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Poinsettia Production

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I. Introduction

A. The scientific name of the poinsettia is *Euphorbia pulcherrima Willd.*

B. The Poinsettia is native to southern Mexico and northern Guatemala where it flowers naturally in midwinter.

C. Poinsettias were introduced to the United States in 1895 by Joel Robert Poinsett, the first U.S. ambassador to Mexico.

D. Poinsettias are the number one potted flowering crop grown in the U.S. In 1986, U.S. production was 36.3 million pots with a wholesale value of $123 million. Over 2.3 million pots were produced in Michigan with a wholesale value of more than $7.7 million. The average wholesale price in Michigan in 1986 was $3.39 per plant.

E. The growth in popularity of the poinsettia over the last 25 years is largely a result of three factors. They are the development of free branching cultivars, the development of cultivars which retain their leaves and bracts, and the development of growth retardants for height control.

F. The poinsettia is grown for its showy colored bracts which are modified leaves. The actual flowers (cyathia) are small yellow bud-shaped structures located at the center of the bracts.

II. Cultivars

A. Most poinsettia cultivars grown today are sports belonging to one of four series.

1. Annette Hegg Series (8- to 9-week cultivars). Representative cultivars include: "Annette Hegg" Dark Red, Brilliant Diamond, Lady, Diva, Topwhite, Pink, Marble.
2. Gutbier Series (8- to 9-week cultivars). Representative cultivars include: "Gutbier" V-14 Glory, V-10 Amy, V-14 White, V- 10 White, V-14 Pink, V-10 Pink, V-10 Marble.
3. Mikkelsen Series (9-week cultivars). Representative cultivars include: "Mikkel" Triumph, Super Rochford, Rochford, White, Pink Rochford, Fantastic, Dawn Rochford.
4. Eckespoint Series (10-week cultivars). Representative cultivars include: "Eckespoint" C-1 Red, C-1 White, C-1 Pink, Jingle Bells.

B. The Annette Hegg, Mikkelsen and Gutbier cultivars are generally free-branching and will produce good multiflowered pinched plants.

C. The Eckespoint cultivars are best suited for single stem unpinched plants.

III. Flower Induction and Development Requirements

A. Flower development sequence

1. A vegetatively growing poinsettia shoot will contain approximately seven or eight microscopic leaves.
2. The smallest three leaves form a whorl of three bracts (the internodes do not elongate) below the primary flower (cyathium) once flower initiation has occurred. The petiole length of these and subsequent bracts is affected by temperature.
3. The primary cyathium initiates after four to eight short photoperiods and this cyathium is visible under a microscope in about 15 days.
4. A single internode stem originates from the axil of each of the primary bracts. Each stem terminates with a secondary cyathium subtended by two secondary bracts. The length of this internode is also affected by temperature.
5. One to five of the original microscopic leaves below the primary bracts will color to become transitional bracts. The number of transitional bracts is reduced by high night temperatures.
6. A minimum of 5 weeks of short days are needed to ensure normal complete flower development.

B. The Poinsettia is a short day (SD) plant.

1. This means it requires a continuous long, dark period each night to form flowers.

2. The length of the dark period for floral initiation cannot be given without some qualifications because both temperature and cultivar influence photoperiod perception. Under normal temperature conditions in the northern United States, the critical photoperiod for initiation is generally considered 12¼ hours.
3. Night temperature is critical for normal flower initiation and development. Night temperatures above 73°F can delay or prevent flower initiation.
4. In addition to the temperature-influenced dark period required for initiation, there is a longer temperature-sensitive dark period required for flower development. Both requirements are normally met by the naturally decreasing daylengths in the fall.
5. Floral initiation under natural photoperiods in Michigan occurs from September 20 to October 1. The date varies somewhat with weather conditions. Clear skies will cause later initiation. Early morning or late evening cloud cover encourages earlier intiation.
6. Floral initiation can be prevented with night interruption lighting under natural short day conditions.
   a. To prevent flowering, use a combination of light intensity and duration corresponding to a minimum of two foot candles for 4 hours.
   b. Flowering may be unintentionally delayed or prevented by light pollution below 2 foot candles.

