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Effect of Growth Regulator on Growth, Yield and Seed Quality Parameters of Okra (Abelmoschus esculentus L.): cv. Utkal Gaurav

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A B S T R A C T

The present investigation entitled, “Effect of growth regulator on growth, yield and seed quality parameters of okra (Abelmoschus esculentus L.): cv. Utkal Gaurav.” Was carried at Central Farm, Breeder Seed Production Unit, College of Agriculture, OUAT during Kharif season of 2015-2016. Foliar spray two growth regulator like GA₃, NAA were spray at different concentration and 20th, 40th, 60th day after sowing. Result revealed foliar spray is significantly positive impact on growth regulator in growth parameters i.e. T₄ (NAA 50 @ ppm at 20days spray) was first flowering (31.47 days), 50 per cent flowering (40.40 days), first harvesting (37.02 days), minimum days to fruit maturity (66.02 days), yield parameter T₅ (NAA 50 ppm at 40 days spray) maximum fruit weight (16.47 gm.), dry fruit weight (5.61 gm.), fruit length (16.58 cm), fruit girth (6.46 cm), fruit yield per plot (4.83 kg), yield per hectare (96.63 q/ha.), and seed quality parameter T₆ (NAA @ 50 ppm spray at 60 DAS) recorded maximum root length (9.40cm), fresh seedling weight (6.43 g), dry seedling weight (26.77mg) and Vigour index type-I & II (2210.29 and 22.58) and as compare to other treatment and T9 (control).

Keywords: Effect, Growth regulator growth yield seed quality parameter of okra.

Introduction

Okra, lady’s finger (Abelmoschus esculentus L.), 2n = 2x = 130 Okra is an important vegetable crop having good demand throughout the year for its tender fruits and consider as one of the major vegetable crops of the tropical and subtropical parts of the world.

Plant growth regulators are the organic substances which are produced naturally in plants, synthesized in one part and usually translocated to other part where every small quantity influence the growth and other physiological function of the plants (Taiz et al., 2010).

Okra is a heavy yielder and high remunerative crop but sometimes grower suffer with recurring economic loss due to poor plant vigour, low pod setting and small pod size. Therefore, besides varieties evaluation, standardization of location specific approach
is essential to improve productivity of okra. Growth regulator is considered to be a key factor in vegetative growth, flowering, pod setting and high yield in okra (Singh et al. 2012).

The growth regulators and their uses are considered to be the most technical and scientific in crop production. The selection of right hormones, their appropriate concentration and their time and method of application are most essential. Even the same growth regulator in different concentrations brings about the different results. Due to high rise in the prices of chemical fertilizers and also to maintain the eco-system of soil, it has become necessary to use eco-friendly chemicals like GA\textsubscript{3}, NAA and IBA. Hence the present investigation has been undertaken to find out the effect of certain growth regulators \textit{viz.}, GA\textsubscript{3} 50 ppm, NAA 50 ppm were spray at different day after sowing 20\textsuperscript{th}, 40\textsuperscript{th}, 60\textsuperscript{th} day after sowing.

**Materials and Methods**

The experiment was conducted during kharif season 2015-16 was carried at Central Farm, Breeder Seed Production Unit, College of Agriculture, OUAT. The experiment was laid out in Randomized Block Design with three replications and nine treatments including growth regulators as GA\textsubscript{3} 50 ppm, NAA 50 ppm were spray at 20\textsuperscript{th}, 40\textsuperscript{th}, 60\textsuperscript{th} day after sowing and one control. The seeds of okra were sown in the main field with recommended package of practices. Observations are collected on the growth of crop in ten randomly selected plants in an each plot.

Treatment details given are below.

T\textsubscript{1} = Foliar spray of 50 PPM GA\textsubscript{3} at 20 DAS
T\textsubscript{2} = Foliar spray of 50 PPM GA\textsubscript{3} at 40 DAS
T\textsubscript{3} = Foliar spray of 50 PPM GA\textsubscript{3} at 60 DAS
T\textsubscript{4} = Foliar spray of 50 PPM NAA at 20 DAS
T\textsubscript{5} = Foliar spray of 50 PPM NAA at 40 DAS
T\textsubscript{6} = Foliar spray of 50 PPM NAA at 60 DAS
T\textsubscript{7} = Foliar spray of GA\textsubscript{3} 20 PPM at 20 DAS + NAA 50 PPM at 40 DAS
T\textsubscript{8} = Foliar spray of NAA 40 PPM at 20 DAS + GA\textsubscript{3} 50 PPM at 40 DAS
T\textsubscript{9} = Control

The vigour index values were calculated as per the method prescribed by Abdul-Baki and Anderson (1973) and expressed in whole number.

