HANDLING OF CUT ROSES - CONDITIONING AFTER HARVEST, USE OF ANTI-TRANSPIRANTS, AND VARIOUS CONSUMER SOLUTIONS

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Four experiments, all with freshly harvested Jacqueline roses, were conducted from November 1975 through June 1976. There were several objectives: (1) evaluate anti-transpirants on cut roses, (2) evaluate 2 experimental flower preservatives, (3) review several features of conditioning at the grower level and various solutions for extending the consumer life of cut roses.

EXPERIMENT 1

Ninety-six stems were harvested in the greenhouse on November 18, 1975, and immediately placed in a solution of distilled water containing 2 percent Floralife(R) and put in a 35°F refrigerator for 72 hours. After this conditioning period, the stems were tied into 8 bunches of 12 stems each. At this time, 6 bunches were treated with various anti-transpirants, keeping the flower buds above the solutions. When the foliage surface dried from the dips, the roses were packed, each bunch separately in a styrofoam mail-order shipping container. The 8 containers were returned to 35°F storage for 24 hours, then held at 70-80°F for 48 hours of simulated mail delivery. The roses were then unpacked, the stem ends recut to remove 2 cm, and each bunch placed in a consumer solution. The roses were removed when wilted and their days of consumer life recorded. The evaluation room was a constant 78°F with 100 f.c. of florescent light, and ventilated by a ceiling exhaust fan.

EXPERIMENT 2

The objective in this experiment was to again compare anti-transpirants as foliage dips but to include dipping of the flower buds. Flowers were harvested from the greenhouse on May 11, 1976. There were 17 treatments, 6 with anti-transpirants, and 11 to compare other conditioning and consumer solutions. Each treatment consisted of 12 stems of Jacqueline roses, harvested in the greenhouse and immediately placed in the various conditioning solutions. The treatments were held for 42 hours at 35° F. After conditioning, the anti-transpirants were applied by dipping the entire stems and blooms. The moisture on the foliage and blooms was allowed to dry, then all treatments were packed, each treatment separately, in a styrofoam mail-order shipping container. The containers were returned to 35°F refrigeration for 92 hours. There was no simulated mail order shipping at a moderate temperature. Following the 92 hours of refrigeration, the containers were unpacked. The flower stems were recut 2 cm and placed in the consumer solutions in the keeping room for consumer-life evaluation.

EXPERIMENT 3

The objective of this experiment was to evaluate a short (2 hour) period of refrigeration for conditioning the flowers in plain distilled water, then placing the bunches into various consumer solutions. Flowers were harvested from the greenhouse on May 13, 1976. The flowers were all placed in plain distilled water in a 38°F refrigerator. After 2 hours of cooling, the stems were cut to a uniform 16 inches. Five stems were placed in each of the 14 consumer solution treatments. The keeping room was the same as in Experiments 1 and 2.

EXPERIMENT 4

The objective of this experiment was to condition the flowers for 24 hours in various

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solutions, using tap water, and then retaining the same solutions for consumer life evaluation. There was no simulated shipping of the flowers. The roses were harvested in the greenhouse on June 29, 1976. The stems were cut to a uniform 16-inch length and 10 stems were placed in separate containers of the 16 solutions. The flowers, in the solutions, were cooled for 24 hours at 38°F. After cooling, the treatments were left in the same solutions and placed in the keeping room for consumer life evaluation.

This was the only experiment in which tap water was used to make the solutions. Tap water was Colorado River water containing 800 ppm dissolved minerals. A plain tap water treatment and a plain distilled water treatment was included in the experiment. A pH of each solution is reported with the results (Table 4).

RESULTS AND DISCUSSION

In Experiment 1, the time elapse between flowers harvested in the greenhouse and receipt by the consumer was 144 hours, or 6 days. If the consumer placed the stems in either a 1 or 2 percent Floralife(R) solution, the average rose life was 6.8 to 7.3 days (Table 1). If placed in plain distilled water, the consumer life was only 2.6 days. This experiment perhaps is a good illustration of what happens to many roses in the commercial trade. Basically, all the flowers in this experiment were well conditioned at the grower level. The simulated shipping period was 48 hours at very warm temperatures, but the flowers were well cooled when packed in the sealed styrofoam boxes. The anti-transpirant dips do not appear to add significantly to rose life. The greatest difference in consumer life appears to be whether the consumer used a floral preservative, or not.

Table 2 shows consumer life of Jacqueline roses in Experiment 2. This experiment had an elapsed time of 134 hours or about 5½ days between flowers harvested by the grower and receipt by the consumer. There was no warm shipping treatment. The benefit of continuous refrigeration from harvest to consumer is reflected in the greater average days of consumer life for most of the treatments shown in Table 2 as compared to similar treatments in Table 1.

