The Pharma Innovation Journal 2022; 11(3): 1411-1414

www.ThePharmaJournal.com

The Pharma Innovation

ISSN (E): 2277- 7695
ISSN (P): 2349-8242
NAAS Rating: 5.23
TPI 2022; 11(3): 1411-1414

www.thepharmajournal.com
Received: 13-12-2021
Accepted: 28-01-2022

**Priyanka Jain**
Department of Vegetable Science, College of Agriculture, Indore, Madhya Pradesh, India

**Diksha Tembare**
Department of Vegetable Science, College of Agriculture, Indore, Madhya Pradesh, India

**Ajay Kumawat**
Department of Vegetable Science, College of Agriculture, Indore, Madhya Pradesh, India

**NK Gupta**
Department of Vegetable Science, College of Agriculture, Indore, Madhya Pradesh, India

**Corresponding Author:**
**Priyanka Jain**
Department of Vegetable Science, College of Agriculture, Indore, Madhya Pradesh, India

# Role of growth stimulators, retardants and inhibitors in combination with micronutrients on growth and development of okra [*Abelmoschus esculentus* (L.) Moench] Variety Arka Anamika

**Priyanka Jain, Diksha Tembare, Ajay Kumawat and NK Gupta**

**Abstract**
The experiment detail for the present investigation was comprised of 13 treatments in Randomized Block Design with three replication, to record morphological, phonological, Growth analysis, yield its attributes and economics. The growth stimulators, Retardant and micronutrient significantly improved the plant height and highest branches of okra. The maximum plant height and highest branches per plant was recorded when sprayed NAA @ 100 ppm followed by $Feso_4$ (0.5%). The higher number of leaves and leaf area ($cm^2$) were recorded at NAA @ 100 ppm followed by $Feso_4$ (0.5%). Higher numbers of internodes, higher length of internodes and plant stem diameter were recorded in foliar spray of NAA @ 100 ppm followed by $Feso_4$ (0.5%). The foliar spray of growth regulators, retardants and micronutrient was recorded in significant improvement in dry weight okra. The days taken to first flowering differed significantly the different treatment. The number of flower bud, the fruit length, fruit width, fruit per plant, fruit yield per plot, and fruit weight and crop growth character are differed significantly in different treatment combination.

**Keywords:** Randomized block design, growth regulators, micronutrients, retardant etc.

## Introduction
Okra [*Abelmoschus esculentus* (L.) Moench] popularly known as 'Bhindi' (ladies' finger) is an economically important vegetable crop grown in tropical and sub-tropical parts of the world (Tindall, 1986) [1]. Okra having chromosome number = 130, belongs to the family Malvaceae. Several species of the genus Abelmoschus are grown in many parts of the world among them *Abelmoschus esculentus* (L.) Moench is most commonly cultivated in Asia and has a great commercial demand due to its nutritional values. Okra is a multipurpose crop due to its various uses of the fresh leaves, buds, flowers, pods, stems and seeds. Okra immature fruits (green seed pods), which are consumed as vegetables, can be used in salads, soups and stews, fresh or dried, fried or boiled. Okra fruits are cooked and consumed in a variety of ways. It has been reported to have an average nutritive value (ANV) of 3.21 which is higher than tomato, eggplant and most of cucurbits except bitter gourd (Grubben, 1977) [2]. Okra [*Abelmoschus esculentus* (L.) Moench] popularly known as 'Bhindi' (ladies' finger) is an economically important vegetable crop grown in tropical and sub-tropical parts of the world (Tindall, 1986) [1]. Okra having chromosome number = 130, belongs to the family Malvaceae. Several species of the genus Abelmoschus are grown in many parts of the world among them *Abelmoschus esculentus* (L.) Moench is most commonly cultivated in Asia and has a great commercial demand due to its nutritional values. Okra is a multipurpose crop due to its various uses of the fresh leaves, buds, flowers, pods, stems and seeds. Okra immature fruits (green seed pods), which are consumed as vegetables, can be used in salads, soups and stews, fresh or dried, fried or boiled. Okra fruits are cooked and consumed in a variety of ways. It has been reported to have an average nutritive value (ANV) of 3.21 which is higher than tomato, eggplant and most of cucurbits except bitter gourd (Grubben, 1977) [2]. The Plant growth regulators available are often inadequate in the plants. The specific quantities in the plants are directly responsible for the promotion, inhibition or otherwise modification in the physiological processes. (Kumar *et al.*, 2018) [12]. The role of plant growth regulators is enhancing the production and quality of crops. They can be divided into five classes i.e., Auxin, Gibberellins, Cytokinins, Abcissic acid and Ethylene. It is known to influence growth and development at very low concentration but inhibit plant growth and development at high concentration (Patel *et al.*, 2018) [11].

