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Effect of pre-plant soaking of corms in bio-regulators on growth, flowering, Yield and quality in gladiolus (*Gladiolus grandiflorus* L.) CV. rani

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Abstract
The present experiment entitled "Effect of pre-plant soaking of corms in bio- regulators on growth, flowering, yield and quality in gladiolus (*Gladiolus grandiflorus* L.) cv. Rani." was carried out at the Jambuvadi Farm, Department of Horticulture, J. A.U., Junagadh (Gujarat) during 2019 to 2020. The results of the study indicated that, the pre-plant soaking of corms in bio- regulator GA_3 (150 ppm) was found effective for earlier sprouting (6.90 days), maximum plant height (78.74 cm) and number of leaves (13.62). Regarding flowering characters, the GA_3 150 ppm responded best especially in commercial traits like spike length (86.82 cm), rachis length (40.30 cm), number of floret/spike (10.63), diameter of 2nd floret (13.09 cm) and duration of flowering (22.34 days).

Keywords: Gladiolus, Bio regulators, GA_3

Introduction
Gladiolus (*Gladiolus grandiflorus* L.) is one of the important bulbous flower crops. It belongs to the family Iridaceae and native to Cape region in South Africa. The word "gladiolus" is derived from the Latin word "gladius" meaning 'a sword' shape like leaves of the plants. It occupies fourth place of world bulbous flower plants area and is referred to as the queen of bulbous flowers. Gladiolus is highly priced in India and abroad for bright, beautiful and differently coloured flowers and is use in cut flower, herbaceous borders, beddings, rockeries, pots. It is also used in bouquet and flower arrangement having excellent keeping quality. Freshly harvested corm and cormels of gladiolus do not sprout immediately even it's placing in favorable growing conditions because of a period of dormancy which is regulated by changes in the stages of endogenous promotory or inhibitory substances. The physiological functions inside the corms are controlled by plant bio-regulators. Plant bio-regulators are the organic chemical compounds which modify or regulate physiological processes in an appreciable measure by breaking dormancy of gladiolus corms and stimulating cell division and cell elongation in plants.

Materials and Methodology
The present investigation was carried out at the Jambuvadi farm, Department of Horticulture, Junagadh Agricultural University, Junagadh (Gujarat) during 2019-2020. Junagadh is situated in Saurashtra region of Gujarat state. Geographically, this place is situated at 21.50 N latitude and 70.50 E longitudes with an altitude of 60 meters above the mean sea level and 80 Kilometers away from Arabian sea. The soil of this region is classified as Vertic Ustochrepts. Physical and chemical properties of the soil of the experimental field were determined with pH 7.85. Medium sized gladiolus (4-6 cm diameter) corms were selected for the experimental purpose. These corms were soaked in the fungicide solutions (Carbendazim @ 0.2 per cent) for 30 min and kept for drying in shade for 24 hrs. Then these corms were soaked for 24 hrs in water (as control) and different solutions of bio-regulators [gibberellic acid (GA_3), benzyl adenine (BA), ethrel and thiourea] as per treatment requirement. These treated corms were further drying for another 24 hrs and finally these were planted in the experimental plots. Planting was carried out randomly in respective plots at a spacing of 30 cm X 20 cm with a depth of 5 cm.

Moderate irrigation was given to the plots a day before planting to keep the plots moist. The experiments were planted on 3rd November 2019. Investigation was laid out in randomized block design (RBD) comprising thirteen treatments including; Gibberellic acid @ 50 ppm (T_1), Gibberellic acid @ 100 ppm (T_2), Gibberellic acid @ 150 ppm (T_3), Benzyl adenine @ 50 ppm (T_4), Benzyl adenine @ 100 ppm (T_5), Benzyl adenine @ 150 ppm (T_6), Ethrel @ 250 ppm (T_7), Ethrel @ 500 ppm (T_8), Ethrel @ 750 ppm (T_9), Thiourea @ 1% (T_{10}), Thiourea @ 2% (T_{11}), Thiourea @ 3% (T_{12}) and Control (T_{13}).

Results and Discussion

Effect of plant bio-regulators on vegetative growth parameters

The result indicates that the pre plant soaking of different solutions of bio-regulators had produced significant effect on growth parameters *viz*., Days to sprouting (days), plant height at 45 and 75 DAP (cm) and number of leaves per plant at 45 and 75 DAP.

