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Effect of Integrated Weed Management Practices on Growth and Yield of Sesame (*Sesamum indicum* L.)

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ABSTRACT: A field experiment was performed to study the "Effect of integrated weed management practices on growth and yield of sesame (*Sesamum indicum* L.)" variety Swetha-Til at Agricultural college, PJTSAU, Polasa, Jagtial, during *Summer* 2022. The soil of the experimental site was sandy clay loam in texture. The experiment was laid in randomized block design with 11 treatments, 3 replications comprising of different weed management practices i.e. T_1: Pendimethalin 30 % EC @ 0.75 kg ha^{-1} at 1-3 DAS fb 1 MW at 30 DAS, T_2: Oxyflourfen 23.5 % EC @ 50 g ha^{-1} at 1-3 DAS fb 1 MW at 30 DAS, T_3: Pre-mix of Pendimethalin 30 % + Imazethapyr 2 % EC @ 250 g ha^{-1} at 1-3DAS fb 1 MW at 30 DAS, T_4: Pyroxasulfone 85 % WP @ 25 g ha^{-1} at 1-3 DAS fb 1 MW at 30 DAS, T_5: Pendimethalin 30 % EC @ 0.75 kg ha^{-1} at 1-3 DAS fb Quizalofop-ethyl @ 50 g a.i. ha^{-1} at 20 DAS, T_6: Oxyflourfen 23.5 % EC @ 50 g ha^{-1} at 1-3 DAS fb Quizalofop-ethyl @ 50 g a.i. ha^{-1} at 20 DAS, T_7: Pre-mix of Pendimethalin 30 % + Imazethapyr 2 % EC @ 250 g ha^{-1} at 1-3 DAS fb Quizalofop-ethyl @ 50 g a.i. ha^{-1} at 20 DAS, T_8: Pyroxasulfone 85 % WP @ 100 g ha^{-1} at 1-3 DAS fb Quizalofop-ethyl @ 50 g a.i. ha^{-1} at 20 DAS, T_9: Mechanical weeding at 20 and 40 DAS, T_{10}: Hand Weeding at 20 and 40 DASand T_{11}:Weedy Check. The data revealed that among integrated weed management practices tested, pre-emergence application of pendimethalin 30 % EC @ 0.75 kg ha^{-1} at 1-3 DAS followed by mechanical weeding at 30 DAS(T_1) shows highest growth parameters & yield parameters such as plant height (99.1 cm),dry matter accumulation (2581 kg ha^{-1}), LAI (1.9), Number of filled grains capsule^{-1} (47.5), Number of Capsules plant^{-1} (58.1), test weight (2.91 g), seed yield (921 kg ha^{-1}) and stover yield(1369 kg ha^{-1}). The most effective and acceptable method of weed control is integrated weed management, which includes both manual/mechanical and chemical weeding.

Keywords: Sesame, Integrated weed management, Pendimethalin, Quizalofop-ethyl, Imazethapyr, Pyroxasulfone, Yield.

INTRODUCTION

Sesame (*Sesamum indicum* L.) (2n=26) belonging to the family Pedaliaceae is one of the earliest domesticated crops of India. It is grown in the tropics and subtropics in warm climates. India is one of the largest exporters of sesame and ranks first in both acreage (1.723 M ha) and production (0.817 M t) with average productivity (474 kg ha^{-1}) (*Indiastat*, 2020-21). In India, 85% sesame production comes from the Gujarat, West Bengal, Andhra Pradesh, Telangana, Tamil Nadu, Madhya Pradesh, Rajasthan and Maharashtra states. In Telangana, it is grown over an area of 21,000 hectares with an annual production of 15000 tons and productivity of 714 kg ha^{-1}. Sesame is grown in summer season in the districts of Northern Telangana *viz*., Adilabad, Jagtial, Karimnagar and Nizamabad in turmeric, cotton and rice fallows. The presence of weeds is a major obstacle in sesame production and can negatively influence sesame yield. Initial slow growth of sesame seedlings makes itself poor competitor with more vigorous weeds. The low competitiveness of this crop with weeds is directly linked to its slow initial growth (Mane *et al.*, 2017). When weed control is not adopted, especially at initial periods, the sesame yield may be reduced by up to 75% (Bhadauria *et al.*, 2012). Pre-emergence of herbicides like pendimethalin, imazethapyr, metribuzin, oxyfluorfen reduced the weed population significantly compared with weedy check but delayed the germination of sesame and caused sesame injury but no reduction in yield (Singh *et al*., 2018). Pre-emergence application of pendimethalin @ 0.75 kg ha^{-1} + 1 HW at 40 DAS recorded the highest seed yield of 1009 kg ha^{-1}

