Effect of Postharvest Treatments on Vase Life of Gerbera

(*Gerbera Jamesonii*)

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Abstract

In floriculture industry, it is mandatory to maintain the standards of making bouquets and floral arrangements with modern technologies to improve the vase life. Aqua pack could be an innovative idea for increasing the vase life of hand-tied bouquets and floral arrangements to provide holding solution at the cut end. Standardizing effective holding solution for aqua pack is the present-day need in floral industry. Hence, the present lab investigation was carried out in the Department of Horticulture, Annamalai University, India, during 2017-2018 in a Completely Randomized Design with three replications. The 19 treatments comprising $AgNo_3$ @ 25 and 50 ppm, Benzyl Adenine @150 and 200 ppm and 8- HQS @ 200 and 300 ppm as individual treatments and in different combinations along with control were tested on gerbera flower stalks of Cv. Dana Ellen in aqua pack containing 200 ml of different holding solutions for each treatment. The flowers were kept in ambient condition for assessment of post harvest parameters, quality and vase life. The result of the experiment revealed that aqua pack with $AgNo_3$@25ppm + 8 HQS@300ppm (T_{10}) as holding solution showed greatest influences over important quality characters and vase life when compared to other treatments. There was a drastic enhancement in the vase life up to 11.95 days in the best treatment (T_{10}). The cost economics also revealed that T_{10} was observed as most cost effective (Total Cost: Vase life Ratio @ 3.72) holding solution to maintain quality and obtain double the vase life in aqua pack.

Keywords: Aqua Pack, Benzyl Adenine, Ag No_3, 8-HQS, Gerbera, Quality characters, Bouquets, Floral arrangements, Vase life etc.,

I. Introduction:

Gerbera (*Gerbera jamesonii)* is an important cut flower grown throughout the world in a wide range of climatic conditions. It belongs to compositae family. It has numerous varieties with commercial importance in the floriculture industry. The wide range of colours and attractive shape of flowers suits very well in cut flower trade across the globe. It has occupied 5th position in the world cut flower trade after rose, carnation, chrysanthemum and tulip. In recent years, gerbera is gaining commercial importance in high profile events as it is widely used for floral arrangements and flower bouquets (Emongor, 2004). The cut flower trade has increased many folds in international and domestic markets. The beauty of the flower lies with the freshness of the flowers for longer time without losing its aesthetic value. All along the marketing channel, there is enormous loss in the value of cut flowers which could be 50 per cent of the farm value (Soad *et al.,* 2011). Vase life is an important parameter for evaluation of cut flower marketability and keeping quality of flowers are affected by internal as well as external factors. The internal factors which are responsible for the keeping quality of cut blooms depend on rate of water absorption and transpiration. Respiration is another internal factor affects life of cut flowers. Some environmental factors such as temperature, relative humidity and wind velocity also affect cut flowers life (Meman and Dabhi, 2006). On other hand, the cut flowers are deprived of their natural resources of water and nutrients after being detached from the mother plant, life process are at the expense of reserved food materials (Nair *et al.,* 2000). Hence, addition of chemical preservatives as supplements to the holding solution is recommended to prolong the vase-life of cut flowers in floral arrangements and bouquets, which is very essential parameter of florist industry. All holding solutions contain two components *viz.*, sugar and germicides. As sugar provides a

respiratory substrate, while the germicides control harmful bacteria and prevent plugging of the conducting tissue (Nair *et al.,* 2003). In the same aspect, Acharyya *et al.*(2013) revealed that treatment combination Ag NO_3 (100 ppm) + Sucrose 4% + Distilled water as holding solution was envisaged as the second best in extending the vase life of gerbera cut flowers viz., Sun Way, Dana Ellen and Rosalin. On other hand, a gift-wrapped (aqua pack) hand-tied design / floral arrangements are often with a holding solution below the binding point, covering the stalks could be an innovative idea, it is intended as a substitute for a vase to extend the freshness of flower (Lynda Owen, 2014). Nowadays, professionals in floristry industry is very keen to improve the standards with respect to making of bouquets and floral arrangements, all their insight into traditional and modern methods to improve the quality and vase life of cut flowers to extended days. In line with above facts, the present investigation entitled "Effect of aquapack with holding solutions on quality and vase life of gerbera" was carried out to find desirable treatment for extending vase life under ambient room temperature.

