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Project Title: Postharvest Handling Procedures for Emerging New Specialty Cut Flowers

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Industry Needs and Project Objectives:
The objectives of this research are to:

1. Screen 10 to 15 new cut flower species/cultivars to select those which have a long postharvest life (Stage I).

2. Determine optimum handling procedures to extend the postharvest life of the four to five most promising new cut flower cultivars identified in Stage I (Stage II). This includes determining ethylene sensitivity and optimum cold storage duration, pretreatments and pulses, vase solutions and substrates, and commercial preservatives for those species.

The need for new and different cut flowers is increasingly important to stimulate customer interest and sales and to replace declining production of the major greenhouse cut flower species, roses, chrysanthemums, and carnations. Continued success of specialty cut flowers requires the proper postharvest information for new species. This research will decrease postharvest problems traditionally associated with new specialty cut flowers and increase the use of specialty cuts in the floriculture industry. For each species we will determine suitability for marketing to wholesaler, florists or the final consumer.

Summary of Work Completed.

Objective 1. We screened 22 new cut flower species/cultivars which had performed well in the 2002 Association of Specialty Cut Flower Growers (ASCFG) Seed and Perennial Trial programs. These species produced large numbers of long stems on weather resistant plants with a minimum of insect and disease problems. The following is the list of species and their basic handling recommendations regarding the use of commercial hydrating solutions (such as Chrysal Prolfessional RVB Hydrating Solution) or holding solutions (such as Chrysal Professional #2 Processing Solution). The indicted products were used only as representatives of commercial preservatives; similar solutions from other companies are likely to work equally well.

Achillea millifolium 'Cassis' - This flower was best handled by placing directly into clean, high quality water to obtain a 12 day vase life. Hydrating and holding solutions decreased vase life.

Celosia 'Toreador Red' - An amazingly long lasting flower of 33 days, which was obtained by using a holding solution. Hydrating solution had no effect.

Dianthus 'Amazon Neon Duo' - This brilliantly-colored flower had a vase life of 15 days which was obtained by using a holding solution. Hydrating solution had no effect.

Dianthus 'Bouquet Purple' - Another of the new heat tolerant dianthus which had a vase life of 18 to 19 days when placed in a holding solution. Hydrating solution had no effect.

Dahlia 'Naomi' - Vase life averaged 5 to 6 days regardless of treatments, which had no effect.

Dahlia 'Thalia' - Vase life averaged 5 to 6 days regardless of treatment, which had no effect.

Eupatorium cannabinum - Long lasting filler flower of 20 to 24 days regardless of treatment.

Eustoma 'Alice Pink' - Use a holding solution on this flower to get a vase life of 17 to 21 days. Hydrating solution had no effect.

Eustoma 'Malibu Purple' - Use a holding solution on this flower to get a vase life of 12 days. Hydrating solution had no effect.

Gladiolus callianthus (*Acidanthera*) - This wildflower version of the common gladiolus had a 10 day vase life when a holding solution was used. Hydrating solution had no effect.

Helenium 'Helena Gold' - This daisy-like flower is sensitive to floral preservatives but lasted 16 days in water only. It was able tolerate the use of either a holding or a hydrating solution, but not the use of both hydrating and holding solutions together which reduced vase life.

Helenium 'Helena Red Shades' - Same as previous cultivar.

Helianthus 'Lemon Éclair' - Vase life averaged 8 days regardless of treatment.

Helianthus 'Stella Gold' - A holding solution had a slight effect and increased the vase life by a day compared to water only, which was 7 days.

Leucanthemum 'Polaris' - This classic daisy lasted the longest, 12.5 days, with a holding solution. Hydrating solution had no effect.

Physostegia 'Summer Spires' - Use a holding solution to get a vase life of 15 days. Hydrating solution had no effect.

Scabiosa atropurpurea 'QIS Deep Red' - A holding solution had a slight effect and increased the vase life by a day compared to water only, which was 7 days.

Trachelium 'Summer Purple' - Use a holding solution on this flower to get a vase life of 13 days. Hydrating solution had no effect.

Trachelium 'Summer White' - Use a holding solution on this flower to get a vase life of 12.5 days. Hydrating solution had no effect.

Zinnia elegans 'Benary's Giant Lime' - Another flower which was best handled by placing directly into clean, high quality water to obtain an amazingly long 23.5 day vase life. It was sensitive to floral preservatives: Hydrating and holding solutions decreased vase life; when both were used together the vase life dropped to 1.3 days.

Zinnia elegans 'Sun Cherry' - This classic flower was best handled by placing directly into clean, high quality water to obtain a 12 day vase life. Holding solution decreased vase life.

Zinnia elegans 'Sun Gold' - This flower which was best handled by placing directly into clean, high quality water to obtain a 11 day vase life. Hydrating and holding solutions decreased vase life.

