

# Cool mornings can control plant height

by John E. Erwin, Royal D. Heins, Robert Berghage,  
Brian J. Kovanda, William H. Carlson and John Biernbaum

Research at Michigan State University during the past four years has developed new concepts for plant height control using temperature. Initially, research showed internode length increased as day temperature (DT) increased or night temperature (NT) decreased.

Later, a totally new concept was discovered: internode length is primarily controlled by the difference (DIF) between day and night temperature (DIF equals DT minus NT) and not absolute temperature (See Figure 1). Poinsettias and campanula also show a small response to average temperature.

## Light-to-dark transitions are key height control points

Response to DIF is also affected by how quickly temperature changes relative to change from light to dark. We noticed this first when some growers observed a greater response to a negative DIF than others.

Growers who observed a large response were ones who opened their thermal blankets abruptly in the morning. Temperatures plunged rapidly from the night temperature to the cooler day temperature. Those who observed a smaller response were opening their blankets gradually in the morn-

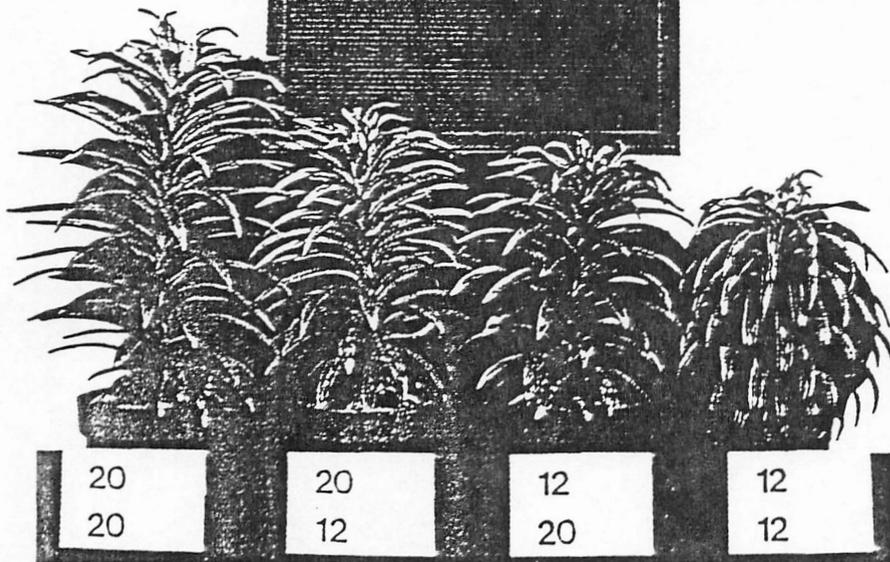
ing, producing a gradual temperature decline over a one- to two-hour period.

We suspected the first two hours of the morning (light) were especially important in influencing a plant's response to DIF. To test this, Easter lilies were grown with either a 68-degree F (20 degrees C) or a 54-degree F (12 degrees C) temperature during the day and 68 degrees F during the night (see Figure 2). The 54-degree F day temperature plants were significantly shorter due to negative DIF, as expected.

Two other groups of plants received either 54 degrees F for only the first two hours of the day or the last seven hours of the day. The exciting results of this experiment showed that stem elongation was reduced almost as much as by cooling the first two hours of the day as by cooling all day.

**DEVELOPMENTAL EFFECT OF TEMPERATURE DELIVERY DURING THE DAY ON LILIUM LONGIFLORUM 'NELLIE WHITE'**  
DAY 37 OF TEMP TRTMT  
20° NIGHT TEMP  
FIRST TEMP 2 HRS  
SECOND TEMP 7 HRS

*Quick temperature drops in the morning are nearly as effective in controlling lily height as a full-fledged MSU cool day/warm night temperature regime.*



Appearance of Easter lily plants 37 days after start of temperature treatments. All plants were grown with 68 degree F (20 degree C) night temperature (NT). The plant on the left was grown with zero DIF (same day temperature, DT and NT). The plant on the far right was grown with a DIF of minus 14 degrees F. The middle two plants had two day temperatures, one for the first two hours of the day and one for the second seven hours. The plant on the middle left had a zero DIF for the first two hours and a minus 14 degrees F DIF for the second seven hours. The plant on the middle right had a DIF of minus 14 degrees F for the first two hours and a zero DIF for the second seven hours.

## Can't keep cool days? Try cool mornings for height control

Preliminary grower observations also show that an abrupt increase in temperature at sunrise increases stem elongation. Therefore, to get the largest plant height response using the DIF concept, change temperature simultaneously with the change from dark to light and as quickly as possible.

These results are especially exciting since they may allow some height control using DIF under conditions where day temperature cannot be maintained below night temperature all day long, for example, during the spring and for growers in the South.

While we do expect a benefit from a drop in temperature at sunrise, it is also important to control day temperatures as much as possible throughout the day for maximum response to the early morning temperature dip. Previous research shows that high temperatures during the afternoon can also increase stem elongation.

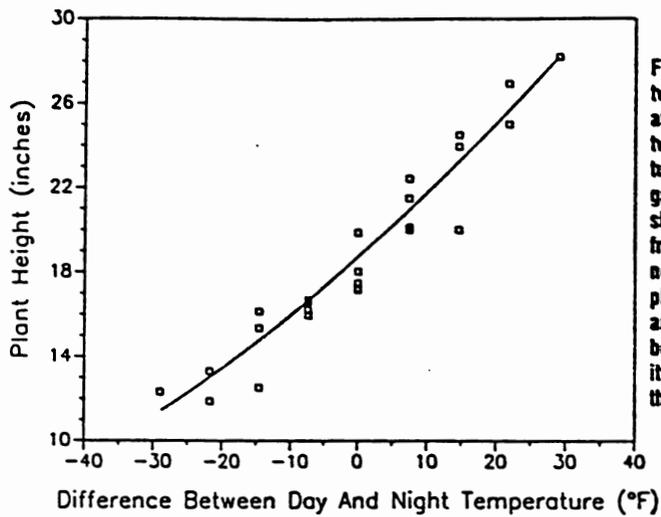


Figure 1. Relationship between Easter lily plant height at flower and the difference between day and night temperature (DIF) that plants were grown under. Internodes shorten as DIF decreases from a positive number to a negative number. Therefore, plants grown at different day and night temperatures may be the same height at maturity as long as their DIFs are the same.

**Two cool hours and warmer day means faster plant development**

Also, the two-hour temperature dip at sunrise allows growers to maintain a higher 24-hour average crop temperature. Since plant development rate increases as average temperature increases, a negative DIF for only the first two hours allows fast crop development rate while still maintaining some height control.

This may be particularly important for this year's Easter lily crop since Easter is so early. A high rate of leaf unfolding will be essential. A day tem-

perature cool enough to provide complete control of height may slow development rate undesirably.

A cool temperature pulse first thing in the morning will allow some height control, but will not reduce average daily temperature so much as a continuous, cool day.

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*John Erwin, Robert Bergbøge and Brian Kovanda, graduate students, and Royal Heins, associate professor, William Carlson, professor, and John Biernbaum, assistant professor, are in the Department of Horticulture, Michigan State University, East Lansing.*