Original Research Article

Effect of Plant Growth Regulators on Growth Parameters of Bottle Gourd (*Lagenaria siceraria*) cv. MGH-4

ABSTRACT

Bottle gourd cv. Warad mgh-4 with two growth regulators having concentration NAA (30, 40, 50, 60, 70 & 80 ppm) and GA3(30,40, 50, 60 & 70 ppm). Water was used as a control. All the treatments were replicated three times in a randomized block design keeping plot size of 2m x 2m. The seed sowing was done on 30 march, 2019 maintaining a planting distance of 2×1m.The crop's reproductive as well as vegetative characteristics are significantly impacted by the use of plant growth regulators. The growth regulators were applied at the two- and four-leaf stage. Application of 40 ppm gibberellin at the 2, 4 leaf stage was found to be the most productive in terms of growth attributes of bottle gourd.

Key words*: Bottle gourd, MGH-4, PGR, NAA, GA_3 and growth.*

INTRODUCTION

In India, the bottle gourd [*Lagenaria siceraria* L. 2n = 2x = 22], also known as lauki, kadu, ghiya, or doodhi, is widely farmed. It may have come from tropical Africa. A good supply of carbs, vitamin A, vitamin C, and minerals may be found in this vegetable. **Hilli *et al*. (2010).** A member of the kingdom Plantae, division Magnoliophyta, class Magnoliopsida, order Cucurbitales, and family Cucurbitaceae is the bottle gourd. The term "lagena," which means "the bottle," is the origin of the bottle gourd genus Lagenaria **Minocha (2015).** Lagenaria siceraria (Molina) Stands, which has a fleshy fruit and seeded pepo, is a popularly grown vegetable crop in tropical nations **(Shah *et al.,* 2010).** Bottle gourd has been discovered in its natural form in South Africa and India, according to De Candolle (1882). Based on the variety of seeds and fruits, **Cutler and Whitaker (1961)** believe that it is likely native to tropical Africa. Rich and poor people both enjoy it because of its delectable, crisp, and tender fruits **(Ram *et al.,* 2006).**

The blooming stage in cucurbits is crucial because it affects both fruiting and productivity. The staminate and pistillate blooms are found on the same plant in different configurations and individually **(*Desai et al.,* 2011).** In India, bottle gourds are typically harvested in two crops: the first from mid-October seeding to mid-March harvesting, and the second from early-March sowing to mid-July harvesting (harvest). It is an annual monoecious plant with a trailing or ascending vine. The stem has a hairy texture and protrudes long, forked tendrils. Flowers have stalks, with the stalks of the female flowers being shorter than the male. They are axillary, unisexual, and solitary. It produces hard-shelled fruits with a variety of morphologies, including long, oblong, and spherical.

The usage of bottle gourd juice in weight reduction treatments is common. It also aids in reducing liver and renal inflammation. Additionally, useful for curing diarrhoea is the juice of the bottle gourd. For people who are experiencing constipation, better food is available. A hair oil made from bottle gourds and sesame oil promotes restful sleep. It serves as one of the treatments for insomnia. Treatment for urinary tract infections with bottle gourd.

Currently, plant growth regulators are employed to manage a variety of physiological processes in crop production, including as blooming and fruiting (fruit set and parthenocarpy). Additionally, they are utilised in post-harvest ripening, germination, growth inhibition, and assimilate partitioning **(Weaver, 1975).** PGRs are used sparingly to control plant growth. Additionally, they regulate blooming, fruit set, shoot and root development, internode length, and fruit ripening. PGRs, which are commonly utilised in horticulture, have been used to alter when certain fruits and vegetables blossom and bear fruit **(Mishra 2014).**

Gibberellic acid is a crucial growth regulator that may be used in a variety of ways to alter plant growth, yield, and yield-contributing traits **(Rafeekher *et al.,* 2002).** Although there are four different forms of gibberellins, gibberllic acid, GA_3, is the most well-known. It stimulates cambial activity, growth, cell elongation, nucleic acid and protein synthesis, seed germination, as well as fruit set, leaf expansion, and dormancy break **(Devlin and Witham, 1986).**

NAA is a crucial plant growth regulator that promotes cell division, cell elongation, and cell enlargement in the apical part of plants, which improves bottle gourd plant development **(Kore *et al.,* 2003).** NAA is utilised in chemical fruit thinning, fruit drop prevention, flower induction, larger fruit setting, and hence higher yield. Through the production of the enzymes needed for the creation of cell wall and cytoplasmic components, NAA interacts with genes. Consistent blooming is started by NAA. The biggest fruits with the highest flesh were obtained in cucumbers after NAA spraying **(Das and Rabha. 1999).**

2. MATERIAL AND METHODS

The present investigation on **" Effect of plant growth regulators on growth, yield and fruit quality of Bottle Gourd (*Lagenaria siceraria*) cv MGH-4"** was conducted at Horticulture Research Field, Department of Horticulture, Naini Agricultural Institute, Sam Higginbottom University of Agriculture, Technology and Sciences, Prayagraj during mid- March to 2- August during the years 2019.

