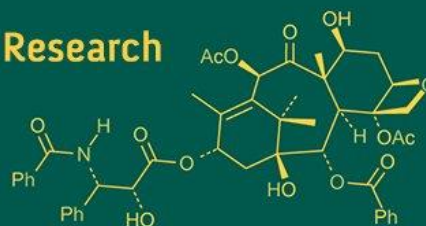


International Journal of Advanced Biochemistry Research



ISSN Print: 2617-4693
ISSN Online: 2617-4707
NAAS Rating (2026): 5.29
IJABR 2026; SP-10(9): 1377-1380
www.biochemjournal.com
Received: 21-07-2026
Accepted: 23-08-2026

Tayade AK
PG Scholar, Department of
Agricultural Botany, Plant
Physiology, Post Graduate
Institute, Dr. PDKV, Akola,
Maharashtra, India

Dr. SM Shinde
Assistant Professor, Department
of Agricultural Botany, Post
Graduate Institute, Dr. PDKV,
Akola, Maharashtra, India

Dr. Amrapali A Akhare
Professor (CAS), Department of
Agricultural Botany, Post
Graduate Institute, Dr. PDKV,
Akola, Maharashtra, India

Ingole DR
PG Scholar, Department of
Agricultural Botany, Plant
Physiology, Post Graduate
Institute, Dr. PDKV, Akola,
Maharashtra, India

Sayyad RA
Agril. Assistant, Department of
Agricultural Botany, Post
Graduate Institute, Dr. PDKV,
Akola, Maharashtra, India

Deshmukh YR
PG Scholar, Department of
Agricultural Botany, Plant
Physiology, Post Graduate
Institute, Dr. PDKV, Akola,
Maharashtra, India

Bilari PS
PG Scholar, Department of
Agricultural Botany, Plant
Physiology, Post Graduate
Institute, Dr. PDKV, Akola,
Maharashtra, India

Corresponding Author:
Tayade AK
PG Scholar, Department of
Agricultural Botany, Plant
Physiology, Post Graduate
Institute, Dr. PDKV, Akola,
Maharashtra, India

Effects of growth regulators on physiology of sesame (*Sesamum indicum* L.)

**Tayade AK, SM Shinde, Amrapali A Akhare, Ingole DR, Sayyad RA,
Deshmukh YR and Bilari PS**

DOI: <https://www.doi.org/10.33545/26174693.2026.v10.i9Sq.10011>

Abstract

A field experiment was conducted during *Kharif* 2025 at the Department of Agricultural Botany, Dr. Panjabrao Deshmukh Krishi Vidyapeeth, Akola, to evaluate effects of growth regulators on physiology of sesame. The experiment was laid out in a Randomized Block Design with three replications and eight treatments - T₁: Control; T₂: NAA @ 50 ppm; T₃: NAA @ 100 ppm; T₄: NAA @ 200 ppm; T₅: GA₃ @ 50 ppm; T₆: GA₃ @ 100 ppm; T₇: GA₃ @ 200 ppm; T₈: Salicylic Acid @ 200 ppm; T₉: Salicylic Acid @ 500 ppm; and T₁₀: Salicylic Acid @ 1000 ppm, applied at 30, 45, and 60 days after sowing (DAS). Morphological observations (plant height, number of branches plant⁻¹, leaf area, leaf area index and days to 50% flowering) and yield attributes (capsules plant⁻¹, seeds capsule⁻¹, 1000-seed weight, harvest index, and seed yield plant⁻¹) were recorded. Foliar application of gibberellic acid (GA₃) at 100 ppm treatment (T₆) significantly enhanced most morphological and yield parameters, recording the maximum plant height (104.60 cm at 70 DAS), highest number of branches plant⁻¹ (6.92), maximum leaf area (1439.58 cm² plant⁻¹) and leaf area index (4.80) at 55 DAS. However, the earliest flowering was recorded with GA₃ at 200 ppm (T₇), which took 39.33 days to reach 50% flowering, compared with 44.00 days in the control. Treatment (T₆) also recorded the maximum capsules plant⁻¹ (47.40), seeds capsule⁻¹ (68.23), 1000-seed weight (3.34 g), and harvest index (29.23%), achieving the highest seed yield of 7.23 g plant⁻¹ compared with 4.07 g plant⁻¹ in the control. These findings indicate that foliar application of GA₃ at 100 ppm is highly effective for improving physiological growth and seed yield of sesame under the present experimental conditions.

