



High Tunnel Cut Flower Peonies in Utah

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Introduction

Peonies are a popular perennial cut flower with potential for high returns in Utah's cut flower market. In some markets, high quality stems are sold individually for \$3 to 5.00 or more. In comparison to annual cut flower crops, the initial investment requirement is fairly high for peonies. Peony plants are expensive and take 3 to 5 years to establish and come into full production.

However, unlike annual cut flowers that need to be replanted each year, peony plants are long lived, often in production for 25 years. They can be produced successfully as a field crop (without protection) and as a high tunnel crop. Cultivating peonies in high tunnels encourages earlier flowering and access to lucrative market windows such as Mother's Day.

High tunnels have increased in popularity in Utah with many growers incorporating them into their operation. High tunnels in Utah are usually used to extend the season, allowing growers to produce crops in the off-season, decreasing competition, and commanding price premiums. High tunnels increase potential for returns but the additional cost of the high tunnel must be considered. USU has several helpful fact sheets about high tunnel construction and management available at tunnel.usu.edu. This fact sheet presents general peony production information, basic high tunnel management guidelines for peonies, and preliminary data comparing peonies produced in a high tunnel to the open field.

Crop Establishment

Site Selection

With the long lasting nature of peonies, careful site selection and preparation are critical. Choose a location that receives at least 6 to 8 hours of direct sunlight as low light conditions will decrease flowering. Peonies prefer a well-drained, loamy soil. If your soil has high clay content, amend the soil with a low-salt compost or other organic matter. A well-drained soil will reduce the

risk of root rot. Clay soils that are prone to excessive moisture should be avoided since peony roots will die in saturated soil. If you are not sure what your soil type is or if the area has not been cultivated recently, it is a good idea to have a soil test. Visit usual.usu.edu for more information on testing, pricing, and sample submission.

Cultivar Selection

There are literally hundreds of different varieties of peonies that can be selected for production. These varieties include different flower types (single, double, bomb, and anemone), colors (whites, pinks, reds, corals, and yellows), blooming dates (early, mid, or late), and fragrant versus unscented. When purchasing plants, they should be varieties that are recommended for cut flower production as compared to just landscaping. In addition, it is important to realize that a careful selection of early, mid, and late season varieties combined with high tunnel season extension will allow a long period of production and harvest. Remember that peonies are like a tree in that they are long-lived. Planting high quality material is important for long-term performance and production.

Planting

Peonies respond best to being planted in the fall, typically as a bare-root plant. Purchase root divisions with at least 3 to 5 eyes as they will reach maturity sooner. Smaller roots (1 to 2 eyes) can also be planted but it takes a few additional years for smaller crowns to begin blooming. When planting bare-root plants, dig a hole deep and wide enough to easily fit the roots without bending the heavy, tuberous roots (Figure 1). The roots will have swollen white, pink, or reddish buds on them called eyes. Set the roots so the tip of the eyes are no deeper than 1 to 2 inches below the soil surface and are pointing up. The most common reason peony plants do not flower is due to excessively deep planting. Do not apply fertilizer when planting bare root plants.

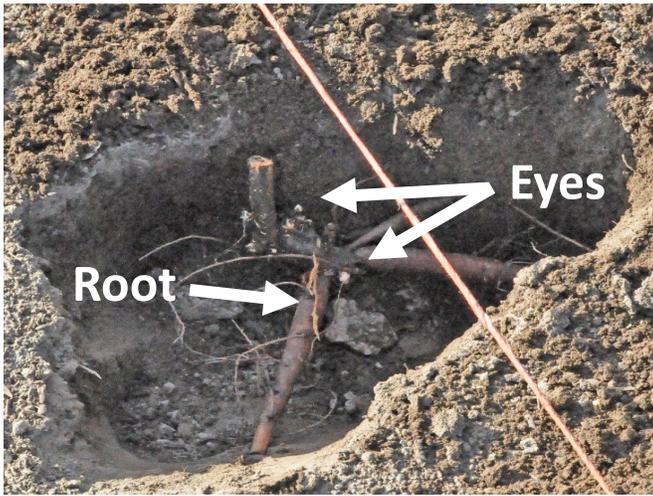


Figure 1. Bare-root peony at planting. Note the large planting hole and peony eyes (buds) facing up.

Peonies can also be planted in the spring, often as a potted plant. When planting a potted peony, dig the hole deep enough to just cover the soil level of the pot. Plant full sized varieties 2 to 3 feet apart, small varieties can be planted slightly closer. If the planting will eventually be covered with a high tunnel, determine the dimensions of the intended high tunnel and carefully plan spacing accordingly. Leave at least 2.5 feet of edge space around each exterior row to where the high tunnel walls will be and 4 feet between rows. Deeply water the newly planted crowns immediately after planting.

