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Effect of Integrated weed management practices on growth and yield of sesame (*Sesamum indicum* L.)

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Abstract

The Field experiment was conducted at Farmers' holding at Karimangalam, Dharmapuri district of Tamil Nadu, during summer, 2021 in order to evaluate integrated weed management practices in sesame. The experiment was laid out with seven treatments and three replications. The treatment consist of Control, hand weeding, pre emergence alone, pre emergence *f b* hand weeding, post emergence alone, pre emergence *f b* post emergence and weed free check. Among the different treatment tried out, weed free check recorded the lowest weed count on 30 and 45 DAS, weed biomass with highest weed control efficiency, weed control index, the highest Plant height (139.14 cm), leaf area index (4.54), number of capsule plant^{-1} (71.67), seed yield (1351.9 kg ha^{-1}) and oil content (54.11%). Among the different herbicide treatment tried out, pre emergence application of imazethapyr 0.015 kg ha^{-1} *fb* post emergence application of quizalofop ethyl 0.05 kg ha^{-1} recorded the lowest weed count (8,13), weed biomass (10.89, 21.69 g) highest Weed Control Efficiency (86.21%, 85.39%), Weed Control Index (83.61%, 82.29%) on 30 and 45 DAS, in respect to highest Plant height (122.34 cm), leaf area index (3.99), number of capsule plant^{-1}(57.21), seed yield (100s8.54 kg ha^{-1}) and oil content (52.41%). The unweeded control treatment recorded the highest weed count on 30 and 45 DAS (58,89), weed biomass (66.41, 122.2 g) with lower Weed Control Efficiency and Weed Control Index with lowest Plant height (85.9 cm), leaf area index (3.06), number of capsule plant^{-1} (21.32), seed yield (687.12 kg ha^{-1}) with oil content (49.29%).

Key wards : Integrated weed management, yield, Sesame, weed parameters.

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Sesame (*Sesamum indicum* L.) is an important oilseed crop in the ancient world because of its drought resistance of sesame crop and oil extraction from sesame seeds great stability. Sesame is quality food, nutrition, edible oil, bio-medicine and health care, all in one and is often called as the 'queen of oil seeds'[2]. Weed infestation is one of the major factors limiting the yield of sesame due to the weeds have enormous stress at the initial growth stages and the effects on the economic yield of sowing crop. The high weed infestation in sesame field produced account about 50% yield losses due to slow sesame growth in the seedling period and earlier growth stages. The application of weed control treatments in these period have very little sesame weed competition and improved the growth characters, yield and its components of sesame[3]. Chemical weed management using pre- and post-emergence herbicides may provide efficient and cost effective weed control tactics throughout critical stages of crop weed competition, which human or mechanical weeding may not be able to do owing to higher cost of cultivation. Farmers in rainfed areas depend on pre-emergence (PE) herbicides to control weeds in the absence of human weeding, however it is often unsuccessful owing to farm-level constraints. Post-emergence (PoE) herbicides sprayed 20 - 30 days after sowing (DAS) seem to be a more realistic option for controlling weed pressure throughout the final phases of crop growth in these circumstances[1].

The Field experiment was conducted at Farmers' holding at Karimangalam, Dharmapuri district of Tamil Nadu in order to evaluate integrated weed management practices in sesame. The Experimental farm is situated at 12.30° N latitude and 78.21° E longitude with an altitude of 488 m above mean sea level. The soil texture is sandy loam, with a pH of 7.0 and electrical conductivity of 0.31 dSm^{-1} at the experimental site. Nitrogen, phosphorus, and potassium availability were low, medium, and high, respectively, at the experimental site. The experiment was laid out in a randomized block design, having seven treatments and replicated thrice. The following treatments were examined in experiment *viz.,* T_1 - unweeded control, T_2 - hand weeding twice (15 and 30 DAS), T_3 – pre emergence application of imazethapyr 0.015 kg ha^{-1}, T_4 – pre emergence application of imazethapyr 0.015 kg ha^{-1} *fb* Hand weeding, T_5 – post emergence application of quizalofop ethyl 0.05 kg ha^{-1}, T_6 – pre emergence application of imazethapyr 0.015 kg ha^{-1} *fb* Post emergence application of quizalofop ethyl 0.05 kg ha^{-1}, T_7 – weed free check.

