

using frequent light watering (no mist) and with a 70- to 75-degree F soil temperature. Germination occurs in 10 to 15 days with a 65- to 70-degree F night temperature and a 75- to 80-degree F daytime temperature. The light intensity during germination should be no more than 2,000 footcandles. Begin fertilizing seed flats a week after germination at a rate of 150 to 200 parts per million nitrogen applied 1 out of every 3 irrigations. Use a low- or no-ammonium fertilizer, such as 17-5-17. A one-time application of 20-10-20 may be used to green the seedlings up if needed. Rinse the foliage with clear water after fertilizing.

Once seedlings are large enough to handle in germination flats (30 to 45 days after sowing), transplant them to 50 to 200 celled flats. Seedlings flats are often picked out several times to select seedlings of uniform size for transplanting into cell flats. Drench the cell flats with Banrot, Subdue, or Truban to prevent diseases. B-Nine can be applied as needed at 700 to 900 parts per million to keep the seedlings compact. Avid and Sanmite can be used on seeding to control thrips that may damage the young foliage and growing point. Marathon can be used to control white flies and Nemasys can be used to control fungus gnats. Seedlings are transplanted into the final containers when leaves begin to touch in the cell flats, about 20 to 30 days in the cell flats depending on the time of year. Gloxinias may also be propagated from tubers or leaf cuttings, but these methods are rarely used commercially.

Handling Purchased Seedlings

Unpack the seedlings and examine them closely for potential problems such as insects, diseases, or shipping damage. Contact the propagator promptly if problems are found. Place the seedlings in a greenhouse and water them

as needed. Allow the plants to acclimate for a day or two. It is not necessary to transplant the seedlings upon arrival, but they should be transplanted by no longer than 5 days. Seedlings left in small containers too long can become stunted and will prematurely set flower buds resulting in poor quality plants.

Gloxinia seedlings are available in 50-, 72-, or 105-celled flats for the standard and compact types, and the mini type seedling also come in 200-celled flats. Which size a grower chooses to purchase depends on the cost per seedling verses the amount of time the grower has to finish the crop. Small seedlings cost less and require more crop time while larger seedlings costs more and require less crop time.

Potting Media

In general, gloxinias require a light, well-drained potting media high in organic matter. To mix your own, start with 50 to 60 percent peat and add perlite, vermiculite, coarse sand, aged bark, or calcine clay for good drainage. The media should be amended with dolomitic limestone to a pH of 6.0 to 6.5. Superphosphate and micronutrients may also be incorporated at about half the recommended rate. Many commercially available peat-lite mixes have also been used successfully.

Potting

Gloxinias may be grown in 4-, 4½-, 5-, 6-, or 7-inch pots depending on the cultivar size group and the size finished plant desired. Within a size group, a larger pot will produce a larger plant and a smaller pot will produce a smaller plant. Before removing the seedlings from the cell flat, hold the flat at each end and flex the center of the flat upward to loosen the soil balls from the cell interiors. This helps prevent damaging the seedlings when they are removed from the flats. Fill the

pots loosely with potting medium and form a hole in the center so the seedlings can be inserted deep enough that only ¼ to ½ inches of the crown and two pairs of leaves are above the soil line. To do this, it may be necessary to bury the lower set of small leaves. Do not intentionally break or remove the lower leaves because this encourages disease problems. Tall seedlings that may have stretched during shipping will finish fine when planted this way. However, if they are not potted deep enough, they will be weak and floppy when mature. Do not pack the soil because poor media aeration results in poor root development and stunted foliage.

The newly potted plants can be held pot-to-pot for the first 4 weeks, then placed at a final spacing when leaves of adjacent plants begin to touch. It is critical to space plants on time. If leaves on adjacent plants begin to push each other upward, crop quality may be reduced. Space the mini types in 4- or 4½-inch pots 9 to 10 inches on center, plants in 5-inch pots 10 to 12 inches on center, and plants in 6-inch pots 12 to 14 inches on center.

Disease Prevention

Always apply a fungicide drench after potting to guard against diseases. Use Cleary's 3336 plus Subdue Max, Cleary 3336 plus Truban, or Banrot. A second application of fungicide may be applied 6 weeks after the first application for complete disease control that will last the entire production period. A light foliar rinse with clear water should be applied after the fungicide drench to eliminate possible injury to foliage and unsightly residue.

