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Standardization of Different Chemicals on the Vase Life of Cut Gerbera (*Gerbera jamesonii*) cv. Julia

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ABSTRACT

Gerbera (Gerbera jamesonii) is an important commercial cut flower to a prominent position amongst the elite group of top ten cut flower of the international flower market. The experiment was carried out to standardization of different chemicals on the vase life of cut gerbera cv. Julia. Flower placed in 15 different combinations vase solution containing sucrose @ 1.0 and 1.5 per cent with sodium hypochlorite (0.3%) and Benzyl adenine (20 ppm) has recorded significantly longest vase life (14.11 and 13.64 days) with higher value in cumulative water uptake (52.57 and 51.92 g/ cut flower), transpiration loss of water (61.59 and 61.88 g/ cut flower), relative fresh weight (98.14 and 94.25[b] *%) and membrane stability index (64.98 and 61.96%) and also recorded minimum cumulative water balance (-8.72 and -10.22 g / cut flower), ion leakage (35.02 & 38.04 %), pH (3.45 and 3.4) and bacterial count (8.83 and 9.81 CFU x* 10^4 m^{-1}*) respectively. Which have contributed to increased vase life if cut gerbera flower.*

Key words: *Gerbera flowers, Sucrose, Benzyl adenine, Sodium Hypochlorite, Vase life.*

INTRODUCTION

Gerbera (*Gerbera jamesonii*) is an important commercial cut flower; belong to the family Asteracea, it occupies the fifth place among cut flower. In India gerbera is grown in an area of 0.82 thousand hectare with the production of 21.8 Metric tons [1]. The attractive blooms of gerbera are suitable for any type of floral arrangements like bouquets, floral ornaments and in making dry flower crafts. The Postharvest longevity of cut flower having economic value can often be improved by the use of different chemicals and sugar, in vase solutions[2,3].

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An effective flower food i.e., a preservative solution should contain three basic components to extend the life of cut flowers. A sugar provide a respiratory substrate, while the germicides control bacterial growth, prevent plugging of the conducting tissues and growth regulator helps to maintain membrane stability and preventing stem bending in gerbera[4]. The vase life of gerbera is normally reduced by wilting premature senescence, folding, stem break and neck bending of the flower stalk celled as scape bending[5].

Therefore, the techniques of prolonging the vase life of flower will be great assets to the grower and uses. Hence the present study the emphasis was given to find out the economical chemical different holing mixtures are used for vase life prolongation of gerbera including sucrose, germicides viz. 8-HQC & NaOCl and mineral salts *viz.* Aluminum sulphate, Citric acid and Benzyl adenine.

MATERIAL AND METHODS

Gerbera flower were obtained from Department of floriculture and Landscape Architecture, college of Horticulture Mudigere. The flowers were harvested at stage two outer rows of disc flowers open and kept in bucket containing water. The preservative solution was freshly prepared by using deionised water. Flowers were placed in conical flasks 250 ml vase solution. Containing T_1 : Control (Deionised water) T_2 : Sucrose (1%), T_3 : Sucrose (1.5%) , T_4 : Sucrose (1.0%) + 8-HQC (200 ppm) + Aluminum sulphate (50 ppm), T_5 : Sucrose (1%) + 8-HQC (200 ppm) + Citric acid (50 ppm), T_6 : Sucrose (1%) + 8-HQC (200 ppm) + Benzylodenine (20 ppm), T_7 : Sucrose (1%)+ NaOCl (0.3%) + Aluminium sulphate (50 ppm), T_8 : Sucrose (1%) + NaOCl (0.3%) + Citric acid (50 ppm), T_9 : Sucrose (1%) + NaOCl (0.3%) + Benzyladenine (20 ppm), T_{10} : Sucrose (1.5%)+ 8-HQC (200 ppm) + Aluminium sulphate (50 ppm), T_{11} : Surose (1.5%) + 8-HQC (200 ppm) + Citric acid (50 ppm), T_{12} : Sucrose (1.5%) + 8-HQC (200 ppm) + Benzyladinine (20 ppm), T_{13} : Sucrose (1.5%) + NaOCl (0.3%) + Aluminium sulpate (50 ppm), T_{14} : Sucrose (1.5%)+ NaOCl (0.3%) + Citric acid (50 ppm) and T_{15} : Sucrose (1.5%) + NaOCl (0.3%) + Benzyladenine (20 ppm) and each treatment replicated three times. The flowers were continuously held in the holding solution and the postharvest physiological characteristics of the flower were studied throughout the vase life period. Experiment was carried out in a Completely Randomized Design.

