Research article

Ecology Journal

ISSN (Print): 2957-4471, ISSN (Online): 2957-448X, Website: https://journal.esbangladesh.org
Ecol. J. (2023) 5 (2) : 181-186

FLOWER QUALITY AND VASE LIFE OF GLADIOLUS AS AFFECTED BY HORMONES

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Received: 13 November 2023, revised: 09 December 2023, accepted: 10 December 2023, DOI: https: //doi.org/10.59619/ej.5.2.11

ABSTRACT

An experiment was conducted at the Floriculture field of Horticulture Research Centre, Gazipur during Rabi season of 2021-22 to find out the effect of preharvest spray of different hormones (GA_3, SA and BA) at different concentrations on flower and vase life of gladiolus. The experiment was laid out in a Randomized Complete Block design with three replications. The treatments were T_1=GA_3 @ 100 ppm, T_2=GA_3 @ 200 ppm, T_3=GA_3 @ 300 ppm, T_4=SA@ 100 ppm, T_5=SA @ 200 ppm, T_6=SA @ 300 ppm, T_7=BA @ 100 ppm, T_8=BA @ 200 ppm, T_9 =BA @ 300 ppm and T_{10}= Control (fresh water). Healthy corms of gladiolus having a diameter of about 5.0 cm were used as planting material. The aqueous solution of GA_3 (100, 200 and 300 ppm), SA (100, 200 and 300 ppm) and BA (100, 200 and 300 ppm) along with control (fresh water) were applied twice on the flower plants at three and six leaves stage. Flowering parameters of plants as well as vase life of flowers were significantly influenced by the application of hormones. Among all the treatments, application of SA @ 100 ppm was recorded to be an outstanding treatment in improving floral and vase quality attributes i.e. highest spike (78.5 cm) and rachis length (52.8 cm), maximum floret number/spike (14.5), biggest floret diameter (10.0 cm) and early spike initiation (65 days) were observed as compared to control. The maximum floret opening (90%), highest water uptake (45.0 g) and maximum vase life (12 days) were also noted with SA @ 100 ppm in gladiolus.

Keywords: Gladiolus, preharvest spray, gibberellic acid, benzyl adenine, salicylic acid, vase life

Introduction

Gladiolus (*Gladiolus grandiflorus*) is a flower of glamour and perfection which is known as the queen of bulbous flowers belongs to family Iridaceae. The gladiolus gained popularity in Bangladesh and different parts of the world due to its unsurpassed beauty and economic value. Now the flower is in high demand due to attractive spikes, big florets, dazzling colours and long vase life (Khan *et al*. 2011). The agro-ecological conditions of Bangladesh are very much conducive for the successful cultivation of gladiolus (Ara *et al*. 2010). The aesthetic value of flowers in the daily life is increasing with the advancement of civilization. Gladiolus is mainly used as cut flower in Bangladesh. The major production belts of this flower in the country are Jashore sadar, Sharsha, Chowgacha, Kushtia, Chuadanga, Satkhira, Khulna, Chittagong, Mymensingh, Dhaka, Savar, Narayangonj, Rangpur and Gazipur regions. Due to higher economic return the flower growers are also very much interested in cultivating this flower (Hoque *et al.* 2022). Therefore, gladiolus is becoming attractive to the growers as well as users now a day. The cut flowers of gladiolus are highly perishable due to high respiration rate and excessive weight loss (Kumar and Gupta 2014,).

Enhancement of vase life of gladiolus cut flower is an important area in horticultural research. The post-harvest quality and longevity of cut flowers is dependent on several pre-and post-harvest factors (Bose *et al*. 2003). Senescence of cut flowers mainly depends on hormonal control and related to the changes in carbohydrate status of the petal (Pal *et al*. 2015). The growth conditions of the plant before harvest would affect the quality of the cut flowers by about 30 - 70% (Marandi *et al*. 2011). It has been reported that pre-harvest spray of salicylic acid has shown a significant difference in morphological, physical parameters and vase life in the flowers like gladiolus (Abdou *et al*. 2007), lilium (Hajizadeh and Aliloo 2013), cut rose (Kazemi *et al*. 2018) and tuberose (Anwar *et al*. 2014). The use of gibberellic acid and benzyl adenine

as pre-harvest sprays has shown promising results in improving the flower quality (Hoque *et al*. 2022, Devi *et al*. 2007, Emami *et al*. 2011) and vase life (Khan *et al*. 2011, Kapri *et al*. 2018 and Kumar and Gupta 2014.) in home and abroad. Therefore, the objective of this research is to study the effect of preharvest foliar spray of different hormones on flower quality and vase life of gladiolus.

