Basics Of Monitoring: Graphical Tracking

Develop a comprehensive monitoring program by borrowing concepts presented in this series to produce quality plants on time for every season.

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CONTROLLING height is a major challenge for growers with most floriculture crops. Unfortunately, not only do environmental growing conditions vary from year to year due to the weather, but growers must continuously adjust their height management strategies due to the introduction of new cultivars, shipping dates and container sizes.

We are all aware of the consequences of crops that do not meet or exceed maximum height requirements: poor quality and damaged plants, higher shipping and labor costs and, ultimately, shrink. So how do you make decisions related to height control in your greenhouse? Relying on your plant growth regulator (PGR) crop notes from last year may not be the best strategy to follow. The first step in making educated decisions and avoiding over- or under-applying PGRs is regularly monitoring the growth and development of your crop.

In this second article in a series of four focused on monitoring, we will provide concepts and ideas to help you develop a comprehensive greenhouse graphical tracking program in which you can monitor the growth and development of your

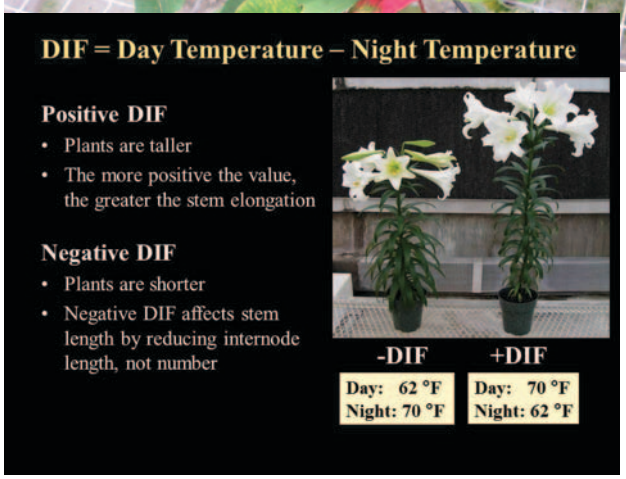

Figure 2. Long, thin and weak poinsettia stems due to tight spacing (shade avoidance response) on the greenhouse bench.

Figure 1. An Easter lily crop that was grown under negative DIF (62 / 70°F) and positive DIF (70 / 62°F).

crops from planting to marketability.

Growth & Development

In the first article of this series published in July, we wrote about the importance of monitoring the greenhouse environment (i.e. light and temperature). Why? Light and temperature influence the growth and development of plants and ultimately influence stem elongation. For example, temperature directly impacts plant height by affecting the number of nodes or leaves on the stem (leaf unfolding rate) and the length between those nodes or leaves (internode length).

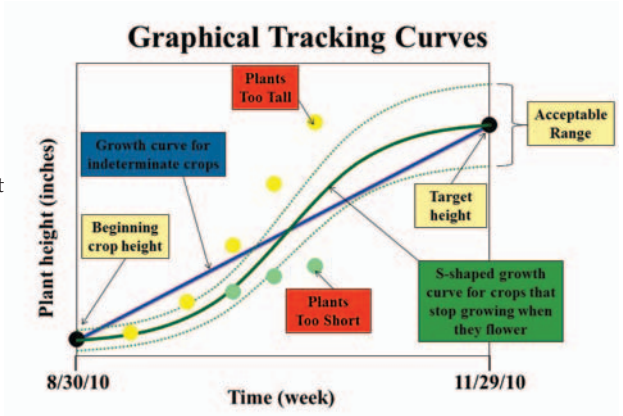

Figure 3. A linear (blue line) and S-shaped graphical tracking curve (green line) that can be used by growers to determine if a crop is too tall or too short.

More precisely, leaf development is affected by the average daily temperature and internode length is affected by how temperature is delivered during the day or night (DIF; Figure 1). Light quality or the relationship between the amount of red, blue and far-red light that plants receive influences their appearance. For example, on a tightly spaced bench, red and blue light are used by plants for photosynthesis and far-red light is transmitted to leaves further down in the canopy. This signals the shade avoidance response, and stems begin to grow longer, thinner and weaker (Figure 2).

By properly monitoring, managing and controlling the greenhouse environment, we can prevent unwanted "stretch." However, growth and development of greenhouse crops may not always meet the narrow finished plant date and market height windows of our industry.

Graphical Tracking

Researchers at Michigan State University developed a simple crop monitoring and management tool that can be used in the greenhouse to plot actual plant height or development of a crop and compare this value to target plant height or development over time. The overall goal of graphical tracking is for growers to plot the height of their crop onto a graph once or twice a week and then make height management decisions based on how their crop is in relation to the desired height at that point in the growing schedule.

