



Dahlia Cut Flower Production in Utah

Eli Oliver, Melanie Stock, Maegen Lewis, Anna Collins, Amanda Pratt, Mark Brenneman, Claudia Nischwitz, and Katie Wagner

Dahlia are tuberous, herbaceous perennial plants that are frost sensitive and therefore grown as a warm-season annual for cut flower production in Utah. Dahlia bloom in summer to fall, with peak production in August and September, and the season ending with first frost. Dahlia cultivars are diverse and grouped by bloom type. Dinnerplate, decorative, and ball types are the most marketable for cut flower production. Plants benefit from early pinching to encourage branching and horizontal trellising or staking to promote straight stems and avoid toppling. Using high tunnels or extended low tunnels with shade, as well as optimum nitrogen rates, improves production along the Wasatch Front.

Dahlia types

Dahlias grown for cut flowers (Figure 1), as opposed to bedding plants, reach up to six feet tall at maturity and prefer temperatures between 64–73 °F (Mariña, 2015). Cultivars range in shape, size, and color and are grouped by bloom type (Figure 2):

- **Ball:** small-sized, rounded, 2–4" blooms. Popular varieties include 'Linda's Baby', 'Jowey Winnie', and 'Cornel'.
- **Decorative:** medium-sized, fully double, 6" blooms that are a staple in bouquets. Popular varieties include 'Castle Drive', 'Nicholas', and 'Sweet Nathalie'.
- **Dinnerplate:** the largest decorative bloom at 6–12" and fully double (Figure 3). They are typically used in large arrangements, as statement pieces, or in specialty displays because of their size. Popular varieties include 'Café au Lait', 'Break Out', and 'Emory Paul'.

- **Single:** 1–4" single blooms. Popular varieties include 'Magenta Star', 'Moonfire', and 'Happy Single Romeo'.
- **Novelty:** includes miscellaneous shapes, such as cactus (narrow and curled petals) and anemone (single row of petals around an open, pincushion-like center). Popular options include 'Alfred Grille', 'Bora Bora', 'Karma Pink Corona', 'Garden Show', 'Polka', and 'The Phantom'.



Figure 1. A field of 'Café au Lait' dinnerplate dahlias at the Utah Agricultural Experiment Station in North Logan, Utah.

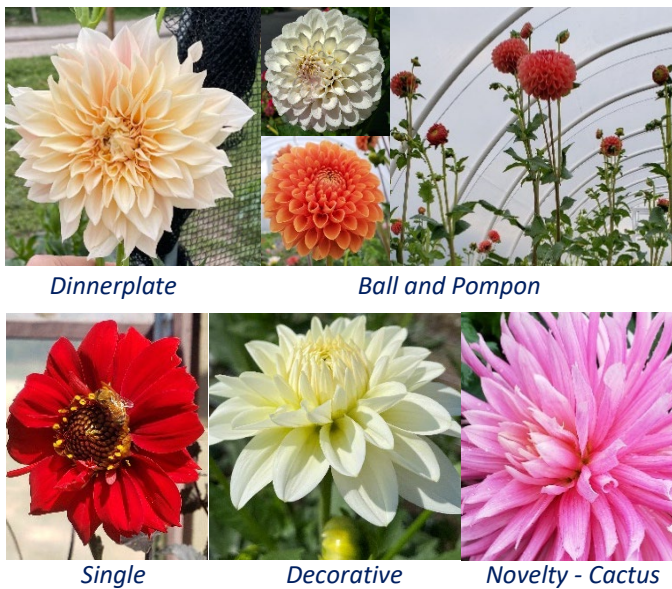


Figure 2. Examples of dahlia bloom types.

Plant stock options

Dahlias can be planted as plugs from seed, tubers, or rooted cuttings. Growing dahlias from seed is less common because the seeds are not true to type; 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, particularly for wholesale.

Germination

Growing dahlia from seed require temperatures between 70 - 80 °F for optimal germination and growth. Starting seeds indoors 8 weeks before the last frost is recommended to improve the emergence rate and give the plants a jumpstart on the season. Seeds should be sown ¼" deep in a size 72-cell tray. Germination occurs within 7 to 21 days under optimal temperatures. Temperatures cooler than 60 °F can lengthen germination time and decrease germination rates. Seed-grown dahlias should be given 16 hours of supplemental light and can be fertilized at 3 to 4 weeks. Harden off seedlings and transplant them outside once the danger of frost has passed.