Vigour index Type-I = Germination (%) x mean seedling length (cm)

Vigour index Type-II = Germination (%) x mean seedling dry weight (g)

**Results and Discussion**

The results obtained from the present investigation as well as relevant discussion have been summarized under following heads

**Effect of foliar spray of growth regulators on different growth parameters in Okra cv. Utkal Gaurav**

The data presented in (Table 1) revealed the significant effect of growth regulators on growth parameters at T\textsubscript{2} (GA\textsubscript{3} @ 50 ppm at 40 DAS) where maximum plant height (107.97cm) was recorded, followed by T\textsubscript{5} (NAA @ 50 ppm at 40 DAS) plant height (104.31cm). Minimum plant height was recorded on T\textsubscript{9} (control treatment). Similar result was reported by Rani et al., (2013),
Patil and Patel 2010 and The application of growth promoters increased the plant height due to enhancement in the cell division and cell elongation at shoot apex and such effect was due to increase in photosynthetic efficiency (Taiz et al., 2010). The maximum stem girth (5.68 cm) was recorded in T4 (NAA @ 50 ppm spray at 20 DAS) while lowest (5.22 cm), was recorded T9 (control). It may be due to decreased apical growth and increase in translocation of food reserves to stem. Similar result was observed with promoters in onion by Shakhada and Gajipara (1998). Among all the treatment minimum days to first flowering (31.47 days), 50 percent (40.40 days) and first harvesting (37.02 days), days to require to fruit maturity T4 (NAA @ 50 ppm sprays at 20 DAS) was recorded and followed by T7 (GA3 @ 20 ppm at 20 DAS + NAA @ 50 ppm at 40 DAS).

Similar result was reported by Chandiniraj et al., (2016) where spray of NAA @ 75 ppm had earliest flowering in chilli. Similar results have been confirmed by Natesh et al., (2005). The increased synthesis of auxin in the root tissue by their enhanced activity due to the application of NAA and their simultaneous transport to the axillary buds would have resulted in a better sink for the mobilization of photo-assimilates at a faster rate. This would have helped in the early transformation from the vegetative phase to reproductive phase. The induction of early flower bud initiation might be influenced by narrowing of the significant accumulation of carbohydrates. The result on earliness in flowering in this experiment goes with the reports by Singh and Mukherjee (2000) in chilli.

Effect of growth regulators on yield parameters of okra cv. Utkal Gaurav

Significant maximum (Table 2) fruit length (16.58 cm), fruit girth (6.46 cm), fresh fruit weight (16.47gm) and dry fruit weight (5.61) were recorded in the T5 (NAA @ 50 ppm at 40 DAS) followed by T7 (GA3 @ 20 ppm at 20 DAS and NAA @ 50 ppm at 40 DAS). Similar results were reported by Chattopadhyay and Sen (1974). The increased fruit length, girth may be due to the increase in number of leaves resulting in increased photosynthesis and maximum distribution of assimilates. These results have been reported by Kore et al., (2003).