Keywords: Sesame, foliar application, morphological parameters, gibberellic acid, naphthalene acetic acid, salicylic acid, growth regulators application, seed yield

1. Introduction

Sesame (*Sesamum indicum* L.) dubbed the “Queen of oilseed crops, it is widely recognized as til, gingeli, sim and is the most ancient significant oilseed crop of the tropics. It is thought that sesame likely originated in Africa and It is classified in the order Tubiflorae and family Pedaliaceae, serving as a significant oilseed crop grown in both tropical and temperate regions globally for its high-grade oil (Chung *et al.*, 2003) [5]. Sesame (*Sesamum indicum* L.) is known for its significant nutritional benefits, therapeutic qualities, and various industrial uses and it acts as a significant source of edible oil, nutritious nourishment, and conventional medicine (Pathak *et al.*, 2014) [11]. India leads in sesame cultivation area globally, covering 15.31 lakh hectares with an annual production of 8.29 lakh tonnes and average productivity of 541 kg ha⁻¹. In Maharashtra, sesame is cultivated across 0.36 lakh hectares, with an annual production of 0.13 lakh tonnes and average productivity of 373 kg ha⁻¹ (Department of Agriculture & Farmers Welfare, GOI (2025)

GA₃ is an occurring plant hormone that significantly influences cell elongation and overall plant growth (Taiz *et al.*, 2015) [15]. Many studies have proved its role in improving plant development and crop yield. Its success depends on the right dosage at the right time and at the right environmental conditions (Thuc *et al.*, 2021) [16]. Some studies have shown that Naphthalene acetic acid (NAA) had stimulating effect on various oil seeds including sesame (Govindan *et al.*, 2000) [8]. It controls physiological processes such as cell elongation, cell division, rooting, fruit setting and prevention of flower and fruit drop (Rademacher, 2015; Basuchaudhuri, 2016) [4, 13].

Salicylic Acid (SA) is also involved in the regulation of physiological processes and has been

investigated for its potential to improve crop performance under abiotic stress conditions (Yousefzadeh Najafabadi *et al.*, 2017) ^[17]. Although individual growth regulator effects are documented, comparative research on the influence of NAA, GA₃, and SA on the physiological characteristics, growth dynamics, yield attributes, and oil content of sesame is limited. Therefore, this investigation was conducted to systematically evaluate how targeted foliar application of individual growth regulators influences the morpho-physiological growth, yield attributes, and oil content of sesame variety AKT 64.

2. Material and Methods

The field experiment was conducted during *Kharif* of 2025 at the Department of agricultural botany research farm of Dr. Panjabrao Deshmukh Krishi Vidyapeeth, Akola, Maharashtra, India. The sesame variety AKT 64, characterized by its early maturity and high yield potential, was utilized. Sowing was done manually in a Randomized Block Design (RBD) with three replications on June 23, 2025, using a seed rate of 2.5 kg ha⁻¹ by maintaining a plant spacing of 30 cm × 10 cm.

The foliar treatments applied at 30, 45, and 60 days after sowing (DAS): T₁: Control; T₂: NAA @ 50 ppm; T₃: NAA @ 100 ppm; T₄: NAA @ 200 ppm; T₅: GA₃ @ 50 ppm; T₆: GA₃ @ 100 ppm; T₇: GA₃ @ 200 ppm; T₈: Salicylic Acid @ 200 ppm; T₉: Salicylic Acid @ 500 ppm; and T₁₀: Salicylic Acid @ 1000 ppm, were evaluated under the study Standard. Cultural and plant protection practices were maintained throughout the crop growth period to keep the field weeds and pest free.

Five representative plants were randomly selected and tagged in each net plot (3.00 m × 1.50 m) to record morphological observations viz., days to 50% flowering and plant height, number of branches per plant, leaf area, leaf area index, at 25, 40, 55, and 70 DAS.

