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Enhancing productivity and profitability through herbicidal weed control in sesame

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ABSTRACT

A field experiment was conducted at Research Farm of College of Agriculture, Tikamgarh, Madhya Pradesh during *Kharif*, 2016 to find out the suitable herbicides for weed control in sesame. The experiment was laid out in a randomized block design with twelve treatments, *viz*. pre-emergence application of pendimethalin at 750 g/ha, post-emergence herbicides; quizalofop-ethyl at 40 and 50 g/ha, fenoxaprop-ethyl at 75 and 100 g/ha, pendimethalin at 750 g/ha *fb* quizalofop at 40 and 50 g/ha, pendimethalin at 750 g/ha *fb* fenoxaprop at 75 and 100 g/ha, pendimethalin *fb* one hand weeding at 20 DAS, two hand weeding at 15 and 30 DAS and weedy check. Hand weeding twice at 15 and 30 DAS recorded the lowest intensity and dry weight of total weeds (2.74 g/m^2) followed by pendimethalin *fb* one hand weeding (3.35 g/m^2) and these treatments significantly reduced the intensity and dry weight of total weeds over rest of the herbicidal treatments and weedy check. Pre-emergence application of pendimethalin *fb* post-emergence, quizalofop and fenoxaprop significantly reduced the weed dry weight over alone application of pendimethalin. The net profit was the highest under two hand weeding (` 35,099/ha) followed by pendimethalin 750 g/ha *fb* one hand weeding (` 30,365/ha) and pendimethalin *fb* fenoxaprop-ethyl at 100 g/ha (` 27,811/ha), whereas the B:C ratio was higher under the application of pendimethalin 750 g/ha *fb* fenoxaprop-ethyl 100 g/ha (2.72).

Sesame is one of the most ancient oilseed crops grown and used by mankind. In Madhya Pradesh, sesame is grown during *Kharif* season in an area of 424 thousand ha area with total production of 1,24,383 tonnes and an average productivity of 293 kg/ha (IOPEPC 2017). One of the causes of lower productivity of sesame in the region is severe weed competition. The competitional stress of weeds on crop for nutrients, water, light and space are mainly responsible for poor yield of sesame. Prevalence of high temperature and frequent rainfall during the crop season coupled with slow plant growth particularly, during early growth stages favour luxuriant weed growth and causes about 50-75% reduction in seed yield of sesame (Dungarwal *et al.* 2003). The period from 15-30 DAS is the most critical period of crop-weed competition in sesame (Badkul *et al*. 2015). Therefore, it is essential to control weeds during the initial growth period. Besides the rising cost of labour, which contributes major share of cultivation charges of sesame, need to be replaced by an alternate effective and economical measure, which can help to boost the production per unit area of the crop (Punia *et al*. 2001). Weed control by using herbicides is one of the easier, time saving and economical alternative as compared to manual weeding. Chemical herbicides are applied as an alternative to hand weeding + hoeing and they are selective, cost effective, easy to apply and have persistence that can be managed. Therefore, the present experiment was carried out to find out the suitable herbicide for weed control in sesame.

Field studies were conducted during *Kharif* season of 2016 at the research farm of College of Agriculture, Tikamgarh situated at 24^0 45" N latitude, 78^0 53" E longitude and an altitude of 426.7 meter above the mean sea level. The soil of the experimental field was sandy loam in texture, neutral in reaction (pH 7.30) having medium in organic carbon (0.88 %) and available N (225 kg/ha), medium in phosphorus (17.70 kg/ha), and high in available K (415.6 kg/ha). The total rainfall received during growing season was 825 mm. The experiment consisted of twelve treatments comprised of pre-emergence application of pendimethalin at 750 g/ha, post-emergence

