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*Production and Postharvest Evaluations of*

# *Fresh-Cut Peonies*



*Kansas State University Agricultural Experiment Station and Cooperative Extension Service*

# 1999 PRODUCTION AND POSTHARVEST EVALUATIONS OF FRESH-CUT PEONIES

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In the fall of 1992, a cultivar trial of peony plants (*Paeonia lactiflora* Pallas) was established at the Kansas State University Horticulture Research Center, Manhattan, KS, to determine which cultivars would produce quality fresh-cut flowers. The cultivar trial plots include five plants set 0.91 m apart within the beds. Beds are 0.91 m-wide with 1.22 m-wide grass aisles between them. In addition to the yield and harvest data, flowers from these trials were used for postharvest evaluations studies.

In 1993, a commercial-size trial was established of the cultivar ‘Shawnee Chief’, a red double. The initial planting included three beds 0.91 m wide with 1.22 m-wide grass aisles between them. Plants were set in double rows in the beds with 0.61 m between the double rows and 0.91 m between plants in the rows. Beds were 32 m long with a total of 70 plants per bed. In the fall of 1995, seven more beds were established in the same manner. Four of these beds contain ‘Shawnee Chief’, and three of them contain ‘Snow Mountain’, a white bomb-type.

This year’s report includes results of the following studies:

Harvest Season and Yield

Flower Senescence Patterns

Initial Postharvest Evaluations

    Cultivar Assessments

    Holding Solution Evaluations

Calcium Salt Pulsing

Long-Term Cold Storage

    Cultivar Assessments

    Prestorage Treatments

    Disease Assessments

## **Postharvest Evaluations of Fresh-Cut Flowers**

Postharvest handling and evaluation of the flowers for all studies were similar. Flowers were harvested in the colored bud stage when they were soft like a marshmallow. They then were prepared by cutting 2.5 cm from the stems under water and by removing the leaves from the bottom two-thirds of the stems. The flowers were placed in 600 ml water in 0.9 liter glass jars. Total vase life was determined from the time flowers were placed in jars to when the flowers became wilted beyond acceptable condition or the petals had abscised. Open vase life was determined as from the time when the flowers were almost open to when they had wilted or the petals had abscised. Diameters were measured when the flowers were fully open.

## **Harvest Season and Yields**

Table 1 contains the harvest season dates and yield data , number of flowers per plant, for peony cultivars evaluated in 1999. The season started early, on May 2, and ended with the last cultivar being harvested on May 26.

**Table 1. 1999 Harvest season and yield results.**

Cultivar	Color	Yield per Plant	Season
Apache, early mid	red	5.4	5/10-16
Comanche, early mid	red	2.4	5/16-18
David Harum, mid	red	14.4	5/14-20
Felix Supreme, mid	red	23.8	5/16-23
Felix Crousse, mid	red	6.8	5/16-20
Grover Cleveland, late	red	5	5/18-24
Henry Bocktoce, early mid	red	5	5/14-20
Karl Rosenfield, mid	red	14.4	5/15-26
Lora Dexheimer, mid	red	16.5	5/15-26
Louis van Houttei, late mid	red	12.4	5/16-24
Peter Brand, early mid	red	4.3	5/10-13
Philippe Rivoire, mid	red	9.6	5/18-26
Raspberry Ice, early	red	1.4	5/10-14
Red Charm, early mid	red	10.0	5/7-15
Richard Carvel, early	red	17.8	5/14-23
Shawnee Chief, mid	red	7.7	5/17-23
Baroness Schroeder, late mid	pink	4.2	5/22-26
Better Times, late mid	pink	3.6	5/12-18
Doris Cooper/Lady Kate, late	pink	3.8	5/20-26
Dr. Alexander Fleming, early mid	dk pink	11.7	5/13-21
Edulis Superba, early	pink	13.2	5/7-15
Grace Batson, late mid	pink	8.4	5/19-23
Hermoine, late mid	pink	7.8	5/18-26
James Pillow, late	pink	2.6	5/20-26
Jayhawker, early	pink	9.6	5/15-16
Mister Ed, early	pink	9.4	5/12-24
Monsieur Jules Elie, early	pink	15.6	5/12-24

Mrs. F.D. Roosevelt, mid	pink	8.2	5/13-19
Raspberry Sundae, mid	pink	10	5/16-22
Reine Hortense, mid	pink	7.8	5/16-21
Rose Pearl, mid-late	pink	5.7	5/16-19
Sarah Bernhardt, late	lt. pink	2.8	5/20-24
Sarah Bernhardt, late	lt. pink	11.9	5/17-26
Dr. Alexander Fleming, early mid	lt.pink	32.2	5/18-24
Therese, mid	pink	18.4	5/19-24
Walter Faxon, mid	pink	14.8	5/19-26
Westerner, mid	pink	2.8	5/16-18
Wrinkles and Crinkles, late	pink	3.2	5/17-24
69A	white	15.8	5/13-23
Bridal Icing, mid	white	7	5/15-23
Bridal Shower, mid	white	12	5/15-23
Candy Heart, early mid	white	7.2	5/17-26
Capitol Dome, mid	white	3.0	5/15-23
Cloud Cap, mid	white	6.6	5/16-23
DH 1460	white	1.7	5/16-21
Dr. F.G. Brethour, late	white	10.6	5/19-26
Duchess de Nemours, early	white	17.4	5/12-19
Festiva Supreme, mid	white	16.8	5/11-20
Festiva Maxima, early	white	8.6	5/12-19
Henry Sass, late mid	white	16.6	5/16-24
Mme. de Vernville, early	white	7.4	5/13-19
Snow Mountain, late	white	7	5/11-19
Spellbinder, early	white	5.3	5/8-14
Coral 'n' Gold, early	coral	3.3	5/10-14
Coral Fay, early	coral	7	5/2-7
Lovely Rose, very early	coral	7.3	5/10-16
Orange Lace, mid	coral	7.2	5/5-9

## **Flower Senescence Patterns for Different Peony Cultivars**

### **Petal Drop or Abscission**

Apache	Edulis Superba	Louis van Houttei	Raspberry Sundae
Better Times	Felix Crousse	Lovely Rose	Red Charm
Bridal Shower	Felix Supreme	Madame de Vernville	Reine Hortense
Bridal Icing	Festiva Maxima	Mister Ed	Richard Carvel
Candy Heart	Grace Batson	Mon. Jules Elie	Rose Pearl
Comanche	Henry Bocktoce	Mrs. FDR	Spellbinder
Coral Fay	Hermoine	Orange Lace	Walter Faxon
Coral'n'Gold	James Pillow	Ozark Beauty	Westerner
Doris Cooper	Jayhawker	Peter Brand	
Duchess de Nemours	Lady Kate	Philippe Rivoire	

### **Petal Wilting**

Snow Mountain	Capitol Dome	Festiva Supreme	DH1460
Solange	David Harum	Cloud Cap	Dr. F.G. Brethour
Mrs. Livingston Farrand	Baroness Schroeder	Grover Cleveland	

