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Michigan State University Extension Service

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# Producing Tuberous Begonias from Seed

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## I. History

- A. With the introduction of new, easy-to-grow varieties, tuberous begonias produced from seed are rapidly gaining in popularity. These newer varieties are shade tolerant, are available in many colors and maintain a clean, neat habit throughout the growing season. They may be marketed as bedding plants, hanging baskets or potted plants.
- B. Native to Peru, Bolivia and Ecuador, tuberous begonias (*Begonia x tuberhybrida*) were brought to the United States by Richard Pierce in the mid-1860s. They belong to the Begoniaceae family, which includes the wax leaf begonia and more than 500 other species.
- C. Benary Seeds of Germany and Sakata Seeds of Japan introduced several new cultivars in the 1970s, including the Non-Stop series. Since then, several other seed companies have also introduced many excellent varieties.

## II. Cultivars

- A. Tuberous begonias were originally grown from tubers. The newer seed-produced hybrid varieties have made growing plants from seed a popular method for production of tuberous begonias.
- B. F1 hybrid seed has many advantages, including a high germination rate, increased vigor and prolific flowering.
- C. Tuberous begonia flower colors include shades of red, pink, orange, yellow and white.
- D. Flower diameter averages 2½ inches and flowers are primarily fully double or semi-double, with some single flowers on each plant.

## III. Propagation

- A. Tuberous begonias can be propagated by tubers or cuttings, but production by seed is now most common.
  1. The seeds are extremely small, with approximately one million seeds per ounce.
  2. Tuberous begonia seed may remain viable for up to 9 years. For best results, however, purchase F1 hybrid seed each year from a reputable supplier. If seeds must be stored from one year to the next, place them in a cool, dry environment away from insects and rodents.
- B. Seeds require a moist, light, sterile medium for good germination.
  1. Peat-lite mixes work very well for seed germination. These mixes are generally free of pathogens, provide good aeration and can maintain adequate moisture levels for good germination. Soil-based mixes are not recommended. If one is to be used, it must be properly sterilized before the seed is sown.
  2. The pH of the growing medium is very important for good germination. A pH of about 6.0 is desirable. As soil pH varies from 6.0, germination will be decreased or inhibited.
- C. Because of the small seed size, sowing must be performed accurately to prevent waste.
  1. The easiest way to sow very small seeds is with an automatic seeder.
    - a. A No. 406 plug tray is small enough to produce the seedlings economically but large enough to allow the plants ample room for growth until transplanting.
    - b. Larger sized plug trays, such as those in the 200 or 300 series, can also be used. These sizes will provide more room for the seedlings, which will reduce the incidence of disease and aid in maintaining a stable nutrient level.

2. Seeds can be sown by hand.
  - a. Preformed seed trays with rows are preferred to open bottom flats to help reduce the spread of disease through the flat.
  - b. Sow no more than 500 seeds per standard seed flat. This prevents overcrowding and keeps the plants from becoming entangled before transplanting.
  - c. The seeds can be mixed with a small amount of sugar or white sand to make the rate of sowing easier to monitor.
  - d. The seeds are sown directly on the soil surface and are not covered.
- D. Adequate moisture levels must be maintained for successful germination. The medium should be thoroughly moistened before sowing to prevent the seeds from being washed away.
  1. Water temperature should be between 70 and 78 degrees F to ensure that the soil temperature is warm enough for good germination.
  2. After sowing, cover the trays with clear polyethylene to maintain high humidity levels. Humidity must be held as close to 100 percent as possible.
    - a. Tuberous begonias require a high humidity level longer than other seedlings. Leave the plastic in place until the first true leaf is at least ¼ inch wide. If the plastic is removed too soon, the plants will become desiccated and die. Take care to keep the temperature under the plastic from reaching damaging levels on warm, sunny days. Seedlings may die at temperatures over 90 degrees F.
    - b. Support the plastic above the seed trays to prevent the seedlings from sticking to the condensate that collects on the plastic. Covered flats should not require watering until after seedlings have emerged.
  3. Capillary mats can be used to help maintain even moisture levels across the flats and to provide subirrigation when flats require water.
- E. Temperature is critical for good germination.
  1. Soil temperatures should be maintained between 70 and 75 degrees F. Temperatures that are too high or too low will delay or reduce germination.
  2. Originally, it was suggested that a soil temperature of 65 degrees F be used to germinate the seeds. Research has shown that the higher temperatures give satisfactory results.
3. Hold seedlings at 70 degrees F for a few days after complete germination is achieved and then lower the temperature to 65 degrees F at night until transplanting.
- F. Tuberous begonias require light for germination.
  1. Provide supplemental lighting 24 hours a day to increase germination and accelerate early growth. Lighting the crop, especially in the early stages of growth following germination, may reduce total crop time by 1 to 2 weeks.
  2. High-pressure sodium lights or cool fluorescent lights will encourage growth without causing excess stretching.
  3. With increased supplemental lighting, additional CO<sub>2</sub> at 1,000 to 1,500 ppm will increase the growth rate.
- G. Germination normally occurs in 10 to 15 days, though complete germination may not be achieved for up to 30 days, especially at temperatures below the recommended range. Maintain warm temperatures and high humidity until germination is complete.
- H. The use of growth rooms is becoming more prevalent in the industry because they offer excellent environmental control. Seeds are sown in an enclosed room under lights where temperature and humidity levels are easier to maintain than in the greenhouse. Seedlings are moved to the greenhouse after they pass the crucial stages of germination and early growth.
- I. Because the seedlings require extended time in the seed flat before transplanting, two to three applications of a balanced fertilizer at a rate of about 100 ppm N are beneficial to prevent the plants from “stalling” in the seed flat. Closely monitor soluble salts levels—the seedlings are sensitive to high salts.
- J. Tuberous begonias are readily available from many suppliers as transplants from plugs. These plants are already 6 to 9 weeks old, so the problems of seed germination and early plant care are eliminated. If you use this production method, purchase plants from a reputable supplier known to produce quality plants.

