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Impact of chemical preservative solution on gerbera (*Gerbera jamesonii*) cut flowers cv Livia

Abhay Mishra and Homraj Sahare

Abstract
A lab experiment was carried out in the experimental laboratory of Department of Horticulture, School of Agriculture, Lovely Professional University, Kapurthala district, Punjab, India during the year 2022 to see the effect of chemical preservative solution on gerbera flowers *Gerbera jamesonii* cv (Livia). The experiment was laid out in a completely randomized design (CRD) with the total of 13 treatments having 3 replications each. The thirteen treatments were: T_{1}- Control (distilled water 500ml), T_{2}- silver nitrate 20ppm, T_{3}- silver nitrate 30ppm, T_{4}- Potassium metabisulfite 250ppm, T_{5}- Potassium metabisulfite 500ppm, T_{6}- Citric acid 100mg, T_{7}- Citric acid 150mg, T_{8}- Gibberellic acid 100ppm, T_{9}- Gibberellic acid 200ppm, T_{10}- salicylic acid 1mM, T_{11}- salicylic acid 3 mM, T_{12}- Sucrose 2%+8-HQC 0.04%, T_{13}- Sucrose 4%+8-HQC 0.02%. Results from the experiment disclosed that out of thirteen treatments taken for the experiment, the treatment twelve and thirteen, (T_{12}) Sucrose 2%+ 8-HQC 0.04%, (T_{13}) Sucrose 4%+8-HQC 0.02% significantly showed superior result in fresh cut flower weight, stem diameter, flower head diameter, Solution uptake, and electrolyte leakage. Hence, it can be concluded that sucrose and 8-HQC can be suggested for the best outcome and for the effect of chemical preservative solution on gerbera cut flower.

Keywords: Vase life, sucrose, 8-HQC, gerbera, preservative solution, distilled water, silver nitrate, potassium metabisulfite

Introduction
Gerbera *(Gerbera jamesonii)*, often identified as the Transvaal daisy, it belongs to the family of asteraceae, gerbera is one from the top ten most well liked and superior commercial cut flowers all over the world, ranking fourth among cut flowers according to worldwide floriculture trends (Soad *et al*., 2011) [14]. It is in highly demand for both domestically and internationally. The blossoms are appealing, appropriate for any sort of floral arrangement, and come in a variety of colours and tones. it is basic include for the creating of dry floral craft as well as for the creating of floral bouquets in addition to arrangements of flower. Cut flowers have a long vase life and command high market prices. For both export world-wide as well as domestic market, maintenance of the quality is a critical criterion for determining the quality of the cut flower. To expand the vase life of cut flowers, different chemical preservatives chemical should be added to the holding solution. Sugar and germicides are two crucial ingredients in all holding solutions. Sugar offers a substrate for a respiration, and the germicides keep hazardous germs at bay and keep the conducting tissues from becoming clogged. As a result, approaches for extending the vase life of flowers will be extremely beneficial to both farmers and users. This study were undertaken in 2000 and 2001 to see if floral preservatives could expand the vase life of cut gerbera blossoms under Bay Island conditions, where there is a scarcity of cut flowers at reasonable rates (Sacalis JN, & Seals JL 1993) [12].

Material and method
The experiment will be carried out to find out the Effect of chemical preservative solution on gerbera (*Gerbera jamesonii*) flowers cv livia in April 2022 at experimental research laboratory school of agriculture, lovely professional university, Phagwara Punjab (144411). The experimental treatment for the investigation conclude 13 treatments and 3 replication: Here, T1- distilled water 500ml, T2- silver nitrate 20ppm, T3- silver nitrate 30ppm, T4- Potassium meta-bisulfite 250ppm, T5- Potassium meta-bisulfite 500ppm, T6- Citric acid 100mg, T7- Citric acid 150mg, T8- Gibberellic acid 100ppm, T9- Gibberellic acid 200ppm, T10- salicylic acid 1mM, T11- salicylic acid 3 mM, T12- Sucrose 2%+ 8-HQC 0.04%, T13- Sucrose 4%+8-HQC 0.02%. The solutions were prepared with the combination of distilled water +ethanol

