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GROWTH AND YIELD RESPONSES OF *ABELMOSCHUS ESCULENTUS* (OKRA) TO GIBBERELLIC ACID

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ABSTRACT

The effect of Gibberellic acid (GA) on the growth characteristics and yield components of *Abelmoschus esculentus* was studied. Plants were sprayed thrice with four concentrations (0, 100, 150 and 200 ppm) of GA at fortnightly intervals. Application of GA to okra plants increased significantly the total dry weight of plant and fruit length at all the concentrations used. The levels of 150 and 100 ppm of GA significantly increased the plant height, number of internodes, shoot dry weight,number ef flowers, number of fruits and consequently the fruit yield. Internode length increased in 150 and 200 ppm treated plants. Leaf area and dry weight per fruit were increased significantly at 150 ppm level but the root dry weight decreased significantly by the treatment. GA treatment delayed the flower initiation and fruit setting. No significant effect was observed in the number of seeds per fruit.

INTRODUCTION

Okra (*Abelmoschus esculentus*) is cultivated in Pakistan mainly for the seed pods which are used as a vegetable of summer season. The present average yield of okra pod is quite low. There is an urgent need of boosting up the production and quality of this vegetable. The application of GA to this plant will result in vigorous growth, more yield and good quality of vegetable. Growth regulators are known to influence morphological and physiological changes in plants. Gibberellic acid (GA) is one of the regulators which have been applied in various ways to a number of plant species. Such chemicals do not become the part the living cell substances but influence the growth, structure and function through their presence as activators generally and sometimes they act

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as inhibitors at certain concentrations. The most striking response of various plant species has been to increase the plant height, number of internodes, leaf area, dry weight of shoot and dry weight of plant (Smith, 1967; Selman and Bora, 1968 and Khan and Rashid, 1983) and decreases the root dry weight (Chhonkar and Singh, 1964 and Khan and Rashid, 1983). GA treatment increased the flower formation, number, length of fruit and yield of okra plants (Nandpuri and Randhawa, 1969,and Pal *et al.*, 1970)and increased the number of pods, yield per plant and total yield of gram plants (Khan and Rashid, 1983).

The present paper, therefore, reports the growth and yield response of *Abelmoschus esculentus* plants to GA.

MATERIALS AND METHODS

The seeds of *Abelmoschus esculentus* var. Ahmadabadi were sown in the experimental area of the University of Agriculture, Faisalabad. The design of the experiment was completely randomised with three replications. The size of the individual plot was 5 x 2½ meter. The row to row distance was 70 cm and plant to plant was 20 cm. In each replication the plants of three sub-plots were sprayed thrice with 100, 150 and 200 ppm GA at fortnightly intervals and those of the fourth with distilled water were kept as control. Four harvests were carried out at fortnightly intervals. At each harvest three plants from each treatment were harvested at random and the data for growth characters were recorded. Ten plants from each treatment were ear-marked to study the number of flowers, fruits and other yield characters. Data for different characters were analysed statistically by the analysis of variance (Fisher, 1958) and effect of treatments and harvests were compared by the Duncan's New Multiple Range Test (LeClarg *et al.*, 1962).

RESULTS AND DISCUSSION

GA treatment (spray) to *Abelmoschus esculentus* plants results in significant increase in total dry weight of plant at the three concentrations used (Table 1 and 1a). Plant height, number of internodes and dry weight of shoot were increased significantly in plants treated with 150 and 100 ppm, while

Table 1. *Effect of GA on the vegetative characters of Abelmoschus esculentus*

Character	Treatment (ppm)	Harvest-1	Harvest-2	Harvest-3	Harvest-4
Plant height (cm)	0	5.07*a	20.17 a	32.97 c	35.97 c
	100	4.27 a	20.03 a	42.13 b	48.70 b
	150	5.07 a	25.83 a	53.27 a	79.33 a
	200	4.57 a	22.83 a	38.30 bc	36.80 c
Number of internodes	0	1.0 a	6.33 a	9.67 a	10.00 c
	100	1.0 a	7.00 a	11.00 a	12.67 b
	150	1.0 a	7.33 a	11.33 a	15.00 a
	200	1.0 a	6.00 a	10.00 a	10.67 c
Internode length (cm)	0	0.57 a	3.19 a	3.42 a	3.63 b
	100	0 53 a	3.33 a	3.83 a	4.13 b
	150	0.60 a	3,53 a	4.71 a	5.34 a
	200	0.50 a	3.90 a	3.81 a	4.31 b
Leaf area (sq. cm)	0	1.13 a	34.74 a	83.36 ab	104.96 a
	100	0.80 a	31.84 a	100.27 ab	108.36 a
	150	1.39 a	41.43 a	104.99 a	127.61 a
	200	1.02 a	18.78 a	78.68 b	80.76 b
Dry weight of shoot (gm)	0	0.03 a	0.83 a	4.00 c	6·79 b
	100	0.04 a	1.40 a	7.86 b	12.27 a
	150	0.03 a	2.40 a	9.23 a	13.30 a
	200	0.02 a	1.60 a	5.60 c	6.70 b
Dry weight of root (gm)	0	0.005 a	0.43 a	1.57 a	2.90 a
	100	0.004 a	0.33 a	0.93 b	2.27 bc
	150	0.007 a	0.23 a	0.73 b	1.87 c
	200	0.006 a	0.17 a	2.00 a	2.53 ab
Total dry weight of plant (gm)	0	0.04 a	1.77 a	5.63 b	8.83 b
	100	0.03 a	1.83 a	9.20 a	10.03 b
	150	0.04 a	2.00 a	9.47 a	15.83 a
	200	0.03 a	0.97 a	6.53 b	14.53 a

