International Journal of Advanced Biochemistry Research

ISSN Print: 2617-4693
ISSN Online: 2617-4707
NAAS Rating: 5.29
IJABR 2025; 9(5): 126-128
www.biochemjournal.com
Received: 10-03-2025
Accepted: 14-04-2025

Prem Das Ratre
Research Scholar, Vegetable Science, Pt. Kishori Lal Shukla College of Horticulture and Research Station, MGUVV, Durg, Chhattisgarh, India

Neelima Netam
Assistant Professor, Department of Floriculture and Landscape Architecture, College of Horticulture and Research Staion Sankra, MGUVV, Durg, Chhattisgarh, India

Dr. Jitendra Singh
Professor, Department of Vegetable Science, Mahatma Gandhi Udyanikee Evam Vanikee Vishwavidyalaya, Sankra, Patan, Durg, Chhattisgarh, India

Dr. Abhay Bisen
Assistant Professor, Fruit Science, L., Pt. Shiv Kumar Shastri College, Chhattisgarh, India

Dr. Dikeshwar Nishad
Assistant Professor, Department of Agricultural Statistics and Social Science, L., Pt. Shiv Kumar Shastri College of Agriculture and Research Station, IGKVV, Raipur, Chhattisgarh, India

Corresponding Author:
Prem Das Ratre
Research Scholar, Vegetable Science, Pt. Kishori Lal Shukla College of Horticulture and Research Station, MGUVV, Durg, Chhattisgarh, India

Effect of plant growth regulators on vegetative growth and leaf yield of radish (*Raphanus sativus* L.) var. Kashi Ardra in Chhattisgarh plain

Prem Das Ratre, Neelima Netam, Jitendra Singh, Abhay Bisen and Dikeshwar Nishad

DOI: https://www.doi.org/10.33545/26174693.2025.v9.i5b.4322

Abstract
The present study entitled "Effect of plant growth regulators on vegetative growth and leaf yield of Radish (*Raphanus sativus* L.) var. Kashi Ardra in Chhattisgarh plain." was carried out during *Rabi* season 2023-24 in the Pt. K.L.S. College of Horticulture and Research Station, Rajnandgaon (C.G.). The field experiment was laid out in Randomized Block Design with three replications and thirteen treatments consisting a control *viz.* (T_0) Control (Water spray), (T_1) GA_3 @ 100 ppm, (T_2) GA_3 @ 150 ppm, (T_3) GA_3 @ 200 ppm, (T_4) IAA @ 50 ppm, (T_5) IAA @ 100 ppm, (T_6) IAA @ 150 ppm, (T_7) NAA @ 100 ppm, (T_8) NAA @ 150 ppm, (T_9) NAA @ 200 ppm, (T_{10}) IBA @ 50 ppm, (T_{11}) IBA @ 100 ppm, (T_{12}) IBA @ 150 ppm. The finding of the present investigation clearly indicated that the foliar application of GA_3 200 ppm gave significantly better performance at vegetative character like maximum plant height (41.93 cm), number of leaves per plant (15.53), leaf length (39.27 cm), Leaf yield per plot (8.19 kg) and maximum leaf yield per ha (25.27 t). Hence, the treatment T_3 (GA_3 200 ppm) was found to be most suitable for higher production of radish.

Keywords: Radish, plant growth regulators, vegetative character, leaf yield

Introduction
The radish (*Raphanus sativus* L.) is diploidy (2n=18) in nature, belongs to Cruciferae family and can be considered as an annual as well as a biennial crop. It is cool season vegetable. It's green leaves and immature pods are also cooked as a vegetable. It is a cross-pollinated (entomophilous) vegetable. (Alam *et al*., 2010) [3]. Radish is a good source of vitamin-C (14.8 mg/100 gm of edible portion) and supplies types of minerals. The characteristic pungent flavour of radish is due to isothiocyanate (Kushwah, 2019) [11]. It is useful in liver and gall bladder troubles. In homoeopathy, radish is used for neuralgic headache, sleeplessness and chronic diarrhoea. Radish is mainly grown in West Bengal, Madhya Pradesh, Bihar, Uttar Pradesh, Karnataka, Punjab, Maharashtra and Assam. In India, radish is cultivated an area of 206 mha with an annual production of 3304 MT. (Anon., 2022) [4, 5]. In Chhattisgarh, Kondagaon, Korba, Surguja, Kanker, Durg, Rajnandgaon, Raipur and Korea are particularly important radish producing districts. The area and production of white radish in Chhattisgarh was 13,833 ha and 179.378 MT. (Directorate of Horticulture and Farm Forestry C.G., 2022) [4]

