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Research Article

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Study of Influence of Plant Growth Regulators (PGRs) on Yield Attributing Characters in Cucumber

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ABSTRACT

A field study was conducted during summer 2013 at Main Horticulture Research Station, College of Agriculture Indore, to study the effect of plant growth regulators on physiology and yield attributing characters in cucumber (Cucumis sativus L.). The experiment was laid out in randomized block design with nine treatments and three replications. The treatments consistsed of two growth promoters viz., gibberrellic acid (50 and 100 ppm), naphthalene acetic acid (50 and 100 ppm), a retardant CCC (250 and 500 ppm), tricontanol (50 and 100 ppm) and a control. Cucumber (Cucumis sativus L.) is a widely cultivated and used by every class of people in day to day life in their diet. It is a monoecious creeper is a nutritious and delicious vegetable of tropical part of the world (Bailey, 1969). It belongs to family cucurbitaceae and having chromosome number 2n= 14. It contributes in vegetable production due to the number of vegetables are prominent members of this family. Cucumber exhibits a fascinating range of floral morphology, including staminate, pistillate and hermaphrodite flowers occurring in various arrangements and expressed various types of flowers. Likewise, maleness is one of the major problems in cucumber production which significantly reduce the fruit yield. The tender green fruits of cucumber are used as salad, pickle, culinary purposes and known as super food in recent days. Now-a-days, it is widely used to manufactures various cosmetics items like face cream, face wash, shampoo etc.

Key words: *Cucumber, Face cream, Face wash, Shampoo, Gibberrellic acid,*

INTRODUCTION

Cucumber (*Cucumis sativus* L.) is an important vegetable and one of the most popular members of the Cucurbitaceae family[8,11]. The cucumber peel contains caffeic acid and ascorbic acid for maintaining healthy skin, relieving irritation and reducing inflammation in human being. In recent years, plant growth, flowering and yield have been manipulated with the help of growth regulating substances.

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Among the plant growth regulators, GA3 and NAA have a great importance on sex modification in various cucurbitaceous crops Hilli, *et al.*[6], Exogenous application of plant growth regulators can alter the sex ratio and sequence, if applied at the two and four-leaf stage, which is the critical stage at which the suppression or promotion of either sex is possible[7].

Besides the environmental factors, endogenous levels of auxin and gibberellins at a time and the set of ontogeny determine the sex ratio and sequence of flowering[3]. Moreover, the appearance of first staminate flower is delayed and pistillate flower initiation is promoted by relatively low concentrations of GA3 Wang and Zeng[12]. Though, the plant growth regulators have to be judiciously planned in terms of optimal concentrations, stage of application, species specificity and seasons, which constitute the major impediments in plant growth regulators applicability. In recent years, plant growth regulators play an important role to modify morphology and physiology of the plants. PGRs influence the plant growth; morphogenesis and yield have been manipulated. They should be applied in optimal concentrations, stage of application, species specificity, seasons etc. accurately Birader and Navalagatti[1], PGRs such as auxin and gibberellins include many aspects of plant growth and development.

Since cucumber is an allogamous (naturally outcrossing) species, recurrent selection for yield can be done by intercrossing the selected families in isolation blocks using bees to save labor. Growth regulators can be used to alter sex expression, resulting in increased intercrossing among cucumber families for population improvement. The rate (percentage) of natural outcrossing has been measured for cucumber families planted in isolation blocks and was measured as 36% (29–43%) cross-, 17% (0–42%) sib-, and 47% (23–77%) self-pollination[14]. In North Carolina, wide-base, medium-base, and elite populations of pickling and slicing cucumbers were improved by testing 352 half-sib families in two replications during the spring season. Based on fruit yield, earliness, and quality, the best 40 families were intercrossed in isolation during the summer season. Actual gain was measured after recurrent selection was practiced[10,13]. and improved populations had been released[13]. However, gain was found to be low and was attributed to low heritability or insufficient intercrossing.

Cucumber is a plant with strong tendency towards maleness, thereby; fruit yield depends on the number of female flowers. Albeit MH is different in nature tha NAA and GA3 may have influence on plant growth and also their success increases when applied at various stages[9]. Thereafter, cucumber selection for commercial cultivation and also breeding purpose is very specific cultural management[4].

