

## Original Research Article

### **Effect of plant growth regulators on floral characteristics and vase life of Gladiolus (Gladiolus grandiflorus L.) Cv. Saffron**

#### **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<sub>3</sub> (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<sub>3</sub> (GA<sub>3</sub> @ 200 ppm) followed by treatment T<sub>2</sub> (GA<sub>3</sub> @ 100 ppm) and T<sub>4</sub> (GA<sub>3</sub> @ 300 ppm) whereas duration of flowering in days found best in treatment T<sub>4</sub> (GA<sub>3</sub> @ 300 ppm) followed by T<sub>2</sub> (GA<sub>3</sub> @ 100 ppm) and T<sub>3</sub> (GA<sub>3</sub> @ 200 ppm) and number of spike per plant found highest in treatment T<sub>7</sub> (BAP @ 150 ppm).

**Keywords:** Gibberellic acid (GA<sub>3</sub>), Benzyl amino purine (BAP), Malic hydrazide (MH)

#### **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 6.0-7 for optimal growth and spike production.

Gladiolus is one of the four famous cut flower in the world (Bai *et al.*, 2009). It has 1st rank of bulbous flower in the world trade (Pragya *et al.*, 2010). It is known fact that application of plant growth regulators such as GA<sub>3</sub>, NAA, CCC and MH head positive effect on growth and development of gladiolus plant at different concentrations (Lal *et al.* 2013). 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 (Jenkins *et al.*, 1970). Gibberellic acids has an important role in different plant processes, including seed germination, stem elongation, leaf expansion and flower development (Olszewski *et al.*, 2002).

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 (Nuvalle *et al.* 2010). The reports indicate that the growth and yield of gladiolus were enhanced by application of GA<sub>3</sub> (Umrao *et al.*, 2007 and Rana *et al.*, 2005).

#### **Material 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<sub>3</sub> (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).

## **Result and discussion:**

### **Floral characters**

#### **Days to first spike emergence**

Treatment T<sub>3</sub> (GA<sub>3</sub> @ 200 ppm) had recorded shortest days to first spike emergence (68.70 days) but it was exhibited statistically similar with treatments T<sub>2</sub> (GA<sub>3</sub> @ 100 ppm) and T<sub>4</sub> (GA<sub>3</sub> @ 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<sub>9</sub> (MH @ 500 ppm).

The earlier spike emergence might be exogenous application of GA<sub>3</sub> may be due to the carbohydrate pathway and the photoperiodic pathway with GA<sub>3</sub> 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.* (2005) and Ramchandradu and Thangam (2007).

#### **Days to first floret open/bloom**

The treatment T<sub>3</sub> (GA<sub>3</sub> at 200 ppm) was took the minimum (72.82 days) for first floret open and it was exhibited similar with treatment T<sub>2</sub> (GA<sub>3</sub> at 100 ppm) and treatment T<sub>4</sub> (GA<sub>3</sub> 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<sub>9</sub> (MH @ 500 ppm).

The result showed significantly shorter days to open first floret might be due to increased photosynthesis and CO<sub>2</sub> fixation and vital role of GA<sub>3</sub> 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.* (2001) and Kumar *et al.* (2010).

#### **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<sub>3</sub> (GA<sub>3</sub> @ 200 ppm) and it was statically similar with treatment T<sub>2</sub> (GA<sub>3</sub> at 100 ppm) and T<sub>4</sub> (GA<sub>3</sub> 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<sub>9</sub> (MH @ 500 ppm).

The explanation for minimum days required for 50 % floret open with application of treatment T<sub>3</sub> may be due to the availability of optimal quantity of GA<sub>3</sub> 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.* (2010) in gladiolus.

#### **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<sub>3</sub> (GA<sub>3</sub> @ 200 ppm) and it was significantly greater to remaining treatments. The lowest Internodal length of floret (4.10 cm) was recorded with treatment T<sub>9</sub> (MH @ 500 ppm).

The superiority of treatment T<sub>3</sub> over the rest of other treatments could be attributed to GA<sub>3</sub> 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.* (2007) and Chopde *et al.* (2011) in gladiolus.

#### **Diameter of floret (cm)**

The data clearly showed that the highest floret diameter (10.80 cm) was observed with treatment T<sub>3</sub> (GA<sub>3</sub> @ 200 ppm) and it was similarly exhibited with treatments T<sub>2</sub> (GA<sub>3</sub> @ 100 ppm), T<sub>4</sub> (GA<sub>3</sub> @ 300 ppm) and T<sub>6</sub> (BAP @ 100 ppm) which varied significantly from other treatment. The lowest value of diameter of floret (8.00 cm) was measured in treatment T<sub>9</sub> (MH @ 500 ppm).

The superiority of treatment T<sub>3</sub> 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.* (2001), Chopde *et al.* (2013) and Patel *et al.* (2013) in gladiolus.

#### **Duration of flowering (days)**

The data clearly showed that greatest flowering duration (13.91 days) has been noted with treatment T<sub>4</sub> (GA<sub>3</sub> @ 300 ppm) and it was statically similar with treatments T<sub>2</sub> (GA<sub>3</sub> at 100 ppm) and T<sub>3</sub> (GA<sub>3</sub> 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<sub>1</sub> (control with tap water).

