Post Harvest Chilling and Vase Life of Herbaceous Peonies

by

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Abstract

Two peony cultivars, 'Sarah Bernhardt' and 'Duchess de Nemours', were treated to a series of cold treatments (0 - 168h in 2013 and 0 - 336h in 2014; 24-h and 48-h intervals, respectively) at 1.5 + 2oC to establish the minimum time necessary for chilling prior to shipping for maximum consumer vase life. Preliminary research found that chilling for 1 week, doubled the vase life, and data from 2013 season corroborated those findings. However, vase life for cut flowers in 2014 decreased significantly and did not improve with chilling. Vase life for 'Sarah Bernhardt' and 'Duchess de Nemours' peonies averaged 6.1d and 5.9d, respectively for the entire treatment period and did not differ from the un-chilled control.
This research did not clearly identify minimum chilling requirements for Alaska peonies. In contrast, cut stems in 2013 showed a linear increase in vase life with chilling (8.2d - 14.2d for 'Sarah Bernhardt' and 6.9d -13d for 'Duchess de Nemours'.

Vase life and bud diameter did not differ among early- mid- and late-season cutting dates for both cultivars. Cut stems from two commercial farms showed the same short vase life, and there was no statistical difference in vase life among farms. Environmental factors during spring growth or post harvest handling differences play a more significant role in defining vase life than simply hours of chilling.

Vase life for 68 cultivars (7 days, 1.5 + 2oC) in 2014 ranged from 4d to 9d (mean 6.0 + 1.0d). In 2013, vase life averaged nearly three days longer, 8.6 + 2.7d (range 4 – 14d). Vase life for 2014 was significantly lower for most cultivars than 2013. In 2013, more than 70% of the cultivars showed an average vase life of 7d or more, while in 2014, only 24% reached that standard. The four main classifications of peonies, semi-double, Japanese, bomb and full double, had an average vase life ranging from 5d to 17d. One class had a vase life of less than 7d for both 2013 and 2014, the Intersectional hybrids.

Introduction

World cut flower sales are a highly competitive, volatile and multi-billion dollar industry. Sales are subject to fashion whims of consumers as well as industry demands for quality blooms that meet bud size standards and ship well; a product that has the requisite stem length/strength; and one with a long vase life. Since the product is a senescing stem, the industry has the daunting task of delivering a product whose consumer life is as long and colorful as possible. The reported consumer life for peonies is 7 days.

Preliminary research at UAF found that chilling at 1°C (34°F) for 1 week doubled the vase life of peonies, but 12 hours was not sufficient. We wanted to determine the minimum time necessary for chilling prior to shipping for maximum consumer vase life. Some growers actually ship the day of harvest, which may not lead to the best product. One of our experiments hinted that vase life of Alaska peonies is double that of the lower latitudes. This experiment was designed to clarify these earlier experiments, and attempt to determine the maximum vase life for herbaceous and Itoh cultivars.

Methods

Peonies were grown since 2001 at the UAF Georgeson Botanical Garden. Our first experiment used two cultivars: 'Duchess de Nemours' (standard double white) and 'Sarah Bernhardt' (double pink). These cultivars comprise the greatest number of roots in Alaska commercial fields.

Treatment design:
Experiment 1:Examine the vase life following chilling treatments up to 14 days.

1. Two cultivars, 3 reps, 5 stems per replicate
2. Stem cutting stage 2.5 maturity index (photo above)
3. Eight chilling treatments 2013: 0, 24, 48, 72, 96, 120, 144, 168 hours of chilling 2014: 0.48.96.144.192.240 and 336 hours of chilling
4. Flowers, tagged, wrapped in newspaper, stored dry, in the dark at 1.9 ± 1.0°C and 85 ± 6.6% relative humidity

Post chilling:

1. Stems re-cut, placed in tap water-filled, clean jars (room temp: 20.8 ± 1.6°C, 56.2 ± 3.2 % relative humidity)
2. Room lighting: natural window light and 24-hour fluorescent room fixtures, (25 μM·m2·s^{-1} measured 1.2m (4 ft) beneath the fixtures.
3. Data included dates from bud to full bloom (guard petals at 90 deg to the stem) and petal wilt/abscission.

