Dahlia Cut Flower Production in Utah

Melanie Stock, Amanda Pratt, Claudia Nischwitz, Eli Oliver, Katie Wagner, and Nick Volesky

Dahlias are tuberous, herbaceous plants that are frost sensitive and therefore grown as a warm-season annual for cut flower production in Utah. Dahlias bloom in summer to fall, with peak production in late summer to early fall, and the season ending with first frost. Plants benefit from pinching to encourage branching and horizontal trellising or staking to promote straight stems and avoid toppling. High tunnels or extended low tunnels with shade, as well as optimum nitrogen and irrigation rates, improve production. As showstoppers in arrangements, dahlia cut flowers are highly desired on local markets and profitable to produce, particularly those with ball, decorative, or dinnerplate blooms.

Dahlia Types

Dahlias grown for cut flowers, as opposed to bedding plants, reach up to six-feet tall at maturity. Cultivars range in shape, size, and color and are grouped by bloom type (Figure 1):

- *Ball:* rounded, 2- to 4-inch blooms that are a versatile staple in bouquets, less prone to shattering, and have a longer vase life than dinnerplate types. Popular varieties: 'Linda's Baby', 'Jowey Winnie', 'Cornel', 'Rock Run Ashley', 'Boom Boom White', 'Crichton Honey'.
- *Decorative*: fully double, 6-inch blooms. Popular varieties: 'Castle Drive', 'Nicholas', 'Sweet Nathalie'.
- *Dinnerplate*: fully double and the largest decorative bloom at 6- to 12-inches that are typically used in large arrangements, as statement pieces, or in specialty displays because of their size. Popular varieties: 'Café au Lait', 'Break Out', 'Emory Paul'.
- *Single*: 1- to 4-inch blooms with one layer of petals and an open center. Popular varieties: 'Apple Blossom', 'Totally Tangerine'.
- *Novelty*: includes miscellaneous shapes, such as anemone, collarette (single row of petals around an open, pincushion-like center), and cactus. Popular varieties: 'Alfred Grille', 'Bora Bora', 'Karma Pink Corona', 'Garden Show', 'Polka', and 'The Phantom'.

Figure 1. *Example dahlia bloom types for cut flowers.*

Plant Stock Options

Dahlias can be planted as plugs from seed, as tubers, or as rooted cuttings. Growing dahlias from seed is less common for cut flowers because the seeds are not true to type (i.e., the blooms vary in shape and color). Most dahlias from seed produce single blooms and thinner stems that are less marketable than cultivars from tubers or cuttings. Tubers and cuttings both produce clones of the mother plant, and therefore the bloom forms and color are more predictable. They also produce more robust and marketable stems for cut flower production. No matter the stock option, make sure to only purchase from reputable sellers. Dahlias are susceptible to many viruses, so sourcing certified disease-free sources can be more difficult to find, but is *highly* recommended.

Seed Germination and Plug Preparation

Start seeds indoors eight weeks before the last frost to improve the emergence rate and give the plants a jumpstart on the season. Sow one to two seeds per cell, ¼" deep, in a 72-cell tray using a high-quality peat/perlite soilless media. Germination occurs in 7 to 21 days at the optimal temperatures of 70 to 80 °F. Cool temperatures (<60 °F) will lengthen germination time and decrease germination rates. Provide 16 hours of supplemental light and fertilize at three to four weeks. For plugs of seedlings or of cuttings, harden off and transplant once the danger of frost has passed (find your local frost date here).

Tuber Preparation

Tubers often come in clumps that can be divided. When separating tubers, ensure each tuber has at least one eye (Figure 2). Tubers can be directly planted in the soil around the last frost date or pre-sprouted indoors two to four weeks prior to planting to advance the season.

Figure 2. *Dahlia tubers that can be divided (white dashed line), such that each tuber has one eye (teal arrow).*

Site Preparation

For optimal growth, dahlias require well-drained soil. Till the soil to incorporate fertilizer or compost based on routine soil test recommendations. Incorporating one-inch of low-salt compost into the soil before planting increases organic matter and fertility, with minimal pH or salinity risk. See USU's Compost and Manure Guidelines for options. A soil test is recommended in new planting areas or where soil testing has not occurred in two years. USU's analytical laboratory performs soil tests with pricing available on their website and instructions for sampling here. Rake the tilled soil smooth and form beds that are 3 to 4 feet wide. Wider beds make it difficult to reach the center rows. Install drip irrigation and plastic mulch, if desired, before planting.

