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Influence of Growth Promoters on Seed Yield and Quality in Sesamum (*Sesamum indicum* L.)

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ABSTRACT: India being the world's largest producer of sesamum, struggles with low yields due to rainfed farming and underdeveloped practices. Sesamum, valued for its high-quality oil and adaptability holds significant potential for productivity improvement. The use of growth promoters plays a crucial role in enhancing crop productivity and quality by influencing key physiological processes in plants. This study evaluated the impact of growth promoters on the growth, seed yield and quality of sesamum cv. GKVK S-1 using an RCBD design with foliar sprays of various growth promoters such as NAA, ascorbic acid, IAA and benzyl adenine. The results revealed that, application of NAA at 100 ppm significantly enhanced the plant height at 40,60,90 DAS and at harvest (45.77 cm, 87.31 cm, 112.55 cm and 118.73 cm), number of branches per plant 40,60,90 DAS and at harvest (4.10, 6.30,7.30 & 7.89), Number of capsules at 60,90 DAS and at harvest (48.40,93.00 & 94.22) seed yield per plant (g), per plot (g) and seed yield (4.01, 1278 & 631.47 kg/ha), seed germination (93.67%), seedling vigour indices I and II (1006 and 390 respectively) and total soluble proteins, oil content and lipase activity (21.83%, 55.04%, 0.33 meq/min/g). This Indicates the efficacy of growth promoters in optimizing physiological and biochemical attributes of sesamum seeds. The study concluded that applying NAA at 100 ppm significantly improved the growth, seed yield and quality of sesamum cv. GKVK S-1.

Keywords: Growth promoters, Seed yield, Seed quality

INTRODUCTION

Oilseeds have long been integral to India's agricultural economy, serving as one of the primary sources of vegetable oils for both domestic consumption and export. Ranking second in demand after cereals, oilseeds contribute significantly to the agricultural sector. In the early 1990s, India's 'Yellow Revolution' briefly propelled the country towards self-sufficiency in oilseeds production [1]. This marked a period of substantial growth, helping India reduce its dependence on imported vegetable oils. However, since that time, India has faced challenges in sustaining such progress. Despite being the fourth-largest oilseed producer globally, behind the USA, Brazil and China - India remains one of the largest importers of vegetable oils, largely due to relatively low domestic productivity.

Among many oilseeds cultivated in India, sesamum holds a special place due to its high-quality edible oil. The crop's resilience and ability to grow in marginal environments have contributed to its widespread cultivation. In the modern world India, China, Myanmar and Sudan are the major producers of sesamum. India, in particular, holds the distinction of being the world's largest producer of sesamum, with an output of approximately 8.66 lakh tonnes grown on 19.47 lakh hectares of land. This accounts for roughly one-third of the world's sesamum production. However, despite India's dominant role in sesamum cultivation, the country's average yield is low, at 413 kg/ha, lags behind other nations such as China (535 kg/ha). Factors such as climatic variability, dependent on rainfed agriculture and underdeveloped farming practices contribute to this productivity gap [2]. From a nutritional standpoint, sesamum seeds are a rich source of edible oil, containing 45-50% oil. The oil is high in unsaturated fatty acids, particularly oleic and linoleic acids, which are beneficial for heart health. Sesamum seeds also provide a good source of fiber, which helps reduce cholesterol and triglyceride levels, thereby lowering the risk of heart disease. In addition to these benefits, sesamum seeds are rich in protein (20%) and carbohydrates (14.2%) [2]. Sesamum oil is naturally resistant to rancidity due to the presence of antioxidants like sesamin, sesamolin and sesamol.

To overcome these challenges, several strategies can be employed, including the use of high-yielding varieties, proper nutrient management and the application of growth promoters. Among this growth promoters have added advantages like accurate action, flexibility, environmental compatibility etc. Plant growth promoters are complex chemicals that, when applied in minute quantities, can significantly influence plant growth and metabolism. Unlike fertilizers and pesticides, which are often used in larger quantities, growth promoters act at much lower concentrations and have a more targeted effect on specific physiological processes. Some of the benefits of growth promoters' application include prolonging photosynthesis, reducing respiration and enhancing the partitioning of photo-assimilates. These regulators also optimize the uptake of minerals and stimulate nitrogen metabolism, all of which contribute to better plant growth, higher yields and improved seed quality. India, being one of the largest producers, has a significant opportunity to enhance its export potential by using this technology and farmers can enhance their average yield and get more return from foreign exchange.