Days to sprouting (days): The effect of different bio-regulators on days to sprout was presented in Table-1. Days to corm sprouting ranged from 6.90 to 16.36 days under different treatments. It was found that treatment T_3 (GA_3 @ 150 ppm) took the shortest time (6.90 days). Whereas the untreated corms T_{13} (control) took the longest period to sprout the corm (16.36 days). These findings might be due to the fact that gibberellic acid breaks the dormancy of corms by activating α-amylase enzyme that stimulates the hydrolyzation of stored food (starch) into simple sugar and provides nourishment and energy during sprouting of bulbous crops. These findings are in agreement with the findings of Halevy *et al*. (1970) [4], Kirad *et al*. (2001) [6], Kumar *et al*. (2010) [8] and Padmalatha *et al*. (2013) [17]. The report of Khan *et al*. (2013) [5] and Sarkar *et al*. (2014) [20] emphasized the formation of hydrolytic enzymes may be a factor, which regulates the mobilization of reserves, ultimately resulting in early sprouting with gibberellic acid. The report of Kumar *et al*. (2009) [7] showed that the gibberellic acid breaking down the reserved food material of mother corms by hydrolytic enzymes and hastened the sprouting process.

Plant height at 45 and 75 DAP (cm): Pre-planting soaking of corm in different bio regulators solution had significant effect on plant height is presented in Table-1. In all treatment the maximum plant height was obtained in T_3 (GA_3 @ 150 ppm) at 45 DAP and 75 DAP (50.68 and 78.74 respectively). While, T_{13} (control) registered in minimum plant height at 45 DAP and 75 DAP (19.63 and 45.20 cm respectively). These findings might be due to the application of GA_3 which increased cell division and cell elongation in plants resulting in more number of cells and increase in cell length which ultimately affected plant growth (Taiz and Zeiger, 1998) [24]. This may be due to that it enhances cell division by promoting DNA synthesis in cell (Sharma *et al*. 2006) [21]. Gibberellins are known to promote the elongation of stem by cell elongation and cell multiplication. This response is in agreement with the results obtained in gladiolus by Suman *et al*. (2008) [23] and Misra *et al*., (1996) [13] in gladiolus cv. Sylvia. It might occur due to application of optimum doses of GA_3 that helps to regulate the vegetative growth by inducing active cell division in the apical meristem.

Number of leaves per plant at 45 and 75 DAP: Higher concentration of T_3 (GA_3 @ 150 ppm) was found effective in increasing the number of leaves at 45 (9.74) and 75 (13.82) days after planting. This may be because GA_3 enhances cell division by promoting DNA synthesis in cell and increasing vegetative growth characters. Earliness in sprouting would be due to the breaking of corm dormancy by GA_3 application. GA_3 also induces active cell division in apical meristem and is also helpful in elongation of individual cells which results in improved vegetative growth (Laishram and Hatibarua, 2013) [10]. The growth regulator promoted cell division and cell elongation thereby, significantly influencing the leaf number and leaf area. Growth regulator application further enhanced the translocation of sugars (Montessori *et al*., 2013) [14].

Effect of plant bio-regulators on flowering, yield and quality parameters

The result indicates that the pre plant soaking of different solutions of bio-regulators had produced significant effect on flowering, yield and quality parameters *viz*., Spike length (cm), rachis length (cm), number of florets per spike, diameter of flower (2nd florets) (cm), duration of flowering (days) and spike yield per ha (in thousands).

Spike length (cm): The length of spike differed significantly due to various bio regulators treatments of corms (Table-2). Among the all treatment the highest spike length was obtained in the treatment T_3 (GA_3 @ 150 ppm). On the other hand shortest spike length (56.39) was produced by T_{13} (control). These results are in accordance with Bhalla and Kumar (2007) [1]. It might be due to rapid intermodal elongation as a result of increased cell division and cell elongation in the intercalary meristem by GA_3. As GA_3 promotes vegetative growth and increases the photosynthetic and metabolic activities causing more transport and utilization of photosynthetic products. This might have resulted in increased spike length represented by Reddy *et al*. (2013) [19], Chopde *et al*. (2015) [3] and Pal and Chowdhary (1998) [18]. Suman *et al*. (2011) claimed that increased spike length may be due to that the gibberellic acid which might have increased auxin content in tissue as it is involved in auxin synthesis.

