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EFFECT OF PLANT GROWTH REGULATORS ON GROWTH AND YIELD OF OKRA (*ABELMOSCHUS ESCULENTUS* L.)

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Abstract

The field experiment was conducted on field of Department of Argil. Botany, College of Agriculture, Parbhani (M.S.), India; during *kharif* season of 2015-2016 to study of plant growth regulators on growth and yield of okra (*Abelmoschus esculentus* L.). The experiment was laid out in randomized block design with nine treatments with three replications. The treatments consisted of two growth regulators *viz*., gibberrllic acid (50, 100, 150 and 200 ppm) and naphthalene acetic acid (50, 100, 150 and 200 ppm). Results revealed that the application of plant growth regulators significantly increased morpho-physiological traits *viz*. plant height, number of branches per plant, yield per plant and plot as compared to control.

Key words : Okra, plant growth regulator, GA_3, NAA.

Introduction

Okra is a tall growing, annual, semi woody and warm season crop. It is self-pollinated crop, but occasionally up to 20% cross pollination occurs by insects. The okra flowers blossoms only one day. Okra pods are harvested when they reach the maximum size but still tender (may be 60-180 days from sowing) around 5-10 days after opening of flower depending on the cultivar grown (Adetuyil *et al*., 2008).

Okra pods are considered nutritious, providing some human supplementary, vitamins such as vitamin C, A, B-complex, calcium, potassium, iron and other minerals (Lee *et al*., 1990; Adebooye and Opunta, 1996). Okra pod contains many nutritional contents which important for human health. One hundred gram of fresh pod has around; moisture (89.6 percent), K (103 mg), Ca (90 mg), Mg (43 mg), P (56 mg), vitamin C (18 mg) and some important metals such as iron and aluminum (Markose and Peter, 1990). The application of plant growth regulators is known as one of the most effective treatments used now a days in agriculture, productivity of horticulture crop productions were increased by application of different growth regulators (Jafarullah *et al.,* 2007). Regulators mainly regulate the plant physiological and biochemical processes. They play a major role in dormancy, organ size, crop improvement, flowering and fruit set, regulation of chemical composition of plants and control of mineral uptake from the soil (Nickell *et al*., 1978). Some of them are naturally occurring, organic substances that affect the plant growth when used at low concentrations and sometimes they act as inhibitors at high concentrations. There are some reports, which indicate that application of growth regulators improved the growth and yield of vegetables (Mukhtar, 2008; Hernandez, 1997).

Plant growth regulators could manage vegetative and reproductive growth balance. PGRs are known as chemical messengers because they are produced in one part of plant and affect on another part. Exogenous application of plant growth regulators improved the yield production and fruit quality of horticulture crops. At the cell level, hormones join to a protein receptor that sends a signal down a transduction pathway to switch on exacting genes. Throughout transcription and translation this guides to production of an enzyme protein, which actually reasons the change in plant growth (Arteca, 1996; Wolfe, 1993). The phytohormones auxinaffects approximately all developmental processes in plants including fruit improvement. However, auxin is produced in meristems and young leaves and moves to other parts of the plant in a polar fashion. In addition, auxin is synthesized in mature leaves but very little amount. Auxins play an important

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role in cell elongation, encourage cell division while Cytokinins induce differentiation of xylem and phloem in vascular tissues (Jacobs, 1952), flower initiation, sex determination, fruit development, parthenocarpic fruits and promote cell wall loosening at very low concentrations. (Vanderhoff and Dute, 1981). Plant growth regulators have many beneficial effects on plant growth. One of them is increased the activity of antioxidant enzymes such as ascorbate peroxidase, glutathione reductase, catalase and peroxidase, which defends plant from chilling (Dwyer *et al*., 1995), high temperature, photo inhibition (Fletcher *et al.,* 2000), SO_2 salinity (Sadhu and Gupta, 1997), ozone injury (Fletcher *et al*., 2000). Moreover, PGRs induce changes in the contents of cytokinins, ethylene and polyamines (Fletcher *et al*., 2000). The second group of plant growth regulators is gibberellins, which is natural plant hormone. Gibberellins were named after a genus of fungi that cause "foolish seedling" disease (Yabuta, 1935). There are more than 100 distinct gibberellins produced primarily in roots & young leaves but GA_3 or gibberellic acid is the most popular available form. GA_3 has many effects on plant growth such as enhance stem and internodeselongation, produce seed germination, enzyme production during germination and fruit settingand growth (Davies *et al*., 1995; Karssen *et al*., 1989).