## Material and Method

The experiments were carried out during Kharif season 2018, at the research field, Department of Horticulture, College of Agriculture, Rajmata Vijayaraje Scindia Krishi Vishwa Vidyalaya, Indore, (M.P.). Indore is situated in Malwa Plateau in western part of M.P. at 22.43" N latitude and 75.66 "E longitudes with an altitude of 555.7 m above the mean sea level (MSL). It has sub-tropical climate having a temperature range from 29 $^0$C - 41 $^0$C as maximum and 7 $^0$C - 23 $^0$C as minimum in summer and winter season respectively. It is hottest during March to May while coolest in December and January. Relative humidity generally fluctuates between 30 to 85%. In this area, most of the rainfall is received during mid-June to early October while winter rains are occasional and uncertain. The average annual rainfall is 941 mm. The soil of experimental field was medium black clay in texture with uniform topography. The experimental area was ploughed and harrowed in order to bring the soil in well pulverized condition. Field was then laid out for the experiment as per plan. A dose at the rate of 100 kg N, 60 kg P2O5 and 80 kg K2O/ha along with 20 tonnes FYM/ha was applied. One third nitrogen and entire quantity of P, K and FYM was applied prior to sowing as basal dose. Remaining dose of nitrogen was applied in two splits at 30 and 60 days after sowing. The data recorded on various parameters such as morphological parameters like Plant height, Leaf area, Number of branches per plant, Number of internodes and length, Number of leaves per plant. Phonological parameters like Number of flower bud and fruits, Days taken to first picking Days to first flowering are recorded. Yield parameters like Fruit length, Fruit diameter, Fruit weight, Fruit yield per plant, Fruit yield per plot.

**Table 1:** Treatment details

| S. N. | Treatments (20,40,60, Days) | Symbol |
|---|---|---|
| 1 | NAA (50 ppm) followed by FeSO4 (0.5%) | T1 |
| 2 | NAA (100 ppm) followed by FeSO4 (0.5%) | T2 |
| 3 | NAA (50 ppm) followed by ZnSO4 (0.5%) | T3 |
| 4 | NAA (100 ppm) followed by ZnSO4 (0.5%) | T4 |
| 5 | Cycocel (1000 ppm) followed by FeSO4 (0.5%) | T5 |
| 6 | Cycocel (1500 ppm) followed by FeSO4 (0.5%) | T6 |
| 7 | Cycocel (1000 ppm) followed by ZnSO4 (0.5%) | T7 |
| 8 | Cycocel (1500 ppm) followed by ZnSO4 (0.5%) | T8 |
| 9 | TIBA (50 ppm) followed by FeSO4 (0.5%) | T9 |
| 10 | TIBA (100 ppm) followed by FeSO4 (0.5%) | T10 |
| 11 | TIBA (50 ppm) followed by ZnSO4 (0.5%) | T11 |
| 12 | TIBA (100 ppm) followed by ZnSO4 (0. 5%) | T12 |
| 13 | Control- Foliar application of Water | T13 |

## Result and Discussion

The higher plant height was observed in the treatment T2 (NAA 100 ppm) followed by FeSO4 (0.5%) while minimum plant height was recorded in $T_{13}$ control (water spray). The variation of plant height was due to different concentration level of growth hormone, retardant with micronutrients. The significant result found that the application of growth promotive substances. The increase in height of plant might be due to effective role of micronutrients. An active synthesis of tryptophan, an amino acid in the presence of FeSO4 and it is precursor of IAA which stimulates the growth of plant tissues. These results are in agreement with the finding, Satpute *et al.* (2013) [5]. The maximum number of leaves was recorded in the treatment T2 (NAA 100 ppm) followed by FeSO4 (0.5%) The increased number of leaves in these treatments might be due to rapid increase in cell division and cell elongation. This result is in agreement with the result found by Kokare *et al.* (2013) [6]. Similar the height number of branches was recorded in the treatment T2 (NAA 100 ppm) followed by FeSO4 (0.5%) while minimum was recorded in the treatment T13 (control - water). The growth retardant chemical cycocel was effective in suppressing apical dominance, thereby promoting the growth of axillary buds into new shoots. The results are in similar with the result found by Bhagure *et al.* (2013) [7]. The higher number of internodes and length of internodes was recorded in the treatment T2 (NAA 100 ppm) followed by FeSO4 (0.5%). The intermodal length was increased in concentration of NAA, the growth of internodes was higher mainly due to NAA which increase cell division and elongation in the apical meristem, Hence length of internodes was increased. NAA enhance internodal length by increased the cell division hence, it increased the number of internodes. Bhagure *et al.*, (2013) [7].

