

Study of Plant Growth Regulators on Growth and Yield Parameters of Radish (*Raphanussativus*L.)

Avinash Tomer, Vijai Kumar¹ and Arun Kumar²

Department of Horticulture, Chaudhary Charan Singh University, Meerut 250004 (U.P.)

¹Department of Horticulture, ²Dept. of Plant Pathology, CCRD College Muzaffarnagar 251001 (U.P.)

*Corresponding Author's E-mail: captvijai@gmail.com

ABSTRACT: The field experiment to study the Study of plant growth regulators on growth and yield parameters of radish (*Raphanussativus*L.) was conducted during the year 2020-2021 at Horticulture Research farm, Department of Horticulture, CCR (PG) College Muzaffarnagar 251001 (U.P) India. There were nine treatments i.e. T₁(GA₃@ 50 ppm), T₂ (GA₃ @ 100 ppm), T₃ (IAA @ 50 ppm), T₄ (IAA @ 100 ppm), T₅ (NAA @ 50 ppm), T₆ (NAA@100ppm), T₇ (MH@100ppm), T₈ (MH@200ppm) and T₉ (control). The findings of the present investigation clearly indicated that the foliar application of GA₃ @ 100 ppm gave significant effect to improve growth and yield parameters of radish viz., plant height (36.86cm), number of leaves (25.31), leaf length (33.71cm), root diameter (5.27cm), weight of root (250.12g) and yield (380.86q/ha) as compared to other treatments. Hence, foliar application of GA₃ @ 100ppm may be suggested for getting maximum vegetative growth and yield of radish under Western Uttar Pradesh conditions.

KEYWORDS: Radish, Growth, GA₃, NAA, IAA, MH, Yield.

Radish (*Raphanussativus* L.), often known as 'Mooli,' is a root vegetable that belongs to the Brassicaceae family and is India's most popular. Radish (*Raphanussativus* L.; 2n = 18) is a popular vegetable that originated in Europe or Asia and is now grown all over the world. Radish is one of the most popular Rabi root crops, and it is widely grown for its high nutritional and therapeutic value. It's a widely consumed vegetable in both tropical and temperate climates. It is planted both as an annual and a biennial crop for root and seed production. West Bengal, Uttar Pradesh, Bihar, Himachal Pradesh, Gujarat, Punjab, and Haryana are among the states in India where it is grown extensively. According to World Scenario, the main radish producing state, West Bengal, has an area of roughly 40.70 thousand ha and produces 508.75 thousand MT of radish, with Nadia and Murshidabad districts leading the way, followed by Haryana and Punjab. It is grown on a total of 13.60 thousand hectares in Punjab, with a production of 294.65 MT (NHB 2016- 2017).

Radish is grown for its young, sensitive tuberous roots, which can be eaten raw or cooked. It contains a lot of vitamins and minerals. 100 gm of edible radish root includes 94.4 percent moisture, 3.4 grams of carbs, 0.7 gm of protein, 0.06 milligrams of thiamine, 0.02 milligrams of riboflavin, 15 milligrams of vitamin C, 35 milligrams of calcium, and 0.04 milligrams of iron (Dhariwal, 6). It has diuretic and invigorating qualities. Radish leaves are a good source of protein that may be extracted commercially. Radish seeds are a wonderful source of non-drying fatty oil that can be used in soap manufacturing, lighting, and cooking. It is eaten as an appetizer and is known for its strong flavor.

