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Effect of different floral preservatives on reducing foliage discoloration and increasing vase life of chrysanthemum (*Dendranthema* × *grandiflora*) cv White Reagan

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ABSTRACT

The experiment was conducted at the Division of Floriculture and Landscaping, Indian Agricultural Research Institute, New Delhi. To enhance the vase life and to reduce the foliage discoloration of chrysanthemum (*Dendranthema* × *grandiflora* Ramat.) cv. White Reagan, different floral preservative treatments consisting of cobalt chloride, salicylic acid, sodium nitro prusside, aluminium sulphate, 8-HQC and sucrose were used. Experiment was laid out in completely randomized block design with eleven treatment combinations and each treatment was replicated thrice. It was observed that maximum vase life, solution uptake, increase in flower size and minimum foliage discoloration was observed in flowers held in preservative containing 400 ppm 8-HQC and 1.5% sucrose, which was significantly superior over all other treatments.

Key words: Chrysanthemum, Cut flowers, Floral preservatives, Foliage discoloration, Salicylic acid, Sodium nitro prusside, Vase life, White Reagan

Chrysanthemum (*Dendranthema* × *grandiflora* Ramat.) belongs to family Asteraceae and ranks second in world cut flower trade. In India chrysanthemum is gaining popularity on cut flower in the urban floriculture trade. Fresh flower loses their freshness and quality both during handling and transportation. Due to high perishability, flower and foliage parts are vulnerable to large postharvest losses. The main postharvest problems for chrysanthemums are premature foliage yellowing, wilting and the failure of the flowers to fully open. The flowers of chrysanthemum have long vase life but its foliage often becomes yellow, brown and wilted during storage and transportation. Foliage yellowing is cultivar specific problem and is caused by poor production, excessive or improper storage and preservative solutions used at higher than recommended concentrations. Leaves of cut chrysanthemum frequently become yellow spontaneously, sometimes prior to the onset of flower senescence, which makes the flowers unsightly, lowers their quality and shortens vase life (Doi *et al.* 2003, 2004). To preserve the best quality of flowers after harvest and to make them tolerant to fluctuations in environmental conditions treatment with floral preservatives is recommended. Influence of different holding solutions on chrysanthemum has been reported earlier (Kofranek and Halevy 1972, Marousky 1969, 1971, Talukdar *et al.* 2004) but still the information on controlling leaf discoloration is not available. Therefore, the present studies were carried out to study the effect of various floral preservatives on reducing foliage discoluration and improving the vase life of chrysanthemum cut flower cv. White Reagan.

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MATERIALS AND METHODS

The present studies were carried out in the Division of Floriculture and Landscaping, IARI, New Delhi during 2011-12. For this experiment, flowers of cv. White Regan were cut to a uniform length of 45 cm and were dressed by removing lower 1/3rd leaves. The cut stems were then placed in various holding solutions like cobalt chloride 50 ppm, cobalt chloride 100 ppm, cobalt chloride 150 ppm, salicylic acid 50 ppm, salicylic acid 100 ppm, sodium nitroprusside 50 ppm, sodium nitroprusside 100 ppm, aluminium sulphate 300 ppm+ sucrose 1.5 per cent, 8-HQC 300 ppm+ sucrose 1.5 per cent, 8—HQC 400 ppm+ sucrose 1.5 per cent, control (distilled water). The experiment was laid out in completely randomized design, replicated thrice with three stems per replication. Observations on vase life, per cent weight loss, percent increase in flower size (cm), solution uptake (ml), leaf yellowing (%), leaf wilting (%) and leaf browning (%) were recorded and data was subjected to analysis of variance (Panse and Sukhatme 1967).

Table 1 Effect of floral preservatives on post harvest handling of chrysanthemum cv. White Reagan

Treatment	Leaf discoloration after 15 days (%)	Leaf discoloration at vase life termination	Vase life (Days)	Solution uptake (ml)	Flower size (cm)	% Physiological weight loss
50 ppm cobalt chloride (T_1)	18.52 (25.10)	61.54 (51.72)	29.00	74.33	3.97	29.98 (32.55)
100 ppm cobalt chloride (T_2)	59.53 (50.50)	80.79 (64.17)	26.36	50.00	3.87	44.96 (42.08)
150 ppm cobalt chloride (T_3)	47.67 (43.32)	55.64 (48.34)	22.43	58.00	3.35	33.75 (35.47)
50 ppm salicylic Acid (T_4)	36.77 (36.54)	88.16 (73.92)	27.00	98.17	3.92	43.46 (41.22)
100 ppm salicylic Acid (T_5)	59.61 (50.57)	100.00 (90.00)	30.57	97.33	4.58	58.62 (49.96)
50 ppm sodium nitroprusside (T_6)	53.20 (46.96)	90.75(72.85)	27.90	75.33	3.78	40.15 (39.26)
100 ppm sodium nitroprusside (T_7)	100.00 (90.00)	100.00 (90.00)	19.00	87.33	2.92	38.38 (38.25)
300ppm aluminium sulphate + 1.5% sucrose (T_8)	42.67 (40.76)	96.00 (78.44)	28.77	85.67	3.57	48.89 (44.35)
300ppm 8-HQC + 1.5% sucrose (T_9)	35.32 (35.70)	68.17 (56.56)	31.00	93.67	4.75	31.54 (34.09)
400ppm 8HQC + 1.5% sucrose (T_{10})	17.09 (24.18)	45.96 (42.64)	33.00	103.67	4.75	37.00 (37.43)
Distilled water (T11)	94.68 (79.34)	94.68 (79.34)	23.63	87.00	3.10	49.85 (44.89)
CD (P = 0.05)	24.86 (16.10)	16.9 5(13.71)	3.87	17.20	0.84	11.03 (6.97)

