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RESEARCH ARTICLE

# Effect of Different Weed Management Practices on Growth and Yield of Rainfed Sesame (*Sesamum indicum L.*) under Vertisol

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## ABSTRACT

A field experiment was carried out at Agricultural Research Station, Kovilpatti, Tamil Nadu Agricultural University during Purattasipattam (October 2017 to January 2018) to study the effect of different weed management practices in rainfed sesame. The experiment was laidout in randomized block design with three replications having ten different weed management treatments in rainfed sesame variety SVPR 1 under vertisol. Application of Alachlor @ 1.5 kg a.i. $ha^{-1}$ as pre emergence *fb* Quizalofop ethyl @ 50 g a.i. $ha^{-1}$ on 25 DAS as early post emergence recorded significantly lesser weed index and higher weed control efficiency and inturn significantly produced higher plant height, dry matter production, seed yield (550 kg $ha^{-1}$) and stalk yield (2432 kg $ha^{-1}$). It was followed by the application of Pendimethalin @ 1.0 kg a.i. $ha^{-1}$ as pre emergence *fb* Quizalofop ethyl @ 50 g a.i. $ha^{-1}$ on 25 DAS as early post emergence.

**Keywords:** *Weed management, Plant height, Dry matter Production, Yield, Rainfed Sesame*

Sesame was a major oilseed in the ancient world because of its easy extraction, great stability, and drought resistance. Sesame (Sesamum indicum L.) is one of the important oilseed crops in Indian agriculture. Sesame seed has pronounced antioxidant activity and thereby offer higher shelf life and is called as “seeds of immortality”. Sesame oil has excellent nutritional, medicinal, cosmetic and cooking qualities. The sesame cake is used as organic manure as well as a good concentrate feed for livestock. India is the world’s largest producer of sesame accounting for nearly 35 per cent of the total production of sesame in the world but productivity is very low. Lack of proper weed management is one of the main constraints for poor yields of sesame. Yield losses due to crop weed competition in sesame have been estimated to be 50- 75 per cent. Simultaneous emergence and rapid growth of weeds leads to weed competition for moisture, light, space and nutrients. Amare, (2011) found a critical period of weed competition in sesame crop between 15 and 30 days after seedlings emergence. So, during that period, the crop is to be maintained in weed free condition in order to realize maximum yield. Therefore, increase in agriculture production has to come from rainfed area which constitutes about 56 per cent of net cultivated area. Rainfed agriculture faces more constraints viz., moisture, nutrient and weeds. Among them, weeds cause major problem in rainfed agriculture. Weeds alone reduce the crop yield up to tune of 70 per cent. Weeds cause enormous stress at the initial growth stages that affects the economic yields of sesame. Weeds are serious pest damage for the most crops caused by competition on light, nutrients, moisture and space and this lead to enormous reduction in crop yield. The application of herbicide as pre emergence, early post emergence and post emergence approach is advantageous because, long and effective control of all weeds during crop season. A suitable, economically viable and ecologically safe combination of chemical with manual weeding would help to achieve weed control and reduced the yield loss. Keeping these points in view the present study was undertaken to find out the effect of pre and early post emergence herbicides in rainfed sesame.

## MATERIAL AND METHODS

Field experiment was conducted at Agricultural Research Station, Kovilpatti, Tamil Nadu Agricultural University during Purattasipattam (October 2017 to January 2018). The investigation was carried out with ten treatments under randomized block design (RBD) with three replications. The test variety was Sesame SVPR 1, spacing 30 x 30 cm. The weed management treatments imposed were $T_1$- PE Pendimethalin @ 1.0 kg a.i. $ha^{-1}$ + One Hand hoeing on 30 DAS, $T_2$ - PE Alachlor @ 1.5 kg a.i. $ha^{-1}$ + One Hand hoeing on 30 DAS, $T_3$ - PE Pendimethalin @ 1.0 kg a.i. $ha^{-1}$ + EPOE Quizalofop ethyl @ 50 g a.i. $ha^{-1}$ on 25 DAS, $T_4$ - PE Pendimethalin

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@ 1.0 kg a.i. $ha^{-1}$ + EPOE Imazethapyr @ 50 g a.i. $ha^{-1}$ on 25 DAS, $T_5$ - PE Alachlor @ 1.5 kg a.i. $ha^{-1}$+ EPOE Quizalofop ethyl @ 50 g a.i. $ha^{-1}$ on 25 DAS, $T_6$ - PE Alachlor @ 1.5 kg a.i. $ha^{-1}$+ EPOE Imazethapyr @ 75 g a.i. $ha^{-1}$ on 25 DAS, $T_7$ - Tank Mix of EPOE Quizalofop ethyl @ 50 g a.i. $ha^{-1}$ + Imazethapyr @ 50 g a.i. $ha^{-1}$ on 15 DAS, $T_8$ - Hand hoeing on 15 and 30 DAS, $T_9$ - Weed free check and $T_{10}$ - Unweeded control. The observations on plant height and dry matter production was recorded at harvest stage. Weed control efficiency and weed index was worked out and yield was recorded and illustrated.