Plant bio regulators have been shown to be an effective approach to boost vegetable yield without sacrificing quality or soil health. Plant growth regulators are known to regulate the physiological and biochemical processes of the plant. Controlling dormancy, organ size, crop development, blooming and fruit set, and regulating nutrient input from the soil are among them (Ganpathiet al., (8). Plant growth and development are influenced by growth regulators at low concentrations, whereas they are inhibited at high doses. The involvement of endogenous gibberellins in the regulation of stem elongation and flower development in radish has received little attention. GA₃ is known to improve seed germination, but NAA is primarily utilized for vegetative growth, especially blooming, but NAA at greater concentrations improves radish yield (Singh et al., 1989). (20)

I. MATERIALS AND METHODS

The field experiment was conducted at the Horticultural Research Farm, Department of Horticulture, Chaudhary Chhotu Ram (PG) college, Muzaffarnagar 251001 (U.P). The average annual temperature in Muzaffarnagar is 24.2 °C. The highest and lowest temperatures ever recorded in Muzaffarnagar are 45 °C (113 °F) on 29 May 1994 and -0.9 °C (30.4 °F) respectively. The rainfall averages 929 mm. The driest month is November, with 8 mm of rain. Highest precipitation falls in July, with an average of 261.4 mm

. Gibberellic acid regulates stem elongation, germination, and senescence of leaves and fruit (Daviere

and Achard, (3), The mechanism of cell growth mediated through auxins entails its interaction with receptors, membranes and other binding surfaces that could lead to the rapid growth of cells (Krishna, (11). The maximum number of leaves per plant (25.31) was manifested with the foliar application of GA₃ @ 100 ppm followed by treatment GA₃ @ 50 ppm (24.41). The minimum number of leaves per plant (19.40) was recorded with control treatment. Similarly, among different treatments of the plant growth regulators, maximum leaf length (33.71 cm) was recorded under the treatment T₂ (GA₃ @ 100ppm) followed by GA₃ @ 50 ppm. The minimum leaf length (33.43cm) was recorded with the foliar application of double-distilled water (control). The findings of the present investigation are in agreement with the findings of Parvez *et al.* (15), Singh and Rajodia (19), Pate *et al.* (14) and Dev *et al.* (5) in case of okra. The results are also in the line with the findings of Mishra and Nagaich (13), who reported that foliar application of GA₃ significantly increased number of leaves per plant and leaf length in case of radish. The probable reasons for enhanced more number of leaves might be due to effect of different plant growth regulator treatments on vegetative growth and new vegetative bud initiation by increasing cell division and controlling of the precise pattern of the epidermal cells of the developing leaf. Little and Mac-Donald (12) reported the GA₃ help to stimulate the activity of sub-apical meristem during new-formed growth and the apical meristem during vegetative bud development. Dawuda *et al.* (4) reported that the foliar application of GA₃ enhances rapid cell elongation in actively growing region of the plant leading to stimulation of new growth. The plant height increased with higher concentration of GA₃

this might be due to the reason that when germination starts there is faster elongation and rapid proliferation of cells in growing portion of the plant results in encouragement of new growth leads to an absolute increase in plant height (Shruthi *et al.* 2016) (17).

It is cleared from the data pertaining to yield parameters that all the yield parameters were significantly influenced by foliar application of plant growth regulators (Table 1). Among different treatments of plant growth regulators, maximum root diameter (5.27 cm) was recorded under the treatments T₂ (GA₃ @ 100ppm) followed by GA₃ @ 50ppm (5.12 cm) as compared to other treatments. Similarly, maximum root weight (250.12 gm) was recorded in the treatment T₂ (GA₃ @ 100 ppm) followed by GA₃ @ 50 ppm (240. gm). But in case of MH, the more length of root (24.60cm) was recorded with the foliar application of lower concentration (MH @ 100 ppm) as compared to the higher one (MH @ 200 ppm) i.e (24.41cm). These findings are closely confirmatory with the findings of Karuppaiah *et al.* (10), Sadana *et al.* (18) and Pate *et al.* (14). The stimulating effect of GA₃ and NAA on root weight and root length might be due to fact that bioregulators particularly gibberellins are known to influence on cell division and cell enlargement (Kamijima, (9) and photosynthetic activity. Ganpathi *et al.* (8) reported that the radish yield component viz., root length, root diameter and fresh weight of root significantly increase due to application of plant growth regulators. Maleic hydrazide is well-known growth inhibitor so the higher concentration of MH could be less effective in respect to the root length as compared to the lower concentration. Root length found to be increase with increased concentration of GA₃ this might be due to the cell growth and cell elongation which results in elongation of root system.^[13]

