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Effect of Plant Growth Regulators on Floral Characteristics and Vase Life of Gladiolus (*Gladiolus grandiflorus L.*) Cv. Saffron

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Authors' contributions

This work was carried out in collaboration between both authors. Both authors read and approved the final manuscript.

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ABSTRACT

The balanced development of plant is governed by the growth regulators those are being increasingly utilized to manipulate the growth and flowering of ornamental plants. An experiment was conducted to study the effect of growth regulators viz., GA_3 (100, 200 and 300 ppm), BAP (50, 100 and 150 ppm) and MH (250, 500 and 750 ppm) on growth and flowering of gladiolus varieties saffron with Randomized Block Design. The results showed that, the minimum days to spike emergence, days to first floret open/bloom, days to 50% floret open, internodal length between floret, diameter of floret, number of florets and vase life was found best in treatment T_3 (GA_3 @ 200 ppm) followed by treatment T_2 (GA_3 @ 100 ppm) and T_4 (GA_3 @ 300 ppm) whereas duration of flowering in days found best in treatment T_4 (GA_3 @ 300 ppm) followed by T_2 (GA_3 @ 100 ppm) and T_3 (GA_3 @ 200 ppm) and number of spike per plant found highest in treatment T_7 (BAP @ 150 ppm).

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1. INTRODUCTION

"Gladiolus is one of the important bulbous flower crops and referred to as the queen of bulbous flowers. It belongs to the family Iridaceae and native to Cape region in South-Africa. It has bright, beautiful and differently coloured flowers and is use in cut flower, herbaceous borders, beddings, rockeries and pots. In the spike, the flowers open from the bottom to the top. It has multi coloured flowers. Gladiolus can be grown in a variety of soil types and requires a pH of 6-7 for optimal growth and spike production" [1].

"Gladiolus is one of the four famous cut flower in the world" [2]. "It has first rank of bulbous flower in the world trade" [3]. "It is known fact that application of plant growth regulators such as GA_3, NAA, CCC and MH head positive effect on growth and development of gladiolus plant at different concentrations" [4]. "The keeping quality of gladiolus makes it a very popular commercial cut flower after rose. Its spikes takes 60 to 100 days after planting to be harvested depending upon the cultivars and time of year" [5]. "Gibberellic acids has an important role in different plant processes, including seed germination, stem elongation, leaf expansion and flower development" [6].

"The increase in flower production and improvement in quality of spike and extend of post-harvest life (vase life) can be achieved by the use of plant growth regulators and use of floral preservatives respectively. Plant growth regulators application is one of the most essential factors in improving the growth, flower quality and yield" [7]. "The reports indicate that the growth and yield of gladiolus were enhanced by application of GA_3" [8,9].

2. MATERIALS AND METHODS

Present work was conducted at the Experimental area, Department of Floriculture and Landscape Architecture, IGKV Raipur, Chhattisgarh, during the year of 2020-21. The experiment was set up in Randomized Block Design with 10 treatments and three replications. The treatment comprised three plant growth regulators viz., GA_3 (100, 200 and 300 ppm), BAP (50, 100 and 150 ppm) and MH (250, 500 and 750 ppm) each at three concentration in addition to tap water spray as control. One corm per hill about (5-6 cm) depth, corm were planted. All chemical applied the plants 30 DAP through foliar spray. The data were statistically analysed and critical differences were work out at five percent level to draw statistical conclusions as suggested by Panse and Sukhatme (1985).

3. RESULTS AND DISCUSSION

3.1 Floral Characters

3.1.1 Days to first spike emergence

Treatment T_3 (GA_3 @ 200 ppm) had recorded shortest days to first spike emergence (68.70 days) but it was exhibited statistically similar with treatments T_2 (GA_3 @ 100 ppm) and T_4 (GA_3 @ 300 ppm) whereas, it was observed significantly batter with remaining of the other treatment. The maximum (80.57 days) for first spike emergence were found in treatment T_9 (MH @ 500 ppm).

The earlier spike emergence might be exogenous application of GA_3 may be due to the carbohydrate pathway and the photoperiodic pathway with GA_3 which reduced the time of emergence of spike, resulting in spike emergence that was nearly 10 days earlier than when growth retardants were used. Similar result was also reported in gladiolus by Kumar et al. [10] and Ramchandradu and Thangam [11].

3.1.2 Days to first floret open/bloom

The treatment T_3 (GA_3 at 200 ppm) was took the minimum (72.82 days) for first floret open and it was exhibited similar with treatment T_2 (GA_3 at 100 ppm) and treatment T_4 (GA_3 at 300 ppm). However, it was recorded significantly shorter days than remaining of the treatments. The highest days required to open first floret (86.87 days) recorded with treatment T_9 (MH @ 500 ppm).

