

# Effect of Sucrose Solutions on Post Harvest Life of Godetia (*Clarkia amoena*)

Robert G. Anderson, Extension Floriculture Specialist

Godetia is an outstanding cut flower that requires a long production period in a cool greenhouse. Research was completed at the University of Kentucky on production practices for godetia or satin flower (*Clarkia amoena*) from 1990 to 1994. Because cut stems were available from the greenhouse production studies, post harvest life of godetia stems ('Grace Rose Pink', 'Grace Salmon Pink' and 'Grace Red') was evaluated with standard cut flower preservatives under standardized vase-life conditions.

## Methods

Treatments for the evaluation of vase life characteristics of cut godetia were based on standards for vase life studies (Reid and Kofranek, 1980). Godetia stems ('Grace Red', 'Grace Rose Pink' and 'Grace Salmon') were harvested from greenhouses at the University of Kentucky Horticulture Research Farm in Lexington KY during December 1992 and January 1993. The cut stems were placed into tap water immediately. Stems were stored in tap water in a refrigerator at 34-36°F overnight (except Experiment 2). The next day, stems were graded, re-cut to a length of 18 inches underwater, and placed immediately in the treatment containers. The graded stems were randomized and placed into randomized individual vases containing the treatment solutions. The vases were placed in a laboratory room and maintained at 72-74°F with fluorescent lighting at 50 foot-candles for 12 hours each day (8:00 am - 8:00 pm).

An overall visual rating of flower quality was determined every 2-4 days. Characteristics of the post harvest life of the flowers were noted, i.e. number of flowers open, number of flowers senesced, petal color, and petal size. Additionally, characteristics of senescence were noted, especially leaf yellowing, leaf necrosis and petal necrosis.

- Visual Rating - 5 = no flaws in flowers or foliage, 4 = some flaws, 3 = minimum rating for acceptable flower arrangement appearance, 2 = major problems, 1 = dead.
- Leaf yellowing rating - 0 = leaves normal, 1 = limited yellowing, 2 = 50% of leaves yellow, 3 = 75 % of leaves yellow, 4 = 100% of leaves yellow with necrosis.
- Leaf necrosis rating - 0 = leaves normal, 1 = limited necrosis, 2 = 50% of leaves necrotic, 3 = 75 % of leaves necrotic, 4 = 100% of leaves necrotic.



Figure 1 Five stem bunches of godetia 'Grace Salmon' (left) and 'Grace Rose Pink' from greenhouse production trials.

**Experiment 1:** Cut godetia stems, 15 of 'Rose Pink' and 15 of 'Salmon' per treatment, in (1) tap water and (2) Floralife® preservative solution.

**Experiment 2:** Cut godetia stems, 15 of 'Rose Pink' and 15 of 'Salmon' per treatment, in (1) tap water and (2) tap water plus 4 ppm sodium hypochlorite (NaOCl; Chlorox®, a biocide) preservative solution. Stems were stored in tap water in a refrigerator (34-36°F [1-2°C]) for 16 days before placement in the post harvest study.

**Experiment 3:** Cut godetia stems, 8 of 'Rose Pink' and 8 of 'Salmon' per treatment, in (1) tap water, (2) tap water and NaOCl, (3) tap water, NaOCl and 0.5% sucrose, (4) tap water, NaOCl and 1.0% sucrose, (5) tap water, NaOCl and 2.0% sucrose, preservative solutions.

**Experiment 4:** Cut godetia stems, 10 of 'Rose Pink', 7 of 'Salmon' and 7 of 'Red' per treatment, in (1) tap water and NaOCl, (2) tap water, NaOCl and 0.5% sucrose and (3) tap water, NaOCl and 2.0% sucrose preservative solutions.

## Results

Godetia is an excellent cut flower. Cut stems are strong and straight when grown properly (Figure 1). Plants for this study were grown as single stem, un-branched plants with one plant per four-inch (10 cm) pot. Stem length varied from 50 to 75 cm. Each stem had 4-15 flower buds, depending on overall vigor. Cut stems had a vase life of 14-18 days but individual flowers last only 4-5 days. All flower buds open to normal size and color when the cut stems receive proper care.