At harvest, five plants were randomly selected and tagged from each net plot to record yield attributes: number of capsules plant⁻¹, number of seeds capsule⁻¹, seed yield plant⁻¹ (g), 1000-seed weight (g), and harvest index (%). All recorded data were subjected to statistical Analysis of Variance (ANOVA) for RBD as outlined by Panse and Sukhatme (1954) ^[12], and Critical Differences (CD) at a 5% probability level were computed.

3. Results and Discussion

3.1 Morphological Growth Parameters

Foliar application of different growth regulators significantly increased plant height, number of branches, leaf area and leaf area index from 40 DAS onwards over the control. At 25 DAS, treatment differences were non-significant, reflecting the vegetative baseline before foliar applications.

3.1.1 Plant Height

Significantly highest plant height was recorded under treatment T₆ (GA₃ @ 100 ppm) at 40, 55, and 70 DAS, reaching 104.60 cm at 70 DAS (Table 1). This represented an increase of 13.8% over the control (T₁, 91.89 cm). Treatment T₆ was statistically at par with T₇ (GA₃ @ 200 ppm, 103.83 cm) and T₄ (NAA @ 200 ppm, 103.31 cm). The increase in plant height may be attributed to the beneficial role of GA₃ in promoting cell division and cell elongation, which enhances internodal growth and overall vegetative development of sesame Sonia *et al.*, (2024) ^[14]; Abdelaal *et al.*, (2025).

3.1.2 Number of Branches Plant⁻¹

The number of branches plant⁻¹ at harvest ranged from 3.16 to 6.92 (Table 1). Significantly highest branch count was observed in treatment T₆ (GA₃ @ 100 ppm, (6.92), which was at par with T₇ (GA₃ @ 200 ppm, 6.38) and superior to all other treatments. The increase in number of branches may be attributed to the beneficial role of GA₃ in promoting cell division and elongation, which enhances vegetative growth and facilitates the development of lateral branches Angel *et al.*, (2022) ^[3].

3.1.3 Days to 50% Flowering

Foliar application of growth regulators significantly hastened reproductive transition (Table 1). Earliest flowering was recorded in treatment T₇ (GA₃ @ 200 ppm, (39.33 days), followed by T₅ (GA₃ @ 50 ppm, (39.67 days) and T₆ (GA₃ @ 100 ppm, (40.33 days), compared to the control, T₁ (44.00 days). The earlier flowering observed under GA₃ treatments in the present investigation may therefore be attributed to the stimulatory effect of gibberellic acid on reproductive development and phenological advancement of sesame Sonia *et al.*, (2024) ^[14].

Table 1: Effect growth regulators on plant height, number of branches plant⁻¹ and days to 50% flowering in sesame

Treatments	Plant height (cm) 25 DAS	Plant height (cm) 40 DAS	Plant height (cm) 55 DAS	Plant height (cm) 70 DAS	Number of branches plant ⁻¹ (At harvest)	Days to 50% flowering
T ₁ (control)	15.21	41.08	68.22	91.89	3.16	44.00
T ₂ (NAA @ 50 ppm)	14.37	45.67	72.61	98.75	4.77	41.33
T ₃ (NAA @ 100 ppm)	15.26	46.02	74.05	100.44	4.73	42.00
T ₄ (NAA @ 200 ppm)	14.28	48.44	77.72	103.31	5.43	43.33
T ₅ (GA ₃ @ 50 ppm)	14.48	44.10	75.76	102.32	5.29	39.67
T ₆ (GA ₃ @ 100 ppm)	13.58	55.43	84.00	104.60	6.92	40.33
T ₇ (GA ₃ @ 200 ppm)	13.52	53.28	80.28	103.83	6.38	39.33
T ₈ (SA @ 200 ppm)	14.37	44.31	71.02	96.91	4.66	42.33
T ₉ (SA @ 500 ppm)	13.73	44.39	72.03	97.51	4.47	43.00
T ₁₀ (SA @ 1000 ppm)	12.82	42.92	69.32	94.56	4.12	42.67
SE(m) ±	0.80	2.22	3.11	2.73	0.73	0.55
CD at 5%	--	6.60	9.26	8.11	0.54	1.64