In this experiment the results indicate that 4 of the anti-transpirant treatments, in combination with conditioning and consumer solutions, increased consumer life of cut roses. Treatment "I," a standard treatment without anti-transpirants, averaged 8.3 days consumer life. Treatments B, C, D, and E were the same procedure as treatment "I" but with the anti-transpirants added. These treatments had a consumer life of 10.6, 10.1, 8.8, and 8.8 days respectively.

An interesting comparison of results in Table 2 is with treatments A, I, M, and Q. The best treatment in this experiment was "A" where the roses were conditioned with distilled water and refrigeration, and a solution of 1 percent Floralife(R) was used at the consumer level, resulting in 11.5 days of consumer life. In treatment "I," where 2 percent Floralife(R) was used for conditioning and then a 1 percent consumer solution, the consumer life was 8.3 days. In treatment "M," where distilled water was used throughout, the consumer life was 6.5 days. But in treatment "Q," the poorest treatment in the experiment, where 2 percent Floralife(R) solution was used for conditioning and distilled water for the consumer solution, the consumer life was only 4.5 days. These contrasting results would lead to the conclusion that conditioning at the grower level in a 2 percent Floralife(R) solution is not beneficial if plain water is to be used by the consumer. Many of the treatments in this experiment showed slight interveinal foliage injury which is suspected to be caused from a 2 percent Floralife(R) solution. This injury is rarely observed with a 1 percent Floralife(R) solution.

"Beautify" is an experimental floral preservative, claimed to improve cut rose life, either as a conditioner at the grower level or as a consumer solution. Treatment "H" was the best treatment using this material as a conditioning solution with 1 percent Floralife(R) at the consumer level. Rose blooms remained bright in color and opened well in each of the treatments involving "Beautify," but in all cases some injury appeared on foliage or blooms. Severe dehydration and leaf drop occurred on treatments "N" and "P."

The anti-transpirant treatments used in both experiments 1 and 2 are difficult to evaluate. Five of these materials were used to make solutions based on label recommendations for other crops (cut flowers not mentioned). The Johnson's acrylic wax is not intended to be a plant product. At the 10 percent solution used in the experiments, this material caused some injury to flower petals, and delayed bud opening, but caused no apparent injury to the rose foliage.

The five other anti-transpirants vary in characteristics of handling and uniformity of coating the rose foliage. Wilt Pruf NCF(R) is white, viscous, difficult to measure, and tends to ball-up on the rose foliage. Polytrap(R) is also white, viscous, difficult to measure, but gives a uniform coating that dries rapidly. Folicote(R) also is white, viscous, difficult to measure, but balls-up on the foliage and dries slowly. Folgard(R) is clear and lacquer-like, easy to measure, and gives a uniform leaf coating. Clear Spray(R) is milk-like, easy to measure and covers well. Johnson's acrylic wax is a clear, thin material, easy to measure and covers well.

After 4 days at the consumer level, notes were made on appearance of foliage with the anti-transpirants. Foliage dipped with Polytrap(R) appeared to have the best sheen. Where blooms also were dipped in the anti-transpirants (Experiment 2), petal injury was noted with Wilt Pruf NCF(R) and Johnson's acrylic wax. Folgard(R) prevented blooms from opening, although foliage and petal injury was not apparent. At the solution concentrations used in these experiments, Polytrap(R) and Clear Spray(R) appear to be anti-transpirants that could have a potential for treating cut roses. The results of Experiment 2 indicate that these two anti-transpirants extended the consumer life of Jacqueline roses over all the other treatments except "A" treatment (distilled water conditioning and 1 percent Floralife(R) consumer solution).

Experiment 3 results are reported in Table 3. Since there were only 2 hours of conditioning at the grower level and no transfer time elapse to the consumer, the days of consumer life are generally greater than similar solution treatments used in Experiments 1 and 2. This experiment is easier to comprehend since the solution for each treatment was used for the 2-hour refrigerated conditioning period and also for the consumer solution.

The best solution was 1 percent Floralife(R) resulting in a consumer life of 14.0 days. A solution of 2 percent Floralife(R) resulted in 10.2 days rose life. This would indicate that 2 percent Floralife(R) is somewhat detrimental to Jacqueline roses as compared to a 1 percent Floralife(R) solution. In this same category, the 2 percent OASIS(R) solution resulted in the roses lasting 5.2 days; again at 2 percent concentration, some ingredient may be adversely affecting rose consumer life.