C. Poinsettia flower development is influenced by cultivar, temperature, and propogation date.

1. Poinsettia cultivars are classified into 8- to 11-week response groups (plants will flower 8 to 11 weeks after the start of short days).
2. Both day temperature and night temperature affect the rate of flower development when night temperatures are below 70°F. Slower flower development will occur as average daily temperature is reduced by either lowering the day temperature and/or the night temperature. **Note the differences between Figures 1 and 2.**
3. Poinsettias from early propagation dates normally flower faster than plants from later propagation dates.

Fig. 1.

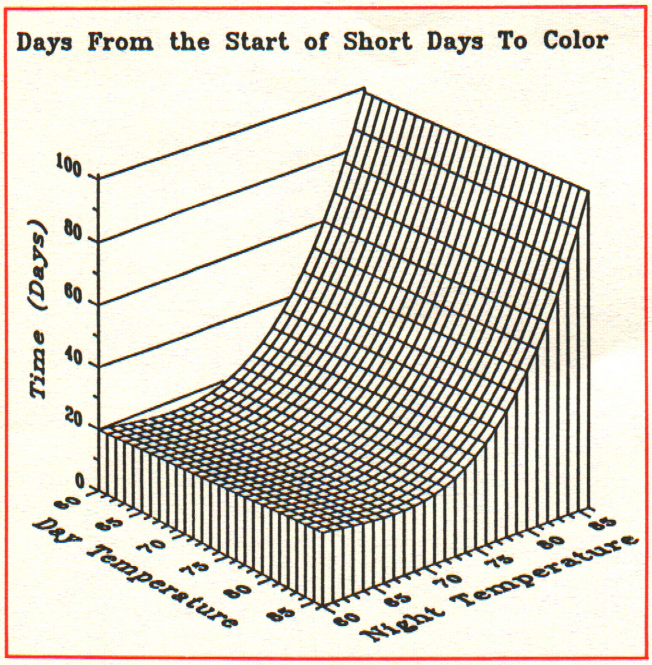
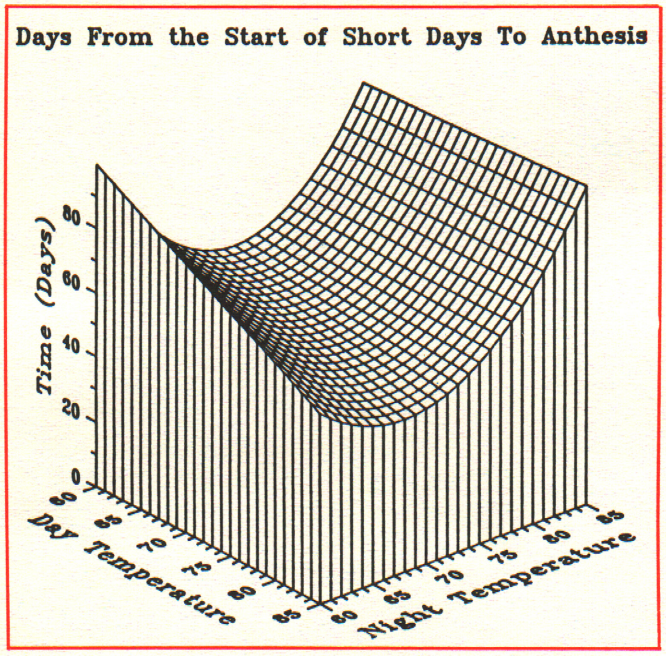


Fig. 2.