#### IV. Transplanting

- A. Tuberous begonia seedlings are ready to transplant 7 to 10 weeks after sowing, depending on the conditions under which the seedlings were grown.
  1. When the third true leaf is at least 1 inch wide, the plants can be successfully transplanted.

2. Unless they're grown in plugs, larger plants will suffer transplant shock when removed from the seed tray. This will delay growth or kill the seedlings.
  3. If the seedlings are planted too thickly in the seed flat, the roots will become entangled and be easily damaged when plants are transplanted.
  4. Plug-grown seedlings do not normally suffer from transplant shock, so they can be held longer before transplanting. Transplant from plugs before the seedlings begin to crowd each other and stretch. The larger the plug size used when the seeds are sown, the longer they can be held before transplanting.
- B. Tuberous begonias are very delicate and easily damaged by rough handling.
1. Handle seedlings by the leaves, not the stem, when transplanting. If a leaf is damaged, a new one will grow in its place. If the stem is crushed, the seedling will die.
  2. Take care to minimize root damage during transplanting. Damaged roots will slow seedling growth and possibly lead to disease problems.
- C. Use a light, sterile medium to grow the plants to flower.
1. A good mix will be free of pests, provide good aeration and be able to hold adequate amounts of moisture.
  2. Perform a soil test before planting. It is easier to make adjustments to the soil before the seedlings are planted.
  3. Tuberous begonias require a soil pH of about 6.0.
  4. Moisten the medium thoroughly before transplanting. If tuberous begonias are transplanted into a dry mix, the root tips will quickly dry out and die. This will delay growth and possibly provide a pathway for disease organisms.
- D. Tuberous begonias may be grown in pots, flats or hanging baskets.
1. No. 18 cell packs are normally used when the plants are to be grown on in flats.
  2. Pot sizes for tuberous begonias range from 4 to 6 inches.
  3. When hanging baskets are used, tuberous begonias do equally well in 8- or 10-inch baskets.

4. Regardless of the type of container used, the finish of the container should be opaque and not translucent to prevent light from reaching the roots.
  5. Pot one tuberous begonia plant per 4- to 6-inch pot and three plants per 8- to 10-inch basket or planter.
- E. After transplanting, hold the temperature at 68 degrees F for a day or two until the plants are established.
- F. Adequate water is important. Water seedlings immediately to prevent drying. If the plants suffer moisture stress at this stage, large numbers may die.

## V. Growing on

- A. Proper greenhouse spacing will allow good air circulation.
- B. Raise the flats off the greenhouse floor to prevent the plants from rooting into the ground. Use saran cloth or plastic risers to elevate the flats. If at all possible, grow tuberous begonias on an open, raised bench, such as one constructed from expanded metal.
- C. When growing tuberous begonias in flats, leave a 1/2- to 1-inch air space between flats to enhance air circulation. If grown in pots, the plants may be placed pot to pot initially but should be spaced out before the leaves of adjacent plants touch.
- D. Recommended spacing:

| POT SIZE (inches) | INITIAL SPACING (inches) | FINAL SPACING (inches) |
|-------------------|--------------------------|------------------------|
| 4                 | 4 X 4                    | 8 X 8                  |
| 5                 | 5 X 5                    | 10 X 10                |
| 6                 | 6 X 6                    | 12 X 12                |
| 8                 | 8 X 8                    | 14 X 14                |
| 10                | 10 X 10                  | 16 X 16                |

1. Temperatures of 79 degrees F or higher reduce plant size, which in turn reduces flower number.
2. Growing temperatures below 62 degrees F encourage tuber formation. This results in little or no plant growth or flowering.
  - a. If the plants are exposed to cool temperatures for too long, the effects cannot be reversed and the plants should be discarded.

