J. Hortl. Sci.
Vol. 9(2):213-216, 2014

Short communication

Effect of plant growth regulators on yield and quality in gladiolus under Bay Island conditions

V. Baskaran, K. Abirami and S. Dam Roy
Central Island Agricultural Research Institute (CIARI)
Port Blair - 744101, Andaman and Nicobar Islands, India
E.mail: vbaski01@gmail.com

ABSTRACT

Field experiments were conducted for two consecutive seasons during 2011-12 and 2012-13 to study the effect of plant growth regulators on gladiolus cv. Chandini. The results revealed that various growth, flowering and corm characters were significantly affected with the application of different growth regulators at different concentrations. Earliness in corm sprouting, spike emergence and maximum duration of spike was observed in GA_3 500ppm. Maximum number of leaves per plant, plant height, maximum spike length, rachis length and number of florets per spike were observed in GA_3 750ppm. More number of shoots per corm (3.3) was recorded by Benzyl Adenine (BA) at 75ppm. With respect to corm characters maximum number of corms and cormels per plant were observed in BA 100ppm. Maximum weight of single corm, weight of corms per plant, size of single corm and volume of single corm were recorded in GA_3 500ppm. Maximum weight of cormels per plant was recorded in BA 100ppm. Maximum value of propagation co-efficient was recorded in GA_3 500ppm (318.3%).

Key words: Gladiolus, GA_3, BA, NAA

Gladiolus (*Gladiolus grandiflorus* L.) is one of the most important bulbous ornamental crops grown in many parts of the world either as cut flower or for garden display. It is popularly known as Queen of the bulbous flowers due to its attractive shades, varying sizes of flowers, brilliant colour tones and long lasting vase life. The magnificent inflorescence is also used for making bouquets and floral decorations. It has a great share in cut flower industry and fetches good premium for the money invested. It is cultivated all over the country due to ever increasing demand of this elegant cut flower. The Andaman and Nicobar Islands offer good scope for cultivation of wide variety of flowers because of its diversities in topography, altitude and climatic conditions. Congenial agro-climatic conditions coupled with rich fertile soils, well distributed rainfall throughout the year ensure year round production of tropical and sub tropical flowers. It has great potential to emerge as the major supplier of many floricultural products. Due to changes in social and cultural lifestyle of people, cut flowers have found an important place in various social functions. Taking into consideration the unique agro-climatic conditions of the bay islands, demand of flowers by islanders and tourists, cultivation of gladiolus has bright prospects. However, this potential remain untapped due to limited access to technologies, the farmers have very little idea about the scientific cultivation of this crop. Synthetic growth regulating chemicals have been reported to be very effective in manipulating growth, flowering and corm production in gladiolus (Mahesh and Misra, 1993; Baskaran and Misra, 2007; Suresh Kumar *et al*, 2008). They have been reported in enabling removal or circumvention of many of the barriers imposed by heredity and environment. Flower cultivation in the Andaman and Nicobar Islands is gaining importance due to its ever increasing demand both for inland and tourism requirements. Gladiolus is one of the major cut flower crops and its cultivation can potentially increase the Island farmers' economic prosperity as the demand is high in the Islands. The performance of any crop or variety largely depends on genotypic and environmental interaction. As a result, crop or cultivars, which perform well in one region, may not perform same in other region of varying climatic conditions. Hence, it is necessary to study the effect of growth regulators on growth, flowering and corm production in gladiolus under Bay Island conditions.

The experiment was conducted for two consecutive seasons during November - April of the years 2011-12 and 2012-13 in the Division of Horticulture and Forestry, CARI, Port Blair, Andaman and Nicobar Islands, which is situated at the Eastern coast of India in Bay of Bengal (10°30' and 13°42' N latitude and 92°14' and 90°16' E longitude) having a typical tropical and humid climate with annual precipitation of 3086 mm with a short dry spell of 4 months (January-April) and the recorded relative humidity is about 82%. Healthy, uniform sized (8-10cm circumference) corms of gladiolus cv. Chandhini were planted at a spacing of 30 x 40cm, following Randomized Block Design with three replications. In total, there were 10 different treatments viz., T_1- BA @ 75ppm, T_2- BA @ 100ppm, T_3- BA @ 125ppm, T_4- GA_3 @ 250ppm, T_5- GA_3 @ 500ppm, T_6- GA_3 @ 750ppm, T_7- NAA @100 ppm, T_8- NAA @ 200ppm, T_9-NAA @ 300ppm and control. Corms were soaked in growth regulator solution overnight (12h) and shade dried. The crop was grown with all recommended cultivation practices throughout the experiment. The observations were recorded on various vegetative growth, floral and corm production parameters. Two years data was pooled and statistically analyzed.