MATERIAL AND METHODS

Seeds of sesamum variety GKVK S-1 were collected from AICRP on oil seed scheme and the field experiment was conducted by using RCBD design during kharif, 2023 at ZARS, University of Agricultural Sciences, GKVK, Bangalore. Different growth promoters listed below were used as a foliar application at flower initiation stage (45 DAS), capsule formation stage (60 DAS) and only ascorbic acid was sprayed at 75 DAS (as it is antioxidant and delays senescence) then observations on growth and quality parameters were recorded. Treatments were used as mentioned as T_1: Control, T_2: Benzyl adenine @ 25 ppm, T_3: Benzyl adenine @ 50 ppm, T_4: NAA @ 75 ppm, T_5: NAA @ 100 ppm, T_6: Ascorbic acid @ 75 ppm, T_7: Ascorbic acid @ 100 ppm, T_8:IAA @ 75 ppm and T_9: IAA @ 100 ppm

RESULTS AND DISCUSSION

Effect of growth promoters on growth and yield parameters

In the present study, among different treatments significantly highest (87.32 cm, 112.55 cm and 118.73 cm) plant height was recorded in T_5 (NAA @ 100 ppm) at 60, 90 DAS and at harvest respectively which was followed by T_4 (NAA @ 75 ppm, 84.23 cm, 108.23 cm and 115.93 cm respectively). While, the lowest (68.28 cm, 94.39 cm and 100.19 cm respectively) was observed in control (T_1) is presented in Table 1. The increased plant height might be due to the stimulating action of auxin (NAA) which softens the cell wall by increasing its plasticity or might be the oxidative decarboxylation of synthetic auxins which could not be catalysed by the enzyme peroxidase [3]. These results were consistent with the findings of [2] and [4] in sesamum.

Application of NAA @ 100 ppm recorded highest (6.30, 7.30 and 7.89) number of branches per plant at 60, 90 DAS and at harvest respectively followed by NAA @ 75 ppm (6.10, 7.10 and 7.38 respectively) and lowest (5.03, 5.83 and 5.67 respectively) were recorded in control (T_1) which is presented in Table 2.NAA enhanced the plant's

Table 1. Effect of growth promoters on plant height (cm) at 40, 60, 90 DAS and at harvest in sesamum cv. GKVK S-1

Treatments	Plant height (cm)			
	40 DAS	60 DAS	90 DAS	At harvest
T_1: Control	44.20	68.28	94.39	100.19
T_2: Benzyl adenine @ 25 ppm	44.02	72.92	96.55	101.85
T_3: Benzyl adenine @ 50 ppm	45.48	74.24	99.01	102.89
T_4: NAA @ 75 ppm	44.57	84.23	108.23	115.93
T_5: NAA @ 100 ppm	45.77	87.31	112.55	118.73
T_6: Ascorbic acid @ 75 ppm	45.08	76.22	100.17	108.17
T_7: Ascorbic acid @ 100 ppm	44.35	78.55	102.52	105.07
T_8: IAA @ 75 ppm	44.22	80.45	105.34	111.09
T_9: IAA @ 100 ppm	44.87	82.46	107.96	114.01
Mean	44.73	78.29	102.97	108.66
S. Em±	1.91	3.46	3.68	5.07
CD (p=0.05)	NS	10.37	11.05	15.19
CV (%)	7.39	7.65	6.20	8.08

Table 2. Effect of growth promoters on number of branches at 40, 60, 90 DAS and at harvest in sesamum cv. GKVK S-1

Treatments	Number of branches			
	40 DAS	60 DAS	90 DAS	At harvest
T_1: Control	4.20	5.03	5.83	5.67
T_2: Benzyl adenine @ 25 ppm	4.07	5.23	6.10	5.90
T_3: Benzyl adenine @ 50 ppm	4.27	5.43	6.43	6.44
T_4: NAA @ 75 ppm	4.03	6.10	7.10	7.38
T_5: NAA @ 100 ppm	4.10	6.30	7.30	7.89
T_6: Ascorbic acid @ 75 ppm	4.03	5.53	6.20	6.33
T_7: Ascorbic acid @ 100 ppm	3.99	5.63	6.63	6.76
T_8: IAA @ 75 ppm	4.07	5.73	6.73	6.92
T_9: IAA @ 100 ppm	4.09	6.00	6.97	7.34
Mean	4.09	5.66	6.59	6.74
S. Em±	0.17	0.24	0.24	0.34
CD (p=0.05)	NS	0.73	0.73	1.01
CV (%)	7.25	7.47	6.37	8.65

ability to uptake and distribute nutrients effectively, which supports the growth of additional branches. These findings align with those reported by [5].