Materials and Methods

The experiment was carried out at the Floriculture field of Horticulture Research Centre, BARI, Gazipur during Rabi season of 2021- 2022. The experimental land was prepared with deep ploughing. Manure and fertilizers were applied @ 5 ton, 200.0 kg, 225.0 kg, 190.0 kg, 20.0 kg, 2.0 kg, 3.0 kg per hectare of Cowdung, Urea, TSP, MoP, S, B and Zn, respectively

(Anon, 2018). Cowdung, TSP, MoP, S, B and Zn were applied as basal and urea was top-dressed in two equal splits at 4 leaf stage and spike initiation stage. Healthy corms of BARI Galdiolus-4 having a diameter of about 5.0 cm were used as planting material. The aqueous solution of GA_3 (100, 200 and 300 ppm), SA (100, 200 and 300 ppm) and BA (100, 200 and 300 ppm) along with control (fresh water) were applied twice on the flower plants at three and six leaves stage to study their effect on the quality and vase life of cut gladiolus. They were GA_3 @ 100ppm (T_1), GA_3 @ 200ppm (T_2), GA_3 @ 300 ppm (T_3), SA @ 100 ppm (T_4), SA @ 200 ppm (T_5), SA @ 300 ppm (T_6), BA @100 ppm (T_7), BA @ 200 ppm (T_8), BA @ 300 ppm (T_9) and control (T_{10}).The unit plot size was 2.5 m ´ 2.0 m and spacing was maintained at 20 cm x 20 cm. The experiment was laid out in Randomized Complete Block design with 3 replications. Management practices like irrigation, weeding, mulching etc were same for all treatments during entire period of study to get a healthy crop.

Various quality parameters of flowers were recorded at the time of harvest from five tagged plants. Cut flowers obtained from all the treatments were subjected to vase life studies. The spikes were cut when lower 2-3 florets showed their blushes of colour. The spikes were brought to the laboratory within ½ hour after harvest. The spikes length was uniformly maintained i.e. 50 centimeter and all the leaves were removed to avoid contact with the solution. Cut flowers of gladiolus were placed in glass jar containing 150 ml of water and kept in laboratory at room temperature (20-25^{O}C) and relative humidity (RH) of 65-80% with adequate aeration. The observation of vase life was recorded at daily interval until the flower petal faded and they were not suitable for vase. Floret opening (%) recorded from the day when the first floret opening till the spike was discarded and expressed in percentage. The data recorded on different parameters were statistically analyzed with the help of MSTAT-C software. The difference between treatments means were compared by Duncan's Multiple Range Test (DMRT) according to Steel *et al*. (1997).

Results and Discussion

The data pertaining to the effect of preharvest foliar application sprays of hormone significantly influenced the flower quality parameters and the data are presented in Table 1. When comparing early appearance of spike, it was found that SA @ 100 ppm (T_4) caused early initiation of spike (65.0 days), which might be due to early flower primordial development, cell differentiation and early utilization of nutrients; whereas control plant (T_{10}) took the maximum days for spike initiation (75.0 days). The present results are agreed with the findings of Padmapriya and Chezhiyan (2002) who stated that SA stimulate early flowering in chrysanthemum. SA induces flowering in a range of plants, controls ion uptake by roots and stomata conductivity (Alaey *et al*. 2011). Spike and rachis length increased with application of SA and maximum was found in 100 ppm treated plants (78.5 cm and 52.8 cm, respectively). Similar observations have also been found previously by Tamrakar *et al.* (2021) in gladiolus at 100 ppm SA. The possible reason for increasing spike length and rachis length might be due to increase in the cell division and cell elongation of intercalary meristem resulting in rapid internode elongation (Shankar *et al*. 2011). Results indicated that number of florets per spike of gladiolus were increased by all concentrations of hormones compared to the untreated plants. However, among all the concentrations of hormones studied SA at 100 ppm gave the highest number of florets per spike