The higher leaf area and plant dry weight was recorded in the treatment T2 (NAA 100 ppm) followed by FeSO4 (0.5%) while, minimum was recorded in the treatment T13 (control). The foliar application of micronutrient improved the dry matter production because of easy availability and translocation of nutrients which enhanced the overall growth of plants and increased the dry matter production ultimately. Similarly, due to use of micronutrients significantly higher leaf area was recorded under soil application of FeSO4 (7.5 kg /ha). The higher leaf area was correlated with the physiological parameters pertaining to photosynthesis, stomata conductance and transpiration which exhibited significant increment with FeSO4 supplied through ferrous sulphate in soil (Sharma *et al.*, 2017 and Kokare *et al.* 2006) [10].

The days to 50% flowering and days taken to first picking was significantly decreased in T2 (NAA 100 ppm) followed by ZnSO4 (0.5%), while maximum was recorded in the treatment T13 (control). The increase in number of pickings might be due to early flowering and a greater number of nodes which might have accounted for more pods at less intervals of time. Similar result also found by Syed *et al.* (1997) [3].

The number of flower bud and fruit per plant was significantly influenced in T2 (NAA 100 ppm) followed by FeSO4 (0.5%). However, the minimum number of flower bud and fruits was recorded in T13 (control). The significant increase in number of fruits with foliar application of could be

attributed to increase in the number of branches plant$^{-1}$. The micronutrients play an important role in various physiological and biochemical processes and contributes to the growth of the meristematic region thereby, enhancing growth of plants. The growth regulators which are capable of redistribution of dry matter in the plant there by bringing about an improvement in yield which depends not only on the accumulation of photosynthetic during crop growth and development but also on its partitioning in the number of flowers due to the acceleration of auxiliary buds into new shoots providing extra sites for more flower. Similar result was observed by Surendra *et al*. (2006) [4]. The Significantly higher fruit length, fruit diameter and fruit weight were recorded in T2 (NAA 100 ppm) followed by FeSO4 (0.5%), while lower was observed under T13 (control water). This increase in number of fruit plant$^{-1}$ might be due to higher number of primary and secondary branches plant$^{-1}$ and due to higher values for various physiological parameters registered by this treatment. Similar result has been found by (Sharma *et al*., 2017 and Kokare *et al.* 2006) [10]. The increase in the size of fruit i.e. length and diameter might be a result of cell enlargement and cell elongation, which is caused by the supply of growth regulators within the plants. Similar use of micronutrients has been found significant increase fruit Characters associated with soil application of FeSO4 @ 50 kg/ha significantly increased the protein content at harvest. Similar results were reported by Sanodiya *et al.* (2017) and Ghritlahare *et al.* (2015) [9, 8].

**Table 2:** Effect of different Growth Stimulators, Retardants, Micronutrients and their combination on Morphology characters at various intervals of the crop stages

| S. No. | Treatment | Plant height (cm) | number of branches | Number of leaves per plant | Leaf area (cm$^2$) | Stem diameter (cm$^2$) | Number of internodes | Internodes length | Dry weight per plant (gm) |
|---|---|---|---|---|---|---|---|---|---|
| 1 | T1 | 37.35 | 3.20 | 8.83 | 230.37 | 3.07 | 5.95 | 2.71 | 15.06 |
| 2 | T2 | 40.67 | 4.02 | 9.81 | 233.12 | 3.45 | 6.46 | 3.22 | 17.28 |
| 3 | T3 | 37.85 | 3.19 | 8.75 | 230.31 | 3.08 | 6.00 | 2.64 | 15.25 |
| 4 | T4 | 39.69 | 3.82 | 9.54 | 232.33 | 3.32 | 6.26 | 3.17 | 16.65 |
| 5 | T5 | 36.66 | 3.07 | 8.10 | 229.21 | 2.90 | 5.58 | 2.41 | 13.99 |
| 6 | T6 | 35.46 | 2.98 | 8.15 | 229.06 | 2.85 | 5.42 | 2.33 | 13.33 |
| 7 | T7 | 36.70 | 3.04 | 7.98 | 229.07 | 2.89 | 5.53 | 2.42 | 14.07 |
| 8 | T8 | 35.75 | 2.96 | 8.12 | 228.89 | 2.93 | 5.47 | 2.36 | 13.27 |
| 9 | T9 | 37.56 | 3.19 | 8.66 | 230.39 | 3.04 | 5.80 | 2.83 | 15.41 |
| 10 | T10 | 38.54 | 3.54 | 9.11 | 230.85 | 3.14 | 6.02 | 2.96 | 15.98 |
| 11 | T11 | 37.87 | 3.19 | 8.55 | 230.13 | 3.03 | 5.83 | 2.71 | 15.27 |
| 12 | T12 | 38.89 | 3.70 | 9.27 | 231.88 | 3.22 | 6.13 | 3.07 | 16.43 |
| 13 | T13 | 32.02 | 2.84 | 6.50 | 225.33 | 2.79 | 4.88 | 2.20 | 10.39 |
| 14 | S.Em ± | 1.23 | 0.20 | 0.50 | 1.28 | 0.16 | 0.20 | 0.15 | 0.66 |
| 15 | CD (5%) | 3.59 | 0.58 | 1.46 | 3.76 | 0.48 | 0.58 | 0.43 | 1.94 |

