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Production and Postharvest Evaluations of

Fresh-Cut Peonies



Kansas State University Agricultural Experiment Station and Cooperative Extension Service

2000 PRODUCTION AND POSTHARVEST EVALUATION 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 3 ft.'s 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

Initial Postharvest Evaluations

 Cultivar Assessments

 Holding Solution Evaluations

Flower Openness Vase Life Evaluations

Bud Maturity Evaluations

Long-Term Cold Storage Studies

 Cultivar Assessments

 Prestorage Treatments

 Storage Disease Incidence with Fungicidal Treatments

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. Flowers were then prepared by cutting 2.5 cm from stems under water and by removing the leaves from the bottom two-thirds of the stems. The flowers were placed in approximately 600 ml water in 0.9 l 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 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 2000. The season started very early, on April 28, and ended with the last cultivar being harvested on May 22. This was the earliest date when peonies were ready for harvest since records of harvest data began in 1995. This year, there were many shoots that did not have flower buds and buds that did not develop. This was most evident with the large planting of the cultivar ‘Shawnee Chief’. It is not included in the Table 1, because the average yield per plant was so low. The winter was mild and may not have provided some cultivars with sufficient chilling to induce flower bud development.

Table 1. 2000 Harvest season and yield.

Cultivar/Season	Color	Stems per Plant	Harvest Season
Apache, early mid	red	4.4	5/9-13
Comanche, early mid	red	3.4	5/12-17
David Harum, mid	red	16.6	5/11-21
Felix Crousse, mid	red	4.2	5/14-18
Felix Supreme, mid	red	19.8	5/13-21
Grover Cleveland, late	red	4.6	5/15-21
Henry Bocktoce, early mid	red	3.3	5/10-16
Lora Dexheimer, mid	red	6.5	5/12-20
Louis van Houttei, late mid	red	14	5/15-21
Peter Brand, early mid	red	6.4	5/7-18
Red Charm, early mid	red	7.8	5/7-10
Richard Carvel, early	red	14.6	5/14-22
Dr. Alexander Fleming, early mid	pink	11.3	5/11-21
Edulis Superba, early	pink	4.8	5/8-13
Grace Batson, late mid	pink	3.2	5/17-22
James Pillow, late	pink	4.4	5/17-22
Jayhawker, early	pink	8.6	5/13-20
Lovely Rose, early mid	pink	4.3	5/7-12
Mister Ed, early	pink	9.8	5/11-17
Monsieur Jules Elie, early	pink	11.6	5/9-19
Mrs. F.D. Roosevelt, mid	pink	8.2	5/11-15
Ozark Beauty, late	pink	7.8	5/14-21
Raspberry Sundae, mid	pink	14.6	5/11-17

Reine Hortense, mid	pink	4.6	5/14-20
Romance, mid	pink	5.8	5/15-20
Rose Pearl, mid-late	pink	4.8	5/17-22
Sarah Bernhardt, late	pink	18.4	5/16-21
Therese, mid	pink	23.8	5/14-22
Walter Faxon, mid	pink	10.4	5/15-22
Westerner, mid	pink	10.2	5/12-20
69A	white	16.6	5/9-22
Bridal Shower, mid	white	10.6	5/8-18
Bridal Icing, mid	white	11.3	5/12-21
Candy Heart, early mid	white	7.0	5/14-22
Dr. F.G. Brethour, late	white	5	5/15-22
Duchess de Nemours, early	white	25	5/9-18
Festiva Supreme, mid	white	6.6	5/11-20
Festiva Maxima, early	white	4.8	5/11-22
Henry Sass, late mid	white	4.8	5/15-22
Madame de Vernville, early	white	14.4	5/9-15
Snow Mountain, late	white	6.4	5/12-20
Spellbinder, early	white	9.8	5/7-13
Coral Fay, early	coral	6.4	4/28-5/7
Coral 'n' Gold, early	coral	5.5	5/7
Orange Lace, early	coral	7.2	5/1-7

Initial Postharvest Evaluations

Peony cultivars every year are evaluated for their vase life performance, until at least 3 years worth of data are collected. They also are evaluated to see how they perform when held in floral preservative. The floral preservative is mixed as prescribed on the label. Flowers are prepared the same way as when held in water.

Nineteen cultivars were evaluated for initial vase life (Tables 2, 3, and 4). Six were singles or Japanese types, 'Comanche', 'Lovely Rose', 'Spellbinder', 'Apache', 'Romance', and 'Westerner'. These forms offer the florist something new and different and are worthy of examination for their cut-flower potential. 'Apache' and 'Lovely Rose' had vase lives less than 5 days, making them unsuitable for cut flowers. The other four cultivars showed much promise and offer a wide range of colors.

Table 2. 2000 Postharvest evaluation of fresh-cut peony flowers held in water

Cultivar/Color	Diameter (inches)	First Day Open	Vase Life(days)		Death
			Total	Open	
Comanche-Red	5.6	3.0	7.3	5.3	drop
Henry Bocktoce-Red	4.9	1.8	6.5	5.6	drop
Lovely Rose-Pink	3.5	1.4	4.9	4.5	drop/wilt
Raspberry Ice-Red	4.6	1.8	7.1	6.3	drop
Rose Pearl-Pink	4.3	2.8	6.8	5.0	wilt
Spellbinder-White	6.1	1.7	7.5	6.8	drop

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

Table 3. 2000 Postharvest evaluation of fresh-cut peony flowers held in floral preservative.

Cultivar/Color	Diameter (inches)	First Day Open	Vase Life(days)		Death
			Total	Open	
Better Times-Pink	4.6	1.9	7.5	6.6	drop/wilt
Grover Cleveland-Red	4.2	3.0	7.1	5.1	wilt
Grace Batson-Pink	5.1	2.2	8.7	7.5	wilt

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

Table 4. 2000 Postharvest evaluation of fresh-cut peony flowers held in water and floral preservative

