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# Weed control in sesame with pre-emergence herbicides

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**ABSTRACT**

Pendimethalin, imazethapyr, metribuzin, oxyfluorfen, imezemox were evaluated as pre-emergence herbicides in sesame during summer season of 2013 and 2014 at ICAR-Directorate of Weed Research, Jabalpur. All the herbicides reduced the weed population significantly as compared with weedy check but delayed the germination of sesame and caused sesame injury. Among all the herbicides, pendimethalin alone and in combination with lower dose of imazethapyr caused less injury to the sesame and produced higher sesame yield. None of the herbicides surpassed the yield what was achieved with 2 HW.

Sesame (*Sesamum indicum* L.) is one of the oldest crops known to humans. There are archeological remnants of sesame dating to 5500 BC in the Harappa Valley in the Indian subcontinent (Bedigian and Harlan 1986). India ranks first in area and second in sesame production by contributing 23.2% and 18.5% of the world area and production, respectively. In India, it is cultivated in an area on 1.86 m ha with a production of 0.81 m t (Anonymous 2007). Its average productivity (437 kg/ha) is far below then that of world average (489 kg/ha) (FAO 2004). Being a slow growing crop during seedling stage weeds affect the growth of sesame and reduce the yield. Yield reduction due to weeds was observed to the tune of 55 to 65% (Punia *et al.* 2001). The period from 15 to 30 days after sowing (DAS) is the most critical period of crop-weed competition in sesame (Venkatakrishnan and Gnanamurthy 1998). Though the conventional methods of weed control are very much effective, but due to high wages and non- availability of labour during critical weeding season, use of herbicides could be more time saving, economical and efficient to check early crop-weed competition. With weak seedling vigor, limited competitive ability, the use of pre-emergence herbicides is essential for sesame production. Therefore, the present investigation is planned to find out the suitable pre-emergence herbicide for weed control during early growth stages of sesame.

A field experiment was conducted at experimental farm of ICAR-Directorate of Weed Research, Jabalpur, (23°132 N, 79°582 E, and 390 m above mean sea level) Madhya Pradesh, India during summer seasons of 2013 and 2014. The soil of experimental field was clay loam in texture, neutral (7.2) in reaction, medium in organic carbon (0.79%), available nitrogen (312 kg N /ha) and phosphorus (18 kg $P_2O_5$/ha) but high in available potassium (291 kg $K_2O$/ha). The experiment was laid out in randomized block design, replicated thrice, comprised 8 treatments with different groups and herbicides, *viz.* pendimethalin 750 g/ha (dinitroaniline), oxyfluorfen 150 g/ha (diphenyethers), imazethapyr 60 g/ha (imidazolinone), metribuzin 200 g/h (triazines), pendimethalin 750 g/ha + imazethapyr 50 g/ha, imazethapyr 35 g/ha + imazemox 35 g/ha (imidazolinone), two hand weeding (15 and 30 DAS) and weedy check. Sesame variety '*TKG-22*' was sown with recommended package of practices. Fertilizers were applied through urea, di-ammonium phosphate and muriate of potash @ 60 kg N, 40 kg $P_2O_5$ and 20 kg $K_2O$/ha. All the pre-emergence herbicides were applied with manually operated 'ASPEE' knapsack sprayer fitted with flat-fan nozzle at spray volume of 500 L/ha. Weed density and dry matter were recorded at 45 DAS with the help of 1 x 1 m quadrate by throwing randomly at three places in each plot. Weeds were removed and counted species wise. Plant height was measured by gentle stretching the main stem of the plant to its full length and

measuring the height in centimeters. Sesame injury was evaluated based on scale of 0 (no stunting) to 100 (complete plant death). Observations were recorded for different characters and mean values were subjected to pooled analysis. The combined analysis of 2 years revealed that the year effect was non-significant, and the mean data of 2 years were analyzed. The statistical analysis of data was done using SAS Windows Version 9.3.

