Progress Report

PRODUCTION AND POSTHARVEST PROTOCOLS FOR CUT LUPINE AND PENSTEMON

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Introduction and Objectives.

New cut flower introductions increase interest and selection availability for consumers and retailers and allow growers to pick species and cultivars ideally suited for their climates. Two underutilized species are annual penstemon (*Penstemon grandiflorus* Nutt.) and garden lupines (*Lupinus polyphyllus* Lindl.). The objectives of this research were to 1) determine the effects of production temperature and transplant age on stem length and number, flower quality and profitability for *Lupinus polyphyllus* 'Tutti Frutti' and 'Russell' mixes and *Penstemon grandiflorus* 'Esprit Mix', 2) investigate ethylene sensitivity and effectiveness of 1-MCP and STS, and 3) the appropriate postharvest treatments for each species including use of commercial floral preservatives, holding solutions, sucrose pulses, and tolerance to floral foam.

Materials and Methods.

Penstemon and lupine production. Penstemon grandiflorus 'Esprit' Mix and *Lupinus polyphyllus* 'Tutti Frutti' and 'Russell' mix seeds were directly sown into 105 plug flats using a peat-lite commercial root substrate and germinated at 21°C. Seedlings were fertigated with 150 ppm N with 20N-10P-20K fertilizer during the week and irrigated with clear water on the weekends. Seedlings were transplanted into lily crates (22 x 14.4 x 9 inches) at the appearance of 2-3, 5-6, and 8-9 true leaves. An additional set of 'Russell' lupine seedlings were transplanted at 8-9 true leaves and

placed at 41°F (5°C) for 4 weeks of vernalization. Fifteen plugs were planted per crate at 10 x 10 cm spacing. After transplanting, crates were placed at 50 or 68°F (10 or 20°)C night temperatures in glass-covered greenhouses. Day temperatures were slightly higher than night temperatures.

In addition to the transplant stage and temperature study, a more extensive vernalization requirement study was initialized where lupine plants with 5-6 true leaves were cooled at 41°F (5°C) for either 1, 2, 4, or 6 weeks.

Penstemon postharvest. For postharvest analysis, flower stems were harvested, placed in tap water, recut after hydration and placed in the appropriate treatments. After treatment, stems were placed at 21°C under 20 $mol \cdot m^{-2} \cdot s^{-1}$ light for 12 hrs/day at 40% to 60% relative humidity. Postharvest vase life was measured. Four of the six postharvest testing protocols have been completed. These include: cold storage duration, commercial preservatives, sucrose pulses, and vase solutions and substrates.

Cold Storage Duration. Cut stems were held 0, 1, 2, or 3 weeks in a 2°C cooler either dry or wet. The 0 week storage (control) stems were placed directly into floral vases. At weeks 1, 2, and 3 stems will be randomly selected from each treatment, recut, and placed in floral vases filled with DI water.

Commercial Preservatives. Cut stems were pretreated with one of three solutions: two commercial hydrating solutions (Chrysal Professional Hydrating Solution or Floralife Hydraflor 100) or DI water and placed in one of three holding solutions: two commercial holding solutions (Chrysal Professional 2 Holding Solution or Floralife Professional) or DI water.

Sucrose Pulses. Stems also received a 24 hr sucrose pulse of 0%, 10%, or 20% sucrose in DI water plus 7 ppm Kathon CG (anti-microbial chemical).

Vase Solutions and Substrates. Cut stems were placed in vases with or without floral foam and 0%, 2%, or 4% sucrose.

Results.

The oldest plugs with 8-9 true leaves had the longest average stem length of 64 cm. However, they also had the thinnest average caliper (3.3 mm) (Fig. 1 and 2). The cool house (50°F/10°C night) produced the most stems (303) compared to 29 in the warm house (68°F/20°C night). The cool house also produced better quality stems with a longer length and thicker caliper than the warm house. In both houses, the 2-3 stage had the thickest caliper and the 8-9 stage had the longest stem length.