Among all the bio regulators, the maximum weight of root per plant (250.12gm) was recorded with the foliar application of GA₃ @ 100 ppm, which was found statistically higher than all other treatments. Similarly, the significantly maximum root yield (380.86 q/ha) was found under the treatments T₂ (GA₃ @ 100 ppm) followed by GA₃ @ 50ppm (370.11q/ha). The findings of the study further confirmed by the findings of Singh and Rajodia (19), Parvez *et al.* (15) and Sadana *et al.* (18). Similarly, another researcher also observed significant improvement in root yield of radish when 50 ppm GA₃ was used as foliar application (Mishra and Nagaich (13). Patel *et al.*, (14) also reported that foliar application of GA₃ @ 20 ppm significantly increased root diameter (5.96 cm) and yield (536.66 q/ha) of radish. The Growth regulators namely, GA₃ and auxins have been found to enhance photosynthetic and enzymatic activity and also help in chlorophyll biosynthesis which could be the possible reason for higher root yield of radish.

Gibberellic acid and IAA have an ability to reduce the chlorophyll loss from lettuce leaves as suggested by Aharoni (1). reported that gibberellic acid stimulate rates of photosynthesis or enhances ultra-structural morphogenesis of plastids and it also help to enhance the *in vitro* activity of RUBP-carboxylase.

Table 1: Study of plant growth regulators on growth and yield parameters of radish (RaphanussativusL.)

| Treatments | Plant height (cm) | Number of leaves per plant | Leaf length (cm) | Root length (cm) | Root diameter (cm) | Root weight (g) | Yield (q/ha) |
|----------------------------|-------------------|----------------------------|------------------|------------------|--------------------|-----------------|--------------|
| T1 GA ₃ @50ppm | 36.80 | 24.41 | 33.43 | 20.39 | 5.12 | 240.72 | 370.11 |
| T2 GA ₃ @100ppm | 36.86 | 25.31 | 33.71 | 22.01 | 5.27 | 250.12 | 380.86 |
| T3 IAA@50ppm | 34.07 | 24.07 | 32.85 | 22.94 | 4.62 | 222.17 | 340.40 |
| T4 IAA@100ppm | 34.77 | 23.31 | 32.53 | 22.43 | 4.55 | 229.65 | 346.16 |
| T5 NAA@50ppm | 35.03 | 23.72 | 32.77 | 22.50 | 4.95 | 232.45 | 350.51 |
| T6 NAA@100ppm | 35.08 | 23.43 | 32.02 | 24.39 | 5.10 | 239.14 | 366.74 |
| T7 MH@100ppm | 32.85 | 23.83 | 31.77 | 24.60 | 4.30 | 217.21 | 331.03 |
| T8 MH@200ppm | 32.33 | 24.10 | 31.10 | 24.41 | 4.53 | 222.04 | 329.41 |
| T9 Control | 27.07 | 19.63 | 26.76 | 18.08 | 3.95 | 189.55 | 286.54 |
| C.D. (P=0.05) | 0.17 | 0.63 | 0.49 | 0.84 | 0.13 | 2.66 | 1.01 |

