

Assessment of different weed management practices in Mustard for enhancement of productivity

ABSTRACT

A field experiment was conducted at Krishi Vigyan Kendra, Sawaimadhopur, Rajasthan, India in two consecutive years during 2018-19 and 2019-20 on Zone III –B of Rajasthan, India. In this experiment was performed in randomized block design which includes four treatments of weed control *i.e.* weedy check (T₁), Hand weeding at 25 DAS (T₂), Hand weeding at 25 & 45 DAS (T₃), Pre emergence application of Pendimethaline @ 1.0 kg a.i. ha⁻¹ (T₄) and replicated five times. Results revealed that Weed Density (no m⁻²) 60 days after sowing, Dry weight (kg ha⁻¹) 60 days after sowing, weed control efficiency (%) and weed index found lowest in two hand weeding at 25 and 45 days after sowing *fb* Pre emergence application of Pendimethaline @ 1.0 kg a.i. ha⁻¹ (T₄) during both the years during 2018-19 and 2019-20, respectively. Highest seed yield (2341 kg ha⁻¹) and (2431 kg ha⁻¹) was found under two hand weeding (25 & 45 days after sowing) during 2018-19 and 2019-20 respectively.

Key words- Hand weeding, Mustard, weed management, Weed density, Yield.

Introduction

Indian Mustard [*Brassica juncea* (L.) Czern & Coss.] is very important oilseed crop of Rajasthan. India is the third largest producer of rapeseed and mustard after Canada, China and contributing total 11 % of world's total production. (DRMR, Bharatapur) In Rajasthan it is cultivated in 2.7 million ha area with productivity of 1586 kg ha⁻¹ whereas in Sawaimadhopur it is major oilseed crop of rabi season which covered 1,49,969 ha area with productivity of 1871 kg ha⁻¹. (Fourth Advance Estimates, Commissionerate of Agriculture, Rajasthan 2019-20). Mustard contain 37-49 % oil content. The seed and oil can be used for multipurpose as curry, pickles etc. (Chisi *et al.*, 2021). In comparison to various factors which play a major role in enhancing production and productivity of Mustard. Weeds play a major role in limiting the productivity of Mustard. Singh *et al.*, 2020 reported that weeds have great competition with plants for light, food and nutrients. Yield loss due to weed flora depends on time, type of weed flora, their intensity, stage and duration of crop-weed competition and weed loss reported upto 25 to 45 % due to weed flora reported by (Singh *et al.*, 2013). Therefore the management of weeds in Indian mustard is very important to enhance the production and productivity. According to Pandey *et*

al., 2022 crop weed competition period for mustard was initial early stage of crop growth which slows growth during 4-8 weeks. However the crop-weed competition period is 15-40 days. So proper and timely weed management in mustard enhances the growth and yield. The traditional practice of hand weeding during early crop growth stage 25 Days after sowing is not enough to control proper flushes of weeds. Weed flushes comes after irrigation and rainfall regularly. Manual weeding is though easy but due to lack of availability of labour and high wages make it costly. Estimation of weed seed bank (Sharma et al., 2020; 2022) is another way to know about the potential weed infestation in the future and control it in a better way, however the method seems to labor intensive and expensive. Therefore use of chemical herbicide for controlling weed flora is a alternative and suitable option. According to Rao and Chauhan, 2015 application of Pendimethaline was found effective in managing the weeds. Hence, keeping these all factors in view assessment of effect different treatments of weed management in mustard including hand weeding and pre emergence application were carried out in this experiment. To assess the best suitable and effective weed management practice in Sawaimadhapur, Rajasthan.