Rachis length (cm): The length of rachis was significantly influenced by different bio regulators treatments of corms in gladiolus (Table-2). Plants from T_3 (GA_3 @ 150 ppm) produced the longest rachis length (40.30 cm). Whereas, plant grown from without bio regulator T_{13} (control) produced the shortest rachis length (26.46 cm). Most of the growth regulators acted as growth promoter but the effect of GA_3 150 ppm was dominant among all other treatments. These results are in agreement with those reported by Naveen Kumar *et al*. (2011) [15], found length of rachis and spike increased due to different chemical treatments. Kumar *et al*. (2009) [7] reported increase in rachis length due to chemicals and growth regulators.

Number of florets per spike: Significantly highest number of florets per spike (10.63) were observed in the plants grown from the corms treated with T_3 (GA_3 @ 150 ppm). The minimum number of florets per spike (6.13) was produced in T_{13} (control). Gibberellic acid acted as a growth promoting chemical, it was also due to early sprouting and good vegetative growth. These results are in agreement with those

reported by Suman *et al*. (2008) [23] was reported that more number of florets per spike and flowering duration due to dipping of corms in growth regulators. Gibberellic acid promotes the auxiliary buds to grow vigorously and their flowering, it might be main reason for production of more flowering spikes (Montessori *et al*., 2013) [14].

Diameter of flower (2nd florets) (cm): The diameter of floret was significantly influenced by the different plant bio regulators (Table-2). The maximum diameter of floret (13.09 cm) was noted in treatment T_3 (GA_3 @ 150 ppm) and lowest diameter of floret (9.50 cm) was recorded in treatment T_{13} (control). Application of 150 ppm GA_3 significantly increased floret diameter. The results are in close conformity with the findings of Padaganur *et al*. (2005) [16] in tuberose. The increase was mainly due to the increase in the number of leaves per plants which might have increased the production of photosythates needed to enhance reproductive growth (Sindu and verma, 1998) [22] in gladiolus.

Duration of flowering (days): The duration of flowering was significantly influenced by the different plant bio regulators (Table-2). Maximum flowering duration observed in T_3 (GA_3 @ 150 ppm) (22.34), while the minimum flowering duration was found in T_{13} (control) (13.54). GA_3 application was found effective in increasing flowering duration as compared to BA, ethrel and including control. It might be due to the role of plant growth regulators in delaying the senescence of flower and reduced the effect of ethylene. There is a possibility of plant growth regulator by delaying the natural rise in ethylene production (Mayak and Halevy, 1980) [12]. Gibberellins is quite effective in reducing juvenile period of plant and inducing reproductive phase (Chopde *et al*., 2015) [3].

Spike yield per ha (in thousands): The spike yield per ha was significantly influenced by the different plant bio regulators (Table-2). The maximum spike yield was observed in T_6 (BA @ 150 ppm) (162.71 spike yield/ha). However, minimum spike yield was recorded in T_{13} (control) (81.18). BA increased the spikes yield, it might be due to the maximum number of shoots per corm (Aier *et al*., 2015). Variation of spikes yield among the treatments was might be due to significant difference in per cent sprouting of corms, number of spikes per plant which is controlled by genotypic factor along with effect of growth regulators. Similar views are expressed by Kumar and Singh (2005) [9], Chopde *et al*., (2011) [2] and Manasa *et al*., (2017) [11] in gladiolus.