- b. After the plants have set buds, lower the temperature to 55 to 60 degrees F at night. Cooler temperatures at this stage will increase flower size.
- F. Tuberous begonias are long-day plants and are photoperiodic as soon as the seeds germinate.
1. For proper flowering, the plants must receive at least 14 hours of light per day. Short days will encourage tuber formation instead of flower initiation.
  2. Some flowers will initiate under short days, but these will be few in number and of poor quality and will initiate axillarily. The growing points of the plant will remain vegetative.
  3. Lighting schedules and intensities similar to those used to keep chrysanthemums vegetative will work satisfactorily for inducing flowering in tuberous begonias. The plants may be lit from 2200 to 0200 with an intensity of at least 10 footcandles. Extending the day period works as well as a night interruption.
- G. Under winter and spring conditions, maintain light levels at 1000 footcandles for 18 to 20 hours. Under the warm conditions of summer, shade the greenhouse to 2,500 footcandles to help control temperature. If the light levels are too low, plants will be poorly formed and have few flowers.
- H. Water tuberous begonias thoroughly after allowing the soil to dry between waterings. Too much water will result in lush, tall plants that are difficult to ship, have a short shelf life and perform poorly for the consumer.
- I. Because tuberous begonias are light to moderate feeders, maintain a low nutrition program. High levels of fertilizer will result in lush growth. High levels of nitrogen will result in plants with many leaves but few flowers.
1. Apply a well balanced fertilizer, such as 15-15-15, at the rate of 100 ppm N as a constant liquid feed, or 350 ppm N once a week. Monitor soluble salt levels regularly to prevent high salts damage.
  2. Reduce fertilizer applications near the finish of the crop to prevent the plants from developing an excessive number of leaves.
  3. Apply fertilizer carefully—fertilizer spots on the leaves will detract from the overall appearance of the plants.
- J. Tuberous begonias show different responses to SADH (B-Nine) and chloromequat (Cycocel).
1. If height control is necessary, chloromequat can be applied as a foliar spray about 30 days after transplanting at the rate of 500 to 1,000 ppm. Foliar discoloration does occur at the higher rates, but the plant will normally out-grow the condition.
  2. SADH is ineffective for height control, but when applied as a foliar spray at 2,500 to 3,000 ppm, it accelerates plant growth and reduces time to flower.
  3. If the plants are grown using good cultural practices, growth regulators are generally not needed.
- K. Achieve well rounded, full plants through pinching.
1. Pinch only plants in baskets, not pots. Pinch 2 to 3 weeks after transplanting, leaving at least four or five leaves per plant.
  2. Pinching will delay flowering about 2 weeks.
- L. Time to flower varies with the size of container.
1. Four- to 5-inch pots should be ready for sale in about 20 weeks from seed; 6-inch pots take about 1 or 2 weeks longer. Plants may be ready for sale as early as 18 weeks or as late as 25, depending on the cultural procedures used.
  2. Baskets usually are ready for sale in about 26 weeks when plants are grown from seed.
  3. When using prestarted plugs, 4-inch pots may flower in as few as 7 to 9 weeks; 6-inch pots in 8 to 10 weeks, and baskets in 9 to 11 weeks.

## VI. Plant problems

- A. Several insects can infest tuberous begonias.
1. Thrips can be a major problem because their small size allows them to go undetected until a large population develops. Look for thrips in the growing points and flowers. Plant symptoms include distorted, twisted growth and streaks on the flowers.
  2. Another major pest is the cyclamen mite. Like the thrips, cyclamen mites can go undetected for an extended period because of their small size. Cyclamen mites are also found in the growing points and cause distorted growth.
  3. Whiteflies are occasionally found on tuberous begonias. These small flying insects can be found on the undersides of the leaves, where they reproduce and feed on plant juices.
  4. Mealybugs, which form white, cottony masses in the leaf axils, have been known to infest tuberous begonias.
  5. Aphids are found on tuberous begonias. These small sucking insects feed at the growing tips of the plants.

