International Journal of Chemical Studies

P-ISSN: 2349–8528
E-ISSN: 2321–4902
IJCS 2019; 7(2): 1553-1556
© 2019 IJCS
Received: 23-01-2019
Accepted: 24-02-2019

Ashwini A
College of Horticulture, Bengaluru, Karnataka, India

Munikrishnappa PM
College of Horticulture, Bengaluru, Karnataka, India

Balaji S Kulkarni
College of Horticulture, Bengaluru, Karnataka, India

Rajiv Kumar
ICAR-IIHR, Bengaluru, Karnataka, India

Amreen Taj
College of Horticulture, Bengaluru, Karnataka, India

Mohan Kumar S
College of Horticulture, Bengaluru, Karnataka, India

Correspondence
Ashwini A
College of Horticulture, Bengaluru, Karnataka, India

Effect of plant growth regulators on vegetative and flowering parameters of gladiolus (*Gladiolus hybridus* L.) cv. adigo yellow

Ashwini A, Munikrishnappa PM, Balaji S Kulkarni, Rajiv Kumar, Amreen Taj and Mohan Kumar S

Abstract
An investigation on "Effect of plant growth regulators on vegetative and flowering parameters of gladiolus cv. Adigo Yellow" was carried out at Department of Floriculture and Landscape Architecture, College of Horticulture, Bengaluru (Under University of Horticultural Sciences, Bagalkot), during 2017-18. The experiment was conducted by planting the corms which were soaked in different plant growth regulators at different concentrations for 24 hours. The treatment comprised of BAP (25, 50 and 75 ppm), GA_3 (50,100 and 150 ppm) and NAA (50,100 and 150 ppm) with control as check. The results revealed that, GA_3 at 150 ppm recorded the early sprouting (9.00) and late sprouting was recorded in control (13.00), maximum sprouting percentage (83.91%) and NAA at 50 ppm was recorded minimum sprouting (66.03), maximum plant height (77.80), stem girth (2.19), spike length (68.10), rachis length (53.97), number of florets per spike (15.07), size of floret (10.80), weight of spike (82.69), vase life (14.03) were recorded in GA_3 at 150 ppm and minimum values were recorded in BAP at 25 ppm. More number of leaves and maximum leaf area were recorded in BAP at 75 ppm. Whereas, minimum number of leaves and leaf area were recorded in control. These results emphasizes the significant differences among the different growth regulators with respect to vegetative and flowering parameters in gladiolus cv. Adigo Yellow, which impact on flower yield and quality.

Keywords: plant growth regulators, flowering parameters, *Gladiolus hybridus* L

Introduction
Gladiolus (*Gladiolus* × *hybridus* L.) a member of family Iridaceae, it is one of the most important high value bulbous ornamental plant cultivated worldwide for cut flowers or garden display. It is a flower of glamour and perfection which is known as the "Queen of bulbous flowers" due to its flower spikes with pleasant florets of massive form, brilliant colors, attractive shapes, sweet fragrance, varying size of flowers and excellent vase life. Gladiolus is grown as flower bed in gardens and floral arrangements for interior decoration as well as making high quality bouquets. 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 its ever increasing demand of this elegant cut flower. Now a day, the use of growth regulators is a common practice for modifying the developmental processes of flowers and ornamental plants. Growth regulating chemicals are reported to be very effective in manipulating growth and flowering in gladiolus. Growth and development are to be regulated either by single or by interaction of several hormones. They play a major role in directing the movement of organic metabolites and in establishing the sink. Vegetative parameters an important role in all crops, which influence on photosynthesis, yield and quality of the particular crop.

Material and methods
The experiment was conducted at Deparment of Floriculture and Landscape Architecture, College of Horticulture, Bengaluru (Under University of Horticultural Sciences, Bagalkot) during 2017-18. There were 10 treatments and 3 replication, comprising of different growth regulators *viz*., BAP (25, 50 and 75 ppm), GA_3 (50, 100 and 150 ppm), NAA (50, 100 and 150 ppm) and control.
Medium sized corms were soaked for 24 hours in different growth regulators solution and also in water as per the treatment schedule.

The soaked corms were dried under shade for 2 hours and then planted. The experiment was laid out in the Randomized Complete Block Design (RCBD) with ten treatments and three replications.

