



RESEARCH ARTICLE

EFFECT OF GROWTH RETARDANTS AND MICRONUTRIENTS ON YIELD OF SESAME (*Sesamum indicum* L.)

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ABSTRACT

The field experiment was conducted at the Experimental Farm of the Department of Agronomy, MIT College of Agricultural Technology in Musiri during 2024. The study aimed to examine the effects of growth retardants and micronutrients on the growth and yield of sesame cultivar TMV3. The results indicated that applying Mepiquat chloride at 125 ppm at the 0+2 leaf stage, combined with foliar applications of ZnSO₄ at 0.5% and MnSO₄ at 0.5% at 30 and 45 days after sowing (DAS), produced the highest seed yield, comparable to that achieved with Chlormequat chloride at 200 ppm under the same conditions. This treatment also yielded the highest net return of ₹22,997 and a benefit-cost ratio of 2.95.

INTRODUCTION

Sesamum (*Sesamum indicum* L.) is one of the oldest and the third most important oilseed crops, following groundnut and mustard. Regarded as the "Queen of oilseed crops" for its superior quality, sesame contains an oil content of 46% to 64% and offers a dietary energy value of 6355 Kcal/kg (Harisudan and Vincent, 2019). Approximately 80% of sesame oil consists of unsaturated fatty acids, predominantly oleic and linoleic acids, making it a popular, cost-effective substitute for ghee. The Indian Council of Medical Research (2009) recommends a daily intake of about 20 grams of edible oil per person. Growth retardants are known to modify the plant canopy structure, leading to an increased number of branches and capsules per plant. Notably, Mepiquat chloride and Cycocel (CCC) have been shown to curtail excessive vegetative growth in sesame (Banon et al., 2023). Additionally, foliar applications of ZnSO₄ at 0.5% and MnSO₄ at 0.3% have been found to enhance plant height, number of branches per plant, number of capsules per plant, number of seeds per capsule, and overall seed yield (Raza et al., 2018). Given these promising results, this study aims to investigate the effects of growth retardants and micronutrients on sesame.

MATERIALS AND METHODS

A field experiment was conducted in 2024 at the MIT College of Agricultural Technology (MITCAT), Department of Agronomy, Experimental Farm in Vellalapatti, located at latitude of 10° 95' N

and a longitude of 78° 44' E, with an elevation of 82 m above mean sea level. The soil at the experimental farm is clay loam with a pH of 7.7. The experimental design employed a Randomized Block Design with nine treatments, each replicated three times. The treatments included:

- T₁ : Control (water spray)
- T₂ : Mepiquat chloride (125 ppm) at the 0+2 leaf stage
- T₃ : Mepiquat chloride (125 ppm) at the 0+2 leaf stage + ZnSO₄ at 0.5% (30 and 45 DAS)
- T₄ : Mepiquat chloride (125 ppm) at the 0+2 leaf stage + MnSO₄ at 0.5% (30 and 45 DAS)
- T₅ : Mepiquat chloride (125 ppm) at the 0+2 leaf stage + ZnSO₄ at 0.5% + MnSO₄ at 0.5% (30 and 45 DAS)
- T₆ : Chlormequat chloride (200 ppm) at the 0+2 leaf stage
- T₇ : Chlormequat chloride (200 ppm) at the 0+2 leaf stage + ZnSO₄ at 0.5% (30 and 45 DAS)
- T₈ : Chlormequat chloride (200 ppm) at the 0+2 leaf stage + MnSO₄ at 0.5% (30 and 45 DAS)
- T₉ : Chlormequat chloride (200 ppm) at the 0+2 leaf stage + ZnSO₄ at 0.5% + MnSO₄ at 0.5% (30 and 45 DAS)

Seed yield of sesame was recorded and the economic analysis was conducted.

RESULTS AND DISCUSSION

Growth retardants and micronutrients significantly influenced seed yield in sesame. A marked increase in seed yield was noted with the

foliar application of micronutrients (Koutroubas and Damalas, 2020). These micronutrients were likely absorbed efficiently by the plant and effectively translocated into the developing capsules, enhancing seed filling and ultimately resulting in higher yields, as demonstrated by Yadav *et al.* (2020) and Wang *et al.* (2022). Table 1 presents data on the seed yield (kg/ha) of sesame cultivar TMV3 across various treatments applied during the field experiment. Each treatment comprised different combinations of growth retardants and micronutrients, highlighting their effectiveness in improving seed yield and identifying the most beneficial treatments. The control group (T₁), which received only a water spray, yielded 682.1 kg/ha, establishing a baseline for comparison with the other treatments. The application of Mepiquat chloride (125 ppm) at the 0+2 leaf stage (T₂) significantly increased the yield to 792.3 kg/ha compared to the control. Subsequently, the addition of ZnSO₄ at 0.5% applied at both 30 and 45 DAS (T₃) led to a further increase in yield to 863.2 kg/ha. Meanwhile, the combination with MnSO₄ at 0.5% (T₄) resulted in a yield of 865.1 kg/ha, indicating that both micronutrients positively influenced seed yield.

The highest seed yield of 966.0 kg/ha was achieved with the combination of Mepiquat chloride, along with both ZnSO₄ and MnSO₄ (T₅), proving to be the most effective treatment for enhancing yield. In contrast, Chlormequat chloride at 200 ppm (T₆) yielded 770.4 kg/ha, demonstrating lower effectiveness than the equivalent treatments with Mepiquat. Furthermore, treatments T₇ and T₈, which included ZnSO₄ and MnSO₄, yielded 861.0 kg/ha and 862.4 kg/ha, respectively. Both treatments showed significant improvements over Chlormequat alone but still fell short of the best Mepiquat treatments.