Cultivar/Color	Diameter (inches)	First Day Open	Vase Life(days)		Death
			Total	Open	
Apache-Red					
Water	4.3ns	1.3*	4.8ns	4.5ns	wilt/drop
Floral Preservative	4.0	1.6	5.3	4.7	wilt/drop
Bridal Icing					
Water	5.1ns	2.0ns	5.4ns	4.4*	drop***
Floral Preservative	5.0	2.1	6.2	5.3	wilt
Candy Heart-White					
Water	4.3**	2.6ns	7.7***	6.0**	drop***
Floral Preservative	5.2	2.3	6.1	4.9	wilt
Duchess de Nemours-White					
Water	5.6ns	2.0ns	5.8***	4.8***	drop***
Floral Preservative	6.1	2.0	4.8	3.8	wilt
Jayhawker					
Water	5.4ns	2.1ns	8.7***	7.6***	wilt/ns
Floral Preservative	5.5	2.1	6.7	5.6	wilt
Madame de Vernville-White					
Water	4.8ns	2.0ns	6.3ns	5.3ns	drop
Floral Preservative	5.0	2.0	6.4	5.4	drop
Red Charm-Red					
Water	6.8ns	1.3**	6.4***	6.1ns	drop
Floral Preservative	7.2	1.1	7.1	7.1	drop
Reine Hortense					
Water	5.1ns	2.0ns	7.9*	6.9ns	drop***
Floral Preservative	5.2	2.2	8.5	7.3	wilt
Romance					
Water	5.2ns	2.9ns	7.5ns	5.7ns	drop*
Floral Preservative	5.9	3.2	7.0	5.0	wilt
Westerner-Pink					
Water	5.0**	2.8ns	7.4*	5.8*	drop***
Floral Preservative	6.0	2.7	6.3	4.6	wilt

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

*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.

All of the other 13 cultivars had acceptable vase lives. Ten were evaluated to determine whether using floral preservatives would extend the vase life of the flowers (Tables 3 and 4). The most pronounced effect of floral preservatives was the way in which the flowers died. Flowers of six cultivars, 'Romance', 'Bridal Icing', 'Duchess de Nemours', 'Candy Heart', 'Reine Hortense', and 'Westerner', died by petal abscissions or drop when held in water, but died by wilting when held in floral preservative.

Floral preservative resulted in bigger flowers for both 'Candy Heart' and 'Westerner', but had the effect of shortening the vase lives of 'Duchess de Nemours' and 'Jayhawker'. Floral preservatives extended the vase lives of 'Bridal Icing', 'Reine Hortense', and 'Red Charm'. Floral preservatives had no beneficial effect on 'Madame de Vernville'.

Overall, floral preservatives did not improve the vase life and flower size of most cultivars, but were not detrimental to the flowers either. In handling peony flowers, floral preservatives could be recommended only as an optional step.

Flower Openness Vase Life Evaluations

Occasionally, growers will find they have flowers that open more quickly than they can harvest them. These open flowers are unacceptable for the wholesale flower trade because they are thought to not last as long as flowers cut in the bud stage, and their petals will bruise easily. This year, the opportunity presented itself to determine whether open flowers last as long as bud flowers when held in cold storage at 2 C for a week, to simulate handling practices in pack houses and retail floral shops.

Four cultivars, 'Duchess de Nemours', 'Madame de Vernville', 'Mons. Jules Elie', and 'Raspberry Sundae', all had flowers that opened quicker than expected. For 'Duchess de Nemours', comparisons were made between open flowers and bud flowers immediately after harvest and included evaluation of holding solutions, water, floral preservatives, and cold storage durations of 1 week vs. 2 weeks (Table 5). The 'Duchess de Nemours' flowers held in cold storage were almost an inch larger in diameter than flowers from buds evaluated immediately after harvest. The vase life was a day shorter for the stored flowers than the flowers evaluated immediately after harvest. Flower performance after 1 week vs 2 weeks of cold storage did not differ.

For 'Madame de Vernville', comparisons were made between bud flowers evaluated immediately after harvest and open flowers held in cold storage in both water and floral preservatives for 1 week. Like 'Duchess de Nemours', the stored flowers were bigger, but no differences were seen in vase life.

For 'Mons. Jules Elie', a comparison was made between bud flowers evaluated immediately after harvest and open flowers evaluated after being held in water in cold storage for 1 week. The stored, open flowers were bigger and lasted longer than the bud flowers.

For 'Raspberry Sundae', a comparison was made between bud flowers evaluated immediately after harvest and open flowers evaluated after being held in floral preservative in cold storage for 1 week. No differences occurred in flower size or open vase life.

Open flowers, even when stored for 1-2 weeks, performed as well as or better than flowers harvested in the bud stage. Growers should have no reservations about offering open flowers for sale to customers, as long as the customers know that they should always be in water and be arranged immediately.

Table 5. 2000 Evaluation of the postharvest performance of open peony flowers under various treatments.

Cultivar/Color Treatment	Diameter (inches)	First Day Open	Vase Life (days)		Death
			Total	Open	
<i>Duchess de Nemours-White</i>					
Control-Open	5.0c ^z	1.0b	7.0a	7.0a	drop
Control-Bud	5.0c		1.4a	6.9a	6.5b
Open flowers held 1 week in cold storage in water	6.2ab		1.0b	6.0b	6.0c
Open flowers held 1 week in cold storage in floral preservative	5.7b	1.0b	6.0b	6.0c	drop
Open flowers held 2 weeks in cold storage in water	5.7b	1.0b	6.2b	6.2bc	drop
Open flowers held 2 weeks in cold storage in floral preservative	6.4a	1.0b	5.9b	5.9c	drop
<i>Madame de Vernville-White</i>					
Control	4.8b	2.4	6.2a	5.1	drop
Open flowers held 1 week in cold storage in water	5.3ab		1.0	5.4b	5.7
Open flowers held 1 week in cold storage in floral preservative	5.7a	1.0	5.7ab	6.1	drop
<i>Mon. Jules Elie-Pink</i>					
Control	4.5** ^y	2.4*	6.5ns	5.1***	wilt
Open flowers held 1 week in cold storage in water	5.8	1.4	7.3	6.7	wilt
<i>Raspberry Sundae-Pink</i>					
Control	5.6ns	2.3*	7.6**	6.3ns	drop
Open flowers held 1 week in cold storage in floral preservative	5.8	1.0	6.4	6.7	drop

^zCultivar values within columns followed by different letters are significantly different at the 5% level of probability.

^yns, *, **, 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.

Bud Maturity Evaluations

As the peony industry expands, it is important to be able to train pickers and wholesalers about the optimum harvest stage for the different cultivars. Because peony production areas vary in climate and weather affects the development of flowers, growers have questioned whether a developmental range exists instead of a given 'optimum' stage from which peony flowers would open satisfactorily. This study applied a fruit maturity series model to identify optimum developmental stages for harvesting several peony cultivars.

