Effect of different plant growth regulators on growth traits of bottle gourds (*Lagenariasiceraria* L.).

Abstract:

The experiment was conducted with the title **"**Effect of different plant growth regulators on growth traits of bottle gourds (*Lagenaria siceraria* L.)" on 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. In this experiment, three plant growth regulators are 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 on Narendra Joyti. The data observed on growth traits 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. Finally, the results showed that in all growth traits, NAA reported that T5 NAA at 150 ppm, GA3 found that T9 and GA3 at 80 ppm, and etheral observed that T13 etheral at 200 ppm performed better. While T1 (control) was found to have poor results in all growth traits.

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 yields 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. Bottle gourd has traditional medicine; bottle gourd 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. The bottle was also anti-inflammatory, used to reduce inflammation and treat urinary infections.

Plant growth regulators are currently used to regulate a wide range of physiological functions, including as fruiting and flowering. Although gender Growth regulators can be used to alter expression, which is a genetic control method (Ying et al., 1994). By reducing male flowers, the exogenous application of growth regulators sprayed between the 2-4 true leaf stage can increase the expression of female flowers (Hossain 2004). Most cucurbitaceous crop plants exhibit female flowering due to the action of common hormones such as auxin, gibberellin, cytokinin, ethylene, and abscisic acid (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 22^0C and the maximum temperature is 45^oC recorded in the months of Feb. to June (respectively). In this experiment, three plant growth regulators, NAA, GA3, and Ethylene, were used with different doses, such as NAA at 50 ppm, 75 ppm, 100 ppm, and 150 ppm, while 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 on Narendra Joyti. The treatment details were T1 (control), T2, T3, T4, T5, T6, T7, T8, T9, 10, T11, T12, and T13. The data observed on growth traits 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. The statistical analysis for RBD was done with the help of Pans and Sukhatme (1985).

Results and discussion

Growth traits:

Number of primary branches:

Table 1 and Figure 1 showed that results in NAA showed that T5 at 150 ppm had the maximum number of primary branches over T4, T3, and T2, while in GA3 it was found that T9 at 40 ppm had the maximum primary branches, followed by T8, T7, and T6, whereas in Ethylene it was recorded that T13 at 200 ppm had the highest primary branches, followed by T12, T11, and T10. However, the lowest primary branches were reported in T1 (control), 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 T1 (control) had taken maximum nodes for anthesis. In NAA, T5 at 150 ppm had taken minimum nodes for male flower anthesis, followed by T4, T3, and T2, while in GA3, it was found that T9 at 40 ppm had taken minimum nodes over T8, T7, and T6, whereas in ethylene, it was reported that T13 at 200 ppm had taken minimum nodes for male flower anthesis, followed by T12, T11, and T10. 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 T5 at 150 ppm was taken as minimum nodes for female flower anthesis, followed by T4, T3, and T2, while GA_3 found that T9 at 40 ppm was taken as minimum nodes over T8, T7, and T6, whereas ethylene reported that T13 at 200 ppm was taken as minimum nodes for male flower anthesis, followed by T12, T11, and T10. However, maximum nodes were taken in T1 (control), 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, T5 had taken a minimum number of days to first male flower opening, followed by T4, T3, and T2, while in GA3, it was recorded that T9 had taken a minimum number of days over T8, T7, and T6, whereas in ethylene, it was recoded that T13 had some minimum days for first male flower opening over T12, T11, and T10. However, in T1 (control), the maximum days for the first male flower to open were taken, 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 T5 was taken as the as the minimum number of days to first female flower opening, followed by T4, T3, and T2, while in the case of GA3, it was recorded that T9 was taken as the as the minimum number of days, followed by T8, T7, and T6, whereas in ethylene, it was recoded that T13 had the minimum days for first female flower opening over T12, T11, and T10. However, in T1 (control), the maximum days for the first female flower to open were taken, 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 T5 had a minimum number of days for first harvesting over T4, T3, and T2, while in the case of GA3, it was reported that T9 had a minimum number of days over T8, T7, and T6, whereas in ethylene, it was recoded that T13 had some minimum days for harvesting over T12, T11, and T10. However, in T1 (control) taken maximum 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 T5 having the maximum vine length over T4, T3, and T2, while in the case of GA3, it was reported that T9 had the maximum vine length over T8, T7, and T6, whereas in the case of the case of ethylene, it was recoded that T13 had the maximum vine length, followed by T12, T11, and T10. However, T1 (the control) had the minimum vine length over all three plant growth regulators, 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	**GA3@20ppm**	5.04	8.06	10.94
T7	**GA3@40ppm**	5.71	7.84	9.94