The corms were planted at 30 cm × 20 cm spacing in unit plot of 2.0m × 0.9m. The crop was fertilized with 50 kg/ha of urea, 60 kg/ha of SSP and 60 kg/ha of MOP (UHS, Bagalkot), intercultural operations like weeding, earthing up and watering were done as and when required. The observations were recorded with respect to growth parameters at 30, 45 and 60 DAP to know the response of gladiolus to different growth regulators at different concentrations.

Results and Discussion

A perusal of data revealed that, days for sprouting and sprouting percentage varied significantly among the growth regulators treatment. Among the growth regulators GA_3 @ 150 ppm recorded early days to sprouting (9.00), on other hand control has taken more number of days to sprouting (13.00). Early number of days to sprouting might be due to free GA_3, which breakdown the reserve food material by hydrolytic enzymes in presence of sufficient moisture, resulted in early sprouting of corms. Similar results were observed by Kumar and Singh (2005) [12] and Baskaran *et al*., (2014) [3] in gladiolus (Table 1).

The sprouting percentage of corms varied significantly among the treatments. However, the maximum sprouting percentage was recorded from GA_3 @ 150 ppm and minimum sprouting in NAA @ 50 ppm. This is due to variation in sprouting percentage of corms was expected to occur as it was controlled by the soil characters (edaphic factors). These results are in conformity with earlier reporters like Ginzburg (1973) [8], Ram *et al*., (2001) [20] in gladiolus and Sudhakar and Kumar (2012) [24] in gladiolus.

Table 1: Effect of plant growth regulators on sprouting percentage and days to sprouting in gladiolus

Treatments	Days to sprouting	Sprouting percentage
T_0- Control	13.00	74.74
T_1- BAP @ 25 ppm	10.33	67.76
T_2- BAP @ 50 ppm	10.00	68.45
T_3- BAP @ 75 ppm	9.33	72.84
T_4- GA_3 @ 50 ppm	11.00	80.92
T_5- GA_3 @ 100 ppm	9.67	82.23
T_6- GA_3 @ 150 ppm	9.00	83.91
T_7- NAA @ 50 ppm	10.33	66.03
T_8- NAA @ 100 ppm	10.67	68.12
T_9- NAA @ 150 ppm	12.00	75.13
S. Em ±	0.46	2.20
CD @ 5%	1.36	6.54

The maximum plant height (77.80 cm) was recorded from treatment GA_3 @ 150 ppm. Whereas, minimum plant height (49.07 cm) was recorded from BAP @ 75 ppm (Table 2). Maximum number of leaves (11.72) per plant was recorded from BAP @ 75 ppm, whereas minimum number of leaves per plant (7.47) was recorded from control. The maximum plant height from GA_3 @ 150 ppm, might be due to rapid cell division and cell elongation at internodal region, which resulted in more number of cells and increase in cell length as reported by Greulach and Haesloop (1958) [9], The minimum plant height with application of BAP might be due to counteracting the apical dominance by encouraging the lateral branching (Table 2) and same treatment recorded maximum number of leaves per plant, this might be due to number of suckers per plant. Similar results have been reported by Gaur *et al*. (2003) [7], Kumar *et al*. (2008) [11], Rana *et al*. (2005) [21], Sharma *et al*. (2004) [23] and Manasa *et al*. (2017) [13] in gladiolus.

Table 2: Effect of plant growth regulators on vegetative parameters in gladiolus

Treatments	Plant height (cm)	Number of leaves per plant	Leaf area (cm^3)	Stem girth (cm)
T_0- Control	62.40	7.47	1124.35	1.60
T_1- BAP @ 25 ppm	57.33	10.87	1875.06	1.33
T_2- BAP @ 50 ppm	55.53	11.80	2045.88	1.40
T_3- BAP @ 75 ppm	49.07	12.76	2173.45	1.51
T_4- GA_3 @ 50 ppm	74.23	9.93	1449.97	2.03
T_5- GA_3 @ 100 ppm	75.50	10.40	1493.36	2.11
T_6- GA_3 @ 150 ppm	77.80	11.72	1505.32	2.19
T_7- NAA @ 50 ppm	56.73	8.00	1368.15	1.39
T_8- NAA @ 100 ppm	60.53	8.10	1370.44	1.41
T_9- NAA @ 150 ppm	64.63	8.70	1431.14	1.62
S. Em ±	2.64	0.64	45.12	0.10
CD @ 5%	6.96	1.89	134.07	0.30