3.1.4 Leaf Area

Leaf area increased progressively up to 55 DAS and declined at 70 DAS due to natural leaf senescence. At 40,

55, and 70 DAS, treatment T₆ (GA₃ @ 100 ppm) recorded the maximum leaf area, reaching 703.24, 1439.58, and 855.48 cm² plant⁻¹, respectively (Table 2). This represented

increases of 25.2, 38.4, and 34.6% over the control (T_1 , 561.64, 1040.54, and 635.71 $\text{cm}^2 \text{plant}^{-1}$, respectively). Treatment T_6 was statistically at par with T_7 (GA_3 @ 200 ppm), recording 686.33, 1399.62, and 840.68 $\text{cm}^2 \text{plant}^{-1}$ at 40, 55, and 70 DAS, respectively. The increase in leaf area

may be attributed to the beneficial role of GA_3 in promoting cell division and cell elongation which supports greater photosynthetic surface development during the leaf-expansion phase Hussain *et al.*, (2024); Abdel-Dayem *et al.*, (2010) ^[1,9].

Table 2: Effect of naphthalene acetic acid, gibberellic acid and salicylic acid on leaf area in sesame

Treatments	Leaf area ($\text{cm}^2 \text{plant}^{-1}$) 25 DAS	Leaf area ($\text{cm}^2 \text{plant}^{-1}$) 40 DAS	Leaf area ($\text{cm}^2 \text{plant}^{-1}$) 55 DAS	Leaf area ($\text{cm}^2 \text{plant}^{-1}$) 70 DAS
T_1 (control)	186.32	561.64	1040.54	635.71
T_2 (NAA @ 50 ppm)	190.05	608.30	1185.55	743.04
T_3 (NAA @ 100 ppm)	191.10	630.44	1242.3	772.97
T_4 (NAA @ 200 ppm)	194.05	664.91	1340.56	817.78
T_5 (GA_3 @ 50 ppm)	182.89	644.93	1287.28	783.75
T_6 (GA_3 @ 100 ppm)	193.28	703.24	1439.58	855.48
T_7 (GA_3 @ 200 ppm)	194.38	686.33	1399.62	840.68
T_8 (SA @ 200 ppm)	178.06	578.22	1092.97	684.68
T_9 (SA @ 500 ppm)	188.03	591.15	1139.58	712.17
T_{10} (SA @ 1000 ppm)	185.10	568.86	1062.28	660.97
SE(m) $\pm$	3.22	26.27	64.12	37.27
CD at 5%	--	78.05	190.52	110.75

3.1.5 Leaf Area Index (LAI)

Leaf area index increased progressively up to 55 DAS and declined at 70 DAS due to natural leaf senescence. At 40, 55, and 70 DAS, treatment T_6 (GA_3 @ 100 ppm) recorded the maximum LAI, reaching 2.67, 4.80, and 2.85, respectively (Table 3). This represented increases of 42.8, 38.3, and 34.4% over the control (T_1 , 1.87, 3.47, and 2.12 respectively). Treatment T_6 was statistically at par with T_7 (GA_3 @ 200 ppm), which recorded LAI values of 2.39,

4.67, and 2.80 at 40, 55, and 70 DAS, respectively. At 55 and 70 DAS, T_6 was also statistically at par with T_4 (NAA @ 200 ppm), recording 4.47 and 2.73, respectively. The increase in LAI may be attributed to the beneficial role of GA_3 in promoting cell division and cell elongation, which enhances leaf expansion and supports greater photosynthetic surface development during the vegetative growth phase Angel *et al.*, (2022) ^[3].