The number of capsules varied significantly among treatments.The highest (48.50, 93.00 and 94.22) number of capsules per plant at 60, 90 DAS and at harvest respectively was recorded in T_5 (NAA @ 100 ppm) which was followed by T_4 (NAA @ 75 ppm- 44.97, 88.58 and 91.09 respectively) while, the lowest (34.82, 74.58 and 81.67 respectively) was recorded in control (T_1) (Table 3).The application of NAA leads to significant increase in number of flower clusters per plant while, reducing the percentage of flower drop. This in turn increased number of capsules per plant in sesamum [4]. These findings are in accordance with the reports of [6] in Ber and [2] in sesamum.

Table 3. Effect of growth promoters on number of capsules in sesamum cv. GKVK S-1

Treatments	Number of capsules		
	60 DAS	90 DAS	At harvest
T1: Control	34.82	74.58	81.67
T2: Benzyl adenine @ 25 ppm	36.52	77.12	83.00
T3: Benzyl adenine @ 50 ppm	37.73	78.92	84.51
T4: NAA @ 75 ppm	44.97	88.58	91.09
T5: NAA @ 100 ppm	48.40	93.00	94.22
T6: Ascorbic acid @ 75 ppm	39.55	86.25	86.83
T7: Ascorbic acid @ 100 ppm	40.27	83.70	87.25
T8: IAA @ 75 ppm	41.52	86.75	89.23
T9: IAA @ 100 ppm	43.30	87.23	90.49
Mean	40.79	84.04	87.81
S. Em±	2.06	3.46	3.19
CD (p=0.05)	6.16	10.39	9.55
CV (%)	8.73	7.14	6.30

Seed Yield Parameters

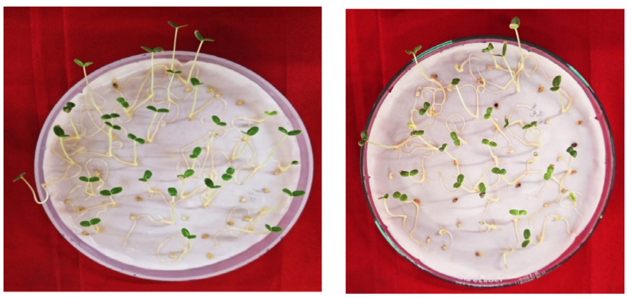
The variation among treatments showed significant difference in seed yield per plant (g), seed yield per plot (g) and seed yield (kg/ha) due to foliar application of growth promoters (Table 4). The treatment T_5 ((NAA @ 100 ppm, 4.01 g,1278.72 g & 631.47 kg ha^{-1}) showed highest seed yield per plant (g), seed yield per plot (g) and seed yield (kg/ha) whereas, lowest result observed in T_1 (control, 2.53 g, 1059.15 g &523.46 kg ha^{-1}) respectively. The increase in yield may be attributed to NAA's role in enhancing the translocation of sugars from source to sink, particularly from photosynthesizing tissues to developing seeds in oil crops [7]. These findings are consistent with the reports of [8] in soybean and [9] in sesamum.

Table 4. Effect of growth promoters on mean seedling dry weight (mg), seedling vigour index-I and seedling vigour index-II in sesamum cv. GKVK S-1

Treatments	Seed germination (%)	Seedling vigour index-I	Seedling vigour index-II
T_1: Control	82.00	689	259
T_2: Benzyl adenine @ 25 ppm	84.00	805	286
T_3: Benzyl adenine @ 50 ppm	85.00	827	300
T_4: NAA @ 75 ppm	91.33	984	370
T_5: NAA @ 100 ppm	93.67	1006	390
T_6: Ascorbic acid @ 75 ppm	87.00	864	308
T_7: Ascorbic acid @ 100 ppm	88.67	879	319
T_8: IAA @ 75 ppm	89.00	913	328
T_9: IAA @ 100 ppm	90.33	956	353
Mean	87.89	880	324
S. Em±	1.97	21.16	7.63
CD (p=0.05)	5.84	62.86	22.66
CV (%)	3.87	4.16	4.07

Seed Germination (%)