herbicides; quizalofop-ethyl at 40 and 50 g/ha, fenoxaprop-ethyl at 75 and 100 g/ha, pendimethalin at 750 g/ha *fb* quizalofop at 40 and 50 g/ha, pendimethalin at 750 g/ha *fb* fenoxaprop at 75 and 100 g/ha, pendimethalin *fb* one hand weeding at 20 DAS, two hand weeding at 15 and 30 DAS and weedy check in a randomized block design with three replications. Sesame variety '*TKG-306*' was sown in row 30 cm apart, using 5 kg/ha seeds. Crop was fertilized 60 kg N, 40 kg P_2O_5 and 20 kg K_2O/ha as basal dose through urea, single super phosphate (SSP) and muriate of potash, respectively. Pendimethalin as pre-emergence, quizalofop-ethyl and fenoxaprop-ethyl was applied at 20 DAS with hand knapsack sprayer fitted with flat-fan nozzle at spray volume of 500 l/ha. Weed density and weed dry weight were recorded at 40 DAS with the help of 1 x 1 m quadrate by throwing randomly at three places in each plot. Weeds were removed and species wise weed dry weight was recorded after drying in hot air oven (60 ± 1^0C for 24 hours). Weed control efficiency was also calculated at harvest. The economics was calculated on the basis of prevailing market rates of agriculture produced and cost of cultivation.

Weed flora

Sesame was infested by wide range of monocot and dicot weeds. The major weed species in the experimental plots were *Cyperus rotundus, Cynodon dactylon, Eclipta alba, Leucus aspera* and *Mollugo pentaphylla*. There was predominance of monocot weeds in experimental field as they constituted the higher relative density of 65.48% as compared to dicot weeds (34.52%). In the monocot weeds, the density of *C. rotundus* was the highest (57.52%) followed by *C. dactylon* (7.96%) whereas among the dicots, *Eclipta alba* was more (14.76%) followed by *M. pentaphylla* (12.56 %) and *L. aspera* (7.20%).

Effect on weeds

Results revealed that hand weeding twice at 15 and 30 DAS recorded the lowest population of total weeds (4.58/m^2) followed by pendimethalin *fb* one hand weeding at 20 DAS (5.48/m^2). Pre-emergence application of pendimethalin 750 g/ha *fb* hand weeding at 20 DAS (5.48/m^2) found significantly superior than its alone application and followed application with post-emergence herbicides; quizalofop and fenoxaprop. Post-emergence application of quizalofop at 40 and 50 g/m^2 and fenoxaprop at 75 and 100 g/ha alone and its application after pre-emergence pendimethalin at 750 g/ha proved significantly superior over pendimethalin alone. Weedy check recorded significantly the highest weed population (8.36/m^2). Similarly, hand weeding twice at 15 and 30 DAS recorded the lowest dry weight of total weeds (2.74 g/m^2) followed by pendimethalin *fb* one hand weeding (3.35 g/m^2), and these treatments significantly reduced the dry weight of total weeds over rest of the herbicidal treatments and weedy check.

The maximum weed control efficiency (WCE) was recorded under hand weeding twice (89.45%) followed by pendimethalin 750 g/ha *fb* hand weeding at 20 DAS (84.86%), and these treatments were at par with pre-emergence application pendimethalin at 750 g/ha *fb* post-emergence fenoxaprop-ethyl at 100 g/ha at 20 DAS (Sukhadia *et al*. 2004). Among herbicidal treatments, pre-emergence application of pendimethalin *fb* fenoxaprop-ethyl at 75 and 100 g/ha and pendimethalin *fb* quizalofop-ethyl at 40 and 50 g/ha registered significantly higher WCE over pendimethalin and quizalofop alone, however, alone application of pendimethalin, quizalofop and fenoxaprop were at par with respect to WCE (**Table 1**).

Effect on crop

All the weed control treatments produced significantly higher number of capsules per plant, number of seeds per capsule, test weight and seed yield than weedy check. Two hand weeding at 15 and 30 DAS resulted in significantly the highest value in capsules/plant, test weight and seed yield over rest of the treatments. Similar findings were reported by Baskaran and Solaimalai (2002). Among the herbicides, alone application of pre-emergence pendimethalin at 750 g/ha, post-emergence quizalofop and fenoxaprop produced significantly lower number of capsules per plant, number of seed per capsule, test weight and seed yield over application of pre-emergence pendimethalin followed by post-emergence herbicides; quizalofop and fenoxaprop. Pendimethalin followed by hand weeding at 20 DAS produced significantly higher number of capsules/plant, number of seeds/capsule, test weight and seed yield over all the herbicidal treatments except pendimethalin followed by fenoxaprop at 75 and 100 g/ha. However, the lowest number of capsules per plant, number of seeds per capsule, test weight and seed yield was recorded under weedy check (**Table 1**).

