

by PAUL FISHER  
and ROYAL HEINS

# COUNT ON YOUR EASTER LILY CROP

ONE of the greatest challenges for Easter lily producers is to manage greenhouse temperature so that the crop flowers in time for Easter sales. Since Easter falls on a different date every year, and bulbs differ depending on the field conditions in which they were grown, there is no "growing recipe" or "average year" for comparison. The growing strategy, therefore, must be dynamic.

In this article, we'll describe leaf number graphical tracking, a new technique to help you monitor and schedule your Easter lily crop. With this technique, you can see whether development toward the visible bud stage is on track, and you can receive a recommendation for the average temperature needed to reach the desired visible-bud date. You can also combine this tool with others, including "isopleth" charts (described in this article), to help you make temperature set-point decisions.

Leaf number graphical tracking was developed as part of the Greenhouse CARE System, a computer program for height control and scheduling of potted plants. The technique was tested during the spring 1994 Easter lily production season. (For more information on CARE, see the November '93 GREENHOUSE GROWER, page 20.) You can use the graphical tracking technique on a computer if you purchase the Greenhouse CARE System program, or you can make your own charts on paper using the template included in this article.

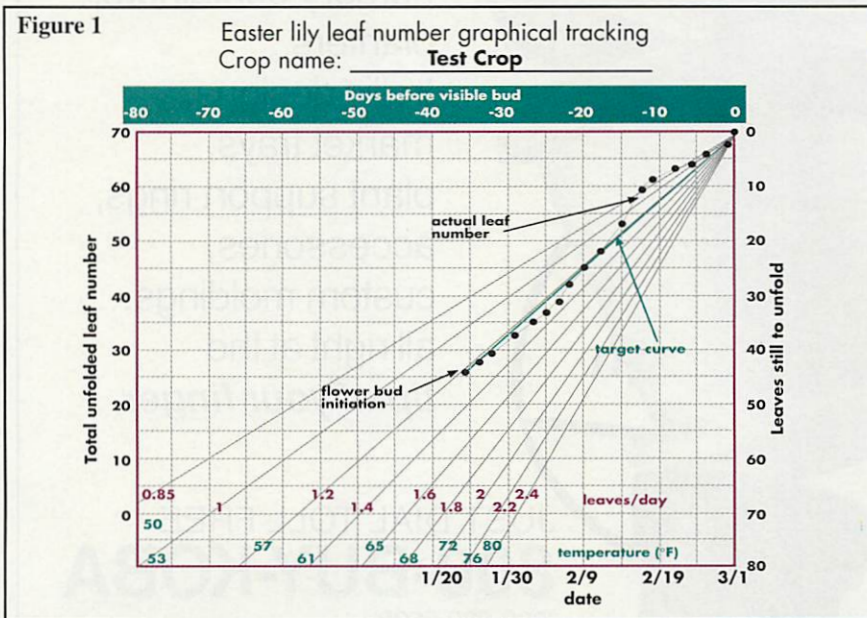
Here are the 10 steps needed to track leaf number, using the crop in Figure 1 as an example.

## STEP 1

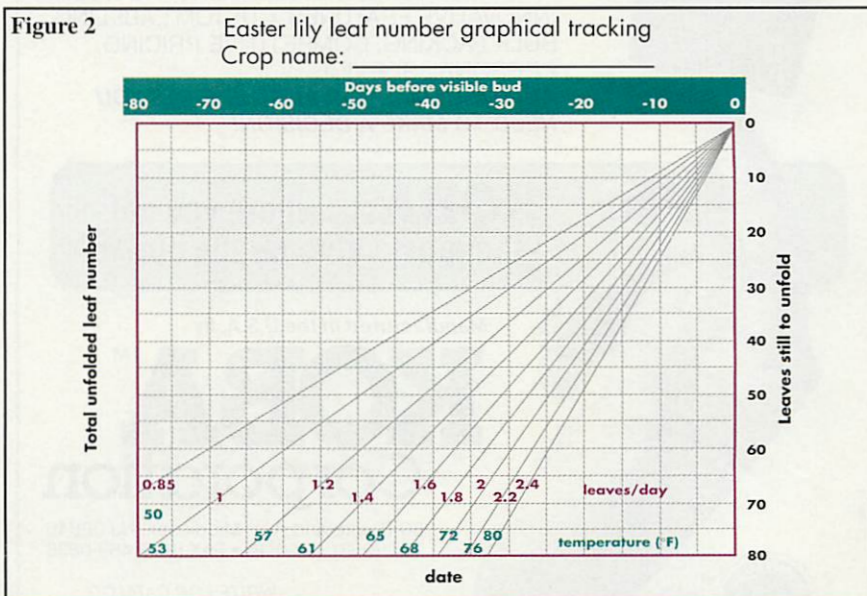
**Set the target visible bud (VB) date.** Visible bud provides a milestone to help you keep crop timing on track. VB is defined as the time when you can look down on a plant without moving any leaves and see at least one flower bud.