Site Preparation

For optimal growth, dahlias require well-drained soil. Soil should be tilled to incorporate fertilizer or compost based on routine soil test recommendations. A soil

nutrient test is recommended in new planting areas or where soil testing has not occurred in 1-2 years. USU's analytical laboratory performs soil tests with pricing and information available on their [website](#). Tilled soil should be raked smooth. Install drip irrigation and plastic mulch, if desired, before planting dahlias.

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

Planting, Spacing, and Pinching

Dahlias are a warm-season crops that are intolerant of freezing conditions. In high tunnels, dahlia can be planted 4-6 weeks before the average last frost date, while field-grown dahlias are planted after the last frost date, particularly if using cuttings or plugs. To find the average last frost date for your area, visit the USU Climate Center [website](#).

Space dahlias 12-18" apart, with more space given to larger varieties, such dinnerplate types. Dahlia tubers should be planted four to six inches deep, ideally when soil temperatures reach 60 °F. Because tubers are planted several inches below ground, thus protected from fluctuating air temperatures, they may be planted up to 1-2 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 dip near freezing after planting, use row cover to protect from freezing conditions. Pinch plants when they are 12" tall to promote branching. To pinch, remove the terminal bud by cutting the stem at the next node (Figure 4). Pinching can slightly delay initial bloom, but increases the total yield of marketable stems.



Figure 3. Dinnerplate dahlias produce the largest blooms. Pictured: 'KA's Cloud'.

Irrigation

Dahlias require consistent irrigation, 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. 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 8-12 inches apart and positioned near the base of the plants in the row. Apply 2-4" of water per week, depending on temperature, growth stage, and soil texture. Early 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/min per 100 ft), for a total of 3-4 irrigation events per week.



Figure 4. The terminal bud was pinched (yellow arrow) when this plant was 12" tall.

Fertilizer

Dahlias have higher requirements for nitrogen and moderate requirements for phosphorous and potassium compared to other cut flower crops. In general, 0.3 – 0.4 lbs of nitrogen should be added per 100 square feet *each year*. For example, a total of 0.4 pounds (1 cup) of conventional urea fertilizer (46-0-0), or 2 pounds (about 2.5 cups) of organic 16-0-0 fertilizer. One application option is to apply half of the nitrogen before or at planting and side-dress the other half about

eight weeks after planting, just prior to bloom.

Alternatively, nitrogen may be applied through a weekly fertigation schedule that begins after planting and ends prior to bloom. For example, dissolving Applications of phosphorous and potassium should be added before or at planting, but should only be applied 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.

Trellising

Providing support for the plants through staking, caging, or horizontal trellis is required to promote straight, marketable stems and keep plants from toppling. Dahlia stems are gravitropic, meaning stems will curve upwards if they begin to bend. The stems are also hollow and susceptible to breakage. Installing stakes every three feet on each side of the bed and use baling twine to corral the plants is an efficient method. At USU, using two levels of mesh trellis (6" x 6") pulled taut across the bed has been most effective (Figure 5). To stake the trellis, install wooden stakes or tall rebar at 3- to 5-foot intervals along the bed (Figure 5). If shading or low tunnels will be used, the supportive hoops can be used to pull the trellis taut across the row and avoid the need for additional stakes (see Rauter for more information). Horizontal trellis is easiest to install before planting and can also serve as a planting grid. As the plants grow, move the trellis upwards. By maturity, position the first level of trellis at a 12" height and the second level of trellising at 24–30". Trellis added after planting, and particularly when plants are taller, is cumbersome and can damage stems.



Figure 5. Dahlia 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

Shade trials for dahlia production in Utah are underway and early results indicate shade may provide cooling and protect against intense afternoon sunlight. For high tunnel production, plastic should be removed by June and replaced with 30% shade cover until September. In counties that are in USDA Hardiness Zones 6-7 and 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 6). Low tunnels will 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](#).



Figure 6. Dahlia 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.

