EFFECT OF SILVER NITRATE ($AGNO_3$) ON VASE LIFE OF GERBERA (GERBERA JAMESONII VAR. RED EXPLOSION) CUT FLOWER

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ABSTRACT

The study was carried out to standardize the concentration of different level of silver nitrate ($AgNO_3$) on vase life of gerbera from 17th September to 28th September, 2014. The experiment was conducted in Completely Randomized Design with 6 treatments. The treatments were, no $AgNO_3$ (control), 20 ppm $AgNO_3$, 40 ppm $AgNO_3$, 60 ppm $AgNO_3$, 80 ppm $AgNO_3$ and 100 ppm $AgNO_3$. Each treatment composed of five sub-samples and replicated thrice. The gerbera (var. Red Explosion) flowers were kept for pulsing in 16 % sucrose solution overnight. The observations recorded were discoloration and shrinkage of florets, water uptake, flower weight loss, petal fall, changes in flower diameter and disease incidence on flowers during its vase life and analyzed using R-stat software. The discoloration of floret was statistically similar in 40 ppm, 60 ppm, 80 ppm and 100 ppm $AgNO_3$ but significantly different with 20 ppm and control. 80 ppm $AgNO_3$ significantly increased water uptake (51.8ml) than other treatment. However, 80 ppm $AgNO_3$ was at par with 100 ppm $AgNO_3$ for 50% petal fall and weight loss. The higher the dose the better the vase performance till 80 ppm $AgNO_3$ but after that, the higher dose of silver nitrate (100 ppm $AgNO_3$) resulted toxic effect on cut flowers. So as per our research observation, 80 ppm $AgNO_3$ is appropriate to prolong the vase life of gerbera.

Key words: *Silver nitrate, vase life, cut flower, pulsing, water uptake*

Introducton

Gerbera is one of the most popular commercial cut flowers in the world. According to the global trends in floriculture it occupies the fourth place among cut flowers (Choudhary and Prasad, 2000). The value of cut flower is rated based on the postharvest quality of flower as consumer buys through their eyes and they want flower in garden fresh condition. But the environmental and physiological factor causes the rapid deterioration of flower affecting its quality. Gerbera is very sensitive to gravity, light and bacterial contamination of vase solution. The major problem faced by the commercial growers of gerbera is rapid bending of stem and breaking of neck. The postharvest problems seen in gerbera are scratching, breaking, bending and petal damages (Paudel, 2014). The major cause of wilting of flower is the imbalance between the solution uptake and transpiration that may be because of the occlusions located in the stem cells due to microbial action or stem cell senescence (Van Doorn, 1997; He et al., 2006). The senescence at cellular level causes the deficit of solution uptake because of reduced water holding capacity of flower tissue (Van Meeteren, 1978).

Use of chemical preservative helps to elongate the vase life of flower either by locking the ethylene produced or by checking the microbial effects (Safar et al., 2014). According to the Bleeksma and Doorn (2003), use of silver nitrate postpone withering, folding of petal and

petal fall like phenomenon as silver reduces the ethylene binding capacity and controls the production of interior ethylene. Awad et al., (1986) opined that the use of silver nitrate in vase solution produce Ag+ ions, which controls the rise of ethylene precursor and results in longer vase life of flower and also silver nitrate in vase solution decreases the chances of bent scapes (Steinitz, 1984). The silver nitrate treatment reduces the wilting, chlorophyll and carbohydrate degradation was reduced as a consequence the vase life of cut roses was extended (Singh and Tiwari, 2002). Martin R.B. (2012) opined that use of silver nitrate controls the effect of ethylene by blocking the action of ethylene in plant cell cultures. This research aimed to study the effect of silver nitrate on vase performances, water relations and disease influences of gerbera (Gerbera jamesonii var. Red Explosion) cut flower.

