Delphinium Cut Flower Production in Utah

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Overview

Delphinium is a perennial crop that produces tall racemes in two flushes per season. Its long stems serve as vertical line elements, adding height and balance to floral arrangements. Popular series are available in striking shades of blue, which are not commonly found among cut flowers, making delphinium an excellent choice for local market production. The crop is cold-hardy, tolerates frosts and light freezes, and performs well in early high tunnel systems. From Utah State University (USU) trials, harvest can be staggered and extended throughout the season by combining high tunnel and open-field production, as well as first- and second-year plantings. Although delphinium can be long-lived in ornamental gardens, commercially grown plants are typically replaced after one to three seasons to maintain consistent yields.

Species, Series, and Colors

The two most common species used for commercial cut flower production are *Delphinium elatum* L. (elatum types) and *Delphinium* × *belladonna* hybrids (belladonna types) (Figure 1). While *Delphinium grandiflorum* L. is less common as a cut flower, it is available on the market. Elatum types can grow up to 6 feet tall and produce dense racemes of double flowers. Belladonna hybrids are shorter and produce stems with loose clusters of flowers, giving a lighter and more informal appearance. Delphinium seeds are often sold by series, which are cultivar groups of varying colors that are bred and marketed together, including unique shades of blue that are rarely found in cut flowers.

Site Preparation

As perennials, delphinium should be planted in sites with optimal year-round conditions, including loamy, well-drained soil and partial to full sun. Performing an initial soil test before incorporating compost or organic matter is recommended for establishment and the long-term health of the soil and plants. USU's Analytical Laboratories (USUAL) perform soil tests, with pricing and sampling instructions available on their website.

For plants grown in high tunnels, install the plastic covering in fall before heavy rain or snowfall to ensure the soil will not be too wet to work early the following spring. For both high tunnel and field systems, till or broadfork (if practicing) and rake the soil smooth, forming 3- to 4-foot-wide beds. If desired, install drip irrigation prior to planting.

***Figure 1**. Harvested delphinium stems in unique shades of blue, processed and prepared for bunching prior to sale on the local florist markets.*

***Figure 2**. Seedlings with one true leaf grown indoors in a 32-cell tray.*

Plug Production

As perennials, delphinium can be planted in the fall; however, most commercial production relies on spring transplants. Starting seeds indoors is recommended to improve germination and advance harvest timing. For optimal plug production, plan for 14 to 16 weeks total, which includes seed chilling, plug development, and hardening off prior to transplanting. In high tunnel systems, plan to transplant at least 5 to 7 weeks before the last expected freeze date. In the field, transplanting can occur at least 2 weeks before the average last freeze date. See Table 1 for anticipated harvest dates based on a recommended sowing and transplant schedule from USU trials.

Delphinium seeds are slow to germinate, typically taking 12 to 21 days, and benefit from a stratification period. Chill seeds dry at 35 °F to 40 °F for 3 weeks before sowing. Fill seedling flats with a high-quality peat/perlite soilless mix or seed-starting media. Sow one to two seeds per cell. Maintain temperatures at 64 °F to 71 °F. Because light improves germination, lightly cover the seeds with fine vermiculite and provide a 16-hour photoperiod. Mist or bottom-water to avoid displacing the seeds until germination occurs.

Once seedlings emerge, water deeply to saturate the entire cell. Thin to one strong seedling per cell. When seedlings develop one to two true leaves (Figure 2), transplant them into larger trays, such as 32-cell flats. Fertilize the plugs with a solution, such as 21-5-20 (%N-%P_2O_5-%K_2O), at a 100 ppm nitrogen (N) proportion.

Transplanting and Spacing

Approximately 5 to 7 days before the intended transplant date, begin hardening off the seedlings by gradually increasing their exposure to outdoor light and temperatures. Transplant in the morning, evening, or on a cloudy day to reduce transplant shock. In a prepared bed or growing area, dig holes sized to accommodate the plug or pot, loosening the surrounding soil to encourage root penetration. Gently remove the seedlings from their containers and tease apart any compacted roots. Place each plant into the hole and settle it by lightly firming the displaced soil (Figure 3). Water thoroughly after transplanting. Space plants 1 foot apart to prevent overcrowding at maturity. Mature second-year plants can tolerate frosts and freezes early in the season, but new transplants may require additional protection (e.g., spunbond fabric of varying weight) on nights when temperatures are forecasted to drop below 32 °F.

