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GROWTH AND YIELD OF BITTER GOURD AS INFLUENCED BY PLANT GROWTH REGULATORS

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ABSTRACT

An experiment was conducted at Department of Vegetable Science, Dr. P.D.K.V., Akola to studied the effect of plant growth regulators on growth, yield and quality of bitter gourd. The plant growth regulators brassinosteroid 1 ppm, brassinosteroid 1.5 ppm, 6-BA 60 ppm, 6-BA 120 ppm, TIBA 20 ppm, TIBA 40 ppm, GA_3 25 ppm, GA_3 50ppm and control are applied at an interval of 15, 30, 45 DAS. The experiment was laid out in a randomized block design (RBD) with three replications. Result shows that application of GA_3 50 ppm found most effective in increasing in the vine length, number of branches per plant, reducing the number of days to first female and male flower appearance, node number on which first female flower appeared,male flower , male female sex ratio. The yield characters *viz*., number of pickings, number of fruits per vine, fruit length, fruit weight, fruit diameter, fruit yield per vine, fruit yield and fruit yield per hectare were increased with application of GA_3 50ppm.

Key words : Growth, Yield , Bitter gourd, Plant growth regulators.

Introduction

Bitter gourd (*Momordica charantia*) is an important vegetable crop which belongs to the family cucurbitaceae. Bitter belongs to genus momordica which includes approximately fifty nine species. The area and production of bitter gourd in India is around 99 thousand hecters and 1198 thousand metric tones (pocket book of Agricultural Statistics, 2019). Bitter gourd has analgesic, immune supressive property, and anti –tumor properties useful in killing bacteria, viruses, fights free radicals (Triveni, 2014). It is claimed that the fruit powder is used for healing wounds, leprous and malignant ulcers (Prasad *et al*., 2006).

Use of plant growth regulators might be a useful alternative to increase the growth and yield of the crops. The plant growth regulators are used mainly in horticulture crops. PGRs are mainly used to enhance the yield (Nickell, 1982). Among plant growth regulators brassinosteroid occupies a significant place due to its capacity to increase the plant growth and development. 6BA increases branching and enhance flowering in wide range of herbaceous and woody ornamentals, improving crop marketability. TIBA induce profuse flowering and fruiting with concomitant loss of apical dominance. GA_3 is an important growth regulator that may have many uses to modify the growth, yield and yield contributing character of plant (Rafeekher *et al*., 2002).

Considering the above facts the present study was under taken to study the effect of plant growth regulators on growth, yield and quality of bitter gourd and to find out the suitable concentration of plant growth regulator.

Materials and Methods

The study was conducted at instructional Farm, Department of Vegetable Science, Dr.P.D.K.V., Akola during the *kharif* season 2022. The soil is black cotton soil and which is suitable for growing all type of vegetables. The experiment was laid out in randomized

block design (RBD) with nine treatments *viz*. T_1 brassinosteroid @ 1ppm, T_2 brassinosteroid @ 1.5ppm, T_3 6BA @ 60ppm, T_4 6BA @ 120ppm, **T5** TIBA @ 20ppm, T_6 TIBA @ 40ppm, T_7 GA_3@ 25ppm, T_8 GA_3 @50ppm and T_9 control with three replications. The plant growth regulators were sprayed at an interval of 15, 30 and 45 DAS. Spraying was done in the morning hours.

The F_1 hybrid was used for the experiment. There were 27 plots measuring 1.5m × 1m. After land preparation FYM 25kg/ht and SSP 100 kg/ht was applied at planting. Urea was applied (200 kg/ht) at 15 and 30 days after emergence. Murate of potash was applied after 15 and 30 days after emergence. Three seeds were placed in each pit and after sowing seeds were immediately covered with the loose soil and irrigation was provided. After emergence of seedlings allowed only two seedlings per pit for growth and development.

During research vine length, number of branches per plant, days to first male and female flower appearance, node at which first female flower appeared, number of male flower and female flower and male female sex ratio were recorded. Yield characters like number of pickings, number of fruits per vine, fruit yield per vine, fruit yield per plot and fruit yield per hectare were taken.

Results and Discussion

Effect of plant growth regulators of bitter gourd

Effect of plant growth regulators on vine length

The investigation of data revealed that foliar application of plant growth regulators significantly influenced the vine length which is recorded in the Table 1. The above result confirmed that application of GA_3 50ppm was recorded maximum vine length (393.00cm) and control shows minimum vine length .Theincrease in vine length due to cell division and cell elongation. Similar result was reported by Sarkar *et al*. (1989) in pointed gourd.