The seed germination (%) differed significantly among treatments is presented in Table 4 and Plate 1. Where, maximum germination percentage was noticed in T_5 (NAA @ 100 ppm, 93.67%) which was on par with T_4 (NAA @ 75 ppm, 91.33%), while lowest was observed in T_1 (Control, 82.00%). The germination percentage is a critical characteristic used to estimate the planting value of seeds. NAA accelerates cell elongation, leading to quicker root and shoot growth, improved nutrient as simulation through a larger root system and enhanced seed vigour, all contributing to the



T_5- NAA @ 100 ppm T_1- Control

Plate 1. Effect of growth promoters on seed germination in sesamum cv. GKVK S-1

Successful through a larger root system and enhanced seed vigour, all contributing to the successful establishment of robust seedlings [10]. These results align with findings reported by [11] in cowpea, [12] in ridge gourd, [13] in okra, [14] in safflower, [15] in gladiolus and [16] in tomato.

Seedling Vigour Indices I and I

The Seedling vigour indices I & II differed significantly among treatments is presented in Table 5.The highest (1006& 390) seedling vigour indices I & II were noticed in T_5 (NAA @ 100 ppm) which was on par with T_4 (NAA @ 75 ppm, 948& 370) while, the lowest (689& 259) was recorded in T_1 (control).

Due to the application of NAA, increased seedling length, seedling dry weight and in turn seedling vigour indices (I & II) have been noted in the cases of soybean [9] and in pigeon pea [17]. Which increased efficient nutrient translocation to developing seeds, ensuring that they accumulate more essential nutrients, hormones and energy reserves such as starch and proteins. This results in seeds with higher metabolic activity and better initial energy stores, which leads to faster germination and more

Table 5. Effect of growth promoters on seed yield in sesamum cv. GKVK S-1

Treatments	Seed yield per plant (g)	Seed yield per plot (g)	Seed yield (kg ha^{-1})
T_1: Control	2.53	1059.15	523.46
T_2: Benzyl adenine @ 25 ppm	2.74	1121.63	553.99
T_3: Benzyl adenine @ 50 ppm	2.89	1143.89	564.90
T_4: NAA @ 75 ppm	3.92	1259.48	622.90
T_5: NAA @ 100 ppm	4.01	1278.72	631.47
T_6: Ascorbic acid @ 75 ppm	3.01	1178.54	582.62
T_7: Ascorbic acid @ 100 ppm	3.46	1205.65	595.11
T_8: IAA @ 75 ppm	3.69	1235.19	610.95
T_9: IAA @ 100 ppm	3.85	1245.37	615.07
Mean	3.34	1191.96	588.94
S. Em±	0.14	48.493	25.38
CD (p=0.05)	0.42	145.39	76.11
CV (%)	7.23	7.046	7.46

vigorous early growth. Additionally, NAA improves hormonal regulation in seeds, particularly by increasing auxin levels, which directly stimulate stronger root and shoot development. Furthermore, the foliar application of NAA may also enhance the seed coat permeability, allowing for quicker water absorption and faster imbibition during germination. Together, these factors contribute to increased seedling vigour. Similar findings were observed by [11] which revealed that NAA 50 ppm recorded significantly highest vigour index in ridge gourd, [18] revealed that NAA 100 ppm recorded maximum vigour index in tomato, [19] recorded that among various concentrations of NAA under his study showed highest vigour index with foliar application of NAA @ 20 ppm in brinjal.

Total Soluble Proteins (%)

There was a significant difference among treatments for total protein content. The highest (21.83%) protein content was observed in treatment T_5 (NAA @ 100 ppm) which was on par with T_4 (NAA @ 75 ppm, 21.61%). The lowest (18.03%) protein content was observed in T_1 (control) is presented in Table 5. Due to foliar application of NAA, there was significant increase in protein content, connected with increased metabolism of nitrogen [9]. The results are in line with the findings of [20] in green gram, [21] in soybean and [22] in mung bean.