IV. Environmental Requirements

A. Light

1. Quantity: Poinsettias require high light levels for best growth. No greenhouse shading is necessary unless temperatures cannot be controlled.
2. Quality: Stem elongation in poinsettias is very sensitive to light quality (red to far-red light ratio). Light filtering by the

leaves alters light quality resulting in taller plants. This occurs as the plant canopy becomes denser. Dense canopies are common with tight plant spacings, particularly late in the crop.

3. Duration: Plants flowered under artificial short days (i.e., 9 hours light) will be shorter than plants flowered under natural daylengths.

B. Temperature

1. Poinsettia growth and development is affected by temperature in a variety of ways.
   a. Average daily (24 hours) temperature influences the general rate of development and tissue differentiation. Low temperatures during bract expansion can result in reduced bract size and poor flower development.
   b. Day temperatures (DT) above 75°F reduce flower quality by increasing bract petiole length, reducing color and reducing cyathia number.
   c. Night temperatures (NT) above 70°F delay flower initiation and when above 75°F, delay flower development. Compare Figures 1 and 2.
   d. The difference between day and night temperatures affects stem and petiole elongation. Higher NT than DT inhibits elongation while higher DT than NT promotes elongation.
2. Vegetative poinsettias can tolerate high temperatures (i.e., 90°F) during the day under high light conditions.
3. Night temperature should be reduced to 62° to 65°F during floral initition.
4. After initiation, temperature is used to control crop development rate. Night temperatures should be maintained at or below 70°F.
5. Reducing temperatures to 55° to 60°F during finishing in the final 1 to 3 weeks of crop production will enhance bract color.
6. Poinsettias are very susceptible to root rot at very low temperatures (50° to 55°F).

C. Nutrition

1. Poinsettias have a high nitrogen requirement, particularly in the early stages of development of rooted cuttings. These plants will benefit from constant liquid feed (CLF) rates of 350 to 400 ppm nitrogen. Leaf color is most rapidly improved with some nitrogen in the ammonium form. Ammonium nitrogen should not exceed 30 percent of total nitrogen at any time.
2. When light levels and temperatures begin to decline, typically near the end of September in Michigan, nitrogen fertilizer should be supplied as NO_3 to avoid ammonium toxicity. CLF rates of 250 to 300 ppm nitrogen should be sufficient for established plants. Ammonium toxicity has also been observed in June under cool weather conditions with no night heating.
3. Potassium (200-250 ppm), phosphorus (20-50 ppm), and molybdenum (0.05-0.1 ppm), should be included in a poinsettia CLF program.
4. A CLF program to supply 263-30-135 ppm N-P-K plus 0.1 ppm Mo is shown below.

Quantity per 1,000 gal H_2O	Fertilizer Carrier
3 lb	Ammonium Nitrate
5 lb	Calcium Nitrate
3 lb	Potassium Nitrate
10 fl oz	75% food grade Phosphoric Acid
1.5 fl oz	Molybdenum stock solution*

*Dissolve 1 lb sodium or ammonium molybdate in 5 gal of water.

5. Osmocote controlled release fertilizer (i.e., Sierra Poinsettia Mix 12-12-15 plus minors or other formulations) can be used either incorporated in the media or as a top dress. Follow the manufacturer's rates. Poinsettias respond best to early top dressed applications. Late applications should be avoided as they have been associated with bract necrosis and shortened postharvest life.
6. Magnesium deficiency is common in poinsettias grown in soilless media. Apply magnesium sulfate (Epsom salts) at 2 lb/100gal water when a soil test shows media contains low levels of manganese.
7. Add trace element mix once. Either incorporate a fritted mix into the media or apply a soluble mix after the cuttings are established in their final containers.

Boron toxicity, expressed as a marginal necrosis of older leaves, may develop where trace elements are added too frequently or where there is in excess of 0.5 to 1 ppm of Boron in the water or fertilizer. Boron toxicity is more likely to develop where calcium supplies are low.