Materials and Methods

The gerbera flowers of uniform size of same varieties (Gerbera jamesonii cv. Red Explosion) were collected from Abloom Flora, Gunjanagar and Chitwan. The experiment was laid out in a Completely Randomized Design (CRD) at the laboratory of Nepal Polytechnic Institute (NPI), Chitwan, Nepal which included 6 treatments. The treatments were, no $AgNO_3$ (control), 20 ppm $AgNO_3$, 40 ppm $AgNO_3$, 60 ppm $AgNO_3$, 80 ppm $AgNO_3$ and 100 ppm $AgNO_3$. Each treatment composed of five sub-samples and replicated thrice. Four percent of sucrose and 100 ppm of HQC was used as a base solution for every treatment. The gerbera cut flowers used for the study were kept for pulsing in 16% sucrose overnight and slanting cut was given (about 1cm) at the base of the spike maintaining the length of 23 cm then the prepared spikes were weighted and kept in beaker filled with 300ml vase solution. The beaker was covered by aluminum foil to avoid the evaporation loss of solution to the environment. The hygrometer machine was used for recording the temperature and relative humidity of laboratory during study period. The head diameter of flowers was measured in every alternative day. Regular observation was done in order to record the data related to petal fall, shrinkage of petal, discoloration of flower and other changes in flower. The temperature and relative humidity was recorded at morning and evening, twice a day.

The visual grading of different senescence stages of flowers was observed on the last day as shown in Figure1. The quality of flower was evaluated on the visual basis of 1-5 point scale at the end of the experiment. The flowers of grade 1 were slightly discolored but they were still fresh, the flowers which are 25% shrinked were numbered in grade 2 and those flowers which are 50% shrinked were enlisted as grade 3. The flowers that are 75% shrinked and slightly wilted were categorized in grade 4. The flowers of these four grades were good enough to keep in vase but the flowers of grade 5 were in terminated stage as they were already wilted (Acharya et al., 2010).

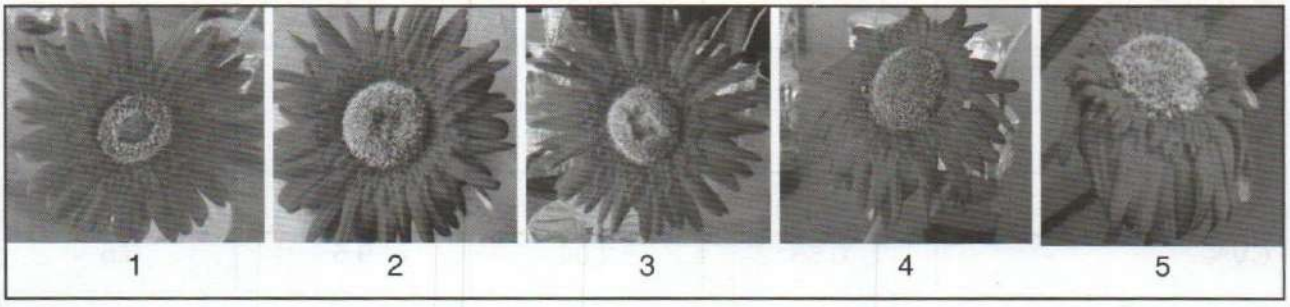

Figure 1. Visual grading score for the vase life of gerbera cut flowers

Result and Discussion

The vase life of cut blooms starts to terminate with the discoloration of floret. As shown in Table 1, the maximum days taken for discoloration of floret was recorded on vase solution containing 80 ppm $AgNO_3$ (9.7) which was at par with the flower in vase containing 100 ppm $AgNO_3$ (9.5), 60 ppm $AgNO_3$ (9.1) and 40 ppm $AgNO_3$ (9.1). The minimum days taken for discoloration of floret was recorded on vase solution containing 0 ppm $AgNO_3$ (7.6) and 20 ppm $AgNO_3$ (8.6).

Petal fall is also one of the factors that represent the ending of effective vase life of cut flowers. The petal fall was accelerated when no silver nitrate was added to the holding solution. The effect of different concentration of silver nitrate solution on days taken for petal fall of gerbera cut flower is shown in Table 1. The treatment with 80 ppm $AgNO_3$ recorded the maximum number of days for 50 % petal fall (11.2) and was at par with 100 ppm $AgNO_3$ (10.9). The control registered the minimum number of days (9.7) for 50% petal fall.