MATERIAL AND METHODS

The experiment was conducted in hi-tech area of polyhouse at Research form of Department of Horticulture, College of Agriculture, Indore (M.P.) during the summer season 2013. Indore is situated in Malwa Plateau in western part of Madhya Pradesh on latitude of 22^{o} 43’ N and longitude of 75^{o}66’ E with an altitude of 555.5 meters above mean sea level, Indore region comes under sub-tropical and semi-arid region, having a temperature range from 29^{o}C – 41^{o}C as maximum and 7^{o}C – 23^{o}C as minimum in summer and winter season, respectively. The soil of the experimental field was red clay with uniform topography. The soil of the experiment field was medium black with 37% clay, 38% salt and 25% send with PH ranging 7.2. The soil was low in Available nitrogen, medium in available phosphorus and high in available potassium. The 9 treatments were replicated three times in randomized block design in 1.0 x 10.0 sqm. plots. The statistical analysis was done as per the standard procedure for analysis of variance for RCBD. Least significant difference was employed for mean comparison.

RESULTS AND DISCUSSION

Fruit length (cm)

The fruit length, (Table 1) was influenced significantly by different growth regulators. The maximum fruit length (21.4) was recorded with gibberellic acid (50 ppm) followed by gibberellic acid (100 ppm) and they did not differ significantly with each other. Minimum fruit length (16.6) was recorded in control which was significantly lower over all other treatments.

Table 1: Influence of plant growth regulators on fruit length (cm) and fruit diameter (cm) at harvest in cucumber

Treatments	**Fruit length (cm)**	**Fruit diameter (cm)**
T_1 - GA_3 (50 ppm)	21.4	4.6
T_2 - GA_3 (100 ppm)	20.2	4
T_3 - NAA (50 ppm)	18.6	3.8
T_4 - NAA (100 ppm)	19.5	4
T_5 - CCC (250 ppm)	17.4	4.1
T_6 - CCC (500 ppm)	17.1	4.4
T_7- Tricontanol (50 ppm)	17.2	3.7
T_8- Tricontanol (100 ppm)	17.3	3.4
T_9 – Control	16.6	3
Mean	18.4	3.9
S.Em±	0.32	0.34
CD (5%)	1.05	1.02

Fruit diameter (cm)

The fruit diameter at harvest (Table 1) indicated significant differences between the treatments. The maximum fruit diameter (4.6) was recorded in gibberellic acid (50 ppm) followed by cycocel (500 ppm) which were on par with each other. Among the treatments, tricontanol (100 ppm) recorded the minimum (3.4) fruit diameter. However, the least fruit diameter was recorded in control as compared to all other treatments.

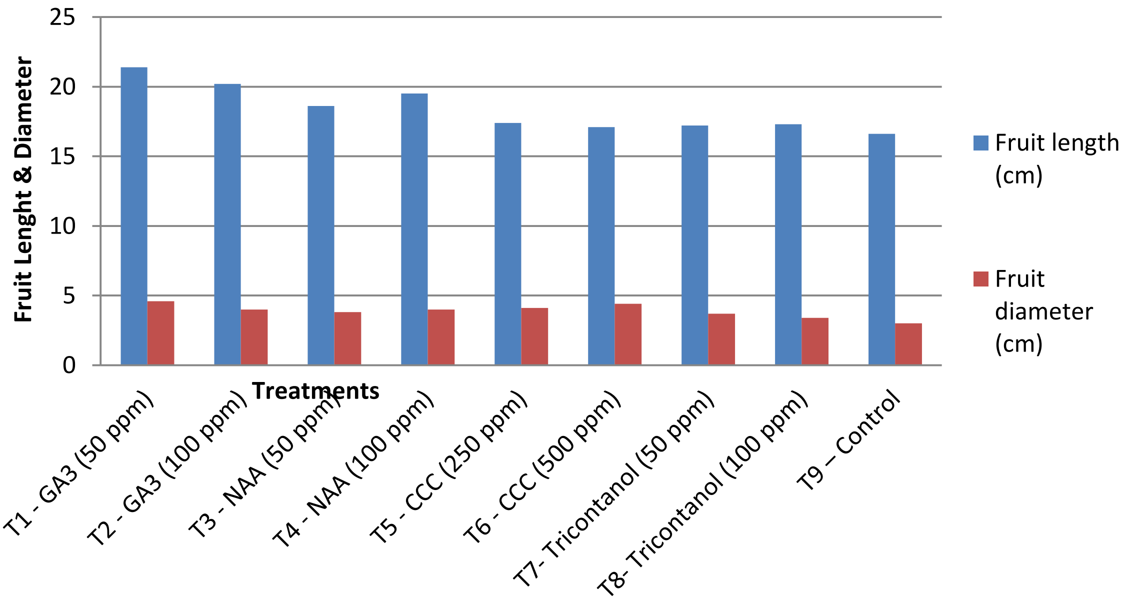

Fig. 1: Influence of plant growth regulators on fruit length (cm) and fruit diameter (cm) at harvest in cucumber.