8. Molybdenum deficiency is common in poinsettias grown in soilless media when it is not included in a CLF program. A single dose application to correct a deficiency should supply 1 ppm molybdenum.
9. Calcium deficiency has been linked to bract necrosis in the cultivar V-14. The bract necrosis is the result of a physiological inability of the plant to absorb adequate calcium regardless of the media calcium level. Bract necrosis develops under conditions of high humidity and cool soil temperatures. Calcium chloride sprays two times per week at 400 ppm have proven effective in reducing the problem. Begin sprays at first sign of bract color.
10. Calcium has also been implicated as a factor in stem strength. Plants with low calcium are likely to have weaker stems.

D. Water

1. Poinsettias require large amounts of water and should not be allowed to totally wilt between waterings. Excessive wilting can result in leaf drop.
2. Plants should be watered in the early morning during very hot weather. Cold water applied on a hot afternoon can cool the roots, restrict water uptake and cause severe wilting and foliar necrosis.
3. Avoid overwatering on newly planted cuttings since root loss can occur.

V. Cultivation

A. Propagation

1. Poinsettias are vegetatively propagated by cuttings.
2. Cuttings can be purchased rooted or unrooted from a propagator or produced from stock plants.
3. Stock plant production
   a. There are nearly as many methods of poinsettia production from stock plants are there are poinsettia growers. There are however, a number of standard procedures for all cutting production schedules.
      1. Cuttings for stock plants should arrive from March to June. Cuttings which arrive before May 15 must be placed under night interruption lighting to prevent flower initiation.
      2. Reserve adequate greenhouse space during the spring so plants are not crowded. Excessive crowding will reduce cutting production.
      3. Use monthly fungicide drenches.
      4. Maintain high nutrition.
      5. Stock plants may be treated with Cycocel (1,500 ppm) to reduce elongation before cuttings are taken.
      6. Take 2½- to 3-inch ("four fingers") long cuttings with relatively short internodes from stock plants.
      7. Cuttings may be taken about 4 weeks after pinching. Take this into consideration when scheduling stock plant cutting production.
   b. Some specific stock plant programs are briefly discussed below.
      1. Large stock plants (traditional method)
         a. Plant rooted cuttings in large pots (8 to 12 inches) or in plastic bags filled with media.
         b. Cuttings are normally received in late March or April.
         c. Leave between 7 and 11 nodes on the first pinch. With stock plants started early enough the first pinch can be retained as a cutting.
         d. Leave a minimum of 2 nodes on subsequent pinches.
         e. Stock plants may be discarded or flowered out as large specimen plants.
      2. Small Stock plants
         a. Plant rooted cutting in 6-inch pots in May.
         b. Leave 7 to 11 nodes on the first pinch of a stock plant. Early stock can be grown single stem until a terminal cutting can be taken.
         c. Stock plants may be flowered out as 6-inch pinched plants.
      3. Tree Production
         a. Plant rooted cuttings in 6- to 12-inch pots in late March or early April.

b. Grow plants single stem until 15 to 18 nodes have developed; then pinch.
c. Take cuttings from lower nodes as they develop. Retain at least two nodes on the upper shoots so lateral buds grow on and flower out as poinsettia trees.

4. Distribution of cutting production
   a. The average percentage of poinsettia cuttings taken per week by Michigan poinsettia propagators is shown below. Propagation percentages for individual growers may deviate greatly from the data in this table. Numbers are based on a survey of Michigan poinsettia producers.

