Homemade Floral Preservatives for Handling Specialty Cuts

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Floral preservatives or flower foods are an important part of proper postharvest handling of cut flowers. Flower foods are widely recommended and extensively used by the industry and consumers for maintaining quality and extending cut flower vase life. Depending on the product, flower foods supply carbohydrates, maintain water uptake, increase flower opening and size, and improve flower color development. Moreover, they are used to lower the pH of water to optimum level of 3.0-4.0 and control microbial contamination in the solutions.

Several companies produce different types and brands of floral preservatives including 1.) hydrators, used immediately after harvest, dry storage, or transit for improving water uptake, 2.) clarifiers, used to control microbial growth in the solutions, or 3.) holding/vase solutions, used to provide carbohydrates for longer vase life and continued flower opening. Moreover, several specific purpose preservatives are available, such as anti-yellowing or anti-ethylene preservatives, which contain plant growth regulators or other compounds, and are used for postharvest handling of specific cut flower crops.

Commercial floral preservatives have been well researched and developed by the companies through decades of work. The preservatives are easy to use and readily available in the U.S. and other developed countries, but in developing countries the preservatives are relatively expensive and difficult to obtain. Moreover, commercial products are not yet labeled for handling organically-grown cut flowers. And to be honest, specialty cut flower growers include a few contrarians who like to do things their own way. With all of this in mind, we tested several folk recipes prepared from common products that were suggested and used by the industry and consumers.

In first set of studies, seven homemade recipes containing lemon/lime soda, lemon juice, citric acid, aluminum sulfate, vinegar, and/or household bleach were compared with two popular commercial preservatives and tap water for cut lisianthus, marigold, rose, and zinnia (Table 1). All ingredients were mixed with tap water and stems were treated either for 48 hours (grower/wholesaler treatment) followed by shifting in tap water, or continuously in one of these preservative solutions until end of vase life (florist/consumer treatment). Every time, fresh solutions were prepared and used after one hour of preparation.

Lisianthus stems had longest vase life when placed continuously in preservatives containing citric greenshield, lemon/lime soda, and citric-Kathon, while short-term application of preservatives except citric-al had no effect (Tables 2 and 3). For cut marigold stems, continuous use of soda extended vase life, while for cut rose or zinnia stems, continuous use of preservatives either had no effect or reduced vase life (Table 2). However, short-term (48 hours) application of citric-al extended vase life of all tested cut flowers longer than continuous use of the preservatives (Table 3). Short-term treatment of marigold stems with soda or citric-Kathon also extended vase life. Moreover, it was observed that continuous use of household bleach, vinegar, or aluminum sulfate had detrimental effects on cut stems of tested species, which reduced vase life and quality, increased pH and EC of the solutions, and allowed microbial contamination in vase solutions. However, citric-al proved best preservative for extending vase life when used as a 2-day treatment. For florists or consumers, citric-Kathon, soda, and citric-Greenshield were the best recipes for extending the vase life of tested cut flowers.

Based on the findings of these studies, the preservative formulations were revised (Table 1) to make sure all solutions had a uniform pH within the optimum range of 2.8-3.2 by altering the amount of the acidifier, excluding ingredients that were detrimental to previously tested cut flowers, and applying them for both short-term (2 day grower/wholesaler treatment) or continuously (florist/consumer treatment). Moreover, three additional cut flower crops, snapdragon, stock, and sunflower, were tested along with the previously tested cut lisianthus, marigold, rose, and zinnia.

Cut stems of majority of tested species had longer vase life when placed continuously in the preservative solution until senescence (Table 4). For preservatives, lisianthus and stock stems had longest

vase life with citric-Kathon, while snapdragon and zinnia stems with solutions containing citric-Greenshield (Table 4). Moreover, stems placed continuously in solutions with soda (except zinnia) or citric acid plus sugar also had longer vase life compared to tap water and were similar to those with commercial preservatives. For marigold stems, all preservative recipes had longer vase life compared to the stems in tap water (Table 5). For roses, all preservative recipes resulted in a similar vase life in both studies except continuous use of soda or lemon juice plus sugar, which reduced the vase life. Similarly, the recipes had no effect on vase life of sunflower except lemon juice plus sugar, which reduced the vase life (Table 5).

In summary, these studies demonstrated that some of homemade floral recipes can be used as alternative to commercial preservatives as they increased postharvest longevity of the popular specialty cut flower crops while a few ingredients, such as bleach or vinegar, should not be used for handling of cut flowers. For majority of tested crops, continuous use of preservative solutions extended the vase life longer than short-term treatment followed by shifting them into tap water until termination. Among preservatives, citric-Kathon, citric-Greenshield, soda, and/or citric acid plus sugar performed best and proved best preservative recipes for growers, wholesalers, florists and consumers, while citric-al can also be used by growers for short-term treatment of cut lisianthus, marigold, rose, and zinnia. However, household bleach, vinegar, citric-al, or lemon juice had detrimental effects on cut stems longevity when used for longer period of time. Therefore, these should not be used for extended periods for handling cut flowers to avoid phytotoxicity, increase in microbial contamination and pH and EC of solutions, and reduction in vase life.