Plant growth regulators have been shown to be an effective approach to boost vegetable yield without sacrificing quality or soil health. Gibberellins are plant growth hormones which promote cell division and regulate numerous physiological processes including, leaf, root and reproductive organs expansion (Achard *et al*., 2009, Schwechheimer and Colebrook *et al*., 2014) [2, 15, 7]. IAA increases the growth of root and sometimes also shoot of plants (Chaudhary and Rasheed, 2003) [6]. Indole-3-butyric acid (IBA) is a plant growth promoter, used to regulate and accelerate the formation of roots of young plant and to elevate crop yields. NAA is basically used for vegetative growth particularly flowering but NAA at higher concentrations enhance the yield of radish (Singh *et al*., 1989) [19]. Synthetic auxins such as 1-naphthalene acetic acid (NAA) induce similar physiological responses as natural auxins in bioassays (Imin *et al*., 2005) [9]. Plant growth and development are influenced by growth regulators at low concentrations, whereas they are inhibited at high doses.

Materials and Methods

The investigation was carried out at Pt. K.L.S. College of Horticulture and Research Station, Pendri, Rajnandgaon (C.G.) during *Rabi* season 2023-24. The field experiment was conducted in Randomized Block Design with three replications having thirteen different treatments with four plant growth regulators concentration *i.e*., GA_3 @ 100, 150 and 200 ppm, IAA @ 50, 100 and 150 ppm, NAA @ 100, 150 and 200 ppm and IBA @ 50, 100 and 150 ppm. The soil was made to fine tilth by continuous harrowing after the area had been carefully ploughed, weeds, stubbles, stones etc., were completely removed. The chemical fertilizers (NPK) were administered at a rate of 50:100:50 kg/ha, with urea providing half of the nitrogen, single super phosphate providing the whole phosphorus and Murata of potash providing half of the potassium as the basal dose. Protective irrigations were done every five to seven days during the cropping period. The desired concentrations of plant growth regulators were prepared and 1st spraying was done at 15 days and 2nd at 30 days after the sowing of radish crop.

Results and Discussion

Vegetative character

Plant growth regulators GA_3 200 ppm gave significantly better performance at vegetative character like maximum plant height, number of leaves per plant, leaf yield per plot (kg) and maximum leaf yield per ha (t). The interpretations were recorded on various vegetative character are presented in Table 1.

Plant height

At 30 days, T_3 (GA_3 @ 200 ppm) recorded significantly the highest plant height (26.33 cm) which was statistically at par with treatments T_2 (GA_3 @ 150 ppm) (25.05 cm) respectively. However, Control (Water spray) recorded the lowest plant height (16.66 cm) among the others.

At 45 days, T_3 (GA_3 @ 200 ppm) recorded significantly the highest plant height (41.93 cm) which was closely followed by the treatment T_2 (GA_3 @ 150 ppm) (38.43 cm), while, it was the lowest (27.20 cm) in Control (Water spray). The increase in plant height was mainly due to the hormonal action of enhancing cell number, cell division and cell size. These results are in conformity with the findings of Ganapathi (2006) [8], Abbas (2011) [1], Priyanka and Nagaich (2019) [12] in carrot.

Number of leaves per plant

At 30 days, T_3 (GA_3 @ 200 ppm) recorded the maximum number of leaves per plant (11.60) which was statistically at par with T_2 (GA_3 @ 150 ppm) (10.83) T_9 (NAA @ 200 ppm) (10.46) and T_6 (IAA @ 150 ppm) (10.36), while, the lowest number of leaves per plant (6.36) was observed in Control (Water spray).

At 45 days, T_3 (GA_3 @ 200 ppm) recorded the highest number of leaves per plant (15.53) which was statistically at par with T_2 (GA_3 @ 150 ppm) (14.86) and T_9 (NAA @ 200 ppm) (14.60), while, the lowest number of leaves per plant (9.56) was observed in Control (Water spray). Gibberellic acid significantly increased the number of leaves on the plant because it has help to stimutate the activity of sub-appical meristem during new-formed growth and the apical meristem during vegetative bud development. Similar result were reported by Abbas (2011) [1]. Singh and Rajodia (2001) [18], (Karuppaiah *et al.* (2007) [10], Shweta *et al.* (2018) [16] and Mishra *et al.* (2019) [12] regarding in radish.

