# A Cut Above The Rest



Researchers at North Carolina State University examined

the post-harvest handling of six greenhouse and field cut flowers.

By John Dole, Frankie Fanelli, William Fonteno, Beth Harden and Sylvia Blankenship



Dahlia 'Karma Thalia'. (Photos: John Dole)

ew cut flowers are fun to look at in the catalogs, research on the Internet and discuss with fellow growers. Expectations are high when the seed or plugs first arrive. Of course, a few cultivars fall by the wayside during the production process, but the rest grow well and look great.

Finally, the moment of truth arrives when the flowers begin to open and are harvested. But will they last? Will they look as good five, seven, 10 days after harvest? Will they be the kind of flower that performs well and commands a high price?

Our work at North Carolina State University answered those question for six new greenhouse and field cut flower species: dahlia 'Karma Thalia' or 'Naomi', linaria 'Lace Violet', lupine 'Sunrise', poppy 'Temptress', rudbeckia 'Indian Summer' and trachelium 'Jemmy Royal Purple'.

#### What We Tested

In evaluating the species, the cut stems were harvested into tap water, recut and placed in deionized water unless otherwise indicated. Then the cut stems were treated to several or all of the treatments listed below depending on the species and amount of cut stems we were able to produce. After treatments, stems were placed at approximately 68° F under roughly 200 foot-candles of light for 12 hours per day.

Flowers were monitored daily to determine the end of consumer vase life for all species and wholesale/retail vase life for linaria and poppy. The consumer vase life was designated as the day a consumer would have disposed of the stem. The wholesale/retail vase life was designated as the first day a change was observed in the inflorescence that would typically prevent it from being sold by a wholesaler or retailer.

**Ethylene sensitivity.** Cut stems were pretreated with AVB (STS, Pokon Chrysal), Ethylbloc (1-MCP, Floralife) or deionized water for four hours and then exposed to 0-, .1- or 1ppm ethylene for 16 hours.

**Long-term cold storage.** Cut stems were kept zero, one, two or three weeks in a 36° F cooler (relative humidity 80-90 percent) either dry in commercial floral boxes or wet in buckets of water.

**Sucrose pulse.** Cut stems received a 24-hour pulse treatment of 0-, 5-, 10- or 20-percent sucrose in deionized water with 8-hydroxyquinoline citrate (8-HQC) added as an anti-microbial agent.

**Pretreatment and short-term storage.** Cut stems received three different 4-hour pretreatments: AVB, Ethylbloc or deionized water. Then they were stored at 41° F for four days either dry in commercial floral boxes or wet in buckets of tap water.

**Vase solutions and substrates.** Cut stems were placed in vases with or without floral foam and in 0-, 2- or 4-percent sucrose floral solution plus 8-HQC.

**Commercial preservatives.** Cut stems were pretreated with one of three hydration solutions: Hydraflor 100 (Floralife), Chrysal Professional 1 Processing Solution (Chrysal) or deionized water and placed in one of three holding solutions: Floralife Professional (Floralife), Chrysal Professional 2 Processing Solution (Chrysal) or deionized water.

**Control solutions.** Cut stems were placed at 72° F in untreated tap water, deionized water adjusted to a 3.5 pH with citric acid or deionized water plus 200-ppm 8-HQC. ◆

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Top: Dahlia 'Karma Naomi'. Bottom: Dahlia 'Karma Thalia' bud ready to cut at the breaking stage.

#### Dahlia

Dahlia Karma is a series of beautiful, mediumsized cut flowers available in several colors. Flowers harvested when fully open are best used for local sales, while those cut as buds should be used for wholesale marketing.

For most experiments, fully expanded, fieldgrown 'Karma Thalia' flowers were harvested. Some experiments were repeated using Naomi flowers, and in some cases, buds were cut at the breaking stage (one petal open) with a minimum of 50-percent color. The end of consumer vase life occurred when browning on the petals was noticeable.

