Influenceof plant growth regulators on growth and flowering behaviors of bottle gourds (*Lagenariasiceraria* L.). cv. Narendra Jyoti

Abstract:

The present investigation was carried out with the title Influence of plant growth regulators on growth and flowering behavior of bottle gourd (*Lagenaria siceraria* L.). cv. Narendra Jyotionat the agriculture research farm of Sanjeev Agrawal Global Educational University, Bhopal, during the *Zaid*season of 2024. The experiment was laid out with RBD (randomized block design) with three replications and thirteen treatments. The experiment was conducted with four levels of each of three plant growth regulators namely (NAA, GA_3 and Ethylene) respectively were sprayed on bottle gourd to find out their response on growth and flowering behavior. In this experiment, three plant growth regulators were used with four split doses, such as NAA at 50 ppm, 75 ppm, 100 ppm, and 150 ppm, GA_3 at 20 ppm, 40 ppm, 60 ppm, and 80 ppm, whereas ethylene also had four split doses at 50 ppm, 100 ppm, 150 ppm, and 200 ppm oncv. Narendra Joyti. Different growth and flowering behaviors such as number of primary branches, number of nodes to the first male flower anthesis, number of nodes to the first female flower anthesis, days to the first male flower opening, days to the first female flower opening, days to the first harvest, and vine length at the time of final harvesting were observed during this experiment.The result indicated that the growth and flowering behaviour of bottle gourds showed significant better result at NAA@ 150 ppm over NAA @100, NAA @50 ppm and NAA @25ppm, while in case of Gibberellic acid GA_3 @80 ppm recorded better results over GA_3@60, GA_3 @40, and GA_3 @ 20 ppm, whereas in ethylene, Ethrel @200 ppm performed better results for all growth and flowering traits over Ethrel @ 150, Ethrel @100, and Ethrel @50 ppm.

Keys words: PGRs, Growth traits, RBD, Narendra Joyti

Introduction

Bottle gourd (*Lagenariasiceraria* L.), also known as calabash or white-flowered gourd, is a member of the Cucurbitaceae family. It is widely cultivated in tropical and subtropical regions around the world. Known for its diverse uses, the bottle gourd is an essential vegetable crop with significant nutritional, medicinal, and economic value. The exact origin of the bottle gourd is debated, but it is believed to have been domesticated independently in Africa and Asia. Bottle gourd is a vigorous, climbing, or trailing annual vine. The leaves are large, heart-shaped, and hairy, providing ample surface area for photosynthesis. Bottle gourd is low in calories but rich in vitamins and minerals. Bottle gourd is a versatile and valuable crop with significant nutritional, medicinal, and economic benefits. Understanding its growth traits and improving its genetic potential through hybridization can lead to better yield and resilience, benefiting both farmers and consumers. It is an excellent source of vitamins such as vitamin C and B-complex and minerals such as calcium, magnesium, potassium, and iron, as well as dietary fiber that aids in digestion and helps in maintaining a healthy weight (Hoque*et al.*, 2023). Bottle gourd has traditional medicinal value likeit has been used for its therapeutic properties and is good for aiding in digestion and alleviating constipation. Its high water content makes it a natural coolant, helping to keep the body hydrated. They had detoxification, which acts as a detoxifying agent, flushing out toxins from the body. It hasanti-inflammatory property, used to reduce inflammation and treat urinary infections (Singh 2019).

Plant growth regulators are currently used to regulate a wide range of physiological functions, including asgrowth, flowering and fruiting. The reason plant growth regulators were used in cucurbitaceous crops was to increase the number of female flowers; due to the increase in the number of female flowers, yield also increased.Although growth regulators can be used to alter expression, which is a genetic control method (Ying *et al.*, 1994). The exogenous application of growth regulators sprayed between the 2-4 true leaf stage can increase the expression of female flowers (Hossain, 2004). The sex expression of most of the cucurbitaceous crops commonly depend upon the upregulation or down regulation of one or more growth regulators like auxin, gibberellins, cytokinin, ethylene and absicisicacid (Hidayatullah *et al.*, 2012).A multipurpose chemical hormone that releases ethylene, ethrel can stimulate female flowers and boost cucurbitaceous plants' fruit production.