**Weed flora**

The most dominant broad-leaved weeds were *Alternanthra philoxeroides, Cichorium intybus, Euphorbia geniculata,* and grassy weeds were *Digitaria sanguinalis, Dinebra retroflexa, Echinocloa colona.*

**Effect of herbicides**

The pre-emergence herbicides have varied response over broad-leaved and narrow-leaved weeds. Among the pre-emergence, pendimethalin + imazethapyr showed better control over *Alternanthra philoxeroides* (**Table 1**) and was at par with pendimethalin alone and other herbicides, except imazethapyr + imazemox, which showed that lower dose of imazethapyr had no impact on *Alternanthra philoxeroides*. Metribuzin controlled *Cichorium intybus* effectively and was at par to oxyfluorfen. Pendimethalin could control approximately 50% whereas imazethapyr had negligible effect on this weed. Emergence of *Euphorbia geniculata* was checked by imazethapyr + imazemox followed by oxyfluorfen and imazethapyr. Pendimethalin was less effective against *Euphorbia geniculata*. The population of *Digitaria sanguinalis* was significantly reduced with the application of imazethapyr and oxyfluorfen. All the herbicides reduced the population of *Dinebra retroflexa,* but the difference was not upto the level of significance. *Echinocloa colona,* the major narrow-leaf weed was effectively controlled by pendimethalin + imazethapyr and by metribuzin and pendimethalin alone. Among pre-emergence treatments minimum dry weight of weed was recorded with the application of pendimethalin + imazethapyr followed by pendimethalin alone (**Table 1**). Byrd and York (1987) also reported that grasses and small-seeded dicot weed species can be controlled with the pre-emergence application of

**Table 1. Effect of pre-emergence herbicides on density (no. /m$^2$) and dry matter (g/m$^2$) of broad and narrow leaf weeds of summer sesame**

| Treatment | Broad-leaved weeds | | | Narrow-leaved weeds (no/m$^2$) | | | Total weed dry matter (g/m$^2$) |
|---|---|---|---|---|---|---|---|
| | *Alternanthra philoxeroides* | *Cichorium intybus* | *Euphorbia geniculata* | *Digitaria sanguinalis* | *Dinebra retroflexa* | *Echinocloa colona* | |
| Pendimethalin 750 g/ha | 2.0$^{C}$ | 13.1$^{B}$ | 9.03$^{A}$ | 2.8$^{ABC}$ | 1.3$^{A}$ | 5.1$^{CD}$ | 28.7$^{BC}$ |
| Oxyfluorfen 150 g/ha | 3.4$^{C}$ | 5.8$^{C}$ | 1.7$^{AB}$ | 1.2$^{D}$ | 4.3$^{A}$ | 11.4$^{AB}$ | 33.6$^{B}$ |
| Imazethapyr 60 g/ha | 3.7$^{BC}$ | 18.7$^{AB}$ | 3.4$^{AB}$ | 1.7$^{D}$ | 1.6$^{A}$ | 7.0$^{BC}$ | 33.7$^{B}$ |
| Metribuzin 200 g/ha | 5.3$^{ABC}$ | 3.6$^{C}$ | 6.6$^{AB}$ | 2.9$^{AB}$ | 4.0$^{A}$ | 4.5$^{CD}$ | 24.1$^{B}$ |
| Pendimethalin 750 + imazethapyr 50 g/ha | 1.7$^{C}$ | 16.2$^{B}$ | 4.6$^{AB}$ | 2.2$^{BCD}$ | 1.3$^{A}$ | 4.1$^{CD}$ | 23$^{CD}$ |
| Imazethapyr 35 g/ha + imazemox 35 g/ha | 9.3$^{A}$ | 20.4$^{AB}$ | 1.2$^{B}$ | 1.8$^{CD}$ | 1.3$^{A}$ | 7.1$^{BC}$ | 26.1$^{CD}$ |
| Two hand weeding | 3.6$^{BC}$ | 4.6$^{C}$ | 1.3$^{B}$ | 1.6$^{D}$ | 1.0$^{A}$ | 1.7$^{D}$ | 16.2$^{D}$ |
| Weedy check | 8.6$^{AB}$ | 25.7$^{A}$ | 6.4$^{AB}$ | 3.84$^{A}$ | 4.3$^{A}$ | 12.9$^{A}$ | 75.4$^{A}$ |
| LSD (p=0.05) | | | | | | | |

