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Postharvest Quality of Goldenrod Cut Flowers on Different Vase Solutions Cv. Tara Gold

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ABSTRACT

Goldenrod (*Solidago canadensis*) is a genus of about 100 to 120 species of flowering plants in the family Asteraceae. Most of them are herbaceous perennial species growing from woody caudices or rhizomes. In floriculture industries, post-harvest losses of flowers are the major problem due to its highly perishable nature and it ultimately affects the quality and vase life of flowers. To overcome these issues proper post-harvest practices are essential. The present research work on the "postharvest quality of goldenrod cut flowers on different vase solutions cv. tara gold" was carried out in the Department of Horticulture, Faculty of Agriculture, Annamalai University, Annamalai Nagar during 2017 to 2018. The experiment was with five replicates in completely randomized design. Cut flower spikes treated with silver nitrate and 8-HQS at 200 ppm along with sucrose at concentrations of 2, 4, 6, 8% and control (distilled water) were used in the study. The results showed that all treatments had improved the keeping quality and vase life of cut flowers when compared to control. Among all these treatments, silver nitrate 200 ppm + sucrose @ 6% (T_3) recorded maximum water uptake, transpirational loss of water, water balance, loss of water and water uptake ratio. Fresh weight, cumulative physiological loss in weight and vase life which was extended to maximum on T_3.

***Key words*:** Goldenrod, Chemical preservatives, Sucrose, Vase life

Goldenrod (*Solidago canadensis* L.) a member of the Asteraceae family and also an important landscape weedy plant. It is considered as one among the popular commercial cut flowers and also an excellent filler material. Fillers add a textural contrast as well as it is said to be the backbone of floral decorations. The flowers are used in the preparation of bouquets, wreath, corsage, and various floral arrangements. Floriculture industries are the good avenue to generate gainful employment for youth and women of urban and rural areas. Goldenrod is a rhizomatous herbaceous perennial plant that has a branched inflorescence with numerous yellow small capitula. Harvesting at the optimum stage of maturity is the most important feature in the ornamental species. In *Solidago*, spikes are harvested at bud stage when the basal florets just start to change color.

In floriculture industries, postharvest losses are the major problem due to its highly perishable nature and it ultimately affects the quality and vase life of flowers. To overcome these issues proper postharvest practices are essential. Senescence is the terminal stage of plant development that follows the physiological maturity consequently leading to the death of cells, organ or the whole plant [1]. Floral senescence is the most serious problem regarding the postharvest management of cut flowers. The right stage, proper method and time of harvesting is an important factor to ensure their long vase-life. Nearly 20 to 40 percent of losses in the production of flower crops due to improper post-harvest handling.

The major reasons for less vase life may be due to nutrient deficiency, bacterial and fungal infection, water stress induced wilting and vascular blockage and the action of ethylene in plant cells. By applying various chemicals, the post-harvest life of cut flowers can be extended. Clogging of vascular tissues of the stem by a material produced by phloem will block the absorption of water. Another important factor which helps the vase life is its content of stored foods. Sucrose act as a source of energy required for the continuation of the vase life of the cut flowers and also helped for the improvement in the keeping quality. By adding sugars such as sucrose to the vase water is effective in improving the post-harvest life of cut flowers [2]. Due to exogenous application of sucrose which might have increased the ability of cut flowers to absorb water by

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influencing the water potential and osmotic potential [3-4]. Sucrose used in the vase solution influenced the water uptake, transpiration loss of water, and also maintained better water relation of cut flowers [5].

MATERIALS AND METHODS

The present investigation was carried out in the Department of Horticulture, Faculty of Agriculture, Annamalai University, Annamalai Nagar, Tamil Nadu during 2017 to 2018. Uniform sized spikes of goldenrod (*Solidago canadensis* L.) cv. Tara Gold free from mechanical injury, diseases and insect injuries were obtained from "Grace and flora" wholesale distributer in Hosur, Tamil Nadu were used for the experimentation. The selected flowers were harvested at proper maturity stage and the flowers were carefully brought to the laboratory without causing any damage and they were kept in clean water. The experiment was with five replicates in completely randomized design. Cut flower spikes were placed in silver nitrate and 8-HQC at 200 ppm along with sucrose at concentrations of 2, 4, 6, 8% and control (distilled water) were used in the study. Treatment details are T_1- $AgNO_3$ 200 ppm + Sucrose @ 2%, T_2- $AgNO_3$ 200 ppm + Sucrose @ 4%, T_3- $AgNO_3$ 200 ppm + Sucrose @ 6%, T_4- $AgNO_3$ 200 ppm + Sucrose @ 8%, T_5- 8-HQC 200 ppm + Sucrose @ 2%, T_6- 8-HQC 200 ppm + Sucrose @ 4%, T_7- 8-HQC 200 ppm + Sucrose @ 6%, T_8- 8-HQC 200 ppm + Sucrose @ 8%, T_9- Distilled water. Parameters recorded are water uptake, transpirational loss of water, water balance, loss of water, flower freshness, water uptake ratio, fresh weight, cumulative physiological loss in weight and vase life.