REFERENCES

- Aharoni, N. (1989). Interrelationship between ethyleneandgrowthregulatorsinthesenescence of lettuce leaf discs. *J. Plant Growth Regul.*; **8**: 309-317.
- Anonymous (2018). *Horticultural Statistics at a Glance*, Ministry of Agriculture & Farmers' Welfare, Government of India, KrishiBhawan, NewDelhi.
- Daviere, J.M. and Achard, P. (2013). Gibberellin signalling in plants. *Development*; **140**: 1147-1151.
- Dawuda,M.M.,Boateng,P.Y.,Hemeng,O.B.and Nyarko, G. (2011). Growth and yield response of carrot (*Daucuscarota*L.) to different rates of soil amendents and spacing. *J. Sci. Tech.*; **31** (2): 11-20.
- Dev, P., Prakash, S., Kumar, J., Singh, M., Kumar, V. and Bhadana, G. (2017). Impact of foliar application of bioregulators and nutrients on the vegetative parameters of okra (*Abelmoschuseculentus*(L.) Moench) cv. ParbhaniKranti. *Prog. Agric.* **17** (1): 107-112.
- Dhariwal,M.S. (2012). *Handbook of Vegetable Crops*. Kalyani Publishers, New Delhi, India.
- Fisher, R. A. (1958). *Statistical Methods for Research Workers* (13th ed.) *Edinburgh: Oliver and Boyd*.
- Ganpathi, M., Hiremath, S.M., Uppar, D.S., Cheeti, M.B. and Koti R.V. (2008). Influences of organics, plant growth regulatorand micronutrient on yield and yield component in carrot. *Intern. J. Plant Sci*; **3** (2): 342-344.
- Kamijima, O. (1981). Consideration on the mechanism of expression of dwarf gene on cell elongationinparenchymaofinternode.*Japanese J. Breeding*; **31** :302-315.
- Karuppaiah, P., Kumar, S.R. andSendhilnathan, R. (2007). Effect of growth regulators on growth, physiological and yield attributes of radish. *Advances in Plant Sci.*; **20** (2) : 457-459.
- Krishna,H. (2012). Physiology of fruit production. *Studium Press Pvt Ltd*. pp.178.
- Little, C.H.A and MacDonald, J.E. (2003). Effects of exogenous gibberellin and auxin on shoot elongation and vegetative bud development in seedlings of *Pinussylvestris*and *Piceaglauca*. *Tree Physiology*; **23** (2): 73-83.
- Mishra, P. and Nagaich, K.N. (2019). Response of gibberellic acid on growth and yield of radish (*Raphanussativus*L.) cv. Japanese White; *J. Pharmaco. and Phytochem.*; **8** (2) :1521-1523.
- Patel, R., Tomar, B.S. and Khan, R. (2017). Response of radish (*Raphanussativus*L.)to different concentration of Gibberellic acid. *Intern. J. Chemical Studies*; **5** (6) : 458-459.
- Pervez,M.A.,Ayub,C.M.Saleem,A.L.,Virk,N.A. and Mahmood, N. (2004). Effect of spacing on growth and yield of radish (*Raphanussativus*L.). *Intern. J. Agric. & Biol.*; **6** (3):504-506.
- Radish seeds are used for making soap and for edible purpose because its seeds contain oil (George, 1999).
- Shruthi HT, Srinivasa V, Ibaad MH. Influence of spacing and growth regulators on growth, flowering, seed yield and quality of radish (*Raphanussativus* L.) Cv. PusaChetki. *Research in Environment and Life Sciences*.2016; 9(3):288-291
- Sadana, A.P., Raju, S.S., Kumar, P.V. and Sunitha,C.(2015).Effectofspacingandseed soaking with GA₃ on growth, yield and quality of radish (*Raphanussativus*L.). *Andhra Pradesh J.Agric. Sci.* **1** (4): 80-84.
- Singh, M. and Rajodia, R.B. (2001). Effect of gibberellic acid on growth and yield attributes of radishvarieties.*CropRes.Hisar*; **21**(2):174-177.
- Singh M, Singh RP, Yadav HS. Response of growth regulators and their method of application on yield of radish. *BhartiyaKrishiAnusandhan Patrika*.1989; 4(2):84-88.

AvinashTomer, et. al. "Study of Plant Growth Regulators on Growth and Yield Parameters of Radish (*Raphanussativus*L.)." *International Journal of Engineering Science Invention (IJESI)*, Vol. 10(10), 2021, PP 58-60. Journal DOI- 10.35629/6734