**Growth and Yield of *Rabi* Sesame as Influenced by Weed Management Practices**

**ABSTRACT**

A field experiment was conducted during the *rabi* season of 2024–25 on sandy loam soils at the S.V. Agricultural College Farm, Tirupati which is geographically situated at 13.5°N latitude and 79.5°E longitude. The experiment was laid out in a randomized block design (RBD) with three replications, comprising ten weed management treatments. Among the various weed management practices evaluated, hand weeding twice at 20 and 40 days after sowing (DAS) were found to be superior and statistically at par with the pre-emergence application of pyroxasulfone 85% WG @ 125 g ha⁻¹ followed by post-emergence application of quizalofop-p-ethyl @ 50 g ha⁻¹ at 20 DAS. These treatments recorded higher values of plant height, leaf area index, and dry matter accumulation at all stages of observation, along with enhanced seed and stalk yields. In contrast, the weedy check treatment registered the lowest growth parameters and yield, indicating the detrimental impact of uncontrolled weed competition on crop performance.

**Key words:** Sesame, pyroxasulfone, quizalofop-p-ethyl, hand weeding, growth parameters, yield

**1. INTRODUCTION**

“Sesame (*Sesamum indicum* L.), commonly known as *til*, is an annual herbaceous plant of tropical origin belonging to the family Pedaliaceae. It is a major traditional oilseed crop extensively cultivated across tropical and subtropical regions of Asia and Africa. Globally, India ranks as the largest producer of sesame, with an area of 15.31 lakh hectares, producing 8.47 lakh tonnes and achieving a productivity of 553 kg ha⁻¹ during the year 2023–24. In Andhra Pradesh, sesame is cultivated over an area of 31 thousand hectares, with an annual production of 11 thousand tonnes and a productivity of 376 kg ha⁻¹ during the same period” ([Indiastat,](http://www.indiastat.com" \t "_new) 2023-24). “Sesame seeds are valued for their high oil content, ranging from 44–57%, along with 18–25% protein and 13–14% carbohydrates. The oil is rich in oleic and linoleic acids, which together constitute 30.9–52.5% of the polyunsaturated fatty acids, contributing to its nutritional and industrial significance” (Bhavani *et al*., 2023). “Sesame seeds contain potent antioxidants such as sesamin, sesamolin and sesamol which prolongs the shelf life of oil by exerting high level of resistance to oxidation and rancidity and because of these sesame seeds are called as 'the seeds of immortality” (Mallick, 2018). “Among various biotic stresses affecting sesame cultivation, weed infestation is a major constraint limiting productivity. The critical period of crop-weed competition in sesame occurs between 15 and 30 days after sowing (DAS)” (Venu *et al*., 2022). If weeds are not effectively controlled during this period, yield losses may reach up to 70% (Bhavani *et al*., 2023). Mechanical weed management poses a challenge in sesame, particularly due to the broadcast method of sowing. Manual weeding, although commonly practiced by farmers, is labour-intensive, costly, time-consuming, and often hindered by labour unavailability during peak weeding times. Therefore, the adoption of pre- and post-emergence herbicide applications has become essential for effective weed control and to minimize the yield losses caused by weed competition in sesame.

