GROWING KNOWLEDGE

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Lighting the way for houseplants

Oregon grows plants well — but winter light is limiting

BY LLOYD NACKLEY, CLINT TAYLOR AND DALYN MCCAULEY

Oregon is one of the best places in the country to grow plants. Mild temperatures, abundant water, long growing traditions, and a skilled workforce have made our state a national leader in nursery and greenhouse production.

But winter production in Oregon has a familiar dark side: month after month where sunshine is in short supply.

Everyone knows Oregon is wet. What's easier to overlook is how persistent fall and winter cloud cover sharply reduces the amount of usable light reaching crops, even in well-designed greenhouses. It's miserable for sun lovers, and for growers trying to maintain quality, consistency, and production timelines through the darker months, light can be the limiting factor.

That dark reality has pushed many greenhouse operations to consider supplemental lighting. The harder question isn't what lighting can do, but when it makes sense to invest.

How much light are your crops really getting?

Light drives photosynthesis, and photosynthesis drives growth. For greenhouse growers, one of the more useful ways to think about light is the total amount delivered over the course of a day — what we call daily light integral, or DLI.

For folks interested in DLI, the American Floral Endowment supported work by James Faust and Joanne Logan to create excellent, freely available DLI maps published in HortScience in 2018 that show how light availability shifts across the country month by month. »

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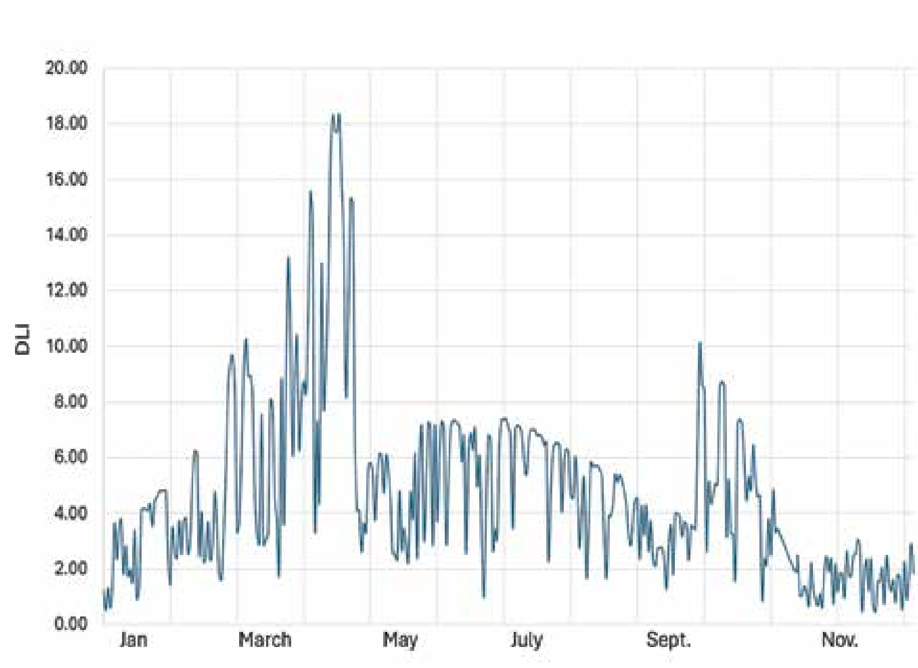
Greenhouse production area densely stocked with tropical foliage plants, including *Philodendron* 'Pink Princess'. Hanging baskets are used to maximize vertical space while also creating shade over crops below, illustrating the high value and intensive management typical of modern houseplant production. PHOTO BY LLOYD NACKLEY



Annual seasonal changes in daily light integral (DLI) measured in a double-walled poly hoop house in Oregon. DLI during winter months remained at or below ~4 mol·m^{-2}·d^{-1}, increased rapidly in spring, and declined in summer after black plastic shade cloth was installed, reducing DLI to approximately 6 mol·m^{-2}·d^{-1}. FIGURE BY LLOYD NACKLEY

DLI integrates day length, cloud cover, greenhouse transmission, and shading into a single value that reflects the total photosynthetically active light delivered to a crop. The DLI is measured in mol·m^{-2}·d^{-1} which is a way of measuring how much usable light a plant receives in a day, by counting the photons, or packets of light energy, hitting a square meter.