Leaf length (cm)

At 30 days, T_3 (GA_3 @ 200 ppm) recorded the highest leaf length (24.27 cm) which was statistically at par with T_2 (GA_3 @ 150 ppm) (23.60 cm) and T_9 (NAA @ 200 ppm) (23.33 cm). While, the lowest leaf length per plant (15.81 cm) was observed in Control (Water spray).

At 45 days, T_3 (GA_3 @ 200 ppm) recorded the highest Leaf length (39.27 cm) which was followed by the treatment T_2 (GA_3 @ 150 ppm) (36.76 cm), while, the lowest leaf length per plant (24.83 cm) was observed in Control (Water spray). Gibberellic acid significantly increased the leaf length on the plant because rise in cell size, cell number and cell division, all of which increase the plant's metabolic activity (Mahabir Singh *et al*., 1989) [19].

Leaf yield per plot (kg)

At 45 days, T_3 (GA_3 @ 200 ppm) recorded the maximum Leaf yield per plot (4.84 kg) which was statistically at par with T_2 (GA_3 @ 150 ppm) (7.77 kg) T_9 (NAA @ 200 ppm) (7.51 kg) and T_6 (IAA @ 150 ppm) (7.46 kg), while, the lowest Leaf yield per plot (6.66 kg) was observed in Control (Water spray). The hormonal activity (cell elongation and cell division of growing portion of leaf) of promoting maximum plant height, more number of leaves and maximum leaf length was the major cause of the rise in leaf yield per plot. The present findings are in confirmation with the findings of Ola *et al.* (2018) [13] and Sinchana (2021) [17] in radish.

Leaf yield per ha (t)

T_3 (GA_3 @ 200 ppm) recorded the highest leaf yield per ha (25.27 t) which was statistically at par with treatments T_2 (GA_3 @ 150 ppm) (23.98 t), T_9 (NAA @ 200 ppm) (23.17 t), T_6 (IAA @ 150 ppm) (23.02 t) and T_{12} (IBA @ 150 ppm) (22.86 t), while, the lowest Leaf yield per ha (19.38 t) observed in Control (Water spray. The present findings are in confirmation with the findings of Ola *et al.* (2018) [13] and Sinchana (2021) [17] in radish.

Table 1: Effect of plant growth regulators on vegetative growth of radish.

Treatment	Plant height (cm) 30 days	Plant height (cm) 40 days	Number of leaves per plant 30 days	Number of leaves per plant 40 days	Leaf length (cm) 30 days	Leaf length (cm) 45 days	Leaf yield per plot (kg)	Leaf yield per ha (t)
T_0 Control (Water spray)	16.66	27.20	6.36	9.56	15.81	24.83	4.84	14.93
T_1 GA_3 @ 100 ppm	23.93	35.10	9.53	13.56	22.73	33.27	7.31	22.56
T_2 GA_3 @ 150 ppm	25.05	38.43	10.83	14.86	23.60	36.76	7.77	23.98
T_3 GA_3 @ 200 ppm	26.33	41.93	11.60	15.53	24.27	39.27	8.19	25.27
T_4 IAA @ 50 ppm	23.10	33.98	8.86	13.13	21.86	32.26	6.91	21.35
T_5 IAA @ 100 ppm	23.30	34.76	9.06	13.4	22.40	32.84	7.12	21.97
T_6 IAA @ 150 ppm	24.36	36.06	10.36	14.03	23.16	34.46	7.46	23.02
T_7 NAA @ 100 ppm	22.79	33.33	8.63	12.56	21.51	32.03	6.81	21.01
T_8 NAA @ 150 ppm	23.86	34.94	9.36	13.53	22.46	33.07	7.35	22.68
T_9 NAA @ 200 ppm	24.46	37.06	10.46	14.60	23.33	34.90	7.51	23.17
T_{10} IBA @ 50 ppm	22.13	32.58	8.30	12.33	21.39	31.33	6.69	20.64
T_{11} IBA @ 100 ppm	23.23	34.72	9.03	13.30	22.13	32.65	7.33	22.62
T_{12} IBA @ 150 ppm	24.32	35.50	9.66	13.73	22.86	33.46	7.41	22.87
SE(m±)	1.08	1.84	0.47	0.66	0.91	1.72	0.26	0.88
C.D. at 5%	3.16	5.37	1.38	1.94	2.68	5.04	0.77	2.57
CV	8.03	9.10	8.73	8.62	7.19	9.02	6.42	6.93

Conclusion

Thus, it can be concluded that the application of GA_3 200 ppm is better for radish vegetative growth and leaf yield as well as plant height (cm), number of leaves per plant, leaf length (cm), leaf yield per plot (kg) and leaf yield per ha (t) of cultivation as compared to other treatments tried in this experiment to future crop planning.