II. Materials and Methods:

2.1 Raw materials: Gerbera (*Gerbera Jamesonii)* Cv. Dana Ellen and aqua pack were collected from M/S, Gayathiri Farm, Hosur, Tamil Nadu, India.

2.2 Description of materials: The gerbera flowers are large in size, attractive yellow colour & capitulum is around 8-12 cm diameter as well as 50-75 cm long thick stalk and aqua pack is made from eco-friendly polyethylene (transparent) sheet with 50-100-micron thickness.

2.3 Pre-treatment: The flowers were harvested at perfect maturity stage and carefully brought to the laboratory without causing any damage and they were kept in sucrose (5%) for 2 hours as a standard pulsing treatment before the experiment.

2.4 Laboratory condition and holding solutions: The experiment was conducted in the Postharvest Laboratory, Department of Horticulture, Faculty of Agriculture, Annamalai University, India, during 2017-2018. It has 80-85 per cent average relative humidity in ambient room temperature under fluorescent lights (40 W) to maintain 12 hours of photoperiod. The holding solution comprising $AgNo_3$ @ 25 and 50 ppm, Benzyl Adenine @150 and 200 ppm and 8- HQS @ 200 and 300 ppm as individual treatments and in different combinations in this experiment.

2.5 Experimental design: This experiment was laid out in Completely Randomised Design (CRD) with three replications. Each treatment unit consisted of fifteen (15) flowers and with five (5) flowers representing a replication (Plate 1).

2.6 Experimental treatments:

T_1 - $AgNo_3$ @ 25ppm	T_{10} - $AgNo_3$ @ 25 ppm + 8-HQS @ 300 ppm
T_2 - $AgNo_3$ @ 50 ppm	T_{11} - $AgNo_3$ @ 50 ppm + BA@150 ppm
T_3 - BA @ 150 ppm	T_{12} - $AgNo_3$ @ 50 ppm + BA @ 200 ppm
T_4 - BA @ 200 ppm	T_{13} - $AgNo_3$ @ 50 ppm + 8-HQS @ 200 ppm
T_5 - 8-HQS @ 200 ppm	T_{14} - $AgNo_3$ @ 50 ppm + 8-HQS @ 300 ppm
T_6 - 8-HQS @ 300 ppm	T_{15} - BA @150 ppm + 8-HQS @ 200 ppm
T_7 - $AgNo_3$ @ 25 ppm + BA @150 ppm	T_{16} - BA @ 150 ppm + 8-HQS @ 300 ppm
T_8 - $AgNo_3$ @ 25 ppm + BA @ 200 ppm	T_{17} - BA @ 200 ppm + 8-HQS @ 200 ppm
T_9 - $AgNo_3$ @ 25 ppm + 8-HQS @ 200 ppm	T_{18} - BA @ 200 ppm + 8-HQS @ 300 ppm
T_{19} - Control (Distilled water)	

2.7 Observations recorded: Flowers were kept for observation at quality and postharvest parameters *viz.*, cumulative uptake of water (g^{-1}flower), cumulative transpiration loss of water (g^{-1}flower), physiological loss in weight, fresh weight of flower and PH of vase solution from 1st day to till the end of the vase life. The stem strength in gerbera was determined by angle between the main stem and stem just below the captiulum and they are classified based on four degrees of bending. The scape curvature was measured using a protractor and expressed in degrees (Ceikel and Reid, 2002), diameter of flower in cm, flower discolouration / fading days was assessed according to the procedure described by Macnish *et al*. (1999) with rating scale of 1= none, 2 = slight fading and 3 = advanced fading and expressed in days. The vase life values were expressed in days and profitability of cost economics was calculated.

2.8 Statistical analysis: The data were subjected to statistical analysis as per the procedure outlined by Panse and Sukhatme (1978) and the results were tested at 5% level of significance.

