Journal of Oilseed Brassica, 14 (1) : 89-92, January 2023

Short Communication

Weed management module for Indian mustard (*Brassica juncea* L.)

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(Received: 18 August 2022; Revised: 28 December 2022; Accepted: 30 December 2022)

Abstract

A field experiment was conducted at Govind Ballabh Pant University of Agriculture & Technology, Pantnagar during *rabi* season of 2019-20 for exploration of weed management module for Indian mustard (*Brassica juncea* L.). The thirteen treatment combinations of different weedicides and their application rates along with weedy check (control) were accommodated in randomized complete block design with three replications. The maximum values of yield attributing characters *i.e.* number of branches per plant, number of siliquae/plant, seed weight per plant seed yield was obtained with application of pendimethalin @ 1.0 kg *a.i.*/ha (PE) + hand weeding (HW) at 30 days after sowing (DAS). Pendimethalin @ 1.0 kg *a.i.*/ha (PE) + HW) at 30 DAS also recorded the maximum weed control efficiency, seed yield and B:C ratio over the other treatments.

Keywords*: Clodinafop, Indian mustard, oxadiargyl, pendimethalin, weed control efficiency*

Introduction

Oilseeds hold the second most important place in agricultural economy of India in terms of area, production as well as value after cereals. Despite being the fourth largest oilseeds producing country in the world, India is one of the largest importers of vegetable oils today (Choudhary *et al.*, 2021). There has been a surge in vegetable oil consumption in recent years in respect of both edible as well as industrial usages. Among the nine oilseeds grown in India, rapeseed-mustard holds major area in entire north Indian belt. The share of India in rapeseed-mustard growing area of the world is 17.2% but its contribution in production is just 8.54%. This gap in area and production is due to various constraints like environmental, technological, economic and organizational. Among all these, environmental constraint has a big role to play. It includes both, biotic as well as abiotic factors. In abiotic factors there is temperature, soil, rainfall pattern, frost, wind and nutrient availability. Biotic factors include insects, weeds and disease causing organisms. Among biotic factors maximum damage is caused by weeds causing 37% damage followed by insects with 29% damage, next to it are insects causing 22% harm, and finally rodents and other pests causing 12% injury to crops (DWR, 2007). In mustard itself weeds cause a yield loss of about 40% reducing the crop productivity and quality by competition with the crop for available resources like nutrients, sunlight, water and space. So keeping in view the importance of weed management in mustard, different herbicide and hand weeding combinations were taken in order to find the most effective model.

Materials and Methods

A field experiment was conducted during *rabi* season of 2019-20 at N.E. Borlaug crop research centre of Govind Ballabh Pant University of Agriculture & Technology, Pantnagar (Uttarakhand) to explore the weed management module for Indian mustard (*Brassica juncea* L.). The soil of the experimental unit was silty clay loam in texture having high organic carbon (0.80%). In case of primary nutrients, the soil was medium in available nitrogen (257 kg/ha), available phosphorus (19.7 kg/ha) and available potassium (247 kg/ha) with neutral reactions having a pH of 7.2. The experiment was laid out in randomized block design with three replications and thirteen treatments. The treatments undertaken were pendimethalin @ 1.0 kg *a.i*/ha (PE), pendimethalin @ 0.5 kg *a.i.*/ha (PE), pendimethalin @ 1.0 kg *a.i.*/ha (PE) + hand weeding (HW) at 30 DAS, pendimethalin @ 0.5 kg *a.i.*/ha (PE)+ HW 30 DAS, oxadiargyl @ 0.09 kg *a.i.*/ha (PE), oxadiargyl @ 0.045 kg *a.i.*/ha (PE), oxadiargyl @ 0.09 kg *a.i.*/ha (PE) + HW 30 DAS, oxadiargyl @ 0.045 kg *a.i.*/ha (PE) + HW 30 DAS, clodinafop @ 0.06 kg *a.i.*/ha (PoE), clodinafop @ 0.03 kg *a.i.*/ha (PoE), clodinafop @ 0.06 kg *a.i.*/ha (PoE)+ HW 60 DAS, clodinafop @ 0.03 kg *a.i.*/ha (PoE) + HW 60 DAS, and control (weedy check). Indian mustard variety NRCHB-101 was sown in rows at the

