AVOIDING POINSETTIA PRODUCTION PROBLEMS

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Poinsettia production is never easy, and any steps that can be taken to avoid problems before they occur are well worth the effort. Perhaps you had fewer problems in 1992 than other growers in North Carolina growers. In that case, many of the observations shared below will not apply. However, most of the basics apply no matter where you are located or how many problems you encountered last year, and reviewing a few key points may help you in the 1993 poinsettia season.

Controlling the Environment

The major benefit of growing plants in a greenhouse is the degree of control we have over the environment. But greenhouse controls are just like computers—garbage in gives garbage out. Many poinsettia crops in 1992 were below average in height and quality, and the problems could have been avoided if more attention had been given to details such as temperature, light, and scheduling.

Temperature During Propagation and Vegetative Growth: Substrate temperature cannot be over emphasized during poinsettia rooting. Keep the substrate at a 75 °F minimum throughout propagation. Some growers were "caught" by trying to direct stick cuttings while growing on an unheated floor. This gamble may pay off if autumn temperatures are warm enough, but cheating on heat during propagation will reduce the quality of the crop during a cool fall.

Once plants are well rooted, maintain a 65 °F minimum night temperature to keep plants actively growing. It is easier to slow down the growth of a vigorous plant than to push a weak, poorly rooted poinsettia. Keep in mind that the growth rate of poinsettias is regulated largely by average daily temperature (average of day temperature + night temperature). Any change in average daily temperature will affect growth rate (Table 1).

Table 1. Estimated number of days required for a 'Annette Hegg Dark Red' poinsettia to develop a three leaf shoot at various average daily temperatures.*

	Average daily temperature (°F)				
	60	63	65	68	71
Number of days	20	18	17	15	14

*Adapted from: Berghage, R., R.D. Heins and J.E. Erwin. 1989. Quantifying leaf unfolding in the poinsettia. Acta. Hort. 272:243–247.

For example, in a "normal" September, the average daily low temperature in Raleigh is approximately 62 °F; the average daily maximum is about 81 °F. Most growers will be venting during September, so daytime temperatures will be governed by the cooling system capacity and ambient weather conditions. Let's assume an average daytime temperature of 76 °F, which should be achievable with fan and pad cooling. Growers that heat to 65 °F at night would have an average daily temperature (average of day + night) of ~71 °F. Growers that do not heat during September may have night temperatures below 65 °F, and the average daily temperature (***and average growth rate***) will be less than in a greenhouse maintaining a 65 °F minimum.

Please do not interpret 71 °F as being "the" required average daily temperature. This example is given merely to illustrate that if you do not heat and maintain a 65 °F minimum, your plants will have a slower growth rate, slower shoot development, and may be shorter at harvest than those of growers maintaining a higher average daily temperature.

Photoperiod and Poinsettias: Test how well you understand photoperiodism in poinsettias: ❶ What is generally considered the critical photoperiod for poinsettias? ❷ When do "short days" start for poinsettias in the fall? ❸ Is the critical photoperiod answer given for question one true for every cultivar? The answers to these questions are: ❶ A 12.25 hour photoperiod (11.75 hour dark period) is usually accepted as the critical photoperiod for poinsettias when the night temperature is 65 °F. ❷ This is a difficult question to answer. September 22 is usually the date of the autumnal equinox, making night and day of equal length in all parts of world (excluding the extension of daylength by "civil twilight," that period of time when the sun is below the horizon but there is still reflected and refracted sunlight illuminating the greenhouse). However, during cloudy weather, the photoperiod (as perceived by poinsettias and other photoperiodic plants) can be shorter than during clear weather. During bright fall days without obstructing clouds, civil twilight can extend the photoperiod, and plants will be under longer days than if the weather was cloudy. Clouds are not the only weather factor that can affect the starting date of short days for poinsettias. If the nights are warmer than 65 °F, poinsettias require a shorter day for floral initiation than at this night temperature. Many cultivars will not initiate inflorescences if night temperatures exceed 72 °F. ❸ No. A good example would be 'Freedom'. Eckes recommends that lighting (to assure long day conditions) begin on September 5 for 'Freedom'; most other cultivars would be lit beginning September 15, a much later date.