Material and Method

A field experiment and assessment was conducted in the two consecutive years during 2018-19 and 2019-20 at farmers field in Village kuthala, Sawaimadhapur, Rajasthan, India. This village was situated in Block Chauth ka barwara in Sawaimadhapur, Rajasthan. Physiological characteristics of experimental field was Sandy loam soil with having pH 7.9 and EC (ds m^{-1}) 0.3 ds m^{-1} , percent organic carbon was low <0.5% (0.30 %), available nitrogen was low 240-480 kg ha^{-1} (243 kg ha^{-1}), available P₂O₅ was medium 11-22 kg ha^{-1} (20.2 kg ha^{-1}) and available potash was Medium 110-280 kg ha^{-1} (247 kg ha^{-1}). Four Weed management practices were laid out in randomized block design which includes Weedy Check (T₁), Hand weeding at 25 DAS (T₂), Hand weeding at 25 DAS & 45 DAS (T₃), Pre emergence application of Pendimethaline @ 1.0 kg a.i. ha^{-1} (T₄) which was replicated 6 times on farmers field. The mustard variety Giriraj was sown manually at the spacing of 30×10 cm apart using seed rate of 5 kg ha^{-1} . Sowing was done on 22- 24 October during both the years. The recommended dose of fertilizers were 80 Kg N ha^{-1} , 40 kg P ha^{-1} and 40 kg K ha^{-1} and zinc 5 kg ha^{-1} , sulphur 40 kg ha^{-1} . Full dose of phosphorus through Single super phosphate and half dose of nitrogen through Urea were applied as basal dose. The hand weedings were done manually by labours and herbicide application was

done by knapsack sprayer fitted with flat fan nozzle. The other package of practices were adopted as per recommendation. Total no of weeds were counting and analyzed after subjecting the original data to square root transformation ($\sqrt{X+0.5}$). For sampling of weeds a metallic quadrat of 0.5×0.5 m were selected in an area of 0.25m² and sampling was done at two places in a plot. Weed control efficiency (%) was computed by using following formula (Mani *et al.*,1973):

$$WCE = \frac{\text{Dry weight of weeds in unweeded control plot (g m}^{-2}\text{)} - \text{Dry weight of weeds in treated plot (g m}^{-2}\text{)}}{\text{Dry weight of weeds in unweeded control plot (g m}^{-2}\text{)}} \times 100$$

Weed index was computed by using the formula (Gill and Kumar, 1969).

$$WI (\%) = \frac{X - Y}{X} \times 100$$

Where, X= Yield from weed free plot (kg ha⁻¹)

Y= Yield from the treated plot for which WI is to be worked out (kg ha⁻¹)

The statistical calculation were done by as per analysis of variance described by Gomez and Gomez 1984.

Result and Discussion

Major Weed Flora of experimental field

Results presented in table – 1 revealed that during the experiment field was infested with no of broad and grassy weeds. Among these *Chenopodium album* L., and *Chenopodium murale* L. were major broad leaf weeds appears with the emergence of crop. *Cyperus rotundus* L. and *Asphodelus tenuifolius* Cavan and *Anagalis arvensis* L. were major weeds which infested the crop during whole crop period.

Table-1 Major Weed Flora of experimental field during 2018-19 and 2019-20

S.No.	Botanical Name	Common Name	English Name	Family
1	<i>Chenopodium murale</i> L.	khartua	Goosefoot	Chenopodiaceae
2	<i>Asphodelus tenuifolius</i> Cavan	Piazi	Wild Onion	Liliaceae

3	<i>Chenopodium album</i> L.	Bathua	Lambsquater	Chenopodiaceae
4	<i>Melilotus alba</i> L.	Safed senji	Sweet Clover	Leguminaceae
5	<i>Cynodon dactylon</i> L.	Doob grass	Bermuda grass	Poaceae
6	<i>Anagalis arvensis</i> L.	krishnaneel	pimpernel	Primulaceae
7	<i>Cyperus rotundus</i> L.	Motha	Purp[le nutsedge	cyperaceae
8	<i>Launea asplenifolia</i> L.	Jangli gobhi	Wild gobhi	Asteraceae

