

Original Research Article

EFFECT OF DIFFERENT GROWTH REGULATORS ON PLANT GROWTH AND YIELD OF BOTTLE GOURD

(LagenariasicerariaL.)cv. ArkaBahar

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ABSTRACT

An experiment was conducted during 2021 to study the effect of different growth regulators on bottle gourd cv. ArkaBahar ~~at Horticultural Research Field, Department of Horticulture, Naini agricultural institute, Sam Higginbottom University of Agriculture, Technology and Sciences, Prayagraj~~ during kharif season with three growth regulators ~~having at different~~ concentrations: Ethrel (100ppm, 200ppm, 300ppm), NAA (150 ppm, 200ppm, 250ppm) and GA₃(50ppm, 100ppm, 150ppm). Water was used as control. ~~(Add something else about materials and methods)~~ ~~The application of plant growth regulators significantly affects the vegetative as well as reproductive attributes of the crop.~~ Plant growth regulators treatments rendered their significant effect on almost all the growth, flowering and yield of bottle gourd. ~~T₁ that~~ the treatment T₉ GA₃ 150 ppm was found maximum in increasing the vine length (9.01m) whereas T₃ i.e. application of Ethrel 200 ppm was found in terms of days to first appearance of male (40.89 days) and female flower (45.44 days), node number to first male (8.11) and female flower (10.11), number of male (16.33) and female flowers (11.33) per vine, fruit diameter(8.67 cm), fruit length (39.84 cm), fruit weight (1064.28 g), number of fruits per plant (10.11), fruit yield per plant (8.72 kg), fruit yield per hectare(29.01 t/ha) was found suitable for application in kharif season bottle gourd cultivation for better yield. The significantly higher gross return (Rs 348120/ha), Net profit (Rs 269898/ha) and B: C ratio (4.45) was also recorded under ethrel 200 ppm (T₃). Conclusion?

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Key words: - Bottle gourd, PGR, Ethrel, NAA, Gibberellic acid, growth and yield.

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INTRODUCTION

Bottle gourd (*Lagenaria siceraria* L.) is an important vegetable crop belonging to the cucurbitaceae family having a chromosome number 2n=22. It is commonly known as calabash gourd, white flower gourd plant, Lauki, kadu, ghiyaor doodhi. It is grown extensively ~~grown~~ in India, might have originated in Tropical Africa. It is a vegetable with a good source of carbohydrates, vitamin A, vitamin C and minerals (Hilli *et al.*, 2010). It has pan-tropical distribution with regional economic importance and is used as a vegetable, container, musical instrument while its seeds are used for oil and protein. Bottle gourd has relatively high nutritional value. The fruit contain moisture (96.3%), carbohydrates (2.9) protein (0.2%), fat (0.5%), mineral matter (0.5%), 0.044 mg thiamine, 0.023 mg riboflavin, 0.33 mg niacin and 12 mg of vitamin C (Ascorbic acid) per 100g fresh weight and the fruit is a good source of glucose and fructose. It also contains vitamin B, ascorbic acid and known for its curative properties. The tender fruit of bottle gourd can be used as vegetable or for making sweets like halva, kheer, petha and burfi. It is also used for making kofta and pickles.