Objective 2. Extensive postharvest testing has already been conducted on two new cut flower species, poppy (*Papaver*) 'Temptress' and *Linaria* 'Lace', resulting in recommendations for optimum postharvest handling. Since the other species planned for the first year of the grant (our granting period ends in the fall) are field-grown cuts, they will be evaluated this summer.

Poppy 'Temptress' and linaria 'Lace' cut stems were subjected to a variety of tests to determine ethylene sensitivity and optimum cold storage duration, pretreatments and pulses, vase solutions and substrates, and commercial preservatives. After treatment, stems were placed at $20 \pm 2^{o}C$ ($68 \pm 4^{o}F$) under 75 to 100 mol m^{-2} s^{-1} light for 12 hrs/day.

Much research has focused on the condition of flowers at the end of the treatments and determined when the flowers were no longer attractive to the consumer (termination date). However, two points are critical in the marketing of a cut flower: when it no longer is marketable and when the consumer would typically dispose of the flower. Flowers were monitored daily to determine the end of retail vase life which was designated as the first day a change was noticed in the flower or inflorescence that would typically prevent the flower from being sold by a wholesaler or retailer. The consumer vase life was designated as the day a typical consumer would have disposed of the stem. For poppies the end of retail vase life was noted when the flowers no longer had a cup shape and the end of consumer vase life occurred when a petal abscissed or became crinkled, discolored or brown or the stem collapsed. For linaria the end of retail vase life occurred when the immature florets opened pale or when more than 50% of the spike was open and the end of consumer vase life occurred when the stem collapsed or more than 75% of florets were discolored or shriveled.

Poppy. A 24-hr 10 or 20 % sucrose pulse increased retail vase life of stems harvested as buds but, interestingly, had no effect on consumer vase life. The 20% pulse produced results no different than the 10% solution, which would be acceptable. Similarly, commercial hydrating solutions increased retail vase life but had no effect on consumer vase life. Commercial holding solutions increased both retail and consumer vase life by 2 days from 5.5 days to 7.6-7.9 days. Increasing sucrose content of the vase solution from 0 to 2 or 4% 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. Stems could be cold stored for one week at 36^{o}F (2^{o}C) with no decrease in vase life either wet or dry. Two weeks cold storage reduced vase life. Treating poppy with either 0.1 or 1.0 ppm ethylene, 1-MCP, or STS had no effect on retail or consumer vase life, indicating that poppies are not ethylene sensitive flowers.

Linaria. A 24 hr 10 or 20% sucrose pulse increased both the retail and the consumer vase life by 2 to 4 days resulting in a consumer vase life of 9 days as compared to control flowers which had a 5 day consumer vase life. The 20% sucrose pulse was produced only a slightly longer vase life so the 10% pulse would be acceptable. Stems lasted the longest, 13.6 to 19.2 days, when held in 2 or 4% sucrose. The use of floral foam decreased vase life, but only slightly when used with either 0 or 2% sucrose. The use of either commercial holding solution (Floralife Professional and Chrysal Professional 2 Processing Solution) increased vase life to 10-13 days. However, neither commercial hydrating solutions (Floralife Hydraflor/100 and Chrysal Professional 2 Processing Solution) had an effect. 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. Cold storage at 36^{o}F (2^{o}C) for one week decreased vase life, but longer storage had little effect. Treating linaria with either 0.1 or 1.0 ppm ethylene, 1-MCP or STS had no effect on retail or consumer vase life indicating that linaria is not an ethylene sensitive flower.

In summary, poppy 'Temptress' is a spectacular flower (Fig. 1) available in a broad range of colors with a relatively short vase life of 5-6 days that could be increased to 7.6-7.9 days by using commercial holding solutions. The 10% sucrose pulse, commercial hydrating solutions, and 2 or 4% sucrose vase solutions increased retail vase life but had no effect on consumer vase life. Stems can be readily stored for one week at 36^{o}F (2^{o}C). In contrast to many cut flowers, poppies can be used in floral foam with no negative effects. Without proper treatment, poppy is best suited to retail sales; however, poppies are suitable for wholesale marketing with proper handling due to the fact that the flowers tolerate cold storage very well.

Linaria ‘Lace’ is an excellent filler flower (Fig. 2) available in several colors with a consumer vase life of 5-7 days that could be increased to 10-19 days with various treatments, including commercial holding solutions, 2 or 4% sucrose in the vase solution, and citric acid + 8-HQS. Stems should not be cold stored and can be used in floral foam with only a slight decrease in vase life. With proper handling linaria is suitable for wholesale marketing.

Promotion of Work.

One article has already been published in *The Cut Flower Quarterly* and a second has been sent to *Grower Product News* and will be published in August. Work sponsored by the AFE has been presented at the Association of Specialty Cut Flower Growers Annual Meeting and Trade Show in Madison, WI, Fall, 2002 and at the NCSU Cut Flower Production Workshop in Raleigh, NC, Spring, 2003. At the ASCFG meeting, approximately 180 participants were in attendance and 122 were at the NCSU Cut Flower Production Workshop.