T8	**GA3@60ppm**	5.77	7.78	8.87
T9	**GA3@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.

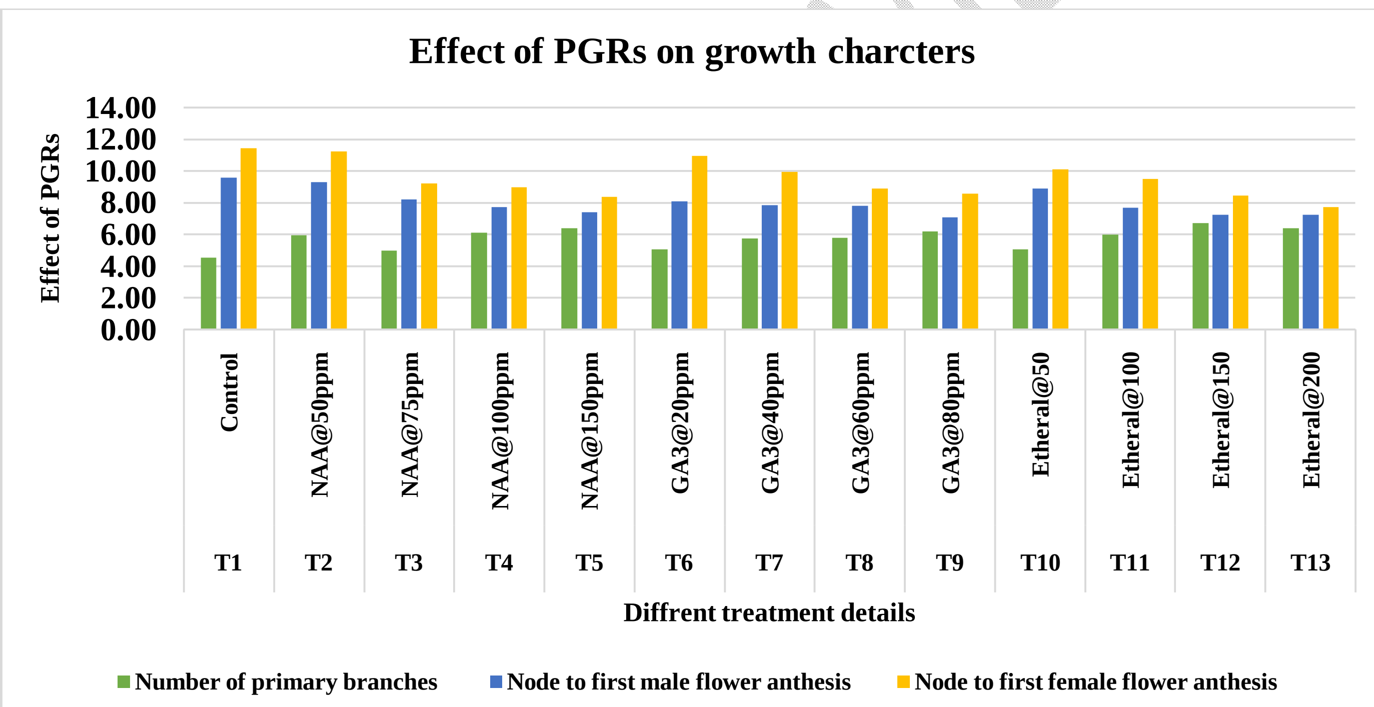
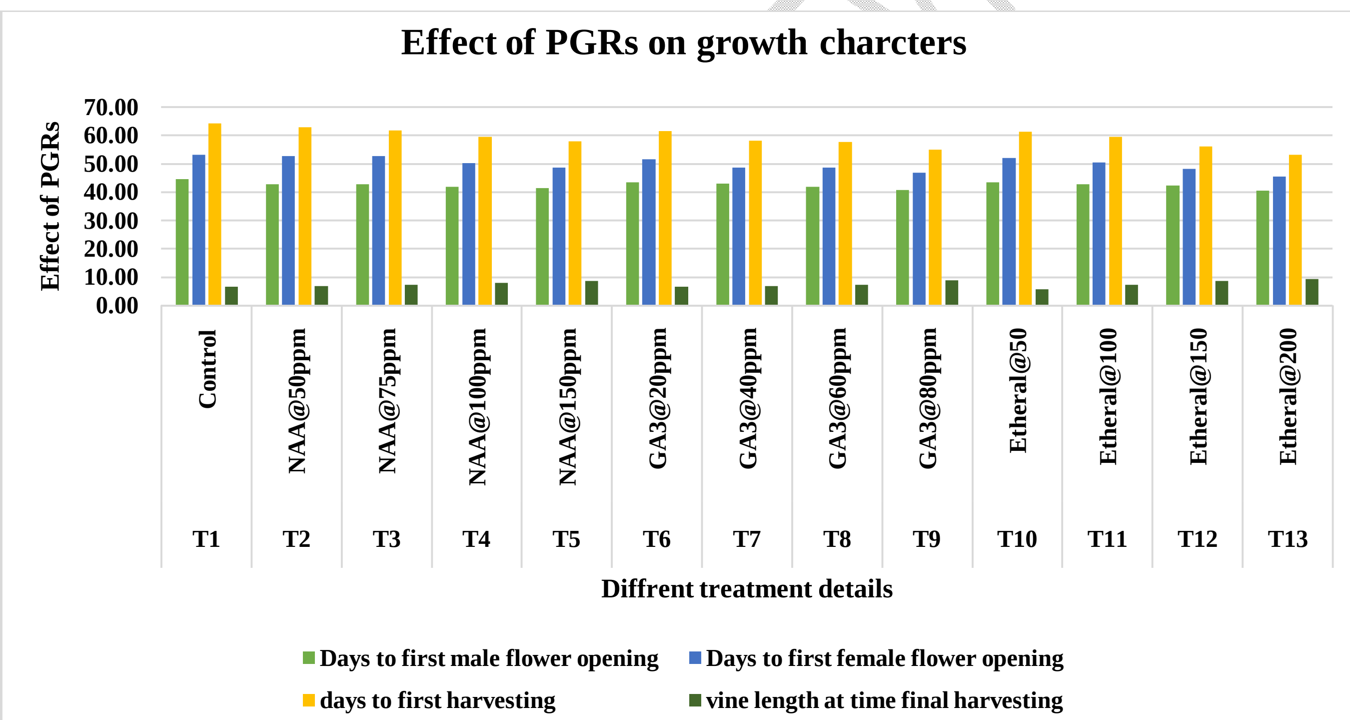


Table-2. Effect of plant growth regulators on days to first male, female flower opening and harvesting and vine length at the time of final harvesting.