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On the other hand, the growth regulators can be a useful alternative for improving crop production. Plant growth regulators have profound influence on fruit production in cucurbits. They are important due to their direct effect on male and female flower production; better fruit set, and ultimately on yield (Bose *et al.*, 1999). Early nodes bear male flowers and higher amounts whereas hermaphrodites and pistillate flowers are found in later nodes. This results in delaying harvesting as well as yield reduction. Thus the solution can be found by the exogenous application of plant growth regulators. Therefore the uses of plant growth regulators like NAA, Ethrel and GA₃ in bottle gourd may become an important tool for increasing flowers as well as increase in yield. Ethrel is an important growth regulator which is used for more production of female flowers due to its property of better development of gynoecium, fruit ripening, stress induction, lateral cell expansion. It stimulates flower opening, adventitious root senescence; activate enzymes in respiration, inducing branching. NAA is a growth promoter stimulates cell division, cell elongation of shoot, photosynthesis, RNA synthesis, enhances leaf area index, leaf chlorophyll content. GA₃ enhances more cell division, cell wall elongation, cell wall plasticity and permeability of cell membranes, induced parthenocarp and extending growth of shoots. By involving plant growth regulators and a high yield variety of the crop can improve the crop production. Keeping this in view, the experiment was undertaken to study the effect of different growth regulators (Ethrel, NAA, GA₃) on plant growth and yield of bottle gourd and to evaluate the suitable dose along with economic feasibility of different treatments.

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MATERIAL AND METHODS

The experiment was conducted at Experimental Research Field, Department of Horticulture, Naini Agricultural Institute, Sam Higginbottom University of Agriculture, Technology & Sciences, Prayagraj (UP) during 2021 during Kharif season, country?

The experiment material consist of Arka Bahar variety of bottle gourd, which is released from Indian Institute of Horticultural Research, Karnataka. The experiment was laid out in randomized block design with three replications consisting of 10 treatments having one control (water spray), three levels of each Ethrel(100,200and300ppm), NAA(150,200 and 250 ppm) and GA₃(50,100 and 150 ppm). The plot size was 2m×2m with 2m×1.5m spacing rows and plants. The pit was dug with 30×30×30 cm³and applied dose of FYM is 20 tonnes/ha and N, P, K is 120 kg, 60kg and 60kg/ha respectively. Two successive sprays of growth regulators were done at 2, 4 leaf stages on the crop plants in all treatments during the morning or evening hours of the day. Statistical analysis of variance was performed on the data collected throughout the experiment. The significance of the treatments was determined using the 'F' test at a level of significance of 5%.The observation were recorded for vine length (m), days to appearance of first male and female flower, node number to first male and female flower, total number of male and female flower per vine, fruit diameter (cm), fruit length (cm), fruit weight (g), no of fruits per vine, fruit yield per plant(kg), fruit yield per hectare (t/ha).

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RESULTS AND DISCUSSION

GROWTH PARAMETERS

The data on growth parameters in different treatment combinations was recorded and are presented in (Table 1). Critical analysis of data displayed in table clearly marked out the

obvious difference among the treatments with respect to growth parameters of Bottle gourd cv. Arka Bahar. Vine length was increased significantly by plant growth regulator application compared to control in the analysis of data. The maximum vine length was recorded in T₁₀ GA₃ 150 ppm (9.01m) being significantly superior while minimum to the T₁ control (5.83m). PGR₂ significantly reduced the number of days for appearance of first male flower in T₃ Ethrel 200 ppm (40.89 days). T₃ Ethrel 200 ppm (45.44 days) significantly reduced the number of days for appearance of first female flower. Node number of first male flower was significantly reduced by PGR and the lowest was in Ethrel 200 ppm (8.11). Similarly, Ethrel 200 ppm significantly decreased the node number of first female flower (10.11). The analysis data of number of male and female flowers per vine showed the significant results. The minimum number of male flowers per vine recorded followed by in T₃ ethrel 200 ppm (16.33) and the maximum in T₁ Control (32.44). The maximum number of female flowers per vine recorded followed by in T₃ ethrel 200 ppm (11.33) and the minimum in T₁ Control (7.00).

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The increased vine length in GA₃ and NAA was due to mechanism in stimulating auxin production, cell division, cell elongation, increases plant height and extending growth of shoots that enhance the vegetative growth of plant (reference). Komal *et al.*, (2019) showed that GA₃ was most effective in increasing the length of vine which was also supported by Mishra *et al.*, (1972). Ethrel might have reduced the growth of vine length and induction of dwarfism which might due to the decrease in level of gibberelin as also reported by Arora *et al.*, (1985).