**2. MATERIAL AND METHODS**

A field trial was conducted during the *rabi* season of 2024–25 at the Dryland Farm of S.V. Agricultural College, Tirupati, under Acharya N.G. Ranga Agricultural University, Andhra Pradesh. The experimental site was characterized by sandy loam textured soils, which is neutral in reaction with initial soil test values indicating available nitrogen (154 kg ha⁻¹), phosphorus (26.3 kg ha⁻¹), and potassium (185 kg ha⁻¹). The experiment was laid out in a randomized block design with ten treatments and three replications. The treatments included pre-emergence application of pyroxasulfone 85% WG @ 100 g ha-1 *fb* quizalofop-p-ethyl @ 50 g ha-1 at 20 DAS (T1), pre-emergence application of pyroxasulfone 85% WG @ 125 g ha-1 *fb* quizalofop-p-ethyl @ 50 g ha-1 at 20 DAS (T2), pre-emergence application of metolachlor 50% EC 500 g ha-1 *fb* quizalofop-p-ethyl @ 50 g ha-1 at 20 DAS (T3), pre-emergence application of metolachlor 50% EC 750 g ha-1 *fb* quizalofop-p-ethyl @ 50 g ha-1 at 20 DAS(T4),pre-emergence application of imazethapyr 10% SL 20 g ha-1 *fb* quizalofop-p-ethyl @ 50 g ha-1 at 20 DAS (T5), pre-emergence application of imazethapyr 10% SL 25 g ha-1 *fb* quizalofop-p-ethyl @ 50 g ha-1 at 20 DAS(T6),pre-emergence application of pretilachlor 50% EC 500 g ha-1 *fb* quizalofop-p-ethyl @ 50 g ha-1 at 20 DAS (T7),pre-emergence application of pendimethalin 30% EC 525 g ha-1 *fb* quizalofop-p-ethyl @ 50 g ha-1 at 20 DAS (T8), hand weeding twice at 20 and 40 DAS (T9) and weedy check (T10). The sesame variety 'Sarada' (YLM-66) was sown by broadcasting on January 3rd, 2025. A recommended fertilizer dose of 40:20:20 kg ha⁻¹ of N, P₂O₅, and K₂O was applied. All other recommended agronomic practices were followed as per crop requirements.

Plant height was measured from the base to the tip of the growing point of the plant and expressed in cm. Leaf area was recorded using LT-300 portable leaf area meter with transparent conveyor belt and electronic display and leaf area index was calculated by using the formula suggested by Watson (1952). For the estimation of dry matter production, the samples were dried in shade and then oven dried at 60°C to a constant weight and expressed as kg ha-1. The numbers of branches were counted and expressed as number of branches plant-1. The stalk and seed yield obtained were weighed and expressed in kg ha-1. The data recorded was analysed statistically by following the analysis of variance for randomized block design as suggested by Panse and Sukhatme (1985).

**3. RESULTS AND DISCUSSION**

**3.1 GROWTH PARAMETERS**

 At 40, 60 DAS and harvest, taller plant stature of sesame was recorded with hand weeding twice at 20 and 40 DAS (T9) which was comparable with pre-emergence application of pyroxasulfone 125 g ha⁻¹ *fb* quizalofop-p-ethyl 50 g ha⁻¹ at 20 DAS (T2). The higher plant height with these treatments was due to the weed-free environment established through hand weeding and sequential use of herbicides. This effective weed control minimized competition for resources, thereby promoting rapid cell division and elongation, which enhanced internodal length. Consequently, this resulted in better overall crop growth and development, as reflected in the increased plant height and taller plants. The results were in similarity with Al-Muhammadi *et al*. (2021), Debnath *et al.* (2022), Saha *et al.* (2022) and Chavhan *et al*. (2023). Shorter plants in the weedy check plot may be due to significantly higher weed infestation, which intensified competition for growth resources, particularly moisture and nutrients, resulting in the shorter plant height.

 Maximum leaf area index of sesame at 40, 60 DAS and at harvest, was recorded with hand weeding twice at 20 and 40 DAS (T9) which was at par with pre-emergence application of pyroxasulfone 125 g ha⁻¹ *fb* quizalofop-p-ethyl 50 g ha⁻¹ at 20 DAS (T2). The superior performance of these practices can be attributed to the reduced competition provided by sustained weed-free conditions increased utilization of resources leading to an increase in both the number and size of leaves which is reflected as the higher LAI. These findings were consistent with the results reported by Al-Muhammadi *et al.* (2021) and Venu *et al*. (2022). In contrast, the weedy check recorded lower LAI due to severe and prolonged weed competition, which restricted crop access to growth resources.