References

1. Abbas ED. Effect of GA_3 on growth and some physiological characterizes in carrot plant (*Daucus carota* L.). Int J Pure Appl Sci. 2011;24(3):52-57.
2. Achard P, Gusti A, Cheminant S, Alioua M, Dhondt S, Coppens F, *et al*. Gibberellin signaling controls cell proliferation rate in *Arabidopsis*. Curr Biol. 2009;19:1188-1193.
3. Alam MK, Farooque AM, Nuruzzaman M, Jamal Uddin AFM. Effect of sowing time on growth and yield of three radish (*Raphanus sativus* L.) varieties. Bangladesh Res Publ J. 2010;3(3):998-1006.
4. Anonymous. Annual report. Raipur (CG): Directorate of Horticulture; 2022.
5. Anonymous. Final estimate of 2021 and second advanced estimate. Area and production of horticulture crops. Delhi: Ministry of Agriculture & Farmers Welfare, PIB; 2022.
6. Chaudhary, Rasheed. Study of the external and internal morphology of *Pisum sativum* L. with growth hormones i.e., indole-3-acetic acid and kinetin and heavy metal i.e., lead nitrate. Pak J Biol Sci. 2003;6(10):407-412.
7. Colebrook EH, Thomas SG, Phillips AL, Hedden P. The role of gibberellin signaling in plant responses to abiotic stress. J Exp Biol. 2014;2(17):67-75.
8. Ganapathi M, Hiremath SM, Uppar DS, Cheeti MB, Koti RV. Influence of organics, plant growth regulators and micronutrients on yield and yield components in carrot (*Daucus carota* L.). Int J Plant Sci. 2007;3(2):342-344.
9. Imin N, Nizamidin M, Daniher D, Nolan KE, Rose RJ, Rolfe BG. Proteomic analysis of somatic embryogenesis in *Medicago truncatula* explants culture grown under 6-benzylaminopurine and 1-naphthaleneacetic acid treatments. Plant Physiol. 2005;137:1250-1260.
10. Karuppaiah P, Kumar SR, Sendhilnathan R. Effect of growth regulators on growth, physiological and yield attributes of radish. Adv Plant Sci. 2007;20(2):457-459.
11. Kushwah L, Sharma RK, Kushwah SS, Singh OP. Influence of organic manures, inorganic fertilizers and their combinations on growth and quality of radish. Int J Chem Stud. 2019;7(6):2972-2974.
12. Mishra P, Nagaich KN. Response of gibberellic acid on growth and yield of radish (*Raphanus sativus* L.) cv. Japanese white. J Pharmacogn Phytochem. 2019;8(2):1521-1523.
13. Ola AL, Rana DK, Jhajhra MR. Evaluation of radish (*Raphanus sativus* L.) varieties under valley condition of Garhwal hills. J Pharmacogn Phytochem. 2018;7(1):2740-2743.
14. Sadana A, Raju SS, Kumar PV, Sunitha C. Effect of spacing and seed soaking with GA_3 on growth, yield and quality of radish (*Raphanus sativus* L.). Andhra Pradesh J Agric Sci. 2015;1(2):80-84.
15. Schwechheimer C, Willige BC. Shedding light on gibberellic acid signaling. Curr Opin Plant Biol. 2009;12:57-62.
16. Shweta DM, Thakur MV, Datta S. Effect of different plant growth regulators (GA_3 and NAA) on growth and yield parameters of radish (*Raphanus sativus* L.) var. Pusa Reshmi. J Pharmacogn Phytochem. 2018;7(3):3434-3437.
17. Sinchana BR. Effect of sowing dates on different genotypes of radish (*Raphanus sativus* L.) under organic and natural farming conditions [MVSc thesis]. Palampur (HP): CSK Himachal Pradesh Krishi Vishwavidyalaya; 2021. p. 1-79.
18. Singh M, Rajodia RB. Effect of gibberellic acid on growth and yield attributes of radish varieties. Crop Res Hisar. 2001;21(2):174-177.
19. Singh M, Singh RP, Yadav HS. Response of growth regulators and their methods of application on yield of radish (*Raphanus sativus* L.). Bharatiya Krishi Anusandhan Patrika. 1989;4(2):84-88.