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# Effect of production and plant growth regulators on quality and economics of hybrid okra [*Abelmoschus esculentus* (L.) Moench]

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**ABSTRACT :** An experiment was conducted to evaluate the effect of plant growth regulatos on quality and economics of hybrid okra cv. MAHYCO HYBRID-10 at Bihar Agricultural College, Sabour during the *Kharif* season, 2006. The crop was foliar sprayed twice, first at 3-4 leaf stage and second after one month of the first spray with 2, 4-D (5, 10, 15 and 20 ppm), NAA (25, 50, 75 and 100 ppm) and CCC (400, 600, 800 and 1000 ppm). The maximum dry weight (14.76%) and TSS (4.14 Brix) of fruits were obtained with 2, 4-D at 5 ppm. The highest protein (1.98%) and ascorbic acid (28.84 mg/100g) were recorded with the application of CCC at 1000 ppm and 600 ppm, respectively. Plant sprayed with 800 ppm CCC fetched the maximum return of Rs. 54951=00 per hectare whereas, the highest benefit cost ratio of 1:2.67 was obtained with application of NAA at 75 ppm. Therefore, spraying of cycocel at 800 ppm or NAA 75 ppm in okra crop is beneficial for getting higher quality and net return.

**Key Words :** Okra, Plant growth regulators, Protein, NAA, 2, 4-D and CCC

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Okra a native of Ethiopia is one of the most important warm season as well as rainy season fruit vegetable grown in tropical and sub-tropical areas. It is grown mainly for its tender non-fibrous edible fruit extensively throughout India. It is very popular among the farmers because of easy in growing and has wider adaptability range. It has good nutritional value. The green tender fruits are rich source of iodine content and vitamins. It also contains protein, calcium, iron, magnesium, ascorbic acid and other minerals.

Growth substances enabled man to control the plant growth and has become the greatest tool in the hands of horticulturists for increasing yield and better quality of vegetables. The use of plant growth regulators has gained a separate field of study besides varietal, manurial and cultural methods of vegetables improvement. Among the various methods, spraying of the whole plant at different stages with growth regulators has been found to be effective and useful because this method can regulate the growth and development of plants from their active phase. The process of absorption is direct to the foliage and inflorescence. The information's on okra as influenced by growth regulators in eastern zone of Bihar is meagre. Hence, the present investigation was undertaken to study the effect of plant growth regulators on hybrid okra.

## RESEARCH PROCEDURE

The experiment was conducted at Bihar Agricultural College, Sabour during July, 2006. The experiment was laid out in R.B.D. with three replications having thirteen treatments. The treatments comprised of the combination of four concentrations of each plant growth regulators. The plant growth regulators used were 2, 4-D (5, 10, 15 and 20 ppm), NAA (25, 50, 75 and 100 ppm), CCC (400, 600, 800 and 1000 ppm). Seeds were sown at the spacing of 60 cm x 45 cm in a plot of 3.00 m x 2.70m. The hybrid used was Mahyco hybrid-10. The crop was fertilized with 12 ton FYM along with NPK @ 120:60:60kg/ha. The plant growth regulators solutions were used as whole plant spray. The first spray was done at 3-4 leaf stage and second spraying was done after one month of first spray.

## RESEARCH ANALYSIS AND REASONING

The plant growth regulators significantly increased the

percentage of dry weight of fruits, TSS, protein and ascorbic acid content in fruits (Table 1). However. the moisture content in fruits was also increased to an extent which did not touch the level of significance.

The maximum dry weight (14.76%) in fruits was recorded under 2, 4-D at 5 ppm which was statistically similar to 2, 4-D (10ppm), NAA (25 ppm) and all the concentrations of CCC. The spray application of 2, 4-D at 5 ppm significantly gave the highest TSS (4.14 Brix) in fruit which was at par with all the concentrations of CCC. It was also observed that every increase in concentration of CCC from 400 to 1000 ppm increased the TSS content of fruits. Therefore, it can be inferred that 5 ppm 2, 4-D was the effective treatment in increasing the TSS content in comparison to other plant growth regulators under test.

The spray application of CCC at 1000 ppm produced significantly maximum protein (1.98%) content in fruits, however, it was being at par with CCC at 600 and 800 ppm as well as NAA at 50 and 75 ppm. So far the performance of three growth regulators, CCC had better effect followed by NAA in respect of protein content. The growth regulator treatments increased the vigorous root system resulting in greater uptake of nitrogen and other nutrients which probably reflected in the increased protein content as well as dry weight of fruits and thereby decreasing the moisture percentage. This is in conformity with results of Rai *et al.* (1998), Ganiger *et al.* (2002) and Anamika and Dhaka (2003). Auxin increases the nucleic acids in the plants which increases the protein content of fruits (Siburger and Skoog, 1953). The other possible explanation of increased protein content may be that the plant under these treatments being physiologically more active and due to the