Treatments 2, 3, and 4 compared 1 percent sucrose solutions with single chemicals which are often combined in one solution. These single-chemical solutions are quite satisfactory for roses. Some very slight foliage injury occurred with treatment 4 which contained 200 ppm of 8-Hydroxyquinoline citrate. This chemical may be the problem where a 2 percent solution of a commercial product such as Floralife(R) or OASIS(R) is used for roses. Treatment 9 (6.8 days) contains all three chemicals, used

separately in treatments 2, 3, and 4. With all three chemicals in one solution, there is a notable reduction in consumer life of roses.

The 2 experimental products, "Beautify" and "X," were not impressive for increasing rose life. Both products caused moderate to severe foliage injury at most of the rates used in the experiment.

Table 4 shows the days of consumer life for 16 consumer solutions used in Experiment 4. This experiment differed from the others in that most solutions were made with tap water containing about 800 ppm dissolved salts. There was one distilled water treatment for comparison with plain tap water. Again, as in Experiment 3, there was a relatively short conditioning period, refrigeration in the solutions for 24 hours at the grower level. There was no simulated warm shipping period. Again, the solution for each treatment was used for the conditioning period and also for the consumer solution. As in Experiment 3, there is a greater consumer life than for Experiments 1 and 2 where there was a long elapse time between grower and consumer.

Experiments 3 and 4 set some consistent trends. In both experiments, 1 percent Floralife(R) (in distilled or tap water) is the best solution for Jacqueline roses. In both experiments the same solutions were used at the grower and consumer levels.

In both Experiments 3 and 4, two other treatments ranked high; they are 1 percent sucrose plus 25 ppm of silvernitrate, and 1 percent sucrose plus 50 ppm of aluminum ion from aluminum sulfate. An inconsistent treatment was 1 percent sucrose plus 200 ppm of 8-Hydroxyquinoline citrate. This solution resulted in 10.2 days consumer life in Experiment 3 and only 3.1 days of consumer life in Experiment 4. Could it be that this chemical acts differently when used with tap water containing large quantities of salts as compared to use with distilled water? Acidity of flower solutions is known to be a factor in consumer life of flowers. In general, the lower pH solutions are also the best treatments (Table 4).

As in Experiment 3, the two experimental products, "Beautify" and "X," do not indicate their potential to further improve rose consumer life over other more proven materials.

CONCLUSIONS

1. Jacqueline cut roses can have a reasonable consumer life of 6.8 to 7.3 days if the consumer uses a preservative solution, even following 6 days elapse time between grower and consumer, assuming the roses were properly conditioned by the grower and properly handled between the grower and consumer.

2. For roses, a 1 percent solution of a commercial preservative, such as Floralife(R) or OASIS(R), is superior to a 2 percent solution.

3. With only 24 hours for conditioning at the grower level and no time elapse to the consumer, the life of Jacqueline roses can be extended to about 14 days if both grower and consumer use a preservative solution.

4. Distilled or deionized water is superior to high salt tap water (800 ppm) for extending cut rose life when no preservatives are used. A 1 percent Floralife(R) solution made with tap water provided rose life about equal to a 1 percent Floralife(R) solution made with distilled water, where both grower and consumer used the preservative solutions.

5. The use of anti-transpirants may have a potential for extending life of cut roses,

but additional research is needed to be certain.

6. Experimental products are frequently reported to be able to extend rose life, but often have not been properly compared with proven commercial products or university solutions. Seldom does an experimental product prove superior to what research has already demonstrated.

7. Maintaining roses at low temperature (35° to 38°F) from grower to consumer, in addition to use of preservative solutions, is also important to obtain maximum consumer life. This temperature maintenance is clearly illustrated in comparing average consumer life of Jacqueline roses with Experiments 1 and 2. The roses in both of these experiments had 5½ to 6 days elapse time between grower and consumer, but roses in Experiment 2 were kept cold during all of the elapse time and the life of the flowers was about double those in Experiment 1.

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Table 1. Days of consumer life of Jacqueline roses, treated with anti-transpirants and conditioned in Floralife(R) solution. (Experiment 1)

Treatments		
Conditioning[1]	Consumer solution	Days, Consumer life
2% Floralife, 10% Johnson's acrylic wax	1% Floralife	7.3
2% Floralife, 10% Wilt Pruf NCF	1% Floralife	7.2
2% Floralife, 20% Folligard	1% Floralife	7.2
2% Floralife	2% Floralife	7.0
2% Floralife, 2% Folicote	1% Floralife	6.9
2% Floralife, 1% Polytrap	1% Floralife	6.8
2% Floralife, 20% Clear Spray	1% Floralife	6.8
2% Floralife	Distilled Water	2.6

[1]Conditioning at 35°F in the 2% Floralife solutions for 72 hours; anti-transpirants treatments applied and treatments packed in individual styrofoam boxes, returned to 35°F for 24 hours; then boxes held at 70-80°F for 48 hours before placing flowers in the consumer solutions. All solutions were made with distilled water.