***Figure 3**. Field-transplanted delphinium with 1-foot spacing and drip tape irrigation.*

***Table 1.** Anticipated succession planting schedule and subsequent harvest from trials in northern Utah.*

System	Plug production		Harvest			
			First flush		Second flush	
	Indoor sowing	Transplant	Year 1 plants	Year 2 plants	Year 1 plants	Year 2 plants
High tunnel	Early Jan to late Jan	Late March to mid-April	Mid-June to late June	Early May to mid-June	Early Aug to late Sept	Mid-July to mid-Aug
Field	Mid-Feb to early March	Early May to mid-May	Mid-July to early Aug	Early June to late June	Mid-Aug to early Oct	Mid-Jul to late Aug

Pinching is generally not recommended for delphinium, as it can delay harvest timing and reduce stem length. However, if plugs or new transplants begin developing buds prematurely, pinching the terminal bud down to the highest node can encourage vegetative growth and ultimately improve flower quality. Using a horizontal trellis (also known as netting) may support the plants and promote straight, marketable stems—particularly in high-wind locations where tall plants like delphinium are vulnerable to lodging. However, trellis use can complicate harvest, as stems may be difficult to pull through the netting without breakage, causing foliage damage.

If used, trellising is most effective when installed before or immediately after planting and can also serve as a planting grid. Installing trellis after plants have grown taller may damage the stems. Mesh netting with 6-by-6-inch openings, stretched taut across the bed, works well when supported by wooden stakes, rebar, or t-posts placed at 3- to 5-foot intervals along the edges. Gradually raise the trellis as the plants grow to reach approximately half the height of the tallest stems.

***Figure 4**. Iron chlorosis affecting early-season plants, with the most severe visual symptoms on the bottom left.*

Nutrient Management

Delphinium has high nutrient requirements. Based on research in other states, the recommendation is 0.4 pound of N per 100 square feet per year. For example, up to 3/4 pound (just over 1 cup) of conventional urea fertilizer (46-0-0) or 3 pounds (about 13 cups) of organic 12-0-0 fertilizer. USU trials found three split applications that were timed with transplant and flowering to optimize production. For example, in high tunnels, apply N in late March before transplant, mid-May before the first flush of blooms, and mid-August before the second flush. In the field, use these same stages, which generally occur in mid-May, mid-Jun, and late July. Add phosphorous and potassium before or at planting, but only apply them based on soil test results, as these nutrients can build up in the soil. USU's Urban Garden Soils: Testing and Management is a useful tool for calculating nutrient applications. Iron deficiency may also occur in plants in alkaline soils. Visual symptoms include interveinal chlorosis and yellowing of young leaves (Figure 4), which is treated with chelated iron fertilizer, ideally EDDHA-based (#138), according to soil or tissue test results (Black et al., 2009).

Irrigation, Insect Pests, and Diseases

Delphinium requires well-drained soil that is consistently moist. During root establishment, ensure adequate near-surface moisture for the new transplants. Though additional research is needed for irrigation requirements after establishment, 1 to 2 inches of water per week is sufficient and depends on temperature, growth stage, and production system. Very early spring high tunnel plantings initially require less water. For early high tunnel plantings, supply water from a freeze-protected culinary source, as most secondary irrigation systems in Utah are not turned on until later in the spring. Delphinium is prone to various insect, mite, and plant disease problems; monitor frequently through the season. See Tables 2 and 3 for common plant pests.

Harvest and Storage

Elatum types typically produce a single stem during the first flush in early summer, followed by multiple stems during a second flush from late summer into fall. In contrast, belladonna types can produce multiple stems during each flush. Harvest both types when half to a third of the florets on the raceme have opened. The optimal time to harvest is early morning when temperatures are cool and the sunlight is less intense. Cut the stem, leaving one to four nodes near the base (i.e., a few inches aboveground).