In laboratory trials, the effect of different concentration of silver nitrate on water uptake was recorded which is shown in Table 1. The final water uptake was recorded highest by the flower of vase containing 80 ppm $AgNO_3$ (51.8) followed by the flower of vase solution containing 100 ppm $AgNO_3$ (44). The lowest water uptake was recorded in the flower of vase solution containing 0 ppm $AgNO_3$ (35) was at par with 20 ppm $AgNO_3$ (39.6).

The weight of cut gerbera at harvest and final weight at the end of vase life as influenced by different concentration of $AgNO_3$ were recorded and presented in Table 1. The maximum weight loss was recorded in the flower of vase solution containing 0ppm $AgNO_3$ (6.5) followed by flower of vase solution containing 20 ppm $AgNO_3$ (5.6). The minimum weight loss was recorded in the flower of vase solution containing 80 ppm $AgNO_3$ (4.1) was at par with 100 ppm $AgNO_3$ (4.3).

Table1. Effect of different concentration of silver nitrate on various parameters during vase life of Gerbera jamesonii var. Red Explosion at 30.6±3.13°C, 2014.

Treatments	Discoloration of floret (days)	50% Petal fall (days)	Weight loss (gm)	Final water uptake (ml)
T_1 ($AgNO_3$0 ppm)	7.6b	9.7c	6.5a	35.6c
T_2 ($AgNO_3$20 ppm)	8.6ab	10.3b	5.6b	39.6bc
T_3 ($AgNO_3$40 ppm)	9.1a	10.4b	5.3b	40.9b
T_4 ($AgNO_3$60 ppm)	9.1a	10.5b	5.1bc	42.1b
T_5 ($AgNO_3$80 ppm)	9.7a	11.2a	4.1d	51.8a
T_6 ($AgNO_3$ 100 ppm)	9.5a	10.9a	4.3cd	44b
Mean	8.9	10.5	5.2	42.3
LSD0.05	1.1*	0.38 ***	0.9***	4.9***
CV%	6.86	2.04	9.5	6.5

LSD = Least significant difference, CV = Coefficient variation, *** = highly significant

The discoloration of flower in vase solution containing $AgNO_3$ was slower than the flower in control solution. That might be because of the Ag+ ions produced by the silver nitrate that might have inhibited the rise of ethylene precursor, thereby enhancing the longevity of cut flowers which is in conformity with the findings of Awad et al., (1986). The flower in 20 ppm $AgNO_3$ solution showed statistically similar result with control treatment that might be because of low concentration of $AgNO_3$ which failed to inhibit the ethylene produced. But there was no significant difference between the days taken for discoloration of petal by the flower in vase solution containing 100 ppm, 80 ppm, 60 ppm and 40 ppm $AgNO_3$.

The flowers in higher concentration of silver nitrate resulted slower petal fall in comparison with the lower concentration of silver nitrate and in control solution which is also supported by the finding of Butt (2005). The high concentrations of silver nitrate were successful for binding the ethylene produced during vase life and also controlling the interior ethylene production for longer period of time that might be reason for delay in petal fall of flower in vase solution containing 80 ppm and 100 ppm $AgNO_3$ which are in agreement with the findings of Nickolova and Koncazak (1986) and Reddy (1989).

The cut surfaces of flower stem releases favorable substances which is ideal for the growth of bacteria and other minute organism causing lower water uptake and weight loss of flower in the absence of germicide or in control treatment that is why the there might have higher weight loss in flower of control solution. Solgi et al., (2009) also opined that the effect of silver particles along with some essential oil on cut gerbera flowers cv. Dune decreased the weight loss as compared to the control.

The stems of gerbera are highly prone to water stress and their might be blockage at the base of the stem due to the bacterial plugging that results in decrease of water uptake by stem. Reid (2009) also stated that air embolism, bacterial plugging and poor water quality might be the major cause of reduced solution uptake. Among all treatments, flower in control solution resulted minimum water uptake which might be because of absence of silver nitrate particles that reduces water uptake which is also supported by the findings of Ketsa et al. (1995) in vase life of Dendrobium. The water uptake was higher in the flower of vase solution containing 80 ppm $AgNO_3$ which might be because of the effective microbial inhibiting action reducing blockage of the vascular tissues.