Materials and methods

The experiment was conducted on agriculture research from Sanjeev Agrawal Global Educational University, Bhopal. The experimental site is located at an altitude of 1506 meters above mean sea level, lying between 32.06° North latitude and 76.61° East longitude. The research work was conducted during *Zaid*, 2024. The mean minimum temperature is 22^{o}C and themean maximum temperature is 45^{o}C recorded in the months of Feb. to June (respectively). In this experiment, three plant growth regulators, NAA, GA_3, and Ethylene, were spray at 2-4 leaf stages with different doses, such as NAA at 50 ppm, 75 ppm, 100 ppm, and 150 ppm, GA_3 at 20 ppm, 40 ppm, 60 ppm, and 80 ppm, and ethylene at 50 ppm, 100 ppm, 150 ppm, and 200 ppm on bottle gourds (Lagenaria siceraria L.). cv. Narendra Jyoti.The treatment details were T_1 (control), T_2(NAA @ 50 ppm), T_3(NAA @ 75 ppm), T_4(NAA @ 100 ppm), T_5(NAA @ 150 ppm), T_6 (GA_3 @ 20 ppm),T_7(GA_3 @ 40 ppm), T_8(GA_3 @ 60 ppm), T_9(GA_3 @ 80 ppm), T_{10} (Ethrel @ 50 ppm), T_{11}(Ethrel @ 100 ppm), T_{12}(Ethrel @ 150 ppm), and T_{13}(Ethrel @ 200 ppm). The data observed on growth and flowering traitswas number of primary branches, number of nodes to the first male flower anthesis, number of nodes to the first female flower anthesis, days to the first male flower opening, days to the first female flower opening, days to the first harvest, and vine length at the time of final harvesting. The statistical analysis for RBD was done with the help of Pans and Sukhatme (1985).

Results and discussion

Number of primary branches:

Table 1 and Figure 1 showed that results in NAA showed that T_5 @ 150 ppm had the maximum number of primary branches over T_4, T_3, and T_2, while in GA_3 it was found that T_9 at 40 ppm had the maximum primary branches, followed by T_8, T_7, and T_6, whereas in Ethylene it was recorded that T_{13} at 200 ppm had the highest primary branches, followed by T_{12}, T_{11}, and T10. However, the lowest primary branches were reported in T_1 (control). Among the PGRs, NAA150ppm performed better results, similar finding reported by Kumari *et al*. (2019) and Barot *et al*. (2022).

Number of nodes to first male flower anthesis:

Nodes to the first male flower anthesis recorded that the T_1 (control) had taken maximum nodes for anthesis. In NAA, T_5 at 150 ppm had taken minimum nodes for male flower anthesis, followed by T_4, T_3, and T_2, while in GA_3, it was found that T_9 at 40 ppm had taken minimum nodes over T_8, T_7, and T_6, whereas in ethylene, it was reported that T_{13} at 200 ppm had taken minimum nodes for male flower anthesis, followed by T_{12}, T_{11}, and T_{10}.Among the PGRs, NAA at 150 ppm had taken minimum number of nodes to first male flower anthesis. The data presented in table 1 and figure 1, closed results reported by Kumar *et al*. (2020) and Sabu *et al.* (2022).

Number of nodes to first female flower anthesis:

Data presented in table 1 and figure 1 revealed that NAA 150 ppm(T_5) was taken as minimum nodes for female flower anthesis, followed by T_4, T_3, and T_2, while GA_3 found that T_9 at 40 ppm was taken as minimum nodes over T_8, T_7, and T_6, whereas ethylene reported that T_{13} at 200 ppm was taken as minimum nodes for male flower anthesis, followed by T_{12}, T_{11}, and T_{10}. However, maximum nodes were taken in T_1 (control). Among the PGRs, NAA150ppm was taken minimum nodes to first female flower anthesis, this result was conformed with Kumar et al. (2020) and Moniruzzama et al. (2019).