For dahlias grown in high tunnels, planning and preparation begin the previous fall by installing the plastic high tunnel covering prior to heavy rain or snowfall. This ensures the soil will be the right moisture level for workability early the following spring and decreases the risk of disease.

Planting, Spacing, and Pinching

Dahlias are a warm-season crop with optimal temperatures for flower production of 64 to 73 °F and an intolerance of freezing conditions. In high tunnels, dahlias can be planted 4 to 6 weeks before the average last frost date, while field-grown dahlias are planted after the last frost, particularly if using cuttings or plugs.

Space dahlias 18 to 24 inches apart, with more space given to large varieties. Dahlia tubers should be planted 4- to 6-inches deep, ideally when soil temperatures reach 60 °F. Because tubers are planted several inches below ground, and thus protected from fluctuating air temperatures, they may be planted up to two weeks prior to last frost. Cuttings must be planted after the danger of frost has passed. Plant cuttings deep enough to bury the first set of leaves to provide stability for the growing plant and ensure strong root contact with the soil. If temperatures unexpectedly drop after planting, use row cover to protect from freezing conditions.

Pinch plants when they are 12-inches tall to promote branching. To pinch, remove the terminal bud by cutting the stem at the next node (Figure 3). Pinching can slightly delay initial bloom but increases the total yield of marketable stems and avoids unmanageable initial stems with unusably large stalks.

Figure 3. *The terminal bud was pinched (yellow arrow) when this plant was 12-inches tall.*

Irrigation

Dahlias require consistent irrigation in Utah, and larger varieties have greater water needs. Maintaining evenly moist soil is critical for timely production. Though many sources warn against overwatering, in Utah, this is less of a concern than underwatering and the soil becoming too dry, especially after tubers have sprouted. Here, our semi-arid conditions naturally result in less moisture in the soil profile and greater evapotranspiration rates. Aim for moist conditions, but not saturated.

Drip irrigation is ideal, as it keeps moisture off the foliage and blossoms, and conserves water. Drip lines can be spaced 8 to 12 inches apart and positioned near the base of the plants in the row. Apply 2 to 4 inches of water per week (1 to 2 gallons of water per square foot), depending on temperature, growth stage, and soil texture. Spring plantings with little root growth initially require less water that is more frequently applied to maintain moisture near the soil surface. As vegetative growth increases, plants are flowering, and tubers are bulking, irrigate less often, but deeply. An example of irrigation at maturity with a high-flow drip system includes irrigating every other day for one hour (rates of 1.34 gal per min per 100 feet), for a total of 3 to 4 irrigation events per week.

Fertilizer

Dahlias have greater requirements for nitrogen and moderate requirements for phosphorous and potassium compared to other cut flower crops. In general, add 0.4 lbs of nitrogen (N) per 100 square feet each year. For example, 14 ounces (1.25 cups) of conventional urea fertilizer (46-0-0), or 2.5 pounds (about 8.0 cups) of organic 16-0-0 fertilizer equals 0.4 lbs of N. Use a slow-release source or apply half of the nitrogen at planting and side-dress the other half eight weeks after planting, or just prior to bloom. Alternatively, nitrogen may be applied through a weekly fertigation schedule that begins at planting and ends prior to bloom. Phosphorous and potassium should be added before or at planting based on a soil test, as these nutrients can build up in the soil. USU's Calculating Fertilizer for Small Areas is a useful tool for calculating applications with test results.

Trellising

Providing support for the plants through staking, caging, or horizontal trellis is required to promote straight, marketable stems and keep plants from toppling. Dahlias are highly gravitropic, meaning stems will curve upwards if they begin to bend. The stems are also hollow and susceptible to breakage. Mesh trellis (6 x 6 inches) pulled taut across the bed is most effective (Figure 4). Trellis is easiest to install at planting and two methods for staking the trellis can be implemented. If shade or low tunnels are used, the hoops can support the trellis across the row (Figure 5). See USU's Low Tunnels for Field Cut Flower Production fact sheet for more information. Alternatively, install wooden stakes or tall rebar at 3- to 5-foot intervals along the bed edge (Figure 4). The trellis should be moved upwards as the plants grow to match half the height of the tallest stems. Two tiers of horizontal trellis may be needed. In USU Trials, one layer of trellis installed 12 inches above the ground and a second layer installed at 24 to 30 inches high was optimal. Using baling twine with stakes is yet another option. Twine can help corral plants upright, but denser plantings are needed, and this method may not withstand strong canyon winds as well as plastic horizontal trellis. For dahlias grown as discontinuous plantings in the landscape (i.e., a diverse cutting garden), tomato cages can work well. Adding any of these support methods after planting, and particularly when plants are taller, is cumbersome and can damage stems, so implementing these early is key.