 At 40, 60 DAS and at harvest, higher dry matter production of sesame was recorded with hand weeding (T9) which was statistically similar with the pre-emergence application of pyroxasulfone 125 g ha⁻¹ *fb* quizalofop-p-ethyl 50 g ha⁻¹ at 20 DAS (T2). The higher dry matter production by these weed management practices was likely due to maintenance of weed free condition during critical periods in hand weeding and sustained weed suppression by the sequential application of pre and post emergence herbicides in T2 allowed the crop to make better use of growth resources resulting in greater dry matter accumulation. Lower dry matter production was observed in the weedy check (T10), where continuous weed-crop competition throughout the season reduced the availability of resources ultimately hampering growth and reducing dry matter accumulation. These findings were in line with the results of Ahirwal *et al*. (2020) and Roy and Umesha (2023).

 Hand weeding twice at 20 and 40 DAS (T9) recorded higher number of branches per plant and it was at par with pre-emergence application of pyroxasulfone 125 g ha⁻¹ followed by quizalofop-p-ethyl 50 g ha⁻¹ at 20 DAS (T2). This might be due to reduced crop weed competition which favoured better utilization of inputs by crop leading to significant increase in growth attributes which in turn promoted the production of greater number of branches per plant. These results were in conformity with Mathukia *et al*. (2013), Debnath *et al.* (2022) and Giridhar (2024). Weedy check (T10) produced significantly low number of branches per plant than all other treatments. This might be due to severe weed competition that deprived the production of branches.

**Table 1:** Growth parameters of sesame as influenced by weed management practices

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Treatments** | **Plant height (cm)** | **Leaf area index** | **Dry matter production****(kg ha-1)** | **Number of branches plant-1** |
| **40 DAS** | **60 DAS** | **At Harvest** | **40 DAS** | **60 DAS** | **At Harvest** | **40 DAS** | **60****DAS** | **At Harvest** |
| T1 | : | Pre-emergence application of pyroxasulfone 85% WG @ 100 g ha-1 *fb* quizalofop-p-ethyl @ 50 g ha-1 at 20 DAS | 51.0 | 98 | 105 | 0.75 | 2.22 | 2.14 | 1012 | 2431 | 2710 | 2.40 |
| T2 | : | Pre-emergence application of pyroxasulfone 85% WG @ 125 g ha-1 *fb* quizalofop-p-ethyl @ 50 g ha-1 at 20 DAS | 56.3 | 106 | 115 | 0.84 | 2.46 | 2.29 | 1109 | 3103 | 3367 | 2.77 |
| T3 | : | Pre-emergence application of metolachlor 50% EC @ 500 g ha-1 *fb* quizalofop-p-ethyl @ 50 g ha-1 at 20 DAS | 46.6 | 88 | 95 | 0.66 | 2.00 | 1.87 | 949 | 1815 | 2120 | 2.03 |
| T4 | : | Pre-emergence application of metolachlor 50% EC @ 750 g ha-1 *fb* quizalofop-p-ethyl @ 50 g ha-1 at 20 DAS | 46.7 | 89 | 95 | 0.67 | 2.02 | 1.93 | 953 | 1881 | 2209 | 2.03 |
| T5 | : | Pre-emergence application of imazethapyr 10% SL @ 20 g ha-1 *fb* quizalofop-p-ethyl @ 50 g ha-1 at 20 DAS | 45.7 | 87 | 94 | 0.64 | 1.99 | 1.80 | 941 | 1745 | 1961 | 1.97 |
| T6 | : | Pre-emergence application of imazethapyr 10% SL @ 25 g ha-1 *fb* quizalofop-p-ethyl @ 50 g ha-1 at 20 DAS | 51.1 | 99 | 107 | 0.75 | 2.25 | 2.16 | 1024 | 2469 | 2789 | 2.47 |
| T7  | : | Pre-emergence application of pretilachlor 50% EC @ 500 g ha-1 *fb* quizalofop-p-ethyl @ 50 g ha-1 at 20 DAS | 41.4 | 78 | 85 | 0.56 | 1.80 | 1.65 | 876 | 1251 | 1513 | 1.63 |
| T8 | : | Pre-emergence application of pendimethalin 30% EC @ 525 g ha-1 *fb* quizalofop-p-ethyl @ 50 g ha-1 at 20 DAS | 41.2 | 77 | 82 | 0.51 | 1.78 | 1.60 | 862 | 1135 | 1402 | 1.57 |
| T9 | : | Hand weeding twice at 20 and 40 DAS | 56.4 | 114 | 120 | 0.86 | 2.55 | 2.31 | 1148 | 3414 | 3641 | 2.87 |
| T10 | : | Weedy check | 32.7 | 62 | 70 | 0.32 | 1.46 | 1.28 | 212 | 419 | 439 | 1.07 |
| SEm± | 1.40 | 2.66 | 2.92 | 0.022 | 0.060 | 0.041 | 18.6 | 128.1 | 135.9 | 0.091 |
| CD (P = 0.05)  | 4.2 | 7.9 | 8.7 | 0.07 | 0.18 | 0.12 | 55 | 381 | 404 | 0.27 |