Place stems in clean buckets filled with cool water immediately after harvest. Remove excess foliage that may interfere with banding. Market feedback from Utah cut flower farmers and cooperatives recommended banding elatum types in five-stem bunches and belladonna types in 10-stem bunches. The minimum marketable stem length of both types was 16 inches. Further grading stem lengths can determine

preferential pricing based on local demand and standards. From USU trials, stems were graded as Premium: 36 inches or greater; Standard: 24 to 35 inches; and Basic: 16 to 23 inches. Stems were unmarketable (culls) if they were too short, deformed, or had insect damage.

When processing, line stems of the same color at the cut end and cut the bunch evenly to the shortest stem. Wrap securely with rubber bands (Figure 5). Store between 36 °F and 41 °F. Delphinium can be held in a cooler for up to 5 days, with an expected vase life of 8 to 10 days with a preservative and one water change during storage. Due to the large size of delphiniums, taller-than-normal buckets or bucket extenders are necessary to prevent tipping or stem damage during storage and transport.

***Figure 5**. Processed bunches of delphinium stems ready for storage in a cooler before sale to local florists. Note the bunching by color, shade, and stem length.*

Economics

In 2025, imported wholesale belladonna-type delphinium were priced at $15.50 to $18.50 per 10-stem bunch ($1.55–$1.85 per stem), and elatum types were not reported (Economics, Statistics and Market Information System, 2025). From 2023 to 2024, USU-grown elatum types sold for $12.00 to $16.00 per five-stem bunch ($2.40 to $3.20 per stem), while belladonna types sold for the same price per 10-stem bunch ($1.20 to $1.60 per stem) in Utah's Cache Valley and Wasatch Front markets. These local markets preferred Belladonna types for their smaller size and versatility, though elatum types remained in demand for niche and large-scale designs.

***Figure 6**. Early powdery mildew infection on delphinium leaf.*

***Table 2**. Common diseases of cut flower delphinium.*

Disease	Identification	Control
Powdery mildew[1]	White, powdery coating (spores) on the leaves and stems causing reduced photosynthesis, distorted growth, and overall aesthetic degradation of the plants (Figures 6 and 7).	Use proper spacing and monitor for early infection. Apply myclobutanil or sulfur-based fungicides (avoid sulfur above 90 °F); effectiveness declines later in the season. Remove and destroy stems after frost.
Various viruses	Delphiniums are susceptible to broad-host-range viruses that cause symptoms like mottling, mosaic patterns, chlorosis, stunting, curling, and ring spots. Because many viruses produce similar symptoms, accurate identification requires molecular testing.	Prevent viruses by using clean seed or plant stock, controlling weeds that host viruses, and managing insect vectors like aphids and thrips. Infected plants cannot be cured and should be removed.
Various fungal diseases causing wilt, crown rots, stem rots, or root rots[2]	Soilborne fungal diseases of delphinium can affect stems, crowns, or roots, causing wilting, discoloration, and decay that weaken structure and hinder growth.	These soilborne diseases are highly host-specific. Prevent spread by avoiding contaminated soil or plants, rotating crops, and removing all plant debris at season's end. Infected plants cannot be cured.

[1]*Erysiphe aquilegiae, Erysiphe* spp., and *Podosphaera* spp. [2]*Fusarium oxysporum* and *Pythium* spp.