If you aim for VB to occur 35 days before flowering using the leaf-counting technique, you are likely to meet your market date on time. For the ex-

Leaf number graphical tracking on Easter lilies can help you better time your crop.



An example of a leaf number graphical tracking chart.



A template for making your own leaf number graphical tracking chart.



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ample in Figure 1, we aimed to flower the crop on April 5, so we set a target VB date of March 1.

Visible bud occurs after nearly all leaves have unfolded (bent over), the rate of leaf unfolding being determined by average temperature. A leaf is defined as unfolded when the leaf tip is bent over 45° or more; leaf unfolding rate is the number of leaves that unfold per day.

## STEP 2

**Identify when the crop reaches flower bud initiation (FBI).** After about 20 leaves have unfolded, remove all the leaves from 3-5 plants from each bulb source twice weekly. Check whether you can see flower buds, and count the leaves.

To dissect a plant, you first need to count all the unfolded leaves, and write down the number. Then remove and count all remaining leaves, using a needle to help remove the small scale-like leaves near the top of the stem. When nearly all leaves have been removed, use a magnifying glass to remove the rest of the tiny leaves and to check for flower buds. The buds will be about 1/16 of an inch or less in diameter at the FBI stage. When you see flower buds on all 3-5 plants, the crop has reached FBI and you can stop plant dissections. The crop in Figure 1 reached FBI on January 24.

## STEP 3

**Calculate the average number of leaves unfolded at FBI.** Average the unfolded leaf number of your dissected plants. In Figure 1, an average of 26 leaves had unfolded for the three dissected plants at FBI.

## STEP 4

**Estimate the number of leaves to unfold by visible bud.** At visible bud, about five leaves will still need to unfold, if you define an unfolded leaf as 45° bent over at the leaf tip. Thus, the number of leaves to unfold between FBI and VB is the total number of leaves not unfolded at FBI minus five leaves.

For example, the crop in Figure 1 has an average of 75 total leaves. If we subtract the 26 unfolded leaves at FBI, the total leaves not unfolded at FBI equals 49, and 49-5 = 44; so, 44 leaves should unfold between FBI and VB. It is worthwhile to dissect another three plants about 20 days before

VB to check your estimate of the number of leaves still to unfold. You can also estimate your bud count when you do the second dissection.

### STEP 5

**Draw the target curve on the graph.** You can see the solid line in Figure 1 runs from FBI on 1-24 to VB on 3-1 along the horizontal x-axis, and from 26 leaves at FBI to 70 leaves at VB on the vertical y-axis. This is the target line for comparison against actual leaf number.

For your crop, you need to write in the actual leaf number on the left side of the graph shown in Figure 2, and then work down in increments of 10 leaves from the total leaf number minus five leaves at the top of the y-axis. You also need to enter the date on the bottom of the graph, working back from VB to FBI in increments of 10 days.

The target line shows the average leaf-unfolding rate needed from FBI to VB (about 1.2 leaves/day), and the desired average temperature (57°F) to achieve this rate. Look along the diagonal dotted lines back to the bottom left of the graph to see the leaf-un-

folding rate and temperature. The required leaf-unfolding rate to reach VB can be read off the graph, or can be calculated using this equation:

$$\text{leaf unfolding rate} = \frac{\text{leaf number still to unfold by visible bud}}{\text{days to visible bud}}$$

So, in Figure 1, the leaf unfolding rate is 44 leaves/36 days = (approximately) 1.2 leaves/day.

