The Pharma Innovation Journal 2022; 11(1): 912-914

www.ThePharmaJournal.com

The Pharma Innovation

ISSN (E): 2277- 7695
ISSN (P): 2349-8242
NAAS Rating: 5.23
TPI 2022; 11(1): 912-914

www.thepharmajournal.com
Received: 03-10-2021
Accepted: 26-11-2021

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Effect of plant growth regulators on growth and yield of bottle gourd (*Lagenaria siceraria*) under Prayagraj agro climatic conditions

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Abstract
The present experiment is "Effect of Plant Growth Regulators on Growth and Yield of Bottle Gourd (*Lagenaria Siceraria* var. Kashi ganga) Under Prayagraj Agro climatic conditions" was carried out during February, 2021to June, 2021 on Research field, Department of Horticulture, SHUATS, Prayagraj. The experiment was laid by randomized block design (RBD), with thirteen treatments T_0 control,T_1GA_3(20ppm) at 2 leaf stage,T_2GA_3(40 ppm) at 2 leaf stage.T_3GA_3 (20ppm) at 4leaf stage, T_4 GA_3 (20 ppm) at 4 leaf stage, T_5 NAA (80 ppm) at 2 leaf stage, T_6 NAA(100 ppm) at 2 leaf stage, T_7 NAA (80 ppm) at 4 leaf stage, T8 NAA (100 ppm) at 4leaf stage, T_9 Ethrel (100 ppm) at 2 leaf stage, T_{10} Ethrel (150 ppm) at 2 leaf stage. T_{11} Ethrel (100 ppm) at 4 leaf stage, T_{12} Ethrel (150 ppm) at 4 leaf stage. The experiment was observation to be recorded Vine length (m), Number of branches per plant, Days to appearance of first male flower, Days to appearance of first female flower, Days to first picking, Fruit length (cm), Fruit weight (gm), Fruit diameter (cm), Number of fruit per plant, Fruit yield per plant(kg), Yield tones ha^{-1}. Among the respective treatment $T_4$was found superior over other treatments. The result of the experiment revealed that application of plant growth regulators (GA_3,NAA,Ethrel) had significant effect on vegetative as well as reproductive attributes. Treatment consisted of T4 GA_3 (20 ppm) at 4 leaf stage through recorded best performances with respect to almost all the characters *viz*., growth, flowering and yield followed by T8 NAA (100 ppm) at 4 leaf stage. It is concluded from the investigation that the treatment T4 GA_3 (20 ppm) At 4 leaf stage through was found suitable growth and yield for bottle gourd.

Keywords: Bottle gourd, GA_3, NAA, Ethrel

Introduction
Bottle gourd (*Lagenaria siceraria*) belongs to the family cucurbitaceous having chromosome number 2n (22). Bottle gourd white flowered gourd or calabash gourd, running or climbing vine of the gourd family. The fruits contain 0.2 percent protein, 2.9 percent carbohydrates, 0.5 percent fat, 0.5 percent mineral matter, 0.044 mg thiamine, 0.023 mg riboflavin, 0.33 mg niacin and 12 mg vitamin - C and 0.6 g fiber per 100 g fresh weight. Bottle gourd has a lot of medicinal properties. The fruit has a cooling effect. It is cardiatonic and diuretic in effect.

Materials and Methods
A field experiment entitled "Effect of Plant Growth Regulators on Growth and Yield of Bottle Gourd (*Lagenaria Siceraria* var. Kashi ganga) Under Prayagraj Agro Climatic Conditions was conducted at Departmental Research Field, Department of Horticulture, Sam Higginbottom University of Agriculture, Technology and Sciences. The experiment was laid by randomized block design with 12 treatments are T0 control, T1 GA_3 (20 ppm) at 2 leaf stage, T2 GA_3 (40ppm) at 2 leaf stage, T3 GA_3(20 ppm) at 4 leaf stage, T4 GA3(40ppm) at 4 leaf stage, T5 NAA (80ppm) at 2 leaf stage, T6 NAA (100ppm) at 2 leaf stage, T7 NAA (80ppm) at 4 leaf stage, T8 NAA (100ppm) at 4 leaf stage, T9 Ethrel (100ppm) at 2 leaf stage, T10 Ethrel (150ppm) at 2 leaf stage, T11 Ethrel (100ppm) at 4 leaf stage, Ethrel (150ppm) at 4 leaf stage. The salient features of plant growth regulators used in this experiment.

