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EFFECT OF PLANT GROWTH REGULATORS ON GROWTH AND YIELD ATTRIBUTES OF CUCUMBER (*Cucumis sativus* L.)

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ABSTRACT

A field experiment was conducted at Main Agricultural Research Station, University Agricultural Sciences, Dharwad, during rabi, 2009, to study the effect of plant growth regulators on total dry weight, leaf area, crop growth rate and fruit yield in cucumber cv. Belgaum Local. Observations recorded on various growth parameters showed that growth regulators had a significant effect on leaf area, total dry weight and absolute growth rate while CCC @ 250 and 500 ppm decreased leaf area. GA_3 @ 50 ppm significantly increased all the growth parameters at later stages which in turn increased the yield.

KEYWORDS: Growth parameters, total growth rate, growth regulators, leaf area

INTRODUCTION

Cucumber (*Cucumis sativus* L.) is one of the most important and popular vegetable crops belonging to the family Cucurbitaceae. The fruits are highly nutritive and have very high water content and very low calories. The fruit is used as a vegetable or salad. It is rich in minerals, thiamine, niacin and vitamin C. (0.38 g, 0.3 mg, 0.2 mg and 78 mg, respectively per 100 g of edible fruit). Fruits consist about 80 percent of edible portion which contains 95% water, 0.7% protein, 0.1% fat, 3.4% carbohydrates, 0.4% fiber and 0.4% ash (Aykroyd, 1963).

It is an ideal summer crop chiefly grown for its edible tender fruits preferred as salad ingredient, pickles, dessert fruit and as a cooked vegetable. Its high water content makes it diuretic. Cucumber has a cleansing action within the body by removing accumulated pockets of old waste material and chemical toxins. It also helps in the treatment of arthritis, since it helps eliminate uric acid. Its low calorie makes it perfect food for diet. Cucumber is a women's friend when they are on a diet but also for its cosmetic properties.

Plant growth regulators (PGRs) are organic compounds, other than nutrients that modify plant physiological processes. PGRs, called biostimulants or bioinhibitors act inside plant cells to stimulate or inhibit specific enzymes or enzyme systems and thus regulate plant metabolism. They normally are active in low concentrations in plants. About sixty plant regulators are commercially being used and several of them have reached considerable importance in crop production. Growth regulators include both growth promoters and retardants which have shown to modify the canopy structure and other yield attributes.

Though the plant growth regulators have great potentialities to influence plant growth and morphogenesis, its application and actual assessments etc. have to be judiciously planned in terms of optimal concentrations, stage of application, species specificity, seasons, etc. which constitute the major impediments in PGRs applicability. In view of their wide spectrum effectiveness on every aspect of plant growth, even a modest increase of 10-15 percent could bring about an increment in the gross annual productivity by 10-15 million tons. With this background, the present investigation was carried out with the objective to find out the effect of plant growth regulators on leaf area, total dry weight, absolute growth rate and fruit yield in cucumber.

MATERIALS AND METHODS

A filed experiment was conducted at Main Agricultural Research Station, University Agricultural Sciences, Dharwad during *rabi* 2009 with an objective to find out the influence of plant growth regulators on total leaf area, dry weight, absolute growth rate and yield in cucumber (*Cucumis Sativus*) cv. Belgaum Local. The experiment consists of nine treatments having two growth promoters *viz.*, gibberrellic acid (50 and 100 ppm), naphthalene acetic acid (50 and 100 ppm), a retardant CCC (250 and 500 ppm), salicylic acid (500 and 1000 ppm) and a control. The experiment was laid out in randomized block design with three replications on black clay loam soil. The spacing adopted was 2.0 m (between rows) and 0.75 m (within rows) with a plot size of 6.0 m x 4.5 m.

The total dry weight (vine + leaf + fruit) was recorded at 40, 55 and 70 DAS. Leaf area per plant was worked out by leaf disc method (Vivekanandan *et al.*, 1972) on dry weight basis and expressed in cm^2 per plant. The absolute growth rate was calculated at 40-55 and 55-70 DAS using the formula given by Radford (1967). The fruit yield at physiological maturity was recorded from the fruits harvested from net plot in each replication and the average of three replications was expressed as t/ha.

RESULTS AND DISCUSSION

It has been observed in the present study that the application of plant growth regulators had a profound influence on assimilatory surface area (Table 1). Significant differences were noticed among the treatments among the treatments at all the stages. The leaf area increased from 40 to 70 DAS. GA_3 @ 50 ppm recorded maximum leaf area at all the stages. The leaf area was decreased by the application of growth retardant, CCC as compared to all other treatments whereas; growth regulators maintained a higher leaf area at latter stage of the crop growth. This could be attributed to the stimulatory effect of the plant growth regulators on cell division and cell enlargement, which lead to enhanced leaf area and hence influenced the growth and development.

The data on total dry matter (TDM) in Table 2 indicated significant differences between the treatments at all the stages. The TDM increased from 40 to 70 DAS in all the treatments. The maximum TDM was observed at 70 DAS with all the growth regulator treatments. Among the treatments, at 55 DAS, GA_3 @ 50 ppm recorded maximum TDM (59.2) followed by CCC @ 250 and 500 ppm which did not differ significantly with each other. The rest of the treatments showed a significant increase in TDM and they were on par with each other. However, control recorded significantly lower TDM compared to all the treatments. A similar trend was noticed at 70 DAS with GA_3 @ 50 ppm showing highest TDM (56.3) followed by CCC @ 250 and 500 ppm. Control continued to record minimum TDM. This increase in TDM may be attributed to an increased leaf area, LAI and LAD. The significant increase in TDM due to growth regulator application indicated the role of growth regulators in translocation of photoassimilates from leaves and vines to developing fruits and thereby enhancing the fruit yield in cucumber. A similar increase in dry weight in cucumber due to GA_3 application was also observed by Vadigeri *et al.* (2001).