## **Initial Postharvest Evaluations**

**Table 2. 1999 Postharvest evaluation of fresh-cut peony flowers held in water**

Cultivar/Color	Diameter (inches)	First Day Open	Total Vase Life (days)	Open Vase Life (days)	Death
Capitol Dome-White	4.4	2.3	7.7	6.4	wilt
Comanche-Red	6.0	1.6	6.9	4.6	drop
David Harum-Red	4.4	2.0	8.5	7.5	wilt
Peter Brand-Red	4.6	2.4	7.9	6.5	drop
Orange Lace-Coral	5.1	1.9	6.2	5.3	drop
Baroness Schroeder-Pink	3.1	2.6	7.0	3.2	wilt
Edulis Superba-Pink	4.6	2.3	7.6	6.3	drop
Grace Batson-Pink	5.7	1.1	8.0	7.8	wilt
Lovely Rose-Pink	3.5	2.2	6.4	5.2	drop
Rose Pearl-Pink	4.5	2.8	7.7	5.5	drop
Westerner-Pink	4.6	3.5	8.7	6.1	drop

Values in table are means of three replications of five flower stems.

**Table 3. 1999 Postharvest evaluation of fresh-cut peony flowers held in floral preservative.**

Cultivar/Color	Diameter (inches)	First Day Open	Total Vase Life (days)	Open Vase Life (days)	Death
Coral Fay-Coral	5.1	1.7	4.4	3.3	drop
Felix Supreme-Red	4.2	1.3	6.9	6.6	drop
Festiva Supreme-White	5.4	2.1	6.1	4.7	wilt

Values in table are means of three replications of five flower stems.

Holding peonies in floral preservative resulted in a change in the way flowers senesced for 'Duchess de Nemours', 'Red Charm', 'Madame de Vernville', 'Henry Bocktoce', and 'Candy Heart'. Flowers held in water senesced by dropping petals, whereas those held in floral preservative wilted (Table 4). Use of floral preservatives resulted in bigger flowers for 'Candy Heart'; faster opening for 'Apache' and 'Coral'n'Gold'; and longer open vase life for 'Apache',

‘Coral’n’Gold’, ‘Candy Heart’, ‘Henry Bocktoce’, ‘Red Charm’ and ‘Spellbinder’. Using water resulted in longer open vase life for ‘Duchess de Nemours’ and ‘Grover Cleveland’.

**Table 4. 1999 Postharvest evaluation of fresh-cut peony flowers held in water and floral preservative**

Cultivar/Color	Diameter (inches)	First Day Open	Total Vase Life (days)	Open Vase Life (days)	Death
Apache-Red					
Water	4.4 <sup>Z</sup>	2.1	5.9	4.8	drop
Floral Preservative	4.0 ns	1.2 ***	6.4 ns	6.3***	drop
Cloud Cap-White					
Water	5.1	2.4	8.9	7.3	wilt
Floral Preservative	5.0 ns	2.3 ns	7.9***	6.7 ns	wilt
Coral’n’Gold-Coral					
Water	3.0	2.5	5.9	4.1	drop
Floral Preservative	3.6 ns	1.4***	4.9***	4.6**	drop/wilt
Candy Heart-White					
Water	4.4	4.2	8.9	5.7	drop
Floral Preservative	5.1*	1.9 ns	8.1***	7.0**	wilt
Doris Cooper/Lady Kate-Pink					
Water	4.9	3.3	8.6	6.3	drop
Floral Preservative	5.7ns	1.9 ns	6.5*	5.6 ns	drop
Grover Cleveland-Red					
Water	4.7	3.5	9.5	7.0	wilt
Floral Preservative	4.0 ns	2.9 ns	7.2***	5.3***	wilt
Henry Bocktoce-Red					
Water	4.4	3.6	7.9	4.7	drop
Floral Preservative	4.2ns	2.6ns	10.1***	7.9**	wilt
Madame de Vernville-White					
Water	5.1	1.5	8.0	7.4	drop
Floral Preservative	4.5*	2.2*	7.0ns	6.6ns	wilt
Red Charm-Red					
Water	5.8	1.7	6.3	5.6	drop
Floral Preservative	6.1 ns	2.2 ns	8.3***	7.0***	wilt
Spellbinder-White					
Water	5.5	3.6	8.8	6.2	drop/wilt
Floral Preservative	5.8ns	3.6ns	11.5***	8.9***	drop
Duchess de Nemours-White					
Water	5.0	1.4	6.9	6.5	drop
Floral Preservative	5.0ns	1.0ns	5.3***	5.3***	wilt

Values in table are means of three replications of five flower stems.

<sup>Z</sup> ns, \*, \*\*, and \*\*\*, means are not significant, significant at 5% level of probability, highly significant at 1% level of probability, and very highly significant at the 0.1% level of probability, respectively.

### **Calcium Salt Studies**

Flowers of the peony cultivar ‘Shawnee Chief’, a red double, were harvested in the mature bud stage and sorted into bunches of five stems. Leaves were removed from the bottom 2/3 of the stems, which were cut under water by 2.5 cm before being placed in the treatment solutions. Treatments included a control (no pulsing) and a two by four factorial of four different sources of calcium (calcium hydroxide, calcium sulfate, calcium nitrate, and calcium chloride) at two levels (10 mM and 100 mM). Flowers were held in treatment solutions for 2 hours at 22° C.

After treatment, the five flower bunches were placed in 0.9 liter glass jars holding approximately 600 ml water and kept at 22° C. Flower diameter, days to open, total vase life, and open vase life were recorded. Visual observations of flower form and color also were recorded. Treatments were replicated three times with five stems per replication.

**Table 5. Flower diameter, vase life, and days to open of ‘Shawnee Chief’ fresh cut flowers treated with calcium chloride, calcium hydroxide, calcium nitrate and calcium sulfate at 10 mM and 100 mM.**

Treatment	Flower Diameter (inches)	Vase Life (days)	Days to Open
Control	4.50	6.00	2.0
Calcium Chloride			
10 mM	4.69	5.07	2.0
100 mM	4.23	5.00	2.0
Calcium Hydroxide			
10 mM	4.47	5.27	2.0
100 mM	4.83	5.00	2.0
Calcium Nitrate			
10 mM	4.63	5.93	2.0
100 mM	3.97	6.07	2.0
Calcium Sulfate			
10 mM	4.77	5.87	2.0
100 mM	4.67	5.33	2.0
LSD at 5% probability level	0.33	0.23	Not Significant

Values in table are means of three replications of five flower stems.

Differences in solubility and pH of the calcium treatment solutions were noted. Calcium chloride and calcium nitrate were soluble at both concentration levels, whereas calcium sulfate was soluble only at the 10 mM level and saturated at the 100 mM level. Calcium hydroxide was saturated at both 10 mM and 100 mM. As expected, the pH of the calcium hydroxide solutions were almost 3 units higher than the pHs of the others.