Experiment 2: Cultivar vase life.

1. Seventy-one cultivars identified by type (single, double, semi-double, Japanese, Full Double, Itoh), 3 reps, 6 stems per replicate
2. Stem cutting stage 2.5 maturity index.
3. Stored, chilled for 7 days as above then evaluated for vase life as above.

Experiment 3 Early mid and late season cutting

1. 'Sarah Bernhardt' and 'Duchess de Nemours', harvested on 1, 10 and 20 July, 2014 (6 stems per cultivar per rep, 3 reps.
2. Stem cutting stage 2.5 maturity index.
3. Stored, chilled for 7 days as above then evaluated for vase life as above.

Experiment 4 Vase life of farm cuts

1. 'Sarah Bernhardt' harvested from 3 commercial farms (6 stems per cultivar per rep, 3 reps.
2. Stem cutting stage 2.5 maturity index.
3. Stored, chilled for 7 days in pack house coolers evaluated for vase life as above.

Data Analysis: Analysis of variance, and regression analysis

1. 'Sarah Bernhardt' and 'Duchess de Nemours', harvested on 1, 10 and 20 July, 2014 (6 stems per cultivar per rep, 3 reps.
2. Stem cutting stage 2.5 maturity index.
3. Stored, chilled for 7 days as above then evaluated for vase life as above.

Data Analysis: Regression analysis and ANOVA, completely randomized design.

Table 1. Growing season weather statistics	2013	2014
Average seasonal air temp (°F)*	53.9	55.9
Air temp (°F) (max- min)	92.0 (27 Jun)- 16.9 (6 May)	84.2 (7 Jul) - 29.3 (30 Aug)
May (mean) (°F)	42.2	48.9
June	64.5	56.4
July	62.8	58.3
Aug	58.2	57.5
Sep	41.9	42.6
Date of last spring frost	22 May	21 May
Date of first autumn frost	25 Aug	30 Aug
Previous winter min (°F)	-45.3 (Jan)	-41.6 (Jan)

* 1 May to 30 Sep, Agricutural and Forestry Experiment Station Weather Station, Fairbanks, Alaska

The Environment

Table 2. Controlled Environment Records*				
	Refrigeration (Lab) 2013	Refrigeration (Conex) 2014	Post harvest lab 2013	Post harvest lab 2014
Air Temperature (mean ± SD)	34.8 + 2.2	33.8+ 3.6	69.4 + 1.6	70.5+1.5
Relative Humidity (% ± SD)	84.9 + 6.0	95.7 + 2.1	55.4 + 1.9	56.1 +1.8
Light uM·m^2.s^{-1}	None	None	Natural Daylight + fluorescent 1.2 m beneath fixtures, 25 uM·m^2.s^{-1}	

*28 June through 31 July

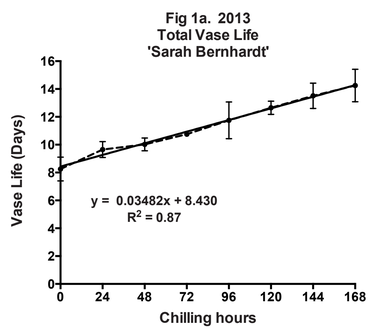
Results: Chilling Duration and Vase Life

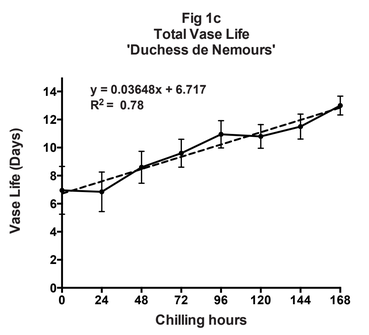
2013- 'Duchess de Nemours' increased linearly from 6.9 ± 1.7 days with no chilling (control) to 13.0 ± 0.7 days with 168 hours of chilling (Fig. 1 a,c).
'Sarah Bernhardt' increased from 8.2 ± 0.9 days (control) to 14.2 ± 1.2 days with 168 hours of chilling.