Weed Density (No m⁻²) 60 DAS

Data presented in table-2 revealed that highest weed density (No m⁻²) 60 DAS was found under weedy Check (T1) due to no any weed management practice was followed under this plot. One hand weeding at 25 days after sowing (DAS) was found weed free environment for a very short initial period and after 60 days after sowing higher weed density (No m⁻²) (5.77 No m⁻²) and (5.05 No m⁻²) was found which was higher over T3 and T4 during 2018-19 and 2019-20, respectively. Lowest weed density (3.90 No m⁻²) and (3.38 No m⁻²) was found under treatment two hand weeding at 25 & 45 days after sowing (DAS) (T₃) during both the years which was at par with Pre emergence application of Pendimethalin @ 1.0 kg a.i. ha⁻¹ (T₄) (4.92 No m⁻²) and (3.89 No m⁻²) during both the years. The luxuriant crop growth was observed under two hand weeding at 25 & 45 DAS (T₃) due to aeration and weeding at proper time intervals. According to Singh et al., 2020 results revealed that due to proper and effective weed management with two hand weeding the photosynthetic activity of plant, nutrient availability and uptake was also increases which leads to yield enhancement. These results are in close conformity with (Pandey et al., 2022). Pre emergence application of pendimethalin @1.0 kg a.i ha-1 was significantly controlled and suppressed the growth of some grassy and broad leaf weeds which resulted in weed free environment upto 30-40 days after sowing resulted in higher yield (Yadav et al., 2017, Gupta et al., 2018). Pendimethalin 750 g/ha PE fb one HW was effective against grassy, broad-leaved and sedge weeds. (Chisi et al., 2021)

Dry weight (Kg ha⁻¹) 60 DAS

Results presented in Table-2 showed that lowest dry weight (Kg ha⁻¹) 60 days after sowing (DAS) (5.61 Kg ha⁻¹) and (1.96 Kg ha⁻¹) was found under two hand weeding at 25 & 45 DAS which was at par with application of pre-emergence pendimethaline @ 1.0 kg a.i. ha⁻¹ during

both the years. During both the years lowest dry weight after 60 DAS was found under two hand weeding due to proper manual weed management at timely intervals. Pre emerge weeds was mainly controlled by pendimethalin during initial days upto 40 and after it mustard itself a smothering crop which suppresses the weed growth. According to Chisi *et al.*, 2021 Pendimethalin 750 g/ha PE *fb* one HW was effective against grassy, broad-leaved and sedge weeds.

Table-2 Effect of different weed management practices in Mustard on weed density and Dry weight (Kg ha⁻¹) 60 DAS

Treatments	Weed Density (No m ⁻²) 60 DAS		Dry weight (Kg ha ⁻¹) 60 DAS	
	2018-19	2019-20	2018-19	2019-20
Weedy Check (T ₁)	13.37 (186.24)	12.45 (163.04)	22.62 (524.76)	21.76 (487.72)
Hand weeding at 25 DAS (T ₂)	5.77 (33.33)	5.05 (25.4)	8.82 (78.55)	6.73 (45.08)
Hand weeding at 25 & 45 DAS (T ₃)	3.90 (14.88)	3.38 (11.24)	5.61 (31.54)	1.96 (3.36)
Pre emergence application of Pendimethaline @ 1.0 kg a.i. ha ⁻¹ (T ₄)	4.92 (23.94)	3.89 (14.76)	7.67 (59.08)	5.34 (28.34)
SE(m)	0.77	0.76	1.05	0.96
CD	2.28	2.27	3.13	2.85

Weed control efficiency (%)