Table 1. Effect of growth retardants and micronutrients on seed yield of sesame

Sl. No.	Treatments	Seed yield kg/ha
1	T ₁ Control (water spray)	682.1
2	T ₂ Mepiquat chloride (125ppm) at 0+2 leaf stage	792.3
3	T ₃ Mepiquat chloride (125ppm) at 0+2 leaf stage + ZnSO ₄ @ 0.5 per cent (30 and 45 DAS)	863.2
4	T ₄ Mepiquat chloride at (125ppm) 0+2 leaf stage + MnSO ₄ @ 0.5 per cent (30 and 45 DAS)	865.1
5	T ₅ Mepiquat chloride at (125ppm) 0+2 leaf stage + ZnSO ₄ @ 0.5 per cent + MnSO ₄ @ 0.5 per cent (30 and 45 DAS)	966.0
6	T ₆ Chlormequat chloride(200ppm) at 0+2 leaf stage	770.4
7	T ₇ Chlormequat chloride (200ppm) at 0+2 leaf stage + ZnSO ₄ @ 0.5 per cent (30 and 45 DAS)	861.0
8	T ₈ Chlormequat chloride (200ppm) at 0+2 leaf stage + MnSO ₄ @ 0.5 per cent (30 and 45 DAS)	862.4
9	T ₉ Chlormequat chloride (200ppm) at 0+2 leaf stage + ZnSO ₄ @ 0.5 per cent + MnSO ₄ @ 0.5 per cent (30 and 45 DAS)	943.0
	S.E.D	14.1
	C.D (p=0.05)	28.3

The combination of Chlormequat chloride with both micronutrients (T₉) resulted in a yield of 943.0 kg/ha, which was nearly as effective as the top Mepiquat treatment. Among the treatments, the application of Mepiquat chloride at 125 ppm during the 0+2 leaf stage, combined with foliar applications of ZnSO₄ at 0.5% and MnSO₄ at 0.5% applied twice at 30 and 45 DAS, produced the highest seed yield of 966 kg/ha. Similar findings were reported by Vasanthan *et al.* (2019) and Patil *et al.* (2020). This treatment also achieved the highest net return of ₹22,997 and a benefit-cost ratio of ₹2.95 (Table 2). The standard error (S_{Ed}) of 14.1 indicates the variability in seed yield measurements across the different treatments, suggesting a relatively consistent result. Additionally, the critical difference of 28.3 at a



Plates 1. Overall view of the research plot



Plate II. Assessment and inspection of the research plot by Agricultural Scientists



Plates. III Treatments combination (R₂ T₁-Control and R₂ T₅-Mepiquat chloride at (125ppm) 0+2 leaf stage + ZnSO₄ @ 0.5 per cent + MnSO₄ @ 0.5 per cent (30 and 45 DAS))

significance level of $p = 0.05$ implies that a statistically significant difference in seed yields exists between treatments when the difference exceeds this value. This further supports the conclusion that these treatments had a notable impact on seed yield. Table 2 summarizes the economic performance of various treatments applied in sesame cultivation, focusing on costs, income generated, net profits, and the efficiency of each treatment in terms of investment return.

The cultivation costs for each treatment range from ₹10,384.47 (T₁: Control) to ₹12,172.47 (T₉: Chlormequat chloride combined with both ZnSO₄ and MnSO₄). The incremental increase in costs reflects the additional inputs, such as growth retardants and micronutrients, used in each treatment.

Table 2. Effect of growth retardants and micronutrients on economics of sesame

Treatments	Cost of cultivation (Rs. ha ⁻¹)	Gross income (Rs. ha ⁻¹)	Net income (Rs. ha ⁻¹)	BC ratio
T ₁	10384.47	24552.00	14167.53	2.36
T ₂	10981.77	28525.32	17543.55	2.59
T ₃	11301.97	31075.56	19773.59	2.74
T ₄	11301.97	31146.12	19844.15	2.75
T ₅	11781.97	34778.88	22996.91	2.95
T ₆	11372.41	27736.92	16364.51	2.43
T ₇	11684.47	30988.44	19303.97	2.65
T ₈	11684.47	31048.92	19364.45	2.66
T ₉	12172.47	33943.68	21771.21	2.79

Produce cost – Rs.95/kg

Gross income represents the total revenue generated from each treatment, with values ranging from ₹24,552.00 (T₁) to ₹34,778.88 (T₅). This indicates that treatment T₅ generated the highest revenue, largely due to its superior seed yield performance. Net income is calculated as the difference between gross income and cultivation costs, ranging from ₹14,167.53 (T₁) to ₹22,996.91 (T₅). A higher net income signifies a more profitable treatment, with T₅ showing the highest net returns, suggesting that the combination of growth retardants and micronutrients offers significant economic benefits.

- T₁ has a BC ratio of 2.36, which means that for every rupee spent, ₹2.36 is earned.
- T₅ has the highest BC ratio of 2.95, indicating the most efficient use of resources to generate income, as it yields nearly ₹3 for every rupee invested.
- The ratios suggest that treatments incorporating Mepiquat chloride and both micronutrients are particularly effective in maximizing returns.

CONCLUSION

The study illustrates that the application of both growth retardants and micronutrients significantly enhances sesame seed yield, with the combination of Mepiquat chloride, ZnSO₄, and MnSO₄ being the most effective.

This research clearly indicates that these treatments not only improve seed yield but also substantially increase net income and economic efficiency. Treatment T₅ emerges as the most profitable strategy, providing the highest benefits in terms of yield and economic return. These findings can assist farmers in making informed decisions about the best practices for sesame cultivation, ultimately optimizing both yield and profitability.

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