The petals of the flowers treated with the higher level of calcium did not appear to open as much as those of the other flowers, but only flowers in calcium nitrate were measured to be smaller (Table 5). The petals also appeared to be more cupped, and the tips of the petals of the calcium sulfate-treated flowers had a bluish cast. Petals of flowers treated with the higher levels of calcium nitrate and both levels of calcium chloride appeared to be orange-red.

None of the calcium treatments improved the vase life of the peony flowers over that of control flowers, and no treatment differences occurred in the length of time for the flowers to open (Table 5). Flowers treated with the 10 mM levels of calcium nitrate and calcium sulfate had vase lives similar to that of the control, but all others had shorter vase lives. Only the calcium nitrate 100 mM treatment significantly affected the size of the flowers.

The use of calcium in pulsing solutions does not appear to be beneficial for extending the vase life of this cultivar, ‘Shawnee Chief, red double, and the carrier anion had no apparent effects. The sulfate, nitrate, and chloride forms all altered the color of the outer petals.

### **Long-Term Cold Storage**

**Table 6. 1999 Postharvest evaluation of fresh-cut peony flowers stored for 4 weeks at 1 C.**

Cultivar/Color	Diameter (inches)	First Day Open	Vase Life(days)		Initial Openness Rating after Storage	Death
			Total	Open		
James Pillow-Pink	4.4	1.8	8.4	7.6	3.5	drop
Orange Lace-Coral	4.3	2.0	4.0	3.0	4.0	wilt
Philippe Rivoire-Red	4.0	2.5	6.8	5.3	2.7	drop
Red Charm-Red	4.2	2.1	4.7	3.8	3.0	drop
Richard Carvel-Red	3.9	2.1	4.8	3.7	2.9	drop
Wrinkles and Crinkles-Pink	3.9	3.7	6.2	3.6	1.5	drop/wilt

Values in table are means of three replications of five flower stems.

‘James Pillow’ was the only cultivar of those tested to have acceptable vase life and bud opening time (Table 6). ‘Red Charm’ flowers had turned dark while in storage.

### **Prestorage treatments**

Flowers were treated with one of three prestorage treatments depending on the number of flowers available and compared to a no-treatment control.

1. 2-hour pulse of 10 % sucrose at room temperature(~22 C)
2. 2-hour pulse of 10 % sucrose+100mM calcium chloride at room temperature(~22 C)
3. 2-hour pulse of 100mM calcium chloride at room temperature(~22 C)

After prestorage treatment, flowers were bunched in fives and placed into 2-gallon self-sealing polyethylene bags. Treatments were replicated three times. Flowers were placed in cold storage, 2 C, for 4 weeks for most cultivars or 8 and 12 weeks for others. When the prescribed storage time was over, stems were cut under water by 2.5 cm and flowers were placed in 1 qt. glass jars filled with approximately 600 ml water. Bud openness, days to open, vase life, flower diameter, and type of death were recorded. For bud openness, flower buds were rated on a 1 to 5 firmness and color scale:

- |                                    |                                     |
|------------------------------------|-------------------------------------|
| 1=firm, no or little color showing | 4=very soft with color showing      |
| 2=firm, with color showing         | 5=very soft with petals almost open |
| 3=soft with color showing          |                                     |

The prestorage pulsing treatments had no effect or no benefit on the postharvest parameters measured for ‘Better Times’, DH1460, ‘Felix Crousse’, ‘Hermoine’, ‘Bridal Icing’, ‘Reine Hortense’, ‘David Harum’, and ‘Louis van Houttei’ (Tables 7, 8, and 9 ). Prestorage pulsing resulted in the flower buds being softer coming out of storage for ‘Grace Batson’, ‘Jayhawker’, ‘Dr. F.G. Brethour’, ‘Raspberry Sundae’, ‘Walter Faxon’, ‘Mons. Jules Elie’, ‘Edulis Superba’, ‘Mister Ed’, and ‘Ozark Beauty’. Flowers of ‘Jayhawker’, ‘Lora Dexheimer’, ‘Edulis Superba’, and ‘Mister Ed’ opened quicker when they had been pulsed. The pulsing pretreatments did not affect the other cultivars. Flowers pulsed with 10% sucrose were larger for cultivars ‘Lora Dexheimer’, ‘Mrs. FDR’, ‘Edulis Superba’, and ‘Mister Ed’. Pulsing with 10% sucrose enhanced the vase lives of ‘Mons. Jules Elie’, ‘Mister Ed’, ‘Ozark Beauty’, and ‘Peter Brand’.

Because many cultivars were unresponsive to the prestorage pulsing treatments, and flowers of several cultivars were much softer coming out of cold storage after pretreatment, the pretreatment pulsing can be considered only for ‘Peter Brand’, whose flowers lasted longer after cold storage when pretreated but had no differences in bud softening.

Flowers of ‘Festiva Maxima’ stored for 12 weeks opened quicker when pulsed with 10% sucrose(Tables 10 and 11). Both pulsing pretreatments resulted in flower buds coming out of storage softer than those of the control flowers.



**Table 7. 1999 Postharvest evaluation of fresh cut peony flowers stored for 4 weeks at 1 C with prestorage pulse treatments of 10% sucrose; 10% sucrose and 100mM calcium chloride; and 100mM calcium chloride(Ca).**

Cultivar/Color Pretreatment	Diameter (inches)	First Day Open	Vase Life(days)		Initial Openness Rating after Storage	Death
			Total	Open		
<b>Dr. F. G. Brethour-White</b>						
Control	5.0 <sup>Z</sup>	2.2	7.5	6.3	2.8b	wilt ab
10% Sucrose	5.5	1.9	7.6	6.7	3.4a	wilt b
10% Sucrose+Ca	5.1	2.0	7.9	6.9	3.4a	wilt ab
Ca	5.5	2.0	7.8	6.8	3.9a	drop a
<b>David Harum-Red</b>						
Control	3.8	2.1	5.7	4.6	2.1b	drop
10% Sucrose	4.3	1.8	6.5	5.7	3.2a	drop
10% Sucrose+Ca	4.1	1.8	6.2	5.4	3.4a	drop
Ca	4.0	1.9	6.1	5.3	3.1a	drop
<b>Louis van Houttei-Red</b>						
Control	3.5	2.0	6.1	5.1	3.1	drop
10% Sucrose	3.6	2.1	6.4	5.0	3.2	drop
10% Sucrose+Ca	3.8	2.1	5.9	4.9	3.5	drop
Ca	4.0	1.9	5.9	5.1	3.7	drop
<b>Mons. Jules Elie-Pink</b>						
Control	5.3	2.0	7.0a	6.0b	2.3c	drop a
10% Sucrose	5.6	1.9	7.0a	6.1b	3.4 b	drop a
10% Sucrose+Ca	5.9	2.1	7.0a	6.5a	4.1a	drop a
Ca	5.4	2.1	6.6 b	5.7 b	3.6 ab	wilt b
<b>Snow Mountain-White</b>						
Control	4.0 c	1.9	7.6	6.7 b	3.8	wilt
10% Sucrose	4.5 ab	1.7	7.9	7.2 b	4.1	wilt
10% Sucrose+Ca	4.8 a	1.5	8.7	8.2	4.3	wilt
Ca	4.3 bc	1.6	8.0	7.4	4.1	wilt
<b>Dr. Alexander Fleming,-Pink</b>						
Control	4.9 b	2.2 b	4.9	3.8 b	2.9	drop
10% Sucrose	4.8 b	2.7 a	5.1	3.4 c	2.7	drop
10% Sucrose+Ca	5.4 a	2.1 b	5.3	4.1 a	2.7	drop
Ca	4.5 b	1.9 b	5.4	4.3 a	2.7	drop
<b>Duchess de Nemours-White</b>						
Control	4.0 b	2.0	5.1	4.1	2.9	wilt b
10% Sucrose	4.9 a	1.9	5.0	4.1	3.5	drop a
10% Sucrose+Ca	4.8 a	2.0	5.0	4.1	3.3	drop a
Ca	4.2 b	1.9	5.0	4.1	3.6	drop a
<b>69A-White</b>						
Control	4.2 ab	1.9 a	6.3 a	5.3 a	2.8 b	drop
10% Sucrose	4.4 a	1.4 b	5.4 b	4.9 ab	4.4 a	drop
10% Sucrose+Ca	4.5 a	1.5 b	5.5 b	5.1 a	4.4 a	drop
Ca	4.0 b	1.7 ab	5.1 b	4.3 b	4.0 a	drop

