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Effect of growth regulating chemicals on flowering, corm production and post harvest life of gladiolus (*Gladiolus grandiflorus*) cv. Punjab Dawn in Bay Islands

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ABSTRACT

Field experiment was conducted for two consecutive seasons during November to April 2013-14 and 2014-15 in the Division of Horticulture and Forestry, Central Island Agricultural Research Institute, Port Blair to study the effect of plant growth regulators on gladiolus [*Gladiolus grandiflorus* Hort.] cv. Punjab Dawn. The results obtained showed that the growth, flowering and corm characters were significantly influenced by the application of growth regulators at different concentrations. Earliness in corm sprouting was observed by GA_3 @ 250 ppm (8.7 days). Maximum number of leaves/plant and plant height were recorded in GA_3 @ 750 ppm (9.6 and 93.6cm respectively). More number of shoots/corm was observed in the treatment BA @ 75 ppm (4.0). With respect to flower characters, early spike emergence and maximum duration of the spike were recorded by GA_3 @ 500 ppm (46.7 days and 16.2 days respectively). Maximum spike length, rachis length, number of florets/spike and floret size (74 cm, 50.2 cm, 14.3 and 11.4 cm respectively) were recorded by GA_3 @ 750 ppm. With regard to post harvest studies, maximum longevity of opened floret and vase life of cut spike (3.9 days and 14.2 days respectively) were recorded by GA_3 @ 750 ppm .With regard to the corm characters, maximum number of corms and cormels/plant were observed in BA @ 100 ppm (3.7 and 11.8 respectively). Weight of single corm, weight of corms/plant, size of single corm, volume of single corm and propagation coefficient were also maximum in GA_3 @ 750 ppm (70.9 g, 169.3 g, 7.0 cm, 79.5 cm^3 and 348.3% respectively).

Key words: BA, GA_3, Gladiolus, NAA, Punjab Dawn

Gladiolus (*Gladiolus grandiflorus* Hort.) is one of the most popular flowering plants and commercially propagated by corms. It is relatively easy to grow and also suitable for bedding and exhibition. The fascinating spikes bear a large number of florets which exhibit varying colours, sizes and forms. The flower spikes are used in flower arrangements, in bouquets and for indoor decoration. Spikes of gladiolus have good keeping quality and hence can be transported to long distance. It is cultivated throughout the length and breadth of the country in many tropical, subtropical and hilly parts due to ever increasing demand of this elegant cut flower. The Andaman and Nicobar Islands are emerging as one of the prominent tourist centres in the country for its scenic beauty and unique landscape. Due to the influx of Indian and foreign tourists to these islands, there is a great demand for cut flowers from the hotels catering to the needs of the tourists. Congenial agro climatic conditions coupled with rich fertile soils, well distributed rainfall throughout the year favours gladiolus flower cultivation in the island. However, major constraints for gladiolus cultivation is the corm dormancy and poor multiplication rate (Kumar *et al.* 2008). Plant growth regulators play an important role and are being used for breaking dormancy, production of good quality bloom and more number of quality corm production in gladiolus (Bhattacharjee 1984). Flower production is significantly influenced by exogenous application of plant growth regulators which play a vital role in enhancing uptake of nutrients in flower crops (Singh 1999, Arun *et al.*1999). Synthetic growth regulating chemicals have been reported to be very effective in manipulating growth, flowering and corm production in gladiolus (Mahesh and Misra 1993, Kumar *et al.* 2002, Baskaran and Misra 2007, Suresh Kumar *et al.* 2008). Growth regulators help in removal of many of the barriers imposed by heredity and environment in plant growth and development. This Island has great potential to emerge as the major supplier of gladiolus cut flower. However, this potential remains untapped due to limited access to technologies and lack of knowledge about the scientific cultivation of this crop among the island farmers. Among the different technologies, the use of growth regulators to increase flower yield and quality will have quick impact for meeting the existing demand for gladiolus in the Island. Hence this experiment was initiated to study the various effects of growth regulating chemicals in gladiolus cv. Punjab Dawn under Bay Island conditions.