Table 1: Effect of plant bio-regulators on vegetative growth parameters

Treatment	Treatment details	Days to sprouting (days)	Plant height (cm)		Number of leaves per plant	
			45 DAP	75 DAP	45 DAP	75 DAP
T_1	GA_3 @ 50 ppm	7.56	41.82	69.59	7.07	9.55
T_2	GA_3 @ 100 ppm	7.83	43.46	69.03	8.29	12.66
T_3	GA_3 @ 150 ppm	6.90	50.68	78.74	9.74	13.62
T_4	BA @ 50 ppm	10.23	36.94	62.07	7.00	10.77
T_5	BA @ 100 ppm	8.20	28.74	49.84	8.11	11.11
T_6	BA @ 150 ppm	11.40	32.53	54.33	8.26	11.25
T_7	Ethrel @ 250 ppm	11.93	40.63	65.73	7.93	10.66
T_8	Ethrel @ 500 ppm	12.96	35.34	59.84	6.72	8.96
T_9	Ethrel @ 750 ppm	12.63	30.80	56.33	7.76	9.94
T_{10}	Thiourea @ 1%	8.03	45.77	73.21	9.14	12.15
T_{11}	Thiourea @ 2%	7.96	47.24	75.84	9.52	13.26
T_{12}	Thiourea @ 3%	7.70	43.61	65.92	9.58	13.52
T_{13}	Control	16.36	19.63	45.20	5.06	8.44
S.Em.±		0.486	2.501	2.901	0.454	0.763
C.D. at 5%		1.41	7.30	8.46	1.32	2.22
C.V. %		8.44	11.33	7.91	9.82	11.77

Table 2: Effect of plant bio-regulators on flowering, yield and quality parameters

Treatment	Treatment details	Spike length (cm)	Rachis length (cm)	Number of florets/ spike	Diameter of flower (2nd floret) (cm)	Duration of flowering (days)	Spike yield/ha (thousand)
T_1	GA_3 @ 50 ppm	74.28	34.66	8.38	11.89	19.36	135.00
T_2	GA_3 @ 100 ppm	74.42	31.80	8.52	12.95	20.55	134.19
T_3	GA_3 @ 150 ppm	86.82	40.30	10.63	13.09	22.34	142.55
T_4	BA @ 50 ppm	63.33	27.16	6.91	11.40	18.21	141.08
T_5	BA @ 100 ppm	68.51	30.56	7.86	10.94	17.89	156.35
T_6	BA @ 150 ppm	71.09	26.83	7.61	11.56	16.51	162.71
T_7	Ethrel @ 250 ppm	61.07	31.33	8.83	11.18	17.03	105.33
T_8	Ethrel @ 500 ppm	66.90	31.40	7.83	11.30	18.22	117.93
T_9	Ethrel @ 750 ppm	69.28	32.10	8.38	11.18	18.26	126.18
T_{10}	Thiourea @ 1%	75.36	32.50	8.52	12.18	17.60	135.68
T_{11}	Thiourea @ 2%	82.24	37.83	8.72	12.79	21.85	141.75
T_{12}	Thiourea @ 3%	77.90	33.03	9.83	12.45	21.67	144.19
T_{13}	Control	56.39	26.46	6.13	9.50	13.54	81.18
S.Em.±		4.288	1.637	0.418	0.621	0.924	6.857
C.D. at 5%		12.51	4.77	1.22	1.81	2.70	20.01
C.V. %		10.41	8.86	8.71	9.18	8.6	8.96

Conclusions

On the basis of results obtained in the present investigation, it can be concluded that the higher concentration of GA_3 (150 ppm) was most effective in increased minimum days to sprouting, plant height, number of leaves per plant, spike length, rachis length, number of florets per spike, diameter of florets and duration of flowering. While, higher concentration of benzyl adenine (150 ppm) was the most effective to spike yield.

