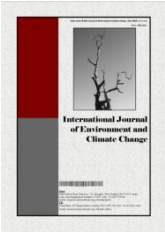

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Studies on the Effect of Preharvest Sprays of Gibberellic Acid and Benzyl Adenine on Postharvest Vase Life of Gypsophila (*Gypsophila paniculata L.*) CV. Star World

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Authors' contributions

This work was carried out in collaboration among all authors. All authors read and approved the final manuscript.

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ABSTRACT

The impact of gibberellic acid (GA_3) and benzyl adenine (BA) dose and application timing on vase life of gypsophila was examined. Freshly cut gypsophila flower stalks with pre harvest sprays of growth regulators *G_1- GA_3 at 150 ppm, G_2- GA_3 at 300 ppm, G_3- GA_3 at 450 ppm, G4- BA at 150 ppm, G_5- BA at 300 ppm, G_6- BA at 450 ppm, distilled water spray - G_7* and were applied twice at S_1- 30 and S_2-at 30 and 45 days after pruning are harvested from the experimental plot early in the morning when 30 to 40% of flowers in the stalk open and held in vases containing 3 % sucrose solution flower stalks are harvested from the experimental plot early in the morning when 30 to 40% of flowers in the stalk open and held in vases Water absorption, fresh weight change, water loss by transpiration, physiological weight loss, 50 % discolouration and vase life. Among all the treatments, the flowers sprayed with GA_3 at 450 ppm and single spray recorded maximum water

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uptake (13.19 g), transpirational loss of water (6.19), fresh weight change (62.51 %), dry weight of flowers (2.09), 50 per cent discolouration (13.41 days), Vase life (14 days) and minimum physiological loss in weight (1.78 g).

Keywords: Gypsophila; GA3-Gibberellic acid; BA- Benzyl adenine; vase life.

1. INTRODUCTION

Flowers have been considered as the symbol of purity, grace and elegance. Flowers are the most natural way to celebrate as they themselves are nature's perfect celebration In India flowers are cultivated in an area of approximately 313 lakh ha and production of 2865 MT [1]. In present scenario flower cultivation is taken as commercial venture due to enormous increase in demand of flowers. Nearly, 30 to 50 % losses of cut flowers occur due to improper post harvest handling during entire market chain [2]. There are frequent price gluts and fluctuations in the Indian flower market. Physiological, ultra structural and biochemical changes that occur during post harvest life influence the quality of cut flowers [3]. Gypsophila is an extremely hardy perennial plant and it can substitute many other cut flowers during off season and has enormous potential as a cut flower crop. Post harvest research in cut flowers is conducted world wide yet feasibility of appropriate post harvest handling is lacking. Hence vase life of cut flowers can be achieved by adapting improved production technology, harvesting at proper stage and by using different chemicals. These chemicals control bacteria and fungi in vase water, which may other wise cause rot of the stem however information on chemicals at effective concentrations are still lacking for cut flowers. Therefore, keeping in mind the above discussed factors, present investigation was planned.

2. MATERIALS AND METHODS

The experiment was conducted in an open ventilated polyhouse using a Factorial completely randomised block design (FCRD) with seven levels of treatments: G_1- GA_3 at 150 ppm, G_2- GA_3 at 300 ppm, G_3- GA_3 at 450 ppm, G_4- BA at 150 ppm, G_5- BA at 300 ppm, G_6- BA at 450 ppm, G_7- distilled water spray and two levels of application schedule S_1-30 days (Single spray), S_2- 30&45 days (Two sprays). During the experiment, the plants had reached the age of one year were completely trimmed to the ground level during the trial. Pruning was done after each flush of production to keep the plants from becoming too tall. One month after pruning, gibberellic acid and benzyl adenine solutions of 150 ppm, 300 ppm, and 450 ppm were prepared by dissolving 150 mg, 300 mg, and 450 mg in small volumes of distilled water, respectively and then filling the volume to 1000 ml with distilled water and applying the plant growth regulators solutions twice. The first and second sprayings were applied 30 and 45 days following pruning, respectively (DAP). During the experiment, all necessary cultural activities (such as irrigation, fertilisation, weeding, hoeing, pesticide application, and so on) were carried out. The 65th day following trimming, flower harvesting for yield and other observations began. Flower stalks were gathered at weekly intervals when 30 to 40% of the flowers on the stalks opened, and flower spikes were immediately placed in a bucket of water and transported to the laboratory for further study, and flower stalks were cut to a uniform length. Following recording the fresh weight, each flower stalk was placed in a 600 ml conical flask containing 250 ml of 3% sucrose solution.