Values in table are means of three replications of five flower stems.

<sup>Z</sup> Cultivar values within columns followed by different letters are significantly different at the 5% level of probability.

**Table 8. 1999 Postharvest evaluation of fresh cut peony flowers stored for 4 weeks at 1 C with prestorage pulse treatment of 10% sucrose.**

Cultivar/Color Pretreatment	Diameter (inches)	First Day Open	Vase Life(days)		Initial Openness Rating after Storage	Death
			Total	Open		
<b>Better Times-Pink</b>						
Control	3.9 <sup>Z</sup>	1.9	5.5	4.6	3.9	drop
10% Sucrose	4.1ns	1.7ns	5.4ns	4.7ns	3.9ns	drop
<b>DH1460-White</b>						
Control	5.3	2.0	7.7	6.7	2.7	wilt
10% Sucrose	5.0ns	1.9ns	7.47ns	6.5ns	3.3ns	wilt
<b>Felix Crousse-Red</b>						
Control	4.2	1.9	7.1	6.2	2.6	drop
10% Sucrose	4.52ns	1.8ns	7.6ns	6.8	3.2ns	drop
<b>Grace Batson-Pink</b>						
Control	4.7	2.0	7.1	6.1	2.7	drop
10% Sucrose	4.7	1.7ns	7.2ns	6.5ns	4.0**	drop
<b>Hermoine-Pink</b>						
Control	4.6	2.6	5.2	3.4	2.4	drop
10% Sucrose	4.4ns	3.2ns	4.7ns	2.5ns	1.8ns	drop
<b>Jayhawker-Pink</b>						
Control	4.7	1.9	8.9	8.0	2.7	drop
10% Sucrose	5.0ns	1.6*	8.7ns	8.1ns	3.9**	wilt**
<b>Lora Dexheimer-Red</b>						
Control	3.5	2.4	6.9	5.3	2.5	wilt/ wilt/
10% Sucrose	4.0*	1.9*	6.1ns	4.9ns	3.2	wilt/ wilt/
<b>Mrs. FDR-Pink</b>						
Control	4.7	2.0	7.3	6.3	3.5	drop
10% Sucrose	5.2*	1.9ns	7.2ns	6.3ns	3.7ns	drop
<b>Raspberry Sundae-Pink</b>						
Control	4.4	2.1	5.9	4.9	2.7	drop
10% Sucrose	4.7ns	2.0ns	6.2ns	5.2ns	3.1*	drop
<b>Walter Faxon-Pink</b>						
Control	4.3	2.0	6.6	5.9	2.9	drop
10% Sucrose	4.3ns	1.8ns	7.0ns	6.2ns	3.7*	drop

Values in table are means of three replications of five flower stems.

<sup>Z</sup> ns, \*, \*\*, and \*\*\*, means are not significant, significant at 5% level of probability, highly significant at 1% level of probability and very highly significant at the 0.1% level of probability, respectively.

**Table 9. 1999 Postharvest evaluation of fresh cut peony flowers stored for 4 weeks at 1 C with prestorage pulse treatments of 10% sucrose or 10% sucrose and 100mM calcium chloride(Ca).**

Cultivar/Color Pretreatment	Diameter (inches)	First Day Open	Vase Life(days)		Initial Openness Rating after Storage	Death
			Total	Open		
<b>Bridal Icing-White</b>						
Control	5.0 <sup>Z</sup>	2.1a	4.9	3.8	2.5b	drop
10% Sucrose	4.8	1.9ab	4.9	4.1	4.1a	drop
10% Sucrose+Ca	5.0	1.6b	4.9	4.4	4.3a	drop
<b>Edulis Superba-Pink</b>						
Control	4.9a	2.0a	5.6	4.6	2.1c	drop
10% Sucrose	5.3a	1.4b	5.1	4.5	4.5a	drop
10% Sucrose+Ca	4.5b	1.7ab	5.3	4.5	3.8b	drop
<b>Mister Ed-Pink</b>						
Control	5.3b	2.0a	7.0	6.0b	2.2b	drop
10% Sucrose	6.0a	1.3b	6.9	6.6a	4.1a	drop
10% Sucrose+Ca	5.3b	2.1a	6.9	5.9b	3.2ab	drop
<b>Ozark Beauty-Pink</b>						
Control	3.8	2.1	6.8a	5.7	2.7b	drop
10% Sucrose	4.2	2.1	6.3a	5.0	3.7a	drop
10% Sucrose+Ca	4.1	1.7	5.6b	4.8	3.9a	drop
<b>Peter Brand- Red</b>						
Control	3.9	2.0	5.1b	4.1c	3.1	drop
10% Sucrose	3.8	2.1	5.7a	4.5b	3.1	drop
10% Sucrose+Ca	3.7	2.0	5.8a	4.9a	3.1	drop
<b>Reine Hortense-Pink</b>						
Control	4.5	1.8	6.1	5.3	3.7	drop
10% Sucrose	4.3	1.9	5.5	4.7	3.5	drop
10% Sucrose+Ca	4.5	1.7	5.5	4.8	4.1	drop

Values in table are means of three replications of five flower stems.

<sup>Z</sup> Cultivar values within columns followed by different letters are significantly different at the 5% level of probability.