The absolute growth rate (AGR) presented in Table 3 indicated an increase in value and reached its peak at 40-55 DAS and declined gradually thereafter towards maturity. Such a decline could be attributed to decrease in rate of dry matter production due to senescence and shading. The rapid increase in AGR observed under the effect of growth regulators over that of control might be due to higher production of dry matter due to increased photosynthetic activities coupled with increased cell multiplication.

The number of fruits per plant was significantly higher with the foliar application of GA_3 @50 ppm followed by CCC @ 500 ppm. The fruit yield was also significantly higher with the foliar application of GA_3 @ 50 ppm followed by CCC @ 500 ppm and the lowest fruit yield was recorded in control. Similar results were also reported by Dostogir *et al.,* (2006) in bittergourd. The increase in fruit yield by GA_3 is probably due to an increase in carbohydrate metabolism and accumulation of carbohydrates (Mishra *et al*., 1972) as well as auxin directed mobilization of metabolites from source to sink (Weaver, 1973 and Vasantkumar and Sreekumar, 1981).

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Table 1. Influence of plant growth regulators on leaf area (d m^2 $plant^{-1}$) at different growth stages in cucumber

Treatments	Days after sowing (DAS)		
	40	55	70
T_1 - GA$_3$ (50 ppm)	31.53	57.37	61.26
T_2 - GA$_3$ (100 ppm)	30.98	53.32	55.13
T_3 - NAA (50 ppm)	29.60	54.84	57.51
T_4 - NAA (100 ppm)	29.38	55.74	58.26
T_5 - CCC (250 ppm)	28.21	45.64	48.56
T_6 - CCC (500 ppm)	27.56	43.72	47.10
T_7 - Salicylic acid (500 ppm)	28.83	52.18	55.68
T_8 - Salicylic acid (1000 ppm)	27.65	49.63	52.65
T_9 - Control	27.26	47.82	51.40
Mean	28.90	51.14	54.17
S.Em±	0.29	0.09	0.39
CD (5%)	0.87	0.06	1.18

Table 2. Influence of plant growth regulators on total dry weight (g $plant^{-1}$) at different growth stages in cucumber

Treatments	Days after sowing (DAS)		
	40	**55**	**70**
T_1 - GA$_3$ (50 ppm)	20.8	59.2	63.8
T_2 - GA$_3$ (100 ppm)	19.3	57.4	61.7
T_3 - NAA (50 ppm)	18.4	56.4	60.8
T_4 - NAA (100 ppm)	20.4	57.1	61.4
T_5 - CCC (250 ppm)	20.8	58.9	63.4
T_6 - CCC (500 ppm)	20.6	59.0	63.5
T_7 - Salicylic acid (500 ppm)	18.1	56.5	60.1
T_8 - Salicylic acid (1000 ppm)	18.0	55.5	57.9
T_9 - Control	17.8	54.5	56.3
Mean	19.4	57.2	60.9
S.Em±	0.76	1.12	0.48
CD (5%)	2.28	3.35	1.45

Table 3. Influence of plant growth regulators on absolute growth rate (g plant^{-1} day^{-1}) at different growth stages in cucumber

Treatments	**Days after sowing (DAS)**	
	40-55	**55-70**
T_1 - GA$_3$ (50 ppm)	2.56	0.31
T_2 - GA$_3$ (100 ppm)	2.54	0.29
T_3 - NAA (50 ppm)	2.53	0.29
T_4 - NAA (100 ppm)	2.45	0.28
T_5 - CCC (250 ppm)	2.54	0.30
T_6 - CCC (500 ppm)	2.56	0.30
T_7 - Salicylic acid (500 ppm)	2.56	0.24
T_8 - Salicylic acid (1000 ppm)	2.50	0.16
T_9 - Control	2.44	0.12
Mean	2.52	0.25
S.Em±	0.10	0.08
CD (5%)	NS	0.26

Table 4. Influence of plant growth regulators on yield and yield components at harvest in cucumber

Treatments	Number of fruits per plant	Fruit yield (Kg plant^{-1})	Fruit yield (t ha^{-1})
T_1 - GA_3 (50 ppm)	8.7	1.71	11.41
T_2 - GA_3 (100 ppm)	7.9	1.66	11.07
T_3 - NAA (50 ppm)	7.7	1.65	11.01
T_4 - NAA (100 ppm)	8.4	1.68	11.21
T_5 - CCC (250 ppm)	8.4	1.69	11.27
T_6 - CCC (500 ppm)	8.6	1.70	11.34
T_7 - Salicylic acid (500 ppm)	7.6	1.62	10.81
T_8 - Salicylic acid (1000 ppm)	7.5	1.61	10.74
T_9 - Control	7.1	1.42	9.47
Mean	7.9	1.64	10.92
S.Em±	0.13	0.01	0.17
CD (5%)	0.34	0.02	0.52