Effect of plant growth regulators on number of branches per plant

The investigation of data revealed that foliar application of plant growth regulators significantly influenced the number of branches per plant which is recorded in the Table 1. The results reported that, the foliar application of GA_3 50 ppm was recorded maximum branches per plant. This is due to main vine and primary branches are directly proportional to each other. Similar findings reported by Sindhu *et al*. (1981) in squash melon.

Effect of plant growth regulators on days to first male flower appearance

Data observed that the days required for first male flower appearance was influenced by various treatments of plant growth regulators. The days to first male flower appearance (43.00) were maximum significantly under the treatment GA_3 50 ppm and minimum under the treatment control (32.00). This is might be due to application of GA_3 induces early flowering. Similar findings found by Shukla *et al*. (2023) in ridge gourd.

Effect of plant growth regulators on days to first female flower appearance

The data revealed that the days to first female flower appearance (32.50) were minimum under the treatment GA_3 50ppm and minimum number of days (42.67) taken to initiation of female flower was exhibited in control. This is due to application of GA_3 induces early flowering. Similar result was there in Farhana (2015) in cucumber.

Table 1 : Effect of plant growth regulators on growth parameters.

Treatments	Vine length (cm)	Number of branches per plant	Days to first male flower appearance	Days to first female flower appearance	Node at which first female flower appeared
T_1- Brassinosteroid -1ppm	372.00	17.33	36.50	37.77	12.13
T_2- Brassinosteroid-1.5ppm	380.67	17.67	36.00	37.00	11.07
T_3- 6-BA-60ppm	340.67	16.33	37.00	39.17	13.47
T_4- 6-BA-120ppm	354.67	16.67	36.33	38.50	12.83
T_5- TIBA-20ppm	369.33	15.67	33.00	38.50	11.60
T_6- TIBA-40ppm	378.67	16.33	36.67	38.00	10.73
T_7- GA_3-25ppm	387.33	17.83	38.33	33.67	10.60
T_8- GA_3-50ppm	393.00	18.67	43.00	32.50	9.80
T_9- Control	323.33	15.33	32.00	42.67	13.17
F-test	Sig	Sig	Sig	Sig	Sig
SE(M)±	11.19	0.63	1.74	1.75	0.64
CD at 5%	33.56	1.90	5.22	5.25	1.92

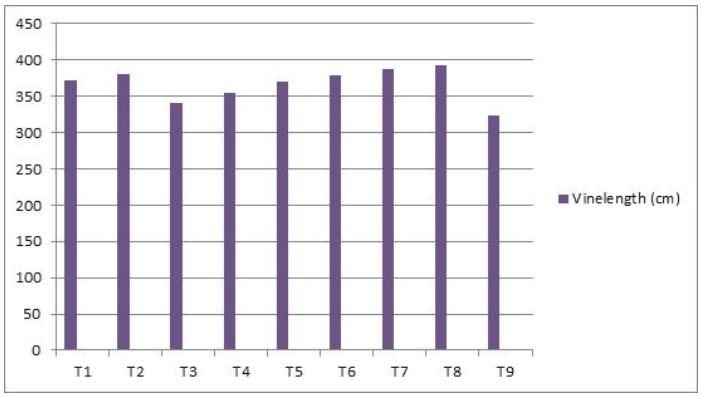

Fig. 1 : Effect of plant growth regulators on Vine length (cm) of bitter gourd.

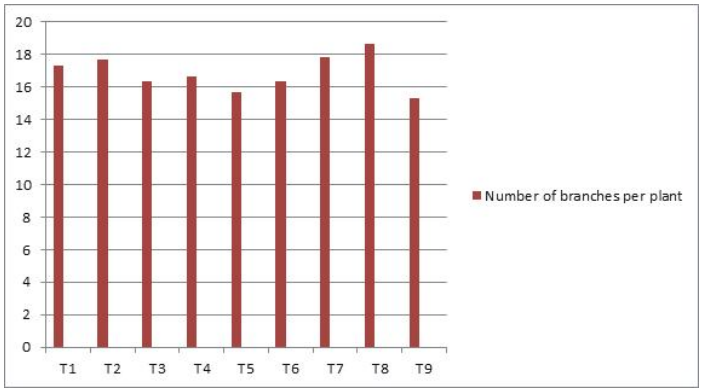

Fig. 2 : Effect of plant growth regulators on Number of branches per plant of bitter gourd.