		Days to first male flower opening	Days to first female flower opening	days to first harvesting	vine length at time final harvesting
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	**GA3@20ppm**	43.44	51.45	61.38	6.46

T7	**GA3@40ppm**	42.85	48.52	58.09	6.74
T8	**GA3@60ppm**	41.70	48.45	57.60	7.19
T9	**GA3@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

On the basis of the results, it was concluded that different plant growth regulators reported that in NAA, 150 ppm performed better results over 100, 50 ppm and 25ppm, while in GA3, 80 ppm recorded better results over 60, 40, and 20 ppm, whereas in ethylene, 200 ppm performed better results for all growth traits over 150, 100, and 50 ppm.

References

Barot, D. C., Pawar, Y., NadodaNisha, A., &Chaudhari Vishal, M. (2022). Response of bottle gourd (*Lagenariasiceraria* (Mol.) Standl.) to foliar application of plant growth regulators. *The Pharma Innovation Journal*, *11*(12), 2705-2707.

Chaurasiya, J., Verma, R. B., Ahmad, M., Adarsh, A., Kumar, R., &Pratap, T. (2016). Influence of plant growth regulators on growth, sex expression, yield and quality of Muskmelon (Cucumis*melo* L.). *Ecology, Environment and Conservation*, *22*, s39-s43.

Duhan, D. S., Singh, J., Panghal, V. P. S., & Raj, H. (2022). Influence of plant growth regulators on growth, flowering and fruit yield of bottle gourd [*Lagenariasiceraria* (Mol.) Standl.]. *Vegetable Science*, *49*(01), 69-74.

Hidayatullah MT, Farooq M, Khokhar MA and Hussain SI (2012) Plant growth regulators affecting sex expression of bottle gourd (*Lagenariasiceraria* Molina) plants. Pakistan J Agri Res 25(1): 50-54.

Hossain, M. B. (2004). *Effects of "Ripen-15" and "Crops care" on the fruit set and yield in cucumber and bittergourd* (Doctoral dissertation, MS. Thesis, Department of Horticulture, Bangabandhu Sheikh Mujibur Rahman Agricultural University, Gazipur).

Jyoti, S., Patel, N. B., & Patel, J. B. (2016). Effect of growth regulators and stages of spray on seed yield and seed quality parameters of ridge gourd [*Luffa acutangula* (Roxb) L.]. *Journal of Applied and Natural Science*, *8*(3), 1551-1555.

Kumar, M., Ranjan, A., Kumari, S., Singh, B. K., Kumari, M., Kumari, K., & Kumar, A. (2020). Effect of plant growth regulators on growth and seed yield of bottle gourd [*Lagenariasiceraria* (Mol.) Standl.]. *Journal of Pharmacognosy and Phytochemistry*, *9*(2), 794-797.

Kumari, K., Kamalkant, K. R., & Singh, V. K. (2019). Effect of plant growth regulators on growth and yield of bottle gourd (*Lagenariasiceraria* (Mol.) Standl.). *Int J CurrMicrobiolApplSci*, *8*(7), 1881-1885.

Moniruzzaman, M., Khatoon, R., Moniruzzaman, M., &Qamruzzaman, A. K. M. (2019). Influence of plant growth regulators on vegetative growth, sex expression and yield of summer bottle gourd.

Panse, V.G. and Sukhatme, P.V. (1985) Statistical Methods for Agricultural Workers. Indian Council of Agricultural Research Publication, 87-89.

Sabu, A., Kerketta, A., &Topno, S. E. (2022). Effect of different growth regulators on plant growth and yield of bottle gourd (*Lagenariasiceraria* L.) cv. ArkaBahar. *International Journal of Plant and Soil Science*, *34*(20), 320-325.

SondarvaJyoti, S. J., Patel, N. B., & Patel, J. B. (2016). Effect of growth regulators and stages of spray on seed yield and seed quality parameters of ridge gourd [*Luffa acutangula* (Roxb) L.].

Ying Z, Narayanan KR, Mcmillan RJ, Ramos, L and Davenport T (1994) Hormonal control of sexual differentiation in bottle gourd (*Lagenariasiceraria*). Plant Growth RegSoc America 22(3):74-83.