## RESULTS AND DISCUSSION

### *Weed flora*

The common weed flora of the experimental field consisted of sedges and broadleaved weeds. None of the grassy weeds was noticed in the experimental field. The major sedge weed was *Cyperus rotundus*. Among the broad-leaved weeds *Acalypha indica, Amaranthus viridis, Commelina diffusa, Convolvulus arvensis, Corchorus fascicularis, Corchorus olitorius, Digera arvensis, Euphorbia hirta, Euphorbia microphylla, Phyllanthus maderaspatensis, Phyllanthus niruri, Trianthema portulacastrum* were the prominent species.

**Table 1. Effect of different weed management practices on weed density, weed control efficiency and weed index in rainfed sesame**

| Treatments | Sedge weed density 45 DAS (No. $m^{-2}$) | Broad leaved weed density (No. $m^{-2}$) 45 DAS | Total weed density (No. $m^{-2}$) 45 DAS | Weed control efficiency (%) | Weed index (%) |
|---|---|---|---|---|---|
| $T_1$-PE Pendimethalin @ 1.0 kg a.i. $ha^{-1}$ + One Hand hoeing on 30 DAS | 5.3 (2.41) | 4.9 (2.32) | 10.2 (3.19) | 92.43 | 15.38 |
| $T_2$-PE Alachlor @ 1.5 kg a.i. $ha^{-1}$ + One Hand hoeing on 30 DAS | 4.7 (2.28) | 4.8 (2.30) | 9.5 (3.16) | 92.95 | 13.60 |
| $T_3$-PE Pendimethalin @ 1.0 kg a.i. $ha^{-1}$ + EPOE Quizalofop ethyl @ 50 g a.i. $ha^{-1}$ on 25 DAS | 4.1 (2.14) | 1.7 (1.48) | 5.8 (2.51) | 95.65 | 7.51 |
| $T_4$-PE Pendimethalin @ 1.0 kg a.i. $ha^{-1}$ + EPOE Imazethapyr @ 50 g a.i. $ha^{-1}$ on 25 DAS | 12.8 (3.58) | 9.7 (3.19) | 22.5 (4.74) | 83.70 | 34.35 |
| $T_5$-PE Alachlor @ 1.5 kg a.i. $ha^{-1}$+ EPOE Quizalofop ethyl @ 50 g a.i. $ha^{-1}$ on 25 DAS | 3.7 (2.05) | 1.3 (1.34) | 5.0 (2.35) | 96.25 | 4.11 |
| $T_6$-PE Alachlor @ 1.5 kg a.i. $ha^{-1}$+ EPOE Imazethapyr @ 50 g a.i. $ha^{-1}$ on 25 DAS | 12.2 (3.49) | 9.5 (3.16) | 21.7 (4.66) | 84.28 | 31.48 |
| $T_7$-Tank Mix of EPOE Quizalofop ethyl @ 50 g a.i. $ha^{-1}$ + Imazethapyr @ 50 g a.i. $ha^{-1}$ on 15 DAS | 7.0 (2.74) | 6.5 (2.65) | 13.5 (3.67) | 89.86 | 19.32 |
| $T_8$-Hand hoeing on 15 and 30 DAS | 5.5 (2.45) | 5.1 (2.37) | 10.6 (3.26) | 92.14 | 17.17 |
| $T_9$-Weed free check | 0.0 (0.71) | 0.0 (0.71) | 0.0 (0.71) | 100.00 | - |
| $T_{10}$-Unweeded control | 75.4 (8.68) | 64.3 (8.02) | 139.7 (11.82) | - | 58.32 |
| SEd | 0.1 | 0.1 | 0.2 | - | - |
| CD(p=0.05) | 0.3 | 0.3 | 0.4 | - | - |

*Figure in parenthesis are transformed values.