The result showed significantly shorter days to open first floret might be due to increased photosynthesis and Co_2 fixation and vital role of GA_3 in the production and regulation floral stimulation that may be enhances early first floret open. These findings are consistent in gladiolus with those of Ram *et al.* [12] and Kumar et al. [13].

3.1.3 Days to 50 % floret open

The data revealed that the minimum days require for 50 % floret open was recorded with the application of treatment T_3 (GA_3 @ 200 ppm) and it was statically similar with treatment T_2 (GA_3 at 100 ppm) and T_4 (GA_3 at 300 ppm). Moreover, it was recorded significantly better with remaining of the other treatments. The maximum days taken to 50 % flower open (94.66 days) was observed in treatment T_9 (MH @ 500 ppm).

"The explanation for minimum days required for 50 % floret open with application of treatment T_3 may be due to the availability of optimal quantity of GA_3 and that their stimulatory effect on cell division, elongation and differentiation of floral primordial and might be enhance to early flowering of gladiolus. The result can be conformity with the finding of Kumar et al. [13] in gladiolus" [1].

3.1.4 Internodal length between floret (cm)

The data table showed the result of the observations regarding to internodal length of the floret had the greatest (5.08 cm) was seen in treatment T_3 (GA_3 @ 200 ppm) and it was significantly greater to remaining treatments. The lowest Internodal length of floret (4.10 cm) was recorded with treatment T_9 (MH @ 500 ppm).

The superiority of treatment T_3 over the rest of other treatments could be attributed to GA_3 induced proliferation of cell and cell elongation at intercalary meristem level, resulting in internodal length increase. Another probable justification might be due to rapid cell division and cell elongation at internodal region of plant, which resulted in more number of cells, cell length and more rachis length and also increase internodal length of gladiolus plant. These results are in line with the findings of Devi et al. [14] and Chopde et al. [15] in gladiolus.

3.1.5 Diameter of floret (cm)

The data clearly showed that the highest floret diameter (10.80 cm) was observed with treatment T_3 (GA_3 @ 200 ppm) and it was similarly exhibited with treatments T_2 (GA_3 @ 100 ppm), T_4 (GA_3 @ 300 ppm) and T_6 (BAP @ 100 ppm) which varied significantly from other treatment. The lowest value of diameter of floret (8.00 cm) was measured in treatment T_9 (MH @ 500 ppm).

The superiority of treatment T_3 may be attributed to role of gibberellic acid may be optimize the size of flower bud, which may be attributed to metabolite translocation at the site of bud development. Another probable reason is the enhance in diameter of floret could be attributed to flower cell elongation that may increase diameter of florets. These results are closed conformity with the findings of Ram et al. [12], Chopde et al. [16] and Patel et al. (2013) in gladiolus.

3.1.6 Duration of flowering (days)

The data clearly showed that greatest flowering duration (13.91 days) has been noted with treatment T_4 (GA_3 @ 300 ppm) and it was statically similar with treatments T_2 (GA_3 at 100 ppm) and T_3 (GA_3 at 200 ppm), whereas it was observed significantly better over remaining of the other treatments. Moreover, the lowest flowering duration (10.21 days) was noticed in treatment T_1 (control with tap water).

The accessibility of an optimal amount of GA_3 under this treatment T_4, resulting in the longest flowering duration. Another possible reason for the longer duration of flowering is GA_3, which is attributed to increased vegetative growth in the early on phase might be due to improved photosynthesis and Co_2 fixation. Exogenous GA_3 application would have favored the convenience of floral initiation factors such as the carbohydrate pathway and the photoperiodic pathway with the GA_3 pathway. This research is supported by Ravidas et al. [17], Kumar et al. [13] and Chopde et al. [16] published in Gladiolus.

3.1.7 Vase life of cut spikes (days)

The data showed that the significantly longest vase life (9.51 days) of gladiolus spike was recorded in treatment T_3 (GA_3 @ 200 ppm) and it was followed by the treatments T_2 (GA_3 at 100 ppm), T_4 (GA_3 @ 300 ppm), T_5 (BAP @ 50 ppm), T_6 (BAP @ 100 ppm) and T_7 (BAP @ 150 ppm). However, it was significantly greater than the remaining of the other treatments. The shortest vase life (5.47 days) was noticed with treatment T_{10} (MH @ 750 ppm).

Cut spike obtained from plants treated with treatment T_3 demonstrated a progressive increase in their vase life. The increased effectiveness of the optimum dose of GA_3 could be attributed to superior activity of auxin, it has been reported to delay senescence and increase the translocation of metabolites, which may be beneficial in increasing the vase life of cut spike. This finding is consonance with the reports of

Tawar et al. [18], Umrao *et al*. [8] and Chopde et al. [16] in gladiolus.