III. Result & Discussion:

3.1 Effect of aqua pack with holding solution on CUW, CTLW, CPLW and P^H of Vase solution in gerbera: The results recorded on cumulative uptake of water, cumulative transpirational loss of water, cumulative physiological loss in weight and PH of vase solution are presented in Table 1. In this experiment, with respect to water relations characters, lower stalks held in holding solution containing T_{10} ($AgNo_3$ @ 25 ppm +8 HQS @ 300ppm) recorded the maximum cumulative uptake of water (35.68 g^{-1} flower), registered minimum transpiration loss of water (30.22 g^{-1} flower) and cumulative physiological loss in weight (18.65 %) with a P^H of 0.84. Enhancement in water uptake by flower might to be due to the fact that silver nitrate present in holding solution acted as a biocide inhibiting microbial population that might have resulted in blockage of the vascular tissues. A similar result was observed by Acharyya *et al*. (2013). Some of the studies revealed that 8-HQS alone or its combinations could increase holding solution uptake in cut flowers by preventing the growth of microorganisms in xylem and maintained water uptake of flower stems by Banaee *et al*. (2013). The ideal combination of holding solution might have contributed to reduced rate of respiration in flower petals resulting in lower cumulative transpiration loss of water. Similarly, Liao *et al*. (2003) reported that water loss through transpiration was maintained at a stable level in the initial days and finally increase in water loss occurred before wilting in cut gerbera. Further, whenever the amount of transpiration exceeds absorption, a water deficit and wilting will develop. This deficit will be reflected in corresponding reduction in water potential of plant tissues.

3.2 Effect of aqua pack with holding solution on fresh weight, stem strength and diameter of flower in gerbera: The results recorded on fresh weight of flower, stem strength and diameter of flower are presented in Table 2. All the treatments were found to be superior over control. The treatment, T_{10} ($AgNo_3$ @ 25 ppm +8 HQS @ 300ppm) retained the maximum fresh weight (131.30 g^{-1} flower), highest resistance on stem strength (50.60^o) and maximum flower diameter at 11th day after experiment. All these characters on different treatments showed a gradual reduction in the values at end of vase life. The aqua pack with holding solution (T_{10}- $AgNo_3$ @ 25 ppm +8 HQS @ 300ppm) maintained fresh weight due to reduction in respiration transpiration rate and to check deterioration of cell ultra structure as resulted out by Das *et al.,* (2008). In this context, curvature was related to water potential of ray petals, increase in scape curvature depending on concentration of bacteria in water which blocks the xylem conducts leads to high resistance in stem strength and maintains flower diameter. This finding is in consonance with Soad *et al., (*2011) in gerbera.

3.3 Effect of aqua pack with holding solution on flower discolouration, vase life, total cost of the treatment and vase life cost per day (ratio) in gerbera: The results recorded on flower discolouration, vase life, total cost of the treatment and vase life cost per day (ratio) are presented in Table 3. Among the treatments, gerbera flower stalks held in $AgNo_3$@ 25 ppm + 8-HQS @ 300 ppm resulted in obtaining longer vase life (11.95 days) whereas shorter vase life of flowers (5.97 days) was obtained by control (distilled water). The prolongation of vase life depended on maintenance of fresh weight, good water balance ratio, improved water uptake and low transpiration loss by Javad *et al*, (2011). The ethylene action inhibiting property of 8-HQS and Silver nitrate as a source of energy might have helped to get longer vase life of the cultivar of gerbera. These results are in conformation with Amith *et al.* (2015) and Jafarpour *et al.* (2015). Overall, it was observed that aqua pack was very effective, might played an important role to maintain quality and enhance the vase life of gerbera Cv, Dana Ellen with irrespective of the treatment except control. During the course of experiment, it was found that growth of microbes in holding solution was inhibited due to presence of biocides. It has clearly indicated that significant influence over water relation characters and other postharvest qualities to vase life enhancement. These findings are in consonance with Lynda Owen (2014) in gerbera as well as many cut flowers.

IV. Conclusion:

Analysing cost economics is most important to select a treatment for commercial adoption. Hence, the treatments were subjected to economic analysis to arrive at conclusion for commercial application as suggested by Chandrashekar (1999). The treatment T_{10} ($AgNo_3$ @ 25 ppm + 8-HQS @ 300 ppm) has recorded the lowest total cost to vase life ratio of 3.47. with 11.95 days of useful shelf life followed by T_6 :8-HQS @ 300 ppm with cost to vase life ratio of 3.54. Hence, it is concluded that keeping the gerbera flowers in aqua pack with $AgNo_3$ @ 25 ppm + 8-HQS @ 300 ppm was considered as best option to adopt by commercial floral vendors (Plate 2).