In the first experiment, many of the characteristics of the vase life of godetia were observed (Table 1). Overall, performance in tap water was superior to performance in a commercial preservative solution. Additionally, the performance of 'Grace Rose Pink' was significantly better than the performance of 'Grace Salmon'. Individual stems had three to four flowers open for five to seven, which seems to be sufficient for a commercial cut flower. Leaf yellowing increased significantly in the commercial preservative treatment compared to those stems in tap water (Figure 2).

The second experiment evaluated tap water and tap water plus a biocide (sodium hypochlorite). These treatments were chosen to determine whether the biocide or the sugar in the preservative solution was responsible for the leaf damage, yellowing and necrosis, seen in Experiment 1. Both solutions performed similarly (Table 2). Thus, it may not have been the biocide in the commercial preservative that reduced performance of cut godetia stems; rather the sugar additive might be the problem.

In the third and fourth experiments, different levels of a sugar additive to the preservative solution were tested. In both experiments, the visual rating was lower with the higher concentrations of sucrose in the solution (Tables 3 & 4). From these experiments, it seems that preservative solutions with little (0.5%) or no sugar additive should be recommended for best vase life of cut godetia stems.

The primary cause for poor performance at the higher concentrations of sugar in the preservative solution is damage done to the leaves. The leaves turn yellow relatively quickly and die in a few days when treated with the higher sugar concentrations (Tables 1, 3 & 4). This damage was visible in 'Salmon, Rose Pink and Red'.



Figure 2 Post harvest leaf yellowing observed on a cut stem of 'Grace Rose Pink' (left) and petal necrosis on 'Grace Salmon' (right) from high sugar concentrations in the preservative solution.

A secondary cause for poor vase life performance occurred only in ‘Grace Salmon’. A distinct petal necrosis, death of the central portion of the petal, occurred in many cut ‘Salmon’ stems (Figure 2). No specific cause for this problem has yet been identified. The necrotic areas are moderate to severe (petals develop abnormally due to the damage). Because no specific aspect of post harvest care could be related to the petal necrosis, it may be due to a genetic defect that is rarely seen by breeders.

**Table 1.** Post harvest performance of cut ‘Grace Rose Pink’ (n=15) and ‘Grace Salmon’ (n=15) godetia stems in tap water or Floralife® floral preservative. (Experiment 1).

Cultivar	Post Harvest Treatment	Days of Post Harvest Evaluation							
		0	2	4	7	9	11	14	17
Visual Evaluation ( $\pm$ standard error)									
Rose Pink	Tap Water	5 $\pm$ 0	5 $\pm$ 0	5 $\pm$ 0	5 $\pm$ 0.1	4.9 $\pm$ 0.3	4.8 $\pm$ 0.2	4.8 $\pm$ 0.3	4.5 $\pm$ 0.3
Rose Pink	Preservative	5 $\pm$ 0	5 $\pm$ 0	5 $\pm$ 0	4.7 $\pm$ 0.3	4.4 $\pm$ 0.4	4.2 $\pm$ 0.3	4.1 $\pm$ 0.3	3.2 $\pm$ 0.9
Salmon	Tap Water	5 $\pm$ 0	5 $\pm$ 0.1	5 $\pm$ 0.1	5 $\pm$ 0.1	4.8 $\pm$ 0.4	4.7 $\pm$ 0.5	4.2 $\pm$ 0.9	4.1 $\pm$ 0.9
Salmon	Preservative	5 $\pm$ 0	4.9 $\pm$ 0.2	4.8 $\pm$ 0.2	4.1 $\pm$ 0.5	3.7 $\pm$ 0.7	3.5 $\pm$ 0.9	3.0 $\pm$ 1.0	2.8 $\pm$ 0.8
Mean Open Flower Number									
Rose Pink	Tap Water	1.8	2.7	3.2	4	3.5	2.8	1.8	1.1
Rose Pink	Preservative	1.3	2.4	3.1	3.9	4.3	4.3	3.6	1.8
Salmon	Tap Water	0.9	1.6	2.5	3.4	3.4	3.4	2.7	2.6
Salmon	Preservative	0.6	1.7	2.6	3.6	3.1	3	1.6	1.1
Leaf Yellowing Rating									
Rose Pink	Tap Water	0	0	0	0	0	0	0	0
Rose Pink	Preservative	0	0	0	0.5	1.4	1.7	2.3	2.8
Salmon	Tap Water	0	0	0	0	0	0	0.1	0.2
Salmon	Preservative	0	0	0	0.9	1.8	2.1	2.8	2.9