Over all of the postharvest treatments the average vase life for control stems held in de-ionized water was only 4.7 days. The cold storage duration study showed that penstemon benefitted from a one week storage period either wet or dry, which increased vase life average to 7.7 days (Table 3). Storage periods for longer than

one week reduced vase life significantly. From the commercial preservatives study it was concluded that penstemon benefits from a holding solution (Table 4). Those treatments without a holding solution were similar to the control. The vase life jumped significantly from 4.7 days to 8.1 days with a 20% sucrose solution (Fig. 3). Penstemon also benefitted from the addition of 7 ppm Kathon to the vase solution, which is shown in the both the sucrose pulses and vase solutions and substrates studies. Penstemon vase life is not affected by floral foam (Table 5). The vase lives across treatments with and without floral foam were almost exact (Table 5). The highest vase life of 9.4 days resulted from 4% sucrose with 7 ppm Kathon solution, regardless of floral foam substrate.

No production or postharvest data were able to be collected from the lupine. While hundreds of seeds were sown only three inflorescences were harvested. The lupine were unproductive due to various cultural factors. The high heat and humidity in North Carolina greenhouses limited growth and made the plants very susceptible to insect pests, such as thrips, spider mites, and leaf miners. Root and crown rot were problems. The purpose of the vernalization requirement study was to see if the lupines needed a more particular cold period to flower and maybe that's why we were not seeing development previously. Ten inflorescences were collected from this study. None of them were marketable.

Changes to original proposal.

Due to the lack of progress with the lupine, it has been replaced with several varieties from the genus *Eucomis,* the Pineapple Lily. We are currently working with *Eucomis comosa* 'Sparkling Burgundy', 'Tegula Ruby', and 'Tegula Jade', and proprietary hybrids called "Lavender," "Cream," and "Coral."

Eucomis bulbs were planted in two different densities (6 or 12 bulbs per crate). The lily crates used were the same as those for the lupine and penstemon. They were planted in two different locations (field and greenhouse). Stem length and caliper data were collected. For postharvest analysis, stems were either placed in a commercial hydrator solution or DI water for four hours. Half the stems from each treatment were then placed in either a commercial holding solution or DI water for two days and then placed into individual jars of DI water and vase life evaluated.

Tables.

Table 1: Average vase lives for penstemon inflorescences subjected to various cold storage lengths.

Cold Storage Duration		
Weeks stored	Storage condition	Vase life after storage (days)
0	-	5.6
1	Dry	7.9
	Wet	7.4
2	Dry	1.6
	Wet	2.4
3	Dry	1.0
	Wet	3.3

Table 2: Average vase lives for penstemon inflorescences subjected to various commercial preservatives.

Commercial Preservatives		
Hydration solution	Holding solution	Vase life (days)
DI water	DI water	4.2
DI water	Floralife Professional	7.0
DI water	Chrysal Professional 2	6.0
Floralife Hydrator	DI water	4.2
Floralife Hydrator	Chrysal Professional 2	5.4
Floralife Hydrator	Floralife Professional	7.4
Chrysal Professional 1	DI water	4.6
Chrysal Professional 1	Chrysal Professional 2	6.4
Chrysal Professional 1	Floralife Professional	6.6

Table 3: Average vase lives for penstemon inflorescences subjected to various sucrose solutions with or without floral foam as a substrate. 7 ppm Kathon was used.

Vase Solutions and Substrates	
Treatment	Vase life (days)
Without floral foam	
DI water	4.5
0% sucrose, Kathon	6.0
2% Sucrose, Kathon	8.4
4% Sucrose, Kathon	9.3
With floral foam	
DI water	5.0
0% sucrose, Kathon	6.4
2% Sucrose, Kathon	8.6
4% Sucrose, Kathon	9.4

Figures.

Figure 1: The average stem length of penstemon inflorescences across transplant stages.