Table 1. Effect of preharvest sprays of hormones on floral parameter gladiolus

Treatment	Spike initiation (days)	Spike length (cm)	Rachis length (cm)	Floret no./spike	Floret diameter (cm)
GA_3@100ppm (T_1)	70.0 b	75.0 ab	47.0b	14.0 ab	9.7 ab
GA_3@200ppm (T_2)	72.0 ab	72.0 b	49.5 ab	13.5 ab	9.6 ab
GA_3@300ppm (T_3)	73.0 ab	71.5 bc	45.8 bc	12.8 ab	9.5 ab
SA@100ppm (T_4)	65.0 c	78.5 a	52.8 a	14.5a	10.0 a
SA@200ppm (T_5)	72.0 ab	74.0 ab	50.0 ab	13.6 ab	9.7 ab
SA@300ppm (T_6)	73.0 ab	71.4 bc	49.0 ab	13.0 ab	9.5 ab
BA@100ppm (T_7)	73.0 ab	70.3 bc	46.0 b	13.5 ab	9.4 ab
BA@200ppm (T_8)	72.0 ab	69.5 bc	45.3 bc	13.0 ab	9.3 ab
BA@300ppm (T_9)	73.0 ab	69.0 bc	45.4 bc	12.8 ab	9.2 ab
Control (T_{10})	75.0 a	67.0 c	42.0 c	10.5 b	8.5 b
Level of Significance	*	*	*	*	*
CV %	9.5	8.6	8.4	7.9	7.5

T_1 = GA_3 @100 ppm, T_2= GA_3 @ 200 ppm, T_3 = GA_3 @ 300 ppm, T_4 =SA @ 100 ppm, T_5 =SA @ 200 ppm, T_6 =SA @ 300 ppm, T_7 =BA @ 100 ppm, T_8=BA @ 200 ppm, T_9 =BA @ 300 ppm and T_{10} =Control Means followed by same letter(s) in a column do not differ significantly at 5% level by DMRT.

(14.5) followed by GA_3 at 100 ppm (14.0).

The results of present study are similar to results of Anwar *et al*. (2014) who stated that exogenous application of SA promoted floret number. These results are also accordance with those of (Kaur *et al*. 2007) who found salicylic acid (100 ppm) has influence on growth and photosynthesis and net photosynthesis rate is positively associated with the crop yield in chickpea. Floret diameter was significantly affected by the growth hormone treatments. The diameter of the floret was maximum (10.0 cm) with spraying of SA (100 ppm) while the lowest was (8.5 cm) was obtained in control. The present study is in conformity with the findings of (Anwar *et al*. 2014) who observed that SA (100 ppm) increased the flower diameter of tuberose. SA might have altered the biophysical properties of cell wall. According to Padmapriya and Chezhiyan (2002), salicylic acid has positive effect on photosynthesis in leaves and carbohydrate in leaves and stem due to this reason flower size increased.

The effect of different hormones on vase quality of gladiolus were investigated in this study. Findings of the study are presented in Table (2) and Figure (1 & 2). Floret opening in spikes for a period of 12 days differed with different treatments (Figure 1). Spikes held in T_4 treatment (100 ppm SA) recorded the highest percent of floret opening (90%), while only 70% floret opened in T_{10} (control). The extension of floret opening as observed in the present investigations, accords with previous results obtained in gladiolus by Padamlatha *et al*. (2014) and Sunita *et al.* (2018) in lilium.

T_1 = GA_3 @100 ppm, T_2= GA_3 @ 200 ppm, T_3 = GA_3 @ 300 ppm, T_4 =SA @ 100 ppm, T_5 =SA @ 200 ppm, T_6 =SA @ 300 ppm, T_7 =BA @ 100 ppm, T_8=BA @ 200 ppm, T_9 =BA @ 300 ppm and T_{10} =Control

Means followed by same letter(s) in a column do not differ significantly at 5% level by DMRT.