Cultivars included in this year's study were --

REDS

Felix Supreme, Peter Brand, Shawnee Chief

WHITES

Duchess de Nemours, Snow Mountain

PINKS

Dr. Alexander Fleming, Sarah Bernhardt, Therese

Based on the harvesting experience of growers and researchers, a maturity rating scale was developed for peony buds and flowers to reflect their development.

Maturity or Bud Openness Rating Scale

1= tight bud with little color showing

2=tight bud with color showing

3=soft bud

4=very soft bud

5=almost open with petals not reflexed

6=fully open

Peony flower buds were harvested over a wide range of maturity or bud openness and sorted into groups or grades by the different levels of maturity or openness. Each group or grade had at least seven flowers, and 10 different grades were used for each cultivar. Because each cultivar has a unique set of characteristics that indicates when it is mature enough for harvest, a different set of criteria was used to sort each cultivar into the different grades. Most of the individual criteria were similar but were used in a different order. These included firmness, petal angle, color shift, amount of color showing, and lift of petals.

The initial maturity rating was recorded for each flower in the different grades. Vase life, flower diameter, and opening time also were recorded. Flowers were considered open when they reached rating 5. Vase life evaluations were conducted for each cultivar by placing all the flowers of each grade in a 0.9 l glass jar filled with water. Stems were cut under water to approximately 40 cm before being placed in the jars. Flowers were held at 20-22° C.

Flowers were held for 1 week at 1-2° C before being graded. This also simulated the handling at some peony operations, where flowers are bulked in cold storage over a week and dispatched to market once per week.

Even before acceptable vase life is considered, knowing how fast the flowers will open is important. Tighter or more firm buds of lower grades tended to open less quickly than softer buds from higher grades. Most were open by the second day (Table 6). The only exceptions were ‘Sarah Bernhardt’ and ‘Therese’, which had many flowers that failed to open, especially those from the lower grades. Initial maturity rating values were related directly to maturity grade assignment; higher values were found in higher grades (Table 7).

Flowers in lower grades had longer vase lives and usually smaller flowers than those in the higher grades (Tables 8 and 9). However, no difference was seen in flower size across the grades in ‘Duchess de Nemours’.

The original purpose of this study was to use the parameters of opening time, vase life, and flower size to judge which level of bud maturity produces the best flowers. Only grades that corresponded to both vase life and flower size were designated as best for harvest. The maturity ratings of these best grades then were summarized, and recommendations were made for the best stage to harvest for each cultivar (Table 10).

Table 6. 2000 Percentage of peony flower buds almost out (stage 5) on day 3 in each grade. Best grades are those with 70% or more open by day 3.

Cultivar	Maturity Grades										Best Grades
	1	2	3	4	5	6	7	8	9	10	
Dr. Alexander Fleming	100	88	88	100	80	75	75	100	100	100	1-10
Duchess de Nemours	100	100	100	100	100	100	100	100	100	100	1-10
Felix Supreme	100	75	75	100	100	100	100	100	100	100	1-10
Peter Brand	100	100	100	100	100	100	100	100	100	100	1-10
Sarah Bernhardt	88	88	63	75	63	88	75	88	88	100	1,2,4 6-10
Shawnee Chief	100	88	100	100	100	100	100	100	100	100	1-10
Snow Mountain	88	100	88	100	100	100	88	100	100	100	1-10
Therese	0	37	50	100	75	100	88	100	88	100	4-10

Table 7. 2000 Initial bud openness rating of buds for the different grades using 1-6 maturity rating scale. LSD = Least significant difference between means within rows at 5% level of significance by analysis of variance.

Cultivar	Maturity Grades										LSD
	1	2	3	4	5	6	7	8	9	10	
Dr. Alexander Fleming	1.0	2.0	2.0	2.0	2.3	2.5	2.8	2.8	3.8	4.4	0.46
Duchess de Nemours	1.6	2.0	2.8	2.5	2.9	3.1	3.3	3.8	4.4	4.9	0.56
Felix Supreme	1.8	2.0	2.3	2.0	2.6	2.7	3.6	3.5	4.0	4.4	0.58
Peter Brand	2.0	2.0	2.1	2.4	2.4	3.4	3.5	4.0	4.6	4.8	0.42
Sarah Bernhardt	1.1	1.3	2.0	2.4	2.5	2.8	3.1	3.1	3.8	4.6	0.62
Shawnee Chief	1.0	1.8	2.0	2.0	2.5	3.0	3.0	3.5	3.9	4.1	0.38
Snow Mountain	1.8	2.0	2.4	2.4	2.0	2.6	2.6	2.9	2.8	3.9	0.51
Therese	1.3	2.1	2.0	2.3	2.3	2.8	2.8	3.4	3.5	4.5	0.49

Table 8. 2000 Flower diameter (cm) of peony cultivars. LSD = Least significant difference between means within rows at 5% level of significance by analysis of variance.

Cultivar	Maturity Grades										LSD	Best Grades
	1	2	3	4	5	6	7	8	9	10		
Dr. Alexander Fleming	4.7	4.9	4.6	4.6	4.8	4.6	5.2	5.4	5.3	4.8	0.47	7-9
Duchess de Nemours	5.4	5.1	5.3	5.4	5.7	5.9	5.8	5.6	6.0	5.6	NS	4-10
Felix Supreme	4.9	4.6	4.8	5.1	4.7	5.4	4.9	5.4	5.2	5.0	0.44	6-10
Peter Brand	4.5	4.6	4.8	4.8	4.9	4.8	4.9	4.6	5.1	5.1	NS	2-10
Sarah Bernhardt	3.4	3.8	3.7	4.4	4.2	4.2	4.3	3.9	4.1	3.9	0.42	6-10
Shawnee Chief	4.1	4.2	4.6	4.9	4.3	4.6	4.5	4.9	4.7	5.3	0.50	8-10
Snow Mountain	4.6	4.6	5.2	4.7	5.4	6.1	5.7	6.3	5.8	6.3	0.74	6-10
Therese	2.5	3.6	4.0	4.5	4.5	5.0	5.1	5.3	5.4	5.4	0.66	6-10

Table 9. 2000 Vase life (days) of peony cultivars. LSD = Least significant difference between means within rows at 5% level of significance by analysis of variance.