### *Weed density*

### *Sedges*

At 45 DAS, among the different treatment combinations, application of Alachlor @ 1.5 kg a.i. $ha^{-1}$ as pre emergence + Quizalofop ethyl @ 50 g a.i. $ha^{-1}$ on 25 DAS as early post emergence and application of Pendimethalin @ 1.0 kg a.i. $ha^{-1}$ as pre emergence + Quizalofop ethyl @ 50 g a.i. $ha^{-1}$ on 25 DAS as early post emergence registered the lowest weed density of sedges (3.7 and 4.1 $m^{-2}$ respectviely). These two treatments were on par with each other. Whereas unweeded control significantly registered highest weed density of sedges (75.4 $m^{-2}$).

***Broad leaved weeds***

At 45 DAS, application of Alachlor @ 1.5 kg a.i. $ha^{-1}$ as pre emergence + Quizalofop ethyl @ 50 g a.i. $ha^{-1}$ on 25 DAS as early post emergence recorded significantly lowest the broad leaved weed density (1.3 $m^{-2}$) and it was on par with application of Pendimethalin @ 1.0 kg a.i. $ha^{-1}$ as pre emergence + Quizalofop ethyl @ 50 g a.i. $ha^{-1}$ on 25 DAS as early post emergence registered density of 1.7 $m^{-2}$. Whereas unweeded control significantly registered highest density of broad leaved weeds (64.3 $m^{-2}$).

***Total weed density***

At 45 DAS, application of Alachlor @ 1.5 kg a.i. $ha^{-1}$ as pre emergence + Quizalofop ethyl @ 50 g a.i. $ha^{-1}$ on 25 DAS as early post emergence recorded significantly reduced the total weed density (5.0 $m^{-2}$) and application of Pendimethalin @ 1.0 kg a.i. $ha^{-1}$ as pre emergence + Quizalofop ethyl @ 50 g a.i. $ha^{-1}$ on 25 DAS as early post emergence was registered lowest total weed density of 5.8 $m^{-2}$. These two treatments were on par with each other. Significantly highest total weed density of 139.7 $m^{-2}$ was recorded under unweeded control.

**Table 2. Effect of different weed management practices on plant height, dry matter production, and seed and stalk yield in rainfed sesame**

| Treatments | Plant height at harvest (cm) | DMP at harvest (kg $ha^{-1}$) | Seed yield (kg $ha^{-1}$) | Stalk yield (kg $ha^{-1}$) |
|---|---|---|---|---|
| $T_1$-PE Pendimethalin @ 1.0 kg a.i. $ha^{-1}$ + One Hand hoeing on 30 DAS | 87.0 | 2660 | 473 | 1956 |
| $T_2$-PE Alachlor @ 1.5 kg a.i. $ha^{-1}$ + One Hand hoeing on 30 DAS | 90.5 | 2784 | 480 | 2075 |
| $T_3$-PE Pendimethalin @ 1.0 kg a.i. $ha^{-1}$ + EPOE Quizalofop ethyl @ 50 g a.i. $ha^{-1}$ on 25 DAS | 97.3 | 3056 | 517 | 2271 |
| $T_4$-PE Pendimethalin @ 1.0 kg a.i. $ha^{-1}$ + EPOE Imazethapyr @ 50 g a.i. $ha^{-1}$ on 25 DAS | 72.6 | 1782 | 367 | 1484 |
| $T_5$-PE Alachlor @ 1.5 kg a.i. $ha^{-1}$+ EPOE Quizalofop ethyl @ 50 g a.i. $ha^{-1}$ on 25 DAS | 101.6 | 3248 | 550 | 2432 |
| $T_6$-PE Alachlor @ 1.5 kg a.i. $ha^{-1}$+ EPOE Imazethapyr @ 50 g a.i. $ha^{-1}$ on 25 DAS | 73.4 | 1946 | 383 | 1516 |
| $T_7$-Tank Mix of EPOE Quizalofop ethyl @ 50 g a.i. $ha^{-1}$ + Imazethapyr @ 50 g a.i. $ha^{-1}$ on 15 DAS | 78.9 | 2227 | 421 | 1705 |
| $T_8$-Hand hoeing on 15 and 30 DAS | 85.1 | 2581 | 463 | 1892 |
| $T_9$-Weed free check | 105.8 | 3342 | 559 | 2583 |
| $T_{10}$-Unweeded control | 66.1 | 1374 | 233 | 944 |
| SEd | 2.4 | 134 | 18 | 91 |
| CD(p=0.05) | 5.2 | 269 | 36 | 183 |

Application of Alachlor @ 1.5 kg a.i. $ha^{-1}$ as pre emergence + Quizalofop ethyl @ 50 g a.i. $ha^{-1}$ on 25 DAS as early post emergence recorded significantly reduced the total weed density (5.0 $m^{-2}$). This results were attributed due to the control of weeds at germination phase by the application of pre emergence herbicides and significant reduction at later growth stage as late germinating weeds were controlled by early post emergence application of herbicides. Similar findings were reported by (Bhadauria *et al.*, 2012) and (Mruthul, 2014) The next order of lower weed density was recorded by application of Pendimethalin @ 1.0 kg a.i. $ha^{-1}$ as pre emergence + Quizalofop ethyl @ 50 g a.i. $ha^{-1}$ on 25 DAS as early post emergence of 5.8 $m^{-2}$. This might be due to the prevention of germination of weed seeds which also controlled the growth of germinated weed seeds. The results are corroborate with findings of (Sukhadia *et al.*, 2004) and (Yadav, 2004). The highest total weed density of 139.7 $m^{-2}$ was recorded under unweeded control.