Harvest and Storage

Dahlias typically begin flowering at 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 7). Harvesting prior to this stage will result in an incomplete opening of the bud and a shorter vase life, while harvesting after this stage results in potential wilting and also reduces vase life. Harvest or deadhead all the blooms to maintain flowering. Florist-grade stems should be a minimum of 6-10" long with a preferred length of 12" or greater for dinnerplates and decoratives. Place the cut stems directly into water while harvesting to avoid wilting. Securing chicken wire

across the openings of buckets allows for stems to be placed in water without the 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 3-7 days is expected if proper harvest procedures are followed and the stems are stored in cool conditions. Larger bloom types, such as dinnerplate varieties, tend to have shorter vase lives than smaller bloom types.



Bud forming.

Bud beginning to expand.



Outer petals expanded, but center of the bloom is closed.

Perfectly formed and ready for harvest.



Optimal harvest stage has passed.

Deformed bloom that is not marketable.

Figure 7. The stages of flower opening, including the optimal stage to harvest, with 'Café au Lait' as an

For non-diseased plants, tubers can be stored over winter and replanted in spring. After first frost and before the soil freezes, the above-ground vegetation dies back and the tubers can be dug up for storage. After digging, allow the tubers to cure for 1-2 days to

reduce the risk of disease, then store in media, such as vermiculite or peat, to preserve moisture. Ideal storage conditions are dark and cool, but above 50 °F. Growers along the southern extent of the Wasatch Front may choose to heavily mulch the soil with hay, straw, or leaves, and leave the tubers in the ground. This practice risks losing tubers in the event of a cold winter, prohibits the grower from splitting the crowns to increase the number of plants next year, but saves labor time in digging and space for storage.

Economics

Dahlia are highly-sought, local flowers due to their showy and unique blossoms, transport limitations, popular colors, and strong stems. Wholesale dahlias are easily damaged during shipping and storage. Therefore, high-quality, locally grown dahlias that are longer than 6 to 10” and a popular color are in strong demand.

Dahlias, particularly dinnerplates, are sold by the stem, not bunched. The wholesale price for dinnerplate dahlias ranges from \$3.50-\$5.00 per stem. USU trial dahlias sold for \$4.00 per stem in the Cache Valley and Wasatch Front markets in 2020.

Dahlia disease

Dahlias are susceptible to viral diseases, which can be common across sources of plant stock. Finding certified virus-free stock is highly recommended, as infected plants cannot be treated and should be isolated or removed to prevent disease spread to other crops. Table 1 details the common diseases that can be found in dahlias and control options. It is important to follow best management practices, such as the sanitization of harvest equipment and control of common pests (Table 2).

TABLE 1. COMMON DISEASES OF DAHLIA.

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 eventually die. Roots are dark, soft, or decayed.	Avoid excessive irrigation/moisture. Plant in well-drained soil. Dig out and destroy infected plants.
POWDERY MILDEW	A fungal disease that produces a white or light gray powder on leaves, stems, and occasionally flowers.	Spray with copper fungicide. Cut down, remove and destroy all stems of the plant after fall freezes. Keep the area weeded and debris free. Early season infestations should be controlled. If late in the season, chemical control may not be warranted.
RUST	Brown/orange-colored spots on the underside of foliage.	Rogue plants that have fungus to prevent spread.
DAHLIA MOSAIC VIRUS (DMV)	DNA virus that is primarily identified by a chlorosis mosaic pattern on leaves. Can also lead to necrosis, stunting, and reduced yield. Commonly spread by aphids that have fed on other infected plants.	Sanitize any pruning/harvesting equipment and control aphids to reduce spread of DMV.
CUCUMBER MOSAIC VIRUS (CMV)	Disease associated with stunting of plants along with mosaic patterns and yellow spots on leaves. Can be spread by aphids and the use of contaminated equipment.	Control of aphids is important in managing CMV, as is the sanitation of any pruning/harvesting equipment. The removal of weeds can also reduce the spread of CMV, and plants should be thrown out if confirmed to have CMV.
IMPATIENS NECROTIC SPOT VIRUS (INSV)	Viral disease with many symptoms including stunting of plant, yellowing of leaves,	Control of thrips is vital in reducing spread of INSV. Keep plants suspected of virus in a separate location from healthy plants, and dispose of any plants that are confirmed to carry INSV.