***Table 3**. Common pests of cut flower delphinium.*

Pest	Identification	Control
Caterpillars	Caterpillars are the larval stage of moths and butterflies. Adults lay eggs on host plants, which hatch into larvae that feed on stems or foliage before pupating and continuing the life cycle. Common species like armyworms, cutworms, and loopers (Figure 8A) vary in the severity of damage they cause. *Identification:* Adult and larval coloration, host plant preferences, and life cycle timing differ by species, making accurate identification important for effective management.	Monitor caterpillar feeding damage, as severity indicates population levels. Use pheromone traps where applicable and exclude egg-laying adults with insect netting or spunbond fabric. Support natural predators by planting flowers and maintaining suitable habitat. Hand-remove and squish larvae or apply an organic or synthetic foliar insecticide labeled for both the pest and crop when necessary.
Aphids	Aphids are a diverse group of small insects that damage plants by piercing tissues and sucking sap. This feeding causes distorted growth, yellowing, sticky honeydew residue, and may spread plant viruses. *Identification:* Aphids are small (~1/8 in), pear-shaped insects. Their color, preferred host plants, and life cycles vary by species.	Monitor frequently using visual observation and yellow sticky cards, as populations can increase rapidly. Release beneficial insects in covered crops (e.g., greenhouses, high tunnels) or attract them outdoors with flowering plants. A strong stream of water can dislodge and kill colonies. When pest thresholds are reached, use an organic insecticide like insecticidal soap or horticultural oil.
Earwigs	Earwigs are omnivorous insects that feed on pests, plants, and organic matter. They hide in dark, tight spaces and may damage stems, leaves, flowers, and fruits, especially during midsummer when populations peak. *Identification:* Earwigs have elongated brown bodies (~5/8 in) with noticeable rear “pincers” (cerci). They are active throughout the season but are most abundant in summer.	Monitor feeding damage and check for earwigs—often hiding in blooms or tight spaces—early in the morning or evening. Use bait traps (e.g., soy sauce or oil in lidded containers with holes) buried at soil level, replacing them regularly and repeating each season. If needed, apply an organic or synthetic insecticide (concentrate or granular) labeled for both earwigs and the target plants.
Fungus Gnats	Fungus gnats are small insects often found in greenhouses or indoor growing areas with moist soil. While adults are mostly a nuisance, larvae can damage seedlings by feeding on roots, leading to stunted growth or dieback (Figure 8B). *Identification:* Adults are delicate, dark-bodied insects (~1/8 in) with long legs and clear wings. Larvae are slender, translucent white, and typically found in the upper soil layer.	Use yellow sticky traps to monitor adults in greenhouses and potato slices on the soil surface to detect larvae. Ensure proper tray drainage and allow the soil surface to dry between waterings. For biocontrol, apply a beneficial nematode drench (keep soil moist) or release predatory mites or rove beetles.
Grasshoppers	Grasshopper adults are highly mobile and recognized by their large hind legs. Their feeding primarily damages foliage but can affect other plant parts as well. *Identification:* Size, color, and pattern vary by species and life stage. Grasshoppers overwinter as egg clusters a few inches below the soil. Population levels depend on weather and past management practices.	Begin monitoring early for young nymphs and feeding damage. Because grasshoppers are highly mobile, manage across a wide area. Baits (e.g., wheat bran with carbaryl) are most effective early in the season. Use trap plants (grasses) around crops and/or row covers. Apply insecticides—preferably on trap plants—only when needed.

Mites *(Spider Mites)*	Spider mites have a wide range of host crops. They feed on the undersides of leaves, causing leaf stippling (small yellow spots), bronzing, or scorching. High populations leave noticeable webbing. *Identification*: Spider mites are microscopic, translucent, and yellow. They are most active during mid to late summer and have multiple generations in a season.	Begin monitoring lower leaves in late spring, as mites crawl up from the ground. Maintain plant health, since stressed plants are more vulnerable. Encourage or release natural predators (e.g., predatory mites) and reduce dust buildup around crops. A strong water spray can dislodge mites. If needed, consider an organic insecticide like insecticidal soap or horticultural oil.
Slugs and Snails	Slugs and snails are soft-bodied mollusks with distinct heads and sensory tentacles (Figure 8C). Snails have a spiral shell, while slugs do not. Most species prefer moist, shaded environments and feed on a wide range of plants, damaging young seedlings or chewing holes in the foliage of mature plants.	Monitor early in the season, particularly in high and low tunnels. Minimize excess moisture and standing water near plants. Use copper barriers around plants and apply bait or set traps with products labeled for slug or snail control and the specific crop.
Thrips	Thrips, including western flower and onion thrips, are common pests. Their punch-and-suck feeding causes stippling, dark fecal spots, and can transmit plant viruses. They affect a wide range of hosts and produce multiple generations each season. *Identification*: Adult thrips are tiny (<1/12 in), yellow-brown, and slender, with two pairs of fringed wings.	Monitor frequently with visual checks and yellow or blue sticky cards, as populations can increase quickly. Release beneficial insects in protected crops or attract them outdoors with flowering plants. A strong water spray can reduce populations. If thresholds are reached, consider an organic insecticide like insecticidal soap or horticultural oil.