Fresh fruit weight/plant/ha. (g/plant)

Table 2: Influence of plant growth regulators on fresh fruit weight (g) and dry fruit weight (g) at harvest in cucumber

Treatments	Fresh fruit weight (g)	Dry fruit weight (g)
T_1 - GA_3 (50 ppm)	105.2	22.7
T_2 - GA_3 (100 ppm)	95.3	19.1
T_3 - NAA (50 ppm)	98.4	20
T_4 - NAA (100 ppm)	101.1	21
T_5 - CCC (250 ppm)	106.6	22.4
T_6 - CCC (500 ppm)	108.2	22.9
T_7- Tricontanol (50 ppm)	88.8	16.4
T_8- Tricontanol (100 ppm)	87.7	15.6
T_9 – Control	82.3	13.6
Mean	97.1	19.3
S.Em±	1.1	1.4
CD (5%)	3.3	4.1

The data presented in Table 2 indicated a fresh fruit weight differed significantly due to growth regulators. Among the treatments, cycocel (500 ppm) recorded maximum (108.2) fresh fruit weight followed by cycocel (250 ppm) and gibberellic acid (50 ppm) and they were on par with each other. The minimum (82.3) fresh fruit weight was recorded in control which was significantly lower compared to all other treatments.

Dry fruit weight/plant/ha. (g/plant)

The data on dry fruit weight (Table 2) indicated a similar trend as that of fresh weight. The maximum dry fruit weight (22.9) was recorded with cycocel (500 ppm) followed by gibberellic acid (50 ppm) and cycocel (250 ppm). The minimum dry fruit weight (13.6) was recorded in control which was significantly lower over all other treatments.

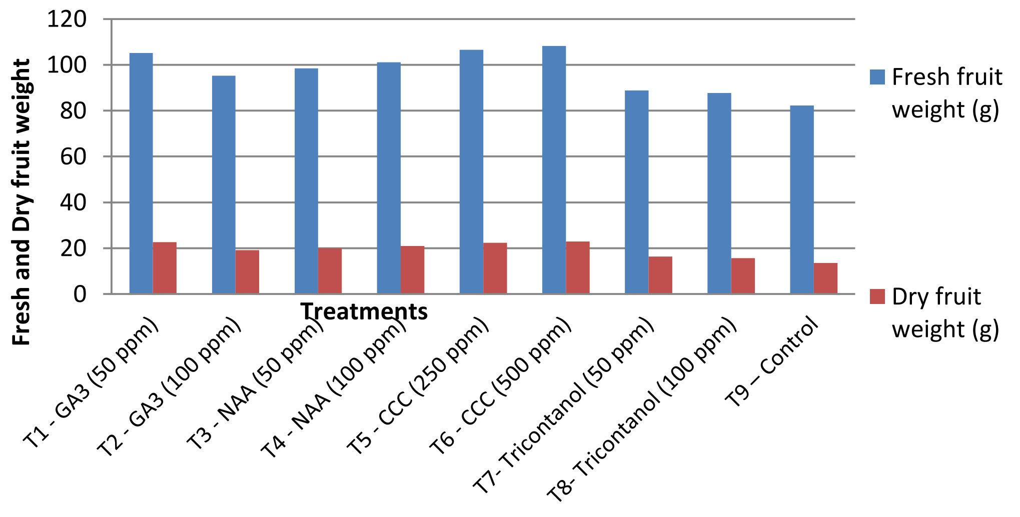

Fig. 2. Influence of plant growth regulators on fresh fruit weight (g) and dry fruit weight (g) at harvest in cucumber.

3.5 Yield and yield components

1 Number of fruits per plant

Table 1: Influence of plant growth regulators on yield and yield components at harvest in cucumber

Treatments	Number of fruit/plants	Fruit yield (Kg/plant)	Fruit yield (t/ha)
T_1 - GA_3 (50 ppm)	8.7	1.71	17.1
T_2 - GA_3 (100 ppm)	7.9	1.66	16.6
T_3 - NAA (50 ppm)	7.7	1.65	16.5
T_4 - NAA (100 ppm)	8.4	1.68	16.8
T_5 - CCC (250 ppm)	8.4	1.69	16.9
T_6 - CCC (500 ppm)	8.6	1.7	17
T_7- Tricontanol (50ppm)	7.6	1.62	16.2
T_8- Tricontanol (100 ppm)	7.5	1.61	16.1
T_9 – Control	7.1	1.42	14.2
Mean	7.9	1.64	16.38
S.Em±	0.13	0.01	0.39
CD (5%)	0.34	0.02	1.19

The data on the number of fruits per plant indicated significant differences between the treatments (Table 1). The maximum number of fruits per plant (8.7) was recorded in gibberellic acid (50 ppm) and it was significantly superior over gibberellic acid (100 ppm), naphthalene acetic acid (50 ppm), Tricontanol (50 ppm), Tricontanol (100 ppm) and control and the treatments naphthalene acetic acid (100 ppm) and cycocel (250 ppm) were on par with each other. The minimum number of fruits was recorded in control (7.1) which was significantly lower over all other treatments.