Table 3: Effect of naphthalene acetic acid, gibberellic acid and salicylic acid on Leaf Area Index (LAI) in sesame

Treatments	Leaf area index 25 DAS	Leaf area index 40 DAS	Leaf area index 55 DAS	Leaf area index 70 DAS
T_1 (control)	0.62	1.87	3.47	2.12
T_2 (NAA @ 50 ppm)	0.63	2.03	3.95	2.48
T_3 (NAA @ 100 ppm)	0.64	2.12	4.14	2.58
T_4 (NAA @ 200 ppm)	0.65	2.29	4.47	2.73
T_5 (GA_3 @ 50 ppm)	0.61	2.15	4.29	2.61
T_6 (GA_3 @ 100 ppm)	0.64	2.67	4.80	2.85
T_7 (GA_3 @ 200 ppm)	0.65	2.39	4.67	2.80
T_8 (SA @ 200 ppm)	0.59	1.93	3.64	2.28
T_9 (SA @ 500 ppm)	0.63	1.97	3.80	2.37
T_{10} (SA @ 1000 ppm)	0.62	1.89	3.54	2.20
SE(m) $\pm$	0.04	0.12	0.27	0.16
CD at 5%	--	0.36	0.80	0.46

3.2 Yield and Yield Attributes

Yield and yield attributes of sesame were significantly influenced by the foliar application of NAA, GA_3 and SA (Table 4). The highest number of capsules plant^{-1} (47.40) was recorded under treatment T_6 (GA_3 @ 100 ppm), which represents a 39.9% increase over the control (33.84). However, T_6 was found statistically at par with treatments T_7 (44.80 capsules), T_4 (42.67 capsules) and T_5 (41.37 capsules).

Similarly, the number of seeds capsule⁻¹ was maximized under treatment T_6 (68.23), which was superior to the control (53.74) and statistically at par with T_7 (67.86), T_4

(66.21), T_5 (64.15), T_3 (62.00) and T_2 (59.98). The 1000-seed weight ranged from 2.32 g in the control to 3.34 g under T_6 , showing a significant improvement with GA_3 application. Treatment T_6 recorded the highest 1000-seed weight, followed by T_7 (3.21 g), T_5 (3.09 g) and T_4 (3.01 g). Economic seed yield plant^{-1} , which integrates all growth and reproductive processes, was significantly highest under treatment T_6 (7.23 g plant^{-1}), followed by T_7 (6.54 g plant^{-1}). This performance represents a 77.6% increase in seed yield over the untreated control (4.07 g plant^{-1}). The harvest index also reflected this partitioning efficiency, peaking at 29.23% under T_6 compared to 20.40% in the control.

Table 4: Effect of naphthalene acetic acid, gibberellic acid and salicylic acid on yield and yield attributes of sesame at harvest

Treatments	Capsules plant ⁻¹	Seeds capsule ⁻¹	1000-seed weight (g)	Harvest Index (%)	Seed Yield plant ⁻¹ (g)
T ₁ (control)	33.84	53.74	2.32	20.40	4.07
T ₂ (NAA @ 50 ppm)	37.27	59.98	2.82	22.43	4.56
T ₃ (NAA @ 100 ppm)	39.23	62.00	2.99	24.59	4.73
T ₄ (NAA @ 200 ppm)	42.67	66.21	3.01	26.21	5.93
T ₅ (GA ₃ @ 50 ppm)	41.37	64.15	3.09	24.50	4.93
T ₆ (GA ₃ @ 100 ppm)	47.40	68.23	3.34	29.23	7.23
T ₇ (GA ₃ @ 200 ppm)	44.80	67.86	3.21	27.37	6.54
T ₈ (SA @ 200 ppm)	35.00	56.75	2.73	21.45	4.30
T ₉ (SA @ 500 ppm)	36.03	58.34	3.10	21.81	4.47
T ₁₀ (SA @ 1000 ppm)	34.67	55.88	2.78	21.16	4.27
SE(m) ±	1.93	2.95	0.10	1.33	0.23
CD at 5%	5.76	8.78	0.50	3.96	0.70