**Table 2.** Post harvest performance of cut ‘Grace Rose Pink’ (n=15) and ‘Grace Salmon’ (n=15) godetia stems in tap water or tap water plus 4 mg/l NaOCl disinfectant. (Experiment 2).

Cultivar	Post Harvest Treatment	Days of Post Harvest Evaluation							
		0	2	4	6	9	11	13	16
Visual Evaluation ( $\pm$ standard error)									
Rose Pink	Tap Water	5 $\pm$ 0	5 $\pm$ 0.1	4.8 $\pm$ 0.2	4.5 $\pm$ 1.0	4.1 $\pm$ 1.0	3.8 $\pm$ 1.0	3.1 $\pm$ 1.3	2.6 $\pm$ 1.2
Rose Pink	NaOCl	5 $\pm$ 0	5 $\pm$ 0	4.8 $\pm$ 0.2	4.7 $\pm$ 0.4	4.6 $\pm$ 0.4	4.0 $\pm$ 1.1	3.6 $\pm$ 1.4	3.0 $\pm$ 1.6
Salmon	Tap Water	5 $\pm$ 0	4.7 $\pm$ 0.4	4.6 $\pm$ 0.6	4.5 $\pm$ 0.8	4.1 $\pm$ 0.8	3.6 $\pm$ 0.9	3.3 $\pm$ 1.1	3.3 $\pm$ 0.9
Salmon	NaOCl	5 $\pm$ 0	4.8 $\pm$ 0.3	4.6 $\pm$ 0.4	4.5 $\pm$ 0.5	4.3 $\pm$ 0.6	3.6 $\pm$ 0.8	3.2 $\pm$ 1.0	3.1 $\pm$ 1.1
Leaf Yellowing Rating									
Rose Pink	Tap Water	0	0	0	0.1	0.1	0	0	0
Rose Pink	NaOCl	0	0	0	0	0	0	0	0
Salmon	Tap Water	0	0	0	0.1	0.4	0.3	0.3	0.3
Salmon	NaOCl	0	0	0	0.1	0.4	0.5	0.6	0.7
Leaf Necrosis Rating									
Rose Pink	Tap Water	0	0	0.2	0.3	0.4	0.4	0.4	0.4
Rose Pink	NaOCl	0	0	0.1	0.2	0.1	0.2	0.2	0.3
Salmon	Tap Water	0	0	0	0.1	0.1	0.1	0.1	0.1
Salmon	NaOCl	0	0	0	0	0.1	0.3	0.3	0.3

**Table 3.** Post harvest performance of cut ‘Grace Rose Pink’ (n=8) and ‘Grace Salmon’ (n=8) godetia stems in (1) tap water; (2) tap water and 4 mg/l NaOCl; (3) tap water, 4 mg/l NaOCl and 0.5% sucrose; (4) tap water, 4 mg/l NaOCl and 1.0% sucrose; or (5) tap water, 4 mg/l NaOCl and 2.0% sucrose preservative solutions. (Experiment 3).