Table 1. Recipes for preservatives. Amounts listed were added to one liter of water or ½ liter of water in the case of the soda.

Experiment 1:

1. Tap water
2. 300 ppm citric acid + 200 ppm aluminum sulfate + 20 gram sugar
3. 300 ppm citric acid + 10 ml household bleach + 20 gram sugar
4. 300 ppm citric acid + 0.05 ml Greenshield + 20 gram sugar
5. 300 ppm citric acid + 7 ppm Kathon CG + 20 gram sugar
6. 500 ml lemon/lime soda (1:1 soda:water, not diet soda)
7. 37 ml lemon juice + 10 ml household bleach + 20 gram sugar
8. 6 ml vinegar + 10 ml household bleach + 20 gram sugar
9. 10 ml Floralife Clear Professional Flower Food
10. 10 ml Chrysal Clear Professional 2

Experiment 2:

1. 500 ml lemon/lime soda (1:1 soda:water, not diet soda)
2. 6 ml lemon juice + 20 gram sugar
3. 100 ppm citric acid + 20 gram sugar + 200 ppm aluminum sulfate (citric-al)
4. 400 ppm citric acid + 20 gram sugar alone
5. 400 ppm citric acid + 20 gram sugar + 0.5 ml Greenshield (citric-Greenshield)
6. 400 ppm citric acid + 20 gram sugar + 7 ppm Kathon CG (citric-Kathon)
7. 10 ml Floralife Clear Professional Flower Food (Floralife)
8. 10 ml Chrysal Clear Professional 2 (Chrysal)

Table 2. Effect of continuous (vase) application of homemade and commercial floral preservative solutions on vase life of 'ABC Blue' lisianthus, 'Double Eagle' African marigold, 'Red Bentley' rose, and 'Deep Red' Benary's Giant zinnia. Stems were placed in jars containing 300 mL of solutions. See table 1 for recipes. Data represent means of 15 stems with three stems per vase.

Preservative solutions	Vase life (days)			
	Lisianthus	Marigold	Rose	Zinnia
Tap water	9.7 b	9.3 bc	9.6 abc	11.4 b
Citric acid + aluminum sulfate + sugar	11.8 b	8.7 bcd	10.8 ab	3.3 e
Citric acid + bleach + sugar	10.1 b	5.9 e	9.4 bcd	4.7 de
Citric acid + Greenshield + sugar	20.4 a	10.9 ab	6.8 b	8.5 bcd
Citric acid + Kathon CG + sugar	18.1 a	8.5 bcd	8.5 cde	9.3 bc
Lemon/lime soda	19.9 a	12.1 a	7.5 de	8.3 bcd
Lemon juice + bleach + sugar	11.4 b	6.8 de	8.6 cde	6.3 cde
Vinegar + bleach + sugar	10.7 b	7.5 cde	9.1 bcd	5.9 cde
Floralife Clear Professional Flower food	16.9 a	9.5 bc	10.7 ab	16.6 a
Chrysal Clear Professional 2	17.5 a	9.4 bc	11.5 a	15.9 a
Significance	<0.0001	<0.0001	<0.0001	<0.0001

Table 3. Effect of short-duration (holding) application of homemade and commercial floral preservative solutions on vase life of 'ABC Purple' lisianthus, 'Double Eagle' African marigold, 'Red Bentley' rose, and 'Deep Red' Benary's Giant zinnia. Stems were either placed in one of the solutions for 48 hours, then moved to jars containing 300 mL tap water. See table 1 for recipes. Data represent means of 15 stems with three stems per vase. Experiment 1.

Preservative solutions	Vase life (days)			
	Lisianthus	Marigold	Rose	Zinnia
Tap water	8.4 b	12.2 ab	9.5 b	12.0 bc
Citric acid + aluminum sulfate + sugar	11.1 a	15.4 1	11.5 a	16.9 a
Citric acid + bleach + sugar	10.1 ab	12.4 ab	10.9 ab	14.4 ab
Citric acid + Greenshield + sugar	10.1 ab	12.5 ab	10.5 ab	15.1 ab
Citric acid + Kathon CG + sugar	9.7 ab	14.9 a	11.3 ab	15.2 ab
Lemon/lime soda	10.0 ab	15.2 a	11.2 ab	14.7 ab
Lemon juice + bleach + sugar	10.0 ab	10.9 b	10.9 ab	10.6 c
Vinegar + bleach + sugar	8.5 b	12.7 ab	11.2 ab	12.1 bc
Floralife Clear Professional Flower food	9.3 ab	15.1 a	10.7 ab	13.8 abc
Chrysal Clear Professional 2	9.3 ab	12.3 ab	10.7 ab	13.7 abc
Significance	<0.0007	<0.0001	0.0492	<0.0001

Table 4. Effect of homemade and commercial floral (holding or vase) preservative solutions on vase life of 'ABC Blue' lisianthus, 'Maryland Plumblossom' snapdragon, 'Midseason Cheerful Apricot' stock, and 'Deep Red' Benary's Giant zinnia. Stems were placed in preservative solutions for 48 h, then moved to tap water, or continuously placed in one of the solutions until termination. See table 1 for recipes. Data represent means of 15 stems with three stems per vase. Experiment 2.

