The Andhra Agric. J 62(2): 420-425, 2015

Effect of Different Combinations of Preservative Solutions on Water Relations During the Vase Life of Cut Gerbera (*Gerbera jamesonii* Bolus ex. Hook.)

M R Bhanusree and N Hariprasad Rao
Department of Horticulture, College of Horticulture, Venkataramannagudem, West Godavari District, Andhra Pradesh

ABSTRACT

An experiment was carried out to study the effect of different combinations of chemicals, on post harvest life of gerbera. The flowers held in 8-HQS 200 ppm + $AgNO_3$ 20 ppm + sucrose 5 % vase solution recorded highest values in water uptake (9.86 g/f), transpirational loss of water (9.95 g/f) and fresh weight change (% of initial weight) (91.66) whereas the flowers held in distilled water (control) were observed with lowest values in water uptake (5.86 g/f), transpirational loss of water (6.78 g/f) and fresh weight (82.88). The water balance in cut gerbera treated with $AgNO_3$ 20 ppm + sucrose 5 % in vase solution was maximum (4.18g/f) and it was minimum (2.90 g/f) in flowers held in distilled water (control). With better water relations and maximum fresh weight, the treatment 8-HQS 200 ppm + $AgNO_3$ 20 ppm + sucrose 5 % recorded longest vase life of cut gerbera (12.22 days). The flowers held in distilled water (control) recorded the lowest vase life (4.78 days).

Key words : Fresh weight change, Transpirational loss of water, Water balance, Water uptakeVase life.

Gerbera (*Gerbera jamesonii* Bolus ex. Hook) is one of the most popular cut flower and commercially important in floriculture trade on account of wide range of flower colours, shapes and sizes. The vase life of cut flowers denotes the total duration from the cut to the wilting of flowers and depends on its water relations (Halevy and Mayak, 1981; Van Doorn, 1997). The major limiting factor in the vase life of many cut flowers is water stress which creates disturbances in the water relations of the cut flowers thereby causes changes in anatomy, physiology and biochemistry of the flower leading to senescence (Wakada *et al*., 1984). The rate of absorption and transpiration of water decides the life span and freshness of cut flowers. The post harvest life of cut gerbera could be enhanced by the use of chemical preservatives in the vase solution. An effective flower food, *i.e.,* a preservative solution contains two basic components *viz.,* a sugar to provide energy to the cut flower, a biocide to kill the bacteria and other organisms and to increase water and nutrient uptake by the flower resulting in improved vase life. Hence the present work was conducted with a view to study the effect of floral preservatives on water relations and vase life of cut gerbera.

MATERIAL AND METHODS

The cut gerbera flowers were obtained from naturally ventilated polyhouse with all recommended fertigation and pest management practices. Flowers were harvested from one year old mother plant at commercial stage (ray florets 3/4 opened) in the morning hours between 6.30 and 7.30 am by pulling with a scape of 50-60 cm from the crowns. Immediately after harvest 5 cm basal woody portion was cut under deionised water and brought to the laboratory. The cut flowers were pre cooled at 4± 2p c for four hours and sorted to uniform length and quality of capitulum, in order to maintain uniformity with in replications. Flower scapes were trimmed under water to 40 cm length as suggested.

The experiment was designed in completely randomized design with factorial concept and each treatment was replicated thrice with five flowers per replication. The treatments studied in the experiment were seven *viz.,* T_{1-} $AgNO_3$ 20 + sucrose 5%, T_{2-} KCl 200 + sucrose 5%, T_{3-} 8-HQS 200 + sucrose 5%, T_{4-} 8- HQS 300 + sucrose 5%, T_{5-} 8- HQS 200 + $AgNO_3$ 20 , T_{6-} 8- HQS 200 + $AgNO_3$ 20 + sucrose 5% and T_{7-} Control (Distilled water). The experiment was carried out at ambient

Table1. Effect of post harvest application of preservative solutions combination on water uptake (g/f) during vase life period of cut gerbera.

Treatment	Days					
	2	4	6	8	10	Mean
$AgNO_3$ 20 + sucrose 5%	12.16	11.40	8.46	6.23	4.23	8.50[c]
KCl 200 + sucrose 5%	10.83	8.90	6.95	5.17	2.55	6.88[f]
8- HQS 200 + sucrose 5%	12.52	11.76	9.11	7.39	4.32	9.02[b]
8- HQS 300 + sucrose 5%	11.33	9.16	7.83	5.72	3.96	7.60[e]
HQS 200 + $AgNO_3$ 20	11.87	9.47	8.39	6.63	4.03	8.08[d]
HQS 200+ $AgNO_3$ 20 + sucrose 5%	13.22	12.57	10.80	8.17	4.53	9.86[a]
Control (DW)	8.25	7.40	5.90	4.58	2.27	5.68[g]
Mean	11.46[a]	10.10[b]	8.21[c]	6.27[d]	3.70[e]	

	F-test	SEm±	CD 5%
Days (D)	**	0.01	0.04
Treatment (T)	**	0.02	0.05
D×T	**	0.04	0.11

** Significant at ($P \leq 0.01$) * Significant at ($P \leq 0.05$) NS: Not Significant
Figures bearing same letters did not differ significantly.