The data presented in Table 1 showed that all the vegetative and floral characters were significantly affected by pre plant corm soaking treatment of plant growth regulators. The growth regulators had profound effect on corm sprouting. Earliness in corm sprouting was recorded by GA_3 at 500ppm (9.2 days) followed by BA at 125ppm (10.4 days) over control (20.3 days). The present results are in conformity with Baskaran and Misra (2007) and Kumar *et al* (2002) in gladiolus. This may be due to free GA_3 which is active in breaking down the reserved food material by hydrolytic enzymes in the presence of sufficient moisture and hence caused earlier sprouting (Kumar and Singh, 2005). Ginzburg (1973) reported that ethephon promoted the growth of dormant corms and application of BA induced ethylene production. Promotional effect of BA was reported by Ram *et al* (2002) in gladiolus cv. Friendship. Maximum number of leaves per plant was obtained by GA_3 at 750ppm (8.5) and minimum was in control (5.7). Number of leaves per plant increased with increasing concentrations of GA_3 which was found to be at par with NAA 200 and 300ppm (7.8 and 7.2, respectively). This may be due to GA_3 exhibited its characteristic effect on shoot elongation leading to the production of more number of leaves. This increase in number of leaves by NAA might be due to the fact that NAA promotes vegetative growth by active cell division, cell enlargement and cell elongation. The similar results are reported by Ravidas *et al* (1992) in gladiolus and Reddy (1998) in tuberose. More number of shoots per corm was observed by BA at 75ppm (3.3), whereas minimum number of shoots was observed in control (1.3). This may be due to breaking of dormancy by BA and thereby enhanced sprouting. BA promotes cell division and shoot differentiation resulting into increased number of shoots per corm. In general, the plants treated with GA_3 recorded the maximum plant height whereas plants treated with BA recorded minimum plant height. Maximum plant height was recorded in GA_3 at 750ppm (92.5cm) and minimum in BA at 125ppm (54.5cm). GA_3 induced the active cell division and cell elongation resulting in enhancement in plant height Greulach and Haesloop (1958). The decrease in plant height with application of BA might be due to reducing apical dominance. Similar results have been reported by Sindhu and Verma (1998); Maurya and Nagda (2002) and Sharma *et al* (2004) in gladiolus.

Table 1. Effect of plant growth regulators on growth and flowering of gladiolus cv. Chandini

Treatments	Days takenfor 50% sprouting	Number of leaves	Number of shoots	Plant height (cm)	First flower initiation (days)	Duration of flower (days)	Number of florets	Spike emergence (days)	Spike length (cm)	Rachis length (cm)
BA 75ppm	12.8	6.0	3.3	55.8	82.3	9.8	7.0	70.7	53.0	30.5
BA 100ppm	13.5	6.3	2.7	55.0	69.5	10.1	8.7	61.3	49.5	21.1
BA 125ppm	10.4	6.7	2.8	54.5	59.3	11.2	7.3	49.7	51.0	33.0
GA_3 250ppm	12.4	7.2	2.2	79.9	54.3	13.0	9.0	46.0	58.3	39.9
GA_3 500ppm	9.2	7.6	2.0	82.9	53.0	15.6	10.0	45.3	62.0	40.2
GA_3 750ppm	11.2	8.5	1.8	92.5	60.9	13.7	11.3	52.3	63.1	45.3
NAA 100ppm	17.4	6.8	1.4	70.9	82.4	10.8	7.7	71.3	53.0	32.8
NAA 200ppm	16.2	7.8	1.4	78.7	69.7	11.7	8.0	59.7	59.6	33.1
NAA 300ppm	14.3	7.2	1.8	73.5	60.5	12.0	7.0	52.0	60.3	32.3
Control	20.3	5.7	1.3	71.4	75.0	8.0	6.7	64.0	53.2	31.5
CD *(P= 0.05)*	3.0	0.9	1.1	9.0	5.3	1.9	2.7	4.2	8.4	8.3