alcohol with various chemicals like, distilled water (control), silver nitrate, Potassium metabisulfite, citric acid, Gibberellic acid, salicylic acid, sucrose + 8-HQC, different chemical preservative solutions are prepared at various concentrations as per the required treatment. All the preservative solutions were prepared by dissolving different chemicals as per treatments in distilled water with the help of ethanol alcohol. All the solutions were used in experiment are freshly prepared. The prepared preservative solutions were placed in conical flask according to the concentration of the treatments. 500 ml solution was filled in each conical flask, initially the stems of cut flowers were kept 25 cm in length accurately and flowers were placed in conical flask containing vase solutions and stored under room temperature.

Results and Discussion

Table 1: Effect of various vase Solution on Fresh weight of gerbera cut flowers cv Livia

Treatment details	2nd DAT	4th DAT	6th DAT	8th DAT	10th DAT	12th DAT	14th DAT
T1- distilled water 500 ml	98.46^{d}	94.99^{c}	91.49^{c}	86.89^{c}	80.5^{c}	54.66^{k}	26.90^{j}
T2- silver nitrate 20 ppm	94.07^{h}	88.28^{h}	80.65^{j}	74.59^{j}	71.87^{j}	56.43^{j}	34.73^{h}
T3- silver nitrate 30 ppm	91.89^{i}	84.49^{k}	81.33^{ij}	75.91^{i}	70.55^{k}	52.80^{l}	35.98^{g}
T4- Potassium meta-bisulfite 250 ppm	94.10^{h}	87.71^{i}	82.16^{hi}	80.13^{f}	76.17^{f}	59.75^{h}	33.81^{i}
T5- Potassium metabisulfite 500 ppm	96.20^{g}	88.91^{g}	83.13^{gh}	78.17^{h}	73.59^{i}	61.66^{fg}	37.52^{e}
T6- citric acid 100 mg	98.90^{c}	93.41^{d}	88.70^{e}	83.08^{e}	78.52^{d}	66.32^{c}	37.11^{f}
T7- citric acid 150 mg	96.60^{f}	89.42^{f}	85.58^{f}	79.72^{f}	75.78^{g}	62.36^{e}	35.87^{g}
T8-gibberellic acid 100 ppm	97.30^{e}	88.98^{g}	83.43^{g}	78.93^{g}	74.18^{h}	57.19^{i}	37.08^{f}
T9- gibberellic acid 200 ppm	96.62^{f}	87.08^{j}	81.40^{ij}	77.77^{h}	73.93^{hi}	61.90^{ef}	34.92^{h}
T10- salicylic acid 1 mM	96.88^{f}	88.67^{gh}	85.37^{f}	79.91^{f}	77.27^{e}	61.22^{g}	38.53^{d}
T11- salicylic acid 3 mM	98.87^{c}	92.61^{e}	90.30^{d}	85.72^{d}	80.20^{c}	63.37^{d}	45.43^{c}
T12- sucrose 2%+8-HQC0.04%	107.39^{a}	99.09^{a}	93.73^{b}	88.36^{b}	82.35^{b}	67.79^{b}	47.65^{b}
T13- sucrose 4%+8-HQC 0.02%	99.43^{b}	98.49^{b}	96.48^{a}	94.81^{a}	90.05^{a}	73.20^{a}	53.98^{a}
CD at 5% (0.05)	0.381	0.422	1.155	0.405	0.345	0.465	0.355
CV%	0.233	0.276	0.796	0.295	0.266	0.451	0.550

Fresh flower weight (%)

The collected data in the (Table 1) expressed that maximum fresh flower weight (53.98%) was observed in sucrose 4%+8-HQC 0.02% (T_{13}), followed by sucrose 2%+8-HQC 0.04% (T_{12}) and the, minimum fresh flower weight (26.90%) was recorded in distilled water (control) (T_1) at 14th DAT. When flower stalks were kept in chemical preservative solution this could be because of absorption of more preservative solution which helps to maximize the stem weight and maintain the turgidity due to more availableness of carbohydrates for the respiration by minimizing the rate of transpiration. Sucrose improves fresh weight, which may be a result of its antidessicant properties, according to studies on tuberose by (Reddy and Singh 1996) [10] (Bhaskar *et al* 2000) [1]. The substance 8-HQS retarded the tuberose spikes' fresh weight by (Reddy *et al*., 1997) [11]. Less loss in weight of chrysanthemum flower was noted in combination of 8- HQS and sucrose (Bhat *et al*., 1999) [2]. Found result is at par with the result of (Cho and Lee 1979) [3] and (Rajan 2020) [9].

