS (37.5:50:40 kg/ha) was applied at the time of sowing in the form of DAP, urea and gypsum and remaining 37.5 kg N was applied at 40 DAS. Mustard crop was irrigated 6 times (including two common irrigation for germination and seeding establishment). Pre-emergence herbicide was applied after sowing. Interculturing and hand weeding was carried out at 25 DAS in respective treatments. All the recommended package of practices was followed for the crop. Species wise weed population per m^2 was recorded with the help of 0.5 x 0.5 m^2 quadrant at 25, 50 DAS and at harvest. Further these species were classified into grassy weeds, broad leaved weeds and sedges. Dry weight of weeds (g/m^2) was recorded at harvest. Weed Index (%) and Weed Control Efficiency (%) were worked out as per the formula suggested by Gill and Kumar (1969) and Kondap and Upadhyay (1985), respectively. The observations on crop yield parameter were also recorded at harvest. Economics were worked out according to prevailing market price of produce. No any insect/pest incidence and disease infestation was observed during throughout the experimentation.

RESULTS AND DISCUSSION

Effect on weeds

Besides weed free treatment, Pendimethalin @ 0.5 kg/ha PE + 1 HW at 25 DAS recorded minimum number of grassy weeds at 25 DAS (2.61 per m^2), 50 DAS (3.29 per m^2) and at harvest (3.94 per m^2) followed by Oxadiargyl @ 75 g/ha PE + 1 HW at 25 DAS, Pendimethalin @ 0.75 kg/ha PE and Pendimethalin @ 0.5 kg/ha PE treatment (Table 1). The less number of grassy weeds count at 25 & 50 DAS as well as at harvest was observed might be due to herbicidal effect in these weeds. In addition to this dense crop canopy might have smothering effect on weeds. These findings corroborate the results reported by Sharma and Jain (2002), Sharma and Singh (2003) and Yadav (2004). Besides weed free conditions, treatment Pendimethalin @ 0.5 kg/ha PE + 1 HW at 25 DAS recorded minimum number of broad leaved weeds at 25

DAS (2.35 per m^2), 50 DAS (3.14 per m^2) and at harvest (3.54 per m^2) followed by Oxadiargyl @ 75 g/ha PE + 1 HW at 25 DAS, Pendimethalin @ 0.75 kg/ha PE + 1 HW at 25 DAS, Pendimethalin @ 0.5 kg/ha PE and Oxadiargyl @ 90 g/ha PE + 1 HW at 25 DAS (Table 1). The lower number of broad leaved weed counts at all growth stages were observed due to effective control of weeds as a result of herbicidal control. Besides treatment weed free, the lowest number of sedge weeds (3.03 per m^2) at 25 and 50 DAS as well as at harvest were recorded under treatment Pendimethalin @ 0.5 kg/ha PE + 1 HW at 25 DAS (Table 1). The lowest sedge weeds were observed under that treatment might be due to effective control of sedge weeds by pendimethalin as pre-emergence since beginning and weeds those escaped from herbicidal control were removed by hand weeding at 25 DAS.

Weed free treatment and Pendimethalin @ 0.5 kg/ha PE + 1 HW at 25 DAS were most effective in minimizing weed infestation and recorded significantly the lowest dry weight of weeds (147.67 kg/ha) (Table 2). These findings are in close conformity with those reported by Rathi *et al.* (2005) and Sharma *et al.* (2005). Besides weed free, treatment Pendimethalin @ 0.5 kg/ha PE + 1 HW at 25 DAS, registered higher weed control efficiency (74.35 %) followed by treatment T_8 (Oxadiargyl @ 75 g/ha PE + 1 HW at 25 DAS), T_3 (Pendimethalin @ 0.5 kg/ha PE), T_7 (Oxadiargyl @ 75 g/ha PE) and T_{10} (Oxadiargyl @ 90 g/ha PE + 1 HW at 25 DAS) with value of 66.55 %, 65.40 %, 59.70 % and 57.46 %, respectively (Table 2). Among the treatments, application Pendimethalin @ 0.5 kg/ha PE + 1 HW at 25 DAS recorded the lowest weed index (2.03 %), which was followed by Oxadiargyl @ 75 g/ha PE + 1 HW at 25 DAS (Table 2). This might be due to lower weed population and dry weight of weeds and high weed control efficiency under these treatments.