Data collected

Cumulative water uptake (CWU) (g/cut flower)

Difference between the initial weight (on the first day) and final weight (on lost day of vase life) of bottle plus solution gives the (CWU) of cut flower.

Cumulative transpiration loss of water (CTLW) (g/cut flower)

Difference between the initial weight (on the first day) & final weight (on last day of vase life) of cut flower along with bottle and solution gives the CTLW water loss of cut flower.

Cumulative water balance (CWB) (g / cut flower)

The CWB in the tissue of flower was calculated by deducting the cumulative transpiration loss of water from the cumulative water uptake.

Relative fresh weight (RFW) (%)

RFW of the flower was determined just before the immersion of the flower into the solution and repeated every day until the vase life of the flower were terminated. The fresh weight of each flower was expressed relative to the initial weight to represent the water status of the flower.

$$\text{Relative fresh weight (\%)} = \frac{\text{Fresh weight on } n^{th} \text{ day}}{\text{Initial fresh weight}} \times 100$$

Ion leakage percentage and Membrane stability index (%)

Ion leakage percentage for estimation of membrane permeability was measured using a portable electrical conductivity meter (VSI-05) based on Pooviah, and Leopold[6] method. On eighth day of vase period petal samples were cut into one centimeter segments and placed in individual flask contacting 25 ml of distilled water after two washes with distilled water to remove surface contamination. These samples were incubated at room temperature (25^0 C) for 24 hours. Electrical conductivity of solution (EC_1) was read after shaking at 150 rpm for 30 minutes on an orbital shaker. Sample were then placed in thermostatic water bath at 95^0C for 15 minutes and the second reading (EC_2) was determined after cooling the solutions to room temperature. Ion leakage percentage was calculated wing the formula given below.

Per cent ion leakage = (EC_1 / EC_2) x100.

Membrane stability index was calculated on the basis of ion leakage of percentage of flower. The membrane stability index was expressed as per cent value according to the formula given below [7].

Membrane stability index (%) = [1-(EC_1 / EC_2)] X 100.

pH of vase solution

Vase solution of 25 ml from each vase solution was taken into the test tube on first day and on day of vase life termination of cut flowers and pH was measured using digital pH meter (EUTECH Instrument Table Model).

Bacterial count (CFU x $10^4 ml^{-1}$)

Dilution plat count technique was adopted to estimate the bacterial population. One ml aliquots of vase solution were isolated from each replication of each treatment at the twelfth day. Afterward fourfold serial dilution was made. Each concentration of diluted samples of 0.1 ml was plated on sterile nutrient agar in sterile petric plates & incubated for 48 hr at 30^0 C. The number of bacteria was counted by the standard plate counting method to determine the number of colony forming units per ml (CFU x $10^4 ml^{-1}$).

Vase life (Days)

Flower vase life was recorded as the number of days on vase until the flowers showed symptoms of bent neck or advanced signs of lading on all petals [8].

Statistical analysis

The data were subjected to statistical analysis as per the Microsoft excel and Web Agri Stat Package (WASP-2) ICAR Goa complex statistical tool. The treatment means were compared by Duncan's Multiple Range test at 0.01.

RESULT AND DISCUSSION

The longevity of gerbera cut flower is very much dependent upon a external supplementation with sucrose, biocides and growth regulators during the vase period. In the current study different combination of these chemicals were significantly extending the vase life of flowers.

Cumulative water uptake (CWU) (g/cut flower)

Significantly highest CWU was recorded with treatment T_{15} (Sucrose 1.5% + Sodium hypochlorite 0.3% + Benzyladenine 20 ppm) (52.57 g) followed by the treatment T_9 (Sucrose 1.0% + Sodium hypochlorite 0.3% + Benzyladenine 20 ppm) (51.92 g) and the minimum of 27.00 g cumulative uptake of water was observed in cut flowers held in T_3 (1.5% sucrose) this might be due to only sucrose in vase solution preferred host for an increased microbial growth (Table 1). The highest water uptake and cumulative water uptake was observed due to Benzyladenine induce special physiological response and alter the source-sink metabolism via sink formation and helps nutrient mobilization, which was supported by the findings of Elham *et al.* [9] in gerbera flower.