The maximum leaf area (2173.45) was recorded from BAP @ 75 ppm. Whereas, minimum leaf area (1124.35) was recorded in control. This might be due to rapid cell division and cell elongation at internodal region, which resulted in more number of cells, cell length and more number of leaves. Maximum stem girth (2.19 cm) was noticed in GA_3 @ 150 ppm and minimum stem girth (1.33) was recorded in BAP @ 25 ppm (Table 2). Significant maximum stem girth from GA_3 treated plants might be due to increased photosynthetic assimilation and increased activity of growth promoting enzymes by synthesizing more nucleic acids. These observations and findings in the present investigation are in conformity with results which were reported earlier by Devadanam *et al*., 2007 [6] in tuberose and Chopde *et al*., 2011 [4] in gladiolus.

Early spike initiation (54.73) was recorded GA_3 @ 150 ppm. Whereas, more number of days for spike initiation (79.20) was noticed in BAP @ 75 ppm (Table 3). This might be due to early emergence of corms, meanwhile early completion of vegetative phase as revealed by rapid cell division and cell elongation and GA_3 is quite effective in reducing the juvenile period of plants Wagh *et al*., (2012) [26]. Similar trends were found by Ram *et al*. (2001) [20] in gladiolus. Another promising reason might be enhanced vegetative growth in early phase due to increased photosynthesis and Co_2 fixation from GA_3 treated plants. Corms treated with BAP at 75 ppm took the more time for spike initiation. This might be due to multiple shooting rather than cell elongation.

Significant maximum spike length (68.10 cm), rachis length (53.97 cm), number of florets (15.07) per spike, size of floret

(10.80 cm), weight of spike (82.69 g) and vase life (14.03 days) was recorded in GA_3 @ 150 ppm. Whereas, minimum spike length (51.93 cm), rachis length (41.33 cm), number of florets (10.00) per spike, weight of spike (58.46 g) was recorded in BAP @ 25 ppm. Whereas, minimum size of floret (8.87 cm) and vase life (9.13 days) was recorded in control (Table 3).

The increased spike length with GA_3 treatment might be due to rapid internodal elongation, rapid cell division and cell elongation in the intercalary meristem. Similar results recorded by Chopde *et al*. (2013) [5] and Padmalatha *et al*. (2013) [17] in gladiolus. The increase in rachis length might be due to increased activity of growth promoting enzymes by synthesizing more nucleic acid and other compounds. These results are in conformity with the findings of Tawar *et al*. (2007) [5] and Chopde *et al*. (2013) [5]. Whereas, the minimum rachis length was observed in treatment BAP at 25 ppm, this might be due to BAP showed reduced plant height and spike length, which directly influenced on rachis length.

Table 3: Effect of plant growth regulators on flowering parameters of gladiolus

Treatments	Days taken for spike initiation (days)	Spike length (cm)	Rachis length (cm)	Number of florets per spike	Size of floret (cm)	Weight of spike (g)	Vase life (days)	Spike yield (Nos)
T_0- Control	66.00	61.03	46.10	12.40	8.87	66.98	9.13	1.10
T_1- BAP @ 25 ppm	77.87	51.93	41.33	10.00	9.03	58.46	9.47	1.27
T_2- BAP @ 50 ppm	78.01	53.50	42.20	10.33	9.20	59.31	9.57	1.43
T_3- BAP @ 75 ppm	79.20	54.47	44.97	10.93	9.23	61.78	9.83	1.47
T_4- GA_3 @ 50 ppm	58.40	58.00	50.47	13.63	9.77	72.04	12.43	1.17
T_5- GA_3 @ 100 ppm	57.93	64.47	52.53	14.10	10.27	76.24	13.23	1.20
T_6- GA_3 @ 150 ppm	54.73	68.10	53.97	15.07	10.80	82.69	14.03	1.23
T_7- NAA @ 50 ppm	77.27	52.27	42.83	11.00	9.47	61.22	10.03	1.11
T_8- NAA @ 100 ppm	76.67	56.43	44.77	11.50	9.57	65.10	10.60	1.13
T_9- NAA @ 150 ppm	74.33	58.53	45.50	12.63	9.67	69.80	11.53	1.14
S. Em ±	0.87	1.27	1.13	0.57	0.30	2.18	0.36	0.06
CD @ 5%	2.59	3.77	3.35	1.68	0.89	6.49	1.06	0.17