**Table 1 : Effect of plant growth regulators on quality of hybrid okra**

| Treatments | Moisture in fruit (%) | Dry weight of fruit (%) | TSS content in fruit (Brix) | Protein content in fruit (%) | Ascorbic acid content in fruit (mg/100g) |
|---|---|---|---|---|---|
| 2,4-D(5 ppm) | 85.24 | 14.76 | 4.14 | 1.76 | 28.10 |
| 2,4-D(10 ppm) | 86.10 | 13.90 | 3.78 | 1.75 | 27.26 |
| 2,4-D(15 ppm) | 86.38 | 13.72 | 3.80 | 1.74 | 26.70 |
| 2,4-D(20 ppm) | 86.35 | 13.65 | 3.77 | 1.85 | 27.80 |
| NAA(25 ppm) | 86.10 | 13.90 | 3.85 | 1.78 | 27.32 |
| NAA(50 ppm) | 86.48 | 13.52 | 3.73 | 1.85 | 28.15 |
| NAA(75 ppm) | 87.25 | 12.75 | 3.85 | 1.86 | 26.64 |
| NAA(100 ppm) | 87.35 | 12.65 | 3.44 | 1.90 | 28.00 |
| CCC(400 ppm) | 86.10 | 13.90 | 3.86 | 1.80 | 27.10 |
| CCC(600 ppm) | 85.95 | 14.05 | 3.91 | 1.94 | 28.84 |
| CCC(800 ppm) | 85.80 | 14.20 | 3.96 | 1.96 | 28.17 |
| CCC(1000 ppm) | 85.75 | 14.25 | 3.97 | 1.98 | 27.38 |
| Control | 86.80 | 13.20 | 3.38 | 1.68 | 20.74 |
| C.D. (P=0.05) | NS | 0.97 | 0.26 | 0.12 | 1.48 |
| C.V. (%) | 5.40 | 4.17 | 4.06 | 3.84 | 4.29 |

NS=Non-significant

**Table 2 : Effect of plant growth regulators on economics of hybrid okra production**

| Treatments | Fruit yield (q/ha) | Gross income (Rs./ha) | Net return (Rs./ha) | B:C ratio |
|---|---|---|---|---|
| 2,4-D(5 ppm) | 79.58 | 55,706=00 | 36,306=00 | 1.87 |
| 2,4-D(10 ppm) | 98.75 | 69,125=00 | 49,715=00 | 2.56 |
| 2,4-D(15 ppm) | 90.32 | 63,224=00 | 43,804=00 | 2.25 |
| 2,4-D(20 ppm) | 88.53 | 61,971=00 | 42,541=00 | 2.18 |
| NAA(25 ppm) | 82.01 | 57,407=00 | 37,917=00 | 1.94 |
| NAA(50 ppm) | 92.95 | 65,065=00 | 45,475=00 | 2.32 |
| NAA(75 ppm) | 103.41 | 72,387=00 | 52,697=00 | 2.67 |
| NAA(100 ppm) | 95.21 | 66,647=00 | 46,857=00 | 2.36 |
| CCC(400 ppm) | 89.53 | 62,671=00 | 42,081=00 | 2.04 |
| CCC(600 ppm) | 93.96 | 65,772=00 | 44,582=00 | 2.10 |
| CCC(800 ppm) | 109.63 | 76,741=00 | 54,951=00 | 2.52 |
| CCC(1000 ppm) | 105.60 | 73,920=00 | 51,530=00 | 2.30 |
| Control | 69.97 | 48,979=00 | 29,861=00 | 1.56 |

action of growth regulators in a catalytic form might have invigorated the enzymes responsible for the enzymes of more protein, starch, cellulose etc in the fruits.

Ascorbic acid content of fruits increased appreciably as a results of growth regulators. The highest ascorbic acid content (28.84mg/100g) was obtained in the fruits under the influence of CCC at 600 ppm which was at par with CCC at 800 and 1000 ppm, 2, 4-D (5 and 20 ppm) and NAA (50 and 100 ppm). Therefore, the spray of okra plants with CCC at 600 ppm was found the most beneficial as regards to increase the ascorbic acid content of okra fruits. This is in agreement with the findings of Chhonkar *et al.* (1977) and Mishra *et al.* (1984). This increase in the ascorbic acid content of fruits may be due to the catalytic influence of the growth regulators on the biological synthesis of ascorbic acid from sugars (Shanmugavalu *et al.*, 1973).

Plant spray with 800 ppm CCC fetched the maximum net return of Rs. 54,951=00 per hectare followed by 75 ppm NAA and 1000 ppm CCC gaining a net return of Rs. 52,697=00 and Rs. 51,530=00 per hectare, respectively (Table 2). The concentrations of plant growth regulators caused an increased in net return over the control, but the differences were much narrower. Benefit cost ratio exhibited a marked variation among the treatments. Plant spray with NAA at 75 ppm having a benefit: cost ratio of 1:2.67 scored over all other treatments in this regard. Plant spray with 10 ppm 2, 4-D, which was next to 75 ppm NAA had a benefit: cost ratio of 1:2.56. And was superior to plant spray with 800 ppm CCC showing benefit cost ratio of 1:2.52. In comparison to CCC the spraying with 2, 4-D or NAA gained better benefit cost ratio, the only reasons being the higher cost involved in application of CCC.

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