Significantly maximum transpiration loss of water was recorded with treatments T_{15} (Sucrose 1.5% + Sodium hypochlorite 0.3% + Benzyladenine 20 ppm) (61.59 g) and T_9 (Sucrose 1.0% + Sodium hypochlorite 0.3% + Benzyladenine 20 ppm) (61.88 g) and the minimum cumulative transpiration loss of water in the flowers held in T_3 (1.5% sucrose) (38.52 g) Table 1. Although the total quantity of water uptake and transpiration loss of water was significantly greater in these treatments, the water uptake dominated over CWL thereby improving the water retention in the cut gerbera flower scapes. These results were in accordance with the findings of [10] in cut tuberose cv. Pearl Double.

Cumulative water balance (CWB) (g / cut flower)

Vase solution had significant effect on cumulative water balance of cut flowers. The maximum cumulative water balance of -8.72 g was obtained in cut flowers treated with Sucrose (1.5%) + Sodium hypochlorite (0.3%) + Benzyladenine (20 ppm) and which was followed by treatment Sucrose (1.0%) + Sodium hypochlorite (0.3%) + Benzyladenine (20 ppm) (-10.22g) and the lower cumulative water balance of -14.48 g was observed in Sucrose (1.0%) + Sodium hypochlorite (0.3%) + Aluminium sulphate (50 ppm) Table 1. The higher cumulative water balance in cut flowers resulted in high degree of freshness of cut flowers for long period[11].

Table 1: Effect of vase holding solution on Cumulative water uptake, transpiration loss of water and water balance, Relative fresh weight, pH and vase life of gerbera cut flowers var. Julia during the vase period

Treatments	CWU (g/cut flower)	CTLW (g/cut flower)	CWB (g/cut flower)	RFW (%)	pH	Vase life (Days)
T_1 : Control (Deionised water)	27.59^{gh}	39.79^{h}	-12.18^{f}	44.22^{h}	4.90^{a}	8.08^{f}
T_2 : Sucrose (1.0%)	28.66^{g}	39.79^{h}	-11.13^{d}	50.88^{g}	4.79^{ab}	8.23^{f}
T_3 : Sucrose (1.5%)	27.00^{h}	38.52^{i}	-11.52^{e}	50.39^{g}	4.87^{a}	8.44^{f}
T_4 : Sucrose (1.0%) + 8-HQC (200 ppm) + Aluminium sulphate (50 ppm)	27.29^{h}	38.56^{i}	-11.27^{de}	51.90^{g}	4.98^{a}	8.11^{f}
T_5 : Sucrose (1.0%) +8-HQC (200 ppm) + Citric acid (50 ppm)	37.09^{de}	50.41^{e}	-10.25^{b}	76.03^{d}	4.78^{ab}	10.45^{d}
T_6 : Sucrose (1.0%) + 8-HQC (200 ppm) + Benzyladenine (20 ppm)	37.42^{d}	50.33^{e}	-10.75^{c}	70.01^{e}	4.61^{b}	9.98^{d}
T_7 : Sucrose (1.0%) + NaOCl (0.3%) + Aluminium sulphate (50 ppm)	42.55^{c}	57.83^{c}	-14.48^{h}	78.35^{d}	4.83^{a}	11.32^{bc}
T_8 : Sucrose (1.0%) + NaOCl (0.3%) + Citric acid (50 ppm)	42.09^{c}	56.12^{d}	-14.03^{g}	77.52^{d}	4.80^{ab}	11.28^{c}
T_9 : Sucrose (1.0%) + NaOCl (0.3%) + Benzyladenine (20 ppm)	51.92^{a}	61.88^{a}	-10.22^{b}	94.25^{b}	3.47^{e}	13.64^{a}
T_{10} : Sucrose (1.50%) + 8-HQC (200 ppm) + Aluminium sulphate (50 ppm)	36.07^{def}	47.97^{f}	-11.27^{de}	66.35^{f}	4.77^{ab}	9.40^{e}
T_{11} : Sucrose (1.5%) + 8-HQC (200 ppm) + Citric acid (50 ppm)	35.74^{ef}	47.94^{f}	-11.17^{de}	65.72^{f}	4.29^{c}	9.26^{e}
T_{12} : Sucrose (1.5%) + 8-HQC (200 ppm) + Benzyladenine (20 ppm)	34.90^{f}	46.34^{g}	-11.53^{e}	66.45^{f}	4.18^{cd}	9.32^{e}
T_{13} : Sucrose (1.5%) + NaOCl (0.3%) +Aluminium sulphate (50 ppm)	44.44^{b}	58.43^{b}	-12.48^{f}	85.24^{c}	4.10^{cd}	11.72^{bc}
T_{14} : Sucrose (1.5%) + NaOCl (0.3%) + Citric acid (50 ppm)	45.27^{b}	58.41^{b}	-13.80^{g}	83.27^{c}	3.99^{d}	11.85^{b}
T_{15} : Sucrose (1.5%) + NaOCl (0.3%) + Benzyladenine (20 ppm)	52.57^{a}	61.59^{a}	-8.72^{a}	98.14^{a}	3.45^{e}	14.11^{a}
S. Em±	0.47	0.19	0.13	0.82	0.07	0.20
CD @ 1%	1.83	0.76	0.49	3.19	0.27	0.77