Table 2. Days of consumer life of Jacqueline roses, using anti-transpirants and stem-water solutions. (Experiment 2)

Treatments			
	Conditioning[1]	Consumer solution	Days, Consumer life
A	Distilled water	1% Floralife	11.5
B	2% Floralife, 1% Polytrap	1% Floralife	10.6
C	2% Floralife, 20% Clear Spray	1% Floralife	10.1
D	2% Floralife, 10% Wilt Pruf NCF	1% Floralife	8.8
E	2% Floralife, 2% Folicote	1% Floralife	8.8
F	2% Floralife, 50 ppm $AgNO_3$	1% Sucrose, 25ppm $AgNO_3$	8.8
G	2% Sucrose, 50ppm $AgNO_3$	Distilled water	8.7
H	6.2% Beautify	Distilled water	8.5
I	2% Floralife	1% Floralife	8.3
J	6.2% Beautify	1% Floralife	8.0
K	2% Floralife, 20% Foligard	1% Floralife	7.8[2]
L	2% Floralife, 10% Johnson's acrylic wax	1% Floralife	7.3[2]
M	Distilled water	Distilled water	6.5
N	6.2% Beautify	3.1% Beautify	6.0
O	Distilled water	1% Sucrose, 25ppm AgN_3	5.3
P	Distilled water	3.1% Beautify	4.9
Q	2% Floralife	Distilled water	4.5

[1]Conditioning at 35°F for 42 hours in the various solutions; anti-transpirant treatments applied and treatments packed in individual styrofoam boxes, returned to 35°F for 92 hours before placing flowers in the consumer solutions. All solutions made with distilled water.

[2]Buds never opened, or very little.

Table 3. Days consumer life of Jacqueline roses in 14 consumer solutions. (Experiment 3)

Treatments[1]	Days, consumer life	Foliage injury[2]
1. 1% Floralife	14.0	0
2. 1% Sucrose, 25 ppm $AgNO_3$	12.4	0
3. 1% Sucrose, 50 ppm Aluminum[3]	12.2	0
4. 1% Sucrose, 200 ppm 8-HQC[4]	10.2	1
5. 2% Floralife	10.2	2
6. 5% Beautify[5]	9.4	5
7. 1% Sucrose, 5% Beautify	9.4	5
8. 1% Sucrose, 1% "X"[6]	8.2	2
9. 1% Sucrose, (+ 2, 3, 4, above)	6.8	3
10. 1% "X"	6.6	3
11. Distilled water	5.8	0
12. 2% Oasis	5.2	1
13. 5% "X"	5.0	4
14. 1% Sucrose, 5% "X"	5.0	5

[1]All treatments conditioned in plain distilled water for 2 hours, then placed in various consumer solutions. All solutions made with distilled water.

[2]Rating made on 4th day. 0 = no leaf injury, 5 = severe injury, leaf drop

[3]From aluminum sulfate

[4]8-Hydroxyquinoline citrate

[5]Experimental product from Delaware

[6]Experimental product from San Diego

Table 4. Days consumer life of Jacqueline roses in 16 consumer solutions. (Experiment 4)

Treatments[1]	Days, consumer life	pH of solutions	Injury[2] to foliage
1% Floralife	14.6	5.4	0
2% Floralife	13.5	5.0	1
1% Sucrose, 50 ppm Aluminum[2]	12.3	5.4	0
1% Sucrose, 50 ppm Al, 200 ppm 8-HQC, 25 ppm $AgNO_3$	11.1	4.6	0
1% Sucrose, 25 ppm $AgNO_3$	10.2	7.5	0
1% Oasis	10.1	4.8	0
2.5% Beautify	10.1	7.1	3
2.5% Beautify, 1% Sucrose	9.2	7.0	5
5.0% Beautify, 1% Sucrose	8.9	6.8	5
Distilled water	5.9	5.6	0
Tap water	3.3	7.3	0
1% Sucrose, 200 ppm 8-HQC	3.1	6.6	2
10% "X," 1% Sucrose	0.3	7.7	wilt
20% "X"	0.2	8.5	wilt
20% "X," 1% Sucrose	0.0	8.0	wilt
10% "X"	0.0	8.1	wilt

[1]All solutions made with tap water, except the plain distilled water treatment. Each treatment conditioned in the solution for 24 hours at 38°F, then returned to the consumer room in the same solution.

[2]Rating made on 6th day. 0 = no leaf injury, 5 = severe injury, leaf drop.