***Weed control efficiency and weed index***

Among the different weed management practices, application of Alachlor @ 1.5 kg a.i. $ha^{-1}$ as pre emergence + Quizalofop ethyl @ 50 g a.i. $ha^{-1}$ on 25 DAS as early post emergence recorded higher weed control efficiency ( 96.25 per cent ) and lower weed index ( 4.11 per cent). It was followed by application of Pendimethalin @ 1.0 kg a.i. $ha^{-1}$ as pre emergence + Quizalofop ethyl @ 50 g a.i. $ha^{-1}$ on 25 DAS as early post emergence which accounts weed control efficiency of 95.65 per cent and weed index of 7.51 per cent (Table 1). It was mainly due to the better control of weeds upto a critical stage and its resulted in lower weed densities, weed biomass and ultimately registered higher WCE. Similar results have been reported by (Chandawat *et al.,* 2004). The lowest weed control efficiency 83.70 per cent and higher weed index 34.35 per cent were recorded with the application of Pendimethalin @ 1.0 kg a.i. $ha^{-1}$ pre emergence + Imazethapyr @ 50 g a.i. $ha^{-1}$ on 25 DAS early post emergence. Due to the reduction in seed yield by the reduction in growth and yield components of sesame which is due to heavy weed competition was occurred in this treatment similar to unweeded control for space, light, nutrient etc. Similar results have been reported by Bhadauria *et al.* (2012) and Mruthul *et al*. (2014).

***Plant height and dry matter production***

Application of Alachlor @ 1.5 kg a.i. $ha^{-1}$ as pre emergence + Quizalofop ethyl @ 50 g a.i. $ha^{-1}$ on 25 DAS as early post emergence, which recorded 101.6 cm of plant height and 3248 kg $ha^{-1}$ of drymatter production (Table 2). This might be due to absence of weed competition during the critical period of crop weed competition particularly in the early stages of crop growth. Application of Alachlor @ 1.5 kg a.i. $ha^{-1}$ as pre emergence + Quizalofop ethyl @ 50 g a.i. $ha^{-1}$ on 25 DAS as early post emergence was on par with application of Pendimethalin @ 1.0 kg a.i. $ha^{-1}$ as pre emergence + Quizalofop ethyl @ 50 g a.i. $ha^{-1}$ on 25 DAS as early post emergence recorded 97.3 cm of plant height and 3056 kg $ha^{-1}$ of drymatter production.Unweeded control recorded significantly lowest plant height of 66.1 cm and DMP 1374 kg $ha^{-1}$ at harvest stages. This results correlates with the findings of Mruthul, (2014).

***Yield***

Application of Alachlor @ 1.5 kg a.i. $ha^{-1}$ as pre emergence + Quizalofop ethyl @ 50 g a.i. $ha^{-1}$ on 25 DAS as early post emergence recorded the 550 kg $ha^{-1}$ of seed yield and 2432 kg $ha^{-1}$ of stalk yield. It was followed by application of Pendimethalin @ 1.0 kg a.i. $ha^{-1}$ as pre emergence + Quizalofop ethyl @ 50 g a.i. $ha^{-1}$ on 25 DAS as early post emergence recorded 517 kg $ha^{-1}$ seed yield as well as stalk yield of 2271 kg $ha^{-1}$. This might be due to effect of pre and early post emergence herbicides which prevented the crop-weed competition and mainly attributed to better control of weeds up to a critical level through the lesser weed density, dry weight resulting in better availability of nutrients, moisture and light to the crop growth. Similar results have been reported by Mruthul *et al.* (2014) and Yadav (2004).

## CONCLUSION

It could be concluded that application of Alachlor @ 1.5 kg a.i. $ha^{-1}$ as pre emergence + Quizalofop ethyl @ 50 g a.i. $ha^{-1}$ on 25 DAS as early post emergence recorded higher weed control efficiency, higher plant height, dry matter production and inturn increased the yield of rainfed sesame.

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