Cultivar	Maturity Grades										LSD	Best Grades
	1	2	3	4	5	6	7	8	9	10		
Dr. Alexander Fleming	5.9	5.6	5.3	5.4	4.8	4.0	4.1	5.0	5.1	4.1	1.01	1-4,8,9
Duchess de Nemours	5.8	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.6	5.1	0.28	1,9
Felix Supreme	7.5	7.5	7.5	7.9	7.6	7.8	7.8	7.1	7.0	8.4	0.52	1-7,10
Peter Brand	5.5	5.3	6.0	5.6	5.0	5.5	5.3	5.3	5.3	4.5	0.62	1,3,4,6
Sarah Bernhardt	5.3	6.0	4.2	4.6	4.3	4.3	4.5	6.1	6.3	5.8	1.06	8-10
Shawnee Chief	7.4	6.9	7.5	6.1	5.6	6.1	6.0	6.0	6.1	5.5	0.51	1-3
Snow Mountain	6.6	7.8	6.6	6.9	7.5	7.4	7.0	7.0	6.9	6.8	0.92	2,5-8
Therese	3.8	4.7	5.1	5.6	5.2	5.9	5.6	6.0	6.0	7.0	0.68	10

Table 10. Summary of best overall grades for harvest of peony flowers and mean, range, and difference of bud maturity ratings for best overall grades and their maturity rating description.

Cultivar	Overall Best Grades	Maturity		Range Difference	Bud Maturity Description
		Mean	Range		
Dr. Alexander Fleming	8-9	3.3	2.8-3.8	1.0	Softer
Duchess de Nemours	1-3	1.8	1.6-2.0	0.4	Firm with color, narrow range
Felix Supreme	1-10	3.1	1.8-4.4	2.6	Soft, wide range
Peter Brand	2-6	2.7	2.0-3.4	1.4	Soft, wide range
Sarah Bernhardt	8-10	3.85	3.1-4.6	1.5	Soft to very soft, wide range
Shawnee Chief	4-7	2.5	2.0-3.0	1.0	Firm with color to soft
Snow Mountain	6-8	2.75	2.6-2.9	0.3	Soft, narrow range
Therese	8-10	3.95	3.4-4.5	1.1	Very soft

Long-Term Cold Storage Studies

Long term cold storage is an option to extend the market for some peony cultivars. The objective of these studies was to determine which cultivars do well in long-term cold storage of 4 weeks or more with and without a pretreatment of 10% sucrose and fungicide treatments.

Cultivar Assessment

After 4 weeks of cold storage at 2 C, only the cultivars ‘Dr. F.G. Brethour’, ‘Felix Crousse’, ‘Henry Sass’, ‘Jayhawker’, ‘James Pillow’, and ‘Mons. Jules Elie’ had acceptable vase lives, ≥ 5 days open (Table11). After 12 weeks of cold storage, only ‘Richard Carvel’ had acceptable vase life, ≥ 4 days open (Table12).

Table 11. 2000 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		
Bridal Icing-White	4.3	2.2	5.0	3.9	2.5	drop
Bridal Shower-White	4.6	1.7	4.7	4.0	3.7	wilt/drop
Dr. F.G. Brethour-White	5.3	2.9	7.5	6.2	2.4	drop
Felix Crousse-Red	3.8	2.0	6.7	6.3	3.7	wilt/drop
Henry Sass-White	5.1	2.1	9.5	8.3	2.5	wilt/drop
Jayhawker-Pink	5.3	1.6	6.8	6.2	3.0	drop
James Pillow-Pink	3.9	2.8	8.6	7.3	2.0	drop
Lora Dexheimer-Red	3.3	3.5	5.0	2.6	2.6	wilt/drop
Mon. Jules Elie-Pink	5.7	1.9	6.0	5.1	3.1	drop
Walter Faxon-Pink	4.9	2.7	6.5	4.8	2.3	drop

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

Table 12. 2000 Postharvest evaluation of fresh-cut peony flowers stored for 12 weeks at 1 C.

Cultivar/Color	First Day Open	Vase Life(days)		Initial Openness Rating after Storage	Death
		Total	Open		
David Harum-Red	2.0	2.5	0.4	2.7	wilt
Dr. Alexander Fleming-Pink	2.0	2.7	0.6	2.9	wilt
Mon. Jules Elie-Pink	1.9	4.3	3.3	3.4	wilt
Richard Carvel-Red	1.9	5.2	4.1	3.1	wilt/drop
Snow Mountain-White	1.0	1.8	0.6	3.0	wilt

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

Prestorage Treatments

Flowers were treated with a 2-hour pulse of 10% sucrose solution at room temperature (~22 C) or received no treatment (control). 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 at 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 0.9 liter 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 | |

After 4 weeks of cold storage, the only effect of prestorage treatment with the 10% sucrose

pulse for most cultivars was to soften the flower buds (Table 13). This was true for '69A', 'Louis van Houttei', 'Raspberry Sundae', 'Shawnee Chief', and 'Therese'. This softening could be detrimental, if the bud is too soft for the market. Long-term cold storage was a disaster for 'Spellbinder', a white single that shows promise as a fresh-cut flower when freshly harvested. The petals opened and also discolored during cold storage. The prestorage treatments had no effect on 'David Harum', 'Duchess de Nemours', 'Edulis Superba', 'Mister Ed', 'Ozark Beauty', 'Richard Carvel', and 'Sarah Bernhardt'. 'Madame de Vernville' and 'Festiva Supreme' had total lives $\frac{1}{2}$ to 1 day longer with no prestorage treatment, whereas the prestorage treatment increased the vase life of 'Snow Mountain'. Pretreated 'Dr. Alexander Fleming' flowers were bigger.

The most important factor in deciding the success of long-term cold storage is acceptable vase life. For flowers stored 4 weeks, 5 days would be acceptable. 'David Harum', 'Louis van Houttei', 'Mister Ed', 'Ozark Beauty', 'Raspberry Sundae', and 'Snow Mountain' were the only cultivars to meet that criterion.

After 8 weeks of cold storage, the prestorage treatment had no effect on '69A', 'Snow Mountain', 'Shawnee Chief', 'Richard Carvel', and 'Duchess de Nemours'. Pretreated flowers of 'Louis van Houttei' and 'Raspberry Sundae' were softer. Pretreated flowers of 'Sarah Bernhardt' were bigger and lasted longer, and those of 'David Harum' also were bigger. Untreated flowers of 'Raspberry Sundae' had a longer total vase life. The only cultivars with an acceptable vase life of 4 days open were '69A', 'David Harum', 'Louis van Houttei', 'Raspberry Sundae', 'Richard Carvel', and 'Shawnee Chief', but only 'Louis van Houttei' and 'Shawnee Chief' looked comparable to fresh unstored flowers.