Table 2. Effect of post harvest application of preservative solutions combination on transpirtional loss of water (g/f) during vase life period of cut gerbera.

Treatment	Days					
	2	4	6	8	10	Mean
$AgNO_3$ 20 + sucrose 5 %	10.61	9.87	9.06	6.64	5.42	8.32[c]
KCl 200 + sucrose 5%	10.24	8.96	8.27	6.39	3.01	7.38[e]
8- HQS 200 + sucrose 5%	11.55	11.31	9.58	9.84[a]	4.92	9.44[b]
8- HQS 300 + sucrose 5%	10.67	9.04	9.25	6.70	4.79	8.09[d]
HQS 200 + $AgNO_3$ 20	10.81	8.93	9.13	7.78	4.64	8.26[c]
HQS 200+ $AgNO_3$ 20 + sucrose 5%	12.30[a]	12.02[a]	10.98[a]	8.70	5.76[a]	9.95[a]
Control (DW)	7.51	8.13	7.97	6.50	3.81	6.78[f]
Mean	10.53[a]	9.75[b]	9.18[c]	7.51[d]	4.62[e]	

	F-test	SEm±	CD 5%
Days (D)	**	0.02	0.05
Treatment (T)	**	0.02	0.06
D×T	**	0.05	0.14

** Significant at ($P \leq 0.01$) * Significant at ($P \leq 0.05$) NS: Not Significant

Table 3. Effect of post harvest application of preservative solutions combination on water balance (g/f) during vase life period of cut gerbera.

Treatment	Days					
	2	4	6	8	10	Mean
$AgNO_3$ 20 + sucrose 5 %	5.55 (1.55)	5.54 (1.54)	3.40 (-0.60)	3.59 (-0.41)	2.81 (-1.19)	4.18[a] (0.18)
KCl 200 + sucrose 5%	4.59 (0.59)	3.94 (-0.06)	2.67 (-1.33)	2.78 (-1.22)	3.54 (-0.46)	3.50[e] (-0.50)
8- HQS 200 + sucrose 5%	4.97 (0.97)	4.45 (0.45)	3.53 (-0.47)	1.55 (-2.45)	3.40 (-0.60)	3.58[d] (-0.42)
8- HQS 300 + sucrose 5%	4.66 (0.66)	4.13 (0.13)	2.58 (-1.42)	3.01 (-0.99)	3.17 (-0.83)	3.51[e] (-0.49)
HQS 200 + $AgNO_3$ 20	5.06 (1.06)	4.55 (0.55)	3.26 (-0.74)	2.85 (-1.15)	3.39 (-0.61)	3.82[c] (-0.18)
HQS 200+ $AgNO_3$ 20 + sucrose 5%	4.93 (0.93)	4.55 (0.55)	3.82 (-0.20)	3.47 (-0.53)	2.77 (-1.23)	3.91[b] (0.09)
Control (DW)	4.74 (0.74)	3.28 (-0.72)	1.93 (-2.07)	2.08 (1.92)	2.47 (1.53)	2.90[f] (-1.10)
Mean	4.93[a] (0.93)	4.35[b] (0.35)	3.03[c] (-0.93)	2.76[d] (-1.24)	3.08[c] (-0.92)	

	F-test	SEm±	CD 5%
Days (D)	**	0.02	0.05
Treatment (T)	**	0.02	0.06
D×T	**	0.04	0.14

** Significant at ($P \leq 0.01$) * Significant at ($P \leq 0.05$) NS: Not Significant

room temperature of 22 ± 2p c, 60 to 75 per cent relative humidity, under 12 hours photoperiod with flowers continuously held in the test solution till the end of vase life. After recording fresh weight, Individual flowers were placed in the 500 ml glass bottles containing test solution of different treatments. The physiological parameters such as water uptake (g/f), transpirational loss of water, water balance (g/f), fresh weight (% of initial weight) were calculated by the procedure given by Venkatarayappa *et al*. (1980). Data were subjected to statistical analysis as per the procedure outlined by Panse and Sukhatme (1967).