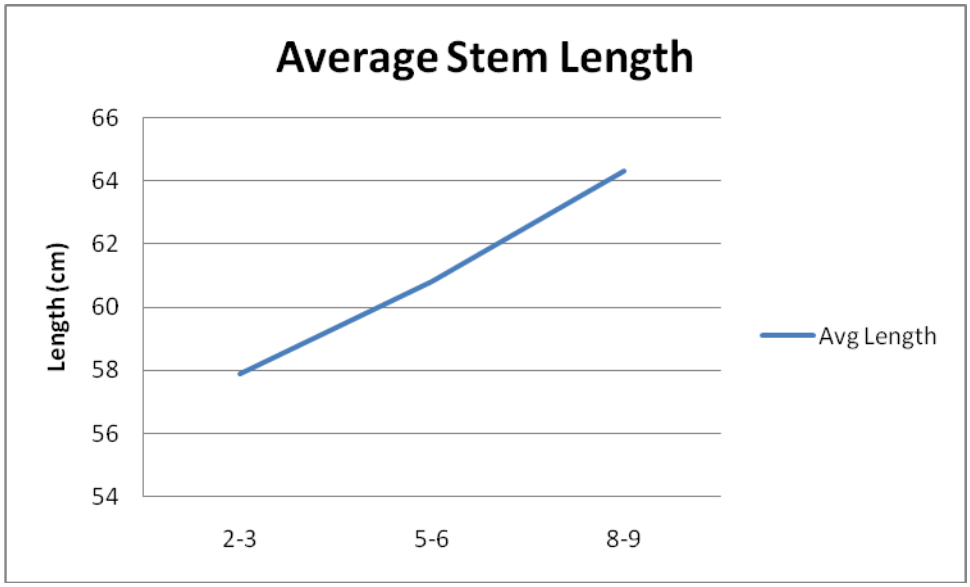

Figure 2: The average stem caliper of penstemon inflorescences across transplant stages.

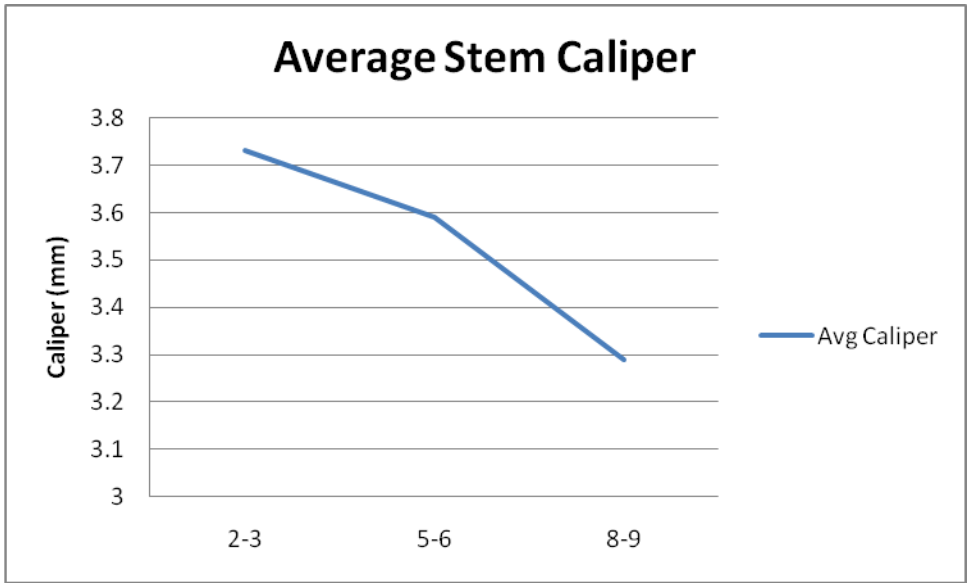

Figure 3: The average stem length of penstemon inflorescences across transplant stages and between the two production temperatures. Cool-50°F/10°C night; Warm-68°F/20°C night.