Cultivar	Post Harvest Treatment	Days of Post Harvest Evaluation							
		0	2	4	6	8	11	13	15
Visual Evaluation ( $\pm$ standard error)									
Rose Pink	1	5 $\pm$ 0	5 $\pm$ 0	4.9 $\pm$ 0.2	4.0 $\pm$ 0.7	3.8 $\pm$ 0.8	3.4 $\pm$ 0.8	3.3 $\pm$ 0.8	2.9 $\pm$ 1.4
Rose Pink	2	5 $\pm$ 0	5 $\pm$ 0	5 $\pm$ 0	4.7 $\pm$ 0.3	4.4 $\pm$ 0.5	3.9 $\pm$ 0.6	3.3 $\pm$ 0.8	2.5 $\pm$ 1.2
Rose Pink	3	5 $\pm$ 0	5 $\pm$ 0	4.8 $\pm$ 0.3	4.6 $\pm$ 0.6	4.4 $\pm$ 0.4	4.1 $\pm$ 0.4	3.8 $\pm$ 0.5	3.5 $\pm$ 0.7
Rose Pink	4	5 $\pm$ 0	5 $\pm$ 0	4.9 $\pm$ 0.2	4.3 $\pm$ 0.5	3.9 $\pm$ 0.4	3.6 $\pm$ 0.4	3.3 $\pm$ 0.5	2.9 $\pm$ 0.7
Rose Pink	5	5 $\pm$ 0	5 $\pm$ 0	4.9 $\pm$ 0.2	3.9 $\pm$ 0.2	3.6 $\pm$ 0.4	3.4 $\pm$ 0.2	3.1 $\pm$ 0.4	2.9 $\pm$ 0.6
Salmon	1	5 $\pm$ 0	5 $\pm$ 0	4.8 $\pm$ 0.2	4.4 $\pm$ 0.3	3.7 $\pm$ 0.7	3.3 $\pm$ 0.7	2.8 $\pm$ 0.9	2.6 $\pm$ 1.0
Salmon	2	4.9 $\pm$ 0.2	4.7 $\pm$ 0.6	4.3 $\pm$ 0.9	3.6 $\pm$ 1.1	3.4 $\pm$ 1.0	2.9 $\pm$ 1.0	2.7 $\pm$ 0.8	2.6 $\pm$ 1.0
Salmon	3	4.9 $\pm$ 0.2	4.7 $\pm$ 0.3	3.8 $\pm$ 1.6	3.7 $\pm$ 0.9	3.3 $\pm$ 0.9	3.0 $\pm$ 0.8	2.8 $\pm$ 0.8	2.5 $\pm$ 0.9
Salmon	4	5 $\pm$ 0	4.8 $\pm$ 0.4	4.3 $\pm$ 0.5	3.6 $\pm$ 0.8	3.0 $\pm$ 0.7	2.7 $\pm$ 0.7	2.3 $\pm$ 0.7	2.1 $\pm$ 0.6
Salmon	5	4.9 $\pm$ 0.2	4.6 $\pm$ 0.6	4.3 $\pm$ 0.7	3.3 $\pm$ 0.7	2.4 $\pm$ 0.5	2.3 $\pm$ 0.5	2.3 $\pm$ 0.5	2.1 $\pm$ 0.7
Leaf Yellowing Rating									
Rose Pink	1	0	0.1	0.8	1.1	1.5	1.8	1.8	1.8
Rose Pink	2	0	0.1	0.4	0.5	0.6	1.0	1.0	1.1
Rose Pink	3	0	0.3	0.6	1.0	1.1	1.6	1.8	1.8
Rose Pink	4	0	0.1	1.0	1.9	2.4	2.6	2.6	2.6
Rose Pink	5	0	0.1	1.0	2.1	2.3	2.4	2.9	3.8
Salmon	1	0	0.3	1.0	1.6	1.4	2.3	2.3	2.3
Salmon	2	0	0.3	1.1	1.9	2.3	2.6	2.5	2.7
Salmon	3	0	0.6	0.8	2.0	2.8	2.8	3.3	3.4
Salmon	4	0	0.5	1.5	2.3	2.9	3.1	3.4	3.6
Salmon	5	0	0.3	0.8	1.5	1.9	2.3	2.8	2.8
Leaf Necrosis Rating									
Rose Pink	1	0	0	0	0	0	0	0	0
Rose Pink	2	0	0	0	0	0	0	0	0
Rose Pink	3	0	0	0	0	0	0	0	0
Rose Pink	4	0	0	0.1	0.1	0.1	0.8	0.8	0.9
Rose Pink	5	0	0.1	0.4	1.0	1.9	2.8	2.8	2.9
Salmon	1	0	0.1	0.1	0.3	0.3	0.8	1.0	1.0
Salmon	2	0	0	0	0	0.1	0.7	1.0	1.0
Salmon	3	0	0	0.3	0.5	0.6	1.0	1.0	1.0
Salmon	4	0	0	0	0.3	1.3	2	2.1	2.1
Salmon	5	0	0.1	0.6	1.1	2.3	2.3	3.0	3.0