**Table 3:** Effect of different Growth Stimulators, Retardants, Micronutrients and their combination on Phenological and yield characters at various intervals of the crop stages

| S. No. | Treatment | Days to 50% flowering | Days taken to first picking | Number of flower bud | Number of fruit per plant | Fruit Length (cm) | Fruit diameter (cm) | Fruit weight (gm) | Fruit yield Kg/plot |
|---|---|---|---|---|---|---|---|---|---|
| 1 | T1 | 38.37 | 41.50 | 18.98 | 16.86 | 13.75 | 4.09 | 13.88 | 3.85 |
| 2 | T2 | 37.33 | 40.34 | 22.21 | 20.25 | 14.61 | 4.47 | 14.55 | 4.22 |
| 3 | T3 | 38.54 | 41.42 | 18.65 | 17.86 | 13.68 | 4.05 | 13.94 | 3.99 |
| 4 | T4 | 37.46 | 40.43 | 20.26 | 19.21 | 14.29 | 4.38 | 14.36 | 4.15 |
| 5 | T5 | 39.18 | 42.05 | 18.10 | 14.88 | 13.60 | 3.65 | 12.44 | 3.59 |
| 6 | T6 | 39.74 | 42.19 | 17.89 | 13.59 | 13.42 | 3.83 | 11.60 | 3.54 |
| 7 | T7 | 39.65 | 42.26 | 18.28 | 14.79 | 13.46 | 3.58 | 12.44 | 3.55 |
| 8 | T8 | 39.25 | 42.22 | 17.81 | 13.50 | 13.35 | 3.76 | 11.84 | 3.42 |
| 9 | T9 | 38.86 | 41.25 | 18.51 | 17.22 | 13.12 | 4.11 | 13.14 | 3.72 |
| 10 | T10 | 38.35 | 40.64 | 19.18 | 18.02 | 13.85 | 4.21 | 14.11 | 3.98 |
| 11 | T11 | 38.78 | 41.21 | 18.78 | 16.44 | 13.28 | 4.17 | 13.67 | 3.83 |
| 12 | T12 | 37.88 | 40.50 | 19.41 | 18.31 | 14.11 | 4.27 | 14.26 | 4.08 |
| 13 | T13 | 41.46 | 44.52 | 14.47 | 11.17 | 11.84 | 2.96 | 10.40 | 2.92 |
| 14 | S.Em ± | 0.63 | 1.43 | 0.55 | 0.81 | 0.37 | 0.22 | 0.26 | 0.15 |
| 15 | CD (5%) | 1.86 | 4.19 | 1.61 | 2.39 | 1.07 | 0.65 | 0.77 | 0.44 |

**Table 4:** Effect of different treatments dry weight per plant and Number of internodes at various intervals of the crop stages