(Mallick *et al.,* 2020). Pyroxasulfone is a pre-emergence applied herbicide for selective control of grasses and small seeded broad leaf weeds. Pyroxasulfone is a group of herbicide that reduces the biosynthesis of very long chain fatty acids (VLCFAs) and acts on emerging seedlings by blocking lipid biosynthesis through inhibition of several VLCFAs (Busi, 2014).

Though the conventional methods of weed control *viz.* hand weeding, mechanical weeding with manually operated star weeder etc. are very much effective but due to high wages and non-availability of labourers during the critical weeding season (15-30 DAS) and incessant protracted rains, use of herbicides and conjunction with cultural methods may be more time-saving, cost-effective, and effective in preventing early crop-weed competition. Therefore, integrated weed management (Manual/Mechanical as well as chemical weeding) is most efficient and acceptable approach to combat with the weed control problems. Evaluation of new herbicide molecules integrated with mechanical weeding may offer efficient weed management in sesame grown in Northern Telangana Zone. Hence, present experiment was undertaken to find out appropriate integrated weed management practice for sesame.

MATERIALS AND METHODS

The field experiment was conducted during *Summer* 2022 at college farm (18º84′35″N latitude and 78º94′98″E longitude and 250.4 m above mean sea level) of Agricultural college, Polasa, Jagtial, Professor Jayashankar Telangana State Agricultural University. The weekly mean maximum temperature during the crop growth period ranged from 22.6°C to 40.8°C. The weekly mean minimum temperature during the crop growth period ranged from 15.3°C to 25.5°C. The weekly mean relative humidity recorded at 7.30 hr (RH-I) during the crop growth period varied from 39.9% to 88.9%. The mean weekly relative humidity at 14.00 hr (RH-II) varied from 31.0% to 52.7%. The weekly mean evaporation during the crop growth period ranged between 1.9 mm and 5.7 mm. The weekly mean bright sunshine hours day^{-1} varied from 3.5 to 9.3 hours. The soil of the experimental field was sandy clay loam in texture having slightly alkaline nature with pH (7.82), EC (0.21), organic carbon (0.61%), available nitrogen (182.7 kg ha^{-1}), Available phosphorous (1.9 kg ha^{-1}), available potassium (321 kg ha^{-1}). This research work was laid in randomized block design (RBD) with three replications comprising of eleven treatments *viz.*T_1: Pendimethalin 30 % EC @ 0.75 kg ha^{-1} at 1-3 DAS fb 1 MW at 30 DAS, T_2: Oxyflourfen 23.5 % EC @ 50 g ha^{-1} at 1-3 DAS fb 1 MW at 30 DAS, T_3: Pre-mix of Pendimethalin 30 % + Imazethapyr 2 % EC @ 250 g ha^{-1} at 1-3DAS fb 1 MW at 30 DAS, T_4: Pyroxasulfone 85 % WP @ 25 g ha^{-1} at 1-3 DAS fb 1 MW at 30 DAS, T_5: Pendimethalin 30 % EC @ 0.75 kg ha^{-1} at 1-3 DAS fb Quizalofop-ethyl @ 50 g a.i. ha^{-1} at 20 DAS, T_6: Oxyflourfen 23.5 % EC @ 50 g ha^{-1} at 1-3 DAS fb Quizalofop-ethyl @ 50 g a.i. ha^{-1} at 20 DAS, T_7: Pre-mix of Pendimethalin 30 % + Imazethapyr 2 % EC @ 250 g ha^{-1} at 1-3DAS fb Quizalofop-ethyl @ 50 g a.i. ha^{-1} at 20 DAS, T_8: Pyroxasulfone 85 % WP @ 100 g ha^{-1} at 1-3 DAS fb Quizalofop-ethyl @ 50 g a.i. ha^{-1} at 20 DAS, T_9: Mechanical weeding at 20 and 40 DAS, T_{10}: Hand Weeding at 20 and 40 DAS and T_{11}: Weedy Check. The seed of sesame "Swetha - Til" was sown on 8th February 2022 with 30 × 10 cm spacing in the plot size of 5.4 × 4.0 m. The fertilizer dose recommended for the cultivar under study is 60-20-40 kg N, P_2O_5 and K_2O ha^{-1}. N, P, K were applied at the time of sowing in the form of urea, single super phosphate and muriate of potash respectively. While urea was applied in split doses (½ as basal dose and remaining ½ at 30 DAS). Pre emergence herbicides are applied at 2 DAS. Observations were recorded on growth, yield attributes and yield. The collected data was statistically analysed by Analysis of Variance utilizing Randomized Block Design (Panse and Sukhatme 1978). Statistical difference (CD) will be tested by applying F-Test at 0.05 level of probability.