Total water uptake and water loss for a period of 12 days by the spike differed significantly in case of different hormone solutions (Table 2). Spikes held in solution T_4 (SA @100 ppm) had the highest water absorption (45.0 g) and water loss (43.0 g) whereas, the spikes held in solutions without hormones (control) having the lowest water uptake (21.0 g) and water loss (28.5 g). In Table 2, it was observed that the water loss uptake ratio was lowest (0.8) for the spikes held in solution T_4 (SA @ 100 ppm) and it was the highest value (1.4) for the spikes held in control (T_{10}). Similar results were reported by Marandi *et al*. (2011) in gladiolus. It was observed that days taken by

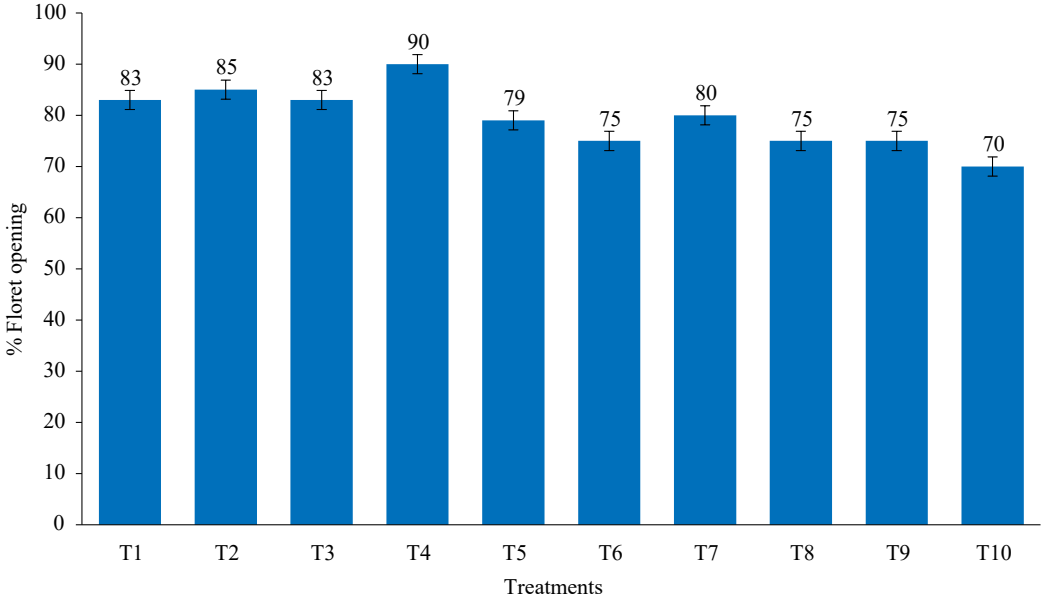


Figure 1. Effect of hormones on %floret opening in gladiolus

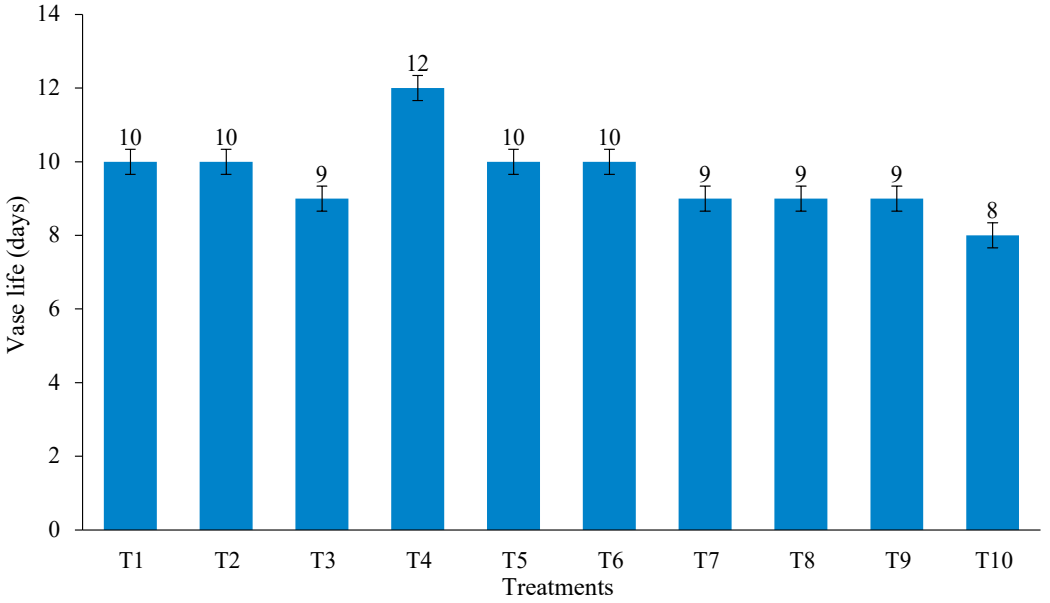


Figure 2. Effect of hormones on vase life of gladiolus

the flowers for deterioration were significantly influenced by different concentrations of hormone level (Table 2). Higher days (10.0 days) were recorded for deterioration started of flowers recorded in T_4 (SA @ 100 ppm). The lowest days (6.0 days) was recorded in control i.e. without hormone solution (T_{10}). At T_4 (SA @ 100 ppm) solution showed better performance because in this treatment water uptake increased and pathogen development reduced. The findings of the experiment are further supported by those of Tawar *et al*. (2003) in gladiolus.

In Figure 2, it was observed that vase life differed with different vase solutions. Spikes held in solution T_4 (100 ppm SA) maintained a maximum vase life for 12 days which was closely similar (11 days) with those held in solution T_2 (200 ppm GA_3) compared with the control and other treatments. It was clear from the above results

Table 2. Effect of different hormones on vase quality of gladiolus

Treatments	Water uptake (g/spike)	Water loss (g/spike)	Water loss uptake ratio	Days taken to deterioration started
T_1	41.0 b	38.5 a	0.9 ab	8.0 ab
T_2	36.4 bc	37.7 bc	1.0 ab	8.0 ab
T_3	34.0 c	34.5 b	1.0 ab	7.0 ab
T_4	45.0 a	43.0 a	0.8 b	10.0 a