Significantly maximum number of florets per spike, size of floret, weight of spike and vase life was recorded in GA_3 @ 150 ppm. This might be due to This might be due to the availability of optimum quantity of GA_3, which increased spike length and rachis length, which are positively correlated to the number of florets per spike. These observations and findings in the present investigation are in conformity with earlier reports by Sarkar *et al*. (2009) [22] in tuberose. Increased size of florets from gibberellins might be due to increased cell division and cell elongation. These observations and findings in the present investigation are in conformity with earlier reports by Padaganur *et al*. (2005) [16] and Nilima *et al*. (2014) [15] in tuberose. Increase in weight of spike might be due to increased activity of enzymes which are involved in cell division and elongation process. While, the minimum spike weight was recorded with BAP at 25 ppm. These results are in conformity with earlier results by Padaganur *et al*. (2005) [16] in tuberose. This might be due to longer spike length and more number of florets per spike which opens in acropetal succession at the rate of one floret in 1-2 days intervals. Similar results were recorded by Nelofar *et al*. (2005) [14] and Patil and Jadhav (2010) [19] in tuberose.

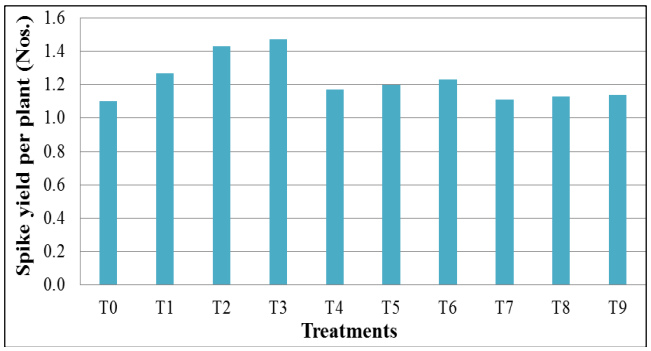

Fig 1: Effect of plant growth regulators on spike yield per plant (Nos.) in gladiolus

T_0- Control T_4- GA_3 @ 50ppm T_8- NAA @ 100 ppm
T_1- BAP @ 25 ppm T_5- GA_3 @ 100 ppm T_9- NAA @ 150 ppm
T_2- BAP @ 50 ppm T_6- GA_3 @ 150 ppm
T_3- BAP @ 75 ppm T_7- NAA @ 50 ppm

Significantly maximum spike yield (1.47) per plant was recorded in BAP @ 75 ppm. While, minimum spike yield (1.10) per plant was recorded in control (Table 3 and fig. 1). This might be due to BAP which showed increased spike yield might be due to the maximum number of shoots per corm (Aier *et al*., 2015) [1]. Variation of number of spikes among the treatments might be due to significant difference in sprouting per cent of corms, number of spikes per plant, which is controlled by genotypic factor along with effect of growth regulators. Similar views have also been expressed by Kumar and Singh (2005) [12] and Chopde *et al*. (2013) [5] in gladiolus.

Conclusion

The study revealed that among the growth regulators GA_3 at 150 ppm resulted better vegetative growth and flower quality attributes. Whereas, BAP at 75 ppm resulted in more number of spikes per plant.

References

1. Aier S, Langthasa S, Hazarika DN, Gautam BP, Goswami RK. Influence of GA_3 and BA on morphological, phenological and yield attributes in gladiolus cv. Red Candyman. IOSR J Agri. Vet. Sci. 2015; 8(6):37-42.
2. Anonymous. Package of Practices. Univ. Hort. Sci., Bagalkot, Karnataka, India, 2017, 215-216.
3. Baskaran V, Abirami K, Roy SD. Effect of plant growth regulators on yield and quality in gladiolus under Bay Island conditions. J Hort. Sci. 2014; 9(2):213-216.
4. Chopde N, Gonge VS, Nagre PK. Effect of growth regulators on growth and flowering of gladiolus. The Asian J Hort. 2011; 6(2):398-401.