Note. Most pests are general classifications, and research is ongoing for further classification.

Figure 7*. Fungicide application to treat powdery mildew is most effective early in the season when symptoms are first observed. Generally, pesticide applications are most efficacious in early morning or later evening to reduce the risk of volatilization.*

Figure 8*. (A) Looper (family Noctuidae) feeding on delphinium bloom. (B) Fungus gnat larval feeding damage on delphinium plug. (C) Milky slug (*Deroceras reticulatum*) on newly transplanted delphinium.*

USU Delphinium Trials

To optimize bloom timing, yield, and quality, we conducted trials from 2023 to 2024 at the Utah Agricultural Experiment Station – Greenville Research Farm in North Logan, UT (Cache Valley; USDA Hardiness Zone 6A; average last freeze date: May 15). We evaluated spring transplant timings in high tunnel and field systems and shade cloth (30% shade) in the field. Data were collected for first-year plants in 2023 and 2024, and second-year plants in 2024 (Table 4) that included three series: 'Magic Fountain' (*D. elatum;* colors: Dark Blue, Mid-Blue, and White), 'Pacific Giant' (*D. elatum;* colors*:* Blue Bird, Summer Skies, and Galahad), and 'Belladonna' (*Delphinium × belladonna*; colors: Blue Donna, Cliveden Beauty, and Casablanca). See Table 5 for series and color descriptions with performance summaries. In each high tunnel and field, we tested two transplant dates: late March and mid-April in high tunnels and early May and mid-May in the field. The rate was a 1-foot grid spacing that resulted in 9 plants per square yard. The crop data collected included harvest date and stem grade.

Extend Production With High Tunnels and Fields

In their first year, high tunnel-grown plants produced 4 to 10 times more marketable stems (i.e., >16 inches) than field-grown plants, and harvest occurred 2 to 5 weeks earlier, beginning in early June in the tunnels and early July in the fields. High tunnel yields averaged 21 stems per square yard compared to eight in the field.

Second-year plants produced more than twice the marketable yield of first-year plants in both production systems, with high tunnels averaging 47 stems per square yard and fields averaging 17 stems per square yard. The first flush of the second-year plants in the high tunnel occurred in early May, up to 8 weeks earlier than first-year plants. These gains were attributed to greater plant maturity and adaptation to local conditions. With the use of first- and second-year plants across both the high tunnel and field systems to stagger production, the harvest window lasted approximately 22 weeks, from early May through mid-October (Figure 9).

Early Transplanting Boosts Yield

The two transplant dates in the high tunnel and field significantly affected yield and stem quality and highlighted the potential to further stagger harvests with transplant intervals (Figure 9). Across systems, earlier transplants reached bloom stage about 1 week earlier and produced up to 1.5 times more marketable stems per square yard. We also observed differences in second-year plants: those transplanted earlier the previous year had higher yields in Year 2, likely due to better establishment and stress tolerance, though they maintained a similar harvest timing in Year 2.

Yield Varies by Species

Belladonna-type hybrids consistently outperformed the elatum types (Magic Fountain and Pacific Giant series) in total and marketable yields across systems, years, and crop ages. The higher yield potential of belladonna types is attributed to their open growth habit, which allows for more, less-densely-flowered stems compared to the larger, more compact racemes of elatum types. Earlier transplanting generally improved yield across all series and colors in both systems, though seasonal environmental factors and biotic stressors created varied results. Color within series had minimal effect on performance, supporting the grouping of cultivars by series rather than color. Table 4 displays the average yields by colors within years and systems.