Figure 4. *Dahlias with the first layer of horizontal trellis at a 12" height. As plants grow, a second layer at 24-30" will be added to prevent toppling and encourage straight stems.*

Shade and Mulch

Shade is recommended after the high tunnel plastic and/or row covers have been removed. During summer production, 30% shade is used to cool the environment, encourage stems to grow longer, protect from wind, and reduce the incidence of flower scorch. For high tunnels, remove plastic in mid- to late-May and replace with shade cover until September. In USDA Hardiness Zones 6-7 or warmer, shade may also increase field production by improving establishment of cuttings, hastening plant growth and the onset of flowering, and encouraging longer stems. Using extended low tunnel arches is an effective method for installing shade cloth in the field. Attach shade cloth to the south side and top of the arches for beds oriented east-west, or to the west side and top when beds are oriented north-south (Figure 5). Low tunnels need to be extended for proper clearance with mature plants. For more information on low tunnel extensions, shading, and other uses for cut flower production, read our fact sheet, Low Tunnels for Cut Flower Production. In areas south of Cache Valley, white plastic mulch may cool the soil and increase yield.

Harvest and Storage

Dahlias typically begin flowering eight weeks after planting, with dinnerplates taking the longest to initiate bloom. Harvest during the cool parts of the day when the center of the blooms has just begun to open (Figure 6). Harvest prior to this stage results in an incomplete opening of the bud, while harvest after this stage results in earlier wilting, both of which reduce vase life. Harvest or deadhead all the blooms to maintain flowering. Florist-grade stem lengths vary by market and use. Some dinnerplates were marketable with stem lengths as short as 6 to 12 inches and used in specialty arrangements, such as arches. However, minimum stem lengths of 12 to 16 inches were more common. Place the cut stems directly into water while harvesting to avoid wilting. Use of chicken wire across the openings of buckets helped place stems in water without blooms falling in and becoming wet. After harvest, strip leaves, trim the ends, and place in warm water with floral preservative. For most dahlias, a vase life of 3 to 7 days is expected if proper harvest and storage procedures are followed. Dipping stems in boiling water may help rejuvenate wilted blooms to modestly extend vase life. Larger bloom types tend to have shorter vase lives than smaller bloom types and are more easily damaged.

Figure 5. *Dahlias oriented east-west at Wheeler Historic Farm in Murray, Utah. This allows for shade to be attached to only the south side and top of the low tunnel for more wind flow and efficient harvests.*

For non-diseased plants, tubers can be stored over winter and replanted in spring. Many storage techniques are successful, and growers often have their favorite go-to methods. In general, after first frost and before the soil freezes, remove the dead, above-ground vegetation and begin digging tubers. Rinse the tubers (if desired), allow to cure for 1 to 2 days, then store in media, such as vermiculite, wood shavings, or plastic wrap, to preserve moisture. Ideal storage conditions are dark, humid, and cool, but above 50 °F. Growers along the southern extent of the Wasatch Front may heavily mulch (e.g., hay, straw, leaves) the soil and leave the tubers in the ground. This practice risks losing tubers in the event of a cold winter and prohibits splitting the crowns to increase the number of plants the next year but saves significant labor time and storage space. In USU storage trials, rinsing and dividing in fall, then wrapping each tuber in 1 to 2 layers of plastic, was the most reliable method. It also saved space and was easy to label. We packed up to 10 tubers together (Figure 7).