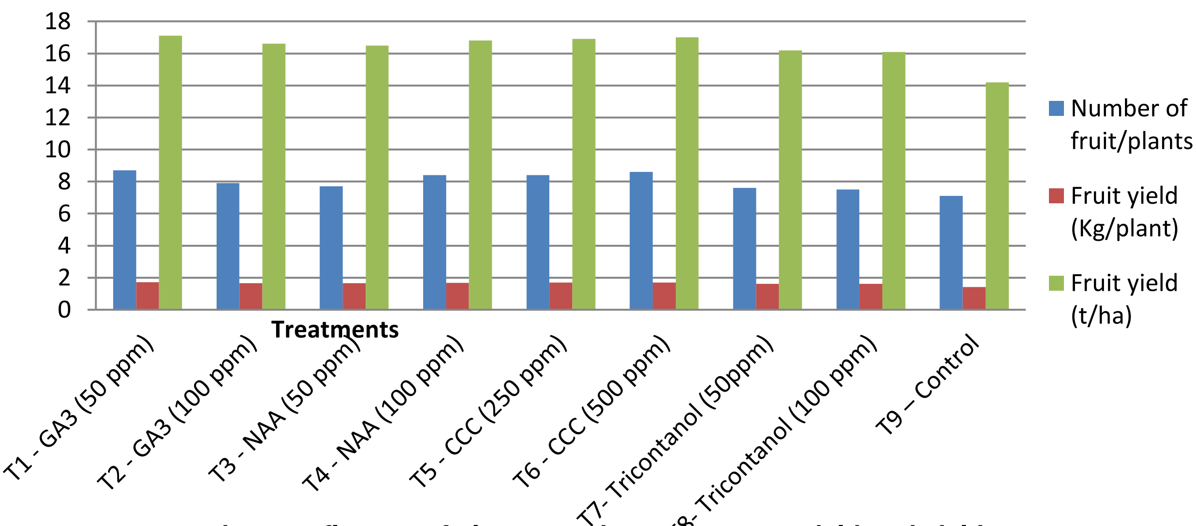

Fig. 1: Influence of plant growth regulators on yield and yield components at harvest in cucumber.

2 Fruit yield (kg/plant)

The data on the fruit yield was taken on the basis of kg/ plant (Table 1) and it indicated significant differences between the treatments. The fruit yield was found to be maximum (1.71 kg/plant) in gibberellic acid (50 ppm) which was on par with cycocel (500 ppm) and the other treatments did not differ significantly with each other. While, the minimum fruit yield (1.42) was recorded in control which was significantly lower compared to all other treatments.

3 Fruit yield (t/ha)

The data on fruit yield was also recorded on t/ha which indicated significant differences between the treatments (Table 1) The fruit yield was found to be maximum (17.10) in gibberellic acid (50 ppm) which was on par with cycocel (500 ppm) and the other treatments did not differ significantly with each other. While the minimum fruit yield (9.47) was recorded in control which was significantly lower over all other treatments.

3.6 Yield attributing characters

Yield is a complex character which involves the interaction of several intrinsic and external factors. It largely depends upon the production and mobilization of carbohydrates, uptake of nutrients and water from the soil and the hormonal balance, in addition to several environmental factors to which plant is exposed during the growing period. Improvement in yield, according to Humphries could happen in two ways i.e. by adopting the existing varieties to grow better in their environment or by altering the relative proportion of different plant parts so as to increase the yield of economically important parts. The growth regulators are capable of redistribution of dry matter in plants, thereby bring about an improvement in yield potential. In addition, crop yield depends not only on the accumulation of photosynthates during the crop growth and development, but also on its partitioning in the desired storage organs. These in turn are influenced by the efficiency of metabolic processes within the plant. The growth regulators are capable of redistribution of dry matter in the plant, thereby bring about improvement in yield.

CONCLUSION

To find out the application of plant growth regulators significantly increased morpho-physiological traits *viz.*, vine length, number of leaves and number of female flowers per plant as compared to control. Growth parameters *viz.*, leaf area, LAI, LAR etc. were also influenced by the application of plant growth regulators. Application of growth regulators increased the dry weight of leaf, reproductive parts and total dry weight significantly and the total dry weight showed a positive correlation with yield. All the yield contributing characters *viz.* fruit length, fruit diameter, percent fruit set, number of fruits per plant and fruit yield increased significantly due to plant growth regulators. The fruit yield was significantly higher with the foliar application of GA_3 (50 ppm) followed by CCC (500 ppm) compared to control. The economics of using different growth regulators revealed that the B:C ratio was maximum with NAA (100 ppm) followed by GA_3 (50 ppm).

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