RESULTS AND DISCUSSION

A. Growth parameters as influenced by different weed management practices

The plant height of sesame crop was significantly influenced by different weed management practices, The Maximum plant height (104.3) was observed in treatment (T_{10}). Two hand weedings at 20 and 40 DAS. Among the integrated weed management tested, Treatment (T_1) Pendimethalin 30 % EC @ 0.75 kg ha^{-1} at 1-3 DAS fb 1 MW at 30 DAS shows the maximum plant height (99.1), followed by treatment (T3) : Pre-mix of Pendimethalin 30 % + Imazethapyr 2 % EC @ 250 g ha^{-1} at 1-3 DAS fb 1 MW at 30 DAS gives plant height (97.8) and minimum plant height (74.5) was observed in T_{11}: Weedy check treatment, the plant height is maximum in T_{10} might with the hand weeding at appropriate time in crop, significantly control the weeds and crop's use of its greatest amount of moisture and nutrients. This was confirmed in findings of Singh *et al*. (2018); Aruna *et al.* (2020). The dry matter accumulation of sesame was influenced by different weed management practices, the maximum dry matter is observed in Treatment T_{10}: Two hand weeding at 20 and 40 DAS (2700 kg ha^{-1}), followed by (2581 kg ha^{-1}) *i.e*., T_1: Pendimethalin 30 % EC @ 0.75 kg ha^{-1} at 1-3 DAS fb 1 MW at 30 DAS and lowest dry matter (183.6 kg ha^{-1}) was observed in T_{11}: Weedy check treatment. This was confirmed in findings of Tamang *et al.* (2018). Leaf area index (LAI) was also significantly influenced by different weed management practices, Maximum LAI (1.89) was observed in treatment T_{10}, that is statistically similar with T_1 (1.88) and lowest LAI (1.32) was observed in treatment T_{11}. This might be due to lowest plant height and less number of branches in weedy check plot. The results are in agreement with the finding of Tamang *et al.* (2018). These results are depicted in (Table 1).

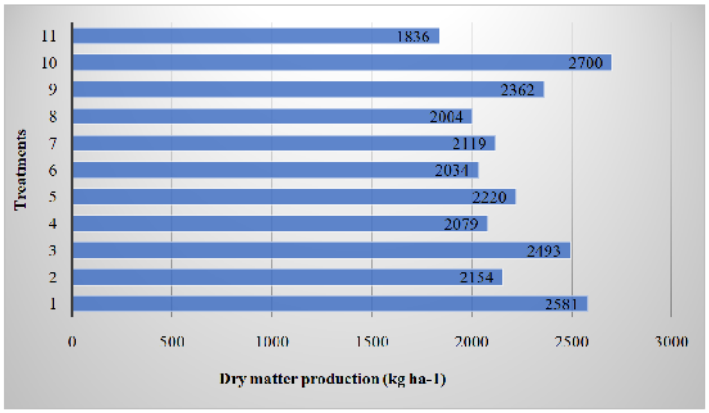

Fig. 1. Effect of different weed management practices on Dry Matter Production (kg ha^{-1}) in sesame.