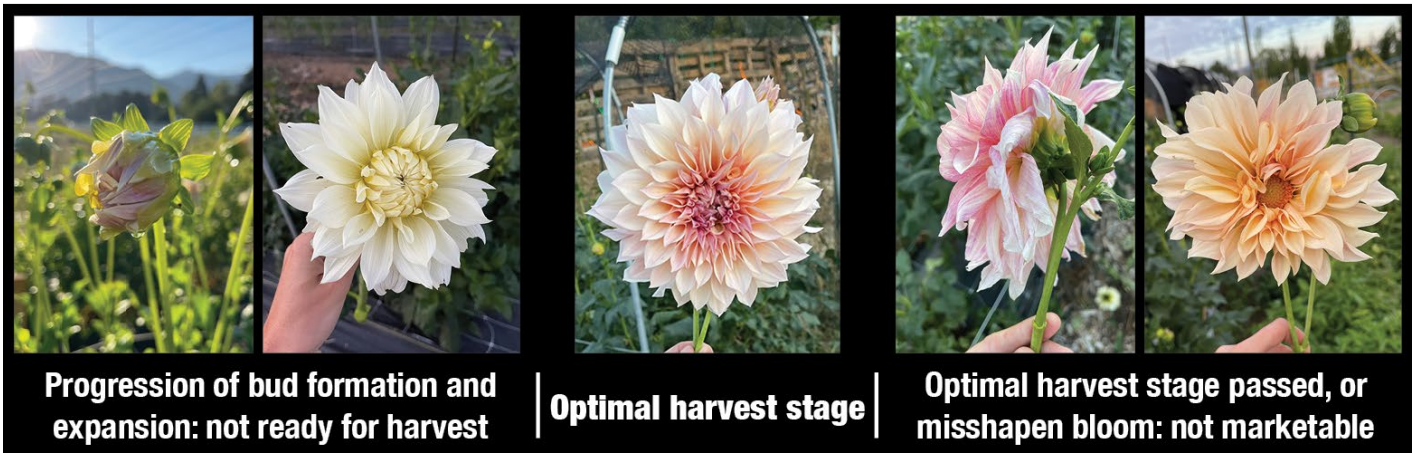

***Figure 6**: Stages of bloom, including before optimal harvest (left), the optimal harvest stage (center), and past harvest or misshapen blooms that should be culled (right).*

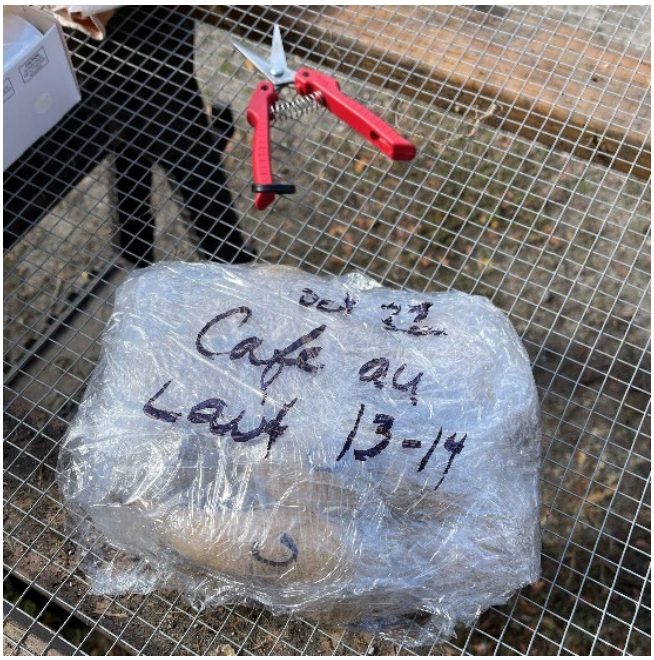

***Figure 7**. Tubers of two divided plants are individually wrapped with plastic, then packed together and labelled for storage in a root cellar.*

Economics

Dahlias are highly sought-after local flowers due to their showy and unique blooms, transport limitations, popular colors, and strong stems (Figure 8). Imports are easily damaged during shipping and storage. In 2022, white, blush, and apricot/champagne were top colors in Northern Utah. Large-bloomed dahlias were typically sold by the stem, while smaller bloom types were bunched. The wholesale price for dinnerplate dahlias was $5.00 per stem, while ball types sold in bunches of five stems for $15.00 in 2022. The reported wholesale import price for unspecified dahlia bloom types ranged $12.50 to $22.50 per 5-stem bunch (USDA-AMS, 2022).

Diseases and pests

Viral diseases are very common, often introduced by infected plant stock. Finding certified virus-free stock is highly recommended, as infected plants cannot be cured and should be isolated or removed to prevent disease spread. Scout plants for virus symptoms (Table 1 and Figure 9) and pests (Table 2), and follow best management practices, such as sanitization of harvest equipment. The USU Plant Pest Diagnostic Lab offers comprehensive testing for in-state growers. Email Dr. Nischwitz (claudia.nischwitz@usu.edu) for more information. Including a picture of the suspected diseased plant, the name of the crop, and your location is recommended.