2.1 Observations Recorded

2.1.1 Water uptake (WU) (g/flower)

The difference between consecutive measurements of container + solution (with out flower) recorded once in two days to measure the water uptake with in that particular duration of period and represented as gram per flower [4].

Initial wt. of container - Final wt. of container

$$= \frac{\text{with out flower} \qquad \text{without flower}}{\text{No.of flower stalks in the conical flask}}$$

2.1.2 Transpirational loss of water (TLW) (g f^{-1})

Flasks are weighed daily along with solution and spikes and the consecutive difference in the weights represents the water loss from the spikes for that particular period and expressed in grams per stalk [4].

Initial wt. of container - Final wt. of container

$$= \frac{\text{with flower} \qquad \text{with flower}}{\text{No.of flower stalks in the conical flask}}$$

2.1.3 Fresh weight change of stalk (FWC % of initial weight)

The difference between the weight of container + solution+ flower stalk and weight of the container + solution decreased at every alternate day represents the fresh weight of the stalks in grams on that particular day. The fresh weight gain or loss is converted into percentage considering the first days fresh weight as 100 per cent [4].

2.1.4 Physiological loss in weight (%)

The difference between in the consecutive fresh weights of cut flowers was calculated and expressed in percentage as physiological loss in weight.

$$= \frac{\text{Initial weight of container} - \text{weight after storage}}{\text{Initial weight}}$$

2.1.5 Dry weight of the flower (g f^{-1})

The flowers with stalk were selected for fresh weight was dried under shade condition after drying, weight of these dried flowers with peduncle was recorded and average weight of flower with stalk was worked out 50 % discolouration.

It was recorded when 50 % of the flowers in the stalk show discolouration when kept in Vase solution.

Vase life (days)

Flower stalks are discarded when 50% of the flowers show discolouration. This stage is considered to be the end of potential useful longevity of Gypsophila and the number of days taken from placing the flower stalks in vase solution to 50 % flower discolouration was considered as termination of vase life and expressed in days.

The data collected was subjected to statistical analysis as per the procedure obtained by Panse and Sukhatme [5].

3. RESULTS AND DISCUSSION

3.1 Up Take of Water (g f^{-1})

The interaction effects between pre harvest application of growth regulators and application schedule showed that the flowers collected from the plot treated with growth regulator GA_3 at 450 ppm + single spray (G_3S_1) recorded the highest water up take) on 2nd day (13.19 g), 4th day (12.23 g), 6th day (10.66 g), 8th day (8.77 g), 10th day (5.03 g), 12th day (4.79 g) while the lowest water uptake was recorded in (G_7S_1- Control). The reason for maximum water uptake in flower stalks under treatment with GA_3 may be due to negative osmotic potential in cell and increased water uptake by hydrolysis of starch and sucrose. Similar findings have been earlier reported by Singh *et al*. [6] in gladiolus, Sunitha *et al*. [7] in lilly.

3.2 Transpirational Loss of Water (g f^{-1})

The interaction effects between pre harvest application of growth regulators and application schedule on transpirational loss of water are presented in Table 1. It was observed that the flowers collected from the plot treated with growth regulator GA_3 at 450 ppm + single spray (G_3S_1) recorded the highest transpirational loss on 2nd day (7.69 g), 4th day (7.59 g), 6th day (7.26 g), 8th day (6.19 g), 10th day (2.93 g), 12th day (2.63 g) while the lowest transpirational loss of water was recorded in control (G_7S_1) with single spray of water on 2nd day (2.83 g), 4th day (2.32 g), 6th day (2.29 g) after which there is no transpirational loss of water observed. all other treatments recorded intermediate values.

3.3 Fresh Weight Change (%)

Fresh weight change (FWC) denotes the amount of weight loss of flowers during storage in vase solution and thus it has direct impact on the vase life of the flowers.

It was observed that the fresh weight change was recorded the highest in the flowers collected from treatment GA_3 450 ppm + single spray (G_3S_1) on 2nd day (62.51 %), 4th day (50.00 %), 6th day (42.63 %), 8th day (33.00 %), 10th day (22.00 %), 12th day (18.79 %) while the lowest fresh weight change was recorded in Control (G_7S_1) with single spray of water on 2nd day (16.08 %), 4th day (12.37 %), 6th day (10.18 %), from 8th day onwards no change in was able to maintain high water uptake when compared to water loss during the initial days of vase life, due to this it might have recorded maximum fresh weight change values during initial days of the vase life when compared to other treatments.

The change in fresh weight of flower is directly influenced by the difference between the rates of water uptake and transpirational loss of water, flower accumulates water and gains weight [9].