	and necrotic spots on leaves. Can be spread by thrips.	
TOBACCO STREAK VIRUS (TSV)	Viral disease which can lead to chlorosis and necrotic streaking on leaves. Mosaic patterns may also be present. Virus will lead to stunting of plants. Can be spread by thrips.	Sanitation of equipment is an important method of preventing disease spread. Control of thrips can also help to reduce spread of TSV.
TOMATO SPOTTED WILT VIRUS (TSWV)	Viral disease that has a wide host range. It causes yellow ringspots on leaves that can turn brown/black. Spread by thrips, a common insect pest.	Prevent infection by purchasing clean plant material, eliminating weeds (hosts) from the area, and immediately removing infected plants. Chemical control of thrips (Table 2) may be warranted, but is difficult.

TABLE 2. PESTS OF DAHLIA.

Insect	Identification	Control
APHIDS	Green, yellow, or black; soft-bodied; sap-sucking insect. Populations can build up very rapidly. Sticky honeydew from the aphids can accumulate on leaves and stems.	Encourage natural predators by avoiding broad-spectrum insecticides. Ladybeetle releases inside a high tunnel can be effective, but will leave the area over time. Minute Pirate Bugs and Lacewings are also effective. Applying insecticidal soaps and oils is the best choice for most situations.
EARWIGS	Omnivorous pest that can feed on aphids and other small pests. Detrimental to ornamental plants as they will also chew on petals and young leaves.	Earwig traps are an effective means of control. A jar or plastic container can be filled with soy sauce and vegetable oil, then capped with holes punched in the lid. Bury the container up to the lid. Earwigs will be attracted to the soy sauce, and the oil will prevent the earwigs from leaving the trap. Empty and replace periodically.
GRASSHOPPERS	Feed on leaves and flowers of snapdragon later in the season. Cause ornamental damage.	Apply bait and sprays early in life cycle (late May/early June). Carbaryl, acephate, and Nosema locustae are effective. Hand-removal and exclusion are the best options for adults, as chemical control is difficult.
TWO-SPOTTED SPIDER MITES	Very small (0.02”), feed primarily on the underside of leaves and cause stippling (light dots) on the leaves that turn bronze then brown and fall off (Figure 5). Sometimes confused for leaf burn. Form webbing that covers leaves.	Provide adequate irrigation to avoid stress. Control surrounding weeds. Keep dust to a minimum (avoid rototilling between rows) as dust increases mite activity. Avoid/limit broad-spectrum insecticide treatments as mite outbreaks often follow. Spray plants with water, insecticidal oils, or soaps. Releasing generalist beneficial insects, such as Minute Pirate Bugs, can also help control populations.
WESTERN FLOWER THRIPS	Very small insect with fringed wings that does not directly damage snapdragons, but transmits viruses and hides in florets, making blooms undesirable for florist use.	Chemical control is difficult, Malathion only protects for 2 days and will kill beneficial insects. Keep weeds (often host plants) clear of the area. Spinosad can be effective but is toxic to natural enemies and bees. Releasing generalist beneficial insects, such as Minute Pirate Bugs, can also help control populations.

USU Dahlia Trials

In 2019–21, trials were conducted at Greenville Research Farm in North Logan, UT (USDA Hardiness Zone 5) and at Wheeler Historic Farm in 2021 (USDA Hardiness Zone 7). In North Logan, nitrogen (N) rates for dinnerplate dahlias with 'Café au Lait'. Rates ranged from no additional N (0 lb per 100 ft²) to high rates of 0.5 lb N per 100 ft²). A second trial in North Logan tested high tunnel production was compared to open field conditions with decorative and dinnerplate varieties that were planted in April in high tunnels and late-May in unprotected fields. High tunnels were covered with plastic until late-June, at which time it was removed and replaced with 30% shade cloth. At Wheeler Historic Farm, the use of white versus black plastic and shade versus no shade with low tunnels were tested in 2021.

Nitrogen Rate Evaluation

Plant growth rates were greater with N application rates of 0.22 lb (3.5 oz) N per 100 ft² (100 lbs N per acre) or more. Harvest began by late July, and the most total and marketable blooms were harvested from plants fertilized at 0.34 lb (5.5 oz) N per 100 ft² (150 lb N per acre). No difference in bloom timing occurred with any N rates tested. Application rates greater than 0.34 lb N per 100 ft², however, returned negligible increases in yield, while increasing production costs.