Results presented in table-3 showed that highest weed control efficiency during 2018-19 and 2019-20 was found under two hand weeding at 25 & 45 DAS (T₂) (93.35 %) and (99.24 %) respectively which was significantly higher over pre emergence application of pendimethaline @ 1.0 kg a.i. ha⁻¹ (87.46 %) and (93.48 %), respectively. In contrast to that lowest weed control efficiency was found under weedy check (T₁) (0.00 and 0.00 %) during both the years. The highest weed control efficiency was observed under two hand weeding due to effective control of broad and grassy weeds during crop growth period *fb* pre emergence application of pendimethaline @ 1.0 kg a.i. ha⁻¹. Similar results was observed by Yadav *et al.*, 2017, Patel *et al.*, 2013 and Pandey *et al.*, 2019. Sewak *et al.* (2004) and Kumar *et al.* (2012) in mustard reported superiority of pendimethalin. According to Kumar *et al.*, 2021 Highest weed control efficiencies of 89.82% at harvest stage was recorded with two hand weedings at 25 and 45 DAS. Pendimethalin @ 0.75 kg ha⁻¹ as pre emergence controlled the weeds to the extent of 68.14 per cent at these stages and thus emerged the most effective herbicidal treatment.

Weed Index (%)

Result presented in Table-3 showed that during 2018-19 and 2019-20 highest weed index (131.17 and 134.93 %) was observed under weedy check (T₁) and lowest weed index was found with two hand weeding (0.00 and 0.00 %) respectively. It has been well known that weed control efficiency and weed index is directly correlated. If a particular treatment showed the highest weed control efficiency and lowest weed index it means weeds has been effectively controlled in particular treatment. These results are in close conformity with Pandey *et al.*, 2019, Bamboriya *et al.*, 2016, Chauhan *et al.* (2005) and Degra *et al.* (2011).

Seed yield (kg ha⁻¹)

Data presented in table-3 showed that highest seed yield (2341 and 2431 Kg ha⁻¹) was observed under two hand weeding at 25 and 45 DAS (T₃) which was significantly higher over application of pre emergence pendimethaline @ 1.0 kg a.i. ha⁻¹ (T₄) (2141 and 2211 Kg ha⁻¹) during 2018019 and 2019-20, respectively. Lowest seed yield was observed under weedy check (T₁) due high infestation and competition of weeds with crop during crop growth period resulted in lowest seed yield. According to Kumar *et al.*, 2012 with the influence of different weed control treatments growth and development of the crop under weed free environment showed influence on the formation of yield attributing character viz., siliquae per plant, seeds per plant and 1000 seed weight increased with herbicide combinations and sequential application. Pendimethalin 0.75 kg ha⁻¹ fb isoproturon 0.75 kg ha⁻¹ remaining statistically at par with trifluralin 0.75 kg ha⁻¹ (pre) fb isoproturon 0.75 kg ha⁻¹ resulted in significantly higher yield attributes. Hand weeding was superior treatment in the order. These results are in close conformity with Pandey *et al.*, 2022, Yadav *et al.*, 2017.

Table-3 Effect of different weed management practices in Mustard on weed control efficiency, weed index and seed yield

Treatments	Weed control efficiency (%)		Weed Index (%)		Seed yield (kg ha ⁻¹)	
	2018-19	2019-20	2018-19	2019-20	2018-19	2019-20
Weedy Check (T ₁)	0.00	0.00	131.17	134.93	1722	1770
Hand weeding at 25 DAS (T ₂)	83.02	89.59	70.29	67.88	2010	2101

Hand weeding at 25 & 45 DAS (T ₃)	93.35	99.24	0.00	0.00	2341	2431
Pre emergence application of Pendimethaline @ 1.0 kg a.i. ha ⁻¹ (T ₄)	87.46	93.48	43.55	46.30	2141	2211
SE(m)	1.80	1.04	2.41	2.26	60.16	58.62
CD	5.3	3.09	7.17	6.71	178.75	174.18

Conclusion

On the basis of two years results it has been concluded that highest weed control efficiency and seed yield was observed under two hand weeding at 25 and 45 DAS *fb* pre emergence application of pendimethalin @ 1.0 kg a.i. ha⁻¹. On the basis of weed density 60 DAS and weed dry weight it is also concluded that pre emergence application of pendimethaline is also an economic weed management practice in comparison to two hand weeding which is costly. It controls grassy and broad leaf weeds and gave weed free environment for growth of crop which resulted in higher yield.

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