Available online at www.ijpab.com

DOI: http://dx.doi.org/10.18782/2320-7051.5671

ISSN: 2320 – 7051

Int. J. Pure App. Biosci. **5 (4):** 1755-1759 (2017)

Research Article

International Journal of Pure & Applied Bioscience

OPEN ACCESS

Evaluation of Bioeffectiveness and Phytotoxicity of Gibberellic Acid on Chilli

Sreenivas, M.* and Sharangi, A. B.

Department of Spices and Plantation Crops, Faculty of Horticulture, Bidhan Chandra KrishiViswavidyalaya (Agricultural University), Mohanpur-741252, Nadia, West Bengal, India

*Corresponding Author E-mail: sreehorti1217@gmail.com

Received: 20.07.2017 | Revised: 29.07.2017 | Accepted: 2.08.2017

ABSTRACT

The investigation was carried out at C-Block farm, kalyani, Bidhan Chandra Krishi Viswavidyalaya during 2015-16 in chilli cv. Beldanga to study the effect of gibberellic acid on growth and yield parameters in chilli. During seedling stage, roots are dipped with different concentrations (0, 10 and 20 ppm) of gibberellic acid and transplanted, which were further sprayed with GA3 of three more concentrations (20, 30 and 40ppm) at flowering stage. The experiment was laid out in RBD with three replication. Among different treatments maximum plant height (73.47cm), plant spread (67.47cm in East-West and 67.67 cm in North-South) and number of primary branches (9.13) at 150DAP was found with 20 ppm seedling dip and 30ppm foliar spray. In respect to the yield parameters, maximum yield (181.37 g/plant) and maximum fruit set per cent (34.61) was observed in 10 ppm seedling dip and 40 ppm foliar spray (34.61) followed by 20 ppm seedling dip-30 ppm foliar spray (34.17). Early fruit maturity (40.33 days), maximum number of fruits (87.80), fruit length (72.73 mm) and fruit width (35 mm) was observed in the plants treated with 20 ppm seedling dip and 30 ppm foliar spray. best yield was obtained from the plots sprayed with 10 ppm seedling dip with 40 ppm foliar spray, 20 ppm seedling dip with 20 ppm foliar spray and 20 ppm seedling dip with 30 ppm foliar spray.

Key words: *chilli, gibberellic acid, growth, yield.*

INTRODUCTION

Chilli (*Capsicum annuum* L.) is regarded as one of the main commercial vegetable and spice crops at global level[1]. It belongs to the family Solanaceae and is grown in almost all parts of tropical and subtropical regions of the world. The genus Capsicum includes 30 species, five of which are cultivated: *Capsicum annuum* L., *C. Frutescens* L., *C. Chinense* Jacq, *C. Pubescens* R. & P. and *C. Baccatum* L[2-4]. India is the largest producer of chillies in the world followed by China. In India chilli occupies an area of 7.75 lakh hectares with an annual production of 14.92 lakh tones during 2013-14[5].

Cite this article: Sreenivas, M. and Sharangi, A.B., Evaluation of Bioeffectiveness and Phytotoxicity of Gibberellic Acid on Chilli, *Int. J. Pure App. Biosci.* **5(4):** 1755-1759 (2017). doi: http://dx.doi.org/10.18782/2320-7051.5671