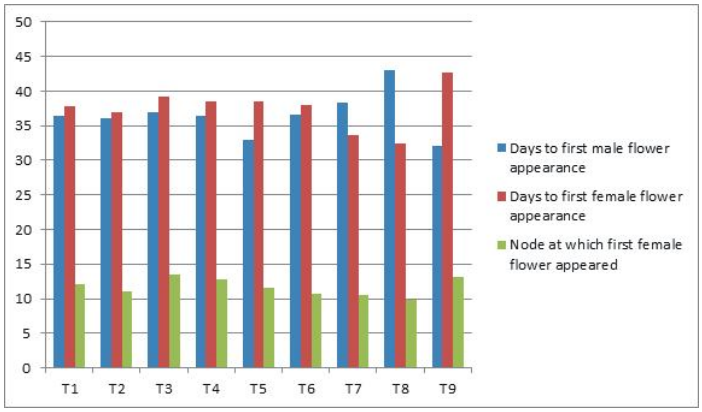

Fig. 3 : Effect of plant growth regulators on days to first male flower and female flower appearance and node at which first female flower appeared.

Effect of plant growth regulators on Node at which first female flower appeared

The nodal position of first female flower appeared was reported treatment wise and then mean values are illustrated in Table 1. Data found that the treatment GA_3 50ppm displayed statistically lowest nodal position for first female flower initiation (9.80). While treatment control recorded the highest nodal position. The result related with the findings of Sindhu *et al*. (1981) in squash melon.

Effect of plant growth regulators on number of male flowers

The present revealed that treatment $GA_3$50 ppm recorded minimum number of male flowers and control recorded maximum number of male flowers .This is due to GA_3 helps to reduce the male flower initiation with the optimum doses in the present study. Similar result earlier reported by Hossain *et al*. (2006) in bitter gourd.

Effect of plant growth regulators on number of female flowers

The present data revealed that treatment GA_3 50 ppm exhibited maximum number of female flower (41.00), where as minimum number of female flower (30.13) found in control due to foliar application of GA_3 supress the male flower and increases the female flower due to acceleration of auxillary buds into new shoots providing extra site for male flowers. Similar results was found in Hossain *et al*. (2006) in bitter gourd and Kadi *et al.* (2018) in cucumber.

Effect of plant growth regulators on male female sex ratio

The present data revealed that treatment T_8 (GA_3 50 ppm) exhibited significantly narrow sex ratio (5.87) which was at par with T_7 (6.40). Treatment T_8 was followed by T_1, whereas wider sex ratio was found in control T_9 (10.07). Foliar application of GA_3 found most effective in lowering the male female ratio due to suppression of the male flower and increasing of female flower. Similar results were obtained by Sindhu *et al*. (1981) in squash melon.

Effect of plant growth regulators on yield parameter

Effect of plant growth regulators on number of fruits per vine

The present data revealed that treatment T_8 (GA_3 50ppm) exhibited significantly highest fruits per vine (37.00), which is at par with T_7 (36.00), T_2 (34.00). Where as lowest number of fruits per vine found in T_9 (27.00). This is due to application of GA_3 suppresses the male flowers and promote the female flowers which results in a greater number of fruit set there by increasing the number of fruits. Similar findings found by Jishnu *et al*. (2023) in sponge gourd and Vadigeri *et al.* (2001) in cucumber.

Effect of plant growth regulators on fruit length

The data represented significant difference among different treatments. The treatment T_8 (GA_3 50ppm)

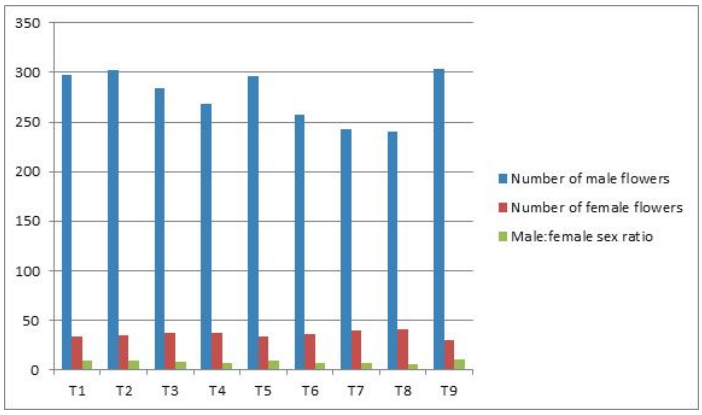

Fig. 4 : Effect of plant growth regulators on Number of male flowers, number of female flowers and male: female sex ratio of bitter gourd.

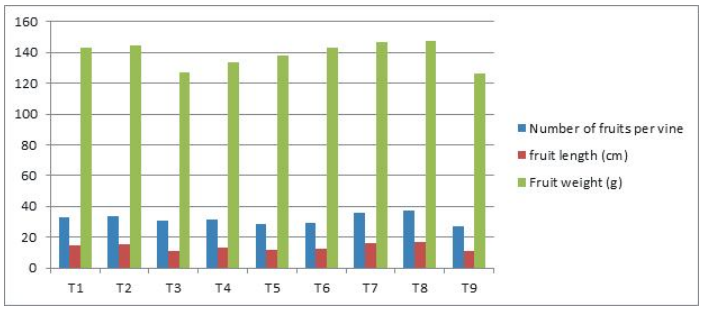

Fig. 5 : Effect of plant growth regulators on number of fruits per vine, fruit length and fruit weight of bitter gourd.

