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Impact of Integrated Weed Management Practices on Weed Dynamics, Productivity and Profitability in Mustard Crop (*Brassica juncea* L.)

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Abstract: The trial was drawn with the aiming on study of weed dynamics and yield of mustard crop in gird zone by using of integrated weed management practices in *Rabi* season during 2021-2022 at agronomy research farm, college of agriculture, Gwalior, RVSKVV in Randomized Block Design with ten treatments replicate thrice on sandy clay loam soil. Studied traits included weed population species wise, total weed population, weed dry weight, weed control efficiency, weed index biological yield, seed yield, harvest index and net income and B:C. It could be concluded that from result the application of Pendimethalin 30 EC, 750 g a.i./ha PE + HW at 45DAS was registered in respect of suppress weed population, increasing weed control efficiency (94.41%); and was achieved yield (2027 kg/ha) 119% than weedy check. It was observed that the maximum net returns (Rs 81935 /ha) and B:C ratio (3.7) was recorded in treatment T_3 (Pendimethalin 30 EC, 750 ga.i./ha PE + HW at 45DAS) followed by Pendimethalin 30 EC, 750 ga.i./ha PE *fb* Quizalofop ethyl 5 EC 50 ga.i./ha POE at 2 to 3 leaf stage(62893 and 3.2).

Keywords: Mustard, weed management, weed flora ,weed control efficiency , yield.

INTRODUCTION

Oilseed crops occupy a significant place in the Indian economy, next to food grains. In India, it is the second most important edible oilseed after groundnut sharing 27.8% in the India's oilseed economy (Shekhawat *et al.* 2012). In India, rapeseed and mustard grown in 7.10 m/ha with production of 7.98 m tonnes average productivity of 1281 kg/ ha (Anonymous 2019). In Madhya Pradesh, Rapeseed and mustard grown in 0.77 m ha with production of 1.05mtonnes with average productivity of 1305 kg /ha (Anonymous 2019).Technological advancement in Rapeseed and mustard production has resulted in increased productivity. But many biotic stresses such as weeds cause severe yield losses up to 45% in Rapeseed and mustard (Singh *et al.* 2013).Weed competition in Indian mustard is more serious during early stage; because crop growth during winter (*Rabi*) season remains slow during the first 4-6 weeks after sowing (Chauhan *et al*.2005).The critical period of crop - weed competition is early growth stages especially between 15–40 days after sowing (Shekhawat *et al.* 2012 and Singh *et al.* 2013).Therefore, to improve the yield of mustard, timely and proper control of weeds is indispensable. Among the various methods of weeds control, the traditional methods of weed control like hand-weeding, hoeing, and intercultural operations have many limitations. These are very often back

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breaking, costly, time consuming and needs so much of human labour/resource. Thus, use of herbicide may be the best option to control the complex weed flora in mustard. Hence, pre and post emergence herbicides application or herbicide along with hand weeding may be the best alternativefor controlling the diverse weed flora in mustard crop. Keeping above in mind, the present experiment was planned to evaluate effect of herbicide integration alone or with hand weeding on diverse weed flora and yield of existing region of mustard.

