

Hot New Cuts for a Cool Greenhouse

North Carolina State University research identifies cut flowers that grow better in a cool greenhouse.

By John M. Dole, Frankie Fanelli, Beth Harden, Sylvia Blankenship, Bill Fonteno and Lane Greer



Linaria 'Lace Violet' (Photos courtesy of John Dole)

In our never-ending search for new cuts, we have been working with three species that have great potential for cool temperature greenhouses. *Linaria* Lace produces tall open spikes of small rose, violet, white or yellow snapdragon-like flowers. Lupine 'Sunrise' has spikes of mildly fragrant, blue flowers with some yellow and white. Poppy 'Meadow Pastels' and 'Temptress' produces 2- to 6-inch wide flowers in a broad range of knock-your-socks-off colors including white, orange, yellow, salmon, rose and pink. Compared with Meadow Pastels, Temptress has longer, thicker stems, longer postharvest life and slightly stronger colors. However, Meadow Pastels is generally much easier to germinate and has a higher germination percentage than Temptress. Some growers have had few problems germinating Temptress while many others have had little success. In fact, germination problems led us to use Meadow Pastels for the production studies instead of Temptress.

Our goal for the production experiments was to develop economical production protocols, examining production temperature, transplant age and supplemental lighting of the plugs. The postharvest work determined ethylene sensitivity, optimum cold storage duration, pretreatments and pulses, vase solutions and substrates, and commercial preservatives for *linaria* and poppy.

PRODUCTION

Linaria 'Lace Violet', lupine Sunrise and poppy Meadow Pastels seeds were directly sown into 105 plug flats using a peat-based commercial media and germinated at 60° F. One half of the plants received ambient light plus eight-hours of HID supplemental lighting, and the other half of the plants were placed under ambient light. Average light levels were 2,145 foot-candles for ambient

light and 2,700 foot-candles for HID supplemental lighting, measured daily at noon. Seedlings were transplanted at the appearance of 2-3, 5-6 or 8-9 true leaves. *Linaria* and poppy seedlings were placed at 41, 50 or 59° F night temperatures in the North Carolina State University Phytotron, and lupine seedlings were placed at 59, 64 or 69° F night temperatures in a polyethylene covered-greenhouse. Day temperatures were 10-17° F higher than night temperatures. *Linaria* seedlings were transplanted into 4-inch pots spaced pot to pot, and lupine and poppy seedlings were transplanted into 6-inch pots spaced pot to pot initially. The poppies were later spaced to 9-inch centers. We used pots for the experiments because we had to move the plants. However, all three species can be easily grown in beds. Plants were irrigated with 150 ppm nitrogen from a premixed commercial 20-10-20 fertilizer during the week and with clear water on the weekends.

Data collected at harvest time includes stem length, stem diameter (measured 2 inches from the base) and harvest date. We also estimated profit/loss for each treatment, which factored in the amount of time in the flat, time in the production area and sales price per stem. *Linaria* and lupine flowers were harvested when ¼-½ of the florets had reflexed petals. Poppy flowers were harvested when the calyx cracked and petal color was visible.

Linaria. *Linaria* proved to be an excellent flower producer, with each plant producing from 4.2-10.0 cut stems. Optimum production temperature was 50° F. Flowers produced in 59° F were unmarketable, while 41° F production temperatures produced longer and thicker stems, though production time was greatly increased. Do not grow this plant warm or the stems will be thin, short and completely unusable. In our work, the first plants to flower were

growing at 59° F, and we thought we had a dud on our hands. However, we completely changed our minds when the plants in the 50 and 41° F treatments flowered. The stems were tall, over 3 feet in some cases, thick and beautifully colored.

At 50° F, seedlings should be transplanted at the 2-3 leaf stage to maximize stem number, length and profitability, which was estimated at \$4.74 per plant. The close spacing allows for many harvestable stems to be produced in a small area. Problems included thrips and root rot on a few plants. Note that when transplanting, the seedlings form branches very low on the plant, which can appear to be separate seedlings.

Lupine. The optimum temperature was 59° F, which resulted in the shortest crop time, longest stems and highest profitability of \$0.76-0.88 per plant. Lower production temperatures should be tried, as the optimum production temperature may actually be lower than 59° F. Warm production temperatures above 64° F should be avoided, as some of the florets aborted. Seedlings should be transplanted at the 2-3 leaf stage under 59° F to obtain the longest, thickest stems; however, profitability was higher for plants transplanted at the 8-9 leaf stage due to longer time in the plug flat. Supplemental HID lighting is not recommended, as it delayed flowering and did not increase profitability. While thrips were a problem, lupine had few other insects or disease problems.

Poppy. Poppy was also an excellent flower producer, with each plant producing from 3.1-6.6 cut stems in the experiment and up to 12 stems per plant in later work. The 59° F temperature was optimal, as it produced the longest stems in the shortest time. At that temperature, plants should be transplanted at the 2-3 leaf stage. Supplemental HID lighting had a negligible effect and did not influence profitability, which averaged \$0.99 per plant. ♦

crop cultivation

Figure 1. Production schedule for linaria Lace.