The buds required 3.1-4.5 days to fully open and lasted 12.1-12.8 days if placed in 2- or 4-percent sucrose or commercial holding solutions. Many of the buds held in water (control) did not fully open or did not attain the flower size and color of buds held in sucrose or commercial holding solutions.

Pretreatments. Commercial hydration solutions had no effect on vase life.

Cold storage/ethylene: One week of cold storage at 34° F reduced vase life up to two days. Ethylene at .1-1 ppm had no effect on dahlia stems, indicating they are not ethylene sensitive. AVB and Ethylbloc had no effect on vase life. Stems could be cold stored at 34° F for up to one week, but this reduced the vase life to 6.6 days as compared to 8.4 days for unstored flowers.

Holding Solutions. Dahlia had a vase life of 6-9 days that could be increased to 10-11 days using commercial holding solutions such as Chrysal Professional 2 Processing Solution or Floralife Professional. Floral foam had no effect on vase life.

#### Linaria

Greenhouse-grown linaria 'Lace Violet' is an excellent filler flower, with tall, open spikes of small, rose, violet, white or yellow snapdragonlike flowers. With proper handling, linaria is suitable for wholesale/retail marketing.

'Lace Violet' stems were harvested when 2-4 florets were open. The end of wholesale/retail vase life occurred when the immature florets opened pale or when more than 50 percent of the spike opened. The end of consumer vase life occurred when the stem collapsed or more than 75 percent of florets were discolored or shriveled.

Pretreatments. A 24-hour 10- or 20-percent sucrose pulse increased the wholesale/retail and consumer vase life by 2-4 days resulting in a consumer vase life of nine days compared to control flowers, which had a 5-day consumer vase life. The 20-percent sucrose pulse produced only a slightly longer vase life so a 10percent pulse can be used.

Cold storage/ethylene. Cold storage at 34° F for one week decreased vase life, but longer storage had little additional effect. Treating linaria with either .1- or 1-ppm ethylene, Ethylbloc or AVB had no effect on vase life. Thus, linaria is not ethylene sensitive.

Holding solutions. Stems lasted the longest (14-19 days) when held in 2- or 3-percent sucrose. The use of floral foam decreased vase life but only slightly when used with either 0- or 2-percent sucrose. The use of a commercial holding solution (Floralife Professional or Chrysal Professional 2 Processing Solution) increased vase life to 10-13 days from 5-6 days in just water. However, neither commercial hydrating **b** 

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solution (Hydraflor 100 or Chrysal Professional 1 Processing Solution) increased vase life. Lowering water pH to 3.5 with citric acid and using an antimicrobial agent such as 8-HQS increased consumer vase life to 11 days from five days in just water.





*Top:* Linaria 'Lace Violet'. *Middle:* Lupine 'Sunrise'. *Bottom:* Lupine stems curved after being stored flat in boxes.

#### Lupine

Lupinus hartwegii ssp. cruikshankii 'Sunrise' produces tall, mildly fragrant spikes with peashaped florets that are blue with a touch of white and yellow. The deep-green foliage and long, strong stems add to this cut flower. It is suitable for local and wholesale marketing.

Greenhouse-grown lupine 'Sunrise' stems were harvested when 1-4 florets were fully opened. The end of consumer vase life occurred when either the stem collapsed or more than 50 percent of florets were discolored, shriveled or dropped.

**Pretreatments.** The vase life of flowers averaged nine days in deionized water. Commercial pretreatments and 24-hour 10- or 20-percent sucrose pulses were not effective in extending vase life.

**Cold storage/ethylene.** Cold storage at 34° F for up to two weeks in high quality water resulted in a 9-day vase life. As with many spike-type flowers, the stems curved after being removed from storage. Lupine stems were ethylene sensitive. The florets and buds abscised or failed to open when exposed to either .1- or 1-ppm ethylene. Stems pretreated with AVB had a vase life of 10 days at the .1 ethylene concentration and a 6.3-day vase life at the 1 concentration. Treatments with Ethylbloc also prevented ethylene damage.

