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Revisiting DIF in Easter Lily Production

Spring is just around the corner - and nothing announces spring quite like the classic Easter lily. Producing perfect potted Easter lilies for market can be challenging. Fortunately, growers can manage greenhouse temperatures using DIF to control final plant height and meet market demands.

Growers are on target to provide potted Easter lilies (*Lilium longiflorum*) by Palm Sunday (March 20), which also happens to be the vernal equinox and the first day of spring. Scheduling plants for an early Easter can be challenging. Easter can occur as early as March 22 and as late as April 25, a period when greenhouse temperature and light levels can widely differ from day to day. Because Easter is earlier this year than most years (it won't happen again in March until 2024), growers in northern climates have been able to utilize temperature management in combination with plant growth regulator treatments to produce compact plants.

Temperature has a profound effect on Easter lily development and plant appearance (morphology). There are many excellent references describing the effects of temperature and light on flower induction, initiation, and developmental rate, though these topics are not discussed in detail here.

Uniform Easter lily crop nearing the end of production. Photo by Beth Scheckelhoff.

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This alert focuses on how temperature affects plant height and physical characteristics of Easter lily. Research has shown that decreasing night temperature from 85 to 55˚F, significantly increases leaf length and flower bud length, and decreases lower leaf chlorosis. Temperature also affects plant height. While increasing day temperature increases plant height and decreasing night temperature decreases plant height, it is the relationship between the difference (DIF) in day temperature (DT) and night temperature (NT) that determines final plant height (DIF= DT-NT).

DIF is undoubtedly one of the most interesting height control techniques to be researched in the last 25 years. It has proven to be an effective tool for managing final plant height in responsive floriculture crops like Easter lily, chrysanthemum, poinsettia, and many bedding plant species. Easter lily plants grown with the same DIF regardless of the actual DT and NT have a similar final plant height. For example, research by Heins and colleagues at Michigan State University found that combinations of day and night temperatures that created a DIF of -4˚C (-7˚F) resulted in Easter lily plants of similar height (i.e., combinations of DT-NT=-7˚F were 57-64, 64-72, 72-79, 79-86).

In addition to stem elongation, DIF affects Easter lily leaf orientation. Leaves grown with a negative DIF curl downward as shown in Figure 1. Leaf orientation increases as the difference between DT and NT increases.

Figure 1. The leaves of Easter lilies grown with a negative DIF curl downward slightly compared to plants grown with a positive DIF. Photo by Beth Scheckelhoff.

Growers can promote stem elongation resulting in taller plants with a positive DIF (warm day and cool night) and reduce stem elongation resulting in shorter plants with a negative DIF (warm night and cool day) compared to plants grown with no DIF (night and day are the same temperature). Growers need to consider fluctuating fuel costs, production timing and other factors that determine the economic feasibility of maintaining a negative or zero DIF-environment throughout the growing period.

Climates where both day and night temperatures can be monitored and controlled, such as the upper Midwest during the winter months, allow for the effective use of DIF. It becomes more difficult and sometimes impossible to manage height with DIF when outdoor temperatures fluctuate widely during the growing season, especially in southern climates. Instead of using DIF, a similar result can be achieved by using a DIP whereby greenhouse air temperature is reduced 5 to 10° F below night temperature for several hours in the early morning around dawn. This technique is effective because stem elongation is greatest at this time of day. Growth suppression may be limited or reversed if high daytime temperatures follow the morning DIP.

Figure 2. Warm days and cool nights (positive DIF) promote stem elongation in Easter lily as noted here. The use of plant growth regulators in combination with temperature management is essential to producing lilies of acceptable height. Photo by Beth Scheckelhoff

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Keeping on Track. How do growers know if their Easter lily crop is on track to finish at an acceptable height? Graphical tracking is used to compare actual plant height to desired or expected height for Easter lily crops at two time periods 1.) from emergence to visible bud and 2.) from visible bud to flower. By monitoring height throughout the crop, growers can determine what management decisions need to be made to keep plants within the desired height specifications. These decisions might include the use of plant growth regulators or temperature manipulation. An example of graphical tracking of an Easter lily crop and corresponding changes to greenhouse temperatures is shown in Figure 3.

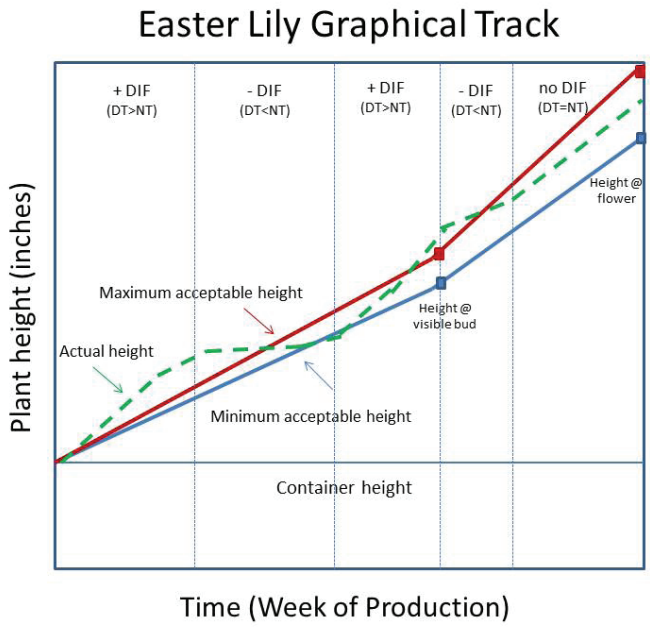

Figure 3. Example graphical track for an Easter lily crop adapted from the Cooperative Extension Service Bulletin E-1406, Producing Easter Lilies, Michigan State University, November 1987.

Additional Resources for Growing Easter Lilies

▫ Producing Easter Lilies from Michigan State University Extension Bulletin E-1406, November 1987.

▫ An annual forcing schedule for Easter lilies from Dr. Richard McAvoy can be found at the University of Connecticut site: http://ipm.uconn.edu/pa_greenhouse/

▫ The basics on graphical tracking from fellow e-Gro contributors Roberto Lopez and Chris Currey: https://ag.purdue.edu/hla/lopezlab/Documents/ExtPubs/BOM2_Final.pdf

▫ Easter lily disease symptoms and management practices from Penn State Unversity: http://extension.psu.edu/pests/plant-diseases/all-fact-sheets/easter-lily-diseases

▫ Determining the heating costs associated with utilizing DIF in bedding plant production (useful basis for determining costs for other crops such as Easter lily): http://www.flor.hrt.msu.edu/assets/Uploads/Temperature-on-bedding-plants.pdf