Table 2: Effect of various vase Solution on Flower head diameter of gerbera cut flowers cv Livia

Treatment details	2nd DAT	4th DAT	6th DAT	8th DAT	10th DAT	12th DAT	14th DAT
T1- distilled water 500 ml	72.09^{g}	62.45^{h}	54.29^{h}	42.91^{g}	38.95^{f}	22.46^{h}	8.93^{h}
T2- silver nitrate 20 ppm	78.62^{cde}	65.76^{gh}	54.32^{h}	46.26^{fg}	43.82^{e}	29.90^{ef}	12.01^{fg}
T3- silver nitrate 30 ppm	83.34^{abc}	73.66^{de}	56.57^{gh}	49.09^{ef}	45.35^{de}	25.78^{gh}	9.54^{h}
T4- Potassium metabisulfite 250 ppm	78.02^{def}	65.67^{gh}	57.93^{g}	50.26^{e}	44.97^{de}	26.79^{fg}	10.14^{gh}
T5- Potassium metabisulfite 500 ppm	73.42^{fg}	67.12^{fg}	56.38^{gh}	54.45^{d}	47.84^{d}	30.25^{ef}	12.04^{fg}
T6- citric acid 100 mg	79.3^{cde}	71.42^{ef}	66.14^{ef}	65.05^{b}	58.47^{bc}	38.88^{d}	13.12^{ef}
T7- citric acid 150 mg	84.71^{ab}	82.81^{a}	69.04^{cd}	63.55^{bc}	59.19^{bc}	36.04^{d}	14.32^{e}
T8- gibberellic acid 100 ppm	75.88^{efg}	68.39^{fg}	63.92^{f}	61.45^{c}	56.66^{c}	30.62^{e}	14.38^{e}
T9- gibberellic acid 200 ppm	83.10^{abc}	73.71^{cde}	68.18^{cde}	63.63^{bc}	57.32^{bc}	42.30^{bc}	14.62^{e}
T10- salicylic acid 1 mM	87.45^{a}	73.13^{de}	67.27^{de}	61.12^{c}	59.55^{bc}	44.57^{bc}	17.82^{d}
T11- salicylic acid 3 mM	81.87^{bcd}	76.70^{bcd}	70.38^{bc}	65.31^{ab}	60.32^{ab}	48.39^{b}	20.68^{c}
T12- sucrose 2%+8-HQC 0.04%	84.27^{ab}	79.99^{ab}	72.16^{ab}	68.81^{a}	62.88^{a}	54.29^{a}	29.48^{b}
T13- sucrose 4%+8-HQC 0.02%	80.42^{abc}	78.22^{bc}	73.63^{a}	65.67^{ab}	62.64^{a}	53.65^{a}	32.02^{a}
CD at 5% (0.05)	4.806	3.41	2.795	3.525	3.026	3.812	2.269
CV%	3.570	3.741	2.607	3.603	3.357	6.105	8.402

Flower head diameter (mm)

The collected data in the (Table 2) expressed that minimum head diameter was found (8.93 mm) in distilled water (control) (T_1) at 14th DAT and maximum flower head diameter found (32.02 mm) was observed in sucrose 4%+8-HQC0.02% (T_{13}) treatment at 14th DAT.When flower stalks were kept in chemical preservative solution this could be because of uptake pf sucrose solution and Antimicrobial activities of 8 HQC play an important role to decrease the physiological blockage in the sterile tissue of gerbera flower. So that it helps to maintain the flower head diameter of flowers. Similar treatments had increased the diameter of gerbera (Yongkweon Y and Wonsun K 2003) [16]. Gladiolus (Nowak and Rudnicki, 1979) [8]. Rose (De and Bhattacharjee, 1999) [4] and chrysanthemum (Bhat *et al*., 1999) [2] (Rameshwar, 1974) [15], rose (De and Bhattacharjee, 1999) [4] and (Hema, 2018) [5].