After 12 weeks of cold storage, the pretreated flowers of 'Shawnee Chief' performed better. They were bigger and lasted longer. However, flowers of 'Duchess de Nemours' were so diseased that they did not open well.

Table 13. 2000 Postharvest evaluation of fresh-cut peony flowers stored for 4 weeks at 1 C with prestorage treatment.

Cultivar/Color	Diameter (inches)	First Day Open	Vase Life(days)		Initial Openness Rating after Storage	Death
			Total	Open		
69A-White						
Control	4.0ns ^z	2.1ns	5.9ns	4.9ns	2.4*	drop
10% Sucrose	4.2	1.9	5.7	4.7	3.1	drop
David Harum-Red						
Control	4.2ns	1.9ns	7.3ns	6.5ns	2.9ns	wilt/drop
10% Sucrose	4.5	1.9	7.4	6.5	3.1	wilt/drop
Dr. Alexander Fleming,-Pink						
Control	4.5*	2.2ns	5.0ns	3.8ns	2.7*	drop
10% Sucrose	5.1	2.0	5.0	4.0	2.1	drop
Duchess de Nemours-White						
Control	5.0ns	1.9ns	5.1ns	4.1ns	2.4ns	drop
10% Sucrose	4.9	1.9	5.1	4.1	2.4	drop
Edulis Superba-Pink						
Control	4.1ns	2.1ns	5.3ns	4.1ns	3.2ns	drop
10% Sucrose	4.3	1.8	5.4	4.6	3.7	wilt/drop
Festiva Supreme-White						
Control	4.4ns	2.1ns	6.1**	4.7ns	2.8****	wilt
10% Sucrose	3.9	2.1	5.3	4.1	4.1	wilt
Louis van Houttei-Red						
Control	4.1ns	2.0ns	6.1ns	5.1ns	2.2*	drop
10% Sucrose	4.2	2.2	6.1	4.9	2.7	drop
Madame de Vernville-White						
Control	4.1ns	1.9ns	5.5****	4.7ns	3.5**	drop
10% Sucrose	4.4	1.6	5.0	4.6	4.6	drop
Mister Ed-Pink						
Control	5.4ns	1.9ns	6.3ns	5.5ns	2.9ns	drop
10% Sucrose	5.6	1.7	6.2	5.5	3.3	drop
Ozark Beauty-Pink						
Control	4.2ns	2.4ns	6.6ns	5.2ns	2.5ns	drop
10% Sucrose	4.4	2.1	6.2	5.1	2.7	drop
Raspberry Sundae-Pink						
Control	4.6ns	1.9ns	6.2ns	5.2ns	2.9**	drop
10% Sucrose	4.8	1.7	6.1	5.5	3.8	drop
Richard Carvel-Red						
Control	4.0ns	2.1ns	5.8ns	4.7ns	2.6ns	drop
10% Sucrose	4.0	2.1	5.9	4.9	3.1	drop
Sarah Bernhardt-Pink						
Control	4.1ns	2.6ns	5.3ns	4.0ns	2.3ns	drop
10% Sucrose	3.8	3.1	5.2	3.2	2.3	drop
Shawnee Chief-Red						
Control	4.3ns	2.3ns	5.8ns	4.5ns	2.7**	drop
10% Sucrose	4.2	1.9	5.8	4.9	3.5	drop
Snow Mountain-White						
Control	4.0ns	2.1*	5.4**	4.4**	2.5****	drop
10% Sucrose	4.3	1.6	6.1	5.5	4.0	drop
Spellbinder-White						
Control	–	1.0ns	2.0****	2.0*	3.8**	wilt**
10% Sucrose	6.3	1.7	3.5	3.1	4.5	wilt/drop
Therese-Pink						
Control	4.4ns	3.0ns	6.1ns	4.5ns	2.2****	wilt/drop
10% Sucrose	4.4	2.4	6.0	4.7	3.3	wilt/drop

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

^zns, *, **, 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 14. 2000 Postharvest evaluation of fresh-cut peony flowers stored for 8 weeks at 1 C with prestorage treatment.

Cultivar/Color	Diameter (inches)	First Day Open	Vase Life(days)		Initial Openness Rating after Storage	Death
			Total	Open		
69A-White						
Control	3.7ns ^Z	2.3ns	5.0ns	3.9ns	2.9ns	drop
10% Sucrose	3.8	1.9	5.0	4.1	3.0	drop
David Harum-Red						
Control	3.2*	2.1*	5.7ns	5.1ns	2.9ns	drop
10% Sucrose	3.8	1.9	5.8	5.1	3.3	drop
Dr. Alexander Fleming, Pink						
Control	4.0***	2.3ns	4.3ns	3.2ns	2.1ns	drop
10% Sucrose	4.5	2.3	4.1	2.8	2.5	drop
Duchess de Nemours-White						
Control	3.5ns	1.9ns	4.4ns	3.9ns	2.5ns	drop
10% Sucrose	3.8	1.9	4.6	3.9	3.0	drop
Louis van Houttei-Red						
Control	3.6ns	2.0**	5.3ns	4.3*	2.7**	drop
10% Sucrose	3.7	1.7	5.5	4.8	3.8	drop
Raspberry Sundae-Pink						
Control	3.8*	1.9*	6.0**	5.1ns	2.3***	drop
10% Sucrose	4.1	1.6	5.5	4.9	3.8	drop
Richard Carvel-Red						
Control	3.3ns	1.9ns	5.6ns	4.7ns	3.7ns	drop
10% Sucrose	3.4	1.8	5.6	4.8	3.4	drop
Sarah Bernhardt-Pink						
Control	3.3***	2.5ns	4.7**	3.5*	2.4ns	drop
10% Sucrose	4.0	1.9	5.1	4.1	2.1	wilt*
Shawnee Chief-Red						
Control	3.9ns	1.9ns	5.1ns	4.1ns	2.9ns	drop
10% Sucrose	4.0	1.9	5.1	4.1	3.2	drop
Snow Mountain-White						
Control	3.9ns	2.0ns	4.3ns	3.4ns	2.6ns	wilt
10% Sucrose	4.3	1.9	4.8	3.9	3.6	wilt

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

^Zns, *, **, 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 15. 2000 Postharvest evaluation of fresh-cut peony flowers stored for 12 weeks at 1 C with prestorage pulsing treatments.