**Table 10. 1999 Postharvest evaluation of fresh cut peony flowers stored for 8 weeks at 1 C with prestorage pulse treatments of 10% sucrose or 100mM calcium chloride(Ca).**

Cultivar/Color Pretreatment	Diameter (inches)	First Day Open	Vase Life(days)		Initial Openness Rating after Storage	Death
			Total	Open		
<b>Dr. Alexander Fleming, Pink</b>						
Control	4.7 <sup>Z</sup>	2.6 a	4.1	2.4 b	2.6	drop
10% Sucrose	4.6	1.9 b	4.1	3.2 a	3.6	drop
<b>Snow Mountain White</b>						
Control	4.4	1.7	5.5	4.9	3.7	wilt
10% Sucrose	4.6	1.4	5.8	5.4	4.7	wilt
Ca	4.1	1.7	5.7	5.1	3.9	wilt

Values in table are means of three replications of five flower stems.

<sup>Z</sup> Cultivar values within columns followed by different letters are significantly different at the 5% level of probability.

**Table 11. 1999 Postharvest evaluation of fresh cut 'Festiva Maxima' peony flowers stored for 12 weeks at 1 C with prestorage pulse treatments of 10% sucrose or 10% sucrose and 100mM calcium chloride(Ca).**

Cultivar/Color Pretreatment	Diameter (inches)	First Day Open	Vase Life(days)		Initial Openness Rating after Storage	Death
			Total	Open		
Control	3.6 <sup>Z</sup>	2.3a	4.4	4.1	2.0b	drop
10% Sucrose	4.1	1.6b	4.2	4.0	3.8a	drop
10% Sucrose+Ca	3.9	2.2a	4.3	3.9	3.2a	drop

Values in table are means of three replications of five flower stems.

<sup>Z</sup> Cultivar values within columns followed by different letters are significantly different at the 5% level of probability.

### **Storage Disease Incidence**

Seven peony cultivars were selected for this study:

‘Bridal Shower’, a white double      ‘Shawnee Chief’, a red double  
‘Duchess de Nemours’, a white double      ‘Snow Mountain’, a white bomb  
‘Felix Supreme’, a red double      ‘Walter Faxon’, a pink double  
‘Sarah Bernhardt’, a pink double

Three treatments were compared to a no treatment control.

1. Methyl jasmonate applied to an absorbent pad and placed in the storage bag with the flowers.
2. Two-hour pulse at room temperature of a 100 mM calcium chloride solution.
3. Prestorage spray of Daconil™ fungicide at the label-prescribed rates of 1 ½ fl.oz. per gallon.

Ten stems of each cultivar were used for each treatment. Each stem in each treatment was numbered and was tracked during the study. Stems were placed in 2-gallon self-sealing polyethylene bags and placed in cold storage at 2-3° C. They were evaluated after 4, 8, and 12 weeks. Evaluations included determining disease incidence and whether disease lesions were present and estimating the extent of the disease and the percent of area covered by the disease. Leaves, sepals, guard petals, and petals were examined. At each evaluation time, buds also were rated for firmness using the scale shown on page 7.

‘Snow Mountain’ (Table 12) and ‘Shawnee Chief’ (Table 13) had the least treatment differences for the parameters recorded. Where treatment differences did occur, stems in the calcium chloride treatment showed greater disease incidence and larger disease lesions. ‘Felix Supreme’ (Table 14), ‘Sarah Bernhardt’ (Table 15), and ‘Bridal Shower’ (Table 16) had more pronounced treatment differences. ‘Felix Supreme’ leaves showed treatment differences in the level of disease incidence but not in the size of the lesions. Stems in the calcium chloride treatment at 4 and 8 weeks of storage had greater levels of disease incidence. ‘Sarah Bernhardt’ leaves, sepals, and guard petals had smaller lesions with the fungicide treatment at 8 and 12 weeks. ‘Bridal Shower’ sepals and guard petals treated with calcium chloride had more disease incidence and larger lesions at 12 weeks than those treated with fungicide. However, at 8 weeks flowers in the methyl jasmonate and control treatments had less disease incidence on the guard petals.

Treatment differences for ‘Walter Faxon’ (Table 17) leaves for both disease incidence and lesion size were attributable to greater incidence and greater size with the calcium chloride treatment. This was also true for lesion size on sepals and guard petals. ‘Duchess de Nemours’ (Table 18) sepals and guard petals had smaller lesions when treated with fungicide. Leaves had greater incidence and larger lesions when treated with calcium chloride.

Cultivars are variable in their response to disease prevention treatments and their susceptibility to disease. ‘Snow Mountain’ and ‘Shawnee Chief’ showed little response to the different treatments. The rest of the cultivars exhibited negative responses to the calcium chloride treatment. Only ‘Duchess de Nemours’ and ‘Sarah Bernhardt’ showed disease suppression with the use of a fungicide.

### **Acknowledgments**

Thanks and appreciation go to Jacob Nielsson for his assistance in data collection for the preparation of this report.

**Table 12. Disease incidence assessment of ‘Snow Mountain’ fresh-cut peony buds at 4, 8, and 12 weeks of cold storage at 0-2°C. Treatment 1= Control; 2= Methyl jasmonate on absorbent pad during cold storage; 3=prestorage pulse of 100 mM calcium carbonate for 2 hours at 22°C; and 4=prestorage spray of Daconil™ fungicide. Incidence assessment is the mean of 10 stems with 0=no disease and 1=disease.**

Treatment/week	Leaf 1		Leaf 2		Leaf 3		Sepals		Guard Petals		Petals		Openness Rating	
	Incidence	% <sup>x</sup>	Incidence	%	Incidence	%	Incidence	%	Incidence	%	Incidence	%		
Treatment	ns <sup>z</sup>	ns	ns	**	ns	ns	*	ns	ns	ns	*	ns	ns	*
Week	*	***	ns	***	ns	***	**	***	ns	***	***	ns	***	ns
TreatmentXWeek	ns	ns	ns	*	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns
1-4 weeks	0.5	5.0	0.7	9.3	0.8	9.3	0.9	6.7	1.0	6.5	0.6	5.8	3.6	
2-4 weeks	0.6	5.8	0.8	10.7	1.0	15.6	1.0	8.0	1.0	8.0	0.4	6.3	3.5	
3-4 weeks	0.2	5.0	0.4	8.8	0.7	7.9	0.8	7.5	1.0	8.0	0.3	5.0	4.4	
4-4 weeks	0.6	8.3	0.6	7.5	0.8	12.5	1.0	7.5	1.0	6.5	0.6	5.0	3.5	
1-8 weeks	0.3	30.0	0.9	25.3	0.7	22.9	0.5	10.0	1.0	12.0	1.5	6.0	3.4	
2-8 weeks	0.3	16.7	0.5	38.0	0.7	33.6	0.9	12.8	1.0	16.0	0.6	7.5	3.6	
3-8 weeks	0.5	22.0	0.7	35.8	0.8	39.4	0.7	10.7	0.9	17.2	0.8	6.1	4.4	
4-8 weeks	0.5	19.0	0.7	15.0	0.7	30.8	1.0	13.0	1.0	21.0	0.5	9.0	3.2	
1-12 weeks	0.5	49.0	0.9	64.4	1.0	66.0	1.0	21.5	1.0	21.0	0.8	10.0	4.1	
2-12 weeks	0.7	39.3	0.8	50.6	1.0	48.9	1.0	30.5	1.0	31.0	0.6	14.2	4.0	
3-12 weeks	0.8	55.6	0.9	80.0	1.0	81.0	1.0	17.5	1.0	25.0	1.0	16.0	4.5	
4-12 weeks	0.8	20.6	0.8	23.8	0.7	46.0	1.0	23.5	1.0	34.0	0.5	25.0	4.1	
LSD 5% <sup>y</sup>	0.4	17.9	ns	20.0	ns	19.6	0.2	7.1	ns	7.6	ns	6.7	1.00	

<sup>z</sup> ns, \*, \*\*, and \*\*\*, means are not significant, significant at 5% level of probability, highly significant at 1% level of probability, and very highly significant at the 0.1% level of probability, respectively.