Andhra Pradesh leads the country in its production, productivity and export followed by Karnataka, West Bengal, Madhya Pradesh and Orissa. Though India is the leading producer, the average yield of chilli is very low (1.11 t/ha dry chilli) as compared to developed countries like USA, China, South Korea, Taiwan etc, where the average yield ranges from 3-4 t/ha. The production of chilli is reduced due to flower and fruit drops, which are caused by physiological and hormonal imbalance in the plants particularly under unfavorable environments, such as extremes of temperature i.e. too low or high temperatures. The production of chilli is governed not only by the inherent genetic yield potential of the cultivars but is greatly influenced by several environmental factors and cultivation practices. The manipulation of growth and increasing productivity and quality is the basis for most plant-related research. As a result many compounds are used to accelerate flowering and fruiting in young plants. Studies on the effect of plant growth regulators in chilli have revealed that the application of some of the plant growth regulators has been found effective in reducing the flower and fruit drops thereby enhancing production of chilli per unit area and per unit time[6]. The most widely available plant growth regulator is GA_3 or gibberellic acid, which induces stem and internode elongation, seed germination, enzyme production during germination and fruit setting and growth. Gibberellic acid (GA_3) is a chemical substance that occurs naturally in many plants. It is an important growth regulator that may have many uses to modify the growth, yield and yield contributing characters of plant[7]. The present study was, therefore, conducted with different concentration of gibberellic acid as foliar spray to find out the effective concentration of gibberellic acid which promoting growth and yield in commercial chilli variety Beldanga as well as to study the effect and phytotoxicity of Gibberellic on growth, yield and quality.

MATERIALS AND METHODS

The study was conducted at "C" Block Farm of BCKV, Kalyani, situated at 23.5^0 N latitude and 89^0 E longitude at a mean sea level of 9.75m. The field experiments were undertaken in autumn-winter season. The soil texture of the farm is sandy loam having neutral reaction, with good water holding capacity and medium fertility.A research activity was initiated with the studies on growth, yield and quality of chilli (Cv. Beldanga) collected from local farmers of Mohanpur and Gadamara, Dist-24 Parganas (North) of West Bengal as influenced by GA_3. The seedlings are treated by dipping with GA_3 (0, 10 and 20 ppm) before planting and field treatment was done by 1^{st} and 2^{nd} spraying with the same PGR at varying concentrations (20, 30 and 40 ppm) during flowering and 20-30 DAFS (days after first spraying) as per the mandate. Observations are recorded on morphological, phenological, yield and yield attributing parameters. For phytotoxicity study plants sprayed with GA 0.45 % SL at different concentrations (0, 30, 40, 60, 80, 120 and160 ppm) as foliar spray. Observations are recorded on 0, 3, 5, 7 and 10 days after spray on yellowing, epinasty, hyponasty and scorching symptoms of the crop. Ten plants were randomly selected from each lot and the total number of leaves these showing phytotoxicity symptoms, were counted. All the data collected were analyzed statistically.

RESULTS AND DISCUSSION

Growth parameters

Maximum plant height (16.33 cm) was recorded by T_5(30 DAP), 39.60 cm in T_6 (60 DAP), 48.67 cm in T_8(90 DAP), 72.00 cm in T_8 (120 DAP) and 73.47 cm in T_8(150DAP). Whereas, the minimum values were recorded by 13.87 in T_9 (30 DAP), 27.02 in T_9 (60 DAP), 40.20 in T_2 (90 DAP) 53.23 in T_{10} (120 DAP) and 53.67 in T_2 (150DAP).Similar findings also reported by[8, 9] in tomato. This could be ascribed to the roles of GA3 in promoting cell enlargement and cell division of which the two important processes enhanced plant height in tomato[10].

At 30 DAP, plant spread (East-West) ranged from 14.00 cm (T_{10}) to 18.07 cm (T_5), at 60 DAP, from 22.73 cm (T_1 and T_{10}) to 27.40 cm (T_4), at 90 DAP, from 33.27 cm (T_1