Materials and Methods

The experiment entitled "To study the effect of plant growth regulators on growth and yield of okra (*Abelmoschus esculentus* L. Moench) were conducted at Department of Agriculture Botany, Vasantarao Naik Marathwada Krishi Vidyapeeth, Prabhani (M.S.), India during *kharif* season of the year 2015-2016. The details of materials used and methods adopted during the course of present investigation are given in this chapter and summarized as below. Okra variety 'Parbhani ok' was sown at 45cm × 30cm spacing during *Kharif* season with a net plot size of $2.6m^2$. The experiment was laid out in Randomized Block Design with three replications and eight treatments including plant growth regulators as GA_3 (50, 100, 150, 200 ppm), NAA (50, 100, 150, 200 ppm) and one control (foliar spray).

Results and Discussion

The data revealed that the plant height increased at all stages except 30 days after sowing (table 1). At 45 days plant height was highest in treatment $\mathbf{T_4}$ (GA 200 ppm) fallowedby treatment $\mathbf{T_7}$ (NAA 150 ppm) and significantly superior over $\mathbf{T_9}$ (control) fallowed bystatistically at par with treatment $\mathbf{T_2}$ (GA 100 ppm), $\mathbf{T_3}$ (GA 150 ppm) and $\mathbf{T_6}$ (NAA 100) and $\mathbf{T_8}$ (NAA 200 ppm), respectively.

At 60 days plant height was highest in treatment $\mathbf{T_2}$ (GA 100 ppm) and treatment $\mathbf{T_7}$ (NAA 150 ppm) and statistically the treatment of GA and NAA were found to be significantly superior over $\mathbf{T_9}$ (control) and statistically at par with treatment T_4 (GA 200 ppm), $\mathbf{T_3}$ (GA150 ppm) and $\mathbf{T_4}$ (GA 50ppm) and treatment $\mathbf{T_5}$ (NAA 50 ppm) and treatment $\mathbf{T_8}$ (NAA 200 ppm), respectively. At 75 days treatment $\mathbf{T_2}$ (GA 100 ppm) and treatment ($\mathbf{T_7}$) NAA 150 ppm were found to be significantly superior over $\mathbf{T_9}$ (control) and statistically at par with treatment $\mathbf{T_3}$ (GA 150ppm), $\mathbf{T_1}$ (GA 50 ppm) and fallowed by treatment $\mathbf{T_6}$ (NAA 100 ppm) respectively. At 90 days treatment $\mathbf{T_2}$ (GA 100 ppm) and treatment $\mathbf{T_7}$ (NAA 150 ppm) were found to be significantly superior over treatment $\mathbf{T_9}$ (control) and statistically at par with treatment $\mathbf{T_x}$ (GA 50 ppm).

The data on mean number of branches per plant as influenced by gibberellic acid and naphthalene acetic acid were presented in (table 2). The data revealed that the number of branches per plant increased at all stages except 30 days after sowing. At 45, 60, 75 days number of branches per plant was highest in treatment $\mathbf{T_2}$ (GA

Table 1 : Mean height of plant (cm).