**Holding solutions.** Using commercial holding solutions (Chrysal Professional 2 Processing Solution or Floralife Professional) either increased vase life an average of two days or did not have an effect. The use of floral foam had no effect on vase life.

#### Poppy

The spectacular-colored flowers of poppy 'Temptress' are an instant hit with buyers. Without proper treatment, poppy is best suited to retail sales; however, poppies are suitable for wholesale marketing with proper handling because the flowers tolerate cold storage well.

Greenhouse-grown poppy 'Temptress' flowers were cut in bud stage B when the petals were visible. Stems wilted immediately after harvest but became turgid after several hours in water. The end of wholesale/retail vase life occurred when the petals opened enough that the flowers no longer had a cup shape. The end of consumer vase life occurred when a petal shattered or became crinkled, discolored, or brown or the stem collapsed.

**Pretreatments.** A 24-hour 10- or 20-percent sucrose pulse increased wholesale/retail vase life of stems harvested as buds. These treatments had no effect on consumer vase life. The 20-percent pulse produced similar results as the 10-percent solution, which would be acceptable. Similarly, commercial hydrating solutions increased wholesale/retail vase life but had no effect on consumer vase life.

**Cold storage/ethylene.** Stems could be cold stored wet or dry for one week at 34° F with no decrease in vase life. Two weeks of cold storage reduced vase life. Treating poppy flowers with .1- or 1-ppm ethylene and Ethylbloc or AVB had no effect on retail **b** 



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Left: Poppy 'Temptress'. Right: Poppy 'Temptress' buds ready to cut at cracked calyx stage.

or consumer vase life. Thus, poppies are not ethylene-sensitive flowers.

**Holding solutions.** Commercial holding solutions (Floralife Professional or Chrysal Professional 2 Processing Solution) increased wholesale/retail and consumer vase life by two days from 5.5 days for stems only in water to 7.6-7.9 days. Increasing sucrose content of the vase solution from 0- to 2- or 4-percent sucrose increased retail vase life but had no effect on consumer vase life. Use of floral foam had no effect on retail or consumer vase life.

#### Rudbeckia

Rudbeckia 'Indian Summer', with its large, yellow, daisy flowers, is a long-lasting cut flower that does not require special handling for a long vase life. Due to its long post-harvest life and tolerance to cold storage, rudbeckia is suitable for wholesale marketing.



Field-grown 'Indian Summer' stems were harvested when the outer petals were fully open. The end of consumer vase life occurred when the stem collapsed or petals began to turn brown. Rudbeckia had a vase life of up to 36 days and no treatments extended vase life.

Pretreatments. No pretreatments increased vase life. The only pretreatments that reduced vase life were 24-hour 10- or 20-percent sucrose pulses.

Cold storage/ethylene. Stems could be stored wet or dry at 35° F for up to two weeks with either no decrease in vase life or an 8-day decrease in vase life, respectively. Treatment with AVB and Ethylbloc had no effect.

Holding solutions. Floral foam reduced the vase life by 50 percent, but 13 days is still a respectable time for a floral arrangement. A few stems wilted and died rapidly no matter what treatments were used. These wilted stems were evident early in the postharvest handling process and should be removed before marketing.

#### **Trachelium**

Trachelium 'Jemmy Royal Purple' is a showy filler flower that produces tall, slender (but strong) stems topped by masses of tiny, starshaped florets. With proper handling, trachelium



Left: Rudbeckia 'Indian Summer' flowers showing the small percentage of wilted flowers that do not rehydrate and should be removed after storage. Right: Rudbeckia 'Indian Summer'



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is suitable for both local and wholesale marketing.