METHOD AND MATERIALS

This field experiment was conducted at Agronomy Research Farm, College of Agriculture, RVSKVV,Gwalior during the *rabi* season of 2021-22. The region of the experimental site falls under the central zone of india and soil of the experimental field was sandy clay loam in texture, slightly alkaline (pH 7.4) in reaction, low in organic carbon (0.46 %), nitrogen (180 kg ha-1) and medium in available phosphorus (12.5 kg ha-1) but high in potassium (200 kg ha-1). The soil moisture content at field capacity was 21%, having bulk density and infiltration rate 1.4mgm^{-3} and 2.2 mm/hr, respectively. The experiment consisted of 10 treatments *viz*. Pendimethalin PE 750 g/ha alone; and with one hand weeding at 45 DAS ; with followed by Quizalofopethyle POE 50g/ha; with followed by Clodinafop-p-ethyle POE 60g/ha, Oxyflurofen PE 230g alone and with one hand weeding at 45 DAS, Quizalofopethyle POE 50g/ha, Clodinafop-p-ethyle POE 60g/ha, Two hand weeding at 30 and 60 DAS and Weedy check which were laid out in Randomized Block Design (RBD) and replicated thrice. Mustard variety RVM-2 was sown on 30th October, 2021, using of seed 5 kg/ha at row and plant spacing of 40 cmx 10 cm apart. Two irrigations were given to mustard crop during the whole growing period. Recommended dose of nitrogen, phosphorous and potassium i.e., 80, 40 and 20kg ha-1 were applied through urea, SSP and MOP respectively. The recommended agronomic practices and plant protection measure of mustard crop were followed.The herbicide were applied using knapsack sprayer fitted with flat fan nozzle with spray volume of 500 l/ha. The post emergence herbicides were applied at 2 to 3 leaf stage and weeding was done manually with help of hand tool '*khurpi*', as required in treatment. Species wise number of weeds were recorded at random in two spot in each plot by using quadrates of 50x50 cm size and weeds pulled out were first, sun dried and thereafter kept in electric oven at temperature of 70+_1^{0c} for 72 hours, until constant weight is attained. Weeds were cut at ground level, washed with tap water, sun dried for a few days and then oven drying at 65°C for 48 hours and then weighted. Total dry matter was determined by the summing up the dry weight of each plant. Weed control efficiency was calculated using weed dry weight data at 60 DAS which was maximum during weed growth period irrespective of treatments. The weed data were recorded on density was subjected to square root transformation to normalized their distribution before analysis. Weed control efficiency was also calculated as suggested by Maity and Mukherjee (2011). The economics was calculated on the basis of prevailing market rates of agriculture produced and cost of cultivation treatments wise.

RESULT AND DISCUSSION

The research trial was mainly infested with *Cynodon dactylon( ), Cyperus rotundus(),Chenopodium album() and Anagalis arvensis()* during *rabi* season at 60 days after sowing. Among the different weed management practices, Pendimethalin 30 EC, 750 ga.i./ha PE + HW at 45 DAS significantly reduced the all weed species at all stages and dry matter of weed at 60 DAS except two hand weeding at 30 and 60 DAS, Pendimethalin

30 EC, 750 ga.i./ha PE *fb* Quizalofop ethyl 5 EC 50 ga.i./ha POE at 2 to 3 leaf stage, Oxyflurofen23.5 EC 230 ga.i./ha PE + HW (45DAS) and Pendimethalin 30 EC, 750 ga.i./ha PE *fb* Clodinafop-p-ethyl 15 WP 60g a.i./ha POE at 2 to 3 leaf stage. In herbicidal treatments, the application of Pendimethalin 30 EC, 750 ga.i./ha PE *fb* Quizalofop ethyl 5 EC 50 ga.i./ha POE at 2 to 3 leaf stage was significantly equivalent to Pendimethalin 30 EC, 750 ga.i./ha PE*fb* Clodinafop-p-ethyl 15 WP 60g a.i./ha POE at 2 to 3 leaf stage in respect of reduce all species of weed population and dry matter of weed. However the maximum species wise weed population at all stages and weed dry weight at 60 DAS was observed in treatment T_{10} (Weedy check). Different weed management practices significantly reduced the weed intensity at all the stages of the crop growth. Since the herbicides are plant killer, their use at appropriate dose and time make them selective to kill certain plant species leaving some plant unaffected. Many weeds appear to be less sensitive to declining leaf water potential than those of the crop. Result indicates that the maximum weed control efficiency and minimum weed index wasrecorded in treatment T_3 (Pendimethalin 30 EC, 750 ga.i./ha PE + HW at 45 DAS) and it was found significantly superior treatment as compared to all other weed control treatments, whereas the minimum weed control efficiency and maximum weed index was observed in treatment T_{10} (Weedy check).

For example, weeds with more extensive root system and better physical tolerance to drought, can quickly exhaust the soil moisture and make crop to suffer greatly for want of soil water. The results are in confirmation with the results achieved by Singh *et al.* (2016), Rathod *et al*. (2017),Singh (2017), Jangir *et al.* (2018), Gupta *et al.* (2018), Nayak *et al*. (2020) andSingh and Kumar (2020).