Results and Discussion
The research results statically provided us with the evidence of improving growth, quality and yield traits of bottle gourd in response to growth regulators. The mean data showed significant to the vine length, 90 days after sowing the highest vine length was recorded T_4 GA_3(20ppm) at 4^{th} leaf stage (6.13) followed by T_8 NAA (100ppm) at 4^{th} leaf stage (6.05), GA_3(20ppm) at 4th leaf stage (5.73) while the lowest vine length was recorded in T_0control(2.03).

Application of GA_3 (40ppm) and Ethrel (100ppm) was found to be the most effective enhancing the protein synthesis, cell division and elongation of vine length of bottle gourd Mishra *et al*., (2005) The mean data showed significant to the number of branches, 90 days after sowing, the more number of primary branches/ plant was recorded in the T_4 GA_3 (20 ppm) at 4 leaf stage (12.22) followed by GA_3 (20 ppm) at 4 leaf stage (10.88), NAA (80 ppm) at 4 leaf stage (10) while the lesser number of primary branches per plant was recorded in T_0control (2.11). Application of NAA (40ppm) and Ethrel (100ppm) was found most effective in converting to femaleness, producing number of branches and increasing the yield Jadav *et al.*, (2002) to be The mean data showed significant to the days to first male flower The lesser number of days to first male flower appearance was recorded in T_4 GA_3 (20ppm) at 4th leaf stage (75.11) fallowed by T3 GA_3 (20 ppm) at 4th leaf stage (76.78) while the more number of days to first male flower appearance was recorded inT0 control (89). The mean data showed significant to the days to first female flower The lesser number of days to first female flower appearance was recorded in T_4 GA_3(20ppm) at 4th Leaf stage (80.33), followed by T3 GA_3 Ethrel 4th leaf stage (85.11). while the more number of days to first female flower appearance T_0 control (90.33) NAA initiates uniform and induction flowering and also it is used to prevention of fuit drop, increase fruit setting, size and thus increasing yield kaushal *et al*., (2022). The mean data showed significant to the days to first fruit picking, The lesser number of days to for first picking of bottle gourd was recorded in T_4 GA_3 (40ppm) at 4 leaf stage (89.2) followed by GA_3(20 ppm) at 4 Leaf stage (90.46). While less number of days to first picking was recorded inT_0 control (101.96). The mean data showed significant to the average fruit weight, The more average fruit weight (g) was recorded in T_4GA_3 (20ppm) at 4 leaf stage (1026.78) followed by T_8 NAA (100 ppm) at 4 leaf stage (941.1) while the lesser average fruit weight (g) was recorded in T_0 control (471.1). Growth regulators increased rate of photosynthesis activity, accelerated translocation and efficiency of utilization of photosynthase, thus resulting in the cell elongation and rapid cell division in the growing portion which ensure longest stem. Kadi *et al.* (2018) [8]. The mean data showed significant to the, The highest average fruit length (cm) T_4GA_3 (20ppm) at4 leaf stage (30.56) followed by T_8 NAA (100 ppm) at 4 leaf stage (28.11), while the lowest average fruit length(cm) was recorded in T_0control (16.17). The mean data showed significant to the fruit diameter, The highest fruit diameter was recorded inT_4 GA_3 (20ppm) at 4 leaf stage (7.01) followed by T_7 NAA (80 ppm) at 4 leaf stage (6.74), while the lowest fruit diameter was recorded in T_0 control (4.80). All the concentration of plant growth regulators (GA_3, NAA, ethrel) increased the girth of fruit (Arora *et al*.) The mean data showed significant to the number of fruits per plant. The more number of fruits per plant was recorded in T_4 GA_3 (20 ppm) at 4 leaf stage (13.33) followed by NAA (100 ppm) at4 leaf stage (11.56), while the lesser number of fruits per plant was recorded in T_0 control (6.33). The mean data showed significant to the fruit yield per plant, the more number of fruit yield per plant (kg) was recorded in T_4 GA_3 (20 ppm) at 4 leaf stage (10.95) followed by NAA (100 ppm) at 4 leaf stage (9.53), while the lesser number fruit yield per plant (kg) was recorded in T_0 control (4.07). The mean data showed significant to the more fruit yield t/ ha (kg) was recorded in T_4 GA_3 (20 ppm) at 4 leaf stage (28.60) followed by T_8 NAA (100 ppm) at 4 leaf stage (24.93), while the lesser fruit yield per plant (kg) was recorded in T_0 control (5.53).Growth regulators significantly increased the size of fruits, average fruit weight, number of fruits and yield of fruit in bottle gourd, gave the best result with respect to fruit length and diameter which was in accordance with the result of choudhury and babel (2000)