Preservative solutions		Vase life (days)			
First 48 h	Vase	Lisianthus	Snapdragon	Stock	Zinnia
Tap water	Tap water	10.2 de	12.3 cd	17.4 gf	8.7 ef
7Up	Tap water	13.4 cde	11.8 cd	8.5 defg	12.7 abcd
Lemon juice + sugar	Tap water	13.0 cde	11.3 cd	9.3 bcdef	13.6 abc
Citric acid + sugar	Tap water	13.1 cde	10.8 cd	8.8 cdefg	13.7 abc
Citric acid + sugar + aluminum sulfate	Tap water	9.3 e	13.9 bcd	8.3 efg	10.0 cdef
Citric acid + sugar + Greenshield	Tap water	12.8 cde	13.4 bcd	8.5 defg	12.1 bcde
Citric acid + sugar + Kathon CG	Tap water	13.7 cde	13.7 bcd	8.7 cdefg	9.3 def
Floralife Clear Professional	Tap water	13.3 cde	10.4 cd	8.7 cdefg	9.4 def
Chrysal Clear Professional 2	Tap water	12.5 cde	11.7 cd	9.1 bcdef	8.0 f
7Up	7Up	19.8 ab	15.7 abcd	10.1 bcde	8.3 ef
Lemon juice + sugar	Lemon juice + sugar	15.0 bcd	9.5 d	7.6 gf	9.8 cdef
Citric acid + sugar	Citric acid + sugar	18.7 ab	13.0 bcd	10.3 abcde	6.7 f
Citric acid + sugar + aluminum sulfate	Citric acid + sugar + aluminum sulfate	12.3 cde	10.4 cd	6.4 g	16.3 a
Citric acid + sugar + Greenshield	Citric acid + sugar + Greenshield	18.7 ab	22.3 a	11.1 abc	14.9 ab
Citric acid + sugar + Kathon CG	Citric acid + sugar + Kathon CG	22.1 a	19.5 ab	12.7 a	15.8 ab
Floralife Clear Professional	Floralife Clear Professional	15.9 bc	16.4 abcd	10.9 abcd	15.2 ab
Chrysal Clear Professional 2	Chrysal Clear Professional 2	15.9 bc	17.1 abc	11.5 ab	
Significance					
Overall		<0.0001	<0.0001	<0.0001	<0.0001
Holding (H)		<0.0001	NS	0.0273	<0.0001
Vase (V)		<0.0001	<0.0001	<0.000	<0.0001

Table 5. Effect of homemade and commercial floral (holding or vase) preservative solutions on vase life of 'Double Eagle' African marigold, 'Red Bentley' rose, and 'Sunbright' sunflower. Stems were placed in preservative solutions for 48 h, then moved to tap water, or continuously placed in one of the solutions until termination. See table 1 for recipes. Data represent means of 15 stems with three stems per vase. Experiment 2.

Preservative solutions		Vase life (days)		
First 48 h	Vase	Marigold	Rose	Sunflower
Tap water	Tap water	7.9 b	10.3 abc	11.7 abcd
7Up	Tap water	11.4 ab	12.7 a	12.7 abc
Lemon juice + sugar	Tap water	13.7 a	11.8 ab	11.5 bcd
Citric acid + sugar	Tap water	13.5a	11.5 ab	12.4 abc
Citric acid + sugar + aluminum sulfate	Tap water	15.5 a	12.1 a	12.2 abc
Citric acid + sugar + Greenshield	Tap water	11.8 ab	12.7 a	11.9 abcd
Citric acid + sugar + Kathon CG	Tap water	12.5 ab	13.1 a	13.0 abc
Floralife Clear Professional	Tap water	11.4 ab	12.9 a	13.1 abc
Chrysal Clear Professional 2	Tap water	11.5 ab	11.5 ab	13.2 ab
7Up	7Up	15.7 a	7.8 d	13.0 abc
Lemon juice + sugar	Lemon juice + sugar	12.8 ab	7.5 d	8.9 e
Citric acid + sugar	Citric acid + sugar	12.7 ab	9.2 bcd	9.9 de
Citric acid + sugar + aluminum sulfate	Citric acid + sugar + aluminum sulfate	12.9 ab	13.1 a	10.9 cde
Citric acid + sugar + Greenshield	Citric acid + sugar + Greenshield	13.7 a	10.6 ab	13.5 ab
Citric acid + sugar + Kathon CG	Citric acid + sugar + Kathon CG	15.5 a	11.4 ab	13.5 ab
Floralife Clear Professional	Floralife Clear Professional	14.7 a	12.4 a	13.7 ab
Chrysal Clear Professional 2	Chrysal Clear Professional 2	14.0 a	11.2 ab	13.9 a
Significance				
Overall		<0.0001	<0.0001	<0.0001
Holding (H)		<0.0001	NS	0.0273
Vase (V)		<0.0001	<0.0001	<0.0001