2.1 Experimental Design and Treatments

MGH-4 cultivar of Bottle gourd was used for the experiment. The experiment was laid out in Randomized Block Design with three replications**.** Gibberellic acid (30, 40, 50, 60, 70 and 80 ppm) and naphthalene acetic acid (30, 40, 50, 60, and 70 ppm) treatments were applied to the bottle guard variety MGH-4 at 2, 4, and 6 days after sowing (DAS). The salient features of the plant growth regulators that were employed in the experiment. Total number of 12 treatments was comprised during course of investigation including different concentration of NAA and GA_3 viz., T1 (Control), T2 (30 ppm NAA), T3 (40 ppm NAA), T4 (50 ppm NAA), T5 (60 ppm NAA), T6 (70 ppm NAA), T7 (80 ppm NAA), T8 (30 ppm GA_3), T9 (40 ppm GA_3), T10 (50 ppm GA_3), T11 (60 ppm GA_3) and T12 (70 ppm GA_3). It was impractical to collect observations on every plant due to the magnitude of the plant population; thus, the technique of random sampling was used to record observations of the plant's many growth metrics during the research. From each plot's representative sample of the whole population, three plants were chosen at random.

2.2 Parameters of Study

2.2.1 Vine Length (m): Length of main vine of all the three plants of a plot was measured and summed up and thereafter average was calculated.
2.2.2 Number of Leaves Per Plant: Total number of green leaves was estimated by counting the individual leaf from top to bottom of the plant and the mean value of three plants selected at random in each treatment was expressed as number of leaves per plant.
2.2.3 Days to First Male Flower Initiation: The number of days taken from the date of sowing to the date of first male flower was observed in all the three plants of a plot and average was calculated and it was recorded as number of days to first male flower.
2.2.4 Days to First Female Flower Initiation: The number of days taken from the date sowing to the date of first female flower initiation was observed in all the three plants or a plot and average was calculated and it was recorded as number of days first female flower.
2.2.5 Number of Male Flowers Per Vine: Number at male flower opened in individual plants of a plot was recorded as number of male flower and average was calculated of the plants.
2.2.6 Number of Female Flowers Per vine: Number at female flower opened in individual plants of a plot was recorded as number of female flower and average was calculated of the plants.

3. RESULTS

The findings of the current study on the impact of plant growth regulators on bottle gourd growth characteristics. The findings have been explained in terms of the effects of several experimental treatments. The results of the experiment have been presented separately under the following headings.

Vine Length (m): vine length data shows the significant results. The maximum vine length recorded in T7 NAA 80 ppm was (8.20 m) followed by GA3 30 ppm (7.45 m) which was found to be at par with each other and both treatments were superior to the T1 control (3.05 m).
Number of Leaves Per Plant: Number of leaves per plant data shows T_7 NAA 80 ppm recorded significantly higher number of leaves per plant (103.5) as compare other treatments at full foliage stage of bottle gourd. whereas minimum number of leaves was recorded in T_1 control water spray (46.083) which was significantly lower over all the treatments.
Days to First Male Flower Initiation: Days to first male flower initiation data shows the significant result. The minimum days to appearance of first male flowering recorded in T8 GA3 30 ppm (42.47) followed by T7 NAA 80 ppm (44.13) which was found to be at par with each other and both treatments were superior to the T1 control (64.12). This might be because GA3 speeded up male flower initiation due to actively or passively helping or boosting the floral apex development.
Days to First Female Flower Initiation: Days to first female flower initiation data shows the significant results. The minimum days to appearance of first female flower recorded in T7 NAA 80 ppm (53.33) followed by T6 NAA 70 ppm (55.83) which was found to be at par with each other and both treatments were observed superior to T1 control (76.58).
Number of Male Flowers Per Vine: Male flower per vine data shows the significant results. The maximum number of male flowers per vine recorded in T10 GA3 50 ppm was 54.08 followed by T7 NAA 80 ppm was 52.33 which was found to be at par with each other. And the minimum was found in T1 (27.75).
Number of Female Flowers Per vine: Number of female flowers per vine data shows the significant results. The maximum number of female flowers per vine recorded in T9 GA3 40 ppm was 17.08 followed by T7 NAA 80ppm was 14.5 which was found to be at par with each other and both treatments were superior to control was 8.0.