Oil content (%)

The data on oil content is presented in Table 6. Showed significantly the highest (55.04%) oil content observed in treatment T_5 (NAA @ 100 ppm) which was on par with

Table 6. Effect of growth promoters on total soluble protein (%), oil content (%) and lipase activity (meq/min/g) in sesamum cv. GKVK S-1

Treatments	Total soluble protein (%)	Oil content (%)	Lipase activity (meq/min/g)
T_1: Control	18.03	46.25	0.20
T_2: Benzyl adenine @ 25 ppm	18.25	46.93	0.21
T_3: Benzyl adenine @ 50 ppm	18.78	47.94	0.23
T_4: NAA @ 75 ppm	21.61	54.85	0.31
T_5: NAA @ 100 ppm	21.83	55.04	0.33
T_6: Ascorbic acid @ 75 ppm	19.96	49.39	0.25
T_7: Ascorbic acid @ 100 ppm	20.01	50.00	0.27
T_8: IAA @ 75 ppm	20.84	52.61	0.28
T_9: IAA @ 100 ppm	21.23	53.39	0.30
Mean	20.06	50.71	2.38
S. Em±	0.58	1.06	0.007
CD (P=0.05)	1.75	3.31	0.02
CV (%)	5.07	3.62	4.51

T_4 (NAA @ 75 ppm, 54.85%). The lowest (46.25%) oil content% was observed in treatment T_1 (control) presented in Table 5. Increased oil content is consequence of increased conversion of carbohydrates to oils. Foliar application of NAA increases the uptake and availability of nutrients and its further assimilation for biosynthesis of oil increasing oil content in seed in the present investigation. These results are comparable with [23], [24] observed in sunflower and [13] in safflower respectively.

Lipase activity (meq/min/g)

The data on lipase activity computed as influenced by foliar application of growth regulators are presented in Table 5. The significant difference was observed among treatments. The highest (0.33meq/min/g) lipase activity was observed in treatment T_5 (NAA @ 100 ppm), which was on par (0.31 meq/min/g) with T_4 (NAA @ 75 ppm) and lowest (0.20 meq/min/g) was observed in treatment T_1 (control). Seed germination increases lipolytic activity in sesamum seeds with lipase primarily hydrolysing saturated fatty acids. The foliar spray of NAA at 100 ppm further enhanced germination in turn increased lipase activity. NAA stimulates metabolic processes like nutrient mobilization, which boosts enzyme production. This leads to higher lipase activity in seeds, improving fatty acid breakdown during germination. The results are in line with [20] in soybean.

CONCLUSION

The present study demonstrated that the application of growth promoters significantly influenced the growth and yield attributes of sesamum (*Sesamum indicum* L.) cv. GKVK S 1. Among the treatments evaluated, foliar application of Naphthalene Acetic Acid (NAA) at 100 ppm showed superior performance, resulting in enhanced plant height, number of branches and improved seed yield components The findings indicate that NAA at 100 ppm effectively stimulates vegetative growth and reproductive development, likely by modulating endogenous hormone levels and promoting cell division and elongation. This suggests that NAA can be effectively integrated into sesame cultivation practices to improve productivity. Further research may focus on optimizing the timing and frequency of application to maximize benefits under varied agro-climatic conditions.

REFERENCES

1. ANONYMOUS (2022a). Yellow revolution.
2. ANGEL RP, NARAYANAN AL AND NADARADJAN S (2022). Growth and yield of sesame (*Sesamum indicum* L.) as influenced by plant growth regulators. *Int. J. Curr. Microbiol. App. Sci.*, **11**(2): 190–197.
3. RAMESH R AND RAMPRASAD E (2013). Effect of plant growth regulators on morphological, physiological and biochemical parameters of soybean (*Glycine max* L. Merrill). *Helix*, **6**: 441–447.
4. SIDDIK A, ISLAM MM, HOQUE A, SHAHIDUL IS, PARVIN S AND RABIN MM (2015). Morpho-physiological and yield contributing characters and yield of sesame with 1-naphthalene acetic acid (NAA). *J. Pl. Sci.*, **3**(6): 329–336.
5. HIVARE VS, DEOTALE RD, DHONGADE AP, PISE SE, RAUT DA AND BLESSEENA A (2019). Morpho-physiological traits and yield in safflower as influenced by foliar application of humic acid and NAA. *J. Soils Crop*, **29**(2): 348–353.
6. PRIYA S, DWIVEDI AK, TRIPATHI VK AND VERMA S (2023). Effect of foliar application of various concentrations of NAA and GAƒ on fruiting, yield and quality attributes of ber cv. Banarasi Karaka, India. *Curr. J. Appl. Sci. Technol.*, **42**(48): 43–51.
7. GANGADHAR KV AND BRAR BS (2020). Response of phosphorus and growth regulators on oilseed crops. *Int. J. Chem. Stud.*, **8**: 2010–2016.
8. UPADHYAY RG AND RANJAN RR (2015). Effect of growth hormones on morphological parameters, yield and quality of soybean (*Glycine max* L.) during changing scenario of climate under mid hill conditions of Uttarakhand. *Int. J. Trop. Agric.*, **33**(2): 1899–1904.
9. EMA S, ADAM AG, KHAN FI AND BEGUM HH (2020). Responses of naphthalene acetic acid and *Pseudomonas* inoculum on growth, yield and some biochemical parameters of sesame (*Sesamum indicum* L. var. BARI TIL-4). *Bangladesh J. Bot.*, **49**(2): 335–341.
10. PATIL PM, THOMBRE PR, THOMBRE AB, DEOSARKAR DB AND GORE VB (2023). Effect of spraying NAA on soybean (*Glycine max* (L.) Merrill.) var. MAUS 71 growth, yield and seed quality. *Pharma Innov. J.*, **12**(12): 1037–1045.
11. BORKAR D, MATTE AD, BHALEKAR MV, KENE DR AND BAGADE TR (1991). Effect of foliar application with different