Week of Year	Percent of Cuttings Taken
July 7	2
July 14	3
July 21	25
July 28	17
Aug. 4	19
Aug. 11	15
Aug. 18	11
Aug. 25	7
Sept. 1	2

5. Root cuttings
   a. Use a sterile, well-drained and aerated medium. Peat pellets and Oasis cubes are well suited for this purpose.
   b. Maintain sanitary conditions at all times to prevent cuttings from contacting disease pathogens.
   c. Do not allow cuttings to dry out. Maintain under mist; initially, 5 seconds every 5 minutes should be adequate during the day. As cuttings root (12 to 14 days) or under low light conditions, reduce misting frequency. Misting is normally controlled with time clocks. The use of time clocks set for sunny, mid-day conditions can result in over-misting, which can delay rooting and promote the growth of fungal pathogens. Computer-based misting control systems are now available which vary misting frequency based on drying rate.
   d. A rooting hormone is not required for rooting, but using one will speed rooting and increase uniformity. Apply hormone as a quick dip of cutting stem in a 2,500 ppm IBA solution made with 50 percent ethanol or isopropyl alcohol, and 50 percent water; alternatively dust the stem bases with a talc formulation. Do not store the IBA solution for more than two days. If using the quick dip method exercise caution to avoid spreading disease organisms.
   e. Give cuttings as much space in the propagation area as possible. Do not allow leaves from one cutting to cover the shoot tip of an adjacent cutting as this shading delays rooting. Remove dead and dying leaves to minimize *Botrytis*.
   f. Bottom heat will speed rooting. Medium temperature should be maintained at 70° to 75°F.
   g. Maintain fertilization program during the rooting stage. Misting tends to remove nutrients from the cutting and the rooting medium. Low levels of nitrogen and potassium (25 to 50 ppm) can be injected into the mist water on a constant basis. Two ounces of KNO_3 and 3 oz of $Ca(NO_3)_2$ per 100 gal provides approximately 55 ppm nitrogen and potassium. An alternative is to fertilize with 150 to 200 ppm nitrogen from a complete water soluble fertilizer (e.g., 20-10-20) 7 to 10 days after sticking or once roots have started to develop. Fertilize weekly or as needed until cuttings are planted.
   h. Cuttings can also be direct-rooted in the finishing pot. Direct sticking reduces transplanting labor and reduces crop time about 1 week. However, more propagation area is required.
   i. For 6-inch pots, direct stick cuttings no later than Aug. 10 and pinch no later than Sept. 11. for 4-inch pots, stick no later than Aug. 25.

B. Planting

1. A root medium with high porosity and water holding capacity is desired for potted poinsettia production.
2. The medium pH should be 6.0 to 6.2. At low pH, molybedum availability is reduced, while at a high pH, magnesium, calcium, and the micronutrients iron, copper, and manganese will become less available to the plant.
3. Light reduces root development. If white pots are used perimeter root development will be restricted. For best root development use a pot that allows minimal light transmission to the root zone.
4. A fungicide drench at planting is recommended to reduce root rot. Include chemical control for both *Rhizoctonia* and *Pythium*.

C. Pinching

1. Apical dominance in the poinsettia is influenced by both the apical meristem and the young expanding leaves.
2. If a soft pinch is used, the young expanding leaves left on the plant will inhibit lateral shoot development. Lateral breaks will develop more slowly and shoots developing in the axils of the young leaves will become dominant and inhibit lower lateral shoot development.
3. A hard pinch (to the first fully expanded leaf) will result in more uniform breaking and shoot development.
4. Intermediate pinching will produce intermediate effects.
5. A very hard pinch into old tissue can result in slow, nonuniform lateral shoot growth.
6. A soft apical pinch with removal of the young expanding leaves can be used to increase the number of shoots developing on a plant. All leaves to the first fully expanded leaf should be removed after the pinch. Uniform breaking and shoot development similar to development from a hard pinch will result. Flowering may be slightly delayed.
7. Pinching must be done early enough to allow sufficient growing time to produce the length of stem required for the pot size. The number of leaves left on the plant will approximate the number of shoots that will develop. In Michigan, the latest recommended pinch date for a 6-inch pot poinsettia is September 11 when using natural photoperiods for flower initiation.