RESULTS AND DISCUSSION

Among the varied concentrations of preservative solutions, the flower spikes held in $AgNO_3$ 200 ppm + Sucrose @ 6% (T_3) recorded highest water uptake (g/flower), Transpirational loss of water (g/flower), fresh weight of cut flower (g/s), water balance (g/flower), cumulative physiological loss in weight (%), flower freshness (days), flower discoloration (days), vase life (days) while the lowest uptake of water was recorded in T_9 (distilled water) (Table 1).

Table 1 Effect of different vase solutions on *Solidago canadensis* cut flowers on 8th day

Treatments	Uptake of water (g/flower)	Transpirational loss of water (g/flower)	Fresh weight of cut flower (g/s)	Ratio between water loss and water uptake	Water Balance (g/flower)
T_1: $AgNO_3$ 200 ppm + Sucrose @ 2%	9.59	9.91	22.07	0.93	0.69
T_2: $AgNO_3$ 200 ppm + Sucrose @ 4%	9.98	9.83	22.24	0.92	0.70
T_3: $AgNO_3$ 200 ppm + Sucrose @ 6%	10.88	10.01	23.52	0.89	0.65
T_4: $AgNO_3$ 200 ppm + Sucrose @ 8%	9.48	9.85	21.66	1.04	-0.35
T_5: 8-HQC 200 ppm + Sucrose @ 2%	9.65	9.29	20.92	0.98	0.77
T_6: 8-HQC 200 ppm + Sucrose @ 4%	8.98	8.83	21.24	0.95	1.14
T_7: 8-HQC 200 ppm + Sucrose @ 6%	8.88	9.01	22.60	9.99	-0.16
T_8: 8-HQC 200 ppm + Sucrose @ 8%	8.48	8.85	21.66	1.02	-0.35
T_9: Distilled water	5.57	6.64	13.12	1.17	-0.56
SED	0.45	0.42	0.43	0.004	0.11
CD (5%)	0.91	0.86	0.87	0.009	0.22

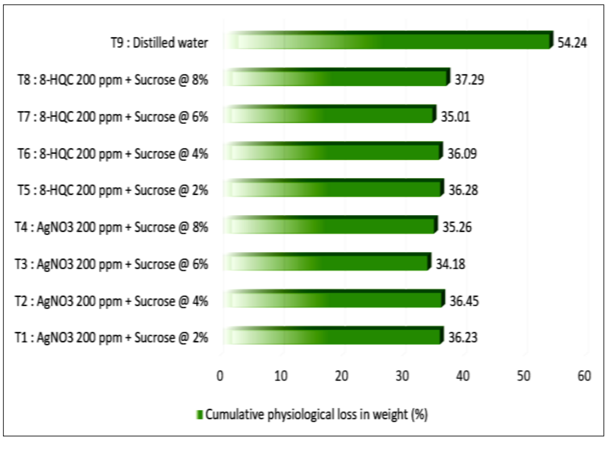

Fig 1 Effect of different vase solutions on physiological loss in weight (%) of *Solidago canadensis* cut flowers

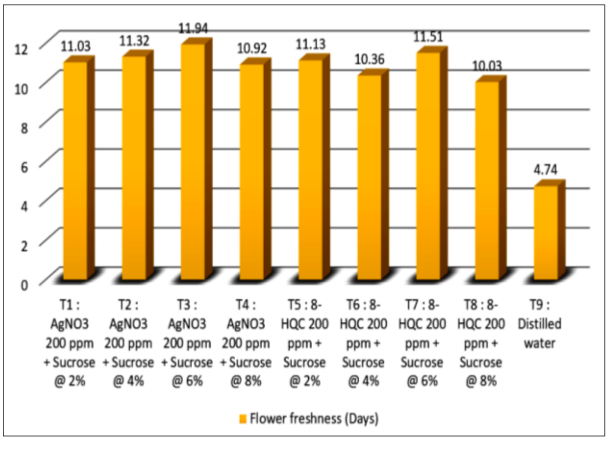

Fig 2 Effect of different vase solutions on solution on flower freshness (Days) of *Solidago canadensis* cut flowers

The higher rate of water uptake obtained in goldenrod spikes is due to the presence of $AgNO_3$ and sucrose, it acidifies vase solution and reduces bacterial proliferation thus enhances the water uptake of cut flowers [6]. Sucrose decreases water loss in petals and increases the uptake of water, by inducing the closure of stomata and increasing the osmotic concentration of the flowers respectively. The present results in goldenrod flowers were similar with the findings of [7] in tuberose, [8] in cut calendula flowers, [9] in cut lisianthus, [10] in cut roses (*Rosa hybrida* cv. Boeing).