and T_4) to 40.33 cm (T_8), at 120 DAP, from 46.00 cm (T_{10}) to 60.73 cm (T_8) and at 150 DAP, from 52.20 cm (T_2) to 67.47 cm (T_8). Maximum North-South canopy spread 18.87 cm was recorded by T_5 at30 DAP, 27.67 cm in T_3 at 60 DAP, 41.07 cm in T_6 at 90 DAP, 63.73 cm in T_8 at 120 DAP and 67.67 cm in T_8 at 150 DAP. Whereas, the minimum values were recorded by 13.47 cm, 19.47 cm, 30.53 cm, 43.47 cm and 48.27 cm at 30, 60, 90, 120 and 150 DAP respectively in T10. Maximum number of primary branches per plant ranged from 1.87 (T_1) to 3.47 (T_8) at 30 DAP, 5.80 (T_{10}) to 7.47 (T_7) at 60 DAP, 6.93 (T_3) to 8.60 (T_9) at 90 DAP, 7.13 (T_3) to 8.73 (T_7) at 120 DAP and from 7.13 (T_3) to 9.13 (T_8). Plant height and number of branches/plant increased significantly with the increasing level of GA*3*. This might be due to rapid increase in cell division and cell elongation in the meristematic region[11, 12]. There were significant differences for days to fruit maturity and it ranged from 40.33 days (T_8) to 43.83 days (T_3). The treatment T_3 recorded 43.83 days followed by 43.33 days in T_4 and T_{10} while the T_8 recorded the minimum (40.33) days to fruit maturity.

Yield and yield attributing characters

Statistically significant results were observed for fruit set per cent, and it varied from 15.23 to 34.17 with a mean of 34.61. The maximum fruit set per cent was observed in T_6 (34.61) followed by T_8 (34.17), whereas the minimum per cent was recorded inT_{10} (15.23) preceded by T_1 (15.92).

There were significant differences for fruit length and width. Fruit length varied from 67.41 mm to 72.73 mm. maximum fruit length 72.73 was observed in T_7 followed by 71.54 mm in T_6 and Minimum values recorded by T_2 (67.41) followed by T_{10} (67.60). fruit width ranges from 32.52 mm (T_{10}) to 35 mm (T_8). Days to 50 per cent flowering ranged from 58 to 79 with a mean of 73 days. The treatments T_2, T_4 and T_{10} recorded maximum number of days to 50 per cent flowering (79), while treatments T_9 (58 days) and T_8 (69 days) were earliest to flower. Plant growth regulators have possibility to increase fruit length and diameter. Plant growth regulators promote the cell wall loosening processes providing a state of extensive flexibility within the cell leading ultimately in plant growth[13]. Plant growth regulators have great potentiality to facilitate the fruit length and diameter of summer tomato[14, 15].

Table 1: Effect of Gibberellic acid on Fruit weight, Number of fruits per plant andYield per plant

Treatments (ppm)	Days to fruit maturity	Percent fruit set	Fruit length (mm)	Fruit width (mm)	days to 50% flowering	Fruit weight	No. of fruits per plant	Yield per plant
T_1 **(0*with 20**)**	43.71	15.92 e	69.40	33.67	74 a	2.35	53.35	104.47
T_2 **(0* with 30****	40.79	19.85 de	67.41	32.59	79 a	2.26	51.67	105.05
T_3 **(0* with 40****	43.83	22.55 cd	68.71	32.88	75 a	2.22	74.90	152.13
T_4**(10* with 20****	43.33	16.32 e	66.59	32.93	79 a	2.31	49.03	103.08
T_5**(10* with 30****	41.00	25.11 cd	69.92	34.29	75 a	2.36	63.97	138.18
T_6**(10* with 40****	40.85	34.61 a	71.54	33.94	72 ab	2.46	87.40	181.37
T_7**(20* with 20****	42.75	31.59 ab	72.73	34.46	70 ab	2.53	85.36	178.52
T_8**(20* with 30****	40.33	34.17a	71.34	35.00	69 ab	2.43	87.80	174.08
T_9**(20* with 40****	41.67	27.77bc	70.77	33.53	58 b	2.41	68.23	147.01
T_{10} **(Control**	43.33	15.23 e	67.60	32.52	79 a	2.28	52.83	92.00
Mean	**42.16**	**24.31**	**69.6**	**33.58**	**73**	**2.36**	**67.46**	**137.59**
SE(m)	**2.12**	**1.54**	**2.44**	**1.05**	**4.15**	**0.1271**	**20.96**	**48.00**
HSD	**NS**	**5.5254**	**NS**	**NS**	**14.8963**	**NS**	**NS**	**NS**

HSD: Honest Significant Difference (HSD) Test used for treatment mean comparison. Means followed by the same letter within the table are not significantly different from each other at 5% probability level.