<sup>y</sup> Least significant difference at the 5% level of probability for the mean of 10 stems.

<sup>x</sup> Values for percent (%) area affected/lesion size are means of only those stems with disease.

**Table 13. Disease incidence assessment of ‘Shawnee Chief’ fresh-cut peony buds at 4, 8, and 12 weeks of cold storage at 0-2°C. Treatment 1= Control; 2= Methyl jasmonate on absorbent pad during cold storage; 3=prestorage pulse of 100 mM calcium carbonate for 2 hours at 22°C; and 4=prestorage spray of Daconil™ fungicide. Incidence assessment is the mean of 10 stems with 0=no disease and 1=disease.**

Treatment/Week	Leaf 1		Leaf 2		Leaf 3		Sepals		Guard Petals		Petals		Openness Rating
	Incidence	% <sup>X</sup>	Incidence	%	Incidence	%	Incidence	%	Incidence	%	Incidence	%	
Treatment	**Z	ns	ns	ns	*	ns	ns	**	ns	ns	ns	ns	***
Week	ns	***	***	ns	***	ns	ns	***	ns	***	**	ns	**
TreatmentXWeek	ns	*	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns
1-4 weeks	0.2	15.0	0.1	20.0	0.0	0	1.0	20.0	1.0	13.5	0.0	0	2.8
2-4 weeks	0.4	22.5	0.1	10.0	0.1	15.0	1.0	17.5	1.0	16.5	0.0	0	3.0
3-4 weeks	0.1	5.0	0.0	0	0.0	0	1.0	17.0	1.0	9.0	0.0	0	4.0
4-4 weeks	0.2	7.5	0.0	0	0.0	0	1.0	18.5	1.0	16.5	0.0	0	2.9
1-8 weeks	0.1	20.0	0.1	20.0	0.0	0	1.0	24.5	1.0	37.5	0.0	0	3.9
2-8 weeks	0.5	19.0	0.0	0	0.3	13.3	1.0	36.1	0.9	41.0	0.2	12.5	3.5
3-8 weeks	0.5	8.0	0.5	9.0	0.4	13.8	1.0	24.5	1.0	28.0	0.1	5.0	4.4
4-8 weeks	0.2	12.5	0.4	8.8	0.1	15.0	1.0	14.0	1.0	32.0	0.0	0	3.5
1-12 weeks	0.3	11.7	0.5	24.4	0.4	16.3	1.0	87.5	1.0	50.5	0.2	25.0	3.2
2-12 weeks	0.6	25.8	0.6	10.0	0.4	41.3	1.0	94.5	1.0	48.0	0.4	32.5	3.5
3-12 weeks	0.7	27.9	0.9	30.8	0.9	31.7	1.0	95.0	1.0	56.0	0.0	0	4.3
4-12 weeks	0.2	42.5	0.3	28.3	0.2	20.0	1.0	74.5	1.0	62.0	0.3	10.0	3.6
LSD 5% <sup>y</sup>	0.4	7.3	0.4	ns	0.3	ns	ns	12.8	ns	11.1	0.3	ns	0.9

<sup>Z</sup> ns, \*, \*\*, and \*\*\*, means are not significant, significant at 5% level of probability, highly significant at 1% level of probability, and very highly significant at the 0.1% level of probability, respectively.

<sup>y</sup> Least significant difference at the 5% level of probability for the mean of 10 stems.

<sup>x</sup> Values for percent (%) area affected/lesion size are means of only those stems with disease.

**Table 14. Disease incidence assessment of ‘Felix Supreme’ fresh-cut peony buds at 4, 8, and 12 weeks of cold storage at 0-2°C. Treatment 1= Control; 2= Methyl jasmonate on absorbent pad during cold storage; 3=prestorage pulse of 100 mM calcium carbonate for 2 hours at 22°C; and 4=prestorage spray of Daconil™ fungicide. Incidence assessment is the mean of 10 stems with 0=no disease and 1=disease.**

Treatment/Week	Leaf 1		Leaf 2		Leaf 3		Sepals		Guard Petals		Petals		Openness Rating
	Incidence	% <sup>X</sup>	Incidence	%	Incidence	%	Incidence	%	Incidence	%	Incidence	%	
Treatment	***Z	ns	***	ns	**	ns	ns	*	ns	ns	ns	ns	*
Week	***	***	**	***	**	***	ns	***	***	**	***	ns	*
TreatmentXWeek	ns	ns	ns	ns	ns	ns	ns	***	ns	ns	ns	ns	ns
1-4 weeks	0.5	40.0	0.5	40.0	0.6	38.0	1.0	15.5	0.2	10.0	0.0	0	2.2
2-4 weeks	0.4	31.3	0.7	32.1	0.4	22.5	0.9	11.7	0.5	14.0	0.1	20.0	2.2
3-4 weeks	1.0	26.0	1.0	23.5	1.0	29.5	1.0	13.5	0.5	13.0	0.1	0	2.8
4-4 weeks	0.3	46.7	0.4	46.3	0.4	57.5	0.9	16.1	0.5	16.0	0.0	0	2.4
1-8 weeks	0.9	33.3	0.8	48.8	0.8	55.0	0.9	20.0	0.4	16.3	0.2	2.0	2.7
2-8 weeks	0.7	39.0	0.8	50.6	0.6	52.0	1.0	18.5	0.6	15.8	0.1	20.0	2.7
3-8 weeks	1.0	47.0	1.0	57.0	1.0	61.0	1.0	18.0	0.5	14.0	0.1	5.0	3.2
4-8 weeks	0.6	40.0	0.6	45.8	0.7	59.2	1.0	15.0	0.4	15.0	0.2	5.0	3.3
1-12 weeks	1.0	69.5	0.9	76.7	1.0	71.3	1.0	28.5	0.8	18.1	0.0	0	2.8
2-12 weeks	0.9	57.8	1.0	60.5	1.0	52.5	1.0	52.5	1.0	41.0	0.5	26.0	2.3
3-12 weeks	1.0	94.0	1.0	97.3	1.0	97.8	1.0	51.0	1.0	27.5	0.4	10.0	3.2
4-12 weeks	0.8	48.1	0.8	55.6	0.9	65.6	1.0	31.0	1.0	23.0	0.5	23.0	2.9
LSD 5% <sup>y</sup>	0.3	25.8	0.3	25.7	0.3	27.2	ns	9.8	0.4	13.8	0.3	ns	0.9

<sup>Z</sup> ns, \*, \*\*, and \*\*\*, means are not significant, significant at 5% level of probability, highly significant at 1% level of probability, and very highly significant at the 0.1% level of probability, respectively.