Tables 1. Effect of weed control measures on weed density and weed dry weight

Treatment	Weed density (no./m²)			Weed dry-wight(g/m²)								
	Grassy 50 DAS	Broad leaf Maturity	Total 50 DAS	Grassy Maturity	Broad leaf 50 DAS	Total Maturity	50 DAS	Maturity	50 DAS	Maturity	50 DAS	Maturity
Pendimethalin 1.0 kg *a.i.*/ha (PE)	1.6#(1.7)*	2.6(6.4)	5.5(29.6)	9.4(87.2)	5.8(33)	9.7(94)	1.6(1.7)	2.6(6.4)	5.5(29.6)	9.4(87.2)	4.0(15.4)	6.8(45.4)
Pendimethalin 0.5 kg *a.i.*/ha (PE)	4.2(17)	4.8(16.1)	10.9(117.1)	11.8(139.4)	11.7(136)	12.5(156)	4.2(17)	4.8(16.1)	10.9(117.1)	11.8(139.4)	4.8(21.7)	7.2(50.8)
Pendimethalin 1.0 kg *a.i.*/ha (PE) + HW 30 DAS	1.4(1.0)	2.1(4.0)	1.2(1)	7.6(57.3)	1.2(4)	7.9(62)	1.4(1.0)	2.1(4.0)	1.2(1)	7.6(57.3)	2.8(7.5)	6.0(35.4)
Pendimethalin 0.5 kg *a.i.*/ha (PE) + HW 30 DAS	2.8(7.0)	3.8(14.2)	3(7.82)	9.6(92.2)	4.3(18)	10.4(107)	2.8(7.0)	3.8(14.2)	3(7.82)	9.6(92.2)	3.2(9.7)	6.1 (37.4)
Oxadiargyl 0.09 kg *a.i.*/ha (PE)	5.6(30.7)	6.7 (44)	14.6(213.0)	13.4(179.1)	15.7(246)	15.0(223.0)	5.6(30.7)	6.7(44)	14.6(213.0)	13.4(179.1)	7.1(48.7)	13.2(172.4)
Oxadiargyl 0.045 kg *a.i*/ha (PE)	7.6(57.2)	6.8(45.7)	13.5(182.0)	14.0(195.8)	15.6(241)	15.6(242)	7.6(57.2)	6.8(45.7)	13.5(182.0)	14.0(195.8)	9.5(89.8)	13.0(168.6)
Oxadiargyl 0.09 kg *a.i.*/ha (PE) + HW 30 DAS	6.6(43.0)	7.0(48.1)	13.2(172.4)	12.3(150.8)	14.7(217)	14.1(200)	6.6(43.0)	7.0(48.1)	13.2(172.4)	12.3(150.8)	3.6(12.4)	9.5(89.2)
Oxadiargyl 0.045 kg *a.i*/ha (PE) + HW 30 DAS	6.8(45.6)	7.1(50.3)	4.9(23.3)	14.5(208.9)	14.4(208)	16.1(259)	6.8(45.6)	7.1(50.3)	4.9(23.3)	14.5(208.9)	4.1(16.3)	11(118.5)
Clodinafop 0.06 kg *a.i.*/ha (30 DAS)	4.0(15.2)	4.5(19.5)	10.8(116.3)	12.4(154.0)	11.5(133)	13.2(174)	4.0(15.2)	4.5(19.5)	10.8(116.3)	12.4(154.0)	6.7(45.1)	13(167.2)
Clodinafop 0.03 kg *a.i.*/ha (30 DAS)	6.3(38.3)	6.5(41.8)	12.2(148.5)	14.2(201.1)	13.7(188)	15.6(243)	6.3(38.3)	6.5(41.8)	12.2(148.5)	14.2(201.1)	7.5(54.8)	15(213.0)
Clodinafop 0.06 kg *a.i*/ha (30 DAS) + HW 60 DAS	5.5(29.3)	3.3(10.2)	11.5(130.5)	11.3(126.5)	12.7(161)	11.7(137)	5.5(29.3)	3.3 (10.2)	11.5(130.5)	11.3 (126.5)	6.0(34.6)	7.9 (61.3)
Clodinafop 0.03 kg *a.i.*/ha (30 DAS)+ HW 60 DAS	6.7(44.3)	4.5(20.0)	15.9(251.8)	14.3(203.7)	17.2(298)	15.0(224)	6.7(44.3)	4.5(20.0)	15.9(251.8)	14.3(203.7)	7.8(59.4)	9.1(82.3)
Control (Weedy check)	13.70(186.7)	8.3(67.9)	17(286.0)	16.2(261)	21.8(474)	18.2(329)	13.70(186.7)	8.3(67.9)	17(286.0)	16.2(261)	11.6(135.2)	19.7(390.7)
SEm±	0.4	0.4	0.5	0.7	0.4	0.6	0.4	0.4	0.5	0.7	0.7	0.6
CD (P = 0.05)	1.2	1.2	1.6	2.0	1.3	1.7	1.2	1.2	1.6	2.0	2.0	1.8