Figure X. Field of 210 'Café au Lait' plants that are divided into 30 plots that each test one of five N treatments: 0, 50, 100, 150, and 200 lb N per acre.

Use of plastic mulch and shade

Overall, the use of 30 % shade improved plant establishment, which was challenging with the late planting dates and the record heat and drought conditions in Utah during 2021. Black plastic without shade resulted in a loss of 17 % of plants, while black plastic with shade resulted in an 11 % loss of plants.

With the use of white plastic, plant loss was only 6 % with or without shade. Harvest of marketable stems began one week earlier with plants grown in white plastic mulch (August 19) compared to black plastic

mulch (August 26), regardless of shading treatment (Figure 2). Though harvest has just begun, plants with white plastic mulch and shade have been more productive (Figure 2). We hypothesize the white plastic mulch and shade may have kept conditions cooler and the solar radiation less intense, leading to improved early growth and production. We are eager to continue monitoring production into October and compare total yields with soil temperature data, as well as repeat this study in 2022.

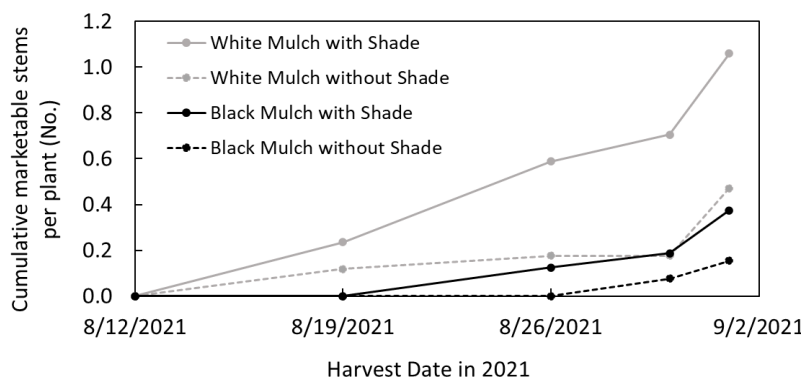


Figure X. Caption.

High tunnel vs. field production

The high tunnel advanced harvest by 35 days, with first harvest occurring on July 9 in the high tunnel, and August 13 in the field (Figure 1). As of August 27, the high tunnel produced an average of ten stems per plant while the field has averaged six (Figure 1). Quality has also been greater with high tunnel production. The minimum standard for marketability with Utah florists is six inches and undamaged blooms. The high tunnel has averaged five marketable stems per plant as of August 27, the average stem length was 11 inches, with stems lengths ranging from 8 to 34 inches. In the field, harvest has only occurred on two dates, with the first marketable stems harvested on August 27. On average, the field has produced one marketable stem per plant (Figure X), indicating the benefit of high tunnels in Northern Utah.

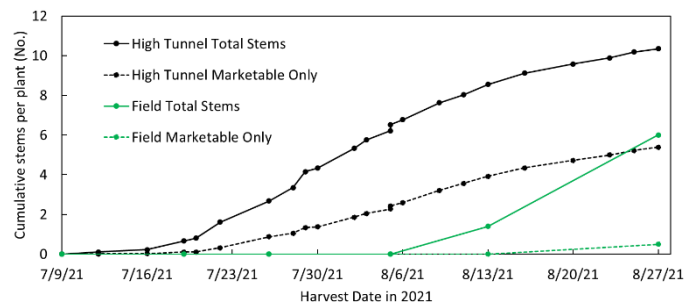


Figure X. The cumulative number of stems from 'Serena' and 'White Pearl' harvested from the high tunnel (green lines) and field (black lines). The solid lines represent total stems (marketable quality + cull), while the dashed lines are only marketable stems.

High tunnels allow for more control of the planting environment. Extremely wet or cold spring conditions can postpone field plantings and further delay field production compared to high tunnels. Suboptimal weather conditions in one year of our trials (2019) resulted in an 8-week delay in field production with 42% lower marketability. This indicates the importance of early field plantings for this cool season crop and highlights the year-to-year consistency high tunnels provide.