Table 3: Effect of various vase Solution on Stem diameter of gerbera cut flowers cv Livia

Treatment details	2nd DAT	4th DAT	6th DAT	8th DAT	10th DAT	12th DAT	14th DAT
T1- distilled water 500 ml	3.10^{i}	2.80^{f}	2.67^{h}	2.60^{e}	2.33^{c}	1.33^{h}	0.80^{e}
T2- silver nitrate 20 ppm	3.38^{h}	2.93^{f}	2.74^{h}	2.65^{de}	2.36^{c}	1.588^{g}	0.96^{cd}
T3- silver nitrate 30 ppm	3.82^{efg}	3.68^{bc}	3.20^{f}	3.01^{bc}	2.43^{bc}	1.71^{de}	0.99^{bcd}
T4- Potassium metabisulfite 250 ppm	4.04^{cde}	3.36^{d}	3.32^{e}	3.20^{abc}	2.75^{a}	1.61^{fg}	1.08^{bc}
T5- Potassium metabisulfite 500 ppm	3.75^{fg}	3.20^{de}	3.08^{e}	2.91^{cd}	2.64^{ab}	1.75^{cde}	1.10^{bc}
T6- citric acid 100 mg	4.26^{bc}	3.75^{bc}	3.46^{cd}	3.24^{ab}	2.66^{ab}	1.71^{e}	1.07^{bc}
T7- citric acid 150 mg	3.75^{fg}	3.59^{c}	3.54^{c}	2.60^{e}	2.45^{bc}	1.79^{bcd}	1.08^{bc}
T8- gibberellic acid 100 ppm	3.80^{efg}	3.25^{de}	3.19^{f}	3.04^{bc}	2.63^{ab}	1.62^{fg}	0.89^{de}
T9- gibberellic acid 200 ppm	4.53^{a}	4.04^{a}	3.69^{b}	3.30^{ab}	2.67^{ab}	1.68^{ef}	1.04^{bc}
T10- salicylic acid 1 mM	4.51^{ab}	3.86^{ab}	3.40^{de}	3.19^{abc}	2.62^{ab}	1.75^{cde}	1.02^{bcd}
T11- salicylic acid 3 mM	3.98^{def}	3.66^{c}	3.49^{cd}	3.21^{abc}	2.66^{ab}	1.82^{bc}	1.09^{bc}
T12- sucrose 2%+8-HQC 0.04%	4.08^{cd}	3.95^{a}	3.90^{a}	3.38^{a}	2.86^{a}	1.85^{b}	1.26^{a}
T13- sucrose 4%+8-HQC 0.02%	3.70^{g}	3.15^{e}	3.06^{g}	2.91^{cd}	2.73^{a}	1.98^{a}	1.31^{a}
CD at 5% (0.05)	0.259	0.194	0.105	0.298	0.237	0.078	0.150
CV%	3.956	3.316	1.903	5.867	5.420	2.715	8.443

Stem diameter (mm)

The collected data in the (Table 3) expressed that minimum stem diameter was found (0.80 mm) in distilled water (control) (T_1) at 14th DAT and maximum diameter found (1.31mm) in sucrose 4%+8-HQC0.02% (T_{13}) treatment at 14th DAT. when flower stalks were kept in chemical preservative solution this could be because of sugar's effect on stomata closure, which reduces the rate of water transpiration and increases the osmotic potential of cytoplasm. So that it helps to maintain the stem diameter of flowers which was at par with the result to (Malakar 2019) [7].