<sup>y</sup> Least significant difference at the 5% level of probability for the mean of 10 stems.

<sup>x</sup> Values for percent (%) area affected/lesion size are means of only those stems with disease.

**Table 15. Disease incidence assessment of ‘Sarah Bernhardt’ fresh-cut peony buds at 4, 8, and 12 weeks of cold storage at 0-2°C. Treatment 1= Control; 2= Methyl jasmonate on absorbent pad during cold storage; 3=prestorage pulse of 100 mM calcium carbonate for 2 hours at 22°C; and 4=prestorage spray of Daconil™ fungicide. Incidence assessment is the mean of 10 stems with 0=no disease and 1=disease.**

Treatment/Week	Leaf 1		Leaf 2		Leaf 3		Sepals		Guard Petals		Petals		Openness Rating
	Incidence	%	Incidence	%	Incidence	%	Incidence	%	Incidence	%	Incidence	%	
Treatment	ns <sup>Z</sup>	ns	**	ns	*	*	ns	***	ns	***	ns	ns	ns
Week	***	ns	***	ns	***	***	ns	***	ns	***	ns	ns	ns
TreatmentXWeek	ns	ns	*	ns	ns	**	ns	***	ns	***	ns	ns	ns
1-4 weeks	0.1	5.0	0.2	5.0	0.3	27.5	1.0	12.5	0.9	13.9	0.0	0	2.1
2-4 weeks	0.3	23.3	0.3	20.0	0.2	5.0	1.0	13.5	0.8	11.9	0.1	5.0	2.3
3-4 weeks	0.6	14.2	0.8	6.3	0.5	6.0	1.0	13.0	1.0	9.5	0.5	7.0	2.4
4-4 weeks	0.4	6.3	0.5	7.0	0.3	5.0	1.0	12.0	1.0	10.0	0.8	8.1	2.5
1-8 weeks	0.4	11.3	0.2	7.5	0.4	16.3	0.9	15.0	0.9	14.4	0.2	4.0	1.7
2-8 weeks	0.5	18.0	0.5	17.0	0.7	12.9	1.0	23.0	1.0	34.0	0.3	5.0	2.4
3-8 weeks	0.6	17.3	0.6	10.0	0.7	18.3	1.0	20.5	1.0	30.5	0.5	7.6	1.9
4-8 weeks	0.4	8.8	0.3	8.3	0.3	8.3	1.0	7.8	1.0	19.0	0.4	8.3	2.3
1-12 weeks	1.0	18.9	1.0	17.1	0.8	27.9	1.0	41.5	1.0	36.0	0.4	7.5	2.1
2-12 weeks	0.6	14.0	0.6	14.0	0.8	35.0	1.0	57.5	1.0	33.8	0.1	5.0	2.6
3-12 weeks	0.9	25.0	1.0	28.0	1.0	68.5	1.0	45.0	1.0	49.0	0.3	10.0	2.4
4-12 weeks	0.7	15.7	0.4	15.0	0.6	18.3	1.0	28.5	1.0	25.5	0.3	15.0	2.2
LSD 5% <sup>y</sup>	0.4	ns	0.4	ns	0.4	16.7	ns	8.3	ns	8.5	0.4	ns	ns

<sup>Z</sup> ns, \*, \*\*, and \*\*\*, means are not significant, significant at 5% level of probability, highly significant at 1% level of probability, and very highly significant at the 0.1% level of probability, respectively.

<sup>y</sup> Least significant difference at the 5% level of probability for the mean of 10 stems.

<sup>x</sup> Values for percent (%) area affected/lesion size are means of only those stems with disease.



**Table 16. Disease incidence assessment of ‘Bridal Shower’ fresh-cut peony buds at 4, 8, and 12 weeks of cold storage at 0-2°C. Treatment 1= Control; 2= Methyl jasmonate on absorbent pad during cold storage; 3=prestorage pulse of 100 mM calcium carbonate for 2 hours at 22°C; and 4=prestorage spray of Daconil™ fungicide. Incidence assessment is the mean of 10 stems with 0=no disease and 1=disease.**

Treatment/Week	Leaf 1		Leaf 2		Leaf 3		Sepals		Guard Petals		Petals		Openness Rating
	Incidence	% <sup>x</sup>	Incidence	%	Incidence	%	Incidence	%	Incidence	%	Incidence	%	
Treatment	*	ns	ns	ns	ns	ns	ns	*	*	**	ns	ns	**
Week	***	***	***	ns	***	ns	ns	***	**	***	***	ns	*
TreatmentXWeek	ns	*	*	ns	ns	ns	ns	***	ns	ns	ns	ns	ns
1-4 weeks	0.0	0	0.0	0	0.5	5.0	1.0	10.5	0.8	14.4	0.0	0	2.9
2-4 weeks	0.1	10.0	0.2	12.5	0.0	0	0.9	15.1	0.6	5.0	0.0	0	2.7
3-4 weeks	0.5	5.0	0.3	5.0	0.3	5.0	1.0	13.5	0.8	8.5	0.3	5.0	3.9
4-4 weeks	0.3	5.0	0.2	5.0	0.2	5.0	1.0	14.5	0.9	7.8	0.2	5.0	3.1
1-8 weeks	0.0	0	0.0	0	0.0	0	0.9	20.0	0.6	24.2	0.2	20.0	3.5
2-8 weeks	0.0	0	0.0	0	0.0	0	0.9	23.3	0.6	16.4	0.1	5.0	3.0
3-8 weeks	0.1	5.0	0.0	0	0.0	0	1.0	17.0	0.8	12.5	0.0	0	3.6
4-8 weeks	0.0	0	0.1	5.0	0.2	20.0	1.0	17.0	1.0	12.0	0.2	0	3.3
1-12 weeks	0.6	11.7	0.6	15.8	0.5	15.0	1.0	40.0	1.0	39.5	0.7	35.0	3.5
2-12 weeks	0.5	12.0	0.7	20.7	0.6	8.3	1.0	36.0	1.0	25.5	0.8	7.5	3.2
3-12 weeks	0.8	34.4	1.0	32.8	1.0	50.0	1.0	60.0	1.0	49.1	0.9	23.9	4.5
4-12 weeks	0.4	14.0	0.3	8.3	0.3	20.0	1.0	34.0	1.0	29.5	0.6	9.2	3.7
LSD 5% <sup>y</sup>	0.3	9.4	0.3	ns	0.3	ns	ns	10.7	0.3	12.3	0.3	ns	0.9

<sup>z</sup> ns, \*, \*\*, and \*\*\*, means are not significant, significant at 5% level of probability, highly significant at 1% level of probability, and very highly significant at the 0.1% level of probability, respectively.