Irrigation

Peony plants should be watered as needed; determine irrigation scheduling by monitoring the soil and irrigate once the top inch of soil is fairly dry. The length of time between irrigation events varies throughout the year but is usually every 7 to 14 days. Apply 1 to 2 inches of water per irrigation. Deep watering encourages deep root development. Drip irrigation (Figure 2) works well for peonies as it keeps the foliage dry, reducing risk of disease.



Figure 2. Newly planted peonies with drip irrigation.

Fertilizer

If the soil was properly prepared before planting and nutrient levels were normal as indicated by a soil test, fertilization is most likely not needed during the first two years. After the plants have been in place for a couple of years, routine fertilization helps maintain strong flowering. In the spring, when peonies are 2 to 3 inches high, apply a low-nitrogen fertilizer (such as a 5-10-10 NPK) to the soil surface around the peony stem at a rate of 2 to 3 pounds of fertilizer per 100 square feet. Well-rotted compost can also be spread around the shoots at this time. Water the fertilizer into the soil immediately after application. For both fertilizer and compost, avoid direct contact with the new shoots to avoid damaging the stems. Do not apply a fertilizer high in nitrogen as excess nitrogen reduces blooming.

Pruning

In order to strengthen root development, remove any flower buds that form during the first 2 to 3 growing seasons after planting. Buds should be pinched off just above the leaves when they are about pea size. If foliage growth is vigorous and the plant seems healthy, a cut flower crop can be harvested in the third spring after planting. Each fall, after the first hard freeze, all stems should be cut back to the ground and debris removed.

High Tunnel Research Experiment

‘Coral Charm’ peonies were planted at the Utah State University Greenville research farm in 2011. A simple, [low-cost high tunnel \(14’ wide by 42’ long\)](#) covered half of the planting and the other half were left uncovered. They were planted 2-feet apart in the row and 4-feet between rows. A 3-foot wide weed barrier cloth was applied between rows to manage weeds. The peonies were watered with drip irrigation and buds were completely removed for the first 2 years. From 2014 to 2016 half of the buds were removed (when pea-sized) just below the bud to allow extra energy partitioning to the roots, any cull buds were also removed at this time. The remaining half of the buds were harvested with short stems (cut below the third true leaf). Full-length stem harvest was initiated in 2017, the 6th year after planting. Due to a miscommunication, removing half of the buds to allow extra energy partitioning was not done this year. This resulted in higher than usual harvest numbers and should be kept in mind when comparing yearly harvest data (Table 2). In 2018, half of the buds were removed when pea-sized and the rest were harvested with full-length (24 inch) stems.

Coral Charm is an early blooming cultivar and high tunnels were successful in moving the harvest window forward each year with an average first harvest date 21 days sooner than field production. Table 1 provides

Table 1. Peony harvest timing and yield comparison between high tunnel and field grown plants.

	1st Harvest		Last Harvest		Harvest Window (d)	
	Tunnel	Field	Tunnel	Field	Tunnel	Field
2014	9-May	27-May	22-May	4-Jun	13	8
2015	20-Apr	11-May	8-May	25-May	18	14
2016	2-May	24-May	20-May	3-Jun	18	10
2017	4-May	25-May	25-May	11-Jun	21	17
2018	30-Apr	21-May	23-May	1-Jun	23	11
Average	30-Apr	21-May	19-May	2-Jun	19	12

detailed harvest timing data for 5 years of peony harvest in North Logan, Utah.

One of the goals of using a high tunnel was to have peonies available for the Mother’s Day floral market, something field grown peonies in Northern Utah usually miss by a couple of weeks. Ideally, a grower could have high tunnel peonies available in the beginning of May for the Mother’s Day market and field-grown peonies available during the end of May for Memorial Day. In all but the first year of harvesting, high tunnel peonies were in full production over the Mother’s Day market in this study. Although flowering times will vary depending on location and from year to year, careful temperature management of the high tunnel should allow growers to manipulate bloom availability. The flowers are considered Grade 1 quality when there is no or only minor bending of the stem, the foliage is healthy, and the stem is at least 24 inches long. Grade 2 quality stems have well-shaped buds but also have minor spots on the

foliage, or slight bending of the stems. Flowers are considered unmarketable (cull) if the bud is misshapen or small, the foliage is heavily damaged, or if the stem is excessively bent or short (Figure 3).