Table 1. Effect of aqua pack with holding solution on CUW, CTLW, CPLW and P^H of Vase solution in gerbera

Treatments	CUW (g^{-1} flower)	CTLW (g^{-1} flower)	CPLW (%)	P^H of Vase solution
T_1	30.10	32.37	43.02	6.98
T_2	28.78	32.00	56.87	7.41
T_3	27.35	33.37	45.08	7.56
T_4	27.58	33.70	43.06	7.32
T_5	32.09	30.78	27.85	5.96
T_6	34.65	30.62	18.65	3.82
T_7	28.41	32.41	39.79	7.29
T_8	28.36	32.60	38.39	7.01
T_9	30.15	31.43	21.97	5.53
T_{10}	35.68	30.22	16.71	3.86
T_{11}	27.74	33.18	42.91	7.56
T_{12}	28.64	32.56	29.82	5.92
T_{13}	30.84	32.24	23.88	5.37
T_{14}	32.93	31.51	20.68	5.42
T_{15}	28.59	34.51	38.22	7.03
T_{16}	28.92	34.47	26.71	6.81
T_{17}	29.90	34.17	25.98	5.72
T_{18}	30.51	34.63	24.35	5.83
T_{19}	25.50	36.86s	71.75	6.11
Grand Mean	**29.82**	**32.82**	**34.51**	**6.233**
SED	**0.16**	**0.15**	**1.34**	**0.12**
CD(P=0.05)	**0.33**	**0.30**	**2.69**	**0.26**

Table 2.Effect of aqua pack with holding solution on fresh weight, stem strength and diameter of flower in gerbera

Treatments	Fresh Weight (gm)		Stem Strength (degree)		Diameter of Flower (cm)	
	1st day	11th day	1st Day	11th Day	1st day	11th Day
T_1	127.60	96.60	77.96	35.25	11.60	8.88
T_2	123.60	83.30	75.32	32.23	10.80	8.24
T_3	126.60	94.00	76.00	32.48	10.95	8.45
T_4	127.60	94.60	76.43	34.00	11.00	8.34
T_5	133.30	111.60	80.75	44.35	11.38	9.45
T_6	137.80	130.60	88.96	50.60	11.87	10.1
T_7	130.00	99.30	79.00	37.57	11.18	9.06
T_8	131.60	107.30	79.66	38.12	11.19	9.20
T_9	137.00	124.30	86.54	49.36	11.75	9.90
T_{10}	138.00	131.30	89.60	54.65	11.63	10.17
T_{11}	129.60	98.30	78.01	35.57	11.17	9.02
T_{12}	132.60	108.60	80.63	42.47	11.36	9.35
T_{13}	136.50	121.60	85.89	49.30	11.59	9.81
T_{14}	137.50	125.30	88.38	49.76	11.84	10.05
T_{15}	132.30	108.00	79.68	40.91	11.22	9.28
T_{16}	135.80	112.30	82.00	44.41	11.45	9.60
T_{17}	136.00	114.00	83.40	48.05	11.49	9.68
T_{18}	136.30	116.00	83.42	48.63	11.53	9.74
T_{19}	117.00	76.30	69.00	31.34	10.37	8.16
Grand Mean	**133.17**	**108.06**	**81.05**	**42.05**	**11.35**	**9.27**
SED	**2.66**	**2.10**	**1.59**	**0.81**	**0.22**	**0.19**
CD(P=0.05)	**5.39**	**4.26**	**3.22**	**1.64**	**0.45**	**0.38**

Table 3. Effect of aqua pack with holding solution on flower discolouration, vase life, total cost of the treatment and vase life cost per day (ratio) in gerbera

Treatments	Flower discolouration / fading (days)	Vase life (days)	Total cost (Rs.)	Vase life cost/ day (ratio)
T_1	8.21	6.09	26.5	4.35
T_2	6.13	6.27	29	4.62
T_3	7.08	7.22	31.5	4.36
T_4	8.19	7.61	34	4.46
T_5	9.50	9.03	36	3.98
T_6	10.52	11.07	42	3.79
T_7	8.47	8.21	34	4.14
T_8	8.57	8.36	36.5	4.36
T_9	10.42	9.72	38.5	3.96
T_{10}	11.33	11.95	44.5	3.72
T_{11}	8.32	8.73	36.5	4.18
T_{12}	9.37	9.71	39	4.01
T_{13}	10.40	10.08	41	4.06
T_{14}	10.48	10.89	47	4.31
T_{15}	8.62	8.93	43.5	4.87
T_{16}	9.50	9.82	49.5	5.04
T_{17}	9.55	9.94	46	4.62
T_{18}	9.58	9.97	52	5.21
T_{19}	4.43	5.97	24	4.02
Grand Mean	**8.87**	**8.92**	-	-
SED	**0.17**	**0.10**	-	-
CD(P=0.05)	**0.35**	**0.21**	-	-

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