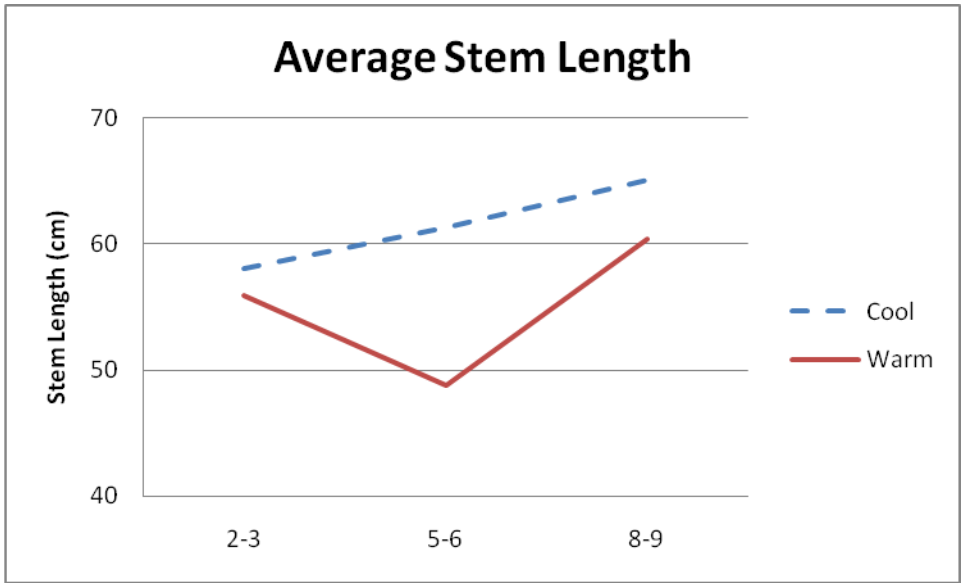

Figure 4: The average stem caliper of penstemon inflorescences across transplant stages and between the two production temperatures. Cool-50°F/10°C night; Warm-68°F/20°C night.

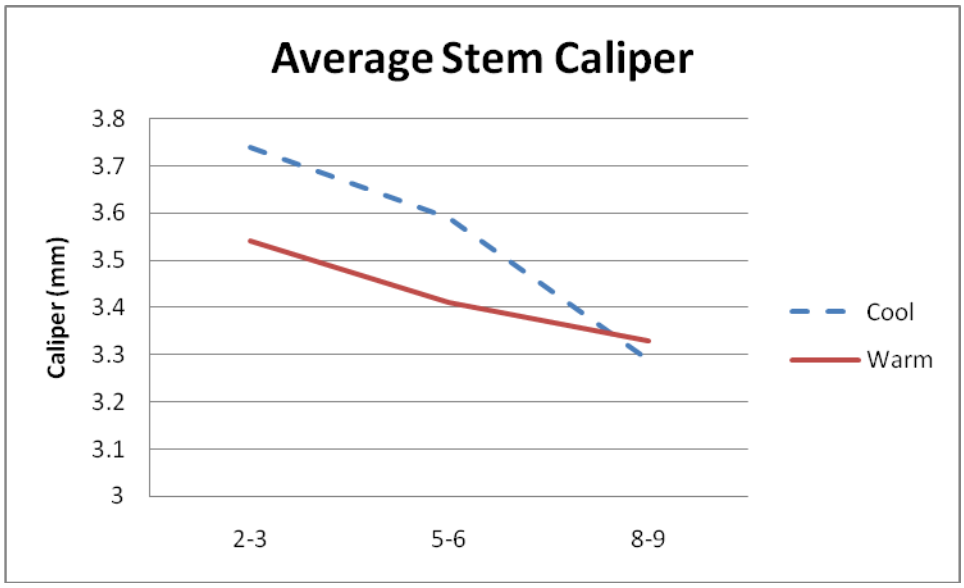

Figure 5: Average vase life of cut penstemon inflorescences with the addition of kathon (7 ppm) and increasing sucrose concentrations.