T_5	39.0 b	36.0 bc	0.9 ab	8.0 ab
T_6	35.0 bc	37.5 bc	1.1 ab	8.0 ab
T_7	36.5 bc	37.2 bc	1.0 ab	7.0 ab
T_8	28.0 d	32.0 bc	1.2 ab	7.0 ab
T_9	30.0 cd	31.0 bc	1.1 ab	7.0 ab
T_{10}	21.0 e	28.5 c	1.4 a	6.0 b
Level of significance	*	*	*	*
CV%	10.5	9.2	9.6	9.8

T_1 = GA_3 @100 ppm, T_2= GA_3 @ 200 ppm, T_3 = GA_3 @ 300 ppm, T_4 =SA @ 100 ppm, T_5 =SA @ 200 ppm, T_6 =SA @ 300 ppm, T_7 =BA @ 100 ppm, T_8=BA @ 200 ppm, T_9 =BA @ 300 ppm and T_{10} =Control Means followed by same letter(s) in a column do not differ significantly at 5% level by DMRT.

that 100 ppm SA proved to be effective in increasing the water uptake resulting prolongation of vase life. These might be due to salicylic citric acid inhibits the microbial growth, reduce moisture stress in cut flowers by affecting stomatal closure, preventing transpiration and water loss (Alaey *et al.* 2011).

T_1 = GA_3 @100ppm, T_2= GA_3 @ 200ppm, T_3 = GA_3 @ 300ppm, T_4 =SA @ 100ppm, T_5 =SA @ 200ppm, T_6 =SA @ 300ppm, T_7 =BA @ 100ppm, T_8=BA @200 ppm, T_9 =BA @ 300ppm and T_{10} =Control

Means followed by same letter(s) in a column do not differ significantly at 5% level by DMRT.

The findings of the experiment are further supported by those of Anwar *et al.* (2014) in tuberose and Suneetha *et al*. (2017) in lilium. Similar results were also reported by Marandi *et al*. (2011) in gladiolus.

Conclusion

Flowering parameters of plants as well as vase life of flowers were influenced by the application of hormones, namely GA_3, SA and BA in gladiolus. SA @ 100 ppm was superior regarding all flowering parameters and reduced time to spike initiation by 10 days for early bloom. The same treatment also increased vase life of flowers by 4 days. Furthermore, SA @ 100 ppm concentration also exhibited the best results in % floret opening and water uptake of gladiolus. From the present study, it might be stated that preharvest application of SA @ 100 ppm was superior for obtaining the maximum number of flowers with longest stalk as well as biggest flower size and prolonged vase life in gladiolus.

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