Watering

Gloxinias thrive best when the soil is maintained uniformly moist. However, they should not remain wet for long periods in

winter. Plants in small pots should never dry out to the wilting point. If they do, flower buds may set prematurely and the plants will flower before reaching the desired size. Gloxinias can be watered overhead with a hose and water breaker, especially in the early stages, as long as the water is tempered and the greenhouse is not too hot and bright. In all seasons, it is a good practice to water early in the morning so the foliage dries quickly. It is important that the water temperature be close to the air temperature when overhead irrigating. If the water is too cold (below 50 degrees F), bleached rings may appear on the leaves called ring spot and roots may be damaged. Many growers temper their water with large water heaters or heat exchangers associated with the boiler heating system. At the final spacing, many growers use microtubes, capillary mats, or ebb-and-flow watering systems to avoid water contacting the foliage and flowers and to provide greater watering uniformity.

Fertilization

Begin fertilizing seedlings transplanted to the final containers about 10 to 14 days after potting. Alternate 17-5-17 and 20-10-20 during the warmer months and use 17-5-17 alone in the cooler months at a rate of 200-250 parts per million nitrogen. Apply fertilizer 1 out of every 3 irrigations. Use the lower rate in the winter and the higher rate in the summer. Plants on subirrigation systems can be fertilized at a rate of 125 parts per million nitrogen. Slow-release fertilizers, such as Osmocote 14-14-14, can be used at one-fourth the recommended rate. However, avoid a 20-20-20 fertilizer or any fertilizer with more than 40 percent of the total nitrogen in the ammonium form because these have resulted in foliar disorders. Twisted, cupped, or curled leaves with a general deep blue-green color are often

symptoms of excess fertilization or high ammonium nitrogen. These symptoms can occur in the winter when plants require water less frequently and less leaching takes place. The recommended electrical conductivity standards for gloxinias are 0.76 to 2.0 mmhos/cm using the saturated media extract method, 0.7 to 1.0 mmhos/cm using the 2:1 method, and 1.0 to 2.6 mmhos/cm using the pour-through method.

Boron Deficiency

Watch for boron deficiency during periods of high light in the summer. This problem usually appears before the plants get large and may be confused with chewing insect damage. Crown leaves will be deformed and appear eaten around the edges. If the leaves have holes or slits, the problem is not boron deficiency but more likely insects, such as thrips. Boron deficiency usually occurs in soilless media with little or no micronutrients. The problem is easily solved using a spray of Borax at ½ ounce per 1,000 gallons, or 1 gram per 75 gallons.

Light

Light intensity for seedling flats and cell flats should be kept low, about 2,000 footcandles measured at noon on a clear day. Removable shade cloth can be used on the greenhouse for this stage. Finish plants should receive 2,000 to 3,000 footcandles depending on the time of year. During the winter season, higher light intensities can be used when temperatures are more controllable and the number of hours of natural light are short. In the summer, lower light intensities are best to help control heat. A 60 percent shade cloth is often used. Many growers in northern parts of the United States can get by with full sun in the winter months. If plants start to stretch and have low flower bud counts, remove some of the shade. If the

foliage appears yellow or mottled, growth is hard, or small gray-brown spots appear on the leaves, add more shade.

Supplemental Light

Dark, overcast weather in the winter can delay gloxinia growth. Supplemental light from high intensity discharge lamps (metal halide or high-pressure sodium) can be used to supplement ambient sunlight and speed progress of the crop by several weeks in the winter. The lamps should supply about 200 footcandles at bench level and be turned on for 14 to 16 hours per day (6:00 a.m. to 10:00 p.m.). Supplemental light is more economical if applied to cell flats or during the 4 weeks plants spend pot-to-pot because fewer lamps will be required to light the crop compared to after they are spaced out. Young plants also respond more to supplemental light than older plants. Supplemental light is useful for standard and compact gloxinias, especially in northern climates.

Temperature

For best growth, the night temperature should be 65 to 68 degrees F and 70 to 75 degrees F during the day in the winter. Progress of the crops can be speeded up or slowed down by increasing or decreasing the night temperature. Do not exceed 90 degrees F during the day in the summer, and do not reduce the night temperature below 62 degrees F in the winter. Greenhouse temperatures of 45 degrees F or lower will cause plant damage. Low day or night temperatures in the winter can delay gloxinia growth. Careful attention should be paid to proper ventilation and reducing relative humidity during the winter to reduce condensation and prevent diseases. Conversely, high relative humidity is important during the hot, dry weather

in the summer. At this time, paths, empty bench tops, and greenhouse side walls can be wet down to raise the humidity.