***Figure 8**. Dahlias as a showstopper in arrangements. 'Café au Lait' dinnerplate is featured here. Photo courtesy of A Lavender Garden.*

TABLE 1. COMMON DISEASES OF DAHLIAS.

Disease	Identification	Control
ROOT, STEM, AND CROWN ROTS	Fungi that infect roots and crowns of plants. Dull-colored foliage or wilting followed by yellowing of plants. Plants may be stunted and then die. Roots are dark, soft, or decayed.	Avoid excessive irrigation/moisture, especially before the tubers sprout. Plant in well-drained soil. Dig out and destroy infected plants. Clean and disinfect tools with 70% ethanol or disinfecting wipes.
POWDERY MILDEW	Fungus growing on leaves, stems, and occasionally flowers. The leaves appear covered in white flour (the fungal spores).	Use a fungicide registered for dahlias with myclobutanil and sulfur active ingredients (do not apply sulfur above 90°F). If late in the season, chemical control may not be warranted. Remove and destroy plant stems after frost.
DAHLIA MOSAIC VIRUS (DMV)	Symptoms range from a mosaic pattern on leaves, to necrosis, stunting, color breaking of flowers, and reduced yield. Can be spread by aphids and introduced on infected plant stock.	Prevent introduction by purchasing clean plant stock. Sanitize pruning/harvesting equipment and destroy infected tubers. For more information, see Gleeson, Nischwitz, and Stock (2022).
CUCUMBER MOSAIC VIRUS (CMV)	Symptoms not yet observed in UT. Can be spread by aphids and introduced on infected plant stock.	Prevent introduction by purchasing clean plant material. Plants should be culled if confirmed to have CMV.
IMPATIENS NECROTIC SPOT VIRUS (INSV)	Symptoms not yet observed in Utah. Can be spread by thrips and introduced on infected plant stock.	Prevent introduction by purchasing clean plant stock. Control thrips early in the season to help minimize disease spread (Table 2). Dispose of plants that are confirmed to carry INSV.
TOBACCO STREAK VIRUS (TSV)	Viral disease that can lead to vein clearing on leaves. Can be spread by thrips and introduced on infected plant stock.	Prevent introduction by purchasing clean plant material. Chemical control of thrips (Table 2) may be warranted early in the season can help minimize disease spread.
TOMATO SPOTTED WILT VIRUS (TSWV)	Viral disease with wide host range. Causes yellow ringspots on leaves that can turn brown/black. Can be spread by thrips and introduced on infected plant stock.	Prevent introduction by purchasing clean plant material, eliminating weeds (hosts) from the area, and immediately removing infected plants. Chemical control of thrips (Table 2) early in the season can help minimize disease spread.

TABLE 2. PESTS OF DAHLIAS.

Insect	Identification	Control
APHIDS	Green, yellow, or black soft-bodied, very small insect that can transmit virus (Table 1). Feeds on buds, stems, and leaves, leaving a sticky "honeydew" that can accumulate on the plant.	Populations grow rapidly. Encourage natural predators, such as ladybeetles, by providing habitat and avoiding broad-spectrum insecticides. Spraying a strong stream of water directly on aphids can remove them. If populations reach a threshold, consider organic insecticidal soaps and horticultural oils.
EUROPEAN EARWIGS	Elongated, brown bodies with a prominent pair of rear "pinchers" (cerci). Hide in tight and dark spaces on the plant. Feed on plant stems, leaves, and blooms, and other arthropods. Damage can be severe if populations are high.	Populations tend to peak in mid-summer, but monitor throughout the season. Scout in the morning when they are often in leaf crevices or blooms. Hand removal or pellets with spinosad (e.g., SluggoPlus®) are most effective. Other options: containers with bait (soy sauce, oil, etc.) and a perforated lid that are buried up to the lid and emptied periodically.
GRASS-HOPPERS	Green to brown, up to a few inches long, and jump with large rear legs. Feed on leaves and flowers, leaving small to large holes and skeletonization of foliage.	Manage over a large area due to their high mobility. Bait (wheat bran with carbaryl or *Nosema locustae*) used by late May/early June is effective, as are insecticides with acephate, beta-cyfluthrin, or bifenthrin. Often hand-removal works best.
LEAFHOPPERS	¼-inch long, varied colors. Adults: highly mobile, quick flight movements. Nymphs: wingless, on the underside of leaves. Cause white stippling along leaf veins, tiny dark spots on the undersides of leaves.	Monitor all season, especially during bloom. Remove nearby weeds and eliminate plant debris that provide overwintering sites. If populations reach a threshold, consider insecticides with acephate, acetamipirid, bifenthrin, cyfluthrin, deltamethrin, lambda-cyhalothrin, or permethrin.
SPIDER MITES	Microscopic insects that feed primarily on the underside of leaves and cause stippling (light dots) on the leaves that can turn bronze then brown and fall off. This is	Avoid drought stress with adequate irrigation. Remove nearby weeds and minimize dust (avoid rototilling nearby). Encourage natural predators (e.g., predatory mites, minute pirate bugs) by avoiding broad-spectrum insecticides. Spraying a strong stream of