Table. 1. Effect of pre harvest application of GA3 and BA on water uptake and transpirational loss of water in gypsophila cv. Star world

Treatments	Water uptake (g/f)						Transpirational loss of water (g/f)					
	2nd day	4th day	6th day	8th day	10th day	12th day	2nd day	4th day	6th day	8th day	10th day	12th day
G_1S_1	5.19	4.60	4.31	3.56	2.70	2.22	2.89	2.65	2.58	2.60	1.37	0.97
G_1S_2	4.85	4.80	4.89	4.17	2.11	1.76	3.11	2.89	2.83	2.79	1.39	1.29
G_2S_1	5.27	4.81	4.67	4.32	2.09	1.58	2.89	2.65	2.53	2.56	1.43	1.26
G_2S_2	7.19	4.73	4.32	3.72	2.81	0.99	3.32	2.91	2.83	2.51	1.44	1.35
G_3S_1	13.19	12.23	10.66	8.77	5.03	4.79	7.69	7.59	7.26	6.19	2.93	2.63
G_3S_2	8.45	8.24	7.89	7.88	4.80	2.24	5.65	4.84	4.69	3.96	2.95	2.75
G_4S_1	7.83	7.32	7.18	6.41	4.07	2.04	4.03	4.14	3.82	3.70	2.65	2.58
G_4S_2	7.50	7.32	6.67	5.38	3.07	0.14	3.94	3.82	3.38	2.63	1.84	1.54
G_5S_1	6.97	6.21	5.87	4.91	3.34	1.05	4.97	4.69	4.59	3.84	2.68	2.48
G_5S_2	5.61	5.07	4.91	4.11	2.73	0.74	3.69	3.42	3.37	3.70	2.26	1.66
G_6S_1	4.61	3.87	3.72	2.74	2.31	1.27	3.58	2.92	2.47	3.69	2.27	1.59
G_6S_2	5.21	4.63	4.36	3.82	1.92	1.63	4.49	3.63	3.40	1.69	1.25	1.08
G_7S_1	4.43	3.34	3.28	-	-	-	2.83	2.32	2.29	-	-	-
G_7S_2	5.00	4.47	3.88	-	-	-	3.14	2.79	2.62	-	-	-
S.E m±	0.06	0.20	0.17	0.11	0.07	0.05	0.11	0.12	0.09	0.10	0.04	0.05
C.D	0.18	0.62	0.54	0.34	0.21	0.15	0.35	0.38	0.28	0.33	0.14	0.16

Table 2. Effect of pre harvest application of GA3 and BA on fresh weight and physiological loss in weight in gypsophila cv. Star world

Treatments	Fresh weight change (%)						Physiological loss in weight (g/f)					
	2nd day	4th day	6th day	8th day	10th day	12th day	2nd day	4th day	6th day	8th day	10th day	12th day
G_1S_1	23.76	21.22	18.14	13.95	12.83	10.66	2.03	3.34	3.88	4.11	4.54	5.14
G_1S_2	21.51	18.00	15.93	14.47	13.28	11.18	2.22	3.04	3.64	3.90	4.65	5.41
G_2S_1	26.87	21.51	19.76	17.00	16.23	15.97	2.65	3.28	3.78	4.47	4.84	5.00
G_2S_2	20.44	16.90	14.97	14.09	12.90	11.85	2.42	3.37	3.65	3.88	4.78	5.63
G_3S_1	62.51	50.00	42.63	33.00	22.00	18.79	1.78	2.93	3.19	3.31	4.14	4.66
G_3S_2	55.26	38.50	31.50	27.43	18.67	17.60	2.12	2.57	3.09	382	4.21	4.99
G_4S_1	45.37	34.51	26.18	20.26	14.51	13.58	4.01	4.77	4.78	5.94	7.07	7.89
G_4S_2	37.50	31.76	27.26	24.26	17.56	15.82	3.21	5.73	5.99	5.10	5.56	5.91
G_5S_1	27.86	25.35	20.03	17.65	12.50	10.76	2.51	3.44	4.19	4.10	4.45	5.18
G_5S_2	22.00	20.67	17.50	13.70	8.12	7.08	2.85	3.31	3.88	4.60	5.05	5.55
G_6S_1	22.87	18.66	15.26	10.13	8.73	7.88	2.88	4.74	4.96	5.47	5.63	6.06
G_6S_2	22.00	20.00	16.63	13.22	9.98	7.26	3.61	3.86	5.35	5.82	6.37	6.69
G_7S_1	16.08	12.37	10.18	-	-	-	3.66	4.92	6.43	-	-	-
G_7S_2	19.90	16.90	14.16	-	-	-	4.23	7.37	8.07	-	-	-
S.E m±	1.01	0.81	0.54	1.51	1.31	0.36	0.05	0.07	0.05	0.11	0.07	0.11
C.D	3.11	2.48	0.76	4.62	4.03	1.10	0.16	0.22	0.17	0.35	0.23	0.37