Effect on crop

Weed free plot established its superiority by recording significantly higher seed yield (1738 Kg/ha) as compared to rest of the treatments. However, it was found at par with Pendimethalin @ 0.5 kg/ha PE + 1 HW at 25 DAS, Oxadiargyl @ 75 g/ha PE + 1 HW at 25 DAS, Pendimethalin @ 0.5 kg/ha PE and Pendimethalin @ 0.75 kg/ha PE + 1 HW at 25 DAS (Table 2). Increase in seed yield of mustard under weed free treatment and above these treatments over weedy check to the tune of 48.80, 45.72, 41.18, 35.70 and 28.08 per cent, respectively. Higher seed yield obtained under these treatments might be due to effective control of weeds at initial stage, which in turn of significantly increases the values of growth and yield attributes under these treatments. In addition to this, the higher yield under weed free and chemical weed control treatments may be attributed to lower dry matter accumulation by weeds and decrease their population which resulting weeds were unable to compete with the crop plants and resulted in better expressing of growth and yield attributing characters *viz*; plant height, dry matter production/plant, number of silique/plant and test weight. These findings are in accordance with those reported by Rana (2006) and Patel *et al.* (2007). Stover yield (4937 Kg/ha) was recorded significantly higher under weed free plot as compared to other treatments. However, it remained statistically at par with Pendimethalin @ 0.5 kg/ha PE + 1 HW at 25 DAS, Oxadiargyl @ 75 g/ha PE + 1 HW at 25 DAS, Pendimethalin @ 0.5 kg/ha PE, Pendimethalin @ 0.75 kg/ha PE + 1 HW at 25 DAS, Oxadiargyl @ 90 g/ha PE + 1 HW at 25 DAS, Pendimethalin @ 0.75 kg/ha PE, and Oxadiargyl @ 75 g/ha PE (Table 2). Favourable effect on growth characters *viz.*, plant height, dry matter production per plant, number of primary and secondary branches per plants by avoiding crop weed competition are responsible for higher stover yield. These findings are

conformity with those reported by Chauhan *et al*. (2005).

The maximum net realization of ₹ 46277 per ha was secured under Pendimethalin @ 0.5 kg/ha PE + 1 HW at 25 DAS followed by weed free plot, Oxadiargyl @ 75 g/ha PE + 1 HW at 25 DAS and Pendimethalin @ 0.5 kg/ha PE under with net realization of 44997, 43771 and 42685 ₹ per ha, respectively (Table 2). The highest seed yield and stover yield as a results of better weed control coupled with lower cost of production under Pendimethalin @ 0.5 kg/ha PE + 1 HW at 25 DAS may be responsible for higher net realization per hectare.

Effect on quality

Pendimethalin @ 0.5 kg/ha PE + 1 HW at 25 DAS was found superior by recording significantly higher Oil content (38.68 %) than rest of the treatments. However, it was found statistically at par with treatment weed free, Oxadiargyl @ 75 g/ha PE + 1 HW at 25 DAS and Pendimethalin @ 0.5 kg/ha PE (Table 2). With respect to oil yield, it was significantly higher (672 kg/ha) under weed free treatment than remaining treatments but it remained at par with Pendimethalin @ 0.5 kg/ha PE + 1 HW at 25 DAS, Oxadiargyl @ 75 g/ha PE + 1 HW at 25 DAS and Pendimethalin @ 0.5 kg/ha PE. The increase in oil yield might be attributed to the higher oil content as well as seed yield recorded under these treatments.

CONCLUSION

From the ongoing discussion, it can be concluded that besides weed free condition, Pendimethalin @ 0.5 kg/ha PE + 1 HW at 25 DAS could be recommended to the farmers for effective weed management, as it was found more effective in reducing the weed population (*viz*., grassy, broad leaved and sedges) resulted into less dry weight of weeds, higher weed control efficiency (74.50 %), lower weed index (2.03 %), high seed and stover yield as well as net return.

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Table 1: Effect of integrated weed management treatments on different weeds population in mustard