**Table 4.** Post harvest performance of cut ‘Grace Rose Pink’ (n=10), ‘Grace Salmon’ (n=7) and ‘Grace Red’ (n=7) godetia stems in (1) tap water and 4 mg/l NaOCl; (2) tap water, 4 mg/l NaOCl and 0.5% sucrose; or (3) tap water, 4 mg/l NaOCl and 2.0% sucrose preservative solutions. (Experiment 4).

Cultivar	Post Harvest Treatment	Days of Post Harvest Evaluation				
		0	3	6	9	14
Visual Evaluation ( $\pm$ standard error)						
Rose Pink	1	5 $\pm$ 0	5 $\pm$ 0	4.6 $\pm$ 0.8	4.1 $\pm$ 1.0	3.2 $\pm$ 0.9
Rose Pink	2	5 $\pm$ 0	5 $\pm$ 0	4.3 $\pm$ 0.3	3.4 $\pm$ 0.6	2.2 $\pm$ 0.9
Rose Pink	3	5 $\pm$ 0	4.9 $\pm$ 0.2	3.5 $\pm$ 0.3	2.3 $\pm$ 0.7	1.2 $\pm$ 0.3
Salmon	1	5 $\pm$ 0	4.8 $\pm$ 0.3	4.4 $\pm$ 0.3	4.0 $\pm$ 0.4	3.6 $\pm$ 0.4
Salmon	2	5 $\pm$ 0	4.5 $\pm$ 0.6	3.5 $\pm$ 0.4	2.7 $\pm$ 0.7	2.1 $\pm$ 0.2
Salmon	3	5 $\pm$ 0	4.3 $\pm$ 0.2	3.1 $\pm$ 0.4	1.4 $\pm$ 0.3	1.0 $\pm$ 0.0
Red	1	5 $\pm$ 0	5 $\pm$ 0	4.9 $\pm$ 0.2	4.4 $\pm$ 0.3	4.1 $\pm$ 0.3
Red	2	5 $\pm$ 0	5 $\pm$ 0	4.4 $\pm$ 0.3	4.0 $\pm$ 0.4	2.3 $\pm$ 0.9
Red	3	5 $\pm$ 0	5 $\pm$ 0	4.1 $\pm$ 0.2	2.8 $\pm$ 0.3	1.0 $\pm$ 0
Leaf Yellowing Rating						
Rose Pink	1	0	0.9	1.1	1.7	1.9
Rose Pink	2	0	0.9	2.1	3.0	3.2
Rose Pink	3	0	0.9	1.5	1.8	1.1
Salmon	1	0	1.0	1.7	2.4	2.4
Salmon	2	0	1.2	3.0	3.4	4.0
Salmon	3	0	0.6	0.9	1.0	1.0
Red	1	0	0.3	0.6	1.4	1.4
Red	2	0	1.0	2.0	2.4	2.6
Red	3	0	0.4	1.7	2.4	2.4
Leaf Necrosis Rating						
Rose Pink	1	0	0	0	0	0.4
Rose Pink	2	0	0.4	0.6	0.7	2.1
Rose Pink	3	0	0.8	3.0	3.6	3.7
Salmon	1	0	0.6	0.1	0.1	0.1
Salmon	2	0	0.7	1.0	1.1	1.4
Salmon	3	0	2.0	3.7	3.9	4.0
Red	1	0	0	0.1	0.3	0.7
Red	2	0	0.3	0.7	1.4	3.4
Red	3	0	0.4	2.0	3.3	3.6

## References

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This work was supported by grants from Sakata Seed America, Inc. and production practices are outlined in the *Ball Red Book*, 16<sup>th</sup> edition (1998).

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