Table 4. *Average total yield in stems per yd² (with % marketable) of first- and second-year plants by series and color.*

Series	Color	Yield in stems per yd² (% marketable)			
		High tunnel		Field	
		Year 1	Year 2	Year 1	Year 2
Belladonna	Cliveden Beauty	49 (82)	193 (64)	27 (53)	48 (87)
	Casablanca	18 (82)	34 (92)	25 (51)	42 (82)
	Blue Donna	24 (85)	40 (98)	14 (54)	25 (83)
Magic Fountain	Dark Blue	27 (85)	67 (92)	7 (41)	7 (57)
	White	12 (77)	26 (80)	5 (53)	11 (62)
	Mid-Blue	22 (87)	43 (83)	9 (56)	20 (85)
Pacific Giant	Summer Skies	27 (81)	36 (95)	6 (40)	8 (74)
	Galahad	20 (89)	57 (92)	7 (54)	8 (93)
	Blue Bird	28 (85)	43 (98)	9 (51)	19 (87)

Note. Year 1 = 2023–2024 and Year 2 = 2024

Shade Cloth Not Needed

Growing in the field under a 30% shade cloth (70% transmission) did not improve yield or stem quality. While other cut flowers have benefited from shade, delphinium in full sun produced long stems that surpassed the minimum marketable stem lengths for local markets. This indicated delphinium is well adapted for production in the high-elevation, semi-arid climate of the Intermountain West without further management.