On the basis of one year data, It was observed that the different treatment combinations of weed management practices significantly influenced the seed yield, biological yield and harvest index in mustard. The maximum seed yield, stover yield, biological yield and harvest index were recorded in treatment T_3 (Pendimethalin 30 EC, 750 ga.i./ha PE + HW at 45DAS) and it was found the best treatment among all the treatments. However, the minimum seed yield per hectare, stover yield, biological yield and harvest index were observed in treatment T_{10} (Weedy check).These results indicated that less inter plant competition in above treatments might be due to less crop-weed competition and more favourable environmental condition which enabled the crop plant to make maximum use of inputs for crop growth and thereby development of yield attributes which was reflected as bolder seeds as compared to other treatments. It may therefore, be expected that low weed competition during the early crop growth period produced beneficial effect on the number of siliqua per plant as well as seeds per siliqua and other yield attributes. Thus we could conclude that with the increase in yield attributing characters the overall yield was increased. These results are supported by the findings of Yadav *et al*. (2017), Gupta *et al.* (2018), Nayak *et al*. (2020) and Singh *et al*. (2020).

Economics of the treatments are presented in Table 4.6. It was observed that the maximum net returns (Rs 81935 /ha) and B:C ratio (3.7) was recorded in treatment T_3 (Pendimethalin 30 EC, 750 ga.i./ha PE + HW at 45DAS) followed by Pendimethalin 30 EC, 750 ga.i./ha PE *fb* Quizalofop ethyl 5 EC 50 ga.i./ha POE at 2 to 3 leaf stage(62893 and 3.2). However the net returns (Rs 31246 /ha) and B:C (2.2) was recorded in treatment T_{10} (Weedy check).

CONCLUSION

It can be concluded that Pendimethalin 30 EC, 750 ga.i./ha PE + HW at 45DAS is the most suitable and effective weed management

Table 1: Effect of integrated weed management practices on weed population species wise/m² at 30, 60 DAS and at harvest stageof mustard crop

Treatment symbols	Monocot weeds						Dicot weeds					
	Cynodondactylon			Cyperus rotundus			Chenopodium album			Anagallis arvensis		
	30 DAS	60 DAS	Harvest	30 DAS	60 DAS	Harvest	30 DAS	60 DAS	Harvest	30 DAS	60 DAS	Harvest
T_1	2.04 (3.67)	2.34 (5.00)	2.04 (3.67)	2.04 (3.67)	2.73 (7.00)	2.41 (5.33)	1.95 (3.33)	2.34 (5.00)	2.27 (4.67)	1.77 (2.67)	2.26 (4.67)	2.11 (4.00)
T_2	2.19 (4.33)	2.54 (6.00)	2.20 (4.33)	2.20 (4.33)	2.91 (8.00)	2.61 (6.33)	2.11 (4.00)	2.47 (5.67)	2.48 (5.67)	2.11 (4.00)	2.47 (5.67)	2.41 (5.44)
T_3	2.04 (3.67)	1.46 (1.67)	1.05 (0.67)	1.46 (1.67)	1.34 (1.33)	1.86 (3.00)	1.34 (1.33)	1.46 (1.67)	1.56 (2.00)	1.46 (1.67)	1.29 (1.33)	1.58 (2.00)
T_4	2.11 (4.00)	1.44 (1.67)	1.86 (3.00)	2.11 (4.00)	1.68 (2.33)	2.61 (6.33)	2.02 (3.67)	1.72 (2.67)	2.41 (5.33)	1.86 (3.00)	1.64 (2.33)	1.90 (2.78)
T_5	4.50 (20.00)	2.15 (4.33)	1.82 (3.00)	4.88 (23.33)	2.42 (6.33)	2.73 (7.00)	4.78 (22.33)	3.97 (15.33)	3.71 (13.33)	4.78 (22.33)	4.17 (17.00)	3.28 (9.44)
T_6	4.58 (20.67)	1.85 (3.33)	1.90 (3.33)	4.95 (24.00)	2.53 (6.00)	2.91 (8.00)	4.78 (22.33)	4.08 (16.33)	3.63 (12.67)	4.88 (23.33)	4.47 (19.67)	3.61 (11.89)
T_7	1.95 (3.33)	1.05 (0.67)	1.39 (1.67)	1.77 (2.67)	2.48 (5.67)	2.27 (4.67)	1.56 (2.00)	2.11 (4.00)	2.11 (4.00)	1.56 (2.00)	1.84 (3.00)	1.44 (1.89)
T_8	2.06 (4.00)	1.34 (1.33)	1.56 (2.00)	1.86 (3.00)	2.54 (6.00)	2.34 (5.00)	1.68 (2.33)	2.20 (4.33)	2.20 (4.33)	1.68 (2.33)	2.34 (5.00)	1.56 (2.00)
T_9	4.44 (19.33)	1.56 (2.00)	1.29 (1.33)	4.98 (24.33)	1.64 (2.33)	2.11 (4.00)	4.63 (21.00)	1.56 (2.00)	1.66 (2.33)	4.56 (20.33)	1.17 (1.00)	1.34 (1.44)
T_{10}	5.01 (24.67)	5.29 (27.67)	5.05 (25.00)	5.24 (27.00)	4.40 (19.00)	4.44 (19.33)	4.84 (23.00)	5.20 (26.67)	4.25 (17.67)	4.95 (24.00)	5.87 (34.00)	4.06 (17.11)
SEm ±	**0.196**	**0.221**	**0.241**	**0.107**	**0.253**	**0.134**	0.139	0.218	0.136	0.128	0.209	0.236
CD 5%	0.583	0.657	0.717	0.319	0.753	0.399	0.412	0.646	0.404	0.381	0.622	0.701