plant growth regulators on growth and yield of cowpea. *J. Soils Crop*, **1**(2): 165–168.

12. HILLI JS, VYAKARANAHAL BS AND BIRADAR DP (2010). Influence of growth regulators and stages of spray on seed quality of ridge gourd (*Luffa acutangula* L. Roxb). *Karnataka J. Agric. Sci.*, **21**(2): 194–197.
13. KHAN SH, CHATTOO MA AND MUFTI S (2013). Effect of plant bioregulators on seed yield, germination and vigour in okra (*Abelmoschus esculentus* (L.) Moench). *Prog. Hort.*, **45**(2): 345–346.
14. KENE HK, SONTAKEY PY, PHADANVIS BN AND DURGE DV (1992). Effects of foliar application of Planofix and cycocel on growth and yield of safflower. *Bioved*, **3**(1): 21–22.
15. HARISH MS, BASAVARAJU GV, VENKAPPA P AND SHUBA AC (2014). Effect of plant growth regulator GAƒ on dormancy in different sized gladiolus seed corms cv. White Prosperity. *Trends Biosci.*, **8**(15): 3756–3760.
16. ARVINDKUMAR PR, VASUDEVAN SN AND PATIL MG (2014). Effect of foliar sprays of NAA, triacontanol and boron on growth and seed quality in bitter gourd (*Momordica charantia* L.) cv. Pusa Visesh. *J. Hort. Sci.*, **9**(2): 148–152.
17. GANGARAJU N, PARAMESH R, SIDDARAJU R AND HARISH MS (2016). Effect of nutrient levels and split application of nitrogen on growth and seed yield of maize hybrid Hema at various stages of plant growth. *Madras Agric. J.*, **102**(4): 131–134.
18. KUMBARI VN (2002). Effect of growth regulators and number of trusses on seed yield and quality in tomato (*Lycopersicon esculentum* Mill.). M.Sc. (Ag.) Thesis, University of Agricultural Sciences, Dharwad.
19. THERAKAM SB (2001). Effect of gypsum, NAA, harvesting stages and post-harvest ripening periods on seed yield and quality in brinjal cv. Composite-2. M.Sc. (Ag.) Thesis, University of Agricultural Sciences, Dharwad.
20. BAI DIS, ABRAHAM AT AND MERCY ST (1987). Hormonal influence on crop performance in green gram. *Legume Res.*, **10**(1): 49–52.
21. RAVIKUMAR GH AND KULKARNI GN (1988). Effect of growth regulators on seed quality in soybean genotypes (*Glycine max* L. Merrill). *Seeds & Farms*, **14**(2): 25–28.
22. PATEL I AND SAXENA OP (1995). Effect of PGR on biochemical changes in developing mung bean. *Plant Physiol. Biochem.*, **23**(2): 196–198.
23. PAIN SK AND SARKAR V (1980). Studies on the growth and development of sunflower plant: Effect of foliar spray of NAA at different concentrations. *Indian Agric.*, **24**(3): 135–143.
24. VASUDEVAN SN, VIRUPAKSHAPPA K, BHASKAR S AND UDAYAKUMAR M (1996). Influence of growth regulators on some productive parameters and oil content in sunflower (*Helianthus annuus* L.). *Indian J. Plant Physiol.*, **1**(4): 277–280.