References

1. Bhalla R, Kumar A. Response of plant bio-regulators on dormancy breaking in gladiolus. J Orna, Horti. 2007;10(4):215-221.
2. Chopde N, Gonge VS, Nagre PK. Effect of growth regulators on growth and flowering of gladiolus. Asian J Hort. 2011;6(2):398-401.
3. Chopde N, Patil A, Bhande MH. Growth, yield and quality of gladiolus as influenced by growth regulators and method of application. Plant Archi. 2015;15(2):691-694.
4. Halevy RH, Shilo R, Sinchon S. Effect of ethrel on health, dormancy, flower and corm yield of gladiolus. J Hort. Sci 1970;45:427-431.
5. Khan FN, Rahman MM, Hossain MM. Effect of benzyladenine and gibberellic acid on dormancy breaking, growth and yield of gladiolus cormsover different storage periods. J Orn. and Horti. Plants, 2013;3(1):59-71.
6. Kirad KS, Banabr RNS, Barche S, Billore L, Meenakshi MD. Effects of growth regulators on gladiolus. Annals of Agri, Res. 2001;22(2):278-231.
7. Kumar K, Chandra SR, Padma M, Siva SA. Effect of plant growth regulators on dormancy, corm and cormel production in gladiolus (*Gladiolus x grandiflorus* L.) J Orna. Hort 2009;12(3):182-187.
8. Kumar R, Dubey RK, Misra RL. Effect of GA3 on growth, flowering and corm production of gladiolus. Proceedings of the National Symposium on Indian Floriculture in the New Millenium, Lal Bagh, Bangalore 2010, 110-113.
9. Kumar V, Singh RP. Effect of soaking of mother corms with plant growth regulators on vegetative growth, flowering and corm production in gladiolus. J. Orna. Hort 2005;8(4):306-308.
10. Laishram N, Hatibarua P. Effect of corm splitting and GA3 application on growth and flowering of gladiolus cv. Pusa Jyotsna. Prog. Agric 2013;13(1):55-59.
11. Manasa MD, Chandrashekar SY, Hanumantharaya L, Ganapathi M, Kumar HP. Influence of Growth Regulators on Vegetative Parameters of Gladiolus cv. Summer Sunshine. Int. J Curr. Microbiol. App. Sci., 2017;6(11):1299-1303.
12. Mayak S, Halevy H. Flower Senescence. In: Thiman, K. V. (Eds.), Senescence in Plants. USA, CRC, Boca Raton, Florida, 1980,131-156.
13. Misra RL, Tripathi DK, Chaturvedi OP. Implication of GA_3 sprayings on the standing crop of gladiolus var. Sylvia. *Progr. Horti*. 1996;25(3):147-150.
14. Montessori N, Bhanishana RK, Hemochandra L, Sharma R, Das R. Effect of application of plant growth regulators in sustainable improvement of gladiolus production in Manipur. Int. J. Pl. Sci. 2013;8(1):103-106.
15. Naveen KP, Reddy YN, Chandrashekar R. Effect of different chemicals on breaking dormancy, growth and flowering of gladiolus cultivar. Indian J. Hort 2011; 68(4):540-546.
16. Padaganur VG, Mokeshi AN, Patil VS. Effect of growth regulators on growth and yield of tuberose cv. Single. Karnataka J. Agril. Sci. 2005;18:469-473.
17. Padmalatha T, Reddy GS, Chandrasekhar R, Siva SA, Chaturvedi A. Effect of pre planting soaking of corms with chemicals and plant growth regulators on dormancy breaking and corm and cormel production in gladiolus. Int. J. Pl. Anim. Env. Sci 2013;3(1):28-33.
18. Pal P, Chowdhary T. Effect of growth regulators and duration of soaking on sprouting, growth, flowering and corm yield of gladiolus cv. Tropic Sea. Hort. J., 1998;11(2): 69-77.
19. Reddy GVS, Nageswararao MB, Umajyothi K, Sasikala K. Studies on the effect of plant growth regulators on flowering, corm and cormel production in gladiolus (*Gladiolus grandiflorus* L.) cv. White Prosperity. J. Res. ANGRAU, 2013;41(2):11-15.
20. Sarkar MAH, Hossain MI, Uddin AFMJ, Uddin MAN, Sarkar MD. Vegetative, floral and yield attributes of gladiolus in response to gibberellic acid and corm size. Scientia Agri. 2014;7(3):142-146.
21. Sharma DP, Chattar YK, Gupta N. Effect of gibberelic acid on growth, flowering and corm yield in three cultivars of gladiolus. J Orna. Hort 2006;9(2):106-109.
22. Sindu SS, Verma TS. Effect of different size of corms and various treatments in gladiolus cv. White oak. Recent Hort 1998;4:69- 70.
23. Suman K, Patel BS, Mahawer LN. Influence of gibberellic acid and planting dates on vegetative growth and flower production in gladiolus cv. Yellow Frilled. Pro. Hort 2008;43(2):117-125.
24. Taiz L, Zeiger E. Plant Phsiology (Sinauer Associate Inc. Publishers) 2nd. Ed 1998, 792.