Cultivar/Color	First Day Open	Vase Life(days)		Initial Openness Rating after Storage	Death
		Total	Open		
Duchess de Nemours-White					
Control	2.0ns ^Z	2.0*	0.2	2.6ns	wilt
10% Sucrose	2.0	2.5	0.4	3.1	wilt
Shawnee Chief-red					
Control	1.9ns	4.6***	3.9*	2.8ns	drop
10% Sucrose	2.1	5.5	4.3	3.1	drop

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

^Zns, *, **, 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.

Storage Disease Incidence with Fungicidal Treatments

Eight peony cultivars were selected for this study:

‘Bridal Shower’, a white double	‘Dr. Alexander Fleming’, a pink double
‘Duchess de Nemours’, a white double	‘Mrs. FDR’, a pink double
‘Snow Mountain’, a white bomb	‘Sarah Bernhardt’, a pink double
‘Shawnee Chief’, a red double	‘Walter Faxon’, a pink double

Two fungicide treatments were compared to a no-treatment control.

1. Prestorage spray of Aspire™ at the label-prescribed rate of 0.16 oz. per gallon.
2. Prestorage spray of Daconil™ at the label-prescribed rate of 1.5 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 (Tables 16, 17, 18, 19, 20, 21, 22, and 23). At each evaluation, flower buds also were rated for openness using the scale shown on pages 6 and 9.

Results showed that no one treatment was superior for all cultivars evaluated. For ‘Mrs. FDR’, disease incidence was greater on untreated leaves, but less on untreated guard petals (Table 16). The Aspire™ treated flowers had larger lesions than the Daconil™ treated flowers and the untreated flowers.

For ‘Walter Faxon’, untreated leaves had less disease incidence, but had larger lesions than the treated leaves (Table 17). Larger lesions occurred on sepals and guard petals with the Daconil™ treatment than the other treatments.

For ‘Shawnee Chief’, the untreated leaves had more and larger lesions than the fungicide-treated leaves (Table 18). The Daconil™ treated sepals had less incidence of disease.

For ‘Sarah Bernhardt’, disease incidence was less for the untreated leaves, guard petals, and petals at 4 weeks (Table 19).

For ‘Dr. Alexander Fleming’, untreated leaves had larger lesions at week 4 than those treated with fungicides (Table 20). No treatment differences occurred for the flowers.

For ‘Snow Mountain’, the Daconil™ treated leaves had smaller lesions than those in other treatments (Table 21). Lesions on sepals in of the Aspire™ treatment were larger at week 12.

For ‘Bridal Shower’, no treatment effects were seen on the leaves (Table 22). With the Daconil™ treatment, lesions were smaller on guard petals and on sepals at week 12.

For ‘Duchess de Nemours’, lesions were smaller on the untreated leaves (Table 23). Lesions on guard petals were smaller in the Aspire™ treatment only at week 4.

Acknowledgments

Thanks and appreciation go to Rebecca Inch for her assistance in data collection for the preparation of this report.

Table 16. 2000 Disease incidence assessment of ‘Mrs. FDR’ fresh-cut peony buds at 4, 8, and 12 weeks of cold storage at 0-2°C. Treatment 1= Control; 2= Aspire™ fungicide prestorage spray; 3= Daconil™ prestorage spray. 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	% ^X	Incidence	%	Incidence	%	Incidence	%	Incidence	%	Incidence	%	
Treatment	**Z	NS	***	NS	NS	*	0	***	***	***	***	NS	NS
Week	NS	NS	NS	NS	NS	***	NS	***	**	***	***	NS	***
TreatmentXWeek	NS	NS	NS	NS	NS	***	NS	***	***	***	**	NS	NS
1-4 weeks	0.3	2.3	0.1	5.0	0.36	7.2	0.7	14.7	0.2	10.6	0	0	2.1
2-4 weeks	0.1	8.8	0.34	1.8	0.23	2.2	1.0	26.2	1.0	29.8	0	0	1.8
3-4 weeks	0	0	0	0	0	0	0.7	11.7	0.7	11.5	0	0	1.9
1-8 weeks	0.3	5.5	0.1	2.4	0.4	19.7	0.7	16.5	0.8	9.6	0	0	2.6
2-8 weeks	0.2	8.8	0.5	5.0	0.5	9.3	1.0	62.5	1.0	50.5	0	0	1.9
3-8 weeks	0	0	0	0	0.3	0.2	0.9	11.1	0.5	9.5	0	0	2.3
1-12 weeks	0.2	9.0	0.1	0	0.25	90.7	0.9	33.7	1.0	15.0	0.1	7.5	2.8
2-12 weeks	0.1	8.8	0.5	13.8	0.4	28.1	1.0	99.5	1.0	79.0	0.8	27.5	2.6
3-12 weeks	0	0	0	0	0.2	24.2	1.0	29.5	0.8	24.6	0	0	3.0
LSD 5% ^y	0.29	NS	0.28	NS	NS	8.9	0.29	1.0	0.31	11.0	0.16	NS	0.15

^Z 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.

^y Least significant difference at the 5% level of probability for the mean of 10 stems.

^X Values for percent (%) area affected/lesion size are means of only those stems with disease.

Table 17. 2000 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= Aspire™ fungicide prestorage spray; 3= Daconil™ prestorage spray. 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	% ^X	Incidence	%	Incidence	%	Incidence	%	Incidence	%	Incidence	%	
Treatment	NS ^Z	NS	*	*	NS	NS	NS	***	NS	**	***	NS	***
Week	*	*	NS	**	NS	**	NS	***	NS	**	**	NS	NS
TreatmentXWeek	NS	NS	NS	NS	NS	NS	NS	***	NS	**	**	NS	NS
1-4 weeks	0.5	0.3	0.3	6.7	0.7	4.6	1.0	11.4	1.0	15.9	0	0	2.2
2-4 weeks	0.3	2.4	0.5	2.0	0.7	7.3	1.0	7.3	1.0	4.9	0	0	2.9
3-4 weeks	0.4	6.8	0.7	2.2	0.7	3.4	1.0	16.1	1.0	18.4	0.1	0	1.8
1-8 weeks	0.6	10.1	0.3	14.7	0.8	14.1	1.0	42.0	1.0	45.5	0	0	2.3
2-8 weeks	0.5	4.3	0.6	6.9	0.7	19.6	1.0	23.5	1.0	10.1	0	0	3.6
3-8 weeks	0.7	11.2	0.8	8.4	0.6	17.4	1.0	60.0	1.0	53.0	0.3	2.0	2.1
1-12 weeks	0.1	26.1	0.3	12.3	0.6	20.2	1.0	81.5	1.0	92.0	0.3	9.7	2.2
2-12 weeks	0.3	8.6	0.2	3.9	0.7	34.2	1.0	46.5	1.0	39.0	0.8	10.0	2.9
3-12 weeks	0.3	14.8	0.6	6.5	0.5	22.8	1.0	95.5	1.0	95.0	1.0	17.5	2.2
LSD 5% ^y	0.42	7.25	0.39	4.15	NS	14.5	NS	11.3	NS	11.5	0.25	NS	0.64

^Z 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.