| S.N | Treatment | Dry weight per plant | | | | Number of internode | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | 20 DAS | 40 DAS | 60 DAS | Mean | 20 DAS | 40 DAS | 60 DAS | Mean |
| T1 | NAA (50 ppm) followed by FeSO4 (0.5%) | 6.47 | 13.24 | 25.48 | 15.06 | 3.03 | 6.47 | 8.34 | |
| T2 | NAA (100 ppm) followed by FeSO4 (0.5%) | 7.76 | 16.62 | 27.46 | 17.28 | 3.58 | 7.13 | 8.67 | |
| T3 | NAA (50 ppm) followed by ZnSO4 (0.5%) | 6.40 | 13.57 | 25.77 | 15.25 | 2.98 | 6.55 | 8.46 | |
| T4 | NAA (100 ppm) followed by ZnSO4 (0.5%) | 7.56 | 15.73 | 26.65 | 16.65 | 3.39 | 6.84 | 8.56 | |
| T5 | Cycocel (1000 ppm) followed by FeSO4 (0.5%) | 6.06 | 12.47 | 23.44 | 13.99 | 2.54 | 6.37 | 7.84 | |
| T6 | Cycocel (1500 ppm) followed by FeSO4 (0.5%) | 6.26 | 11.37 | 22.34 | 13.33 | 2.46 | 6.30 | 7.51 | |
| T7 | Cycocel (1000 ppm) followed by ZnSO4 (0.5%) | 6.15 | 12.61 | 23.45 | 14.07 | 2.57 | 6.40 | 7.62 | |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| T8 | Cycocel (1500 ppm) followed by ZnSO4 (0.5%) | 5.86 | 11.69 | 22.26 | 13.27 | 2.49 | 6.34 | 7.59 | |
| T9 | TIBA (50 ppm) followed by FeSO4 (0.5%) | 6.86 | 14.10 | 25.26 | 15.41 | 2.73 | 6.50 | 8.15 | |
| T10 | TIBA (100 ppm) followed by FeSO4 (0.5%) | 7.39 | 14.45 | 26.11 | 15.98 | 3.14 | 6.58 | 8.32 | |
| T11 | TIBA (50 ppm) followed by ZnSO4 (0.5%) | 7.06 | 13.65 | 25.08 | 15.27 | 2.82 | 6.45 | 8.21 | |
| T12 | TIBA (100 ppm) followed by ZnSO4 (0. 5%) | 7.44 | 15.58 | 26.27 | 16.43 | 3.25 | 6.69 | 8.45 | |
| T13 | Control- Foliar application of Water | 5.17 | 10.33 | 15.67 | 10.39 | 2.27 | 5.95 | 6.41 | |
| | S.Em ± | 0.23 | 0.57 | 1.19 | 0.66 | 0.25 | 0.17 | 0.17 | |
| | CD at 5% | 0.67 | 1.68 | 3.48 | 1.94 | 0.73 | 0.51 | 0.49 | |

## References


1. Tindall H. Vegetables in the Tropics. London; Macmillan Press Ltd., 1986, 533p.
2. Grubben CJH. Okra in Tropical vegetables and their resources, IBPGR, Rome, 1997, 111-114.
3. Syed Asghar Hussain SA, Nawab Ali. Effect of exogenous growth regulators on growth, flowering and yield of okra (*Abelmoschus esculentus* L). Sarhad Journal of Agriculture. 1997;13(5):449-453.
4. Surendra P, Nawalagatti CM, Chetti MB, Hiremath SM. Effect of plant growth regulators and micronutrients on yield and yield components in okra. Karnataka Journal of Agricultural Sciences. 2006;19(2):264-267.
5. Satpute NR, Surywanshi LB, Waghmare JM, Jagtap PB. Response of summer Okra (cv. Phule Utkarsha) to iron, zinc and boron in inceptisol. The Asian Journal of Horticulture. 2013;8(2):541-546.
6. Kokare RT, Bhalerao RK, Prabhu T, Chavan SK, Bansode AB, Kachare GS. Effect of plant growth regulators on growth, yield, and quality of okra [*Abelomoschus esculentus* (L.) Moench]. Agri. Sci. Digest. 2013;26(3):178-181.
7. Bhagure YL, Tamble TB. Effect of seed soaking and foliar sprays of plant growth regulators on germination, growth and yield of okra var. Parbhani Kranti. Asian Journal of Horticulture. 2013;8(2):399-402.
8. Ghritlahare Akhilesh, Mishra SP. Determination of key parameters and it influence on mix proportioning of self-compacted concrete. International Journal of Advanced Engineering Research and Studies, 2015, E-ISSN2249–8974.
9. Kanhaiyalal Sanodiya, Geeta Pandey, Saklesh, Pranjal Singh Rajput, Ajay Kuma Verma. Effect of seed treatment with growth regulator on growth, yield and seed quality parameters of okra. International journal of chemical studies. 2017;5(5):2301-2304.
10. Raunak Sharma, Bairwa LN, Ola AL, Kumari Lata, Atma Ram Meena. Effect of zinc on growth, yield and quality of okra. Journal of Pharmacognosy and Phytochemistry. 2017;7(1):2519-2521.
11. Patel HB, Saravaiya SN, Patil SJ, Chhatrola HN, Vashi JM, Sravani V. Influence of PGRs on growth parameters and plant growth analysis of cluster bean cv. Pusa Navbahar. Intern. J. Chem. Stud. 2018a;6(3):922-926
12. Kumar S, Singh R, Singh V, Singh MK, Singh AK. Effect of plant growth regulators on growth, glowering, yield and quality of tomato. J. Pharm. Phytoche. 2018;7(4):41-44.