

Maximizing the Benefits of Supplemental Lighting

The amount of photosynthetic light inside greenhouses can be a limiting factor when crops are grown during the winter and early spring. For most ornamental crops, a common goal is to deliver an average daily light integral (DLI) of at least 10-12 mol·m⁻²·d⁻¹, while that for vegetable crops is often higher.

The only way to increase the DLI in a meaningful way is to provide high-intensity supplemental lighting from electric lamps, such as high-pressure sodium (HPS) fixtures or light-emitting diodes (LEDs). Purchasing, installing and operating lighting is fairly expensive, so it's wise get the most out of your lighting.

Here are some tips and considerations to maximize your supplemental lighting system.

Operation of lamps.

Consider when you run your lamps on both a daily and seasonal basis. There is little to no benefit of operating lights when it's sunny outside. Thus, lamps should be controlled by an environmental control system or a quantum sensor, and not simply run on a timer.

- Operate lamps only at night and during cloudy weather.
- Turn the system off when the average DLI exceeds 10-12 mol·m⁻²·d⁻¹. For growers in the northern U.S. and Canada, this usually begins in March or early April.
- If you have HPS lamps controlled by a computer, have different on/off settings so there is a deadband, ensuring that lamps don't repeatedly turn off and on during partly cloudy conditions. Repeated on/off cycles reduces the longevity of bulbs. This is not the case with LEDs, so they can turn on/off based on instantaneous conditions.

Uniform intensity. Crop growth is more uniform when the intensity of supplemental lighting is uniform. When lamps are installed without a specific lighting plan produced by your lighting supplier, intensity can be quite variable. Under higher light, growth is increased and plants dry out faster than plants under less light, which makes moisture management difficult. In

addition, non-uniformity during the young plant stage can lead to non-uniformity after transplant.

Replace/clean HPS bulbs and reflectors. The output of light from an HPS bulb decreases as it ages. A standard recommendation is to replace HPS bulbs after around 12,000 hours of operation, when their output is 85 to 90 percent of the original intensity. Although bulb output decreases, they still consume the same amount of energy, so their lighting efficacy

decreases while the benefits to crops also decrease. In addition, one out of ten bulbs fail after 14,000 hours of use.

Over time, both bulbs and reflectors get dusty and dirty, which each reduce the amount of light to your crops. Research at Utah State University showed that dirty bulbs and reflectors can each reduce light output by as much as 10 to 15 percent. Therefore, periodically cleaning bulbs and/or reflectors (every year or two) is recommended by most, but not all, lighting companies. Contact them for recommended cleaning methods.

Ensure other factors aren't limiting. The major "ingredients" to photosynthesis are light, carbon dioxide (CO₂), and water, plus adequate nutrition. If CO₂, water or fertility are too limited, the benefits of supplemental lighting are reduced. Water and fertility are often managed to suppress extension growth, which is fine, assuming that plants don't experience nutritional deficiencies, and plants

aren't withheld from water to the point of wilting. CO₂ is usually not measured in a greenhouse, but it can become limiting in tightly-sealed greenhouses that are full with plants. In that case, consider periodically bringing in fresh air when lighting, or enrich the greenhouse with supplemental CO₂.

Time to upgrade? The efficacy of lighting (the conversion of electricity into photosynthetic light) has increased dramatically in the past few years, for both HPS lamps and LEDs. If you have old HPS lamps, consider upgrading to new fixtures, especially if your electricity rate is high. The most efficient HPS lamps are now at least twice as efficient as older lamps, and the most efficient LEDs are nearly three times more efficient. Run the numbers to determine if an upgrade is a worthwhile investment. [gpn](#)



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