*Transformed values √(x+0.5), figures in the parenthesis indicate original values

Table 2: Effect of integrated weed management practices on total weed population/m² at 30, 60 DAS and at harvest stage, weed dry weight , weed control efficiency and weed index of mustard crop

Treatment detail	Total weed population/m²			Weed dry weight (g) at 60 DAS	Weed control efficiency (%)	Weed index (%)
	30 DAS	60 DAS	Harvest			
Pendimethalin 30 EC, 750 ga.i./ha PE	3.71 (13.33)	4.71 (21.67)	4.26 (17.56)	17.33	79.70	30.59
Oxyflurofen23.5 EC 230 g*a.i.* /ha PE	4.14 (16.67)	5.08 (25.33)	4.70 (22.22)	20.27	76.34	40.77
Pendimethalin 30 EC, 750 ga.i./ha PE + HW (45DAS)	2.97 (8.33)	2.54 (6.00)	2.85 (7.89)	4.80	94.41	0.00
Oxyflurofen23.5 EC 230 ga.i./ha PE + HW (45DAS)	3.89 (14.67)	3.04 (9.00)	4.30 (17.33)	7.20	91.74	31.66
Quizalofop ethyl 5 EC 50 ga.i./ha POE at 2 to 3 leaf stage	9.41 (88.00)	6.55 (43.00)	5.84 (32.56)	34.40	60.35	42.47
Clodinafop-p-ethyl 15 WP 60g a.i./ha POE at 2 to 3 leaf stage	9.53 (90.33)	6.77 (45.33)	6.09 (34.89)	36.27	57.58	44.62
Pendimethalin 30 EC, 750 ga.i./ha PE*fb*Quizalofop ethyl 5 EC 50 ga.i./ha POE at 2 to 3 leaf stage	3.24 (10.00)	3.72 (13.33)	3.53 (12.33)	10.67	87.60	19.29
Pendimethalin 30 EC, 750 ga.i./ha PE*fb*Clodinafop-p-ethyl 15 WP 60g a.i./ha POE at 2 to 3 leaf stage	3.48 (11.67)	4.14 (16.67)	3.71 (14.11)	13.33	84.51	23.87
Two hand weeding at 30 and 60 DAS	9.24 (85.00)	2.78 (7.33)	3.08 (8.67)	5.87	93.23	10.55
Weedy check	9.96 (98.67)	10.38 (107.33)	8.87 (79.44)	85.87	0.00	53.77
SEm ±	0.133	0.245	0.177	2.474	2.134	
CD 5%	0.395	0.729	0.525	7.351	6.341	

practices for achieving higher grain yield (2026.65 Kg/ha) by reducing the weed growth throughout the period in wheat crop and enhancing weed control efficiency (94.41%) with higher net (Rs 81935 /ha) monetary returns and B:C(3.7).

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