<sup>y</sup> Least significant difference at the 5% level of probability for the mean of 10 stems.

<sup>x</sup> Values for percent (%) area affected/lesion size are means of only those stems with disease.

**Table 17. Disease incidence assessment of ‘Walter Faxon’ fresh-cut peony buds at 4, 8, and 12 weeks of cold storage at 0-2°C. Treatment 1= Control; 2= Methyl jasmonate on absorbent pad during cold storage; 3=prestorage pulse of 100 mM calcium carbonate for 2 hours at 22°C; and 4=prestorage spray of Daconil™ fungicide. Incidence assessment is the mean of 10 stems with 0=no disease and 1=disease.**

Treatment/week	Leaf 1		Leaf 2		Leaf 3		Sepals		Guard Petals		Petals		Openness Rating
	Incidence	% <sup>X</sup>	Incidence	%	Incidence	%	Incidence	%	Incidence	%	Incidence	%	
Treatment	**Z	**	***	***	***	***	ns	***	ns	**	ns	ns	***
Week	***	***	ns	***	*	***	ns	***	ns	***	***	**	ns
TreatmentXWeek	ns	ns	ns	***	ns	***	ns	**	ns	ns	ms	ns	ns
1-4 weeks	0.4	6.3	0.5	6.0	0.4	6.7	1.0	26.5	1.0	22.0	0.2	5.0	2.7
2-4 weeks	0.6	7.5	0.3	6.7	0.1	5.0	1.0	23.5	1.0	26.0	0.4	7.5	2.0
3-4 weeks	0.9	6.7	0.9	8.3	1.0	13.5	1.0	34.0	1.0	29.5	0.6	7.5	3.2
4-4 weeks	0.7	5.0	0.4	6.3	0.4	5.0	1.0	23.0	1.0	20.5	0.6	5.8	3.1
1-8 weeks	0.3	13.3	0.3	13.3	0.5	6.7	1.0	57.0	1.0	43.5	0.1	5.0	3.4
2-8 weeks	0.1	10.0	0.4	20.3	0.5	13.0	1.0	42.7	1.0	50.0	0.6	15.7	2.5
3-8 weeks	0.5	18.0	0.8	38.8	1.0	46.7	1.0	34.0	1.0	67.0	0.2	5.0	2.9
4-8 weeks	0.2	5.0	0.1	30.0	0.3	10.0	1.0	39.0	1.0	50.0	0.3	8.3	3.4
1-12 weeks	0.5	18.0	0.6	21.7	0.7	20.0	1.0	88.0	1.0	71.0	0.8	11.6	3.3
2-12 weeks	0.5	13.0	0.4	23.0	0.7	25.0	1.0	91.0	1.0	74.5	0.8	14.4	2.3
3-12 weeks	1.0	41.1	1.0	72	1.0	91.7	1.0	98.5	1.0	81.5	0.8	15.0	2.6
4-12 weeks	0.4	11.3	0.3	16.7	0.7	25.0	1.0	83.5	1.0	78.5	1.0	9.2	2.9
LSD 5% <sup>y</sup>	0.4	13.4	0.4	14.3	0.4	13.4	ns	10.3	ns	12.8	0.4	5.4	0.8

<sup>Z</sup> ns, \*, \*\*, and \*\*\*, means are not significant, significant at 5% level of probability, highly significant at 1% level of probability, and very highly significant at the 0.1% level of probability, respectively.

<sup>y</sup> Least significant difference at the 5% level of probability for the mean of 10 stems.

<sup>x</sup> Values for percent (%) area affected/lesion size are means of only those stems with disease.

**Table 18. Disease incidence assessment of ‘Duchess de Nemours’ fresh-cut peony buds at 4, 8, and 12 weeks of cold storage at 0-2°C. Treatment 1=Control; 2= Methyl jasmonate on absorbent pad during cold storage; 3=prestorage pulse of 100 mM calcium carbonate for 2 hours at 22°C; and 4=prestorage spray of Daconil™ fungicide. Incidence assessment is the mean of 10 stems with 0=no disease and 1=disease.**

Treatment/Week	Leaf 1		Leaf 2		Leaf 3		Sepals		Guard Petals		Petals		Openness Rating
	Incidence	% <sup>X</sup>	Incidence	%	Incidence	%	Incidence	%	Incidence	%	Incidence	%	
Treatment	***Z	**	***	ns	*	ns	ns	***	*	**	ns	ns	***
Week	***	***	***	***	***	***	ns	***	*	***	***	ns	ns
TreatmentXWeek	ns	***	ns	*	ns	ns	ns	*	ns	ns	ns	ns	ns
1-4 weeks	0.2	15.0	0.2	15.0	0.1	20.0	1.0	20.5	0.6	15.0	0.0	0	2.6
2-4 weeks	0.3	10.0	0.4	17.5	0.2	10.0	1.0	21.0	0.8	14.4	0.0	0	3.0
3-4 weeks	0.8	5.0	0.8	5.0	0.4	6.3	1.0	13.0	0.9	6.1	0.1	5.0	3.7
4-4 weeks	0.2	5.0	0.1	5.0	0.1	5.0	1.0	1.1	1.0	6.5	0.0	0	3.2
1-8 weeks	0.6	15.0	0.6	15.0	0.7	13.3	1.0	58.0	0.7	18.6	0.0	0	2.4
2-8 weeks	0.7	10.7	0.6	15.8	0.6	13.0	1.0	58.7	0.8	21.3	0.2	12.5	2.9
3-8 weeks	1.0	12.5	0.9	14.4	0.9	15.0	1.0	56.0	0.9	14.4	0.0	0	3.8
4-8 weeks	0.7	10.0	0.2	7.5	0.5	10.0	1.0	43.0	1.0	22.0	0.1	10.0	3.4
1-12 weeks	1.0	26.5	0.9	33.9	0.8	36.3	1.0	89.0	1.0	39.0	0.5	7.0	2.6
2-12 weeks	0.9	15.0	0.7	21.4	0.9	25.0	1.0	78.5	1.0	52.0	0.5	21.0	3.0
3-12 weeks	1.0	41.4	1.0	46.4	1.0	54.1	1.0	89.1	1.0	36.4	0.4	18.8	3.7
4-12 weeks	0.9	15.0	0.8	11.9	0.8	22.5	1.0	70.0	1.0	36.0	0.7	13.6	3.4
LSD 5% <sup>y</sup>	0.3	8.6	0.4	12.4	0.4	15.5	ns	8.1	0.3	9.0	0.3	ns	1.0

<sup>Z</sup> ns, \*, \*\*, and \*\*\*, means are not significant, significant at 5% level of probability, highly significant at 1% level of probability, and very highly significant at the 0.1% level of probability, respectively.

<sup>y</sup> Least significant difference at the 5% level of probability for the mean of 10 stems.

<sup>x</sup> Values for percent (%) area affected/lesion size are means of only those stems with disease.

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