D. Guidelines for cutting, propagation, planting, and pinching dates in Michigan

1. Listed below are the normal and latest suggested dates for propagating, planting, and pinching in the production of high quality poinsettias in Michigan. Highest quality will normally be obtained when the indicated procedure is carried out within a few days of the normal date. Dates are based on a survey of Michigan poinsettia growers.

Pot Size (inches)	Normal Propagation Date	Planting Date		Pinching Date	
		Normal	Latest	Normal	Latest
4	Aug. 18	Sept. 3	Sept. 11	Sept. 16	Sept. 21
5½	Aug. 4	Sept. 1	Sept. 8	Sept. 10	Sept. 14
6	July 30	Aug. 24	Sept. 3	Sept. 7	Sept. 11

The propagation dates of growers direct sticking cuttings averaged about 1 week later than those shown above.

E. Growth Regulators

1. Cycocel, B-Nine, A-Rest, and Bonzi are labeled for height control in the poinsettia.
2. Cycocel is the most frequently used. It is labeled for use as a drench, but is often applied as a spray.
   a. Cycocel is typically applied at 750 to 2,000 ppm. The most commonly applied rate is 1,500 ppm. The most common spray application rate is 2 to 4 quarts per 100 ft, or to foliage run-off.
   b. Apply Cycocel about 2 weeks after pinching when shoots are 1½ to 2 inches in length. Cycocel sprays may cause a blotchy marginal yellowing of leaves. A half application and the balance 4 to 7 days later helps prevent this chlorosis.
3. B-Nine is not recommended for use in Michigan due to potential reduction in bract size.
4. Researchers have found that B-Nine and Cycocel (750 to 1,500 ppm each chemical) applied as a tank mix spray can be very effective in controlling height. Reduction in bract size and delayed development as a result of tank mix applications can be a major concern (Figure 5). Do not apply the tank mix later than September 25 in poly greenhouses, October 1 in glass greenhouses. Growers using a tank mix for the first time should use the 750 ppm rate and experiment on a limited number of plants.

5. A-Rest is effective as a drench (0.5 mg/6-inch pot). Apply A-Rest 3 weeks after the pinch when breaks are 4 to 6 inches long or 8 to 12 weeks before the crop finishes.
6. Bonzi is a new product labeled for use on poinsettias in 1986.
   a. Bonzi effectively controls plant height. Very small doses are required and there is a corresponding small margin of error between enough and too much. It is recommended that growers experiment to determine the proper rates for their conditions.
   b. Drench applications are the most effective for uniform height control. Rates of application are between 0.125 and 0.25 mg per 6-inch pot.
   c. Rates for spray applications should be 10 to 30 ppm. Spray volume should be 2 quarts per 100 square feet. Repeat applications with a low concentration gives greater precision in height control with less chance of damage with this highly active growth regulator. Nonuniform sprays result in nonuniform plant response.
7. Growth retardants are most effective when applied before first color. Potential for growth is less after color and potential for reduction in bract size is greater.

VI. Problems

A. Diseases

1. Root rot.
   a. *Rhizoctonia solani* causes stem and root rot. Symptoms include brown rot of the stem at the soil line and roots with brown lesions.
   b. *Pythium ultimum*, a water-mold, causes root rot. Symptoms include rotting of root tips and cortex. It may advance up the stem causing lower leaves to yellow and rot. Pythium is the most common root rot pathogen attacking poinsettia plants under commercial conditions.
   c. *Thielaviopsis basicola* causes a black root rot. Roots develop black rooted areas. Plants show lack of vigor, leaf yellowing, leaf drop, and sometimes sudden collapse, particularly after temperatures have dropped below 60°F.
   d. Control root rot with a drench at planting and at 1- to 2-month intervals. (See Extension bulletin E-2017, *Chemical Disease Controls for Michigan Greenhouse Industry*, for chemical control measures.)
2. *Botrytis cinerea* or grey mold on leaves and bracts is often a problem, especially during propagation and late in plant development. Symptoms include rotting of tissue, frequently starting on the leaf and bract edges. Control can be obtained by maintaining adequate air circulation and lowering humidity. Remove dead plant tissue from plants regularly during propagation.
3. *Erwinia carotovora* causes a stem rot characterized by the complete collapse of the stem. Erwinia is a problem normally only during propagation, particularly under poor sanitary conditions. Erwinia is a bacterial pathogen that can spread rapidly and is difficult to control. The best prevention is good sanitation. There are no effective chemical controls.