HW: Hand weeding, DAS: Day after sowing, *: Figures in parenthesis are original, #: Weed density transformed to $\sqrt{x + 0.5}$.

geometry of 30 cm × 10 cm on 01st November 2019, and harvested on 21st March 2020. The data related to weeds were taken from a quadrate of 0.25 m^2 area and converted to m^2. The weed samples were dried to a constant weight in a hot air drier maintained at 65±5°C temperature. The dry matter of weeds was reported as g/m^2 on 25, 50, 75 DAS and at harvest. The yield attributes, seed yield and economics were calculated as per the standard protocols. To test the significance of variance in the data obtained from various parameters, the ANOVA technique for RBD was adopted and results were presented at 5 % (p = 0.05) level of significance.

Results and Discussion

It was observed that in the grassy weed category *Phalaris minor* Retz. was the most noticeable weed followed by *Cynodon dactylon* (L.) Pers. Sedges were not so prominent; the only sedge observed was *Cyperus rotundus* L., whose population was very sparse. Among the broadleaf weeds, the most populated ones were *Medicago denticulata* L. and *Chenopodium album* L. followed by *Anagallis arvensis* L. *Cirsium arvensis* (L.) Scop was the most notorious weed observed in the field. Density (weeds/m^2) and dry weight of weeds were recorded significantly lowest with pendimethalin 1.0 kg *a.i.*/ha (PE) + HW 30 DAS among all the treatments, which was followed by the pre-emergence application of pendimethalin 1.0 kg *a.i.*/ha (Table 1). Oxadiargyl was not efficient in controlling weeds at preliminary stages, due to which growth of mustard was suppressed. And also, after hand weeding at 30 DAS, weed emergence was noticed as crops were inefficient to smother them. Clodinafop applied at 30 and 60 DAS tend to cause necrosis of the foliage, but its only for short period and weeds regenerated after two to three weeks after application. As the dry matter accumulation is the parameter to assess the crop-weed competition, the presence of weeds in early stage competes with the crop, and makes it devoid of any resources. Application of pendimethalin 1.0 kg *a.i*/ha+ HW at 30 DAS effectively controlled the weed in initial stage, the crop dominated the weeds and grew healthy. In the later stages, the crop spread its canopy and developed strong root system. Eventually the weeds, which emerged later, did not survive being devoid of sunlight and nutrients. In case of Indian mustard, the critical period of crop weed competition being 25-50 DAS**.** Application of pendimethalin 1.0 kg a.i./ha (PE) + HW 30 DAS provided a proper environment for growth and proliferation of the crop which led to a good economic yield and also resulted the highest weed control efficiency among different treatments (Table 2).

Application of pendimethalin 1.0 kg *a.i.*/ha (PE) + HW 30 DAS followed by pendimethalin 0.5 kg *a.i.*/ha (PE) + HW 30 DAS produced the highest number of branches per plant (Table 2). Branching in mustard is affected by temperature as well as the resources availability. As weed management helped the crop to effectively absorb and assimilate all the supplied nutrients and water, those plants had copious branching. The lowest number of branches was noted in case of control (weedy check). Similarly for number of siliquae per plant, seed weight per plant and

Table 2: Effect of weed management on weed control efficiency (WCE), yield attributes, seed yield and B:C ratio of Indian mustard