Growth Regulator

B-Nine can be applied as a spray at a rate of 1,250 parts per million, 10 to 14 days after potting or when the first set of leaves reaches the pot edge to prevent main stem and petioles from stretching. A second application can be applied 7 to 10 days later, if needed, to the standard types under low light conditions. Under proper cultural conditions, i.e. light levels and watering practices, a second application is often unnecessary. One application or no growth retardant may be needed for the compact types. Do not apply B-Nine to mini types. All B-Nine applications should be completed in the first 3 weeks after potting. If plants need additional height control toward the end of production, Bonzi at a rate of 15 parts per million gives good height control without delaying flowering.

Scheduling

The schedule shown in Figure 1 is a generalization and individual stages may require a week less than indicated or a week more

depending on the time of the year and geographic location. Starting from seed, large-growing types require 20 to 27 weeks. Seed can be sown in August for Valentine's Day sales and in November for Mother's Day sales. The compact types generally require 4 to 8 weeks less time than the standard gloxinias.

For growers who order seedlings from propagators, time to finish is about 10 to 14 weeks for the large growing types, 6 to 10 weeks for the compact types, and 7 to 10 weeks for the mini gloxinias (Table 1). The variation in time to finish in different seasons reflects changes in light levels and temperatures.

Disbudding

Growers often remove the first pair of dominant flower stalks that arise from the canopy before they show color. A few of the uppermost leaves may also be removed if the center is congested to expose the remaining flower buds to light. This results in a flush of 6 to 8 flowers opening at one time—a showy gloxinia product.

Postharvest

If plants are sleeved and placed in a box, flower buds showing color will open during shipment. Shipping temperatures

should be above 45 to 50 degrees F, or plant injury will occur.

Gloxinia Cost of Production

The following budgets typify the cost of producing and marketing about 500 gloxinias in different container sizes.

Cultural Problems

- Premature flower buds may be caused by leaving plants in cell flats too long, excess heat or light, lack of nitrogen, or allowing very small plants to dry out too much before potting.

- Twisted, curled, or cupped leaves are caused by some type of fertilizer toxicity, such as high ammonium in winter, or by cold drafts.

- Deep blue-green foliage that may appear stunted is caused by excess fertilizer or excess B-Nine.

- Flowers hidden under the foliage or plants remaining in a vegetative state without flowers are usually caused by excess fertilizer, high ammonium, or too low day night temperature.

- Yellowing of leaves with lighter yellow areas between the veins is caused by excessive sunlight, high ammonium fertilizers, a combination of high light and too little nitrogen, or root loss due to high soluble salts or overwatering.

Table 1. Production Time for Standard Gloxinias in 6-inch Pots

Weeks to finish from:	Winter	Spring	Summer	Fall
2¼-inch liner	13 - 14	12	10	11-12
1½-inch liner	13.5-14.5	12.5	10.5	11.5-12.5
Production Time for Compact Gloxinias in 4½-inch Pots				
Weeks to finish from:	Winter	Spring	Summer	Fall
2¼-inch liner	9-10	8	6-7	7-8
1½-inch liner	9.5-10.5	8.5	6.5-7.5	7.5-8.5
Production Time for Mini Gloxinias in 4-inch Pots				
Weeks to finish from:	Winter	Spring	Summer	Fall
200 plug	9-10	8-9	7-8	8-9

General Production Schedule, Standard Gloxinia

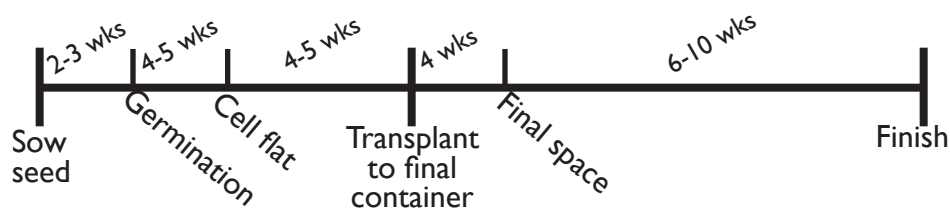


Figure 1. For growers who order seedlings from propagators, time to finish is about 10 to 14 weeks for the large-growing types, 6 to 10 weeks for the compact types, and 7 to 10 weeks for the mini gloxinias (Table 1). The variation in time to finish in different seasons reflects changes in light levels and temperatures.

Insect Problems

Caterpillars, cyclamen mites, foliar nematodes, spider mites, and thrips can be problems on gloxinias. However, thrips are the most difficult.

- Caterpillars chew the leaves of gloxinias and are most likely to be a problem in summer or fall. Apply Dipel, Conserve, or any of the pyrethroid insecticides labeled for caterpillars.

- Cyclamen mites are too small to be seen without a magnifier, but may be detected by stiffening and discolored reddish brown young leaves. Use Talstar for light infestations and Pylon for heavy infestations.