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MATERIALS AND METHODS

The experiment was conducted for two consecutive seasons during November to April 2012-13 and 2013-14 in the Division of Horticulture and Forestry, ICAR-CIARI, Port Blair. Healthy corms of uniform size (8-10 cm circumference) of gladiolus cv. Punjab Dawn were planted at a spacing of 30 × 30 cm. The experiment was laid out in randomized block design with three replications in each treatment. There were a total of 10 treatments, viz. T1- BA @ 75 ppm, T2- BA @ 100 ppm, T3- BA @ 125 ppm, T4- GA_3 @ 250 ppm, T5- GA_3 @ 500 ppm, T6- GA_3 @ 750 ppm, T7- NAA @ 100 ppm, T8- NAA @ 200 ppm, T9- NAA @ 300 ppm and control. Corms were dipped in growth regulator solution overnight, shade dried and after which planting was done. Standard cultural practices were followed during the entire crop period for all the experimental plots. Data were recorded on various parameters. Two years data were pooled together and statistical analysis was carried out according to Gomez and Gomez (1983).

RESULTS AND DISCUSSION

A perusal of the data presented in the Table 1 indicated significant effect on various growth parameters of gladiolus cultivar Punjab Dawn. The growth regulators had profound effect on sprouting of corms. Earliness in corm sprouting was observed by GA_3 @ 250 ppm (8.7 days) followed by GA_3 @ 750 ppm (9.5 days) when compared to control (24.1 days). Application of GA_3 at all concentrations had a significant positive effect in early sprouting of corms. The present results are in conformity with the findings of Baskaran and Misra (2007) and Kumar *et al.* (2008) in gladiolus. GA_3 plays a role in releasing dormancy by breaking down the reserved food material by hydrolytic enzymes and hence caused earlier sprouting in the presence of enough moisture (Vijaikumar and Singh 2005). Maximum plant height (93.6 cm) and number of leaves (9.6)/plant were recorded in GA_3 treatment @ 750 ppm. Increase in plant height by GA_3 could be attributed to the induction of increased cell division and cell elongation. Further GA_3 also known to increase the sink strength of the actively growing parts which also contributed to increase plant height (Dhaduk *et al.* 2007). Similar findings of positive influence of application of GA_3 on plant height have been reported by Sindhu and Verma (1998), Maurya and Nagda (2002) and Sharma *et al.* (2004) in gladiolus and Beena and Mercy (2003) in anthurium. Irrespective of the concentration, BA applications reduced plant height and this may be selected for growing under pot condition due to dwarfing nature. The present results are in conformity with the findings of Baskaran and Misra (2007) and Suresh Kumar *et al.* (2008) in gladiolus. More number of shoots/ corm (4.0) was observed in the treatment BA @ 75 ppm, whereas minimum number of shoots was recorded in control (1.6). This might be due to the influence of BA broke the dormancy and thereby enhanced (sprouting) in meristematic activity which results in increased shoot production. Similar results have been reported by Baskaran and Misra (2007) and Suresh Kumar *et al.* (2008) in gladiolus.

Table 1 Effect of plant growth regulators on growth, flowering and postharvest life of gladiolus cv. Punjab Dawn

Treatment	Days taken for 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)	Floret size (cm)	Longevity of opened floret (Days)	Vase life (Days)
BA 75 ppm	14.5	5.7	4.0	62.7	82.5	10.2	8.7	72.0	58.8	38.7	8.3	1.9	9.2
BA 100 ppm	15.6	5.8	3.5	60.4	76.8	10.7	9.0	66.3	54.0	39.3	8.7	2.0	9.9
BA 125 ppm	17.3	6.2	3.0	57.5	59.0	11.4	9.3	51.0	56.7	48.2	9.6	2.3	9.5
GA_3 250 ppm	8.7	8.2	2.3	81.0	56.7	14.5	10.3	50.2	64.3	43.9	9.5	2.3	12.4
GA_3 500 ppm	10.3	8.6	2.8	84.8	52.3	16.2	11.3	46.7	67.3	48.8	10.9	3.3	13.3
GA_3 750 ppm	9.5	9.6	2.3	93.6	58.5	15.1	14.3	50.0	74.0	50.2	11.4	3.9	14.2
NAA 100 ppm	12.8	7.3	2.0	70.6	66.7	12.2	10.0	56.7	55.0	41.7	9.5	1.9	10.2
NAA 200 PPm	18.2	7.8	1.7	75.0	89.0	13.3	9.0	78.7	58.7	35.2	9.7	2.3	10.4
NAA 300 ppm	13.5	8.0	1.8	77.4	66.8	14.0	9.7	58.0	63.0	44.7	9.9	2.5	11.7
Control	24.1	5.5	1.6	69.2	74.3	9.0	7.7	63.0	52.7	31.8	7.8	1.2	7.9
CD (P=0.05)	3.1	0.9	1.3	8.8	4.7	2.1	2.5	4.6	10.5	8.8	0.04	0.03	0.02