Photoperiodism in poinsettias is not a cut and dry topic. However, you can take measures to control floral initiation without becoming a photoperiod expert. Start lighting September 5 to assure long days are being maintained. Supply 10 to 20 footcandles of light (60 Watt bulbs placed 2 to 3 feet above the plant and 4 feet apart is recommended) from 10:00 PM until 2:00 AM. This should guarantee long day conditions regardless of the cultivar or the night temperature, assuming you are supplying a 65 °F minimum night temperature as recommended previously. Pull blackcloth prior to October 6 (up through October 5) to assure short day conditions, if your schedule requires short days prior to this date. The dark period should be at least 13 hours every night. Keep night temperatures below 72 °F during short day treatment to avoid heat delay of floral initiation. Controlling photoperiod and assuring timely floral initiation is the only way to guarantee the validity of a schedule.

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Relative Humidity: Relative humidity is one aspect of the greenhouse environment that we tend to ignore, and many growers could benefit from paying closer attention to humidity control. High relative humidity reduces foliar evapotranspiration in plants. This means that since the leaves are losing less water, the plants take up less water. Less nutrients are transported to the shoot in the transpirational stream and less water is removed from the pot by the roots. High relative humidity has been implicated as a contributing factor in bract necrosis, possibly relating to less calcium being accumulated under very humid conditions, since calcium travels in the transpirational stream. High relative humidity increases the chances for *Botrytis*. High humidity reduces evaporation of water off of leaf surfaces and increases the problem with condensation and dripping; both favor *Botrytis*.

Evening venting can help reduce relative humidity at a very low cost to the grower. As cool air is warmed, the relative humidity (RH) will be decreased because warmer air can "hold" more moisture than cooler air. As an example, assume it is 40 °F outdoors and raining; RH outside is 100% (there are 37 grains of water per pound of air given these conditions). It is 65 °F in the greenhouse and relative humidity inside is 90% (there are 83 grains of water per pound of air). Exhaust fans are turned on and vents are opened to exchange ½ of the volume of air in the greenhouse, and the greenhouse is heated back to 65 °F. The resulting RH is 65% (there are only 60 grains of water per pound of air). How much did the venting and heating of the outside air cost? Our example greenhouse has a volume of 39,348 ft^3 (it is a 86 ft × 36 ft Quonset style greenhouse). Therefore, 19,674 ft^3 of air must be vented, replaced with 40 °F air, and heated to 65 °F. For the temperature range of a greenhouse, it is safe to assume that 1 BTU of energy can raise approximately 52 ft^3 of air 1 °F. The total BTU output required to heat the air in this example is $[19{,}674\ ft^3 \div 52\ ft^3/BTU/°F] \times 25\ °F = 9{,}459$ BTU's of heater output. Assuming a 70% efficient natural gas heating system, the cost to produce 9,458 BTU's of energy is about 6¢. If we vent the greenhouse every evening from 1 September until 15 December, the cost of heating after venting would be $6.36 for this greenhouse. Assuming 80% benching efficiency and 16-inch centers for poinsettia spacing, this greenhouse would hold 1,393 plants. The per plant cost of venting would be less than ½¢ and would only add 4.6¢ to the production cost of each plant if the greenhouses were vented 10 times each night. Obviously, venting only once per evening will not control humidity all night long. However, any reduction in the length of time plants are subjected to high humidity levels will help avoid Botrytis blight, and 10 ventilations per night should be sufficient to effectively reduce RH for at least an eight hour period. How much would it cost to treat this same greenhouse just once with a fungicide for control of *Botrytis*?

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Light Intensity: Why are greenhouses (poinsettias) shaded? Shadecloth and whitewash are used in this instance to moderate temperature in the greenhouse. Acclimated poinsettias can take full sun, and some propagators in the South maintain poinsettia stock plants outdoors under minimal shade. However, full sun can cause pale leaf color during summer and early autumn and can cause "hard growth" resulting in fewer side shoots. The key word with respect to light intensity is *acclimated.* Any sudden increase in the light plants receive can cause the problems mentioned above. For example, cuttings may be rooted and newly potted plants maintained under as much as 60% shadecloth. A common recommendation is to remove shadecloth in the Southeast about the first of October. If plants go from a 60% shaded situation directly to full sun, leaves and growing points can be damaged. A gradual increase in light such as reducing shading from 50-60% down to 20% for about 3 to 5 days prior to full sun would be ideal, but is not always possible. If you cannot reduce shading in steps, at least wait until a cloudy period to remove shadecloth so that the transition can be buffered with a few days of cloudy weather prior to full sun. Waiting for a few days of cloudy weather is more important than removing shadecloth exactly on October 1. Use shadecloth mainly as a temperature controller and not just a light reducer. Supply and acclimate plants to as much light as possible during poinsettia production for best plant growth.

Avoiding Nutritional Disorders

The following text outlines the major nutritional disorders seen during 1992. Do not view it as a fertilization program, but rather a list of cautions to consider as you are designing your poinsettia fertilization program.