4. DISCUSSION

NAA induces cell division and cell growth and also improve synthesis and translocation of photosynthesis that enhance the vegetative growth of plant, hence vine length increased showed that application of GA3 at 5, 10 and 15 ppm and NAA at 25, 50 and 75 ppm at 4 to 6 true leaf stage increased the main vine length with increasing concentration in muskmelon cv. Hara Madhu. Similar results were found by **Kore *et al*. (2003)** reported different growth regulators showed significant effect on growth, flowering and yield. Maximum vine length (304.01 cm) was obtained with NAA at 20 ppm followed by GA3 at 5.0 (303.61 cm) and both treatments were superior to the control (250.07 cm).

The superiority in number of leaves of different treatment over control might be due to foliar application of NAA as it has physiological effects on growth parameters of plant. The suppressive action of NAA on apical meristem might be the result in cell elongation and cell division.

The application of NAA (50 ppm) produced the first male flower earlier (43 days) and was significantly superior to all other treatments in bitter gourd and application of GA3at 85 ppm showed significant influence on days to first male flower (34.7) in bitter gourd. The earliest (30.63 days) was obtained in control**.**

This increase in number of female flowers by the foliar spray of NAA may be due to the fact that this substance is reported to increase functional female organs and compatibility besides reducing the embryo abortion in plants. NAA (50 or 100 ppm) and stages of spray on days to first male and female flowering in bitter gourd Cv. Coimbatore long (green) was studied. Among the growth regulators, NAA at 50 ppm was found to be most effective for early appearance of first female flower (53.55 days), by the application of NAA resulted in the lowest number of days to first pistilate flower appearance (37.98 and 31.59) and 50% female flowering (59.76 and 50.25) during the summer and kharif seasons by**.**

Number of male flowers per vine be due to well-known effects of GA3 on early floral initiation **(Ganelevin and Zieslin, 2002)** as GA3 is mandatory for the shift from vegetative to reproductive stage, revealing florigenic effect **(Naor *et al.,* 2004)**. GAs can replace the requirement of growing cells for maintenance of cellular division during early flower development.

Chovatia *et al.,* (2010) observed that in a field experiment three concentrations each of GA3, NAA, Ethrel, MH and CCC were applied at the 2-leaf and 4-leaf stages on bitter gourd (*Momordica Chrantia* Linn.) cv. Priya. Its application was found to be the most effective in enhancing the number of branches per vine, number of pistillate flowers, fruit length, fruit diameter and number of fruits per vine and ultimately produced the highest fruit yield.

TABLE 1. Effect of Plant Growth Regulators on Growth Parameters of Bottle Gourd (*Lagenaria siceraria*) cv. MGH-4

Sr. No.	Treatments	Vine Length (m)	Number of Leaves Per Plant	Days to First Male Flower Initiation	Days to First Female Flower Initiation	Number of Male Flowers Per Vine	Number of Female Flowers Per vine
1.	T1 (Control)	3.053	46.083	64.127	76.583	27.750	8.00
2.	T2 (30 ppm NAA)	3.420	63.750	61.160	58.083	30.667	11.250
3.	T3 (40 ppm NAA)	3.183	76.667	57.783	60.00	35.500	12.750
4.	T4 (50 ppm NAA)	4.680	82.417	47.813	56.083	31.083	10.917
5.	T5 (60 ppm NAA)	2.537	93.917	50.313	56.583	33.917	12.00
6.	T6 (70 ppm NAA)	6.177	98.500	46.127	55.833	37.00	10.833
7.	T7 (80 ppm NAA)	8.203	103.500	44.127	53.333	52.333	14.500
8.	T8 (30 ppm GA_3)	7.457	50.917	42.470	68.250	38.583	11.333
9.	T9 (40 ppm GA_3)	6.447	94.500	45.720	74.500	54.083	17.083
10.	T10 (50 ppm GA_3)	6.597	91.917	55.910	65.833	40.250	11.917
11.	T11 (60 ppm GA_3)	5.190	90.417	52.500	72.750	38.167	10.583
12.	T12 (70 ppm GA_3)	4.193	68.917	55.190	70.250	35.917	9.250
	SEm (±)	**0.75**	**4.28**	**0.46**	**2.51**	**2.01**	**1.07**
	C.D. at 5% of Level	**1.56**	**8.93**	**0.97**	**5.23**	**4.19**	**2.25**
	C.V.	**18.01**	**9.21**	**1.47**	**4.8**	**6.72**	**11.28**