4. Conclusion

Foliar application of plant growth regulators, particularly gibberellic acid, significantly influenced the vegetative growth, physiological attributes and yield performance of sesame. The investigation demonstrated that foliar application of GA₃ @ 100 ppm (T₆) was the most effective treatment for enhancing crop growth and productivity. It recorded the highest plant height at 40, 55 and 70 DAS (55.43, 84.00 and 104.60 cm, respectively), number of branches plant⁻¹ (6.92), leaf area plant⁻¹ at 40, 55 and 70 DAS (703.24, 1439.58 and 855.48 cm², respectively), and leaf area index (2.67, 4.80 and 2.85, respectively). The treatment also promoted earlier flowering, with 40.33 days to 50% flowering, at harvest, treatment T₆ recorded the highest number of capsules plant⁻¹ (47.40), seeds capsule⁻¹ (68.23), seed yield plant⁻¹ (7.23 g), 1000 seed weight (3.34 g) and harvest index (29.23%). The seed yield represented a 77.6% increase over the control (4.07 g plant⁻¹), supported by superior yield-contributing attributes. Treatment (T₆) may be recommended as an effective growth regulator treatment for improving vegetative growth, physiological performance and seed yield of sesame, at 30, 45, and 60 DAS and as a standard growth regulators management practice after confirming the results by conducting multi-environmental trials over the years.

References

- Abdel-Dayem HM, Mady MA, El-Desouky SA, Eid RSM. Effect of some bioregulators on growth, yield and chemical composition of sesame. 2010.
- Abdelaal MSM. Effect of spraying with some growth regulators and microelements on growth, productivity and oil content of sesame. Journal of Plant Production. 2026;17(4):97-104.
- Angel I, Poonguzhalan R, Narayanan AL, Nadaradjan S. Growth and yield of sesame (*Sesamum indicum* L.) as influenced by plant growth regulators. International Journal of Current Microbiology and Applied Sciences. 2022;11(2):190-197.
- Basuchaudhuri P. 1-Naphthaleneacetic acid in rice cultivation. Current Science. 2016;52-56.
- Chung SM, Jung KM, Hur CG, Myung BJ, Park I, Chung CH. Comparative analysis of expressed sequence tags from (*Sesamum indicum*) and *Arabidopsis thaliana* developing seeds. Pl Mol Biol. 2003;52(3):1107-1123.
- Donald CM. In search of yield. Journal of the Australian Institute of Agricultural Sciences. 1962;28:171-178.
- Directorate of Economics and Statistics (DES). Agricultural Statistics at a Glance 2024. Ministry of Agriculture & Farmers Welfare, Government of India; 2024.
- Govindan K, Thirumurugan V, Arulchelvan S. Response of soybean to growth regulators. 2000.
- Hussain I, Ali M, Ullah M. Effect of foliar application of naphthalene acetic acid on physio-morphological attributes and green biomass production of sorghum [*Sorghum bicolor* (L.) Moench.]. International Journal of Applied and Experimental Biology. 2024;3(1):75-82.
- Indian Council of Agricultural Research, Department of Agriculture, Government of Maharashtra, Krishi Maharashtra. Krishi Maharashtra. 2026.
- Pathak N, Rai AK, Kumari R, Bhat KV. Value addition in sesame: a perspective on bioactive components for enhancing utility and profitability. Pharmacognosy Reviews. 2014;8(16):147-147.
- Panse VG, Sukhatme PV. Statistical methods for agricultural workers. New Delhi: ICAR Publication; 1954.
- Rademacher W. Plant growth regulators: backgrounds and uses in plant production. Journal of Plant Growth Regulation. 2015;34(4):845-872.
- Sonia E, Ratnakumar P, Pandey BB, Ramesh K, Reddy SN, Hemalatha V, et al. The influence of plant growth modulators on physiological yield and quality traits of sesame (*Sesamum indicum*) cultivars under rainfed conditions. Agricultural Research. 2024;13(3):436-449.
- Taiz L, Zeiger E, Moller IM, Murphy A. Plant physiology and development. 6th ed. 2015. p. 761.
- Thuc LV, Sakagami J, Khuong NQ, Orgill S, Huu TN, Lang NTT, et al. Effects of spraying gibberellic acid doses on growth, yield and oil content in black sesame (*Sesamum indicum* L.). Asian J Crop Sci. 2021;13:1-8.
- Yousefzadeh Najafabadi M, Ehsanzadeh P. Photosynthetic and antioxidative upregulation in drought-stressed sesame (*Sesamum indicum* L.) subjected to foliar-applied salicylic acid. Photosynthetica. 2017;55(4):611-622.