- B. A few disease problems may appear on tuberous begonias.
1. The major disease problem is powdery mildew. Powdery mildew is characterized by a white fungal growth on the surface of the leaves. Reduce the incidence of powdery mildew by increasing the air circulation around the plants.
  2. A second major disease problem is botrytis. Botrytis is a grayish mold on the upper surface of the leaves or soil. Botrytis is especially prevalent under cool, humid conditions, or when dead plant matter, such as old flowers, is allowed to remain on the leaves.
  3. At seedling emergence, tuberous begonias may experience damping-off due to pythium or rhizoctonia. Seedlings quickly emerge but wither and die at the soil line. Reduce the incidence of damping-off by using sterile material for seed germination and growth.
- C. Insect and disease problems can be controlled with cultural and chemical controls.
1. Cultural controls
    - a. The easiest way to control insect and disease problems is to prevent them from occurring. Use proper cultural procedures—temperature, watering and humidity—to help keep problems to a minimum.
    - b. Use sterile soil and keep weeds to a minimum under benches and around greenhouses to eliminate host areas for disease and insect problems.
  2. Chemical controls
    - a. Many excellent chemical controls are available for use against insect and disease problems. Use these chemicals with caution—if used improperly, they can be dangerous. New chemicals are constantly being introduced. Consult with your county Cooperative Extension Service agent to determine which chemicals are currently recommended.
    - b. When using a chemical for the first time on any crop, it is important to test a small part of the crop first to determine if the chemical will have any phytotoxic effects on the plants.
- D. Several physiological problems may detract from plant quality.
1. Apparently healthy seedlings die soon after germination. If high humidity conditions end before the first true leaf is at least  $\frac{1}{4}$  inch wide, the plants will die. Maintain high humidity until seedlings are of the appropriate size.

2. No plant growth occurs in the seed flat. Tuberous begonias are shallow-rooted and remain in the seed flat much longer than other seedlings. Nutrients, especially nitrates, will leach away quickly, causing the plants to starve and stall in growth. Closely monitor nutrition levels in the seed flats and fertilize as required.
3. No plant growth occurs after transplanting. If proper environmental conditions are not maintained after transplanting, tuberous begonias will begin the production of tubers. Once this starts, plants usually cannot be brought back and should be discarded. Tuberous begonias must have long days (photoperiods longer than 14 hours) and temperatures above 62 degrees F to prevent tuber formation. Monitor thermostats and light systems to be sure that the desired conditions are supplied.

## VII. Postharvest considerations

- A. Tuberous begonias are normally sold when in flower.
- B. Properly identify the plants for the consumer with some type of label.
- C. Water the plants well before shipping to prevent drying in transit.
- D. Handle the plants with care to prevent damage.
- E. An application of 50 ppm silver thiosulfate (STS) applied before shipping will greatly extend shelf life.
1. To prepare an STS solution: dissolve 0.42 grams of silver nitrate ( $\text{AgNO}_3$ ) in  $\frac{1}{2}$  liter of water. In a separate container, dissolve 2.48 grams of sodium thiosulphate ( $\text{Na}_2\text{S}_2\text{O}_5 \cdot 5\text{H}_2\text{O}$ ) in  $\frac{1}{2}$  liter of water. Add the silver nitrate solution to the sodium thiosulphate solution while stirring the mixture. Add an additional 9 liters of water for a total volume of 10 liters of spray solution. Use as soon as possible.
  2. Research has shown that geraniums infected with pythium will die if treated with STS. It is not known if the same effect occurs with tuberous begonias. Be sure plants are disease free before treating with STS.
- F. Inform the retailer of proper plant care.
1. The plants should be unboxed immediately upon receipt. Extended boxing causes bud drop.
  2. Plants should be given adequate space in a shady location.
  3. The retailer should check for the need for water several times a day.

4. Frost and cool temperatures are very common during the marketing period for tuberous begonias. If possible, the plants should be marketed from a greenhouse-type structure. If the plants must be stored outdoors, the retailer should monitor night temperatures carefully and, if necessary, take action to prevent freeze damage.

Many other Extension publications are available on commercial flower production. Call, write or visit the Cooperative Extension Service Office in your county for more information. Following is a list of related publications available there or by writing to the MSU Bulletin Office, P.O. Box 6640, East Lansing, MI 48826-6640.

- E-1275, *Chemical Controls for Michigan Commercial Greenhouse/Bedding Plant Production* (55¢, for sale only)
- E-1276, *Insect Controls for Michigan Commercial Greenhouse/Bedding Plant Production* (55¢, for sale only)
- E-1375, *Producing Petunias for Profit* (free)
- E-1400, *Identifying Major Pests of Greenhouse Bedding Plants* (45¢)
- E-1443, *Producing Marigolds for Profit* (free)
- E-1493, *Geranium Rust—Symptoms/Disease Development/Control* (free)
- E-1579, *Growing Fibrous Begonias for Profit* (free)
- E-1580, *Producing Impatiens for Profit* (60¢, for sale only)
- E-1663, *Producing Salvia for Profit* (60¢, for sale only)
- E-1664, *Producing Coleus for Profit* (free)
- E-1861, *Producing Potted Marguerite Daisies for Profit* (free)
- E-1996, *Producing Seed Geraniums for Profit* (40¢, for sale only)



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