**3.2 SEED AND STALK YIELD OF SESAME**

 Among the various weed management practices, higher seed yield of sesame was recorded with hand weeding twice at 20 and 40 DAS (T9) and pre-emergence application of pyroxasulfone 125 g ha-1 *fb* quizalofop-p-ethyl 50 g ha-1 (T2) which was statistically similar with each other. This can be attributed to the reason that control of weeds in hand weeding twice and in sequential application of pre and post-emergence herbicides during important crop growth stages reduced competition for growth resources leading to efficient translocation of assimilates from the source to the sink which ultimately reflected in the form of higher seed yield. These results were in conformity with Nongmaithem and Pal (2016), Grichar *et al*. (2021), Joshi *et al*. (2022) and Hota *et al*. (2024). The significantly lower grain yield was observed in the weedy check (T10), underscoring the critical role of effective weed management. This reduction in yield could be attributed to intense weed infestation, which led to heavy competition between the crop and weeds for essential growth resources. Consequently, this competition likely disrupted the efficient partitioning of photosynthates from source to sink, as reflected by the reduced crop growth, poor yield attributes, and ultimately, lower sesame yield.

 The higher stalk yield of sesame was obtained with hand weeding twice at 20 and 40 DAS (T9), which was statistically at par with the pre-emergence application of pyroxasulfone at 125 g ha⁻¹ *fb* quizalofop-p-ethyl at 50 g ha⁻¹ (T2). The rise in yield can be credited to good weed control during critical period by hand weeding and pre-emergence herbicide prevented the initial flush of weeds whereas the post-emergence herbicides prevented the emergence and establishment of weeds at later stages of crop growth which eliminated resource competition and offered favourable conditions such as highest availability of nutrients, moisture and light for the crop plants. Consequently, the crop displayed improved vegetative growth as evident from higher plant height, leaf area index and dry matter production resulting in enhanced stalk yield. These results were in conformity with Sujithra *et al*. (2019), Aktar *et al.* (2021) and Hota *et al*. (2024). The lower stalk yield was recorded in the weedy check (T10), highlighting the importance of effective weed management. This could be as a result of a severe weed infestation that created strong competition for growth resources between the crop and the weed, leading to a poor partitioning of photosynthetic pigments from source to sink.