Ethrel helps in stimulating the initiation of flowers and stimulates the flower opening. Randhir Kumar *et al.*, (2019) caused the reduction of days for the first male flower appearance which was also in the agreement with those of Baruas and Das *et al.*, (1997) in bottle gourd. The increase of starch and carbohydrate due to the ethrel application resulted in earliest production of female flowers. Abdul Majid Ansari *et al.*, (2018) revealed that the application of ethrel 100 ppm reduced the minimum days to appearance of female flower in bottle gourd. Similar results were found in the findings of Sidhu *et al.*, (1981) in squash melon. Application of ethrel caused reduction of Node number of first male flower. Similar results also reported by Sidhu *et al.*, (1982) in Muskmelon and Node number of first female flower. Similar results also reported by Chowdhary *et al.*, (2018) in bottle gourd.

Sanjeevan Gosai *et al.*, (2020) observed that Ethrel was found effective in decreasing the number of male or staminate flowers per vine. Similar results were also observed by Ghani *et al.*, (2013) in bitter gourd. Sexual differentiation is controlled by endogenous levels of auxin which are altered by the ethrel, which developed flowering primordia and during flowering act as anti-gibberellin substance. This anti-gibberellin effect suppressed staminate flowers and promotes more pistillate flowers and ethrel was found most effective in increasing flowers per vine in the experiment showed by Patel A N *et al.*, (2017). Similar results were also observed by Sulochanamma *et al.*, (2001) in muskmelon (scientific name).

Table 1.Effect of different plant growth regulators on yield trait of Bottle gourd (*Lagenaria siceraria* L.) cv Arka Bahar

Treatments	Treatment combinations	Vine length (m)	Days to first appearance of male flower	Days to first appearance of female flower	Node number to first male flower	Node number to first female flower	Number of male flowers per vine	Number of female flowers per vine
T ₁	Control	5.83	50.78	55.44	12.44	15.22	32.44	7.00
T ₂	Ethrel 100 ppm	6.32	41.33	47.11	8.44	11.14	18.33	10.22
T ₃	Ethrel 200 ppm	6.82	40.89	45.44	8.11	10.11	16.33	11.33
T ₄	Ethrel 300 ppm	7.52	42.22	47.56	8.67	11.56	20.22	9.11
T ₅	NAA 150 ppm	7.26	48.89	54.56	9.22	14.33	31.33	7.67
T ₆	NAA 200 ppm	7.96	43.78	52.44	11.22	12.56	24.89	7.89
T ₇	NAA 250 ppm	8.08	44.67	53.56	10.11	13.11	25.78	9.00
T ₈	GA ₃ 50 ppm	8.16	46.22	52.89	10.67	13.22	29.11	7.22
T ₉	GA ₃ 100 ppm	8.64	44.56	51.22	9.89	12.44	27.22	8.00
T ₁₀	GA ₃ 150 ppm	9.01	42.33	52.22	11.56	13.67	22.67	8.11
	S.Ed. (±)	0.19	0.63	0.83	0.20	0.32	0.37	0.32
	C.D (P=0.05)	0.40	1.31	1.74	0.42	0.68	0.78	0.67
	C.V.	3.08	1.72	1.98	3.24	3.10	1.82	4.58