Table 2. Effect of plant growth regulators on corm production of gladiolus cv. Chandini

Treatments	Number of corms per plant	Number of cormels per plant	Weight of single corm (g)	Weight of corms per plant (g)	Weight of cormels per plant (g)	Size of corm (cm)	Volume of one corm (cm^3)	Propagation co-efficient (%)
BA 75ppm	2.7	13.1	40.2	102.6	4.7	4.4	47.4	212.0
BA 100ppm	3.1	16.6	42.1	123.9	6.0	4.5	50.2	258.3
BA 125ppm	2.9	14.4	45.9	129.6	5.2	4.4	53.4	265.9
GA_3 250ppm	1.9	12.0	56.6	99.6	4.3	5.6	65.3	206.2
GA_3 500ppm	2.7	14.7	62.5	153.3	5.3	6.5	71.0	318.3
GA_3 750ppm	2.3	12.3	61.7	116.3	4.4	6.3	70.3	239.7
NAA 100ppm	2.1	13.1	50.2	92.6	4.7	5.2	57.4	195.6
NAA 200ppm	2.6	14.3	51.7	113.6	5.1	4.9	58.5	237.7
NAA 300ppm	2.7	14.9	46.9	108.0	5.4	5.0	52.8	227.8
Control	1.4	7.8	34.3	40.3	2.8	4.2	40.1	86.3
CD *(P=0.05)*	0.6	2.0	6.5	18.2	0.7	0.9	6.7	22.8

Early spike emergence was recorded by GA_3 at 500ppm (45.3 days) which was found to be at par with GA_3 at 250ppm (46 days) whereas late spike emergence was observed in NAA at 100ppm (71.3 days). Early flowering was recorded in GA_3 at 500ppm (53.0 days) which was found to be at par with GA_3 at 250ppm (54.3 days) whereas, late flowering was recorded in NAA 100ppm and BA 75ppm (82.4 and 82.3 days, respectively). Advanced bud formation and onset of flowering in GA_3 treated plants are responsible for early flowering. The results are in line with findings of Baskaran and Misra (2007) in gladiolus, whereas late flowering by the application of NAA which might have caused ethylene formation which is correlated with an inhibition of the growth instead of promoting the cell division (Krishnamurthy, 1981). GA_3 at 500ppm was found most effective in increasing the flowering duration (15.6 days) and it was minimum (8.0 days) in control. The results are in agreement with the findings of Baskaran and Misra (2007) and Sharma *et al* (2004) in gladiolus. GA_3 at 750ppm gave the maximum spike length and rachis length (63.1cm and 45.3cm, respectively). These results are in conformity with Sharma *et al* (2004) and Baskaran and Misra (2007) in gladiolus. This might be due to the enhanced growth rate of vegetative plant parts as influenced by GA_3 which also increases the photosynthetic and metabolic activities causing more transportation and utilization of photosynthetic products. This might have resulted in the better quality spike production (Halevy and Shild, 1970). Maximum number of florets per spike was recorded in GA_3 750ppm (11.3) and minimum was recorded in control (6.7). Gibberellic acid promotes the growth of auxiliary buds and their flowering.

It is evident from Table 2 that all the characters pertaining to corm production were significantly influenced by plant growth regulator treatments. Maximum number of corms and cormels per plant was observed in BA 100ppm (3.1 and 16.6, respectively). BA promoted the sink activity of developing corm and cormels at the expense of flower spike, this might be the reason for increase in number of corms and cormels and poor quality flower spikes. Similar results were also observed by Tawar *et al* (2007) in gladiolus cv. Jester. Maximum weight of single corm was recorded by GA_3 at 500ppm (62.5g) closely followed by GA_3 750ppm (61.7g). Similarly, maximum weight of corms per plant was recorded in GA_3 500ppm (153.5g) whereas weight of cormels per plant was recorded maximum in BA 100ppm (6.0g) and minimum was recorded in control (2.8g). This increase in weight of cormels by NAA might be due to their involvement in cell division, cell expansion and increased volume of intercellular spaces in the mesocarpic cells. These results are in agreement with the earlier findings by Ravidas *et al* (1992) in gladiolus. Maximum size (6.5cm) and volume (71.0cc) of single corm was also recorded in GA_3 500ppm closely followed by GA_3 750ppm (6.3cm and 70.3cc, respectively) which were statistically at par. The increase in weight, size and volume of the corm with the application of GA_3 can be attributed to increase in number of leaves per plant which increased the photosynthetic assimilates. These assimilates are transported to the resulting daughter corms, thereby, increasing their weight, size and volume. Regarding corm and cormel production which ultimately affect the propagation co-efficient, GA_3 at 500ppm as corm dipping for 12 hours gave maximum propagation co-efficient (318.3%) followed by BA at 125ppm (265.9%). Similar findings have also been reported by Kumar *et al* (2002) and Suresh Kumar *et al* (2008) in gladiolus.