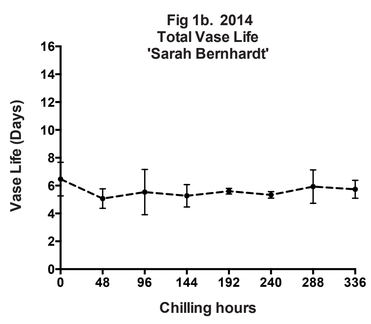
2014- no linear increase in vase life was observed for either cultivar. (Fig. 1b,d).

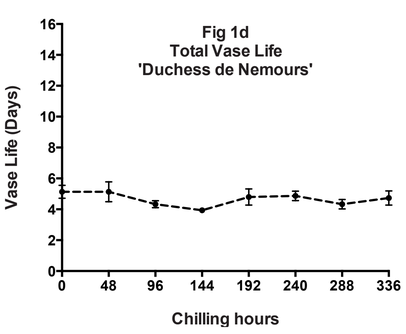
Three factors might explain these results:

1. Environmental differences between years. (Table 1).
2. Changes in storage conditions between years (Table 2).
3. Measurement error: different student interns between seasons









Results: Vase Life and Harvest Date

- No difference among early-, mid- and late-season harvests within each cultivar (Table 3).
- Significant differences between cultivars in total vase life (P < .05) and bud diameter (P <.001).
- Consistent bud diameter through season for 'Sarah Bernhardt' . Highly variable seasonal bud diameter for 'Duchess de Nemours'

Table 3 Vase life of 'Sarah Bernhardt' and 'Duchess de Nemours' peonies at three different harvest dates during th 2014 season.						
	Vase Life (Days + SD)*			Bud diameter (mm + SD)***		
Cultivar	Early (1 July)	Mid (8 July)	Late (15 July)	Early (1 July)	Mid (8 July)	Late (15 July)
Sarah Bernhardt**	6.4 ± 1.2	5.5 ± 1.6	6.1 ± 1.0	44.6 ± 0.5	43.7 ± 1.9	44.3 ± 1.3

* Followed 7 days of chilling at 34F, 3 replicates of 6 peony stems each.

** Cultivars differed significantly for total vase life (P < .05), no difference in harvest dates

***Cultivars were highly significantly different for bud diameter (P<.001) but not for harvest date

Results: Vase Life for Flower Classes

- Vase life was > 2 days longer for all cultivars in 2013 and 2014.
- Cultivar and year effects were highly signifncant (P<.001) as was the interaction.
- The number of cultivars showing a vase life of >7 dropped by 45% between 2013 and 2014.

Table 4. Vase life for peony flower classes		
Cultivars and Classification	Cultivars with > 7 days average vase life (%)*	
	2013	2014
All cultivars	71	26
Japanese (n=10)	90	30
Semi Double (6)	50	33
Bomb (3)	100	33
Full Double (41)	90	24
Interstctional (Itoh) (8)	0	0
Total Vase Life Days (mean) [min-max]		
Japanese (n=10)	9.8 ± 2.0 {6-10]	6.7 ± 1.2 [5-9]
Semi-Double (6)	8.8 ± 1.2 [6-15]	6.0 ± 1.1 [4-7]
Bomb (3)	8.0 ± 0.5 [7.5 - 8.5]	7.0
Full Double (41)	9.4 ± 2.9 [5-17]	6.0 ± 1.0 [4 - 8]
Intersectional (Itoh) (8)	5.3 ± 0.2 [5 - 5.6]	4.2 ± 0.4 [4 - 5]

* Total n= 68. Only included cultivars with harvestable blooms both in 2013 and 2014

What we Learned:

During the past 10 years, vase life for Alaska peonies always exceeded the minimum 7 days. For many cultivars, the vase life was doubled the published average except for Intersectional cultivars. These cultivars rarely exceeded 5 days vase life.

In 2014, flowers from nearly all cultivars did not respond to chilling, and vase life rarely exceeded 5 days. Environmental factors either outdoors or in the cold storage facility obviously make a huge difference in consumer vase life.

This project did not clearly identify an optimum cold storage treatment for maximum vase life. Nor did it support the statement that Alaska peonies have double the national standard.

The recommendation to harvest at a particular time of day was not supported.

With the exception of Intersectional hybrids, the often-repeated statement that full double peonies have a longer vase life than other classes such as Japanese, is not correct. Selections for long vase life should be made by cultivar, not flower class.

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