For this experiment, the sesame variety TMV - 7 was chosen and it was seeded at a 30 x 30 cm spacing. Nitrogen through urea, phosphorus through single super phosphate and potassium through muriate of potash were applied as per the RDF (35:23:23 kg N, P_2O_5 and K_2O ha^{-1}). Half of N, entire P_2O_5 and K_2O were applied as basal. The remaining half of N was top dressed on 25 DAS. The $MnSO_4$ @ 5 kg ha^{-1} was applied immediately after sowing. A need-based approach to plant protection was taken based on the economic threshold of pests and diseases. The gross and net plot sizes were 5 x 4 m and 4.4 x 3.6 m respectively. The net plot area was used for the determination of crop yields. The crop observation was taken on 30 DAS, 60 DAS and harvest stage. The

weed parameters were recorded on 15, 30 and 45 DAS. Five samples in each plot were marked randomly for recording biometric observations. The observations were recorded at different stages of crop growth. The weed observation was taken on 45 DAS 0.25 m^2 quadrats were randomly positioned at each site to observe weeds. The samples of weeds and crop were air-dried first, then oven-dried at 70°C until they attained a uniform dry weight, which was then recorded. The mean dry weight was calculated in kg per hectare. The crops were harvested manually at physiological maturity and yield was taken at 14% moisture level. Using Gomez and Gomez's[4] method, biometric data obtained from plant samples and computed data were all statistically examined. The critical difference was determined at a 5% probability level in cases where the F test indicated that the treatment difference was significant.

Weed parameters :

The experimental field comprised the weeds like *Chloris barbata, Commelina benghalensis, Cyperus iria, Cyperus rotundus, Cynodon dactylon, Clitoria ternatea, Portulaca oleracea, Eclipta alba, Gomphrena decumbens, Tridax procumbens, Euphorbia hirta, Boerhavia erecta, Croton sparsiflorus, Cleome viscosa, Parthenium hysterophorus, Trianthema portulacastrun* and *Phyllanthus niruri*. Among these, the dominant weed species *viz*., *Cynodon dactylon and Chloris barbata* largely contributed for the total weed count.

At 30 and 45 DAS, the least individual weed count was recorded in weed free check (0,0) and it was followed by imazethapyr 0.015 kg ha^{-1} (PE) at 3 DAS + quizalofop ethyl 0.05 kg ha^{-1} (PoE) at 21 DAS (8,13). However, it was on par with imazethapyr 0.015 kg ha^{-1} (pre emergence) at 3 DAS + 1 hand weeding (9,15). Highest individual weed count of 58,89 was recorded under unweeded control (T_1). The similar trend was followed in weed biomass with the least weed dry matter production was recorded in weed free check (T_7) with the value of 0.00, 0.00 g m^{-2}. It was followed by imazethapyr 0.015 kg ha^{-1} (PE) at 3 DAS + quizalofop ethyl 0.05 kg ha^{-1} (PoE) at 21 DAS (T_6) with the value of 11.37, 22.99 g m^{-2}. However, it was on par with imazethapyr 0.015 kg ha^{-1} (PE) at 3 DAS + 1 hand weeding (T_4) with the value of 10.89, 21.69 g m^{-2}. Highest weed dry matter production of 66.41, 122.2 g m^{-2} was recorded under unweeded control (T_1). The lowest dry matter production observed under these treatments due to weed free condition maintained and when needed and early season control of weeds by application of pre emergence herbicides and later stage by post emergence herbicide along with hand weeding. Treatment unweeded control (T_1) recorded significantly the highest dry matter of weeds. This might be due to uncontrolled condition favoured luxurious weed growth leading to increased dry matter. This findings is in conformity with the report of Mathukia *et al.*[5].

During 30 and 45 DAS, 100 per cent weed control index was recorded with weed free check (T_7). It was followed by imazethapyr 0.015 kg ha^{-1} (PE) at 3 DAS + quizalofop ethyl 0.05 kg ha^{-1} (PoE) at 21 DAS (T_6) with the value of 83.61, 82.29 per cent. The treatment imazethapyr a0.015 kg ha^{-1} (PE) at 3 DAS +1