* Means in the column followed by same letters are not statistically significant as Duncan multiple range test at P =0.01%

* 8-HQC: 8-Hydroxyquinoline Citrate * NaOCl: Sodium hypochlorite

Relative fresh weight (RFW) (%)

As we see in Table 1 cut flowers treated with Sucrose (1.50%) + Sodium hypochlorite (0.3%) + Benzyladenine (20 ppm) had the highest percentage of flower relative fresh weight of 98.14 per cent followed by cut flowers treated with Sucrose (1.0%) + Sodium hypochlorite (0.3%) + Benzyladenine (20 ppm) (94.25 per cent) up to eleventh day. This indicated that, Water absorption from the vase maintains a better flower freshness which saves from early wilting and reflecting on vase life improvement. An increase in fresh weight could be attributed to improved water balance in the floral tissue. The results with cut gerbera treated with different concentrations of mineral salts were in accordance with the reports given by [12].

Ion leakage (%) and membrane stability index (%)

Changes in the rate of ion leakage from tissue samples demonstrate changes in membrane permeability. Tissues with normal permeability properties can retain uptake of water. Hence, better vase life was accompanied by low ion leakage percentage.

Fig. 1 indicate that on eight day of vase period of gerbera var. Julia treated with Sucrose

(1.5%) + Sodium hypochlorite (0.3%) + Benzyladenine (20 ppm) had significantly lower percentage of ion leakage and higher membrane stability index value 35.02 per cent and 64.98 percent respectively, which was followed by cut flowers treated with Sucrose

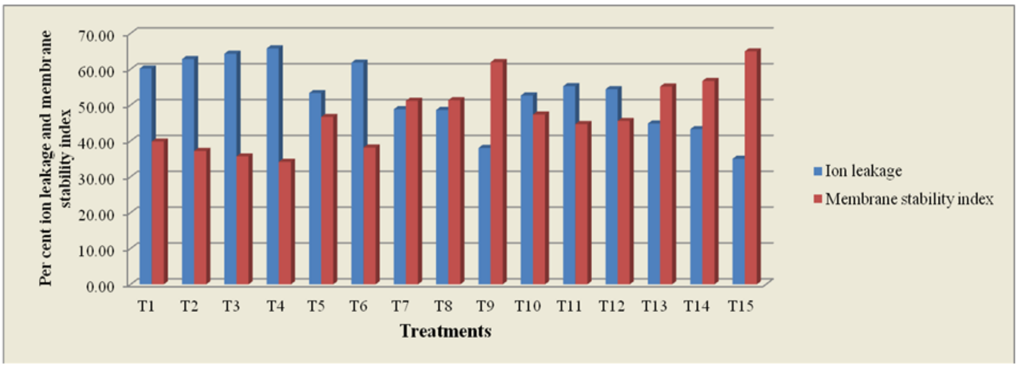

Fig. 1: Effect of vase holding solution on ion leakage (%) and membrane stability index (%) of gerbera cut flowers var. Julia on eight day of vase period

(1.0%) + Sodium hypochlorite (0.3%) + Benzyladenine (20 ppm) (38.04 %) and higher membrane stability index (61.96 5). The higher percentage of ion leakage of 65.83 per cent and lower membrane stability index 34.17 per cent was noticed with Sucrose (1.0%) + 8-HQC (200 ppm) + Aluminium sulphate (50 ppm) treated cut flowers. The same trend of longer vase life associated with lower ion leakage was also noticed by [13] in gerbera.