Early spike emergence (46.7 days) and early flowering (52.5 days) were recorded in the treatment GA_3 @ 500 ppm, whereas late spike emergence (78.7 days) and late flowering (89 days) were observed in the treatment NAA @ 200 ppm. Earliness in flowering might be due to the fact that GA_3 application enhanced the translocation of food for the development of floral primordial, which lead to early flowering (Singh and Srivastava 2009). Similar results have also been reported by Mukhopadhyay and Bankar (1986); Baskaran and Misra (2007) and Jhon *et al.* (1997) in gladiolus and Sarkar *et al.(*2009) and Shradha *et al.(*2002) in tuberose. Maximum spike length and rachis length were recorded in the treatment GA_3 @ 750 ppm (74 cm and 50.2 cm respectively).The increased spike and rachis length could be due to promotive effect of GA_3 on cell division and cell elongation. Results are in consonance with the findings of Naveen kumar *et al.* (2008), Baskaran and Misra (2007), Srivastava *et al.* (2005) and Sharma *et al.* (2004) in gladiolus. The effect might be due to the fact that GA_3 promotes vegetative growth and increases the photosynthetic and metabolic activities resulting in better transport and utilization of photosynthetic products (Halevy and Shild 1970). The number of florets/spike was maximum in the treatment GA_3 @ 750 ppm (14.3). Giberellic acid promotes the axillary buds to grow vigorously and influences the flowering behavior. It might be the main reason for production of more number of florets/spike at high concentration of GA_3. These results are in conformity with Mahesh and Misra (1993) and Mohanty *et al.* (1994) in gladiolus. The treatment GA_3 @ 500 ppm gave the maximum durability of the whole spike on plant (16.2 days) and the minimum was recorded by control (9.0 days). The results are in agreement with the earlier findings by Baskaran and Misra (2007) and Sharma *et al.* (2004) in gladiolus. Maximum size of floret (11.4 cm) was recorded by GA_3 @ 750 ppm. The increase in floret size with GA_3 application can be attributed to active cell elongation in the florets to increase the sink strength of the actively growing parts. Gibberellic acid has been reported to induce an entire developmental program by activation of master regulatory genes in the later stages of corolla development (Weiss 2000), which contributed to improved floret size. Gibberellic acid also induces the expression of gibberellins induced gene 1 (gip1) which has been linked to the processes of cell expansion in the petals (Ben Nissan and Weiss 1996). The increase in petal size with GA_3 application has also been reported in gerbera (Emongor 2004). Application of growth regulating chemicals exhibited significant role in characters pertaining to postharvest life of gladiolus flowers. Maximum longevity of opened floret and vase life of flower spike were observed in the treatment GA_3@ 750 ppm (3.9 days and 14.2 days respectively). Antioxidative property of GA_3 (Wood and Pleg 1974) is known to exhibit stabilizing effects on lipid bilayers and membranous system decreased lipid peroxidation activity and delayed electrolytic leakage. Thus, stabilized membrane integrity and cellular structure ultimately delayed floret senescence and increase the longevity in $GA_{3.}$ Singh (2005) reported that use of antioxidants in retaining membrane integrity and for antisenescence effects during aging. Thus antioxidant property of GA_3 contributed to enhance vase life. Similar effects of enhancing vase life with GA_3 was observed in gladiolus (Singh *et al.* 2005), rose (Sabehat and Zeislin 1994), chrysanthemum (Elanchezhian and Srivastava 2000) and heliconia (Bahybali *et al.* 2011).