^y Least significant difference at the 5% level of probability for the mean of 10 stems.

^X Values for percent (%) area affected/lesion size are means of only those stems with disease.

Table 18. 2000 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= Aspire™ fungicide prestorage spray; 3= Daconil™ prestorage spray. 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	% ^X	Incidence	%	Incidence	%	Incidence	%	Incidence	%	Incidence	%	
Treatment	*** ^Z	***	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	0.75	32.0	0.84	11.1	0.89	13.5	0.98	15.1	1.0	9.3	0.02	0	2.4
2-4 weeks	0.52	0.2	0.69	0.5	1.0	5.3	1.0	16.7	0.88	8.7	0.02	0	2.4
3-4 weeks	0.13	8.4	0.36	5.1	0.68	2.0	0.45	10.2	0.66	22.9	0.2	10.0	2.0
1-8 weeks	0.87	30.0	0.84	17.1	0.89	33.7	0.98	37.4	1.0	26.6	0.15	30.0	2.7
2-8 weeks	0.77	9.2	0.81	5.6	1.0	32.1	1.0	55.9	1.0	33.3	0.02	0	3.1
3-8 weeks	0.90	5.6	0.69	7.7	0.91	11.1	1.0	44.8	1.0	34.7	0.03	0	2.4
1-12 weeks	0.87	34.0	0.72	47.5	0.77	77.5	0.98	93.7	1.0	71.8	0.65	35.0	2.8
2-12 weeks	0.90	15.0	0.56	19.6	1.0	57.3	1.0	85.3	1.0	83.9	0.02	0	3.3
3-12 weeks	0.35	1.5	0.69	8.7	0.91	23.7	1.0	88.7	1.0	77.5	0.30	25.0	3.1
LSD 5% ^Y	0.27	13.3	NS	12.5	0.27	21.0	.16	14.5	0.19	14.4	0.28	NS	0.83

^Z 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.

^Y Least significant difference at the 5% level of probability for the mean of 10 stems.

^X Values for percent (%) area affected/lesion size are means of only those stems with disease.

Table 19. 2000 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= Aspire™ fungicide prestorage spray; 3= Daconil™ prestorage spray. 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	% ^X	Incidence	%	Incidence	%	Incidence	%	Incidence	%	Incidence	%	
Treatment	NS ^Z	NS	***	NS	*	NS	NS	NS	**	NS	**	NS	NS
Week	*	NS	*	**	NS	***	NS	***	**	***	***	***	*
TreatmentXWeek	NS	NS	NS	NS	NS	NS	NS	NS	**	**	NS	NS	NS
1-4 weeks	0.4	4.0	0.6	7.7	0.7	19.5	1.0	12.1	0.6	17.6	0.0	0	2.3
2-4 weeks	0.6	4.0	0.9	8.8	1.0	11.4	1.0	16.1	1.0	10.8	0.4	3.9	2.6
3-4 weeks	0.4	5.1	0.4	13.0	0.8	16.7	1.0	14.5	1.0	13.3	0.2	0.5	3.1
1-8 weeks	0.7	10.6	0.9	15.6	0.9	35.4	1.0	15.5	0.9	17.4	0.0	0	2.7
2-8 weeks	0.8	12.4	1.0	20.7	1.0	28.9	1.0	30.1	1.0	20.0	0.2	0.2	2.6
3-8 weeks	0.8	7.6	0.7	17.1	0.9	26.7	1.0	22.0	1.0	19.8	0.1	6.5	3.2
1-12 weeks	0.8	7.2	0.8	25.2	0.9	57.7	1.0	52.1	1.0	41.5	0.5	16.0	2.3
2-12 weeks	0.8	20.1	1.0	44.0	1.0	63.5	1.0	54.0	1.0	59.0	0.9	24.0	2.3
3-12 weeks	0.8	12.6	0.6	38.3	0.9	48.4	1.0	44.0	1.0	61.0	0.6	24.2	2.2
LSD 5% ^y	0.34	NS	0.33	20.0	0.24	24.7	NS	11.8	0.18	8.8	0.33	6.8	0.73

^Z 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.

^y Least significant difference at the 5% level of probability for the mean of 10 stems.

^X Values for percent (%) area affected/lesion size are means of only those stems with disease.

Table 20. 2000 Disease incidence assessment of ‘Dr. Alexander Fleming’ fresh-cut peony buds at 4, 8, and 12 weeks of cold storage at 0-2°C. Treatment 1= Control; 2= Aspire™ fungicide prestorage spray; 3= Daconil™ prestorage spray. 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	% ^x	Incidence	%	Incidence	%	Incidence	%	Incidence	%	Incidence	%	
Treatment	NS ^z	NS	NS	**	NS		NS	*	NS	NS	NS	NS	*
Week	*	**	*	***	NS		NS	***	NS	***	***	***	*
TreatmentXWeek	NS	NS	NS	NS	NS		NS	NS	NS	*	NS	NS	NS
1-4 weeks	0.9	17.1	1.0	16.0	1.0	35.6	1.0	4.76	1.0	31.6	0	0	3.1
2-4 weeks	0.64	10.5	0.89	37.6	1.0	31.2	1.0	40.6	1.0	26.6	0.01	0	2.7
3-4 weeks	0.8	29.6	0.8	43.0	1.0	47.5	1.0	40.3	1.0	19.4	0.1	0.14	2.4
1-8 weeks	0.9	30.0	1.0	24.0	1.0	53.9	1.0	62.0	1.0	27.0	0.1	3.8	3.6
2-8 weeks	1.0	23.0	1.0	43.7	1.0	42.9	1.0	52.1	1.0	44.6	0.01	0	3.1
3-8 weeks	0.9	26.8	1.0	23.0	1.0	55.1	1.0	42.5	1.0	39.5	0.3	23.5	2.5
1-12 weeks	1.0	45.0	1.0	54.0	1.0	89.5	1.0	100.0	1.0	83.5	1.0	50.5	2.4
2-12 weeks	1.0	46.1	1.0	58.8	1.0	81.3	1.0	99.9	1.0	91.9	1.0	54.6	2.5
3-12 weeks	1.0	40.0	1.0	54.5	1.0	78.5	1.0	98.0	1.0	93.6	1.0	77.0	2.6
LSD 5% ^y	0.25	20.2	0.16	18.1	NS	25.6	NS	12.3	NS	11.5	0.20	15.3	0.73

^z 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.