hand weeding (T_4) 82.89, 81.22 percent came next order of ranking. The unweeded control registered the least weed control index of 0 per cent. WCE on 30 and 45 DAS, higher weed control efficiency of 100.00 per cent was recorded with weed free (T_7). It was followed by imazethapyr 0.015 kg ha^{-1} (PE) at 3 DAS + quizalofop ethyl 0.05 kg ha^{-1} (PoE) at 21 DAS (T_6) with the value of 86.21, 85.39 per cent. The treatment imazethapyr 0.015 kg ha^{-1} (PE) at 3 DAS + 1 hand weeding (T_4) 84.48, 83.15 per cent came next order of ranking. The unweeded control registered the least weed control efficiency of 39.66 per cent. This is mainly because of effective weed control which ultimately leads to higher seed yield. Remarkable higher weed control index and weed control efficiency was recorded under treatment (T_1) unweeded control because of greater weed competition stress. Similar finding was reported by Mathukia *et al.*[5].

Plant parameters :

Among the growth parameters, significant difference in plant height due to different weed management practices was observed in three stages of crop growth. Among the various treatments evaluated weed free check (T_7) was registered the tallest plants height of 139.14 cm at harvest stage. This was followed by twice hand weeding (T_2) recorded the value of 131.76 cm. Next to that herbicide application of imazethapyr 0.015 kg ha^{-1} (pre emergence) at 3 DAS + quizalofop ethyl 0.05 kg ha^{-1} (post emergence) at 21 DAS (T_6) has recorded the value of 122.34 cm and this was on par with imazethapyr 0.015 kg ha^{-1} (pre emergence) at 3 DAS + 1 hand weeding at 21 DAS (T_4) was recorded the value of 118.52 cm at harvest stage. Leaf area index was significant difference due to different weed management practices was taken in 45 DAS of crop growth. Among the different treatment weed free check (T_7) recorded the maximum value of 4.54 at 45 DAS. This was followed by Twice hand weeding (T_2) furnished the value of 4.22 at 45 DAS. Next to that application of herbicide imazethapyr 0.015 kg ha^{-1} (Pre emergence) at 3 DAS + quizalofop ethyl 0.05 kg ha^{-1} (post emergence) at 21 DAS (T_6) has recorded the value of 3.99 at 45 DAS. And this was on par with the application of herbicide imazethapyr 0.015 kg ha^{-1} (Pre emergence) at 3 DAS + 1 hand weeding at 21 DAS (T_4) has recorded the value of 3.87 at 45 DAS. And the minimum value was recorded in 3.06 at 45 DAS, were recorded in the treatment unweeded control (T_1). This might be due to the application of both the PE as well as PoE herbicide that helped to decrease the weed population and finally in the reduction of crop-weed competition both for the above and below growth factors. This situation helped and provided congenial growing environment for the crop and better utilization of nutrients, moisture from below the ground and solar radiation, space and air from above the ground when weeds were in control. This was ultimately attained increased in plant height. All weed parameters were furnished in Table 1. Similar result related to plant height was observed by Sujithra *et al.*[7].

T_1 - Unweeded control, T_2 - Hand weeding twice (15 and 30 DAS), T_3 – Pre emergence application of Imazethapyr 0.015 kg ha^{-1}, T_4– Pre emergence application of Imazethapyr

Table-1. Effect of Integrated weed management of weed Parameters

Treatments	Weed Count		Weed Biomass		Weed Control Efficiency		Weed Control Index	
	30 DAS	45 DAS	30 DAS	45 DAS	30 DAS	45 DAS	30 DAS	45 DAS
T_1	58.02 (7.65)	89.12 (9.46)	66.41 (8.18)	122.2 (11.08)	0.00	0.00	0	0.00
T_2	35.01 (5.96)	24.07 (6.96)	39.13 (6.30)	36.87 (6.11)	39.66	73.03	41.10	69.89
T_3	26.05 (5.15)	39.01 (5.15)	31.22 (5.63)	60.36 (7.86)	55.17	56.18	53.01	50.71
T_4	9.04 (3.08)	15.07 (3.08)	11.37 (3.45)	22.99 (4.85)	84.48	83.15	82.89	81.22
T_5	20.07 (4.64)	21.02 (4.64)	23.67 (4.92)	31.26 (5.64)	65.52	76.40	64.37	74.47
T_6	8.08 (2.92)	13.04 (2.92)	10.89 (3.37)	21.69 (4.71)	86.21	85.39	83.61	82.29
T_7	0.00 (0.71)	0.00 (0.71)	0.00 (0.71)	0 (0.71)	100.00	100.00	100.00	100.00
S. Ed.	0.15	0.15	0.35	0.19				
C. D. (p=0.05)	0.35	0.35	0.13	0.45				

0.015 kg ha^{-1} *fb* Hand weeding, T_5 – Post emergence application of Quizalofop ethyl 0.05 kg ha^{-1}, T_6 – Pre emergence application of Imazethapyr 0.015 kg ha^{-1} *fb* Post emergence application of Quizalofop ethyl 0.05 kg ha^{-1}, T_7 – Weed free Check. The data were subjected to square root transformation; Figures in the parentheses are original values.