Treatments		Grassy Weeds Per m^2			Broad Leaved Weeds Per m^2			Sedge Weeds Per m^2		
		25 DAS	50 DAS	At harvest	25 DAS	50 DAS	At harvest	25 DAS	50 DAS	At harvest
T_1	Weedy check	5.31* (27.67)	6.42 (40.67)	7.18 (51.00)	5.46* (29.33)	6.15 (37.33)	6.94 (47.67)	4.10* (16.33)	4.98 (24.33)	6.52 (42.00)
T_2	IC + one HW at 25 DAS	3.44 (11.33)	4.53 (20.00)	5.28 (27.33)	3.39 (11.00)	4.42 (19.00)	5.34 (28.00)	4.22 (17.33)	4.64 (21.00)	5.55 (30.33)
T_3	Pendimethalin @ 0.5 kg/ha as PE	3.29 (10.33)	3.85 (14.33)	4.53 (20.00)	3.03 (8.67)	3.54 (12.00)	4.02 (15.67)	3.19 (9.67)	3.39 (11.00)	3.85 (14.33)
T_4	Pendimethalin @ 0.5 kg/ha as PE + one HW at 25 DAS	2.61 (6.33)	3.29 (10.33)	3.94 (15.00)	2.35 (5.00)	3.14 (9.33)	3.54 (12.00)	3.03 (8.67)	3.24 (10.00)	3.72 (13.33)
T_5	Pendimethalin @ 0.75 kg/ha as PE	3.19 (9.67)	3.67 (13.00)	4.18 (17.00)	3.39 (11.00)	3.85 (14.33)	4.22 (17.33)	3.54 (12.00)	4.06 (16.00)	4.64 (21.00)
T_6	Pendimethalin @ 0.75 kg/ha as PE + one HW at 25 DAS	2.86 (7.67)	3.54 (12.00)	4.10 (16.33)	3.03 (8.67)	3.54 (12.00)	3.89 (14.67)	3.34 (10.67)	3.85 (14.33)	4.22 (17.33)
T_7	Oxadiargyl @ 75 g/ha as PE	3.63 (12.67)	4.53 (20.00)	5.31 (27.67)	3.58 (12.33)	4.38 (18.67)	4.67 (21.33)	3.39 (11.00)	4.14 (16.67)	4.56 (20.33)
T_8	Oxadiargyl @ 75 g/ha + one HW at 25 DAS	2.68 (6.67)	3.63 (12.67)	4.26 (17.67)	2.86 (7.67)	3.58 (12.33)	3.94 (15.00)	3.19 (9.67)	3.58 (12.33)	4.02 (15.67)
T_9	Oxadiargyl @ 90 g/ha as PE	3.72 (13.33)	4.30 (18.00)	4.95 (24.00)	3.54 (12.00)	4.14 (16.67)	4.60 (20.67)	3.76 (13.67)	4.34 (18.33)	4.85 (23.00)
T_{10}	Oxadiargyl @ 90 g/ha as PE + one HW at 25 DAS	3.39 (11.00)	3.98 (15.33)	4.53 (20.00)	3.29 (10.33)	3.67 (13.00)	4.06 (16.00)	3.67 (13.00)	3.94 (15.00)	4.42 (19.00)
T_{11}	Oxyfluorfen @ 100 g/ha as PE	4.38 (18.67)	4.81 (22.67)	5.15 (26.00)	4.22 17.33)	4.53 (20.00)	4.67 (21.33)	3.81 (14.00)	4.74 (22.00)	5.67 (31.67)
T_{12}	Weed free	0.71 (0.00)	0.71 (0.00)	0.71 (0.00)	0.71 (0.00)	0.71 (0.00)	0.71 (0.00)	0.71 (0.00)	0.71 (0.00)	0.71 (0.00)
S.Em.±		0.18	0.19	0.19	0.14	0.19	0.20	0.17	0.18	0.22
C.D. at 5 %		0.53	0.56	0.57	0.41	0.55	0.58	0.50	0.54	0.64
C.V.%		9.58	8.43	7.47	7.54	8.48	8.08	8.80	8.36	8.59

**** Original data given in parentheses were subjected to square root transformation ($\sqrt{x}$ + 0.5) before analysis.***

Table 2: Effect of different weed management treatments on weed parameters, yield, economics and quality parameters of mustard

Treatments		Dry Weight of Weeds (kg/ha)	WCE (%)	WI (%)	Grain Yield (kg/ha)	Stover Yield (kg/ha)	Net Return (Rs/ha)	Oil Content (%)	Oil Yield (kg/ha)
T_1	Weedy check	579.00	0.00	32.80	1168	4099	28209	36.73	429
T_2	IC + one HW at 25 DAS	318.33	45.02	25.30	1298	4192	31452	37.22	483
T_3	Pendimethalin @ 0.5 kg/ha as PE	200.33	65.40	8.77	1585	4678	42685	38.08	604
T_4	Pendimethalin @ 0.5 kg/ha as PE + one HW at 25 DAS	147.67	74.50	2.03	1702	4875	46277	38.89	662
T_5	Pendimethalin @ 0.75 kg/ha as PE	281.00	51.47	19.30	1402	4419	35750	37.64	528
T_6	Pendimethalin @ 0.75 kg/ha as PE + one HW at 25 DAS	249.67	56.88	13.91	1496	4637	38557	37.67	564
T_7	Oxadiargyl @ 75 g/ha as PE	233.33	59.70	21.37	1366	4413	34191	37.87	517
T_8	Oxadiargyl @ 75 g/ha + one HW at 25 DAS	193.67	66.55	5.10	1649	4788	43771	38.22	630
T_9	Oxadiargyl @ 90 g/ha as PE	277.33	52.10	22.60	1345	4342	33165	37.70	507
T_{10}	Oxadiargyl @ 90 g/ha as PE + one HW at 25 DAS	246.33	57.46	18.03	1424	4444	35332	37.50	534
T_{11}	Oxyfluorfen @ 100 g/ha as PE	346.67	40.13	27.85	1254	4127	30245	37.27	467
T_{12}	Weed free	0.0	100.0	0.0	1738	4937	44997	38.68	672
S.Em.±		13.36	2.73	1.25	1738	4937	-	0.32	34.58
C.D. at 5 %		39.17	8.01	3.67	95.26	182.56	-	0.95	101.4
C.V.%		9.03	8.45	13.20	279.39	535.43	-	1.48	10.90

Selling price of mustard = Rs 35.00 per kg, Stover = Rs1 per kg
PE= Pre emergence, IC=Interculturing, HW= Hand weeding, DAS= Days after sowing, WCE= Weed Control Efficiency, WI= Weed Index

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