The growth regulator treatments significantly influenced the corm production characteristics (Table 2). Maximum number of corms and cormels/plant were observed in the treatment BA @ 100 ppm (3.7 and 11.8 respectively), whereas minimum was recorded in control (1.4 and 5.1 respectively). It shows that BA, characteristically causes more splitting than increasing the size of corms. Present results are in conformity with the work of Raju (2000) in lilies, Sehgal (1984) and Baskaran *et al.* (2009) in gladiolus. Maximum weight of single corm was recorded in the treatment GA_3 @ 750 ppm (70.9 g) followed by GA_3 @ 500 ppm (59.8 g). Similarly maximum weight of corms/plant, size of single corm and volume of single corm were

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

Treatment	Number of corms/plant	Number of cormels/plant	Wt of single corm (g)	Wt of corms/plant (g)	Wt of cormels/plant (g)	Size of corm (cm)	Volume of one corm (cm3)	Propagation co-efficient (%)
BA 75 ppm	3.3	10.4	39.3	114.8	3.7	4.3	46.6	240.3
BA 100 ppm	3.7	11.8	39.4	136.3	4.3	4.5	46.7	282.7
BA 125 ppm	3.7	10.5	44.6	147.0	3.8	4.7	52.1	308.7
GA3 250 ppm	2.0	9.9	58.2	108.3	3.9	5.5	67.1	219.0
GA3 500 ppm	2.3	10.2	59.8	124.0	3.7	5.9	68.5	251.7
GA3 750 ppm	2.7	10.4	70.9	169.3	4.1	7.0	79.5	348.3
NAA 100 ppm	2.1	10.0	51.6	97.7	3.6	5.9	58.2	184.7
NAA 200 PPm	2.6	9.9	54.3	117.0	3.6	5.5	61.9	244.3
NAA 300 ppm	3.2	10.8	55.3	140.3	3.9	5.3	62.0	286.0
Control	1.4	5.1	32.5	62.8	2.0	4.3	37.3	99.0
CD (P=0.05)	0.6	1.8	8.7	22.7	0.7	1.3	8.6	23.2

also recorded in the treatment GA_3 @ 750 ppm (169.3 g, 7.0 cm and 79.5 cc respectively). This increase in weight, size and volume of corms by GA_3 might be due to its involvement in cell division, cell expansion and increased volume of intercellular spaces in the mesocarpic cells. The corm and cormel production were maximum in the corm dipping treatment with GA_3 @ 750 ppm and this had a positive increase in the propagation co-efficient (348.3%) followed by BA @ 125 ppm (308.7%). Similar findings were reported by Bhattacharjee (1984), Misra *et al.* (1993), Kumar *et al.* (2002) and Suresh Kumar *et al.* (2008) in gladiolus.

From the present investigation, it can be concluded that vegetative, flowering, postharvest life and corm production characteristics were significantly influenced by GA_3.

REFERENCES

Arun D S, Ashok A D and Rengasamy P. 1999. Effect of different growth regulators on nutrients and pigment composition of First red rose grown under protected conditions. *South Indian Horticulture* **47:** 119–24.

Mangave B D, Singh A, Chawla S L and Dhaduk B K. 2011. Effect of harvesting and post harvest handling on quality and vase life of Heliconia inflorescence. *Journal of Ornamental Horticulture* **14(1&2):** 45–52.

Baskaran V and Misra R L. 2007. Effect of plant growth regulators on growth and flowering of gladiolus. *Indian Journal of Horticulture* **64(4):** 479–82.

Baskaran V, Misra R L and Abirami K. 2009. Effect of plant growth regulators on corm production in gladiolus. *Journal of Horticultural Sciences* **4(1):** 78–80.

Beena R and Mercy S T. 2003. Effect of growth regulators on the growth and flowering of anthurium. *Indian Journal of Plant Physiology (Special issue)* 656–60.

Ben-Nissan G and Weiss D. 1996. The petunia homologue of tomato gas 1: Transcript accumulation coincides with gibberellins induced corolla cell elongation. *Plant Molecular Biology* **32:** 1 067–74.

Singh B and Srivastava R. 2009. Effect of foliar application of growth regulators on flowering of tuberose (*Polianthes tuberose* L.). *Journal of Ornamental Horticulture* **12(3):** 188–92.

Bhattacharjee S K. 1984. The effect of growth regulating chemicals on gladiolus. *Gartenbauwissenschaft* **49(3):** 103–6.

Dhaduk B K, Kumari S, Singh A and Desai J R. 2007. Response of gibberellic acid on growth and flowering attributes in anthurium. *Journal of Ornamental Horticulture* **10(3):** 187–9.

Elanchezhian R and Srivastava G C. 2000. Effect of growth regulators on senescence of chrysanthemum flowers. *Indian Journal of Plant Physiology* **6:** 233-43.

Emongor V E. 2004. Effects of gibberellic acid on postharvest quality and vase life of gerbera cut flowers. *Journal of Agronomy* **3(3):** 191–5.