Beyond moving the production window earlier, high tunnels offer protection from wind and rain/snow events that can negatively affect peonies. During bloom, peony stems are brittle, top-heavy, and prone to tipping over. Added moisture from snow or rain can easily cause a crop to topple over, breaking off valuable buds or causing bending in the stems (Figure 4), both of which can significantly decrease the number of marketable stems harvested. A high tunnel shields the plants from wind and moisture, negating this problem. In 2017, a spring storm event knocked over many of the blooms in the outdoor research plot, while the protected high tunnel plants remained upright. Not only were there more total stems per plant in the high tunnel, there were nearly three times as many high quality stems per plant inside the high tunnel than in the field (Table 2).



Figure 3. Peony stem grading. Grade 1 (left), straight stem well-shaped bud and healthy foliage. Grade 2 (middle), slight bending, well-shaped bud and minor foliage blemishes. Cull (right), heavy bending, damaged bud and damaged foliage



Figure 4. Peony plants bent over due to a 2017 late spring snow event.

Table 2. Average number of stems per plant for peony plants grown under a high tunnel compared to unprotected (field) grown plants over 2 years.

	Quality			
	Total Stems	Grade 1	Grade 2	Cull
2017				
Tunnel	19.4	11.6	4.9	3.0
Field	17.9	4.3	5.9	7.7
2018				
Tunnel	11.3	5.2	4.7	1.4
Field	8.4	3.7	3.2	1.6

High Tunnel Construction

During the initial establishment period it is not necessary to cover your peony crop. Since the buds are picked off during this stage, there is no benefit of pushing the plants to produce earlier in the season. Additionally, if the high tunnel is in place during the establishment period, labor costs of tunnel management and tunnel depreciation costs increase. Construct the high tunnel over your crop in the fall of the third year after planting. Fall construction allows the tunnel to be in place for forcing the next year's cut flowers. Waiting to construct the tunnel until winter is also a possibility but for areas with significant snow accumulation it is better to have the tunnel in place before snowfall. Drying out a tunnel during the winter is extremely difficult since the moisture is trapped inside the tunnel. High tunnels are relatively simple to construct, but building one over an existing crop can complicate the building process slightly. Take care to avoid stepping on or driving equipment over the peonies.

High Tunnel Management

Once the high tunnel has been constructed over the peony crop it needs to be managed throughout the winter and spring. On a sunny day, high tunnel temperature can be 30 to 40°F warmer than outside temperatures; extended exposure to these warm temperatures can cause the peonies to break dormancy earlier than desired. Use ventilation practices such as opening endwall vents or propping the doors open to cool the high tunnel. Installing a thermometer in the high tunnel will help as you monitor tunnel temperatures. See USU's [high tunnel temperature management fact sheet](#) for more detailed information. Peonies require winter chilling in order to bloom. During the winter dormancy period, tunnels must be kept open to maintain ambient temperatures until forcing begins.

At our research plots in North Logan, we begin managing the tunnel temperature for Spring growth on February 1st. Adjust this date earlier or later depending on your location. Production in the Greenville trials was done by opening endwall vents in the morning when the temperature forecast was for temperatures over 40°F and then closing at night. When the temperature forecast was

for 60°F, doors on both ends of the tunnels were opened in the morning. Continue managing the tunnels during bloom. Once the high tunnel has finished flowering, high tunnel plastic should be removed and stored in a dark place until fall. Removing the plastic decreases the tunnel management needs and will extend the life of the plastic, reducing depreciation costs.

Crop Maturity

Harvest

Once the plants are fully established, harvest of full-length stems is fine and will not harm the plant. However, removing half of the buds early on is still necessary to maintain excellent plant health. Harvest stems when the buds are in the 'marshmallow' stage (Figure 5). Test the stage of the bud by gently grasping and pressing on the top of the bud. The bud should 'give' slightly, feeling about the same as a marshmallow. Harvesting at this stage reduces stem breakage and increases storage life. Peonies must be harvested daily during bloom and may even benefit from harvesting twice per day during peak development and if temperatures are warm. Once at room temperature, buds will quickly open. Care must be taken that not all stems are harvested. As a perennial plant, it is critical that some stems and foliage be left in place to support plant growth and carbohydrate storage for the following year's growth. Cutting the 'cull' stems at the first leaf node to leave as much foliage as possible is helpful.



Figure 5. Peony bud at marshmallow stage, ready to harvest.

Storage

Peonies have a relatively short harvest window, but if harvested and stored correctly, stems can be stored for 2 to 4 weeks. Peony flower buds can be stored dry, packed carefully in plastic and laid flat on a cooler shelf. The

TABLE 3. COMMON DISEASES OF PEONY.

