Simplifying Light

A NEW WEB-BASED CALCULATOR TAKES THE GUESSWORK OUT OF GREENHOUSE LIGHT MANAGEMENT.

By Joli Hohenstein

As Roberto Lopez helped more and more growers working to better understand and manage light in their greenhouses, a light bulb came on: There had to be an easier way.

Working with graduate student Christopher Currey, Lopez, an associate professor and floriculture Extension specialist at Purdue University, quickly approached Brian Krug, an Extension assistant professor at the University of New Hampshire Cooperative Extension.

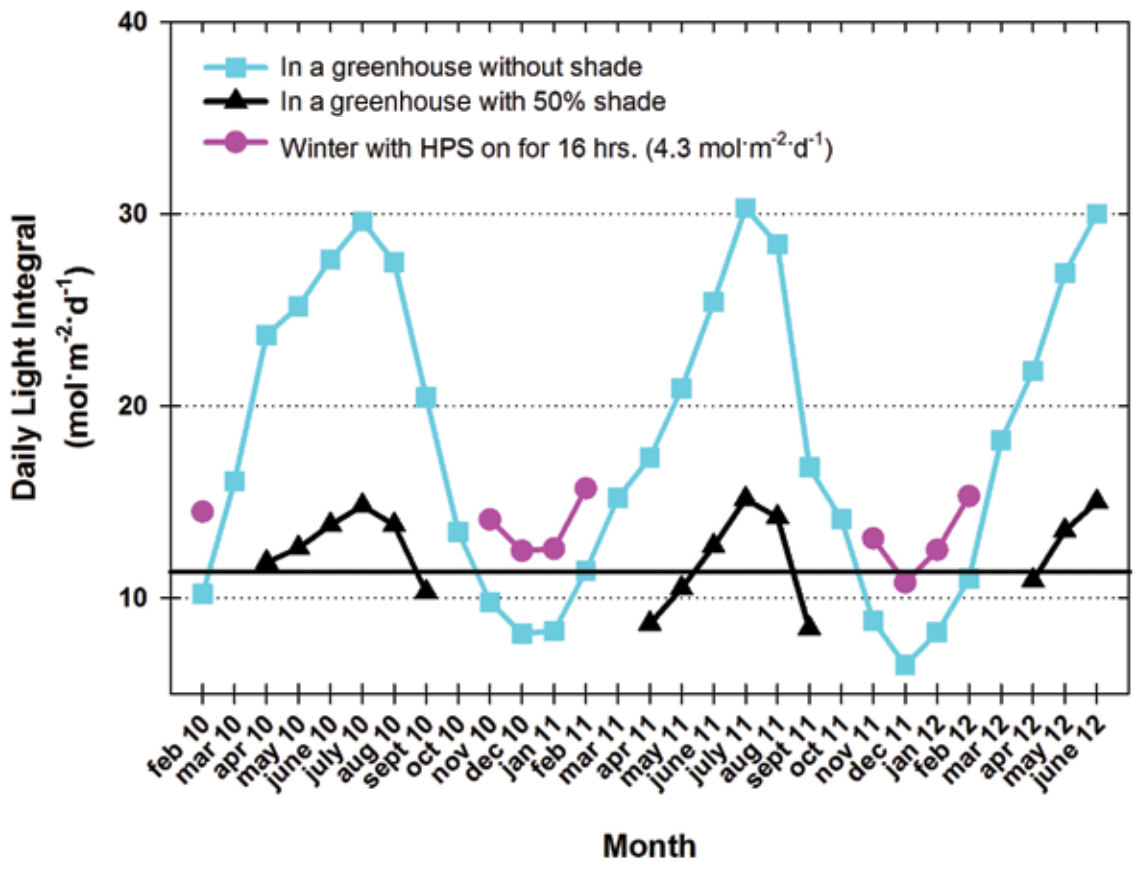
Krug, who has already developed GRO-CALC, a collection of three web-based calculators (ALKCALC, FERTCALC and PGRCALC) for greenhouse growers, immediately saw the potential in building a tool to give growers the answers to one of production's most nebulous factors: light.

"We want to take the guesswork out of production for growers," he says. "We're helping them speed up their processes."

Why DLI?

As research at Purdue and other universities is showing the economic benefits of monitoring and managing light, growers are moving away from foot-candles or lux as the preferred measuring units and adopting daily light integral (DLI).

Table 1: Sample DLI readings for an Indiana greenhouse with and without shade and with HPS lighting



Foot-candles and lux are only a measure of light visible to the human eye. Growers are interested in measuring photosynthetic light, which is in micromoles per m^2 per second. But, this is still an instantaneous reading, and light levels are constantly changing. That's where DLI comes in.