- Foliar nematodes cause small tan, sunken areas to form

on leaf tips and margins. Spots become dry and dull black. Destroy infected plants. Water plants in a manner that keeps leaf surfaces dry and does not splash water from plant to plant.

- Broad mites and 2-spotted spider mites occur mostly on the underside of leaves and their feeding causes a mottled or speckled appearance on the upper leaf surface. Spider mites can develop quickly under warm, dry conditions. Apply Talstar.

- Thrips can attack the growing tips of small plants and cause the leaves to grow out deformed with cuts, holes, or ragged edges. Develop a spray rotation of several different insecticides with different modes of action. Good success has been achieved with BotaniGard or

Naturalis to plants without flowers. Conserve and Mesurool can be used if populations are high. Thrips feeding on flowers is a difficult problem because the delicate open blooms of gloxinias are subject to damage by many insecticides. Avid and Sanmite can be applied to flowers open.

Disease Problems

Botrytis blight, Myrothecium, Phytophthora, Pythium, and viruses can infect gloxinias. Greenhouse sanitation procedures can go a long way toward preventing these problems.

- Botrytis Blight causes small water-soaked lesions that form on infected petioles and spread to leaf blades. Infected flowers fade prematurely. Space plants and provide ventilation to avoid high humidity. Remove fading flowers and yellowing leaves. Apply Decree or Compass. Do not use Chipco 26019 or Cleary because they leave an unsightly residue on the foliage.

- Myrothecium causes petioles of lower leaves to develop darkened spots. The spots enlarge down the stems and stems are easily broken. Plant in clean

Table 2. Estimated Variable Costs of Producing Gloxinias in the Southeastern U.S. Salable crop = 500 in 6-inch pots. Crop timing is 50 plug = 12 weeks, 72 plug = 13 weeks of production.

Materials	Description	Unit	Quantity	\$/Unit	\$/Crop	\$/Unit	\$/Crop
Plugs	50 plug	each	500	\$0.55	\$275.00		
Plugs	72 plug	each	500			\$0.51	\$255.00
Shipping	Average for S.E. states	each	500	\$0.05	\$25.00	\$0.05	\$25.00
Pots	6-inch press fill pots (500 per case delivered)	case	1	\$0.06	\$30.00	\$0.06	\$30.00
Media	3 cubic foot bags (\$9.00/ bag delivered)	bag	11	\$0.20	\$99.00	\$0.20	\$99.00
ID Tags	300/bundle (color printed)	each	500	\$0.02	\$10.00	\$0.02	\$10.00
Fertilizer	Peters 15-16-17	bag	1	\$0.05	\$20.50	\$0.05	\$20.50
Pesticide	Banrot	bag	1	\$0.15	\$57.00	\$0.15	\$57.00
Total				\$1.08	\$516.50	\$1.04	\$496.50

Table 3. Estimated Variable Costs of Producing Gloxinias in the Southeastern U.S. Salable crop = 500 in 4-inch pots. 50 plug = 9 weeks, 72 plug = 10 weeks, 200 plug = 11 weeks of production.

Materials	Description	Unit	Quantity	\$/Unit	\$/Crop	\$/Unit	\$/Crop	\$/Unit	\$/Crop
Plugs	50 plug	each	500	\$0.55	\$275.00				
Plugs	72 plug	each	500			\$0.51	\$255.00		
Plugs	200 plug	each	500					\$0.25	\$125.00
Shipping	Average for S.E. states	each	500	\$0.05	\$25.00	\$0.05	\$25.00	\$0.05	\$25.00
Pots	4-inch press fill pots (500 per case delivered)	case	1	\$0.04	\$20.00	\$0.04	\$20.00	\$0.04	\$20.00
Media	3 cubic foot bags (\$9.00/bag delivered)	bag	4	\$0.07	\$36.00	\$0.07	\$36.00	\$0.07	\$36.00
ID Tags	300/bundle (color printed)	each	500	\$0.02	\$10.00	\$0.02	\$10.00	\$0.02	\$10.00
Fertilizer	Peters 15-16-17	bag	1	\$0.04	\$20.50	\$0.04	\$20.50	\$0.04	\$20.50
Pesticide	Banrot	bag	1	\$0.12	\$57.00	\$0.12	\$57.00	\$0.12	\$57.00
Total				\$0.89	\$443.50	\$0.85	\$423.50	\$0.59	\$293.50

media and do not reuse containers. Apply Chipco 26019 to leaves and stems. Maintain moderate temperatures and low humidity.