Calcium Deficiency and Ca : Mg Ratios: Why is calcium such a problem today as compared to 10 or even 5 years ago? Many of the newer cultivars are "less forgiving" than older ones such as 'Annette Hegg' selections. Soilless substrates have increased in popularity and the buffering and "holding capacity" of mineral soils is now absent in the greenhouse. Fertilizers and fertilization programs may have been changed without examining calcium nutrition. We sometimes unknowingly cause a problem because we fail to realize the whole story.

As an example, a grower historically fertilized poinsettias with 250 ppm nitrogen supplied with 20-10-20 amended with 4 oz of magnesium sulfate per 100 gallons alternated with calcium nitrate plus potassium nitrate. This program supplied sufficient N, P, K, Ca, and Mg for poinsettias. Two years ago, this grower switched to a 250 ppm N program supplied with a 15-5-25 poinsettia special. The 15-5-25 was still amended with the Epsom salts as in previous years. However, the 15-5-25 already had sufficient Mg included for poinsettias, and it did not contain a source of Ca. The result was a crop of Ca deficient poinsettias, but looking only at the Ca content of the leaves would not have indicated a Ca problem. Foliar analysis indicated that the Ca concentration was 0.6%; the critical minimum for Ca is usually considered at 0.5% (a normal range is 1.0 to 1.75%). The problem became evident when the Mg concentration was examined. The minimum critical level for Mg in poinsettias is around 0.2% (a normal range is 0.3 to 1.0%). The Mg concentration in the tissue sampled was 1.1%, almost twice that of Ca. The ratio of Ca to Mg is as important as the concentration of each. A ratio of 3 : 1 to 2 : 1 for Ca : Mg is normal and is recommended for poinsettias. Make sure to adjust the total nutrition program when you change one aspect of the program.

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Nitrogen: All nitrogen is not created equal, and different forms of nitrogen have different effects on poinsettia growth. Ammoniacal nitrogen (N as NH_4^+ or urea) causes softer, more lush growth, and greater leaf and internode expansion than nitrate nitrogen (N as NO_3^-). Some ammoniacal nitrogen is beneficial for stimulating leaf expansion and internode elongation; supply at least 10% of the N in the NH_4^+ form. However, too much NH_4^+ can cause excessive stretching and too soft growth; supply a maximum of 40% of the N in the NH_4^+ (or urea) form.

Molybdenum: In poinsettias, Mo toxicity is close to impossible, and Mo deficiency is close to disaster. Why take chances? Supply elevated levels of Mo throughout poinsettia production. Supply at least 0.1 ppm Mo in a constant feed program, or spray plants monthly using 2 1/2 oz of sodium molybdate or ammonium molybdate per 100 gallons of water.

Lithium: Lithium toxicity is real. Injury from Li is very distinct in where and when it appears on the plant. Leaves just below newly expanding shoots exhibit marginal burning when Li levels are too high. The burn first appears just after pinching and as the side breaks begin to develop. Leaves forming on the new breaks do not exhibit the marginal burning, just those on the main stem. As little as 20 ppm Li in the foliage is enough to cause injury. Lithium has been found in some vermiculite and calcined clay materials. However, the presence of Li in the substrate does not always lead to Li injury in the plants. Low substrate pH (below 5.6), low pH irrigation water, and low bicarbonate water seem to increase the chances of Li injury. These factors may be affecting the solubility/availability of Li in the substrate solution. Areas having relatively high pH and bicarbonate concentrations in their irrigation water may never encounter Li toxicity, but other growers having low substrate solution pH and lithium present in the substrate may want to watch for Li toxicity symptoms. The latest edition of the Ecke's poinsettia manual has an excellent discussion and descriptive picture of Li toxicity on poinsettias.

Understanding Cultivar Differences

Many poinsettia production problems can be traced back to improper scheduling or improper treatment of a particular cultivar. Although you can treat them all the same, results will be best if the individual "quirks" of cultivars are taken into consideration during production.

Photoperiod Response Groups: There are different photoperiod response groups within poinsettias. For example, 'Freedom' is very quick to color and flower (a member of the 8 week response group). 'V-14 Glory' is slower to color and flower (9.5 week response cultivar). Precise scheduling requires growers to count back from the targeted market date to determine when short days should begin. As discussed earlier, the only way to be absolutely sure when short days begin is to keep night temperatures below 72 °F and to follow the lighting and blackcloth scheme previously described.