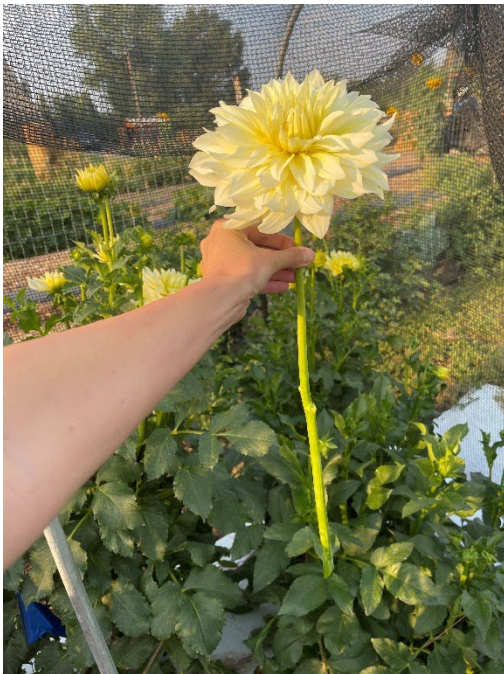


Figure X. A 23.5" stem of 'La Luna' dinnerplate dahlia that was harvested from a plant with white plastic mulch and shade cloth from a low tunnel.

Conclusions

Dahlias are a high demand flower that come in a wide variety of size and color. They are highly sensitive to freezing conditions, and larger varieties must be supported in some way when the plant begins to reach a height of two feet. Dahlias can be affected by a wide range of diseases and pests, and care should be taken to sanitize equipment when dealing with suspected viral plants in order to reduce any viruses that may be

present. Dahlias benefit most from higher nitrogen rates, with 150 lbs N per acre optimizing yield. The use of white mulch and shade reduced temperatures that improved production, and high tunnels can be employed to lengthen the growing season and provide a more controlled environment compared to the field.

References

- Fisher, A. 2019. Digging, Dividing, and Storing Tubers. The American Dahlia Society. <<https://www.dahlia.org/docsinfo/articles/digging-dividing-and-storing-tubers/>>.
- Mariña, L.J. 2015. Cultivation of the Dahlia. Cultivos Tropicales, 36(1), 103–110. <<https://www.haifa-group.com/sites/default/files/article/Cultivation%20of%20the%20Dahlia.pdf>>.
- Moorman, G. W. 2015. Tobacco Mosaic Virus. Penn State Extension. <<https://extension.psu.edu/tobacco-mosaic-virus-tmv>>.
- Moorman, G. W. 2011. Cucumber Mosaic Virus. Penn State Extension. <<https://extension.psu.edu/cucumber-mosaic-virus>>.
- Moorman, G. W. 2011. Impatiens Necrotic Spot Virus. Penn State Extension. <<https://extension.psu.edu/impatiens-necrotic-spot-virus>>.
- Rauter, S. et al. 2021. Low tunnels for field cut flower production. <https://digitalcommons.usu.edu/extension_curall/2242/>.
- Utah State University Extension. 2020. Dahlia mosaic virus. <<https://extension.usu.edu/pests/news/dahlia-mosaic-virus>>.
- Utah Climate Center. 2021. Utah Freeze Dates. Utah State University. <<https://climate.usu.edu/reports/newFreezeDates.php>>.

Disclaimers

All photos, graphs, and tables may not be used without written permission from the authors. Pictures by E. Oliver, M. Stock, and A. Pratt. 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.



In its programs and activities, Utah State University does not discriminate based on race, color, religion, sex, national origin, age, genetic information, sexual orientation or gender identity/expression, disability, status as a protected veteran, or any other status protected by University policy or local, state, or federal law. The following individuals have been designated to handle inquiries regarding non-discrimination policies: Executive Director of the Office of Equity, Alison Adams-Perlac, alison.adams-perlac@usu.edu, Title IX Coordinator, Hilary Renshaw, hilary.renshaw@usu.edu, Old Main Rm. 161, 435-797-1266. For further information on notice of non-discrimination: U.S. Department of Education, Office for Civil Rights, 303-844-5695, OCR.Denver@ed.gov. Issued in furtherance of Cooperative Extension work, acts of May 8 and June 30, 1914, in cooperation with the U.S. Department of Agriculture, Kenneth L. White, Vice President for Extension and Agriculture, Utah State University.

DRAFT