	sometimes confused for leaf burn. They also form thin webbing on leaves.	water directly on spider mites can remove them. Consider organic insecticidal soaps or horticultural oils.
Thrips	Brown-yellow, very small, with fringed wings. Cause stippling or irregular white blotches on foliage and flowers. Most notably, they transmit viruses (Table 1) and hide in blooms, making them less desirable. Monitor with blue or yellow sticky traps.	Remove weeds and plant debris that provide overwintering sites. Provide habitat, avoid broad-spectrum insecticides to encourage natural predators. Thrips build resistance to insecticides; chemical control is difficult and not recommended. Spray a strong stream of water directly on thrips to remove them. If populations are at threshold, consider organic insecticidal soaps or horticultural oils.
Lygus Bugs	Adults are pale green to brown, ¼-inch long, with a characteristic upside-down triangle on their back. Feed on the stems, leaves, and blooms. Their toxic saliva can cause general spotting and discoloration.	Populations tend to be greatest mid-summer to fall, but monitor throughout the season. Remove nearby weeds and eliminate plant debris that provides overwintering sites. If damage reaches a threshold, consider insecticides with active ingredients of permethrin, gamma-cyhalothrin, or malathion.

Figure 9*. Left) A dahlia leaf with faint mosaic patterns from Dahlia Mosaic Virus (DMV). Right) An uninfected, healthy leaf.*

Conclusions

Dahlias come in a variety of sizes and colors and are in high-demand on local markets. Varieties grown from tubers or cuttings are highlighted for use as cut flowers. They are sensitive to freezing conditions, and support must be provided to plants through horizontal trellis, staking, corralling, or caging. Proper nutrient, irrigation, pest, and disease management is critical to optimize production. Harvest when the blooms have fully expanded. Ball and dinnerplate varieties were most popular in Northern Utah from 2019 to 2022.

References

Fisher, A. 2019. Digging, Dividing, and Storing Tubers. The American Dahlia Society. 10/18/2022

Gleeson, S., C. Nischwitz, and M. Stock. 2022. Dahlia Mosaic Virus. 10/25/2022.

Mariña, L.J. 2015. Cultivation of the Dahlia. Cultivos Tropicales, 36(1), 103–110. 10/18/2022

Moorman, G. W. 2015. Tobacco Mosaic Virus. Penn State Extension. 10/18/2022.

Moorman, G. W. 2011. Cucumber Mosaic Virus. Penn State Extension. 10/18/2022.

Moorman, G. W. 2011. Impatiens Necrotic Spot Virus. Penn State Extension. 10/18/2022

Rauter, S., M. Stock, B. Black, and D. Drost. 2021. Low tunnels for field cut flower production. 10/12/2022.

USDA-AMS. 2022. Specialty Crop Market News. USDA, Agricultural Marketing Service. 10/26/2022.

Utah Plant Pest Diagnostic Laboratory. 2022. Utah Plant Pest Diagnostic Lab. 10/25/2022.

Utah Climate Center. 2022. Utah Freeze Dates. 10/12/2022.

Disclaimers

Tables and figures may not be used without written permission from the authors.

We sincerely thank Mollie Payne of Foothill Farm Flowers and the Utah Flower Market, Lindy Bankhead of Paisley Flower Farm, and Ali Harrison of Florage Farms for reporting market data. This project was funded by Western SARE, the Association of Specialty Cut Flower Growers (ASCFG), and USU Extension. The information reflects the views of the author(s) and not granting agencies.