DISEASE	Identification	Control
<i>BOTRYTIS (GRAY MOLD)</i>	Fungus that thrives in high humidity conditions, causing young shoots to rot at ground level when they are 5 to 8 inches tall. Stems will have a water-soaked appearance and then suddenly fall over. Large, irregular shaped spots form on leaves. Gray mold will grow on the stem and small buds will turn black, large buds turn brown and fail to open.	Avoid excessive irrigation/moisture. Strive to keep humidity levels low if growing inside a high tunnel. Cut down, remove and destroy all stems after fall freezes. Copper sulfate applied early in the season can help protect plant.
<i>PHYTOPHTHORA BLIGHT</i>	Fungus thrives in moist soils and causes the stems at the soil-line to darken and appear leathery. Stems may wilt and die. It can cause the root/crown to rot and the entire plant can die. Whole plant will pull up easily.	Do not plant in heavy clay soil. Avoid excessive irrigation/moisture. Strive to keep humidity levels low if growing inside a high tunnel. Cut down, remove and destroy all stems after fall freezes. Fungicides have little effect. Dig up and remove infected plants.
<i>POWDERY MILDEW</i>	A fungal disease that produces a white or light gray powder on leaves, stems and occasionally flowers. Early season infestations should be controlled. If late in the season, chemical control may not be warranted.	Spray with sulfur or copper fungicide. Cut down, remove and destroy all stems of the plant after fall freezes. Keep area weed and debris free.

TABLE 4. INSECT PESTS OF PEONY.

INSECT	Identification	Control
<i>STRAWBERRY ROOT WEEVIL</i>	Small brown/black adults make irregular notches on leaves. Legless cream-colored larvae feed on roots. If heavy root feeding occurs, plant can be weakened or killed.	Adult stage: use a foliar spray (pyrethroids, Sevin or Merit). Larval stage: use a soil drench in late spring or early fall (Merit).
<i>FLOWER THRIPS</i>	Very small insect with fringed wings feed on flower buds and leaves. Leaves will develop a stippled appearance and petals deformed.	Cut stems while buds are in the tight bud stage and open indoors. Chemical control is difficult, Malathion only protects for 2 days and will kill beneficial insects.
<i>ANTS</i>	Ants are attracted to the sap of the peony buds/flowers and are commonly found on peonies. They do not damage the plant/flower and are considered a nuisance pest.	Ant traps can be set out to reduce numbers.

cold slows the flower development. Ideal storage temperatures are 32 to 34 °F. Most household refrigerators are kept in the 36 to 40 °F range. Peonies can still be stored at the higher temperature but storage life will be somewhat reduced. Be sure to securely seal the plastic to ensure good humidity around the stems as most coolers/refrigerators have low humidity that can be harsh on the buds.

Cut stems can also be stored in water but this method takes up more room. If the flowers are in a more advanced bud stage when cut, storing them upright in water is recommended. Adding floral preservative to the water and keeping stems in a cooler will help further extend storage life.

In general, the harder the bud when it is cut the longer it takes to open. If cut softer and it will open sooner. It is possible to harvest when the bud is so hard it will never open. When storing, remove most of the leaves to reduce transpiration and bulk. Once the flowers are removed from the cooler, re-cut the stems and move them into tepid water. The stems will hydrate and begin to open.

Diseases

Prevention is the best control option for any disease of peony. Selecting a proper site, practicing good sanitation and managing the crop properly will help reduce your chance of having diseases affect the crop. Using drip irrigation to irrigate will keep the plant canopy dry and greatly reduces disease occurrence. Keeping the planting free of weeds and old plant debris will also help minimize disease.

When pruning out a diseased plant, be sure to sanitize your pruners in a 10% bleach solution before moving onto the next plant to avoid spreading the disease. Remove infected plant material and carefully dispose of it. Table 3 describes some common diseases that infect peony.

Insect Pests

Peonies in Utah have relatively few insect pests. Table 4 describes common insects of peony and control options. As with diseases, keeping the planting weed-free and well-managed can help keep pest occurrence low.

Conclusion

Peonies have a long history as a favored spring flower and with the current popularity of the blooms for weddings and other events, they are an excellent choice for cut flower producers. Although patience and high initial investment are required, with proper care and the right markets, they can be a profitable cut flower crop. Using a high tunnel to extend the notoriously short window of peonies and allows growers in Utah to supply peonies an average of 2 additional weeks. Additionally, quality of high tunnel grown peonies increased under the protected cultivation high tunnels supply.

Resources

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