The net monetary returns (NMR) under each treatment was determined by subtracting the cost of cultivation from gross monetary returns (GMR) of each treatment. The marginal profit of ` 8540/ha was obtained when crop was not weeded throughout the

Table 1. Effect of different herbicides on weed density, weed dry weight, weed control efficiency, yield attributes, seed yield, net monetary return and benefit cost ratio of sesame

Treatment	Weed density (no./m^2)	Weed dry weight (g/m^2)	Weed control efficiency (%)	No. of capsules/ plant	No. of seeds/ capsule	Test weight (g)	Seed yield (kg/ha)	Net monetary returns (x10^3 `/ha)	B:C Ratio
Pendimethalin 750 g/ha as pre-emergence	7.10(49.9)	8.75(76.1)	42.26	18.13	41.93	2.70	290	13.96	2.01
Quizalofop-ethyl 40 g/ha at 20 DAS	7.26(52.2)	8.08(64.7)	42.32	18.50	42.67	2.72	308	15.56	2.13
Quizalofop-ethyl 50 g/ha at 20 DAS	7.10(50.0)	7.78(59.9)	45.71	18.77	43.13	2.73	324	16.87	2.21
Fenoxaprop-ethyl 75 g/ha at 20 DAS	7.02(48.8)	7.60(57.3)	48.96	19.00	43.33	2.75	335	17.82	2.27
Fenoxaprop-ethyl 100 g/ha at 20 DAS	6.89(47.1)	7.33(53.2)	56.53	19.33	44.00	2.76	353	19.05	2.32
Pendimethalin 750 g/ha *fb* quizalofop-ethyl 40 g/ha at 20 DAS	6.22(38.3)	6.93(47.5)	62.49	21.20	47.33	2.78	435	25.49	2.64
Pendimethalin 750 g/ha *fb* quizalofop-ethyl 50 g/ha at 20 DAS	6.07(36.5)	6.70(44.4)	66.46	21.77	48.00	2.79	443	25.97	2.65
Pendimethalin 750 g/ha *fb* fenoxaprop-ethyl 75 g/ha at 20 DAS	6.00(35.6)	6.43(40.8)	68.10	22.03	48.67	2.81	454	26.93	2.70
Pendimethalin 750 g/ha *fb* fenoxaprop-ethyl 100 g/ha at 20 DAS	5.90 (34.3)	6.08(36.4)	76.56	22.27	49.33	2.82	468	27.81	2.72
Pendimethalin 750 g/ha *fb* hand weeding at 20 DAS	5.48(29.5)	3.35(10.7)	84.86	23.27	51.00	2.87	524	30.36	2.62
Hand weeding at 15 and 30 DAS	4.58(20.5)	2.74(7.0)	89.45	25.17	56.67	2.88	610	35.10	2.60
Weedy check	8.36 (69.8)	10.4(111.4)	0.00	16.27	38.67	2.68	212	8.58	1.72
LSD (p=0.05)	0.59	0.98	15.09	1.74	3.12	0.11	73.30	-	-

*values in parentheses are original values

crop season whereas it was the highest under two hand weeding (` 35,099/ha) followed by pendimethalin 750 g/ha *fb* one hand weeding (` 30,365/ha) and pendimethalin *fb* fenoxaprop-ethyl at 100 g/ha (` 27,811/ha). B:C ratio was higher under the application of pendimethalin 750 g/ha *fb* fenoxaprop-ethyl 100 g/ha (2.72) followed by pendimethalin 750 g/ha *fb* fenoxaprop-ethyl 75 g/ha (2.70) and pendimethalin 750 g/ha *fb* quizalofop ethyl 50 g/ha (2.65). Hand weeding twice and pendimethalin *fb* one hand weeding registered B:C ratio of 2.60 and 2.62, respectively, whereas it was the lowest (1.72) under weedy check. These results are in accord with Mathukia *et al*. (2015).

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