### STEP 6

**Monitor actual leaf number.** After FBI, begin counting actual leaf number on five plants per crop twice weekly. Because there is some subjectivity to leaf counting, it is important that the same person measures the same group of plants each time.

Many growers find it is convenient to put a string loop about 2 inches in diameter around the leaves yet to unfold. So when they return to count a few days later, all the newly unfolded leaves are inside the loop, and they

can simply count these leaves and move the loop up the plant.

### STEP 7

**Plot the actual leaf number on the graph.** Enter onto the graph the average leaf number for each measurement date, and join this point with a line to the last measurement point. In Figure 1, you can see that leaf number was measured about every 2-3 days.

### STEP 8

**Read the required average temperature from the graph.** Warm weather, changes in light conditions, or other factors may cause the actual leaf number to deviate from the target, even if the environmental computer is set for the required average temperature (e.g., 57°F).

If actual leaf number is above the target curve, as occurred on February 16 in Figure 1, you need to cool down temperatures to reduce the leaf-unfolding rate. You can read the required leaf-unfolding rate and temperature from the bottom left of the chart, based on where the measurement point lies with respect to the diagonal dotted lines (0.85 and 50°F, respec-

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tively, for February 17). Conversely, if actual leaf number is below the curve, you can use the graph to help decide how much you need to warm up temperatures to increase the leaf unfolding rate.

We do not recommend average temperatures above 75°F or below 50°F, since crop quality may be affected. As you approach the last week toward VB, treat the recommendations from the graphical track graph with caution, because slight errors in leaf

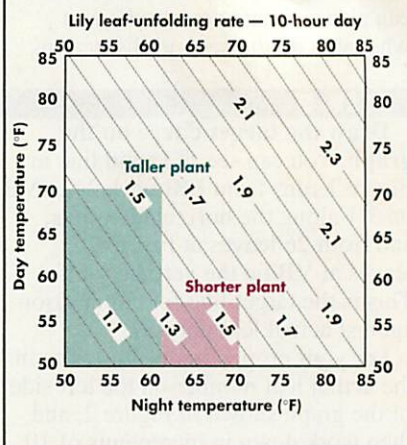
counting can cause extreme temperature recommendations.

### STEP 9

**Use isopleth charts to decide on day and night set-points.** Once you have decided on an average 24-hour temperature for your crop, the next decision is what combination of day and night temperatures will best achieve this average.

Figure 3 shows an isopleth chart that indicates various combinations of

Figure 3



An isopleth chart showing different combinations of day and night temperatures for a given leaf-unfolding rate, assuming a 10-hour day length.

day and night temperatures that result in a given leaf unfolding rate and average temperature, assuming a 10-hour day length. High day and cool night temperatures, or a positive DIF (DIF equals day minus night temperature), result in taller plants than crops grown under warm nights and cool days, or a negative DIF.

The height of your plants, therefore, is also important when you are choosing temperature set-points. If you are graphically tracking plant height, this will help you decide whether you should use a negative or positive DIF: Negative DIF is best if plants are taller than desired, whereas positive DIF promotes stem elongation.

### STEP 10

**At visible bud, change to other grower tools.** Leaf number graphical tracking is only useful up to VB. Once the crop is at VB, base your average temperatures on the number of days from VB to flower, and later on bud length using a bud meter.

Figure 2 shows an empty template on which you can draw your graphical tracking curves for other crops. Copy it and make a separate graphical track curve for each of your crops. (If you would like a larger copy of Figures 2 and/or 3, please contact GREENHOUSE GROWER.)

We hope you find this a useful addition to your Easter lily tools. **GG**

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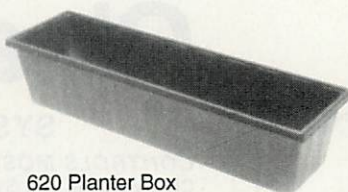
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