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Growth Rate and Final Height: Poinsettia cultivars grow at different rates and vary in final height. 'Annette Hegg' is a vigorous grower that will grow too tall, if unchecked. 'Supjibi' and 'Freedom' grow more slowly and require more time for vegetative growth from time of pinch until start of short days. These cultivars also have less internode elongation and require less height control than 'Annette Hegg' cultivars. Schedule each cultivar based on growth habit for best plant form. This includes allowing more or less time for vegetative growth after pinching and prior to short days as well as adjusting height control programs such as changing the concentration and frequency of application of chemical growth retardants.

Temperature and Light Intensity: Although most cultivars do well under the temperature and light recommendations given previously, there are exceptions to every rule. 'Lilo', 'Red Sails', and 'Lemon Drop' develop lateral shoots best under cooler day temperatures and lower light intensities than other poinsettias. If plants of these cultivars are grown under too high of light (>4000 footcandles) or too warm (>85 °F day temperature), development of side breaks is very slow. Place 'Lilo', 'Red Sails', and 'Lemon Drop' plants in the cool and shady sections of the greenhouse. Growers in North Carolina have the best luck with these cultivars when they are grown next to the evaporative pads, at the cool end of the greenhouse. This technique is especially useful during stock plant development when initiation of side branches is crucial for cutting production. Try syringing plants during the afternoon to keep them cooler and encourage better development of side breaks. Not only will misting plants reduce the temperature, it will also raise the humidity around newly developing shoots and could help prevent them from "hardening" through desiccation.

Pests, Diseases, and Physiological Problems

Supplying an environment conducive to good growth, avoiding nutritional problems, and adjusting schedules and programs for differing cultivars is still not enough to insure success with poinsettias. Every year insect, disease, and physiological problems such as bract necrosis seem to increase in intensity during the poinsettia season. Whiteflies have become a way of life in some greenhouse ranges. We wait in anticipation for some miracle treatment for whitefly control, while current methods seem to ebb in effectiveness. Other problems that appear on the rise appear below.

Fungus Gnats: The larvae of fungus gnats have become a major problem for some propagators. Maggots burrow into the hollow center of poinsettia stems and seem to increase the incidence of *Rhizoctonia*. Our growers and Jim Baker name 'Supjibi' as the cultivar most susceptible to this problem. Sanitation during propagation is essential. Eliminate all sources of fungus gnat larvae, including algae and weeds that may be growing under benches in the greenhouse. Algae serves as a reservoir for both fungus gnats and shore flies. Controlling these insects requires control of the algae.

Rhizoctonia: Most growers follow a preventative drench program and avoid *Rhizoctonia* stem rot. However, some growers drenched and still encountered problems with stem rot. Although most materials used for *Rhizoctonia* control (such as thiophanate methyl) are systemic (can be taken up by the roots and translocated to the stem to offer protection against the pathogen), this does not insure protection from *Rhizoctonia*. Application technique is very important in preventing the disease. Growers applying drenches through drip tubes reported less effective control than growers applying drenches in a manner that wet the entire substrate surface. Many substrates used today have limited lateral movement of water and very rapid channeling of water downward in the pot. A newly planted cutting has a limited root system. If the material applied to the substrate does not come in contact with the roots, it cannot be absorbed and cannot offer systemic protection against a disease organism. Make sure your drenching technique puts the chemical in contact with the roots and preferably with the substrate immediately surrounding the crown of the plant.

Hand in hand with a preventative fungicide program is prevention of damage to newly planted cuttings. Avoid bruising cuttings at potting and do not apply high concentrations of fertilizer too soon after planting. A bruised stem or salt burn at the substrate surface can provide the perfect opening for *Rhizoctonia*.

Bract Necrosis: Calcium deficiency, pesticide injury, micronutrient toxicity, fluoride toxicity, soluble salts burn, *Botrytis*, and succulent growth that is easily damaged due to stress have all been implicated as causes of bract necrosis in poinsettia. No one factor seems to account for the problem in every greenhouse. One common element does appear to be the status of the plant during final bract expansion. Soft growth caused by high humidity and heavy water and feed seems to be closely associated with bract necrosis in the Southeast. Ten years ago, Jim Barrett and Terril Nell suggested reducing relative humidity, reducing fertilization, and reducing watering during the last four weeks of production to help prevent bract necrosis. This advice is still valid today, and following these suggestions along with continual monitoring of plant nutrient status is still the best bract necrosis prevention program.

New Problems in 1993?

Every year brings a new poinsettia crop and a new set of problems. What will the major production problem be in 1993? If you know, your crystal ball is better than mine. The list of poinsettia production problems confronting us seems endless. However, you can reduce the register of possibilities by taking steps discussed above to prevent some of the headaches. After all, the best way to solve a problem is to prevent its occurrence.