Days to first male flower opening:

Table 2 and Figure 2 showed that in NAA@ 150 ppm (T_5) had taken a minimum number of days to first male flower opening, followed by T_4, T_3, and T_2, while in GA_3, it was recorded that T_9 had taken a minimum number of days over T_8, T_7, and T_6, whereas in ethylene, it was recoded that T_{13} had some minimum days for first male flower opening over T_{12}, T_{11}, and T_{10}. However, in T_1 (control), the maximum days for the first male flower to open were taken and among the PGRs, NAA150ppm was taken minimum days to first male flower opening, result conformed with Duhan et al. (2022) and Barot et al. (2022).

Days to first female flower opening:

In the case of days to first female flower opening presented in Table 2 and Figure 2, it was recorded that NAA@150 ppm(T_5) was taken as the as the minimum number of days to first female flower opening, followed by T_4, T_3, and T_2, while in the case of GA_3, it was recorded that T_9 was taken as the as the minimum number of days, followed by T_8, T_7, and T_6, whereas in ethylene, it was recoded that T_{13} had the minimum days for first female flower opening over T_{12}, T_{11}, and T_{10}. However, in T_1 (control), the maximum days for the first female flower to open were taken, andamong the PGRs, NAA150ppm was taken minimum days to first female flower opening,the findings align with those reported by Sabu et al. (2022) and Kumari et al. (2019).

Days to first harvest

Data presented in table 2 and figure 2 showed that NAA@ 150 ppm(T_5) had a minimum number of days for first harvesting over T_4, T_3, and T_2, while in the case of GA_3, it was reported that T_9 had a minimum number of days over T_8, T_7, and T_6, whereas in ethylene, it was recoded that T_{13} had some minimum days for harvesting over T_{12}, T_{11}, and T_{10}. However, in T_1 (control) taken maximum days to first harvesting, andamong the PGRs, NAA150ppm was taken minimum days to first harvesting, results closely match those of Barot et al. (2022) and Kumar et al. (2020), Barot *et al.* (2022) and Kumari (2019).

Vine length at the time of final harvesting:

Vine length at the time of final harvesting was recorded as NAA @ 150 ppm (T_5) having the maximum vine length over T_4, T_3, and T_2, while in the case of GA_3, it was reported that T_9 had the maximum vine length over T_8, T_7, and T_6, whereas in the case of the case of ethylene, it was recoded that T13 had the maximum vine length, followed by T_{12}, T_{11}, and T_{10}. However, T_1 (the control) had the minimum vine length over all three plant growth regulators, and among the PGRs, NAA150ppm had maximum vine length, result was conformed with Kumar et al. (2020) and Kumari et al (2019).

Table-1. Effect of plant growth regulators on number of primary branches, number of nodes to first male and female flower anthesis.

		Number of primary branches	**Number of nodes to first male flower anthesis**	**Number of nodes to first female flower anthesis**
T1	**Control**	4.53	9.55	11.44
T2	**NAA@50ppm**	5.94	9.27	11.20
T3	**NAA@75ppm**	4.97	8.18	9.20
T4	**NAA@100ppm**	6.11	7.70	8.94
T5	**NAA@150ppm**	6.35	7.38	8.36
T6	**GA_3@20ppm**	5.04	8.06	10.94
T7	**GA_3@40ppm**	5.71	7.84	9.94
T8	**GA_3@60ppm**	5.77	7.78	8.87
T9	**GA_3@80ppm**	6.17	7.07	8.54
T10	**Etheral@50**	5.06	8.87	10.10
T11	**Etheral@100**	5.97	7.65	9.47
T12	**Etheral@150**	6.71	7.24	8.42
T13	**Etheral@200**	6.37	7.20	7.70
	C.D.	**0.49**	**0.72**	**0.86**
	SE(m)	**0.17**	**0.25**	**0.29**
	SE(d)	**0.24**	**0.35**	**0.41**
	C.V.	**5.05**	**5.31**	**5.33**

Figure-1. Effect of plant growth regulators on number of primary branches, number of nodes to first male and female flower anthesis.