Gomez K A and Gomez A A.1983. *Statistical Procedures for Agricultural Research.* An IRRI Book, John Wiley and Sons, New York

Jhon A Q, Paul T M and Siddique M A A. 1997. Nutritional studies in gladiolus, growth and floral characters. *Advances in Plant Science* **10(1):** 45–9.

Mahesh K S and Misra R L. 1993. Effect of growth regulators in gladiolus. *Journal of Ornamental Horticulture* **1(2):** 12–5.

Maurya R P and Nagda C L. 2002. Effect of growth substances on growth and flowering of gladiolus (*Gladiolus grandiflorus* L.) cv. Friendship. *Haryana Journal of Horticulture Science* **31**(3 & 4): 203–4.

Misra R L, Tripathi D K and Chaturvedi O P. 1993. Implication of giberellic acid spraying on the standing crop of gladiolus var. Sylvia. *Progressive Horticulture* **25**(3-4): 149–52.

Mohanty C R, Jena D K and Das R C. 1994. Studies on effect of corm size and pre planting chemical treatments of corm on growth and flowering of gladiolus. *Orissa Journal of Horticulture* **22**(1 & 2): 1–4.

Mukhopadhyay A and Bankar G J. 1986. Preplanting soaking of corm with giberellic acid, modified growth and flowering of gladiolus cultivar Friendship. *Indian Agriculture* **30**: 317–9.

Kumar N P, Reddy Y N and Chandrashekhar R. 2008. Effect of growth regulators on flowering and corm production in gladiolus. *Indian Journal of Horticulture* **65**(1): 73–8.

Kumar R, Dubey R K and Misra R L. 2002. Effect of GA_3 on growth, flowering and corm production of gladiolus. (*In*) *Floriculture Research Trend in India,* pp 110–3. Misra R L and Misra Sanyat. ISOH, New Delhi.

Raju D V S. 2000. 'Effect of plant growth regulators and disbudding on growth and development of Asiatic hybrid lily cv. Corrida'. M Sc thesis, IARI, New Delhi.

Sabehat A and Zeislin N. 1994. GA_3 effects on post harvest alteration in cell membranes of rose (Rosa x Hybrida) petals. *Journal of Plant Physiology* **144:** 513–7.

Sarkar J, Misra R L, Singh S K, Prasad K V and Arora A. 2009. Effect of growth regulators on growth and flowering in tuberose under north India conditions. *Indian Journal of Horticulture* **66**(4): 502–7.

Sehgal O P. 1984. 'Studies on vegetative propagation of gladiolus'. Ph D thesis, IARI, New Delhi.

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. *Journal of Ornamental Horticulture* **7(3-4):** 154–8.

Shradha G, Belorkar P and Mohariya V. 2002. Effect of bulb soaking, foliar spray of GA_3 on growth, flowering and yield of tuberose. *Journal of Soil and Crops* **12**: 105–7.

Sindhu S S and Verma T S. 1998. Effect of different size of cormels and various treatments in gladiolus cv. White Oak. *Recent Horticulture* **4**: 69–70.

Singh A K. 1999. Response of tuberose growth, flowering and bulb production to plant bio regulators spraying. *Progressive Horticulture* **31**(3&4): 181–3.

Singh V P. 2005. Deterioration of membrane during flower senescence in gladiolus and its amelioration with free radical scavenger, *Journal of Ornamental Horticulture* **8**(1): 8–12.

Singh V P, Kiran D and Arora A. 2005. Effect of spermine, spermidine and putrescine on vase life and associated parameters in two gladiolus cultivars. *Journal of Ornamental Horticulture* **8**(3): 161–6.

Srivastava R, Kandpal K and Jauhari S. 2005. Effect of pulsing solution, packaging material and storage duration of post harvest life of gladiolus. *Journal of Ornamental Horticulture* **8(2):** 115–8.

Suresh Kumar P, Bhagawat R, Kumar, R and Ronya T. 2008. Effect of plant growth regulators on vegetative growth, flowering and corm production of gladiolus in Arunachal Pradesh. *Journal of Ornamental Horticulture* **11(4):** 265–70.

Vijaykumar and Singh R P. 2005. Effect of giberellic acid and growing medium on flowering and corm production in gladiolus. *Journal of Ornamental Horticulture* **8(2):** 146–8.