RESULT AND DISCUSSION

Cut gerbera held in different combinations of holding solutions differed significantly on water uptake, transpirational loss of water, water balance and fresh weight during vase life period as seen from the data presented in table 1, 2, 3 and 4. Highest water uptake was recorded with HQS 200 ppm + $AgNO_3$ 20 ppm + sucrose 5% (9.86 g/f) followed by HQS 200 ppm + sucrose 5% (9.02g/f) and $AgNO_3$ 20 + sucrose 5% (8.50 g/f) with significant difference (Table 1). Lowest water uptake was however, observed with control (5.68 g/f) during . Water uptake was noticed to decrease significantly

Table 4. Effect of post harvest application of preservative solutions combination on fresh weight change (% of initial wt) during vase life period of cut gerbera.

Treatment	Days					
	2	4	6	8	10	Mean
$AgNO_3$ 20 + sucrose 5 %	107.28	102.08	80.50	71.62	61.78	84.65[c]
KCl 200 + sucrose 5%	104.01	95.00	81.42	69.69	63.66	82.96[c]
8- HQS 200 + sucrose 5%	108.51	102.55	79.51	70.75	66.48	85.56[b]
8- HQS 300 + sucrose 5%	104.63	99.36	85.10	68.97	60.93	83.80[c]
HQS 200 + $AgNO_3$ 20	107.57	98.99	85.93	77.37	65.37	87.05[b]
HQS 200+ $AgNO_3$ 20 + sucrose 5%	108.44	103.47	90.24	80.72	75.18	91.66[a]
Control (DW)	106.57	91.41	78.63	71.49	66.87	82.88[c]
Mean	106.72[a]	99.02[b]	83.05[c]	72.95[d]	65.35[e]	

	F-test	SEm±	CD 5%
Days (D)	**	0.57	1.62
Treatment (T)	**	0.68	1.92
D×T	**	1.52	4.28

** Significant at ($P \leq 0.01$) * Significant at ($P \leq 0.05$) NS: Not Significant
Figures bearing same letters did not differ significantly.

Table 4.7. Effect of post harvest application of preservative solutions combination on vase life period (Days) of cut gerbera.

Treatments	vase life (days)
$AgNO_3$ 20 + sucrose 5 %	8.81[c]
KCl 200 + sucrose 5%	7.98[c]
8- HQS 200 + sucrose 5%	9.98[c]
8- HQS 300 + sucrose 5%	8.69[c]
HQS 200 + $AgNO_3$ 20	8.35[c]
HQS 200+ $AgNO_3$ 20 + sucrose 5%	12.22[a]
Control (DW)	4.78[d]
Mean	8.69
SEm±	0.33
CD 5%	1.02
F. test	**

** Significant at ($P \leq 0.01$) * Significant at ($P \leq 0.05$) NS: Not Significant
Figures bearing same letters did not differ significantly.

from 11.46 g/f (day 2) to 3.70 g/f (day 10). The treatment, HQS 200 ppm + $AgNO_3$ 20 ppm + sucrose 5% recorded significantly highest water uptake during entire vase life period *i.e.,* on day 2, 4, 6, 8 and 10 (13.22, 12.57, 10.80, 8.17 and 4.53 g/f ,respectively) followed by HQS 200 ppm + sucrose 5% from day 2 to day 10 with significant difference. Increased water uptake in these treatments could be due to synergistic effect of chemical compounds *viz.*, HQS and $AgNO_3$ which might have caused suppression of microbial growth in vase solution resulting in more water uptake. Similar results were observed by Kesta *et al*. (1980) in orchids and Nagaraja *et al*. (2001) in cut gerbera.

It is vivid from the data in table 2 that cut flowers of gerbera treated with 8-HQS 200 + $AgNO_3$ 20 + sucrose 5% recorded highest transpirational loss of water (9.95 g/f) whereas the flowers treated with distilled water (control) were observed with lowest transpirational loss of water (6.78 g/f). Transpirational loss of water was observed to increase from day 2 (10.53 g/f) to day 10 (4.62 g/f) with significant difference at each successive interval of observation. These results are in line with the findings of Krishnappa and Reddy (2004) in cut carnation who observed that normal rate of transpiration was essential for extending the vase life of cut flowers and any process that hinders normal transpiration would decrease the vase life of cut flowers.

Data presented in the table 3 revealed that cut gerberas held in vase solution containing $AgNO_3$ 20 + sucrose 5% recorded highest water balance (4.18 g/f) which was significantly superior over other treatments. However, the flowers held in distilled water (control) were observed with lowest water balance (2.90 g/f) compared to other treatments. The water balance significantly decreased from day 2 (4.93 g/f) to day 8 (2.76 g/f) and then significantly increased at day 10 (3.08 g/f) with non significant difference between day 6 and day 10. Similar findings were also reported by Kim and Lee (2004) in cut roses.