Research-based DLI maps show that during winter months, outdoor DLI across western Oregon often falls between 5 and 10 mol·m^{-2}·d^{-1}. Once greenhouse structure, glazing, condensation, and sun angle are accounted for, crops inside greenhouses may receive only 2–4 mol·m^{-2}·d^{-1} for extended periods.

At those levels, many crops don't stop growing — but they slow dramatically. Development stretches out. Uniformity declines. Finishing dates become harder to predict.

Houseplants: fast-growing markets, faster-changing targets

This light challenge intersects directly with one of the most dynamic segments of modern horticulture: houseplants.

Over the past decade, houseplants have surged from a niche category to a cultural phenomenon. Sales have roughly doubled, fueled by younger consumers, urban living, and a renewed interest in indoor spaces as living environments. Alongside this growth has come an explosion of books, magazines, podcasts, and social media devoted to houseplants, including influential voices based right here in Portland. We see you, @HousePlantClub @AriumBotanicals and @PistilsNursery.

For wholesale growers, this attention has been a double-edged sword.

Demand has never been higher, but trends now move at internet speed. A cultivar can command premium prices one season and become widely available just a few years later as propagation scales rapidly. The rise (and normalization) of *Monstera deliciosa* 'Thai Constellation' and *Philodendron* 'Pink Princess' are familiar examples: once rare, now far more accessible.

This isn't a failure of the market; it's the market working efficiently. But it does mean growers are operating in an environment where timing matters as much as quality.

From conversation to question

A few years ago, a group of us in the Nackley Lab were making the familiar drive down the road from the North Willamette Research and Extension Center to one of our nursery neighbors, **Little Prince of Oregon** (Aurora, Oregon). It's a short trip, and one we always look forward to.

Little Prince has built a reputation for great new plant selections and innovative production methods, but what really makes those visits memorable is the people. Whether we're being hosted by Mark, Alexa, or Mike, and lately running into familiar faces of recent Oregon State graduates now part of the next generation of Oregon nursery production, we end up doing what plant people do best: talking plants.

On this particular visit, the conversation centered on houseplants and their growing importance to the nursery's production portfolio. Demand was rising, new cultivars were coming online fast, and crops that once felt niche were suddenly occupying meaningful greenhouse space.

At some point, the conversation turned to a simple question: Would adding LED lighting to their heated hoop houses actually push production forward?

It sounded straightforward. It wasn't.

Why houseplants are different

Unlike established global greenhouse commodities, like tomatoes, cucumbers, peppers, or even leafy greens and floriculture crops, houseplants don't come with decades of lighting recipes. For lettuce or basil, we know exactly how much light is needed to hit specific growth targets. For poinsettias or bedding plants, lighting guidelines are well worn into extension manuals and grower intuition alike.

Houseplants are different.

We know they tolerate low light. In fact, that's part of why they've become so popular in homes and apartments. They don't collapse when placed ten feet from a window, and they forgive a lot of neglect. But tolerance isn't the same as optimization.

In their natural environments, many tropical foliage plants don't spend their entire lives in deep shade. They creep. They climb. They slowly work their way up trunks and stems, inching toward brighter canopy light. That behavior tells us something important: while these plants can survive low light, they may very well thrive — and finish faster — under higher light.

And that's where the question gets interesting for growers.

What we learned about light and houseplants

When growers bring us questions like

"Would adding lighting be worth it?", our job isn't to guess—it's to diagnose. At NWREC, we have tools that allow us to look directly at how plants respond to different light environments, particularly by measuring photosynthesis across a wide range of light levels.

Terms like "low," "medium," or "bright indirect" light work well at retail. But those categories don't tell a grower how fast a crop will finish, how consistently it will grow, or whether additional light will actually pay off in production.

To answer that question, we brought twelve commercially important tropical foliage cultivars into a controlled environment and measured their photosynthetic response across a wide range of light levels. The group included *Philodendron*, *Monstera*, *Syngonium*, and *Goeppertia* (often still referred to as *Calathea*).