**Table 1** Effect of foliar spray of growth regulators on different growth parameters in Okra cv. Utkal Gaurav

| Treatment                          | Final height (cm) | Stem girth (cm) | Days to first flowering | Days to 50 per cent flowering | First harvesting | Days require to fruit maturity |
|------------------------------------|-------------------|-----------------|-------------------------|-------------------------------|-----------------|-------------------------------|
| T1- GA3 @ 50 ppm at 20 DAS         | 101.32            | 5.54            | 33.11                   | 43.91                         | 40.27           | 68.51                         |
| T2- GA3 @ 50 ppm at 40 DAS         | 107.97            | 5.47            | 35.87                   | 45.15                         | 42.24           | 71.30                         |
| T3- GA3 @ 50 ppm at 60 DAS         | 98.23             | 5.26            | 38.58                   | 47.94                         | 44.16           | 72.47                         |
| T4-NAA @ 50 ppm at 20 DAS          | 100.75            | 5.68            | 31.47                   | 40.40                         | 37.02           | 66.02                         |
| T5-NAA @ 50 ppm at 40 DAS          | 104.31            | 5.46            | 36.04                   | 45.36                         | 43.08           | 71.13                         |
| T6-NAA @ 50 ppm at 60 DAS          | 97.97             | 5.37            | 38.17                   | 47.87                         | 44.23           | 70.90                         |
| T7-GA3 @ 20 ppm at 20 DAS + NAA @ 50 ppm at 40 DAS | 103.31 | 5.63 | 33.08 | 42.05 | 39.72 | 68.14 |
| T8-NAA @ 40 ppm at 20 DAS + GA3 @ 50 ppm at 40 DAS | 100.24 | 5.51 | 33.96 | 44.24 | 40.87 | 70.23 |
| T9-Control                        | 95.07             | 5.22            | 39.04                   | 49.33                         | 45.14           | 76.34                         |
| Mean                               | 101.02            | 5.46            | 34.59                   | 45.14                         | 41.86           | 70.56                         |
| SEm (±)                            | 1.75              | 0.13            | 0.92                    | 1.12                          | 0.86            | 0.72                          |
| CD 5%                              | 5.24              | 0.39            | 2.77                    | 3.35                          | 2.57            | 2.15                          |

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### Table 2: Effect of foliar spray of growth regulators on different yield parameters in okra cv. Utkal Gaurav

| Treatment                                      | Fruit fresh weight (g) | Dry fruit weight (g) | Fruit length (cm) | Fruit girth (cm) | Fruit yield/plot (kg) | Yield (q/ha) |
|------------------------------------------------|------------------------|----------------------|-------------------|------------------|-----------------------|--------------|
| T<sub>1</sub> - GA<sub>3</sub> @ 50 ppm at 20 DAS | 14.47                  | 4.47                 | 14.72             | 5.75             | 4.43                  | 88.62        |
| T<sub>2</sub> - GA<sub>3</sub> @ 50 ppm at 40 DAS | 14.33                  | 4.53                 | 13.91             | 6.25             | 4.58                  | 91.52        |
| T<sub>3</sub> - GA<sub>3</sub> @ 50 ppm at 60 DAS | 12.87                  | 4.41                 | 12.72             | 5.51             | 4.33                  | 86.56        |
| T<sub>4</sub> - NAA @ 50 ppm at 20 DAS          | 15.01                  | 4.73                 | 14.38             | 5.36             | 4.32                  | 86.44        |
| T<sub>5</sub> - NAA @ 50 ppm at 40 DAS          | 16.47                  | 5.61                 | 16.58             | 6.46             | 4.83                  | 96.63        |
| T<sub>6</sub> - NAA @ 50 ppm at 60 DAS          | 12.22                  | 4.39                 | 13.07             | 5.62             | 4.35                  | 87.12        |
| T<sub>7</sub> - GA<sub>3</sub> @ 20 ppm at 20 DAS + NAA @ 50 ppm at 40 DAS | 15.14                  | 4.97                 | 14.98             | 5.97             | 4.63                  | 92.60        |
| T<sub>8</sub> - NAA @ 40 ppm at 20 DAS + GA<sub>3</sub> @ 50 ppm at 40 DAS | 12.67                  | 4.35                 | 13.51             | 5.68             | 4.42                  | 88.40        |
| T<sub>9</sub> - Control                         | 11.67                  | 4.03                 | 10.89             | 4.97             | 3.97                  | 79.37        |
| Mean                                           | 13.87                  | 4.61                 | 13.86             | 5.73             | 4.42                  | 88.58        |
| SEM±                                           | 0.31                   | 0.17                 | 0.34              | 0.18             | 0.13                  | 2.01         |
| CD %                                           | 0.94                   | 0.50                 | 1.02              | 0.55             | 0.40                  | 6.02         |