Treatment	WCE (%)	Branches	Siliquae / plant	Seed weight/ plant (g)	Seed yield (Kg/ha)	B:C ratio
Pendimethalin 1.0 kg *a.i.*/ha (PE)	88.6	8.8	165	9.3	2550	2.5
Pendimethalin 0.5 kg *a.i.*/ha (PE)	83.9	7.8	144	7.4	2306	2.3
Pendimethalin 1.0 kg *a.i.*/ha (PE) + HW 30 DAS	94.4	10.7	186	12.7	3373	3.2
Pendimethalin 0.5 kg *a.i.*/ha (PE) + HW 30 DAS	92.8	9.5	177	10.6	2820	2.8
Oxadiargyl 0.09 kg *a.i.*/ha (PE)	63.9	5.7	132	6.2	2055	1.8
Oxadiargyl 0.045 kg *a.i*/ha (PE)	33.5	5.2	101	4.1	1376	0.9
Oxadiargyl 0.09 kg *a.i.*/ha (PE) + HW 30 DAS	90.8	7.5	152	8.1	2044	1.5
Oxadiargyl 0.045 kg *a.i*/ha (PE)+ HW 30 DAS	87.9	7.2	122	5.9	1932	1.4
Clodinafop 0.06 kg *a.i.*/ha (30 DAS)	66.6	5.0	113	4.6	1445	1.0
Clodinafop 0.03 kg *a.i.*/ha (30 DAS)	59.4	4.7	97	3.4	1148	0.7
Clodinafop 0.06 kg *a.i*/ha (30 DAS) + HW 60 DAS	74.4	5.7	120	4.9	1659	1.05
Clodinafop 0.03 kg *a.i.*/ha (30 DAS) + HW 60 DAS	56.0	5.0	115	4.3	1346	0.68
Control (Weedy check)	-	4.6	84	2.5	968	0.44
SEm±	-	0.4	11	0.6	177	-
CD (P = 0.05)	-	1.1	31	1.6	515	-

seed yield, application of pendimethalin 1.0 kg *a.i.*/ha (PE) + HW 30 DAS gave the highest values of these parameters. The yield recorded with application of pendimethalin was much higher than what was harvested with the pre as well as post-emergence application of other herbicides, due to weed free conditions, which was in accordance with the report by AICRP-RM (2008). The lowest seed yield was harvested in case of control (no weed management) which remained statistically on a par with that of the post-emergence application of clodinafop. This was due to higher weed population during the earlier stage of the crop. As in case of mustard slow growth during the initial stages leads to dominance of the weeds which later affects the yield, which is also confirmed by Chauhan *et al*. (2005). All the pendimethalin applied treatments had the B:C ratio of more than 2.0. The weedy check had the lowest B:C ratio of 0.44.

Conclusion

It can be concluded that application of pendimethalin @ 1.0 kg *a.i.*/ha (PE) followed by hand weeding at 30 days after sowing was found most effective in controlling the weeds properly at early growth stage during the critical period of weed control and also resulted the maximum weed control efficiency, productivity and B:C ratio.

References

AICRP-RM. 2008. Annual Progress Report of National Research Centre on Rapeseed-mustard. DRMR. pp.8–18

Chauhan YS, Bhargava MK and Jain VK. 2005. Weed management in Indian mustard (*B. juncea*). *Indian J Agron* **50**(2): 149-151.

Choudhary RL, Langadi AK, Jat RS, Anupama, Singh HV, Meena MD, Dotaniya ML, Meena MK, Premi OP and Rai PK. 2021. Mitigating the moisture stress in Indian mustard (*B. juncea*) through polymer. *J Oilseed Brassica* **12**: 21–27.

DWR. 2007. Perspective plan vision 2025.National research center for weed science, Jabalpur. Madhya Pradesh

Patel HB, Patel GN, Patel KM, Patel JS, and Patel NH. 2013. Integrated weed management in mustard. *AGRES- Int e-J* **2**(3): 276-282.

Punia SS, Yadav D, Pal A, Yadav R and Malik Y. 2010. Different herbicidal effect on yield of Indian mustard (*B. juncea*). *Indian J Weed Sci* **42**(1 &2): 70-72.

Sharma SK, Singh V and Panwar KS. 2005. Weed management in Indian mustard (*B. juncea*) under dryland conditions. *Indian J Agric Sci* **75**(5): 288-289.