Table 1: Growth parameters of sesame at harvest as influenced by different weed management practices.

	Treatment details	Plant Height (cm)	Dry matter production (Kg ha^{-1})	LAI
T_1	Pendimethalin 30 % EC @ 0.75 kg ha^{-1} at 1-3 DAS fb 1 MW at 30 DAS	99	2581	1.88
T_2	Oxyflourfen 23.5 % EC @ 50 g ha^{-1} at 1-3 DAS fb 1 MW at 30 DAS	92	2154	1.65
T_3	Pre-mix of Pendimethalin 30 % + Imazethapyr 2 % EC @ 250 g ha^{-1} at 1-3 DAS fb 1 MW at 30 DAS	98	2493	1.82
T_4	Pyroxasulfone 85 % WP @ 25 g ha^{-1} at 1-3 DAS fb 1 MW at 30 DAS	83	2079	1.50
T_5	Pendimethalin 30 % EC @ 0.75 kg ha^{-1} at 1-3 DAS fb Quizalofop-ethyl @ 50 g a.i. ha^{-1} at 20 DAS	92	2220	1.69
T_6	Oxyflourfen 23.5 % EC @ 50 g ha^{-1} at 1-3 DAS fb Quizalofop-ethyl @ 50 g a.i. ha^{-1} at 20 DAS	84	2034	1.56
T_7	Pre-mix of Pendimethalin 30 % + Imazethapyr 2 % EC @ 250 g ha^{-1} at 1-3 DAS fb Quizalofop-ethyl @ 50 g a.i. ha^{-1} at 20 DAS	87	2119	1.58
T_8	Pyroxasulfone 85 % WP @ 100 g ha^{-1} at 1-3 DAS + Quizalofop-ethyl @ 50 g a.i. ha^{-1} at 20 DAS	79	2004	1.42
T_9	Mechanical weeding at 20 and 40 DAS	95	2362	1.80
T_{10}	Hand Weeding at 20 and 40 DAS	104	2700	1.89
T_{11}	Weedy check	74	1836	1.31
	CD (P=0.05)	12.63	35.97	1.88
	SEm ±=	4.28	12.19	1.65

B. Yield Attributes of sesame as influenced by different weed management practices

The yield Attributes were significantly influenced by different weed management practices, Number of filled grains capsule^{-1}, Number of Capsules plant^{-1}, test weight (1000 seed weight). The highest number of filled grains capsule^{-1} (51.7) is observed in treatment T_{10}, followed by treatment T_1, among the integrated weed management practices, T_1 shows highest number of filled grains capsule^{-1} (47.5) and lowest number filled grains capsule^{-1} (23.4) is observed in T_{11}. This was confirmed in findings of Aruna *et al.* (2020). Maximum number of capsules plant^{-1} (61.7) were found T_{10}, followed by treatment T_1 and lowest number filled grains capsule^{-1} (23.4) is observed in T_{11}. This might because of removal of weeds with in time with application of pendimethalin as pre-emergence herbicide combined with mechanical weeding at 30 DAS. Test weight of seeds highest (2.96) in treatment T_{10} is statistically similar with (2.91) with treatment T_1, lowest test weight (2.6) observed in treatment T_{11}. Bhadauria *et al.* (2012) also reported the same results. These observations are shown in (Table 2).

The treatment with having highest yield attributes gives highest yield content. The maximum seed yield (1057.1 kg ha^{-1}) and stover yield (1570.3 kg ha^{-1}) is given treatment T_{10}. This may have because of hand weeding can effectively removing weeds within crop weed competition period and increased the crop's uptake of nitrogen and water while reducing the weed count. Among the integrated weed management practices highest seed yield (921.3 kg ha^{-1}) and stover yield (1369.3 kg ha^{-1}) are observed in T_1. The lowest seed yield (412.3 kg ha^{-1}) and stover yield (749 kg ha^{-1}) are observed in T_{11}. These findings are confirmed with Kamani *et al.* (2019).

Table 2: Yield Attributes & Yield of sesame as influenced by different weed management practices.