DLI is the cumulative amount of light a plant receives over the course of a day. Think about light as you would rainfall. We record how much rain falls over a 24-hour period (DLI). How wet you get depends on how hard it's raining (light intensity) and how long it rains (duration). Of course in the color industry, hundreds of varieties are grown, and "one size does not always fit all" with plants and light.

Simply put, DLI is a cumulative measure of light over the course of the day — and thus a more accurate way to determine how much photosynthetic light crops are getting.

At Purdue University, Lopez along with graduate students Christopher Currey and Wesley Randall have conducted research on the light requirements of seed and vegetatively propagated bedding plants, both as cuttings and seedlings. Of course, each plant species has its own special needs, but generally, providing 8 to 10 moles per meter squared per day during propagation is sufficient.

To put economics behind it, using DLI could help reduce rooting time, increase quality and decrease energy costs.

Lopez, Currey and Krug aim to make that implementation easier for growers with the development of DLICALC, the fourth in the University of New Hampshire's GROCALC web-based calculator package, which also includes ALKCALC, FERTCALC and PGRCALC.

By using DLICALC in conjunction with target DLI, you will get a more exact measure of supplemental light and more efficient use of equipment. So, for example, you aren't running your lamps longer than you need to or, conversely, aren't running them long enough to meet your target DLI.

If you don't have an environmental control system that can manipulate DLI, you can use DLICALC to predict how long you should run your lamps. You could add potential energy savings to the list of benefits DLICALC provides by giving guidelines on when lamps or shade should be used.

"At our research greenhouse, we've cut back on energy consumption for supplemental lighting by approximately 25 percent by monitoring and targeting a specific DLI for a given crop," says Lopez.

If your environmental control system can target a specific DLI, such as 10 to 12 moles, and you can program it to automatically shut off when that DLI is reached, you could realize additional efficiencies in supplemental lighting use.

DLI & Shade

DLICALC also could have ramifications for how growers use shading systems, such as how they could use and select them more effectively and efficiently, says Kurt Parbst, president of Ludvig Svensson, which helped sponsor the calculator's development.

Using reflective overhead and side screens (generally for blackout or shading) helps increase lighting efficiency, especially near the greenhouse perimeter.

Parbst sees potential for that to be addressed using the current knowledge.

In addition, growers will see some shade operation guidance from DLICALC. The DLI is an issue during low-light times when supplemental lighting is beneficial. "However, DLI could also be an issue during warm weather when growers may shade for worker comfort and sacrifice quality due to overshading," he says. "Can we suggest a shading strategy (perhaps intensity set points) based on crop targeted DLIs?"

Using DLI could help reduce rooting time, increase quality and decrease energy costs.

DLICALC could also be useful in helping growers make best management decisions. Many garden/bedding plants are co-located and need to grow in a general climate, while specialty cuts or potted plants are generally grown in their own zone. "This tool could be used to help these growers properly select shading levels considering both intensity and DLI based upon their crop needs, location and structure or glazing," says Parbst.

Where to Begin

Start by looking at a map of average DLI readings across the United States, which DLICALC

provides. Then, use that figure to make an educated guess as to the natural DLI in your greenhouse. (A typical greenhouse will see about a 50 percent reduction in light due to glazing, coverings, hanging baskets, etc.) Next, figure out how much light you need to add to the sunlight to meet your plants' needs. DLICALC makes it easy.

DLICALC can tackle two different scenarios, depending on the grower's need:

1) You want to know what DLI you're getting from your supplemental lighting.

Simply enter the light intensity you're providing, enter the type of lamp you're using, and tell DLICALC how long you're running your lamps. The calculator provides your approximate supplemental DLI.

2) You want to achieve a specific supplemental DLI.

Enter in your target DLI and the light intensity you're receiving from your lamps. The calculator will tell you how long you need to run the lamps to reach your target supplemental DLI.

Easy to use with no training required, DLICALC takes the user through a short series of only three to four input boxes and dropdowns to answer questions such as lamp type, light intensity and light measurement. Simply click "Calculate" to generate a report with the answers for your specific greenhouse.

Along with the maps, DLICALC will feature supplemental information including tips for reducing DLI (particularly valuable for the southern half of the country year-round and the remainder during summer's high light conditions) and tips on how to actually measure light using different meters and equipment.

A short screen capture tutorial will also be accessible online, though you may not need it. "Using the DLI calculator will take you two minutes the first time you do it and 30 seconds after that," says Krug.

DLICALC will be available by January 2013 on the University of New Hampshire Cooperative Extension website, www.nhfloriculture.com. Click on Grower Tools to access it.

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