

GROWERTALKS

Features

10/1/2024

Is Your Light Right?

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Walk through any horticulture trade show or attend any greenhouse conference these days and you're sure to see plenty of lights and find just as many sessions on lighting and lighting technologies. It's clear that improving lighting strategies can result in measurable improvements in crop quality and energy use reductions even when infrastructure changes can be costly. Before investing in such upgrades, understanding your light is critical.



Foot candles vs. $\mu\text{mol}\cdot\text{m}^{-2}\cdot\text{s}^{-1}$

Let's start with some basics. When considering light, you probably know light (from the sun or from bulbs) has differences in quality, intensity and duration. These three factors cover wavelength, color, total time and a total amount of light. Photosynthesis in plants is impacted primarily by light with a wavelength of 400 to 700 nanometers, also called PAR light, which is also the light humans can see.

Historically, our industry has measured light in foot candles, but over the past decade, researchers have moved to a different measurement that's far more precise and less limited. Foot candles are units capturing visible light at the time measurements are taken and much more applicable to the light humans see versus the light that drives photosynthesis in plants. Light changes over the course of 24 hours and a foot candle reading doesn't accurately explain how much light a plant actually receives.

Instead, a better measurement is micromoles per square meter per second of PAR ($\mu\text{mol}\cdot\text{m}^{-2}\cdot\text{s}^{-1}$). It's a measurement of how many particles of light energy actually used in photosynthesis that hit 1 square meter of space every second.

It's not clear who coined the phrase, "consider light accumulation like you do rain," but the point is that measuring the amount of PAR light accumulated in 1 square meter during a 24-hour period is the optimal way to track light hitting your crops. This leads us to DLI—daily light integral.

Scientists came up with the DLI measurement to cumulatively capture the amount of PAR received by plants in a day and is micromoles per square meter per day ($\mu\text{mol}\cdot\text{m}^{-2}\cdot\text{s}^{-1}$ over a 24-hour period). There are solid resources available to determine the DLI required for production of different crops and maps showing seasonal natural light DLI by month (scan the QR codes below). Researchers explain that although growers can access these resources and

gain general knowledge of DLI in their local area and the DLI for each crop, many factors impact exactly how much light is hitting your crops. Structural dimensions and glazing materials, bench height, general obstructions and more must be factored in. Some estimates indicate your crops might only receive 50% of the reported DLI.

How to measure your light

When developing light plans for crops or using light plans created by lighting or plant suppliers, you must first have a solid grasp on the light actually hitting your crops, as measured in $\mu\text{mol}\cdot\text{m}^{-2}\cdot\text{s}^{-1}$. The best way to do this is with a light meter or a few of them.

Quantum PAR meters are available from greenhouse supply companies and your best options are meters developed specifically for greenhouse use. Some of the most popular meters used by greenhouse technical experts are from Apogee Instruments. Started in 1996 by Dr. Bruce Bugbee (researcher and crop physiology professor at Utah State University—an industry guy), Apogee offers a range of greenhouse sensors, including PAR, DLI and photoperiod meters.

No matter which greenhouse-specific light meter you choose, the goal is to measure $\mu\text{mol}\cdot\text{m}^{-2}\cdot\text{s}^{-1}$ or DLI at the level your plants are growing (bench, floor, basket line, etc.). And you'll need to move meters around multiple locations to generate the best data. Meters are available for placement on flat surfaces or with stakes to insert in pots and can record data over multiple days, weeks or months. The data recorded and collected can either be viewed on the small screen on most meters or downloaded to a computer. Many newer environmental control systems offer sensors or integrate with the sensors you use. Check with your supplier to determine how best to use the information you collect. **GT**

In this video, Dr. Bruce Bugbee explains how Apogee Instruments meters are used to provide PAR, DLI and photoperiod measurements in commercial greenhouses.

Daily light integral (DLI) maps detail light delivered daily during each month across the entire U.S. [These maps](#) were researched and developed by James Faust of Clemson University and Joanne Logan of The University of Tennessee.