Figures within parentheses are transformed values

RESULTS AND DISCUSSIONS

It is clear from the Table 1 that flowers held in 100 ppm sodium nitroprusside showed 100 per cent foliage discoloration after 15 days, while minimum leaf discoloration (17.09%) was observed in a solution containing 400 ppm 8-HQC +1.5 % sucrose (T_{10}) and was statistically at par with T_4 and T_9. At the time of termination of vase life minimum leaf discoloration (45.96%) was observed when flowers were held in a solution containing 400 ppm 8-HQC+ 1.5 percent sucrose (T_{10}) and was at par with T_1 and T_3, however, 100 percent leaf discoloration was observed in flowers held in 100 ppm salicylic acid (T_5) and 100 ppm sodium nitroprusside (T_7) and it was statistically at par with T_8 and T_{11}. This may be due to the reason that exogenous application of sucrose during postharvest handling may preserve chlorophyll loss and hence, prevented yellowing. Our findings are in corroboration with the findings of Reyes-Arribas *et al.* (2000) , who observed that floating the leaves of chrysanthemum cv. Tara in one per cent sucrose solution preserved the chlorophyll content and extended the yellowing time from 3- 9 days. Moreover, it also reported earlier that the carbohydrate deprivation commonly occurs in higher plants during senescence (Peoples and Dalling 1988), in darkness (Elmarani *et al.* 1994) and under postharvest conditions (King *et al.* 1990).

Data presented in Table 1 indicates that maximum vase life (33.0 days) was recorded in flowers held in a solution containing 400 ppm 8HQC + 1.5 percent sucrose (T_{10}) and it was statistically at par with T_9 and T_5, while minimum vase life (19.0 days) was observed under treatment T_7, i.e 100ppm sodium nitroprusside which was statistically at par with T_3. Among the preservative solutions which are used to increase cut flowers longevity, 8-HQ is more effective to control microbial agents (Kader 2002, Reddy *et al.* 1995, Khalighi and Shafiei 2000). The most probable reason of extending vaselife is that 8- HQ has bacteriostatic properties and along with citric acid it reduces the pH of vase solution. Reduction of pH in preservative solution controls the growth of bacteria at the cut ends of flower stem and reduces the vascular plugging thereby, increases water uptake and hence, enhanced the vaselife. Hussain *et al.* (2001) reported that sucrose in combination with citric acid or aluminium sulphate maintains endogenous levels of soluble sugars and soluble proteins which in turn provide energy as well as required osmaticum for floret development and longevity. Similar were the findings of Yuniarti *et al*. (2007) who reported that use of holding solution containing citric acid increased the vase life of chrysanthemum cv. Cat Eye's by 9.00 days compared to control. It also corroborates with the studies of Jain *et al*. (2009) who reported the maximum vase life of chrysanthemum cv. Shyamal with 150 ppm citric acid +1000 ppm $Al_2(SO_4)_3$ +2% sucrose. Similarly, Wiraatmaja *et al.,* (2007) also reported that longer vase life (6.02 days over control) of chrysanthemum cut flower with 2.70% of sucrose +400 ppm of citric acid. Similarly, Bartoli *et al.* (1997) and Weiming *et al*. (1997) reported that, the vase life of chrysanthemum cut flowers was significantly increased when treated with 8-HQS +sucrose which was attributed to the inhibition of ethylene action by 8-HQS.

The maximum solution uptake (103.67 ml) was observed when the flowers were kept in a preservative solution containing 400 ppm 8-HQC + 1.5% sucrose (T_{10}) and it was statistically at par with T_4, T_5, T_7, T_9 and T_{11}. However, minimum solution uptake (50.00ml) was observed when flowers were kept in a solution containing 100 ppm cobalt chloride (T_2) and was statistically at par with T_3. The possible reason for maximum uptake includes reduced water stress due to the presence of citric acid and decreased microbial population in vase solution due to hydroxyl quinoline. Sucrose in holding solution acts as osmotically active molecule, leading to the promotion of subsequent water relations. Moreover, vase solution enriched with 8-HQ encourage free flow of the water uptake by elimination of the microbial growth and physiological blockage

(Marousky 1972).

It is evident from the Table 1 that the maximum flower opening (4.75cm) was observed in flowers held in a preservative solution containing 300 ppm 8-HQC +1.5% sucrose and it was statistically at par with T_1, T_4 and T_5, however minimum flower size (2.92 cm) was observed with 100 ppm sodium nitroprusside solution (T_7) and was at par with T_3, T_8 and T_{11}. The flowers kept in preservative solution containing citric acid, biocide and sucrose have maximum solution uptake and exogenous supply of respirable substrate which helped in the maximum opening of flower, because addition of sucrose allow the flower to develop fully which is not possible under control. The data presented in Table 1 shows that minimum physiological loss in weight (29.98%) was observed when flowers were held in a solution containing 50 ppm cobalt chloride (T_1) and was at par with T3, T_9 and $T_{10,}$ however, maximum weight loss (58.62%) was observed in flowers held in 100 ppm salicylic acid (T_5) and was statistically at par with T_8 and T_{11}.

CONCLUSIONS

Comparison of all the treatments reveals that the cut flowers of cv. White Reagan held in preservatives containing 400ppm 8-HQC and 1.5 % sucrose (T_{10}) showed maximum vase life, volume of solution uptake, minimum weight loss, minimum foliage discoloration.

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