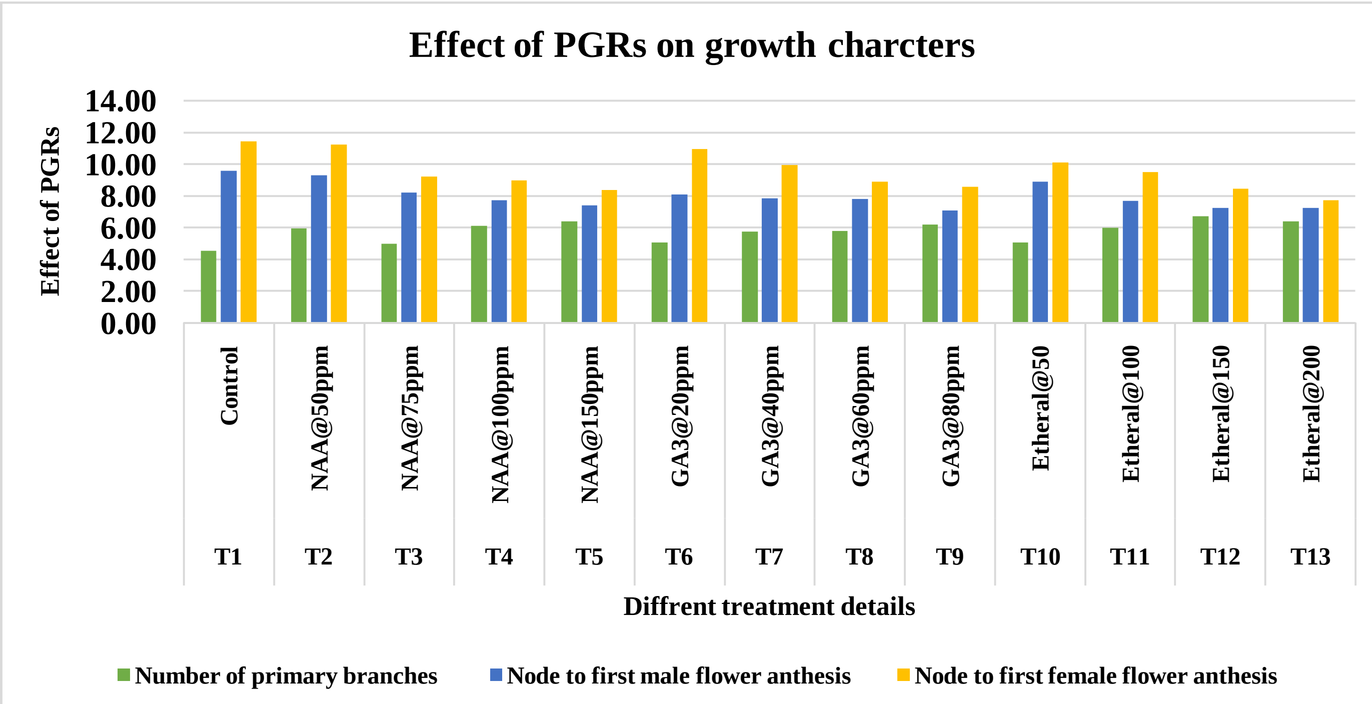
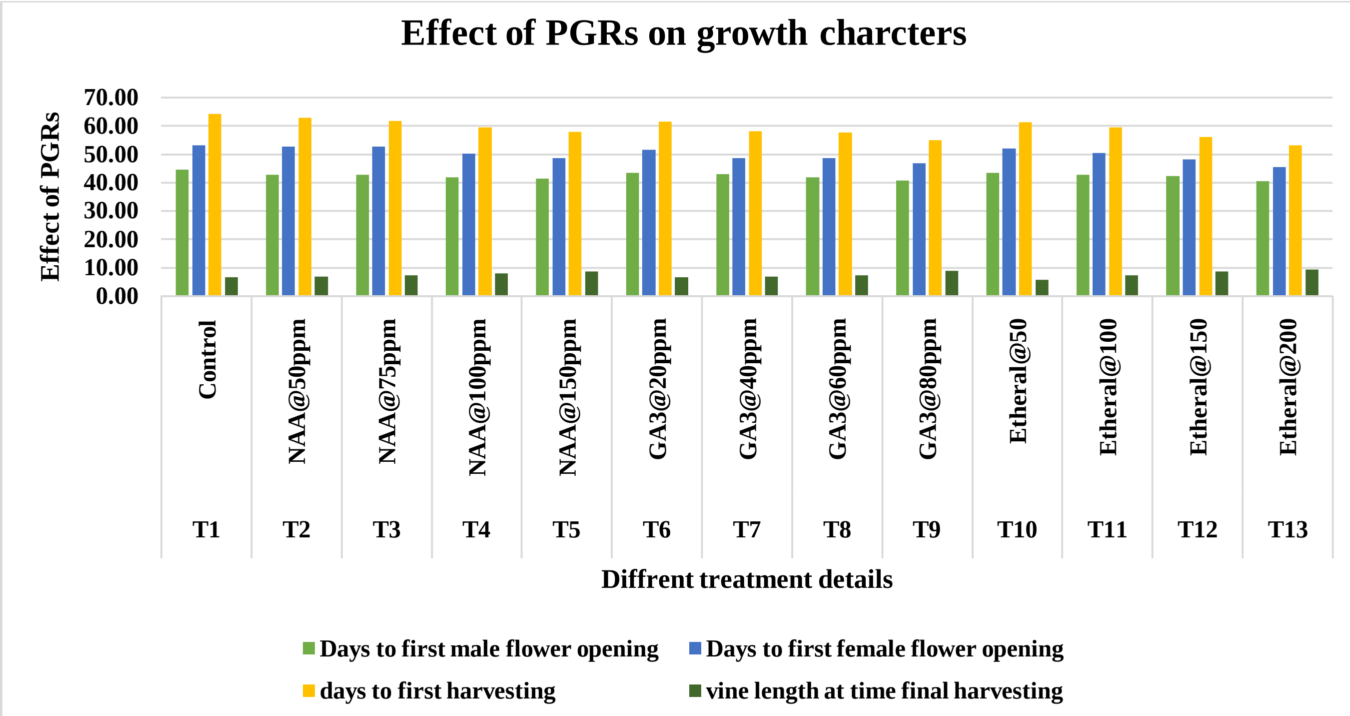