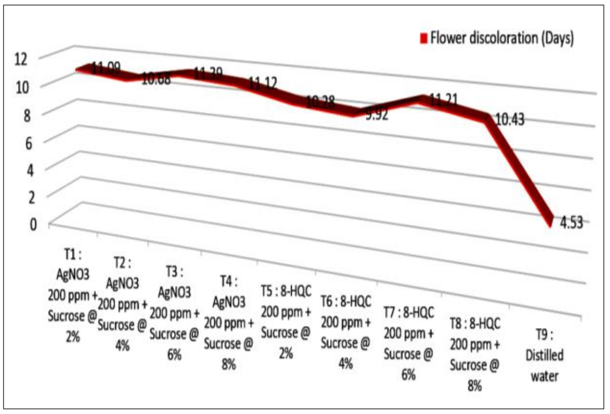

Fig 1 Effect of different vase solutions on physiological loss in weight (%) of *Solidago canadensis* cut flowers

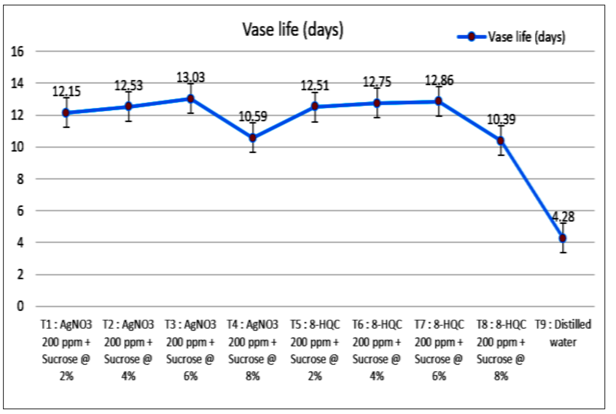

Fig 2 Effect of different vase solutions on solution on flower freshness (Days) of *Solidago canadensis* cut flowers

Among all flowers treated with $AgNO_3$ @ 200 ppm + 6% sucrose (T_3) recorded lowest TLW when compared to control. The minimum loss of water might be because of sucrose and silver nitrate, causes closure of stomata leading to reduction in water loss. The results of present study are in close conformity to the findings of [11] in gerbera and [12] in tuberose flower. Water balance of cut flowers is considered as determining factor for its quality, longevity and vase life which is influenced by the uptake and transpiration loss of water. $AgNO_3$ extended the vase life and improved water relation of cut rose flowers by antimicrobial effect [13]. Sucrose plays an important role in improving the water balance of cut flowers by affecting the osmotic potential of cut flowers and the water holding capacity of the tissues allowing less water to be transpired [14]. The use of sugars in the pulsing solution effectively influences the water balance. Anuradha *et al.* [15] found that higher water balance in cut flowers resulted in high degree of freshness of cut flowers for long period. A positive water balance is crucial for longevity of cut shoots. Application of such chemical on vase solutions resulted longer vase life on cut flowers which is generally in line with findings of the present study and various scholars [16]. Chemical preservatives in the vase solution significantly enhanced the fresh weight and cumulative physiological loss in weight of goldenrod flowers. Higher fresh weight and lower physiological loss in weight of cut flower were found in the treatment consist of $AgNO_3$ @ 200 ppm + 6% sucrose, while the lowest fresh weight and higher PLW was recorded in control (distilled water). Atiqullah and Gopinath [17] noticed that significant influence of sucrose as pulsing agent resulted in lower physiological loss in weight of goldenrod flowers.

The present investigation stated that goldenrod flowers remain fresh in vase solution containing different preservative chemicals along with sucrose, out of that (T_3) $AgNO_3$ @ 200 ppm + 6% sucrose recorded the higher vase life period, followed by (T_7 8-HQC 200 ppm + Sucrose @ 6%, whereas control (distilled water) obtained the minimum vase life as shown in (Fig 4). The increase in vase life might be attributed to interaction of sucrose and silver nitrate. Addition of sucrose replaces the depletion of carbohydrates from cut stems and maintains respiratory pool there by prolongs vase life [18]. It was reported that senescence process of cut flowers was delayed by the application of sucrose [19]. This was in confirmation with the results of [20] in cut Hippeastrum flower cv. 'Apple Blossom' and [12] in tuberose (*Polianthes tuberosa* L.) cv. Hyderabad Double, [17] in goldenrod flowers.

CONCLUSION

From the above results it can be concluded that, the maximum water uptake, transpirational loss of water, water balance, loss of water and water uptake ratio, fresh weight, cumulative physiological loss in weight and vase life of cut flowers positively reacted to $AgNO_3$ 200 ppm + Sucrose @ 6% (T_3). This is because the preservative solution provides nutrient support reduced the bacterial and fungal infection, water stress induced wilting and vascular blockage. The action of ethylene in plant cells were also delayed thus delayed senescence which leads to improving the postharvest quality of the flowers. Adding sucrose to the holding solution it acts as a source of nutrition for tissue approaching carbohydrate starvation, and also dissolved sugars in the cells of the petals may act as osmotically active molecule thereby longevity of cut flowers has been prolonged.

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