3.1.8 Number of spike per plant

The result showed that the highest number of spike per plant (2.20) was observed with application of treatment T_7 (BAP @ 150 ppm) and it was showed *at par* with treatments T_5 (BAP @ 50 ppm), T_6 (BAP @ 100 ppm) and T_8 (MH @ 250 ppm) whereas, significantly greater over all other treatments. Moreover, the least number of spike per plant (1.00) was noticed with treatment T_1 (control with tap water).

The superiority of treatment T_7 (BAP @ 150 ppm) on number of spike per plant over the rest of the treatments might be due to the reason that cytokinin stimulate cell division and lateral bud development which led to multiple shooting. Similar views have also been expressed by [19] in gladiolus.

3.1.9 Number of florets per spike

"The result showed that the treatment T_3 (GA_3 at 200 ppm) had the greatest number of florets per spike (13.33) and it was closely followed by the treatment T_2 (GA_3 at 100 ppm) and T_4 (GA_3 at 300 ppm) and statistically greater with remaining of the other treatments. However, the treatment T_1 control had the fewest florets per spike (10.27) tap water."

Treatment T_3 (GA_3 @ 200 ppm) is superior over the other treatments with respect to number of floret per spike might be due to the explanation for the increased number of florets is that this treatment provide an optimal amount of GA_3 of growth stage that may be increases spike length and length of rachis, both of which are enhanced the number of florets per spike. Similar result was reported by Kumar et al. [10] and Chopde et al. [16] in gladiolus.

Table 1. Effect of plant growth regulators on floral characteristics and vase life of gladiolus

Treatments	Days to spike Emergence	Days taken to first floret open	Days to 50% floret Open	Internodal length of floret	Diameter of Floret
T_1 Control	75.90	82.10	90.30	4.58	7.67
T_2 GA_3@100 ppm	69.80	74.19	79.79	4.44	10.23
T_3 GA_3@200 ppm	68.70	72.82	78.29	5.08	10.80
T_4 GA_3@300 ppm	69.30	73.92	79.88	4.57	10.47
T_5 BAP@ 50 ppm	76.54	83.30	88.97	4.20	9.27
T_6 BAP@100 ppm	75.72	81.09	88.47	4.26	10.40
T_7 BAP@150 ppm	74.26	79.19	86.31	4.37	9.84
T_8 MH@ 250 ppm	78.91	84.88	92.61	4.23	9.67
T_9 MH@ 500 ppm	80.57	86.87	94.66	4.10	8.00
T_{10} MH@750ppm	79.90	86.02	92.61	4.30	8.53
S.Em±	0.67	0.87	0.87	0.09	0.30
C.D. at 5%	1.98	2.59	2.59	0.27	0.89

Table 2. Effect of plant growth regulators on floral characteristics and vase life of gladiolus

Treatments	Flowering duration (days)	Number of spike per plant	Number of floret per spike	Vase life (days)
T_1 Control	10.21	1.00	10.27	5.54
T_2 GA_3@100 ppm	12.44	1.00	13.00	8.70
T_3 GA_3@200 ppm	13.49	1.20	13.33	9.51
T_4 GA_3@300 ppm	13.91	1.30	12.13	8.48
T_5 BAP@ 50 ppm	11.21	2.10	11.53	7.12
T_6 BAP@100 ppm	11.56	2.00	11.93	7.27
T_7 BAP@150 ppm	12.01	2.20	11.54	7.28
T_8 MH@ 250 ppm	10.97	1.80	11.40	5.62
T_9 MH@ 500 ppm	11.01	1.42	11.27	5.89
T_{10} MH@750ppm	10.87	1.11	11.20	5.47
S.Em±	0.55	0.48	0.35	1.22
C.D. at 5%	1.65	1.43	1.04	3.61

4. CONCLUSION

Plant growth regulators we use with different doses. The results showed that, the minimum days to spike emergence, days to first floret open/bloom, days to 50% floret open, internodal length between floret, diameter of floret, number of florets and vase life was found best in treatment T_3 (GA_3 @ 200 ppm) at par with treatment T_2 (GA_3 @ 100 ppm) and T_4 (GA_3 @ 300 ppm) whereas duration of flowering in days found best in treatment T_4 (GA_3 @ 300 ppm) followed by T_2 (GA_3 @ 100 ppm) and T_3 (GA_3 @ 200 ppm) and number of spike per plant found highest in treatment T_7 (BAP @ 150 ppm).

5. FUTURE SCOPE

To identify the best plant growth regulators for different agro climatic zones of Chhattisgarh, detailed study is needed and also application of some other PGR's like NAA, CCC, IAA and IBA etc. at different concentration to assess its effectiveness on growth, flowering and corm production in gladiolus.

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COMPETING INTERESTS

Authors have declared that no competing interests exist.

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