Graphical tracking is fairly simple and consists of the following steps:

1. Create a graph of target heights for each crop;

2. Monitor and record the growth and development of the crop;

3. Plot the height of the crop on the graphical tracking graph;

4. Make timely height-control decisions

Computer-based graphical tracking curves have been developed for poinsettias, Easter lilies, geraniums and chrysanthemums. To create a graphical tracking curve:

1. Begin by using lined or graph paper, or a computer program, to create a graph for each crop variety or cultivar (Figure 3). Label the vertical axis "Plant Height" and the horizontal axis "Time." Now, write down the date of transplant or pinch – whichever occurs later – where the horizontal and vertical axis cross (left side of graph). Determine the number of weeks until your crop is marketable and record that date on the horizontal axis (right side of the graph).

2. On the graph, write "Target Height" and the acceptable height range. For example, the target height for a 6.5-inch poinsettia crop may be 15 inches, but 14 to 16 inches is an acceptable height range.

Figure 4. A PVC pipe with height denotations is a useful tool to track the growth of your crop.

3. Select 10 plants of each cultivar from across your greenhouse that are representative of the crop. Using a ruler, take height measurements of your crop (at transplant or pinch) for the 10 plants you've selected. Determine the average plant height of the 10 plants, record this value on the graph and label it "Beginning Crop Height." Mark these plants with a stake or flag so they are easily identifiable for future reference.

4. Draw a straight line or an S-shaped curve from the "Beginning Crop Height" to the "Target Height." The shape of the curve will depend on the crop you are growing. For determinate crops such as poinsettia and chrysanthemum, you will use an S-shape growth curve (green line, Figure 3). An S-shaped growth curve is used because growth is initially slow as apical dominance is broken from pinching, then rate of stem elongation increases to a maximum and finally decreases as flowers develop and then stops as the flowers mature. For indeterminate crops such as petunia or verbena that continue to develop flowers as stems grow, you will use a linear growth curve (blue line, Figure 3). Additionally, the shape of the growth curve can depend on the crop and even the cultivar.

5. Once or twice a week, measure height of the 10 plants previously measured and record the average height on the graph. At this point you should see where your crop is in relation to the growth curve you drew in Step 4.

6. You may not need to take any action to slow down or accelerate the growth of your crop. However, if your crop is several inches above the growth curve, immediate action will need to be made to reduce further increases in stem elongation ("Plants Too Tall," Figure 3). This can be accomplished in many ways, including the use of chemical PGRs, providing a cool day and a warm night (negative DIF), or prevent-

ing stretch by increasing plant spacing.

7. It is not uncommon to find that the plant height of your crop is below the growth curve ("Plants Too Short," Figure 3). If plant height continues to be below the curve, this is an indication that stem elongation of your crop needs to increase more rapidly so your crop does not finish below the acceptable range. For this scenario, you can space plants closer together, provide warm days and cool nights (positive DIF) or apply PGRs that contain gibberellic acid such as Fascination or Fresco to help increase stem elongation.

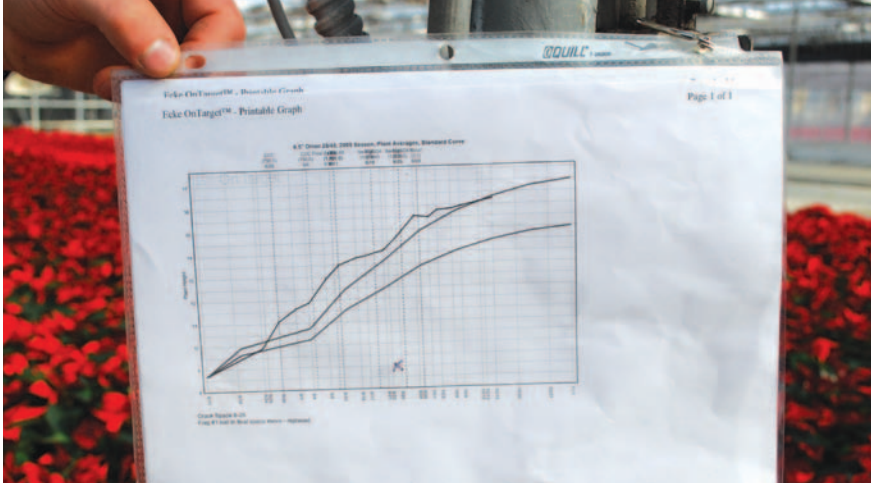

Figure 5. This greenhouse operation has its graphical tracking curves in plastic folders in the greenhouse.

To ensure success with graphical tracking, the following tips should be taken into consideration:

- The same person should take weekly height measurements to avoid errors and increase consistency.
- Use a yardstick to measure and remember to include container height when taking plant height measurements.
- Place a "height stick" or PVC pipe with height denotations near your crop to give a better idea of overall height (Figure 4).
- Measure the same plants (as long as they continue to represent the average crop height).
- Do not "jump the gun" and apply a PGR if your plants are less than one-quarter of an inch above the curve.
- Record on your graph when PGRs were applied or when temperatures were adjusted.
- Keep a copy of your graphical tracks in a clear plastic folder next to your crop so you can see how your actions are influencing stem elongation (Figure 5).

Graphical tracking is ultimately a grower-friendly monitoring and decision support tool that will show you if your crop is too tall or too short. It is then up to you to decide which is the best management tool to get your crop back into the desirable height range. **GG**

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