	Treatment details	No. of grains capsule^{-1}	No. of capsule plant $^{-1}$	Test Weight (g)	Seed yield (Kg ha$^{-1)}$	Stover yield (Kg ha$^{-1)}$
T_1	Pendimethalin 30 % EC @ 0.75 kg ha^{-1} at 1-3 DAS fb 1 MW at 30 DAS	48	58	2.93	921	1369
T_2	Oxyflourfen 23.5 % EC @ 50 g ha^{-1} at 1-3 DAS fb 1 MW at 30 DAS	34	46	2.83	789	1105
T_3	Pre-mix of Pendimethalin 30 % + Imazethapyr 2 % EC @ 250 g ha^{-1} at 1-3 DAS fb 1 MW at 30 DAS	46	55	2.90	884	1328
T_4	Pyroxasulfone 85 % WP @ 25 g ha^{-1} at 1-3 DAS fb 1 MW at 30 DAS	29	40	2.78	651	850
T_5	Pendimethalin 30 % EC @ 0.75 kg ha^{-1} at 1-3 DAS fb Quizalofop-ethyl @ 50 g a.i. ha^{-1} at 20 DAS	39	49	2.87	813	1118
T_6	Oxyflourfen 23.5 % EC @ 50 g ha^{-1} at 1-3 DAS fb Quizalofop-ethyl @ 50 g a.i. ha^{-1} at 20 DAS	33	44	2.80	706	954
T_7	Pre-mix of Pendimethalin 30 % + Imazethapyr 2 % EC @ 250 g ha^{-1} at 1-3 DAS fb Quizalofop-ethyl @ 50 g a.i. ha^{-1} at 20 DAS	34	45	2.80	766	1011
T_8	Pyroxasulfone 85 % WP @ 100 g ha^{-1} at 1-3 DAS + Quizalofop-ethyl @ 50 g a.i. ha^{-1} at 20 DAS	27	38	2.77	601	847
T_9	Mechanical weeding at 20 and 40 DAS	42	50	2.88	868	1255
T_{10}	Hand Weeding at 20 and 40 DAS	52	62	3.02	1057	1570
T_{11}	Weedy check	23	35	2.63	412	749
	CD (P=0.05)	4.70	1.83	0.19	97.39	97.61
	SEm ± =	1.53	0.62	0.07	33.01	33.09

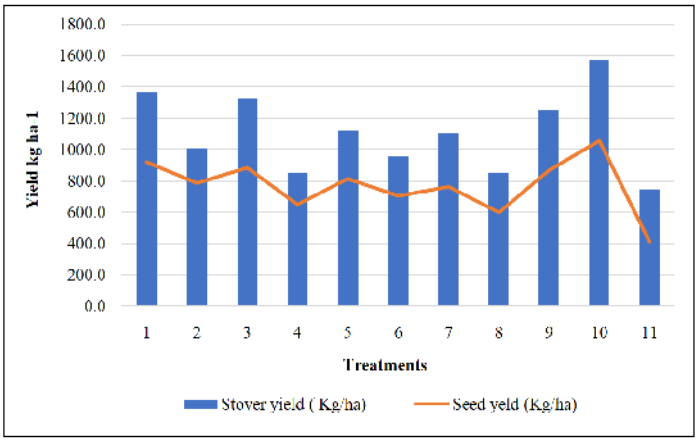

Fig. 2. Effect of Different weed management practices on seed and stover yield of sesame.

CONCLUSION

It was concluded that among the different weed management practices in sesame crop evaluated, two hand weedings at 20 and 40 DAS gives the maximum growth and yield compared to other practices, Among the integrated weed management practices tested, Treatment T_1: Pendimethalin 30 % EC @ 0.75 kg ha^{-1} at 1-3 DAS fb 1 MW at 30 DAS gives the maximum growth and yield, this might be due to the control the weed population with in time, crop's use of its greatest amount of moisture and nutrients, with the application of pre emergence herbicide pendimethalin 750 g ha^{-1} and mechanical weeding at 30 DAS.

FUTURE SCOPE

The most effective and acceptable method of weed control method is integrated weed management, which includes both chemical and mechanical weeding. Pre emergence application of Pendimethalin 30% EC integrated with mechanical weeding may offer efficient weed management in sesame in Northern Telangana Zone.

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