B. Insects

1. The most common insect pest is white fly. Other major pests include spider mites, tortrix (leaf rolers), and fungus gnats.
2. Control these insects with standard chemicals. (See Extension bulletin E-2014 and E-2014S, *Insect and Mite Management in Commercial Greenhouses* for chemical control measures.)

C. Physiological

1. Center drop is a condition where the flower buds abscise prematurely. It is caused by a carbohydrate depletion in the plants. The occurrence of center drop can be decreased by early flower initiation in late September, proper night temperature control in October and early November, followed by lower night temperatures in late November and December. Spacing plants to maximize light penetration as plants are marketed is another good preventive measure.
2. Leaf drop is a disorder associated with moderate to severe plant stress. Causes can include water stress, low light, cold temperatures, overwatering, fertilizer injury to the roots, etc. Once the abscission process is started it cannot be reversed. This is not as great a problem with newer cultivars.

3. Latex eruption or crud is caused by bursting of cells as a result of high turgor pressure. Latex spills over the tissue and upon drying creates a growth restricting layer. It occurs mainly under conditions of low temperature, high humidity, and high soil moisture. It is controlled by avoiding these factors.
4. Stem splitting or split bracts is a disorder where floral initiation occurs under conditions that are not conducive to subsequent floral development. A flower initiates but fails to develop causing the apex to cease growth. Three shoots then develop in a whorl below the aborted terminal bud. Splitting will occur if inductive photoperiods are followed by long days or if plants are exposed to low night temperatures. It can also occur in older stems with 20 to 30 leaves under continuous LDs.
5. Bract burn or necrosis has been linked to a number of cultural and environmental factors. High rates of fertilization late in crop development, particularly with slow release fertilizers, will cause bract necrosis. A physiological calcium deficiency observed under high humidity and cool media temperatures can also cause bract necrosis. *Botrytis* infection will often follow in damaged bracts.
6. Leaf crippling, distortion, or puckering is thought to be caused by environmental factors that promote gutation. Gutation in younger tissues may result in concentration of salts at the tips of the veins killing the young cells. Subsequent enlargement thus cannot occur in these regions and hence the leaf puckers as the blade expands.
7. Rabbit tracks is a disorder characterized by the breakdown of the bract tissue located on either side of the midrib of the bract. It occurs late in the development of the flower. The appearance of this condition is associated with high nutritional levels late in plant development along with warm night temperatures (greater than 65°F).

VII. Harvest, Handling, Marketing

A. Production conditions to maximize postharvest longevity

1. Cool finishing temperatures increase bract and leaf retention.
2. Reduced fertilization during finishing (stop fertilization 1 to 2 weeks before shipping) increases leaf retention.

B. Handling

1. Store plants for a minimum time and in the light. Plants stored in the dark have increased leaf drop and cyathia abscission.
2. Sleeve just before shipping to minimize damage in transit. Sleeves should be removed as soon as possible to limit epinasty (droopy leaves).
3. Store plants at temperatures in the 50° to 60°F range for best longevity. Do not expose plants to temperatures less than 50°F.

C. Display conditions

1. "High" light intensity (75 to 225 fc) and long photoperiods reduce leaf loss. Less leaf loss occurs under incandescent light than cool white fluorescent.
2. Cooler temperatures (about 60°F) increase longevity.