Greenhouse-grown 'Jemmy Royal Purple' stems were harvested when 25 percent of the florets in a head were open. The end of wholesale/retail vase life occurred when the florets' appearance was no longer uniform. Consumer vase life ended when the undersides of florets turned brown or when florets closed and/or did not continue to open.

Pretreatments. Pulsing with

either 10- or 20-percent sucrose for 24 hours reduced vase life.

**Ethylene sensitivity.** Trachelium was sensitive to ethylene at .1 or 1 ppm. The florets either closed entirely or did not continue to open. Applying Ethylbloc or AVB prevent-



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**Top:** Trachelium 'Jemmy Royal Purple'. **Bottom:** Trachelium flowers that did not open due to exposure to .1 ppm ethylene.

ed the open florets from closing and promoted opening of new florets.

Pretreatments/simulated shipping and storage. Stems were pretreated with AVB, Ethylbloc or water and stored at 41° F for four days dry or wet in a holding preservative or high quality water. Stems tolerated four days of storage regardless of pretreatment and produced a vase life of 9-13 days. Fewer of the florets opened on stems that were stored. A subsequent test was conducted with stems harvested when 75 percent of the florets were open and stored at 34, 41 or 68° F for three days in water. The wholesale/retail vase life for the stems stored at 34° F and 41° F was four days, and the consumer vase life was nine days. Those stored at 68° F had a 2- and 6-day wholesale/retail and consumer vase life, respectively.

Holding solutions. Stems held in 2- or 4-percent sucrose had a longer wholesale/retail and consumer vase life compared with water only. Using floral foam was not detrimental when used with sucrose solutions. However, floral foam without sucrose reduced consumer vase life.

The use of commercial holding solutions produced varied results based on the product. Stems in Chrysal Professional 2 Processing Solution had a wholesale/retail vase life of 10 days and a consumer vase life of 18 days compared with nine days wholesale/retail vase life and 15 days consumer vase life for the controls in water. Stems held in Floralife Professional had a wholesale/retail vase life of eight days and a consumer vase life of 11 days. Combining the commercial hydrators with holding solutions pro-

duced a wholesale/retail vase life of 8-9 days and a consumer vase life of 11 days for both products. **GPN** 

Author's Note: This research was supported primarily by the American Floral Endowment with assistance from the Association of Specialty Cut Flower Growers.

## The Take-Home Message

What is the best way to handle these greenhouse and field cut flower species? Listed below are the recommended methods for getting the most out of these varieties.

#### Dahlia 'Karma Thalia'

and 'Karma Naomi'

- Cut in bud stage
- Place in commercial holding solutions
- Cold store at 34° F for less than one week

#### Linaria 'Lace Violet'

- Pulse with a 10-percent sucrose solution
- Place in 2- or 3-percent sucrose solution or
- Cold store at 34° F for less
- than one week

#### Lupine 'Sunrise'

- Pretreat with AVB or Ethylbloc
- Place in commercial holding solutions
- Cold store at 34° F for two weeks or less

#### **Poppy 'Temptress'**

- Pretreat with 10-percent
- sucrose for 24 hours
  Place in 2- or 4-percent sucrose solution or
- commercial holding solutions
  Cold store at 34° F for one week or less

#### Rudbeckia 'Indian Summer'

- Cut into clean, high-quality water
- Discard the small percentage of flowers that remain wilted after hydration
- Cold store wet at 34° F for two weeks or less
- Cold store dry at 34° F for one week or less

#### Trachelium 'Jemmy Royal Purple'

- Cut into clean, high-quality water
- Place in 2-percent sucrose solution, especially if using floral foam
- Cold store at 34° F for one week or less

Several suppliers, including Modena Seed, Germania Seed, Fred C. Gloeckner, American Takii and Ernst Benary of America, provided seed and plant materials. Appreciation is expressed to Ingram McCall and Diane Mays for plant care, experimental set up and data collection; Debra McGuinn for ethylene

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