Table 2 : Effect of plant growth regulators on growth parameters.

Treatments	Number of male flowers	Number of female flowers	Male: female sex ratio
T_1 - Brassinosteroid -1 ppm	296.90	33.00	9.22
T_2 - Brassinosteroid-1.5 ppm	302.57	34.27	8.65
T_3 - 6-BA-60ppm	283.60	36.83	7.73
T_4 - 6-BA-120ppm	267.93	37.00	7.26
T_5 - TIBA-20ppm	295.90	33.00	9.00
T_6 - TIBA-40ppm	257.27	35.67	7.27
T_7 - GA_3-25ppm	242.33	39.33	6.40
T_8 - GA_3-50ppm	240.57	41.00	5.87
T_9 - Control	303.90	30.13	10.07
F-test	Sig	Sig	Sig
SE(M) ±	9.59	1.64	0.44
CD at 5%	28.75	4.94	1.34

exhibited significantly maximum fruit length (17.00cm) which is at par with the treatments T_7 (16.33), T_2 (15.53). Whereas, minimum fruit length was found in treatment T_9 (control) (10.77). This may be due to higher photosynthesis and respiration occurs in treated plants compared to control (water spray). The similar results were reported by jishnu *et al*. (2023) in sponge gourd, and Kadi *et al*. (2018) in cucumber.

Effect of plant growth regulators on fruit weight

The foliar application of treatment T_8 (GA_3 50ppm) exhibited significantly maximum fruit weight (147.33g), which is statistically at par with treatment T_7 (146.67g), T_1 (143.33g), T_2 (144.67g), T_4 (133.67g), T_5 (143.00g). Whereas, minimum fruit weight was recorded in treatment T_9 (126.33g). During early stages of fruit development GA_3 directly or indirectly influences the cell number, size and density. The results are in agreement with the findings of Jishnu *et al*. (2023) in sponge gourd., and Kadi *et al*. (2018) in cucumber.

Effect of plant growth regulators on fruit yield per plot

The above results recorded that there is increase in the fruit yield per plot due to the use of foliar application of plant growth regulators. The highest fruit yield per plot (37.27 kg) was recorded in treatment T_8 over control. The increasing fruit yield per plot is GA_3 might be due to the consequence of GA_3 on cell elongation, stimulated RNA and protein synthesis and better diversion of food material towards fruit. Similar result found by Dalai *et al*. (2016) in cucumber.

Effect of plant growth regulators on fruit yield per hectare

The data related to findings of fruit yield per hectare as influenced by treatment T_8 (GA_3 50ppm) imparted maximum fruit yield per hectare (236.67q) which was at par with the treatment T_7 (222.67q). While, minimum fruit yield per hectare (171.00q) was resulted in treatment T_9 (control). The probable reason for increased fruit yield by GA_3 treatment may be due to increased fruit set

Table 3 : Effect of plant growth regulators on yield parameters.

Treatments	Number of fruits per vine	Fruit length (cm)	Fruit weight (g)	Fruit yield per plot	Fruit yield per hectare (q/ha)
T_1-Brassinosteroid -1 ppm	33.00	14.47	143.33	21.00	204.33
T_2-Brassinosteroid-1.5 ppm	34.00	15.53	144.67	31.31	212.00
T_3- 6-BA-60ppm	30.67	11.20	127.33	24.84	180.25
T_4- 6-BA-120ppm	31.33	13.40	133.67	32.10	197.65
T_5- TIBA-20ppm	28.33	12.00	137.67	19.23	182.67
T_6- TIBA-40ppm	29.33	12.50	143.00	19.52	203.33
T_7 -GA_3-25ppm	36.00	16.33	146.67	36.00	222.67
T_8- GA_3-50ppm	37.00	17.00	147.33	37.28	236.67
T_9- Control	27.00	10.77	126.33	18.07	171.00
F-test	Sig	Sig	Sig	Sig	Sig
SE(M)±	1.15	0.82	4.97	1.162	6.28
CD at 5%	3.47	2.48	14.91	3.48	18.83

percent, fruit weight, length and diameter of fruits ultimately produced the highest yield. Similar result was found by Dalai *et al*. (2016) in cucumber.

Conclusion

It can be concluded that among application of different growth regulators, spraying of GA_3 at 50 ppm gave maximum vine length, number of branches per plant, narrow sex ratio and maximum yield. The study also concluded that significant effect on all growth and yield attributes of bitter gourd crop was found with the application of GA_3 50 ppm.

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