Table 3. Effect of pre harvest application of GA3 and BA on dry weight (g), 50 percent discolouration and vase life in gypsophila cv. Star world

Treatments	Dry weight (g/f)	50 percent discolouration (days)	Vase life (days)
G_1S_1	1.15	11.00	11.51
G_1S_2	1.39	10.51	12.51
G_2S_1	1.93	10.76	11.00
G_2S_2	1.51	11.56	12.00
G_3S_1	2.09	13.41	14.00
G_3S_2	1.82	12.00	12.27
G_4S_1	2.03	12.56	13.00
G_4S_2	1.03	9.26	10.24
G_5S_1	1.59	12.51	13.00
G_5S_2	1.09	10.00	11.51
G_6S_1	1.84	10.00	10.06
G_6S_2	1.56	11.51	11.51
G_7S_1	0.94	5.01	6.00
G_7S_2	0.83	5.91	7.26
S.E m±	0.03	0.34	0.23
C.D	0.11	1.06	0.70

GA_3 450 ppm + single spray (G_3S_1) was able to maintain high water uptake when compared to water loss during the initial days of vase life, due to this it might have recorded maximum fresh weight change values during initial days of the vase life when compared to other treatments.

3.4 Physiological Loss in Weight (%)

Physiological loss in weight (PLW) denotes the amount of moisture loss from the flowers during storage in vase solution and thus it has direct impact on the vase life of the flowers.

During the interaction there is significant effect of pre harvest application of growth regulators and application schedule on physiological loss in weight. Among the interactions minimum percentage of physiological loss in weight was recorded in the flowers collected from the plot treated with GA_3 450 ppm + single spray (G_3S_1) on 2nd day (1.78 %), 4th day (2.93 %), 6th day (3.19 %), 8th day (3.31 %), while the highest percentage of physiological loss in weight was recorded with control (G_7S_2) on 2nd day (4.23 %), 4th day (7.37 %), 6th day (8.07 %) and after which no physiological loss in weight was observed.

3.5 Dry Weight (g f^{-1})

Interaction between growth regulators and application schedule was significant. The maximum dry weight of flowers (2.09 g) was reported in the flowers collected from the plot treated with GA_3 at 450 ppm + single spray (G_3S_1) followed by BA at 150 ppm + single spray (G_4S_1-2.03 g) while minimum dry weight was recorded in control (G_7S_1-0.84 g) with single spray of water. The increase in dry weight of flowers may be attributed to the increase in fresh weight and also due to more accumulation of carbon compounds from sucrose. Similar findings have been reported by Aparna et al. [8] in chrysanthemum, Mohammad [10] in china aster, Muhammad et al. [11] in chrysanthemum, Pragnya et al. [12] in china aster.

3.6 50 % Flower Discolouration (days)

The maximum number of days for 50 percent discolouration (13.41 days) was reported in the flowers treated with GA_3 at 450 ppm + single spray (G_3S_1) followed by BA at 150 ppm + single spray (G_4S_1-12.56 days) while early discolouration was seen in control (G_7S_1- 5.01 days).

3.7 Vase Life (days)

Maximum days of vase life of 14 days was recorded in the flowers treated with GA_3 450 ppm + single spray (G_3S_1) followed by BA 150 ppm + single spray (G_4S_1-13.00 days) while the lowest vase life was recorded in control (G_7S_1- 6 days) this is due to GA_3 has beneficial effects on flower longevity by enhancing vase solution

uptake, keeping membrane stability and increasing the antioxidant enzymes activity [13] and also vase life extension by GA_3 could be attributed to hindering the protein degradation by promoting protein synthesis and hampering protease activity [14].

4. CONCLUSION

The flower stalks of gypsophila with a pre-harvest spray of GA_3 at 450 ppm and a single spray recorded the maximum transpirational loss of water, water uptake, minimum physiological loss in weight, fresh weight change, days for 50% discoloration, dry weight, and a vase life of 14 days, according to the results of the experiment.

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CONFLICT OF INTEREST

The authors declare that no conflict of interest exists in the course of conducting research. All the authors had final decision regarding manuscript and the decision to submit findings for the publication.

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