Seedling dip***** with foliar spray**

Application of plant growth regulators significantly increases yield of fruit per plant. Application of GA_3 increased the fruit yield per plant as compared to the fruit set where hormone was not applied. This might be occurs due to higher number of fruit setting and single fruit weight per plant that increased by plant hormones. The highest fruit yield per

plant with plant growth regulators on bell pepper. Average fruit weight varied from 2.22g to 2.53 g with a mean of 2.36g[16]. The maximum fruit weight was noticed in T_7 (2.53g) followed by T_6 (2.46) and T8 (2.43g) and the minimum was in T_3 (2.22g) preceded by T_2 (2.26g). Application of plant growth regulators significantly increased single fruit weight of summer tomato[15, 17]. The number of fruits per plant ranged from 51.67 to 87.80 with a mean of 67.46. The highest mean performance for this trait was recorded for T_8 (87.80) followed by T_6 (87.40), T_7 (85.36) whereas the lowest for T_2 (51.67) preceded by T_{10} (52.83)[8]. Improvement in pepper growth and yield under GA_3 application compared to the control was observed. This might be ascribed to more efficient utilization of food for reproductive growth (flowering and fruit set), higher photosynthetic efficiency and enhanced source to sink relationship of the plant, reduced respiration, enhanced translocation and accumulation of sugars and other metabolites. Inhibition of growth performance on exposure to the other PGRs occurred[18].

Phytotoxicity symptoms

Observation taken for 0, 3, 5, 7 and 10 days after spray on yellowing, epinasty, hyponasty and scorching symptoms of the crop. Ten plants are randomly selected from each plot and the total number of leaves these showing phytotoxicity symptoms, if any were counted. The data collected were converted in to percentage. Percent phytotoxicity calculated by using the following formula.

$$\text{Percent phytotoxicity} = \frac{\Sigma \text{ Numerical ratings}}{\text{Highest grade of rating} \times \text{total number of plants examined}} \times 100$$

Table 2: Percent phytoxicity for Yellowing, Epinasty, Hyponasty and Scorching(10DAS)

	Yellowing	Epinasty	Hyponasty	Scorching
0 ppm	0.00	0.00	0.00	0.00
30 ppm	0.00	0.00	0.00	0.00
40 ppm	0.00	0.00	0.00	0.00
60 ppm	0.00	0.00	0.00	0.00
80 ppm	2.00 (7.95)	1.00 (5.74)	1.00 (4.62)	1.00 (5.74)
120 ppm	2.00 (8.13)	1.33 (6.54)	1.33 (6.54)	1.33 (6.54)
160 ppm	2.33 (8.74)	2.00 (8.13)	1.67 (7.33)	1.67 (7.33)
SEm	0.49	0.30	1.05	0.41
CD (5%)	1.51	0.93	3.24	1.26
CV (%)	23.88	17.90	68.97	25.22

No phytotoxicity symptoms were observed for 0, 30, 40 and 60 ppm of gibberellic acid even after 10 days of spray. Few phytotoxic symptoms were observed in 80, 120 and 160 ppm of gibberellic acid spray. Maximum Percent phytotoxicity values were observed for the following symptoms like yellowing (2.33), epinasty (2), hyponasty (1.67) and scorching (1.67) for 160 ppm gibberellic acid, followed by 120 ppm and 80 ppm.

CONCLUSION

It may be recommended that GA_3 sprayed with 10 ppm seedling dip with 40 ppm foliar spray, 20 ppm seedling dip with 20 ppm foliar spray and 20 ppm seedling dip with 30 ppm foliar

spray is the best for chilli without any phytotoxicity symptoms up to 60 ppm.