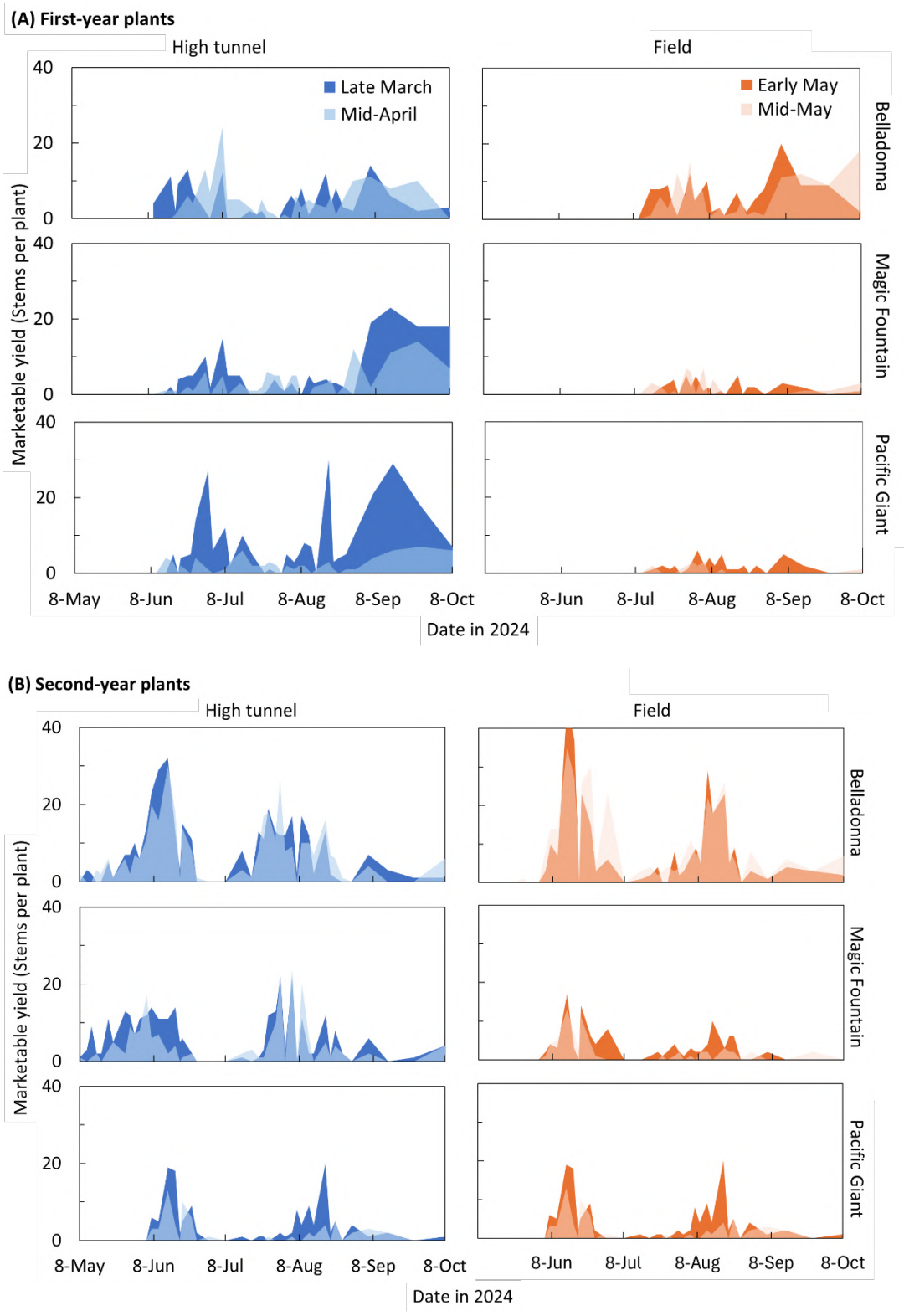

Figure 9. *The average daily marketable yield (in stems per plant) in 2024.*
Notes. Harvested plants were transplanted in late March (dark blue) and mid-April (light blue) in high tunnels (left panels) and early May (dark orange) and mid-May (light orange) in fields (right panels). The top panels are yields of Belladonna, middle panels are of Magic Fountain, and bottom panels are of Pacific Giant series. Marketable yields are given for (A) first-year plants, and (B) second-year plants from early May to early October.

***Table 5**. Delphinium cultivars grouped by series or type included in USU trials in North Logan, UT.*

Belladonna Types	 **Cliveden Beauty** Florist favorite, airy stems and distinct spurs, 2 to 5 feet tall. High yields with strong germination; produces several stems per flush. *Color:* pale blue blooms with white centers.	 **Casablanca** Delicate, airy stems and distinct spurs, 2 to 5 feet tall. Difficult to germinate and establish but can produce multiple stems per flush. *Color:* pure white.	 **Blue Donna** Vibrant, airy stems and distinct spurs, 2 to 5 feet tall. Moderate germination; produces multiple stems per flush. *Color:* deep blue with dark centers.
Magic Fountain Series	 **Dark Blue with Dark Bee** Statuesque, dense semi-double blooms, 3 to 5 feet tall. High yields. *Color:* purple and indigo color with dark centers.	 **White with White Bee** Striking, dense semi-double blooms, 3 to 5 feet tall. Low to moderate yields. *Color:* white with white centers.	 **Mid-Blue with White Bee** Opulent, dense semi-double blooms, 3 to 5 feet tall. Moderate yields. *Color:* pale blue blooms with white centers.
Pacific Giant Series	 **Summer Skies** Eye-catching, dense semi-double blooms, 3 to 6 feet tall. High yields. *Color:* pale blue blooms with white centers.	 **Galahad** Lush, dense semi-double blooms, 3 to 6 feet tall. Low to moderate yields. *Color:* white with white centers.	 **Blue Bird** Regal, dense semi-double blooms, 3 to 6 feet tall. High yields. *Color:* vibrant blue with light centers.

Summary

Delphinium is a perennial with long racemes that produces two flushes per season, making it an excellent crop choice for early-season high tunnel production. Start seeds 8 to 12 weeks before the average last freeze date. In trials, early transplant dates across high tunnel and field systems, as well as crops at both first- and second-year maturity, staggered harvest for a total of 22 weeks, allowing for a continuous market supply. Florists value delphinium for their distinctive colors, impressive stature, and versatility in various arrangements. The crop also offers competitive gross receipts for farms, with prices ranging from $12.00 to $16.00 per bunch when sold as wholesale. Overall, delphinium is well-suited for long-stem production, with transplant timing most critical for management.

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