- Phytophthora crown rot causes roots to have a dark, water-soaked appearance. This spreads to petioles and leaf blades. Young plants are often quickly killed. Pot in clean media and destroy infected plants as soon as they show symptoms. Apply Banol, Banrot, Subdue 2E, Subdue MAXX, Terrazole, or Truban to protect healthy plants.

- Pythium root rot causes dark brown roots. Plants wilt, yellow, and die. Pot in clean media and destroy infected plants as soon as they show symptoms. Apply Banol, Banrot, Subdue 2E, Terrazole, or Truban to protect healthy plants.

- Virus infection symptoms vary. Leaves may have dark brown to black dead areas in line patterns. Flower petals may be spotted. Leaves may be downwardly cupped, mottled, or narrowly shaped. Leaves may have line or ring spot patterns. Shoots may be elongated. Impatiens

necrotic spot virus, tobacco mosaic, tomato spotted wilt, or tomato ring spot virus can be problems on gloxinias. Impatiens necrotic spot is probably the most serious and widespread. Maintain good thrips control including screening them out with fine-mesh screen. Destroy infected plants. Eliminate weeds within the production area and within 30 feet outside the greenhouse. Do not use tobacco products when handling plants. Keep gloxinias away from other crops known to be susceptible to impatiens necrotic spot virus.



ANR-1258

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2.1M, New Sept 2004, ANR-1258

Greenhouse Production of Gloxinias

History

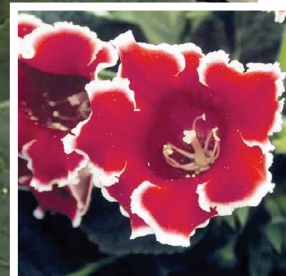
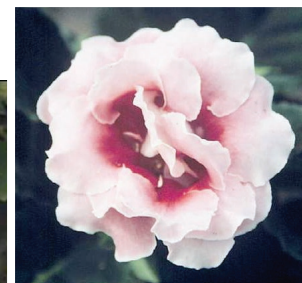
The species from which Florists Gloxinias were derived came from Brazil in 1785. The name *Gloxinia speciosa* was originally assigned in 1817 by Conrad Loddiges, an English nurseryman, in honor of P.B. Gloxin of Strasburg, Germany. In 1825, the species was renamed, placing it in the correct genus, *Sinningia*. The original species had slipper or nodding flowers, but by the mid-1800s, an erect, bell-shaped flower appeared. The modern gloxinia is a hybrid from two Brazilian tropical species; *Sinningia speciosa* and *Sinningia maxima*. It arose as a chance seedling raised by a Scottish gardener, John Fyfianna, in the nineteenth century. This hybrid was the basis for most modern gloxinia cultivars.

Scope of Production

Most growers produce gloxinias on a small scale. Producers usually obtain established seedlings from specialized propagators for either year-round production or, more often, to meet holiday demands. The primary holidays are Mother's Day and Valentine's Day.

Cultivars

Gloxinia flowers may be single or double and come in a variety of colors from pure white to pink, lavender, red, or dark purple. Bicolors and those with petals edged in white are very popular. However, the velvet reds and purples outsell all others. Hybridization and selection has resulted in three cultivar size



Gloxinia cultivars are available in a variety of flower colors and styles.

groups; standard types may grow 20 to 24 inches in diameter with 50 to 100 flower buds per plant and are grown in 6- to 7-inch pots, compact types may grow 12 to 18 inches in diameter with 50 to 75 flower buds per plant and are grown in 5- to 6-inch pots, and miniature types (minis) may grow 6 to 10 inches in diameter with 50 to 75 flower buds per plant and are grown in 4- to 4½-inch pots. Mini types come in two flower types, tubular-shaped flowers, which sell the best, and slipper-shaped flowers. Mini types generally have fewer production problems and ship better than the other two sizes. They have more flexible foliage and can be sleeved, which is difficult with the other two sizes. All size types of gloxinia seedlings require basically the same cultural

procedure with the exception of crop timing and pot size.

Propagation

Many growers today purchase established seedlings of high quality cultivars from specialized propagators. However, excellent cultivars are available for the grower to produce from seed. Gloxinia seed are very small (800,000 seed per ounce). Therefore, seed should be sown in open flats (often wooden flats that are steam sterilized between use) using a fine-screened, sterile, peat-lite medium that is 1½ to 2 inches deep. A layer of coarse vermiculite is added on top of the germinating media to hold moisture. Gloxinia seed may be mixed with sand and shaken thinly onto the vermiculite surface. Do not cover the seed. Germinate the seed