5. Chopde N, Gonge VS, Warade AD. Influence of growth regulators on gladiolus varieties. J Agri. Res. Tech. 2013; 38(3):369-374.
6. Devadanam A, Shinde BN, Sable PB, Vedpathak SG. Effect of foliar spray of plant growth regulators on flowering and vase life of tuberose (*Polianthes tuberosa* L.). J Soils and Crops. 2007; 17(1):86-88.
7. Gaur GS, Chaudhary TC, Trivedi JD. Effect of GA_3 and IAA on growth, flowering and corm production in gladiolus cv. Eurovision. Farm Science J. 2003; 12(1):1-3.
8. Ginzburg C. Harmonal regulation of cormel dormancy in Gladiolus grandiflorus. J of experimental Botany. 1973; 24:558-566.
9. Greulach VA, Haeshloop JC. The influence of GA_3 on cell division and cell elongation in *Phaseolus vulgaris* L. American J Botech. 1958; 45:568-570.
10. Khan FN, Rahman MM, Hossain MM. Effect of benzyl adenine and gibberellic acid on dormancy breaking, growth and yield of gladiolus corms over different storage periods. J Orn. Hort. Plants. 3(1):59-71.
11. Kumar PS, Bhagawati R, Kumar R, Ronya T. Effect of plant growth regulators on vegetative growth, flowering and corm production of gladiolus in Arunachal Pradesh. J Orn. Hort. 2008; 11(4):265-270.
12. Kumar V, Singh RP. Effect of soaking of mother corms with plant growth regulators on vegetative growth, flowering and corm production in gladiolus. J Orn. Hort. 2005; 8(4):306-308.
13. Manasa MD, Chandrashekar SY, Hanumantharaya L, Ganapathi M, Hemanth Kumar P. Influence of growth regulators on vegetative parameters of gladiolus cv. Summer sunshine. Int. J Curr. Microbiol. App. Sci. 2017; 6(11):1299-1303.
14. Nelofar Jhon AQ, Paul TM, Nazki IT, Qadri ZA, Mir MM. Influence of gibberellic acid and thiourea on growth and flowering in tulip cv. Cassini. J Orn. Hort., 2005; 8(3):204-207.
15. Nilima B, Barad AV, Bhosale N. Effect of storage period and GA_3 soaking of bulbs on growth and flowering of tuberose (*Polianthes tuberose* L.) cv. Double. Hort. Flora. Res. Spec. 2014; 3(2):154-157.
16. Padaganur VG, Mokashi AN, Patil VS. Effect of growth regulators on growth and yield of tuberose cv. Single. Karnataka J Agric. Sci. 2005; 18(2):469-473.
17. Padmalatha T, Reddy GS, Chandrasekar A, Shankar S, Chatarvedi A. Effect of pre planting soaking of corms with chemicals and plant growth regulators on dormancy breaking and corm and cormels production in gladiolus. Indian J. Plant Animal Sci. 2013; 3:28-33.
18. Patel BB, Desai JR, Patel GD, Patel HF. Influence of foliar application of nitrogen and plant growth regulators on growth, flowering and corm production of gladiolus cv. American beauty. BIOINFOLET- A Quarterly J Life Sci. 2013; 10(2):415-417.
19. Patil ND, Jadhav PB. Effect of growth regulators and bulb size on flower yield of tuberose cv. Double. Indian J Hort. 2010; 67:372-377.
20. Ram R, Mukherjee D, Manuja S. Plant growth regulators affect the development of both corms and cormels in gladiolus. Hort. Sci. 2001; 37(2):343-344.
21. Rana P, Kumar J, Kumar M. Response of GA_3, plant spacing and planting depth on growth, flowering and corm production in gladiolus. J Orn. Hort. 2005; 8(1):41-44.
22. Sarkar J, Misra RL, Singh SK, Prasad KV, Arora A. Effect of growth regulators on growth and flowering in tuberose under north India conditions. Indian J Hort. 2009; 66(4):502-507.
23. Sharma JR, Gupta RB, Panwar RD. Growth flowering and corm production gladiolus cv. Friendship as influenced by foliar application of nutrients and growth regulators. J Orn. Hort. 2004; 7(4):154-158.
24. Sudhakar M, Kumar SR. Effect on corm size and growth regulators on growth and flowering of gladiolus cv. White Friendship. Indian J Plant Sci. 2012; 1(3):133-136.
25. Tawar RV, Sable AS, Kakad GJ, Hage ND, Ingle MB. Effect of growth regulators on corms and cormels production of gladiolus (cv. Jester). Annals of Plant Physiology. 2007; 21(2):257-258.
26. Wagh VK, Chawla SL, Gaikwad AR, Parolekar SS. Effect of bulb size and GA3 on vegetative and floral characters of tuberose (*Polianthes tuberosa* L.) cvs. Prajwal and Calcutta Single. Progressive Hort. 2012; 44(1):27-31.