The effect of treatment over the number of capsule plant^{-1} was observed to be significant on yield component. Among the weed control measures, weed free check (T_7) recorded the topmost value of 71.67 number of capsule plant^{-1}. After that twice hand weeding (T_2) noticed that the value of 66.34. Adjacent to that application of herbicide imazethapyr 0.015 kg ha^{-1} (Pre emergence) at 3 DAS + quizalofop ethyl 0.05 kg ha^{-1} (post emergence) at 21 DAS (T_6) has noticed the value of 57.21. And this as match as with the application of herbicide imazethapyr 0.015 kg ha^{-1} (pre emergence) at 3 DAS + 1 hand weeding at 21 DAS (T_4) has observed the value of 56.89. And the little value was recorded in number of capsule plant^{-1} with the value of 21.32 in the treatment unweeded control (T_1). The treatments attained significance in altering seed yield (kg ha^{-1}) was observed to be significant on yield. Based on

the weed management practice measures, weed free check (T_7) recorded the highest value of 1351.9 kg ha^{-1}. Next to that twice hand weeding (T_2) described that the value of 1276.81kg ha^{-1} followed to that imazethapyr 0.015 kg ha^{-1} (Pre emergence) at 3 DAS + quizalofop ethyl 0.05 kg ha^{-1} (post emergence) at 21 DAS (T_6) has noticed the value of 1198.54 kg ha^{-1}. And this was commensurate with the application of herbicide imazethapyr 0.015 kg ha^{-1} (Pre emergence) at 3 DAS + 1 hand weeding at 21 DAS (T_4) has obtained that the value of 1062.65 kg ha^{-1}. And the dwarfish value was recorded 687.12 kg ha^{-1} in the treatment unweeded control (T_1). Oil content did not significantly influence by the Weed management practices. This might have increased nutrients and water uptake by the crop leading to increased rate of photosynthesis. Supply of photosynthesis to various metabolic sinks might have favoured yield attributes and yield. The superiority of these treatments could be explained on the basis of better growth, development and higher uptake of nutrients under these practices might have produced more photosynthetic and converted into numerous metabolites needed for such yield attributes and yield. The lowest value of yield attributes and yield *viz.,* number of capsules per plant, seed yield and oil content produced under treatment unweeded control (T_1). All plant parameters explained in Table-2. These finding are in close conformity with the research findings of Mruthul *et al.*[6].

Table-2. Effect of integrated weed management practices on growth and yield of sesame

Treatments	Plant Height (cm)	LAI	Number of capsules plant-1	seed yield (kg ha^{-1})	oil content (per cent)
T_1	85.9	3.06	21.32	687.12	52.19
T_2	131.76	4.22	66.34	1276.81	53.38
T_3	109.64	3.53	47.65	1062.65	51.87
T_4	118.52	3.87	56.89	1157.65	52.02
T_5	97.21	3.21	40.12	917.65	51.45
T_6	122.34	3.99	57.21	1198.54	52.78
T_7	139.14	4.54	71.67	1351.9	53.11
S. Ed.	4.07	0.09	2.64	32.71	0.33
C.D. (p=0.05)	8.76	0.20	6.23	67.98	NS

T_1 - Unweeded control, T_2 - Hand weeding twice (15 and 30 DAS), T_3 – Pre emergence application of Imazethapyr 0.015 kg ha^{-1}, T_4– Pre emergence application of Imazethapyr 0.015 kg ha^{-1} *fb* Hand weeding, T_5 – Post emergence application of Quizalofop ethyl 0.05 kg ha^{-1}, T_6 – Pre emergence application of Imazethapyr 0.015 kg ha^{-1} *fb* Post emergence application of Quizalofop ethyl 0.05 kg ha^{-1}, T_7 – Weed free Check.

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