It may be concluded that among all the treatments used in our study, GA_3 at 750ppm followed by GA_3 at 500ppm is very effective in producing quality bloom. BA at 100ppm was found to be the best for corm production in gladiolus cv. Chandini.

REFERENCES

Baskaran, V. and Misra, R.L. 2007. Effect of plant growth regulators on growth and flowering of gladiolus. *Indian J. Hort*., **64**:479-482

Ginzburg, C. 1973. Hormonal regulation of cornel dormancy in *Gladiolus grandiflorus* L. *J. Exp. Bot.*, **24**:558-566

Greulach, V.A. and Haeshloop, J.C. 1958. The influence of GA_3 on cell division and cell elongation in *Phaseolus vulgaris. American J. Bot.*, **45**:568-570

Halevy, A.H. and Shild, R. 1970. Promotion of growth and flowering plants treated with endogenous GA_3 in gladiolus plants treated with growth retardant CCC. *Physiol. plant.*, **23**:820-827

Krishnamurthy, H.N. 1981. Plant growth substances-including applications in agriculture. Tata McGraw Hill Publishing Co. Ltd., New Delhi, India

Kumar, R., Dubey, R.K. and Misra, R.L. 2002. Effect of GA_3 on growth, flowering and corm production of gladiolus, p. 110-113 In: Floriculture Research Trend in India, Misra R.L. and Sanyat Misra, (Eds.). ISOH, New Delhi, India

Mahesh, K.S. and Misra, R.L. 1993. Effect of growth regulators in gladiolus. *J. Orn. Hort.*, **1**:12-15

Maurya, R.P. and Nagda, C.L. 2002. Effect of growth substances on growth and flowering of gladiolus (*Gladiolus grandiflorus* L.) cv. Friendship. *Haryana J. Hort. Sci.*, **31**:203-204

Ram, R., Mukherjee, D. and Sandeep, M. 2002. Plant growth regulators affect the development of both corms and cormel in gladiolus. *Hort. Sci.*, **37**:343-344

Ravidas, L., Rajeevan, P.K. and Valsalakumari, P.K. 1992. Effect of foliar application of growth regulators on the growth, flowering and corm yield of gladiolus cv. Friendship. *S. Indian Hort.*, **40**:329-335

Reddy, B.S. 1998. Pre and post harvest management in tuberose (*Polianthes tuberosa. L.*) Cv. Double. PhD. Thesis, Choudhary Charansing Haryana Agricultural University, Haryana

Sharma, J.R., Gupta, R.B. and Panwar, R.D. 2004. Growth, flowering and corm production of gladiolus cv. Friendship as influenced by foliar application of nutrients and growth regulators. *J. Orn. Hort.*, **7**:154-158

Sindhu, S.S. and Verma, T.S. 1998. Effect of different size of cormels and various treatments in gladiolus Cv. White Oak. *Recent Hort.*, **4**:69-70

Suresh Kumar, P., Bhagawat, R., Rajiv Kumar and Ronya, T. 2008. Effect of plant growth regulators on vegetative growth, flowering and corm production of gladiolus in Arunachal Pradesh. *J. Orn. Hort.*, **11**:265-270

Tawar, R.V., Sable, A.S., Kakad, G.J., Hage, N.D. and Ingle, M.B. 2007. Effect of growth regulators on corms and cormels production of gladiolus (cv. Jester). *Annal Pl. Physiol.*, **21**:257-258

Kumar, V. and Singh, R.P. 2005. Effect of Gibberellic acid and growing medium on flowering and corm production in gladiolus. *J. Orn. Hort.*, **8**:146-148

(MS Received 20 September 2014, Revised 22 November 2014, Accepted 28 December 2014)