pH of vase solution

The perusal of data in Table 1 revealed that, at the end of vase period the lower pH value of 3.45 was observed in treatment Sucrose (1.50%) + Sodium hypochlorite (0.3%) + Benzyladenine (20 ppm) and was at par with cut flowers treated with Sucrose (1.0%) + Sodium hypochlorite (0.3%) + Benzyladenine (20 ppm) (3.47), whereas the higher pH was noticed in Sucrose (1.0%) + 8-HQC (200 ppm) + Aluminium sulphate (50 ppm) treatment (4.98) was recorded. It may be due to antimicrobial compounds sodium hypochlorite depending on the hydrolysis of chlorine to hypochlorous acid helps to maintain pH of the vase solution [14].

Bacterial count (CFU x $10^4 ml^{-1}$)

The lowest bacterial count 8.83×10^4CFU ml^{-1} was recorded in the treatment T_{15} (Sucrose 1.50% + Sodium hypochlorite 0.3% + Benzyladenine 20 ppm) (Fig. 2) and was on par with cut flowers treated with Sucrose (1.0%) + Sodium hypochlorite (0.3%) + Aluminium sulphate (50 ppm) + Benzyladenine (20 ppm) (9.81×10^4CFU ml^{-1}) compared to other treatments (Fig. 2). The highest bacterial count of 68.89×10^4CFU ml^{-1} was recorded with samples drawn from control (T_1). According to the obtained results, addition of Sodium hypochlorite decreased the bacterial population of gerbera var. Julia cut flowers, since Sodium hypochlorite is a very effective antimicrobial agents and acidifying agent in inhibiting the growth of microorganisms[15].

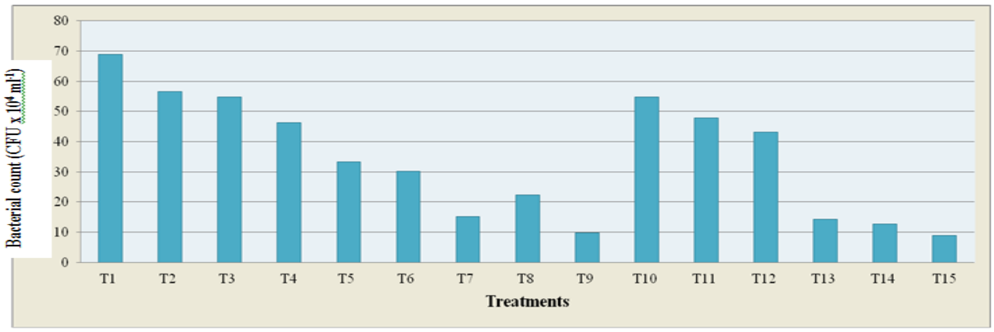

Fig. 2: Effect of vase holding solution on bacterial count (CFU x 10^4 ml^{-1}) of gerbera cut flowers var. Julia on twelfth day of vase period

Vase life (Days)

Most of the treatments resulted in the vase life of up to eleven days; it may be due to the toxic effect of chemical concentration or high microbial population. But the best water retention values and flower freshness were observed in the treatments longest vase life of 14.11 days was obtained with gerbera var. Julia cut flowers treated with Sucrose (1.50%) + Sodium hypochlorite (0.3%) + Benzyladenine (20 ppm) and was on par with cut flowers treated with Sucrose (1.0%) + Sodium hypochlorite (0.3%) + Benzyladenine (20 ppm) (13.64 days), indicating the best vase life till the last day of period under study and shortest vase life of 8.08 days observed in cut flowers placed in control. This may be due to the positive effect of kinetin (BA) where increased with sucrose combination increased sink strength[16].

CONCLUSION

Based on the results of this study, it could be concluded that all chemicals used in this study have improved the keeping quality of the cut gerbera flowers. The present study indicates that Sucrose 1.5 and 1.0 per cent in combination with Sodium hypochlorite (0.3%) and Benzyladenine (20.0 ppm) treatments were improved flower quality by increasing vase life, eater uptake, relative fresh weight, membrane stability index and inhibit bacterial population. Therefore the above chemicals have a potential to be used as a cut flower preservatives solution for prolonging vase life and post harvest quality of gerbera var. Julia cut flowers.

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