Conclusion

As per the result of experiment conducted, the vase solution containing 100 ppm, 80 ppm, 60 ppm and 40 ppm $AgNO_3$ provided significantly similar result in discoloration of petal. The water uptake by flower was higher (51.8ml) in vase solution containing 80 ppm $AgNO_3$ than other treatment. The minimum weight loss of flower and delayed petal fall (50%) was recorded in vase solution containing 80 ppm and 100 ppm $AgNO_3$ solution. The vase life of gerbera cut flowers increased with the increase in concentration of silver nitrate in vase solution so the flower in 80 ppm $AgNO_3$ resulted better. But the use of high dose of silver nitrate 100 ppm $AgNO_3$ might have been toxic and affected the flower that is why the performance of flower in vase solution containing 100 ppm $AgNO_3$ was not better than flower in 80 ppm $AgNO_3$. But the overall performance of flower on vase solution containing 80 ppm was better for prolonging the vase life of gerbera (Gerbera jamesonii var. Red Explosion) cut flower.

Literature Cited

Acharya, A.K., Baral D.R., Gautam D.M, and Pun U.K. Influence of Seasons and Varieties on Vase Life of Gerbera (Gerbera jamesonii Hook.) Cut Flower. Nepal Journal of Science and Technology 11 (2010). p. 41-46.

Awad, A.R.E., Meawad A., Dawh A.K. and El-saka. (1986). Cut flower longevity as affected by chemical pretreatment. J. Ornamental Hort. 181. p. 177-193.

Bleeksma, H.C. and Van Doorn W.G. (2003).Embolism in Rose stems as a result of vascular occlusion by bacteria. Postharvest Biology and Technology 29. p. 334-340.

Butt, S.J. (2005). Extending the vase life of Roses (Rosa hybrid) with different preservatives. International Journal of Agriculture and Biology. p. 97-99.

Choudary, M.L. and Prasad K.V. (2000). Protected cultivation of ornamental crop- An insight. Indian Hort. 45(1). p. 49-53.

He, S., Joyce D.C., Irving D.E., Faragher J.D. (2006). Stem end blockage in cut Grevillea, Crimson Yullo, in inflorescence. Postharvest Biol. Technol. 41. p. 78-84.

Ketsa, S., Y. Piyasaengthong and S. Parthuangwong, (1995). Mode of action of $AgNO_3$ in maximizing vase-life of Dendrobium Pompodour flowers. Post-havest Biol. Technol. 5. p. 09-117.

Martin, R. B. (2012). HOT TUB SILVER. An Alternative to Preserving Cut Roses. Pacific Rose Society. Escondido, California.

Nikolov, N. and I. Koncazak, (1986). Development of tight greenhouse rose buds into flowers on an artificial medium. Acta Hort. 167. p. 435-40.

Paudel, S. (2014). Gerbera Production in Nepal. Depart. of Hort. IAAS.

Reddy, T. V. (1989). Mode of action of nickel extending the vase life of cut rose. Scientia Horticulure. 36. p. 303-13.

Reid, M. S. (2009). The commercial storage of fruits, vegetables and florist and nursery stocks. p. 36-66.

Safar, M., Mehrdad J. and Abdolrahman M. (2014). Betterment vase life and keeping quality of cut Gerbera flowers by post-harvest nano silver treatments. International Journal of Farming and Allied Sciences.

Singh, A. K. and Tiwari A. K. (2002). Effect of pulsing on postharvest life of Rose v. Doris Tystermann. South-Indian- Hort. 50. p. 140-144.

Solgi, M., Kafi M., Taghavi T. S. and Naderi R. (2009). Essential oils and silver nanoparticles as novel agents to extend vase life of gerbera (Gerbera jamesonii cv. 'Dune') flowers. Postharvest Biol. Technol. 53. p. 155-158.

Steinitz, B., (1984). The influence of sucrose and silver ions on dry weight, fiber and lignin contents and stability of cut gerbera flower stalks. Gartenbauwissenschaft, 48. p. 67-71.

Van Doorn, WG. (1997). Water relation of cut flowers. Hort Rev18. p. 1-85.

Van Meeteren, U. (1978). Water relations and keeping quality of cut gerbera flowers. I. The cause of stem break. Scientia Hort.8. p. 65-74.