S. no.	Treatments	30 DAS	45 DAS	60 DAS	75 DAS	90 DAS
$\mathbf{T_1}$	GA 50 ppm	19.27	33.33	63.10	76.20	78.47
$\mathbf{T_2}$	GA 100 ppm	20.53	39.07	72.83	81.00	82.93
$\mathbf{T_3}$	GA 150 ppm	17.07	38.47	63.73	76.40	76.43
$\mathbf{T_4}$	GA 200 ppm	19.60	41.63	68.27	74.67	76.00
$\mathbf{T_5}$	NAA 50 ppm	17.73	29.20	63.93	71.10	70.77
$\mathbf{T_6}$	NAA 100 ppm	18.93	33.80	62.40	73.67	70.40
$\mathbf{T_7}$	NAA 150 ppm	22.00	39.20	73.33	80.13	84.30
$\mathbf{T_8}$	NAA 200 ppm	20.07	35.63	68.97	70.70	73.73
$\mathbf{T_9}$	Control	17.67	21.87	44.39	50.83	62.00
	S.E.±	1.52	2.61	3.37	1.76	1.91
	C.D.at 5%	N.S.	7.82	10.11	5.27	5.73

Table 2 : Mean number of branches per plant.

S. no.	Treatments	30 DAS	45 DAS	60 DAS	75 DAS	90 DAS
T_1	GA 50 ppm	1.40	1.80	2.40	2.53	2.66
T_2	GA 100 ppm	1.50	2.70	3.16	3.13	3.16
T_3	GA 150 ppm	1.27	1.50	2.33	2.56	2.53
T_4	GA 200 ppm	1.20	1.66	2.23	2.46	2.60
T_5	NAA 50 ppm	1.20	1.63	2.36	2.66	2.70
T_6	NAA 100 ppm	1.20	1.53	2.33	2.63	2.63
T_7	NAA 150 ppm	1.27	2.90	3.06	3.23	3.40
T_8	NAA 200 ppm	1.20	1.76	2.40	2.40	2.13
T_9	Control	1.25	1.13	1.80	1.90	1.60
	S.E.±	0.14	0.18	0.16	0.12	0.12
	GD.at 5%	N.S	0.56	0.49	0.37	0.38

Table 3 : Mean pod yield per plant and mean pod yield per plot.

S. no.	Treatments	Pod yield/plant (gm)	Pod yield/plot (Kg)
T_1	GA 50 ppm	221.57	8.39
T_2	GA 100 ppm	236.70	8.85
T_3	GA 150 ppm	199.17	7.43
T_4	GA 200 ppm	197.98	7.90
T_5	NAA 50 ppm	216.62	8.36
T_6	NAA 100 ppm	207.01	8.41
T_7	NAA 150 ppm	226.60	9.57
T_8	NAA 200 ppm	197.53	7.62
T_9	Control	177.90	7.16
	S.E. ±	1.71	0.01
	C.D.at 5%	5.14	0.04

100 ppm) and treatment T_7 (NAA 150 ppm) and were found to be significantly superior over treatment T_9 (Control).

At 90 day number of branches per plant was highest in treatment T_2 (GA 100 ppm) and treatment T_7 (NAA 150 ppm) were found to be significantly superior over treatment T_9 (control) and followed by treatment T_1 (GA 50).

The data on mean pod yield per plant as influenced by gibberellic acid and naphthalene acetic acid were presented in (table 3). The data revealed that the pod yield per plant increased by all the treatment as compare to T_9 (control). With incremental application of gibberellic acid and naphthalene acetic acid, numbers of pod were found increased. The highest pod yield per plant was found in treatment T_2 (GA 100 ppm) and T_7 (NAA 150 ppm) significantly superior over treatment T_9 (Control) and fallowed by treatment T_1 (GA 50 ppm). The data on mean pod yield per plot as influenced by gibberellic acid and naphthalene acetic acid were presented in table 3. The data revealed that the pod yield per plot increased by all the treatment as compare to control. With incremental application of gibberellic acid and naphthalene acetic acid, numbers of pod per plot were found increased. The highest pod yield per plot was found in treatment T_2 (GA 100 ppm) and T_7 (NAA 150 ppm) significantly superior over treatment T_9 (Control) and fallowed by treatment T_1 (GA 50 ppm) and treatment T_6 (NAA 100 ppm), respectively.

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