In a column, means followed by common letter are not significantly different at 5 % level by DMRT

**Table 2. Effect of pre-emergence herbicides on seed yield and yield attributing characters of sesame**

| Treatment | Days to 50% germination | Plant height (cm) | No. of branches/plant | No. of capsules /plant | Test wt (g) | Sesame stunting (%) | Seed yield (kg/ha) |
|---|---|---|---|---|---|---|---|
| Pendimethalin 750 g/ha | 12.0$^{B}$ | 105.9$^{AB}$ | 5.65$^{AB}$ | 55.1$^{AB}$ | 3.12 | 16.3$^{C}$ | 546.3$^{B}$ |
| Oxyfluorfen 150 g/ha | 13.3$^{B}$ | 80.0$^{C}$ | 3.63$^{CD}$ | 31.3$^{CD}$ | 3.14 | 36.6$^{A}$ | 373.5$^{CDE}$ |
| Imazethapyr 60 g/ha | 13.6$^{B}$ | 92.1$^{ABC}$ | 3.81$^{CD}$ | 41.8$^{BCD}$ | 3.08 | 32.0$^{AB}$ | 411.4$^{CD}$ |
| Metribuzin 200 g/ha | 20.6$^{A}$ | 98.5$^{ABC}$ | 4.66$^{BCD}$ | 45.8$^{BC}$ | 3.09 | 26.6$^{B}$ | 459.6$^{BC}$ |
| Pendimethalin 750 + imazethapyr 50 g/ha | 13.6$^{B}$ | 104.3$^{AB}$ | 5.12$^{BC}$ | 52.4$^{AB}$ | 3.06 | 17.3$^{C}$ | 531.7$^{B}$ |
| Imazethapyr 35 g/ha + imazemox 35 g/ha | 13.0$^{B}$ | 82.8$^{BC}$ | 3.35$^{D}$ | 31.7$^{CD}$ | 3.09 | 30.3$^{AB}$ | 342.1$^{DE}$ |
| Two hand weeding | 7.0$^{C}$ | 109.8$^{A}$ | 7.10$^{A}$ | 66.7$^{A}$ | 3.08 | 0.00$^{D}$ | 682.0$^{A}$ |
| Weedy check | 7.3$^{C}$ | 107.5$^{A}$ | 3.27$^{D}$ | 29.1$^{D}$ | 3.12 | 0.00$^{D}$ | 271.33$^{E}$ |
| LSD (p=0.05) | | | | | | | |

In a column, means followed by common letter are not significantly different at 5% level by DMRT

pendimethalin. All the broad-leaved and narrow-leaved weeds were effectively controlled by two hand weeding (2 HW) and the lowest population of all the weeds (broad and narrow leaved) was observed with this treatment except *Alternanthra philoxeroides*. Significantly higher populations of grassy as well as broad-leaved weeds were recorded in weedy check. Bhadauria *et al.* (2012) also observed similar findings in their studies.

Significantly higher plant height, no. of branches per plant, no of capsules and yield was recorded with 2 HW, while weedy check yielded lowest (**Table 2**). All the pre-emergence herbicide reduce the plant height of sesame but significantly lower plant height was observed with oxyfluorfen and imazethapyr + imazemox when compared with 2 HW and untreated check. During initial stages of plant growth, the stunting was observed with all the pre-emergence herbicide tried. Significantly higher stunting was observed with oxyfuorfen whereas pendimethalin alone and in combination with lower dose of imazethapyr caused least injury to the sesame. Due to suppressive effect on initial crop growth and subsequently on yield attributes, in spite of good weed control, seed yield was poor in plots treated with pre-emergence herbicide. This was in confirmation with findings of Punia *et al.* (2001) and Grichar *et al.* (2009). Among pre-emergence herbicide tried, the maximum plant height, no. of branches per plant and yield and less stunting was observed with pendimethalin alone followed by pendimethalin + imazethapyr (**Table 2**). It showed that dinitroanilines were much safer to sesame as compared to imidazolinone, triazines and diphenyethers (Bhadauria *et al.* 2012). Rao and Rao (1965) also reported significantly higher yield of sesame with the application of pendimethalin.

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