REFERENCES

1. Chattopadhyay, A., Sharangi, A.B., Dai,N. and Dutta,S. Diversity of genetic resources and genetic association analyses of green and dry chillies of eastern India. *Chilean JAR.* **71 (3)**: 350-56 (2011).
2. Bosland, P. W. and Votava, E. J. Peppers: Vegetable and Spice Capsicums. Crop Production Science in Horticulture Series No. 12. CABI Publishing, United Kingdom, (2000).
3. Wang, D. and Bosland, P.W. The genes of *Capsicum*. *Hort Science*.**41**: 1169-1187(2006).
4. Ince, A. G., Karaca, M. and Onus, A. N. Genetic relationships within and between Capsicum species. *Biochem Genet.* **48(1)**: 83-95 (2010).
5. Indian Horticulture database. All India 2013-14 (Final Estimates), Department of Agriculture & Cooperation, (2014).
6. Thapa, U., Pati, M.K. Chattopadhay, S.B. Chattopadhyay, N. and Sharangi, A B. Effect of growth regulators on growth and seed yield of chilli (*Capsicum annuum* L.). *J Inter academicia*. **7:** 151-154(2003).
7. Rafeekher, M., Nair, S.A., Sorte, P.N., Hatwal, G.P. and Chandhan, P.N., Effect of growth regulators on growth and yield of summer cucumber. *J. Soils Crops*. **12(1):** 108-110 (2002).
8. Akash Kumar, Biswas, T.K., Singh, N. and Lal, E.P. Effect of Gibberellic Acid on Growth, Quality and Yield of Tomato (*Lycopersicon esculentum* Mill.). IOSR-JAVS.**7 (7)**: 28-30 (2014).
9. Khan, M.M. A., Gautam, C., Mohammad, F., Siddiui, M. H., Naeem, M. and Khan, M. N. Effect of Gibberellic Acid Spray on Performance of Tomato. *Turk J Biol.* 11-16 (2006).
10. Arteca, R. N. Plant Growth Substances. Principles and Application. Chapman and Hall Inc. New York. (1996).
11. Gupta, P.K. and Gupta, A.K. Efficacy of plant growth regulators (IAA and NAA) and micronutrient mixture on growth, flowering, fruiting and shelf life of tomato. (*Lycopersicon esculentum* Mill.). *Bioved.* **11:** 25-29(2000).
12. Rai, N., Yadav, D.S., Patel, K.K., Yadav, R.K., Asati, B.S. and Chaudey, T., Effect of plant growth regulators on growth, yield and quality of tomato (*Lycopersicon esculentum* Mill). *J. Veg. Sci.* **3(2):** 180-182 (2006).
13. Prasad, S. and Kumar, U. Principles of Horticulture. *Agrobios Publisher*, Jodhpur, India, pp: 376-401 (2003).
14. Sarkar, M.A.H., Hossain, M.I., Uddin, A.F.M.J., Uddin, M.A.N. and Sarkar, M.D. Vegetative, floral and yield attributes of gladiolus in response to gibberellic acid and corm size. *Sci. Agri.* **3:** 142-146 (2014 a).
15. Choudhury, S., Islam, N., Sarkar, M.D. and Ali, M.A. Growth and yield of summer tomato as influenced by plant growth regulators. *Intl. J. Sustain. Agric.* **5:** 25-28 (2013).
16. Hasanuzzaman, S.M., Hossain, S.M.M., Ali, M.O., Hossain, M.A. and Hannan, A. Performance of different bell pepper (*Capsicum annuum*L.) genotypes in response to synthetic hormones. *Int. J. Sustain. Crop Prod.* **2:**78-84 (2007).
17. Sarkar, M.D., Jahan, M.S., Kabir, M.H., Kabir, K. and Rojoni, R.N. Flower and fruit setting of summer tomato regulated by plant hormones. *App. Sci. Report.* **3:** 117-120 (2014 b).
18. Georgia, O., Ilias, I., Anastasia, P. G. and Papadopoulou. Comparative study on the effects of various plant growth regulators on growth, quality and physiology of *Capsicum annuum* L. *Pak. J. Bot*.**42(2):** 805-14 (2010).