Table-2. Effect of plant growth regulators on days to first male, female flower opening and harvesting and vine length at the time of final harvesting.

		Days to first male flower opening	Days to first female flower opening	days to first harvesting	vine length at time final harvesting (m)
T1	**Control**	44.45	53.05	64.11	6.46
T2	**NAA@50ppm**	42.75	52.72	62.82	6.88
T3	**NAA@75ppm**	42.65	52.52	61.55	7.28
T4	**NAA@100ppm**	41.78	50.12	59.49	7.81
T5	**NAA@150ppm**	41.41	48.65	57.76	8.48
T6	**GA_3@20ppm**	43.44	51.45	61.38	6.46
T7	**GA_3@40ppm**	42.85	48.52	58.09	6.74
T8	**GA_3@60ppm**	41.70	48.45	57.60	7.19
T9	**GA_3@80ppm**	40.59	46.85	54.82	8.73
T10	**Etheral@50**	43.36	51.99	61.26	5.59
T11	**Etheral@100**	42.66	50.39	59.33	7.17
T12	**Etheral@150**	42.15	48.20	55.91	8.57
T13	**Etheral@200**	40.36	45.32	52.95	9.36
	C.D.	**2.26**	**4.72**	**4.33**	**0.79**
	SE(m)	**0.77**	**1.61**	**1.48**	**0.27**
	SE(d)	**1.09**	**2.27**	**4.36**	**0.38**
	C.V.	**3.16**	**5.58**	**5.33**	**6.29**

Figure 2. Effect of plant growth regulators on days to first male, female flower opening and harvesting and vine length at the time of final harvesting.



Conclusion

It was concluded that different plant growth regulators reported that in NAA @ 150 ppm performed better results over 100, 50 ppm and 25ppm, while GA_3@ 80 ppm recorded better results over 60, 40, and 20 ppm, whereas in ethylene @ 200 ppm performed better results for all growth and flowering traits over 150, 100, and 50 ppm.Among the PGRs, NAA150ppm was found to be best for growth and flowering traits of bottle gourd.

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