CONCLUSION

Based on the results on the present investigation entitled “Effect of plant growth regulators on growth, yield and fruit quality of Bottle Gourd (*Lagenaria siceraria*) cv MGH-4” this is concluded from the investigation that the treatment T9 i.e. application of 40 ppm GA_3 at 2, 4 leaf stage was found superior in terms of growth parameters of bottle gourd.

REFERENCES

Cutler HC, Whitaker TW. (1961) History and distribution of the cultivated cucurbits in the Americas. *American Antiquity.*;**26**:469-485.

Chovatia, RS., Ahlawat, T.R., Kavathia, Y.A., Jivani, L.L. and Kaila, D.C., (2010). Effect of plantgrowth regulators on vegetative growth, flowering and yield of bitter gourd cv. Priya. *IndianJournal of Horticulture,***67**:254-258

Devlin, R. M. and Witham, F. H. (1986). Plant physiology. CBS Publicaion and Distributors., New Sex expression and fruit yielf or bottle gourd *(Lagenaria siceraria)* (01) StandlJ Cv. Fusamusk melon (*Cucumis melo* L.). *Plant archives*, **15**(2): 899-Delhi. pp. 410-447. 91

Das, A, and Rabha, B, K, (1999). Effect of growth regulators on Size and quality of cucumber inplastic green house during rabi season, *Crop Res*., **18**(3): 390-396.

Desai, K.D., Saravaiya, S.N., Patel, B.N. and Patel, N.B., (2011). Response of grov.th retardants on sex expression and fruit yield of bottle gourd (*Lagenaria siceraria* (Mol.) Standl.l cv. Pusa Naveen under South Gujarat conditions. *Asian Journal of Horticulture,***6**(1):22-25

Ganelevin R, Zieslin N (2002). Contribution of sepals and gibberellin treatments to growth and development of rose (*Rosa hybrida*) flowers. Plant Growth Regul. 37:255-261.

Hilli JS, Vyakarnahal BS, Biradar DP, Hunje R. (2010) Effect of growth regulators and stages of spray on growth, fruit set and seed yield of ridge gourd *Lufla acutangula* L. Karnataka J Agri. Sci.; **23**(2):239-242

Kore, V.N., Khade, H.P., Nawale, R.N., Patil, R.S. And Mane, A.V., (2003), Effect of growth regulators on growth, flowering and yieldof bottle gourd variety Samrat under Konkan conditions. *Journalof Soils and Crops,***13**(1):18- 21.

Mishra, N. (2014). Growth and yield response of pea (*Pisum sativum* L) to IntegratedNutrient Management- A Review. *Journal of Plant and Pest Science,***1**(2): 87-95.

Minocha, S., (2015). An overview on *Lagenaria siceraria* (bottle gourd). *Journal of Bio-medical and Pharmaceutical Research,***4**(3):4-10

Naor V, Kigel J, Ziv M (2004). Hormonal control of inflorescence development in plantlets of calla lily (*Zantedeschia* spp.) grown *in vitro*. Plant Growth Regul. **42**:7-14. 96

Rafeekher M, SA Nair, PN Sorte, GP Hatwal and PM Chandhan, (2002). Effect of growth regulators on growth and yield of summer cucumber.*Journal of Soils and Crops,* **12**: 108-110

Ram D, Rai M, Rai N, Yadav DS, Pandey S, Verma A, Lal H, Singh N, Singh S. (2006). Characterization and evaluation of winter fruited bottle gourd, *Lagenaria siceraria* (Mol.) USDA, 2016. National Nutrient Database for Standard Reference, Release 28 slightly revised May, 2016. Basic Report 11218, Gourd. white-flowered (calabash), raw. Report date January 29, 2018, 08:53 EST. Retrieved from http://ndbnal.usda.gov/ndWfoods/show/2970

Shah, B.N., A.K. Seth, and R.V. Desai. (2010a). Phytopharmacological profile of *Lagenaria siceraria*: a review. *Asian J. Plant Sci*. **9**(3):152–157.

Singh, K, and 2003, K, S. (2013). vegetative growth, flowering and fruiting of bottle gourdas affected by certain plant growth substances. *PAU.J. Res.,***6**; 793-800.