The accessibility of an optimal amount of GA<sub>3</sub> under this treatment T<sub>4</sub>, resulting in the longest flowering duration. Another possible reason for the longer duration of flowering is GA<sub>3</sub>, which is attributed to increased vegetative growth in the early on phase might be due to improved photosynthesis and CO<sub>2</sub> fixation. Exogenous GA<sub>3</sub> application would have favored the convenience of floral initiation factors such as the carbohydrate pathway and the photoperiodic pathway with the GA<sub>3</sub> pathway. This research is supported by Ravidas *et al.* (1992), Kumar *et al.* (2010) and Chopde *et al.* (2011) published in Gladiolus.

#### **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<sub>3</sub> (GA<sub>3</sub> @ 200 ppm) and it was followed by the treatments T<sub>2</sub> (GA<sub>3</sub> at 100 ppm), T<sub>4</sub> (GA<sub>3</sub> @ 300 ppm), T<sub>5</sub> (BAP @ 50 ppm), T<sub>6</sub> (BAP @ 100 ppm) and T<sub>7</sub> (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<sub>10</sub> (MH @ 750 ppm).

Cut spike obtained from plants treated with treatment T<sub>3</sub> demonstrated a progressive increase in their vase life. The increased effectiveness of the optimum dose of GA<sub>3</sub> 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.* (2002), Umrao *et al.* (2007) and Chopde *et al.* (2013) in gladiolus.

### **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<sub>7</sub> (BAP @ 150 ppm) and it was showed *at par* with treatments T<sub>5</sub> (BAP @ 50 ppm), T<sub>6</sub> (BAP @ 100 ppm) and T<sub>8</sub> (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<sub>1</sub> (control with tap water).

The superiority of treatment T<sub>7</sub> (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 (Murti and Upreti, 1995) in gladiolus.

### **Number of florets per spike**

The result showed that the treatment T<sub>3</sub> (GA<sub>3</sub> at 200 ppm) had the greatest number of florets per spike (13.33) and it was closely followed by the treatment T<sub>2</sub> (GA<sub>3</sub> at 100 ppm) and T<sub>4</sub> (GA<sub>3</sub> at 300 ppm) and statistically greater with remaining of the other treatments. However, the treatment T<sub>1</sub> control had the fewest florets per spike (10.27) tap water.

Treatment T<sub>3</sub> (GA<sub>3</sub> @ 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<sub>3</sub> 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.* (2005) and Chopde *et al.* (2013) 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 <sub>1</sub> Control	75.90	82.10	90.30	4.58	7.67
T <sub>2</sub> GA <sub>3</sub> @100 ppm	69.80	74.19	79.79	4.44	10.23
T <sub>3</sub> GA <sub>3</sub> @200 ppm	68.70	72.82	78.29	5.08	10.80
T <sub>4</sub> GA <sub>3</sub> @300 ppm	69.30	73.92	79.88	4.57	10.47
T <sub>5</sub> BAP@ 50 ppm	76.54	83.30	88.97	4.20	9.27
T <sub>6</sub> BAP@100 ppm	75.72	81.09	88.47	4.26	10.40
T <sub>7</sub> BAP@150 ppm	74.26	79.19	86.31	4.37	9.84
T <sub>8</sub> MH@ 250 ppm	78.91	84.88	92.61	4.23	9.67
T <sub>9</sub> MH@ 500 ppm	80.57	86.87	94.66	4.10	8.00
T <sub>10</sub> MH@750ppm	79.90	86.02	92.61	4.30	8.53
<b>S.Em±</b>	0.67	0.87	0.87	0.09	0.30
<b>C.D. at 5%</b>	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 <sub>1</sub> Control	10.21	1.00	10.27	5.54
T <sub>2</sub> GA <sub>3</sub> @100 ppm	12.44	1.00	13.00	8.70
T <sub>3</sub> GA <sub>3</sub> @200 ppm	13.49	1.20	13.33	9.51
T <sub>4</sub> GA <sub>3</sub> @300 ppm	13.91	1.30	12.13	8.48
T <sub>5</sub> BAP@ 50 ppm	11.21	2.10	11.53	7.12
T <sub>6</sub> BAP@100 ppm	11.56	2.00	11.93	7.27
T <sub>7</sub> BAP@150 ppm	12.01	2.20	11.54	7.28

T <sub>8</sub> MH@ 250 ppm	10.97	1.80	11.40	5.62
T <sub>9</sub> MH@ 500 ppm	11.01	1.42	11.27	5.89
T <sub>10</sub> MH@750ppm	10.87	1.11	11.20	5.47
<b>S.Em±</b>	0.55	0.48	0.35	1.22
<b>C.D. at 5%</b>	1.65	1.43	1.04	3.61

### 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<sub>3</sub> (GA<sub>3</sub> @ 200 ppm) at par with treatment T<sub>2</sub> (GA<sub>3</sub> @ 100 ppm) and T<sub>4</sub> (GA<sub>3</sub> @ 300 ppm) whereas duration of flowering in days found best in treatment T<sub>4</sub> (GA<sub>3</sub> @ 300 ppm) followed by T<sub>2</sub> (GA<sub>3</sub> @ 100 ppm) and T<sub>3</sub> (GA<sub>3</sub> @ 200 ppm) and number of spike per plant found highest in treatment T<sub>7</sub> (BAP @ 150 ppm).

### 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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