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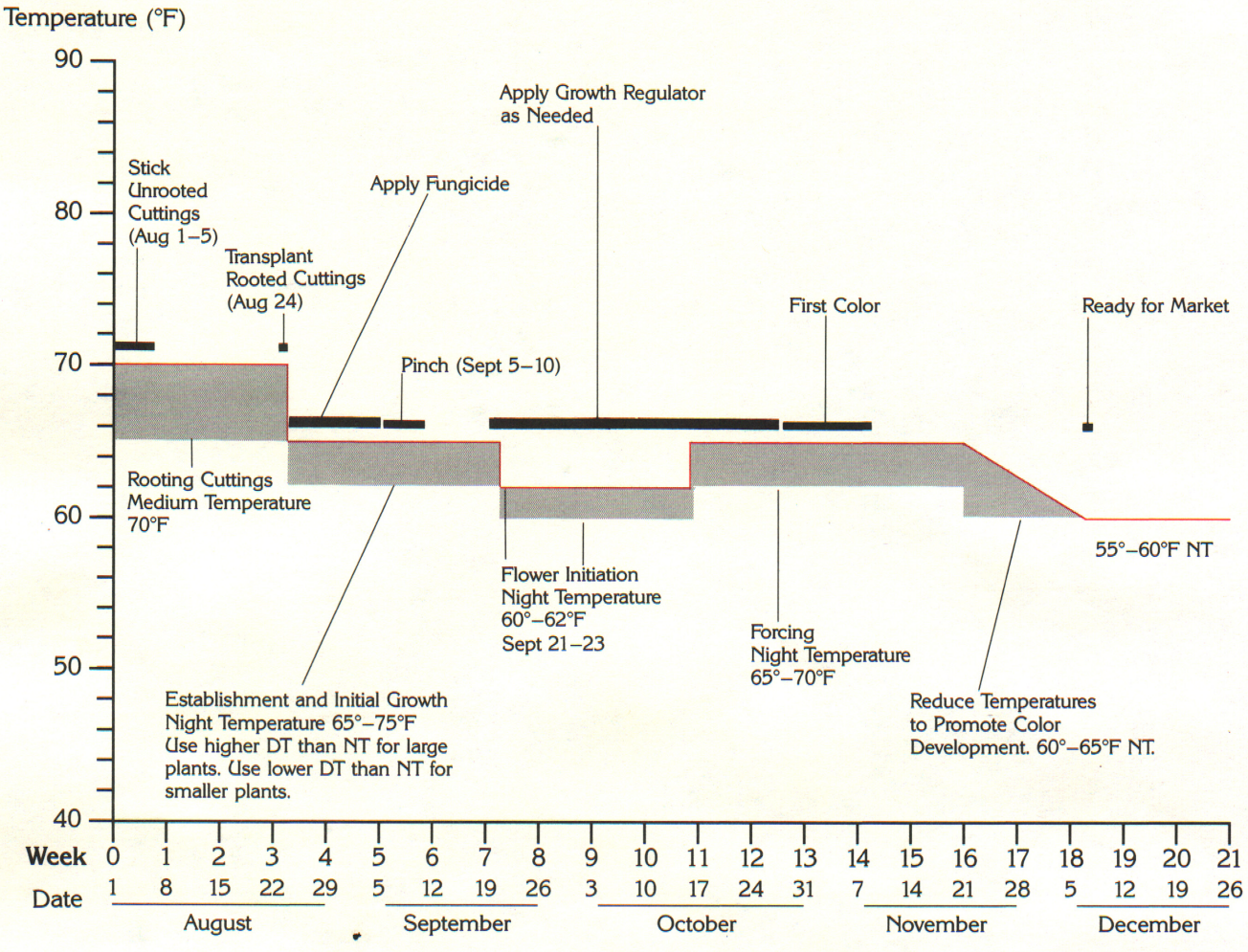
Schedule

5½-6" Pinched Natural Daylength Poinsettia Production



Stage of Development

Action to Take

Temperature