Table 1: Mean performance of growth and flowering parameters of bottle gourd

Treatments combination	vine length	Number of branches	Days to first male flower appearance	Days to first female flower appearance	Days to first fruit picking	fruit weight	Fruit length	Fruit diameter	Number of fruits/plant	Fruit yield/ plant (kg)	Fruit yield (t/ha)
T_0	2.03	5.11	89.00	90.33	99.86	471.11	16.17	4.80	6.33	4.07	5.53
T_1	5.05	6.77	79.89	88.22	97.76	628.89	23.56	5.99	7.44	6.03	18.17
T_2	5.05	6.66	81.00	86.33	97.20	664.44	23.56	5.93	7.89	6.44	19.38
T_3	5.73	10.88	76.78	85.11	90.46	913.33	26.78	6.64	11.11	8.61	21.18
T_4	6.13	12.22	75.11	80.33	89.20	1026.78	30.56	7.01	13.33	10.95	28.60
T_5	4.67	7.77	82.78	86.89	98.73	632.22	22.94	5.94	8.89	6.71	16.31
T_6	4.57	7.66	77.67	86.67	99.10	660.33	23.58	5.86	8.56	6.52	16.84
T_7	4.97	10.00	83.00	82.22	92.86	791.78	25.67	6.74	10.11	7.63	20.28
T_8	6.05	8.55	77.22	89.11	99.10	941.11	28.11	6.36	11.56	9.53	24.93
T_9	5.24	5.22	84.00	86.78	92.86	684.00	25.67	5.98	7.00	4.58	9.41
T10	2.11	7.77	79.44	85.78	95.20	605.56	17.13	5.30	7.78	5.35	9.40
T11	2.57	7.44	78.89	87.87	97.16	646.67	18.62	5.41	8.78	5.04	7.48
T12	2.43	6.44	79.89	86.56	99.53	678.89	18.53	5.33	8.56	6.52	11.92
S.Ed(+)	0.20	0.35	1.84	1.44	0.7	81.09	0.86	0.34	0.61	0.65	2.73
C.D.(0.05)	0.41	0.71	3.73	2.92	1.2	164.16	1.73	0.69	1.23	1.31	5.54

Conclusion

From the present investigation, it was concluded that the plant growth regulators treatments rendered their significant effect on the better germination, growth and development of the bottle gourd crop. The treatment, T_4 consisted of GA_3 (20 ppm) at 4 leaf stage recorded best performances with respect to growth parameters like vine length (m), number of branches per plant, days to first male flower appearance, days to first female appearance, days to first picking of fruits and yield parameters like average fruit length (cm), average fruit weight (gm), fruit diameter (cm), fruit yield per plant, yield per hectare, Total soluble solids and vitamin-C content (mg/100gm).

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