internode length increased at 150 and 200 ppm GA as compared to control. The maximum increase in plant height, number of internodes, length of internodes and dry weight of shoot was observed in plants treated with 150 ppm GA. Plant height and shoot dry weight were influenced by the treatment in third and fourth harvest. The results of the present investigation agree with the findings of Burkovac *et al.* (1957), Mittal (1967), Selman and Bora (1968) and Khan and Rashid (1983). They reported increase in growth parameters when the foliar applications of GA were applied to tomatoes, dahlia, coleus blumei, brussels sprouts and gram plants, repectively.

Table 1a. *Treatment means*

GA concentration (ppm)	Plant height (cm)	Number of internodes per plant	Internode length (cm)	Leaf area per plant (sq. cm)	Shoot dry weight (gm)	Root dry weight (gm)	Total plant dry weight (gm)
0	23.54*c	6.75b	2.70c	55.98b	3.1835c	1.2261a	4.07c
100	28.78b	7.92a	2.96bc	60.32ab	5.3924b	0.8844c	5.27b
150	40.88a	8.67a	3.55a	68.86a	6.2420a	0.7101c	6.84a
200	25.63bc	6.92b	3.13b	44.81c	3.4811c	1.1764b	5.52b

*Means with the same letter are not significantly different at $P<0.05$.

The results of the present investigation indicated that leaf area was increased significantly at 150 ppm,while it decreased significantly at 200 ppm GA as compared to control. The difference among control and 100 ppm and 150 and 100 ppm was not significant. Similar results were also reported by Moh and Alan (1967) who observed that the dwarf mutant beans developed much larger with light green leaves. These findings were contray to those of Selman and Bora (1968) who recorded reduction in unit leaf area. The root dry weight decreased significantly by this treatment in the present investigation. The maximum decrease was observed in 150 ppm GA treated plants. Similar results were also recorded by Chhonkar and Singh (1964) and Khan and Rashid (1983) who reported that root growth was inhibited and root dry weight decreased by the application of GA on late drum-head cabbage and gram plants, respectively.

GA treatment in this investigation has shown pronounced effects on the yield characteristics of okra (Table 2). Fruit length increased significantly by the application of GA at the three concentrations used. The number of flowers and fruits per plant and consequently the fruit yield increased significantly by the application of GA at 150 and 100 ppm while dry weight per fruit was increased significantly in 150 ppm treated plants. These results are in agreement with Nandpuri and Randhawa (1969) and Pal *et al.* (1970); they reported that 100 ppm GA treatment to okra plants increased significantly the flower formation, number and length of fruit, and yield. Khan and Rashid (1983) reported that GA at 100 ppm level increased the number of pods, yield per plant and total yield of gram. The treatment of okra plants in this investigation with 200, 150 and 100 ppm GA delayed the flowering and fruit set by one to four days.

Table 2. *Effect of GA on reproductive characters of Abelmoschus esculentus*

Treatment (ppm)	No. of flowers/ plant	No. of fruits/ plant	Averagelength of fruits/ (cm)	Dry weight per fruits/ (gm)	No. of seeds per fruit	Fruit yield/ ten plants (No.)
0	14*b	10.90 b	13.52 c	5.00 b	43.07 a	109 b
100	17 a	14.50 a	15.35 a	5.95 b	50.20 a	145 a
150	21 a	15.90 a	15.83 a	6.41 a	53.60 a	159 a
200	15 b	12.40 b	14.33 b	4.94 c	46.27 a	124 b

*Means with the same alphabet are not significantly different at $P<0.05$.

These results are contrary to the findings of Burkovac *et al.* (1957) who reported that flowers and fruit set occurred earlier than in untreated tomato plants at 100 and 25 ppm, respectively. Number of seeds per fruit was not influenced by the treatment. The differences may be due to variation in dosage, method of application and sensitivity of the experimental material to GA.

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