### Table 3: Effect of foliar spray of growth regulators on different seed quality parameters in Okra cv. Utkal Gaurav

| Treatment                                      | Test weight (g) | Shoot length (cm) | Root length (cm) | Fresh seedling weight (g.) | Dry seedling weight (mg.) | Vigour index type - I | Vigour index type – II |
|------------------------------------------------|-----------------|-------------------|------------------|---------------------------|--------------------------|-----------------------|------------------------|
| T<sub>1</sub> - GA<sub>3</sub> @ 50 ppm at 20 DAS | 7.00            | 15.40             | 8.43             | 5.89                      | 24.33                    | 2184.50               | 22.30                  |
| T<sub>2</sub> - GA<sub>3</sub> @ 50 ppm at 40 DAS | 7.17            | 15.58             | 8.56             | 5.81                      | 24.50                    | 2092.21               | 21.23                  |
| T<sub>3</sub> - GA<sub>3</sub> @ 50 ppm at 60 DAS | 6.67            | 16.95             | 8.83             | 6.15                      | 26.03                    | 2122.47               | 21.43                  |
| T<sub>4</sub> - NAA @ 50 ppm at 20 DAS          | 6.33            | 14.83             | 8.67             | 5.69                      | 24.57                    | 1950.50               | 20.39                  |
| T<sub>5</sub> - NAA @ 50 ppm at 40 DAS          | 8.03            | 16.33             | 8.90             | 6.09                      | 25.70                    | 2161.71               | 22.02                  |
| T<sub>6</sub> - NAA @ 50 ppm at 60 DAS          | 6.93            | 16.81             | 9.40             | 6.43                      | 26.77                    | 2210.29               | 22.58                  |
| T<sub>7</sub> - GA<sub>3</sub> @ 20 ppm at 20 DAS + NAA @ 50 ppm at 40 DAS | 7.67            | 15.97             | 7.93             | 6.03                      | 24.57                    | 2079.30               | 21.38                  |
| T<sub>8</sub> - NAA @ 40 ppm at 20 DAS + GA<sub>3</sub> @ 50 ppm at 40 DAS | 6.33            | 16.52             | 7.17             | 5.12                      | 23.27                    | 2029.52               | 19.94                  |
| T<sub>9</sub> - Control                         | 5.33            | 13.68             | 5.21             | 4.75                      | 19.93                    | 1561.64               | 16.48                  |
| Mean                                           | 6.83            | 15.79             | 8.12             | 5.77                      | 24.41                    | 2043.57               | 20.86                  |
| SEM±                                           | 0.11            | 0.14              | 0.10             | 0.07                      | 0.19                     | 50.87                 | 0.44                   |
| CD 5%                                          | 0.32            | 0.22              | 0.56             | 0.43                      | 0.29                     | 152.50                | 211.99                 |
| CD 1%                                          | -               | 0.30              | 0.77             | 0.60                      | 0.40                     | 211.99                | 1.85                   |

Fruit yield of 4.83 kg/plot and 96.63 (q/ha) fruit yield per hectare was recorded in T<sub>3</sub> (NAA @ 50 ppm at 40 DAS) followed by T<sub>7</sub> (GA<sub>3</sub> @ 20 ppm at 20 DAS and NAA @ 50 ppm at 40 DAS) were superior to control. It is a well-established fact by several workers that increased yield is product of increased yield parameters like fruit length, width and number of seeds. The increased yield with NAA is due to greater mobilization of reserved food materials to fruit and seed, which ultimately increase the fruit length, width and number of seeds. Similar results were reported by Kishan et al., (2001).
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Among the growth regulator (Table 3) maximum test weight was maximum (8.03gm) in T₅ (NAA @ 50 ppm at 40 DAS). Similar results were reported by Godara et al., (2013). This may be due to better diversion of photosynthesis to the fruit and better accumulation of food reserves in the seeds. Similar results have been confirmed by Bhat and Singh (1997).

Growth regulator improved the seed quality parameters over control i.e. T₆ (NAA @ 50 ppm spray at 60 DAS) recorded maximum root length (9.40cm), fresh seedling weight (6.43 g), dry seedling weight (26.77 mg) and Vigour index type-I & II (2210.29 and 22.58). Similar result was reported by Premchand et al., (2013). Seeds become more viable and vigorous due to proper development of embryo and endosperm by proportionate use of growth regulators. Similar result was recorded in Khan et al., (2013).These results are in conformity with that of Baruah & Paul (1997) and Velumani and Ramaswamy (1977)

On the basis of results obtained during the present investigation reveals that use of growth regulators (foliage spray) enhanced the growth, yield and seed quality parameters of okra So, it can be concluded that foliar spray of T₅ (NAA @ 50 ppm 40 days after sowing) is most effective in enhancing the yield of okra and improved the seed quality parameters T₆ NAA @ 50 ppm spray at 60 DAS.

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