**Table 2:** Seed yield (Kg ha-1) and stalk yield (Kg ha-1) of sesame as influenced by weed management practices

|  |  |  |
| --- | --- | --- |
| **Treatments** | **Seed yield****(Kg ha-1)** | **Stalk yield****(Kg ha-1)** |
| T1 | : | Pre-emergence application of pyroxasulfone 85% WG @ 100 g ha-1 *fb* quizalofop-p-ethyl @ 50 g ha-1 at 20 DAS | 850 | 1779 |
| T2 | : | Pre-emergence application of pyroxasulfone 85% WG @ 125 g ha-1 *fb* quizalofop-p-ethyl @ 50 g ha-1 at 20 DAS | 984 | 1958 |
| T3 | : | Pre-emergence application of metolachlor 50% EC @ 500 g ha-1 *fb* quizalofop-p-ethyl @ 50 g ha-1 at 20 DAS | 769 | 1538 |
| T4 | : | Pre-emergence application of metolachlor 50% EC @ 750 g ha-1 *fb* quizalofop-p-ethyl @ 50 g ha-1 at 20 DAS | 792 | 1566 |
| T5 | : | Pre-emergence application of imazethapyr 10% SL @ 20 g ha-1 *fb* quizalofop-p-ethyl @ 50 g ha-1 at 20 DAS | 771 | 1523 |
| T6 | : | Pre-emergence application of imazethapyr 10% SL @ 25 g ha-1 *fb* quizalofop-p-ethyl @ 50 g ha-1 at 20 DAS | 867 | 1790 |
| T7 | : | Pre-emergence application of pretilachlor 50% EC @ 500 g ha-1 *fb* quizalofop-p-ethyl @ 50 g ha-1 at 20 DAS | 714 | 1310 |
| T8 | : | Pre-emergence application of pendimethalin 30% EC @ 525 g ha-1 *fb* quizalofop-p-ethyl @ 50 g ha-1 at 20 DAS | 706 | 1308 |
| T9 | : | Hand weeding twice at 20 and 40 DAS | 1030 | 2097 |
| T10 | : | Weedy check | 135 | 288 |
| SEm± | 17.4 | 68.2 |
| CD (P = 0.05) | 52 | 203 |

**4. CONCLUSION**

The experimental results showed that hand weeding twice at 20 and 40 DAS and pre-emergence application of pyroxasulfone at 125 g ha⁻¹ *fb* quizalofop-p-ethyl at 50 g ha⁻¹ recorded higher growth and yield of sesame. Significantly lower growth and yield was recorded in weedy check (T10). Hence, pre-emergence application of pyroxasulfone @125 g ha⁻¹ *fb* quizalofop-p-ethyl @ 50 g ha⁻¹ can be recommended under the labour scarcity to obtain higher growth and yield of sesame.

**Disclaimer (Artificial intelligence)**

Option 1:

Author(s) hereby declare that NO generative AI technologies such as Large Language Models (ChatGPT, COPILOT, etc.) and text-to-image generators have been used during the writing or editing of this manuscript.

Option 2:

Author(s) hereby declare that generative AI technologies such as Large Language Models, etc. have been used during the writing or editing of manuscripts. This explanation will include the name, version, model, and source of the generative AI technology and as well as all input prompts provided to the generative AI technology

Details of the AI usage are given below:

1.

2.

3.