Among the treatments with different combinations of preservative solutions (Table 4), 8-HQS 200 + $AgNO_3$ 20 + sucrose 5% recorded highest fresh weight of cut flowers (91.66) while the lowest fresh weight was recorded with control (82.88) which was on par with KCl 200+ sucrose 5% (82.96), HQS 300+ sucrose 5% (83.80) and $AgNO_3$ 20 + sucrose 5% (84.65). Fresh weight was significantly decreased from day 2 (106.72) to day 10 (63.65) at each successive interval of observation.

Data on vase life in table-5 revealed that cut gerberas treated with 8-HQS 200 + $AgNO_3$ 20 + sucrose 5% recorded longest vase life (12.22 days) while shortest vase life (4.78 days) was observed with flowers treated with distilled water (control). This could be attributed to improved water relations as a result of antimicrobial (Van Meetern, 1978; Halevy and Mayak *et al*., 1979) any ethylene antagonist property of $AgNO_3$ (Bayer, 1976) and anti microbial property of 8-HQS (Albert *et al*., 1953). Another possible reason for improved vase life could be due to sucrose in vase solution which inhibits ethylene production in cut flowers (Dilley and Carpenter., 1975) and improve water balance by regulation of stomatal activity (Marousky, 1969). Abdal Khader and Rogers (1986) in cut gerbera and Krishnappa and Reddy (2004) in cut carnations also reported similar results. Based on the result of the study, it can be concluded that vase life of cut flowers of gerbera could be extended with 8-HQS 200 + $AgNO_3$ 20 + Sucrose 5% in vase solution.

LITERATURE CITED

Abdal Kader H and Rogers M N 1986 Post harvest treatment of *Gerbera jamesonii*. *Acta Horticulturae*, 181: 169-176.

Albert A, Gibson M and Rubbo S D 1953 The influence of chemical constitution on anti bacterial activity. The bacterial action of 8-hydroxy quinoline (oxine). *British Journal of Experimental Pathology*, 34: 119-130.

Beyer Jr E 1976 Senescence and post harvest physiology of cut flowers- part I, p. 204-236. In: J Janick (ed.) Horticultural Reviews. Vol.I, A VI Publishing, Westport, Conn.

Dilley D R and Carpenter W I 1975 The role of chemical adjuvents and ethylene synthesis on cut flower longevity. *Acta Horticulturae*, 41: 117-132.

Halevy A H and Mayak S 1981 Senescence and post harvest physiology of cut flowers-part II. Horticultural Reviews 3: 59-143.

Kesta S, Raksritong T and Suanpairote S 1980 The holding solutions for cut orchid flowers (Abstr.). In: International symposium on Horticultural Crops Production, 25-26 August, 1992. Kasetsart University, Bankok, pp: 18.

Kim Y A and Lee J S 2004 Changes in lignin content, phenylalanine ammonia lyase activity, and peroxidase activity as affected by bent neck and senescence of cut rose flowers. *Journal of the Korean Society for Horticultural Science*, 43(2) : 208-212.

Krishnappa K S and Reddy N S 2004 Effect of cultivars, fertigation levels and floral preservatives in extending vase life of carnation cut flowers. *Mysore Journal of Agricultural Sciences*, 38 (3): 314-318.

Marousky F J 1969 Vasicular blockage and moisture retention in cut roses indused by pH, 8- hydroxyl quinoline citrate and sucrose. *Journal of American Society of Horticultural Sciences*, 94: 223-226.

Nagaraja G S, Gopinath K and Sangamma 2001 Effect stage of harvest on vase life of gerbera (*Gerbera jamesonii* Hook.) *Mysore Journal of Agricultural Sciences*, 35: 20-25.

Panse and Sukhatme P V 1967 Statistical methods for Agricultural workers. Indian Journal of Agrucultural Research, New Delhi.

Van Doorn W G 1997 Water relations of cut flowers. In Horticultural Reviews 18 (ed J Janick). John wiley and Sons Incorporation, New York, USA.

Van Meeteren U 1978 Water relations and keeping quality of cut gerbera flowers. I. The cause of stem break. Scientia Horticulture 8: 65-76.

Venkatarayappa T, Tsiuta M J and Murr D P 1980 Influence of cobaltus ion (co_2^+) on the post harvest behaviour of 'Samantha' roses. Journal of American Society for Horticultural Sciences. 105: 148-151.

Wakada A E, Herner R C, Kader A A, Ramani R J and Stayby G L 1984 terminology for the description of developmental stages of horticultural crops. Hort Science 19: 20-21.

(Received on 03.09.2013 and revised on 22.11.2013)