^y Least significant difference at the 5% level of probability for the mean of 10 stems.

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

Table 21. 2000 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= Aspire™ fungicide prestorage spray; 3= Daconil™ prestorage spray. 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	% ^X	Incidence	%	Incidence	%	Incidence	%	Incidence	%	Incidence	%	
Treatment	NS ^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	0.3	3.2	0.58	14.2	1.0	42.7	0.7	24.3	0.7	18.6	0.1	9.0	2.6
2-4 weeks	0.47	21.6	0.78	27.8	0.5	10.6	0.66	25.3	0.45	4.0	0	0	2.9
3-4 weeks	0.7	5.3	0.70	14.5	0.4	12.5	0.8	12.3	0.4	9.2	0	0	2.5
1-8 weeks	0.8	14.8	0.91	30.6	1.0	70.4	1.0	24.8	0.8	19.5	0.1	14.0	3.2
2-8 weeks	0.58	40.4	0.73	55.4	0.7	33.7	0.99	23.9	0.89	14.6	0	0	3.2
3-8 weeks	0.9	12.2	0.89	28.1	0.8	31.6	0.9	18.7	1.0	18.5	0	0	2.7
1-12 weeks	0.9	18.3	0.91	45.3	1.0	95.4	1.0	53.0	1.0	46.5	0.6	26.4	3.7
2-12 weeks	0.69	67.2	0.89	77.4	1.0	67.1	0.99	75.5	1.0	58.7	0.99	26.2	3.8
3-12 weeks	0.9	26.3	0.89	55.6	0.8	56.3	1.00	52.0	1.0	45.5	0.9	29.0	3.0
LSD 5% ^y	0.36	15.3	NS	20.9	0.28	22.6	0.29	16.4	0.28	13.9	0.24	NS	0.83

^Z 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.

^y Least significant difference at the 5% level of probability for the mean of ten stems.

^X Values for percent (%) area affected/lesion size are means of only those stems with disease.

Table 22. 2000 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= Aspire™ fungicide prestorage spray; 3= Daconil™ prestorage spray. 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	% ^X	Incidence	%	Incidence	%	Incidence	%	Incidence	%	Incidence	%	
Treatment	NS ^Z	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
1-4 weeks	0.4	3.2	0.5	1.2	0.3	1.0	1.0	23.3	0.9	9.8	0.0	0	2.7
2-4 weeks	0.5	0.5	0.3	0.6	0.5	0.1	1.0	15.2	1.0	14.1	0.0	0	1.6
3-4 weeks	0.6	9.7	0.5	10.5	0.3	9.6	1.0	18.7	1.0	7.1	0.0	0	2.8
1-8 weeks	0.4	2.9	0.3	1.6	0.2	17.2	1.0	41.5	1.0	25.3	0.0	0	2.4
2-8 weeks	0.2	4.3	0.3	2.8	0.43	3.4	1.0	40.0	1.0	38.0	0.0	0	2.3
3-8 weeks	0.3	12.7	0.4	12.0	0.4	10.4	1.0	30.0	1.0	19.5	0.0	0	3.0
1-12 weeks	0.8	44.1	0.8	54.7	0.6	67.4	1.0	93.0	1.0	74.0	0.9	14.3	2.9
2-12 weeks	0.7	19.6	0.6	16.1	0.8	30.7	1.0	100	1.0	94.0	1.0	77.0	2.9
3-12 weeks	0.5	19.8	0.4	19.7	0.6	28.9	1.0	72.5	1.0	66.0	0.9	36.0	3.4
LSD 5% ^y	0.43	13.4	NS	14.6	NS	19.9	NS	11.1	NS	10.9	0.13	NS	0.67

^Z 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.

^y Least significant difference at the 5% level of probability for the mean of 10 stems.

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

Table 23. 2000 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= Aspire™ fungicide prestorage spray; 3= Daconil™ prestorage spray. 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	% ^X	Incidence	%	Incidence	%	Incidence	%	Incidence	%	Incidence	%	
Treatment	NS ^Z	**	**	**	NS	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	*	NS	NS	NS
1-4 weeks	0.9	22.0	0.9	23.0	0.9	25.5	1.0	24.5	1.0	34.1	0.1	0.93	1.9
2-4 weeks	0.9	42.5	1.0	36.5	0.9	34.1	1.0	41.0	0.8	10.0	0.0	0	2.4
3-4 weeks	0.9	40.1	1.0	47.5	0.9	35.6	1.0	29.0	1.0	43.2	0.4	14.4	1.9
1-8 weeks	0.9	35.5	0.7	38.5	1.0	42.1	1.0	81.0	0.9	27.7	0.0	0	2.1
2-8 weeks	0.9	63.6	1.0	47.0	1.0	52.0	1.0	81.0	0.9	18.2	0.0	0	2.3
3-8 weeks	0.9	60.2	1.0	64.5	0.9	53.8	1.0	86.0	1.0	34.0	0.0	0	2.2
1-12 weeks	1.0	61.5	1.0	63.5	0.9	72.3	1.0	91.0	1.0	71.0	0.5	6.8	2.2
2-12 weeks	1.0	88.0	1.0	92.0	1.0	94.0	1.0	100.0	1.0	78.5	0.8	42.6	2.2
3-12 weeks	1.0	74.0	1.0	93.0	1.0	85.0	1.0	100.0	1.0	84.0	0.8	23.4	2.3
LSD 5% ^Y	NS	19.9	0.17	23.5	NS	24.0	NS	14.6	NS	14.7	0.29	NS	NS

^Z 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.

^Y Least significant difference at the 5% level of probability for the mean of 10 stems.

^X Values for percent (%) area affected/lesion size are means of only those stems with disease.

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