**REFERENCES**

1. Ahirwal, A., Sapre, N., Singh, V., & Sharma, P. (2020). Efficacy of pyroxasulfone 5% + pendimethalin 40% ready mixture on associated weed flora, growth and yield of soybean (CV JS 20-29). *Journal of Pharmacognosy Phytochemistry*, 9(6), 403-406.
2. Aktar, M.N., Karim, M.F., Chakma, S., Marma, A., & Rahman, M.A. (2021). Effect of weed management on the improvement of growth and yield of sesame (*Sesamum indicum* L.). *Biochemical & Cellular Archives*, 21(1),1809.
3. Al-Muhammadi, J.M.H., & Al-Kaisy, A.L.M. (2021). Effect of weed management on growth, yield and quality in different Sesame varieties. *Indian Journal of Ecology*, 13, 160-168.
4. Bhavani, R., Reddy, G.K., Reddy, P.M., Kumari, P.L., & Sagar, G.K. (2023). Nutrient uptake as influenced by methods of sowing and weed management practices in summer Sesame (*Sesamum indicum* L.). *Andhra Pradesh Journal of Agricultural Sciences,* 9(2), 100-103.
5. Chavhan, K.R., Chaudhari, R.D., Kolage, A.K., & Mahajan, H.S. (2023). Response of sesame to different weed management practices in Maharashtra, India. *International Journal of Plant & Soil Science,* 35(15): 111-115.
6. Debnath, S., Ghosh, P., Chaudhuri, A., & Dolai, A.K. (2022). Growth and productivity of sesame as influenced by different weed management practices in red and laterite belt of West Bengal. *Environment and Ecology*, 40(1), 19-23.
7. Grichar, W. J., Rose, J. J., Dotray, P. A., Tredaway, J. A., Bagavathiannan, M., Shankle, M. W., & Langham, D. 2021. Sesame (*Sesamum indicum* L.) response to delayed applications of pre-emergence herbicides applied 3 or 6 days after emergence. *Journal of Experimental Agriculture International*, 43(1), 34-50.
8. Giridhar, M. (2024). Weed management in line sown and broadcasted gingelly (*Sesamum indicum* L*.*). *M.Sc. (Ag.) Thesis.* Acharya N G Ranga Agricultural University, Guntur.
9. Hota, S., Dash, S., & Joshi, B. (2024). Sole and sequential application of herbicides and botanicals for weed management in summer sesame. *Plant Science Today*, 11(4), 1022-1027.
10. Indiastat. Selected State-wise Area, Production and Productivity of Sesame in India (2023-24). https://www.indiastat.com/.
11. Joshi, N., Joshi, S., Sharma, J. K., Shekhawat, H. S., & Shukla, U. N. (2022). Efficacy of sequential application of pre-and post-emergence herbicides for weed management in sesame. *Indian Journal of Weed Science*, 54(3), 279–282.
12. Mallick, P.P. 2018. Performance of summer sesame (*Sesamum indicum* L.) under various irrigation schedules and weed management practices. *M.Sc. (Ag.) Thesis.* Orissa University of Agriculture and Technology, Bhubaneswar, Orissa.
13. Mathukia, R.K., Sagarika, B.K., & Jadav, C.N. (2013). Efficient and economical weed management in summer sesame (*Sesamum indicum* L.). *Journal of Agriculture Science and Technology*, 2(3), 1-4.
14. Nongmaithem, D., & Pal, D. (2016). Growth and yield of sesame, green gram and black gram as affected by different weed management practices. *International Journal of Bio-resource and Stress Management*, 7(6), 1255-1261.
15. Panse, V.G., & Sukhatme, P.V. (1985). *Statistical Methods for Agricultural Workers*. ICAR, New Delhi.
16. Roy, P., & Umesha C. (2023). Productivity of Sesame on growth and yield as influence by plant spacing and weed management practices. *International Journal of Environment and Climate Change,* 13(10), 2268-2276.
17. Saha, S., Thakur, A. K., Kumar, M., Chandrakar, T., & Singh, D. P. (2022). Effect of different herbicides on yield and yield attributing characters of summer sesame (*Sesamum indicum* L.). *International Journal of Current Microbiology Applied Science,* 11(1), 400-404.
18. Sujithra, P., Hemalatha, M., Joseph, M., & Sobhana, E. 2019. Effect of different weed management practices on growth and yield of rainfed sesame (*Sesamum indicum* L.) under vertisol. *Madras Journal of Agricultural Sciences,* 106(1&3), 1-4.
19. Venu, M., Reddy, G.S., Mahesh, N., & Devi, M.U. (2022). Effect of integrated weed management practices on growth and yield of sesame (*Sesamum indicum* L.). *Biological Forum-An International Journal,* 14(2), 271-275.
20. Watson, D.J. (1952). The physiological basis of variation in yield. *Advances in Agronomy*, 6, 103-109.