Table 4: Effect of various vase Solution on uptake of water by gerbera cut flowers cv Livia

Treatment details	2nd DAT	4th DAT	6th DAT	8th DAT	10th DAT	12th DAT	14th DAT	Total water uptake (ml)
T1- distilled water 500 ml	12.41^{h}	12.34^{h}	11.35^{h}	9.86^{h}	6.93^{j}	5.06^{i}	4.38^{i}	62.33
T2- silver nitrate 20 ppm	13.13^{g}	13.06^{g}	12.95^{de}	10.98^{e}	7.88^{h}	7.02^{f}	5.10^{f}	70.12
T3- silver nitrate 30 ppm	13.30^{g}	13.23^{g}	12.87^{e}	10.8^{f}	7.20^{i}	6.89^{g}	5.02^{g}	69.31
T4-Potassium metabisulfite 250 ppm	13.17^{g}	13.10^{g}	12.90^{e}	10.76^{f}	7.82^{h}	6.98^{f}	5.06^{fg}	69.79
T5-Potassium metabisulfite 500 ppm	12.49^{h}	12.43^{h}	11.38^{h}	10.41^{g}	8.00^{g}	6.58^{h}	4.56^{h}	65.85
T6- citric acid 100 mg	15.04^{c}	14.97^{c}	13.08^{c}	11.12^{d}	9.57^{e}	7.28^{e}	6.09^{a}	77.15
T7- citric acid 150 mg	14.07^{e}	14.00^{e}	12.55^{g}	11.01^{e}	9.42^{f}	7.49^{d}	5.86^{c}	74.40
T8- Gibberellic acid 100 ppm	13.63^{f}	13.57^{f}	12.47^{g}	11.34^{c}	9.99^{d}	7.58^{c}	5.61^{d}	74.19
T9- Gibberellic acid 200 ppm	14.09^{e}	14.02^{e}	13.77^{b}	11.85^{b}	10.02^{d}	7.54^{cd}	5.48^{e}	76.77
T10- salicylic acid 1 mM	13.96^{e}	13.9^{e}	12.7^{f}	11.10^{d}	10.06^{d}	7.50^{d}	6.00^{b}	75.22
T11- salicylic acid 3 mM	14.62^{d}	14.55^{d}	13.04^{cd}	11.86^{b}	10.18^{c}	8.01^{b}	5.93^{bc}	78.19
T12- sucrose 2%+8-HQC0.04%	17.01^{b}	16.95^{b}	13.92^{a}	12.01^{a}	10.29^{b}	8.06^{ab}	6.09^{a}	84.33
T13- sucrose 4%+8-HQC 0.02%	17.66^{a}	17.59^{a}	14.00^{a}	12.05^{a}	10.59^{a}	8.12^{a}	6.12^{a}	86.13
CD at 5% (0.05)	0.209	0.197	0.099	0.073	0.073	0.068	0.071	-
CV%	0.879	0.830	0.457	0.389	0.481	0.563	0.771	-

Solution uptake (ml)

The collected data in the (Table 4) expressed that that minimum solution uptake was found (4.38 ml) in distilled water (control) (T_1) at 14th DAT and maximum solution uptake was found (6.12 ml) in sucrose 4%+8-HQC0.02% (T_{13}) treatment at 14th DAT. This could be because of transported of more sucrose which maximize the concentration of osmotic potential So that it helps to increase the water se in to the flow uptake and extend the vase life of flower. The found result was supported by (Rajan 2020) [9] and the water intake of the tuberose cut spike was considerably affected by the combination of Al2 (SO4)2 and sucrose in the vase water (Reddy and Singh, 1996) [10]. Also, (Saini *et al.* 1994) observed that tuberose blooms absorbed more water. Similar, results were noted by (Khondakar and Mazumdar 1985) [6] in tuberose.

Conclusion

Chemical preservative solutions are useful to extend the vase life of gerbera cut flowers. So, as per the results of preservative solution in uptake of solution by the cut spike that helps to influence the vase life of gerbera cut flower. The chemical preservative solutions which contain sucrose 2%+8-HQC0.04%, sucrose 4%+8-HQC0.02%, are suitable to maintain the turgidity and freshness of the gerbera cut flower and maximize the vase life of gerbera cut flower cv Livia.

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