Cultural Step	Weeks	Temperature	Comments
Sow seed and Produce plugs	4-5	60-68° F	Use 105 to 288 flats.
Growing on	7-11	41-50° F	Transplant when seedlings have 5-6 leaves; begin fertilization with 150 ppm nitrogen; space at 4 x 4 inches.
Total time to first flower harvest	11-16	41-50° F	If growing in pots, discard after first flush of shoots are harvested.
Harvest period	+7-9		

Figure 2. Production schedule for lupine ‘Sunrise’.

Cultural Step	Weeks	Temperature	Comments
Sow seed and produce plugs	2-3	60-68° F	Use 105 flats.
Growing on	7-8	60° F	Transplant when seedlings have 2-3 leaves; begin fertilization with 150 ppm nitrogen; space at 6 x 6 inches.
Total time to first flower harvest	9-11	60° F	If growing in pots, discard after first flush of shoots are harvested.
Harvest period	+1		

Poppies suffered from powdery mildew, which not only attacked the foliage but also the flower stems. By the end of the season, the plants were large with many leaves, which made thorough spraying difficult and the disease problem worse. Experiment with trying to rejuvenate plants near the end of the season by removing some of the older foliage to increase air circulation and allow more light to penetrate to the crown. We also had problems with thrips, whiteflies and Botrytis.

POSTHARVEST

Linaria Lace and poppy Temptress cut stems were subjected to a variety of

tests to determine ethylene sensitivity, optimum cold storage duration, pre-treatments and pulses, vase solutions and substrates, and commercial preservatives. After treatment, stems were placed at 68° F under 330-500 foot-candles for 12 hours per day to simulate a retail or consumer environment.

Two points are critical in the marketing of a cut flower: When it is no longer 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 a retail vase life was noted when flowers no longer had a cup shape, and the end of consumer vase life occurred when a petal abscised or became crinkled, discolored or the stem collapsed. For linaria, the end of retail vase life occurred when immature florets opened pale or when more than 50 percent of the spike was open, and the end of consumer vase life occurred when the stem collapsed or more than 75 percent of florets were discolored or shriveled.

Linaria. Lace Violet is an excellent filler flower with a consumer vase life of 5-7 days that could be increased to 10-19 days with various treatments, including commercial holding solutions such as Floralife Professional and Chrysal Professional 2 Processing Solution, 2 or 4 percent sucrose in the vase solution, and citric acid plus 8-HQS. Stems were harvested when five florets were open. Treating linaria with either 0.1 or 1.0 ppm ethylene, 1-MCP (Ethylbloc) or STS (AVB) had no effect on retail or consumer vase life, indicating that poppies are not ethylene-sensitive flowers. Stems should not be cold-stored for very long but can be used in floral foam with only a



Lupine ‘Sunrise’

crop cultivation

Figure 3. Production schedule for poppy ‘Temptress’ or ‘Meadow Pastels’.

Cultural Step	Weeks	Temperature	Comments
Sow seed and produce plugs	4-5	60-68° F	Use 105 to 400 size flats.
Growing on	7-10	50-60° F	Transplant when seedlings have 2-3 leaves; begin fertilization with 150 ppm nitrogen; space at 6 x 6 inches.
Total time to first flower harvest	11-15	50-60° F	Respace at 9 x 9 inches if growing in pots.
Harvest period	+6-8	N/A	N/A

slight decrease in vase life. With proper handling, linaria is suitable for both retail and wholesale marketing.

Lupine. While we did not conduct postharvest evaluations on lupine Sunrise, the cut stems lasted 6-8 days. Growers recommend using a floral holding solution with Sunrise. Other lupines are sensitive to ethylene, indicating that they should be treated with an anti-ethylene agent such as STS or 1-MCP to delay petal drop. Stems were harvested when 4-5 of the lower florets were open.

Poppy. Temptress is a spectacular flower with a relatively short vase life of six days when harvested fully open, which could be increased to 7.6-7.9 days by using commercial holding solutions such as Floralife Professional and Chrysal Professional 2 Processing Solution. Interestingly, the 10 percent sucrose pulse, commercial hydration solutions, and 2 or 4 percent sucrose vase solutions increased retail vase life but had no effect on consumer 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. Stems can be readily stored for one week at 36° F. 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, because flowers tolerate cold storage very well, poppies are suitable for wholesale marketing with proper handling. Poppies can be harvested in the cracked bud stage for easy shipping. Be sure to look for petal color. However, a percentage of the buds, approximately 10 percent, will never fully open. For bucket sales, harvest fully open; vase life will still be six days.



Poppy ‘Temptress’

Linaria and lupine may be new to most of your customers, which will necessitate some education. Poppies always attract attention, but many buyers are concerned they won’t last long. Be sure to tell them that they have a six-day vase life that goes up to over seven days when place in floral preservative and that the flowers can be used in floral foam. **GPN**

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