YIELD PARAMETERS

The exogenous application of plant growth regulators at 2 and 4 leaf stages significantly affected the yield characters of bottle gourd as shown in table 2. The maximum fruit diameter (8.67cm) was found in ethrel 200 ppm (T₃) which is significantly at par with by T₂ ethrel 100 ppm (8.32 cm) and the minimum was in control (6.43cm). Length of the fruit increased significantly with plant growth regulator maximum (39.84 cm) long fruits with the application of ethrel 200 ppm (T₃) and the shortest length was in control (29.44 cm). The maximum fruit weight was increased significantly by the application of ethrel and the minimum fruit weight was in control (605.13). The analysis data of number of fruits per plant showed the significant results. The maximum number of fruits per plant recorded followed by in T₃ ethrel 200 ppm (10.11) and the minimum in T₁ Control (6.22). The data revealed that fruit yield of bottle gourd per plant was significantly increased by various treatments. The maximum Fruit yield per plant (kg) recorded in followed by in T₃ ethrel 200 ppm (8.72kg) and the minimum in T₁ Control (4.67 kg). The data of total fruit yield hectare (t/ha) varied from 15.56 t/ha to 29.01 t/ha. The maximum fruit yield per hectare (t/ha) recorded T₃ ethrel 200 ppm (29.01 t/ha) followed by T₂ ethrel 100 ppm (26.49 t/ha) and the minimum in T₁ Control (15.56 t/ha).

The length of the fruit with the application of ethrel might be due to cell enlargement as well as activation of metabolic activity of fruit. Length of fruit significantly with ethrel which was revealed by B M Chowdhary *et al.*, (2018). This was in accordance with the Prasad *et al.*, (1994) in bottle gourd. Prakash Mahala *et al.*, (2014) ethrel applied at the 2,4 leaf stage on bottle gourd in significantly higher fruit weight was found in ethrel. The increase in fruit weight by the application of ethrel is due to the plant remained physiologically more active to build up sufficient food stock for developing flowers and fruits, ultimately leading to higher fruit weight. These findings are in close consonance with those of Kashirsagar *et al.*, (1996) in cucumber. The increase the number of fruits per vine in ethrel was due to better fruit set because of more number of female flowers. Similar results were reported by Mandai *et al.*, (1990) in bottle gourd. The increase in the yield of fruit per plant in ethrel and these findings were in consonance with Parmar *et al.*, (2003) in sponge gourd.

CONCLUSION

Based on the present investigation it was concluded among the 10 treatments, the treatment T₃ i.e. application of Ethrel 200 ppm at 2,4 leaf stage was the most beneficial in terms of days to first appearance of male and female flower, node number to first male and female flower, number of male and female flowers per vine, fruit diameter, fruit length, fruit weight, number of fruits per plant, fruit yield per plant, fruit yield per hectare for application in kharif season bottle gourd cultivation for better yield.

[Implication? What else to do for further research?](#)

Table2. Effect of plant growth regulators on yield trait of Bottle gourd (*Lagenaria siceraria* L.) cv Arka Bahar

Treatments	Treatment combinations	Fruit diameter (cm)	Fruit length (cm)	Fruit weight (g)	No of fruits per plant	Fruit yield per plant (kg)	Fruit yield (t/ha)
T ₁	Control	6.43	29.44	605.13	6.22	4.67	15.56
T ₂	Ethrel 100 ppm	8.32	36.42	941.11	9.22	7.95	26.49
T ₃	Ethrel 200 ppm	8.67	39.84	1064.28	10.11	8.72	29.01
T ₄	Ethrel 300 ppm	7.89	30.38	853.11	8.56	7.73	23.55
T ₅	NAA 150 ppm	7.49	32.60	811.11	7.22	6.31	20.28
T ₆	NAA 200 ppm	7.27	31.61	779.56	6.78	6.09	21.03
T ₇	NAA 250 ppm	6.96	33.46	785.33	7.00	5.58	18.59
T ₈	GA ₃ 50 ppm	7.23	32.87	614.44	7.44	5.20	17.46
T ₉	GA ₃ 100 ppm	6.64	31.53	807.00	7.67	6.05	20.14
T ₁₀	GA ₃ 150 ppm	7.47	33.91	834.89	7.56	6.74	22.46
	S.Ed. (±)	0.12	0.78	31.42	0.30	0.17	0.59
	C.D (P=0.05)	0.26	1.64	66.01	0.62	0.37	1.24
	C.V.	2.01	2.88	4.75	4.66	3.53	3.35

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