Opening Strategies for Energy Curtains

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Research out of the Netherlands has shown that subtle differences in the opening and closing times of energy curtains affect the growth of tomato plants. Can those findings be applied to U.S. floriculture?

An increasing number of growers in temperate climates have installed retractable energy curtains inside their greenhouses to reduce heat loss during cold weather. Engineers, curtain manufacturers and growers alike have reported energy savings of up to 20 to 30 percent, depending on the curtain's material, construction, management, climate and greenhouse location. For growers with energy curtains, the question often arises how to manage opening and closing of the curtains. In particular, when should curtains open in the morning and close at night?

There is a tradeoff between having the curtains closed during portions of the day and the total quantity of light available to plants. During the winter and early spring, light levels inside greenhouses can be undesirably low. The challenge then becomes how to provide as much light as possible while optimizing the energy-saving potential of the energy curtains.

Although the present price of natural gas is low, everything we can do to reduce energy consumption has a positive impact on your balance sheet as well as the environment.

Dr. John Erwin at the University of Minnesota is researching this topic, but in the meantime, I came across an article published by Dieleman and Kempkes in the Netherlands in *Acta Horticulturae* in 2005. They performed an analysis to address the optimal opening strategy of energy screens on a tomato crop grown in the Netherlands. I think their results have applications to the floriculture industry in North America.

They grew tomatoes in greenhouses under an energy curtain that opened when the outside global radiation was 54 foot-candles. In separate greenhouses, curtain opening was delayed until outside radiation was 540 foot-candles. During the experiment, from January to May, plants under the delayed curtain opening strategy received only 0.3 percent less light — essentially the same amount — as plants under the more traditional curtain opening strategy. However, heat demand was 3.4 percent less when curtain opening was delayed (50 $W \cdot m^{-2}$) compared to the traditional method (5 $W \cdot m^{-2}$).

These results indicate that energy screens can remain closed until outside radiation exceeds 50 $W \cdot m^{-2}$ with essentially no detrimental effect on crops. The curtain used in the study was made of a clear plastic that provided very little shading (direct and diffuse light transmission were reduced by only 12 percent and 19 percent, respectively). It is possible that results would have differed if the curtain had provided a higher level of shading.

Some growers are installing a second energy curtain with a high light transmission. This provides a further reduction in heat loss at night and, if used during portions of the day, has less impact on reducing light levels compared to a more traditional aluminized curtain. In many floriculture crops, the effect of increasing the daily light integral on crop timing begins to diminish once plants receive about 10 $mol \cdot m^{-2} \cdot d^{-1}$ of light. However, further increases in light improve the quality of many floriculture crops, which can include greater branching, thicker stems and more flowers.

Whatever setpoints are used to manage retractable curtains, it is important that light sensors are level, clean and unobstructed by light. They also should be recalibrated about every three years to ensure accurate readings. Although the present price of natural gas is low, everything we can do to reduce energy consumption has a positive impact on your balance sheet and the environment. GPN

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