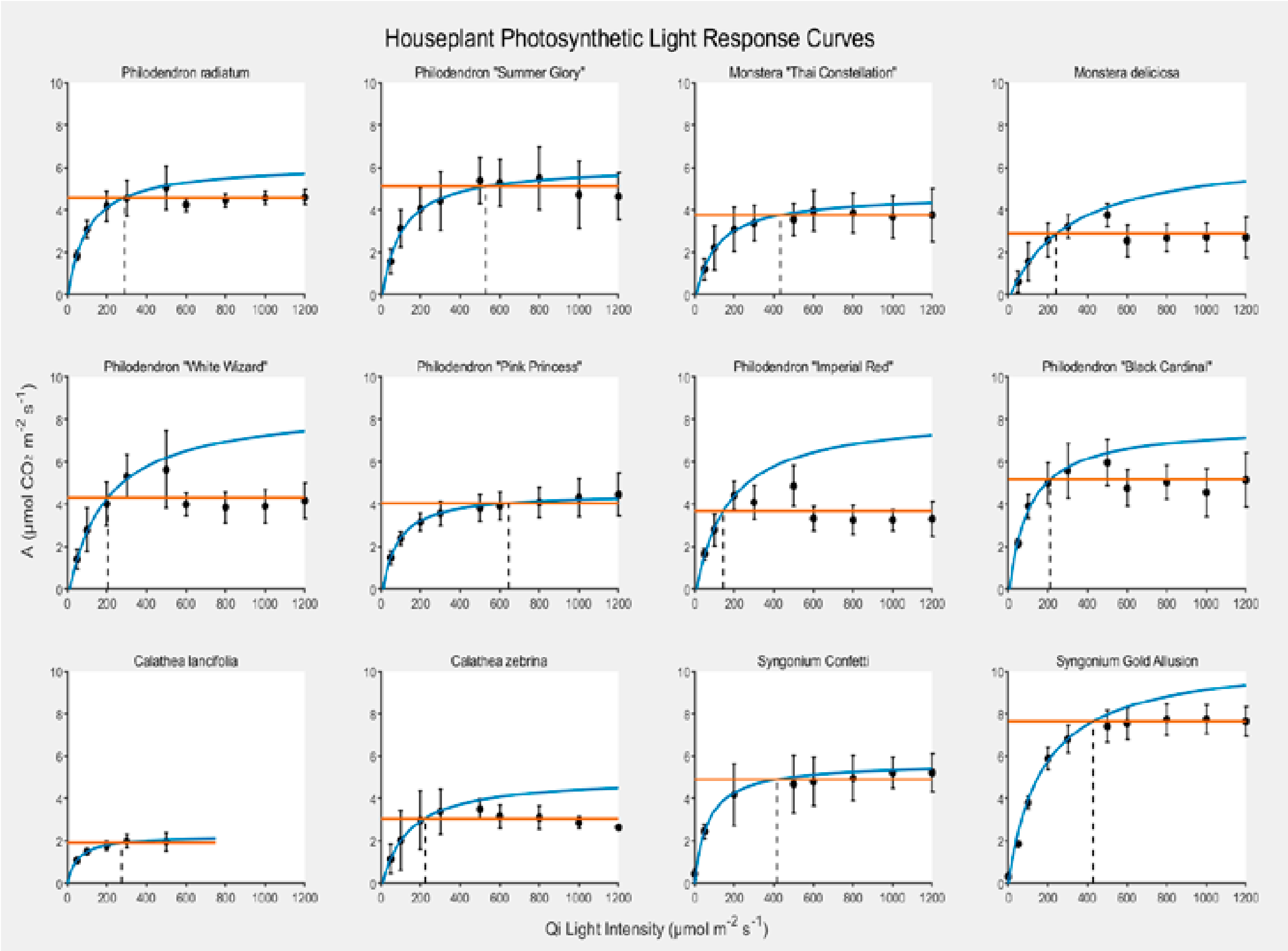
Plants were grown under uniform conditions and tested using a portable gas-exchange system, which allows us to measure how much carbon dioxide a leaf is taking up, which is a direct indicator of photosynthetic activity. Leaves were exposed to stepwise increases in light intensity, from near darkness to very bright conditions, and photosynthesis was measured at each step.

From those data, we derived three values that help explain how plants behave under different light environments:

- the light compensation point, where photosynthesis just balances respiration;
- the light saturation point, beyond which additional light no longer increases photosynthesis; and
- the light-saturated photosynthetic rate, which reflects how fast a plant can photosynthesize when light is no longer limiting.

One need not memorize those terms to understand the takeaway. What matters is how differently plants behaved.

Across the twelve cultivars, we observed substantial variation in how much light plants could use effectively. Some species reached photosynthetic saturation at relatively low light levels. Others continued to respond positively as light



Photosynthetic light response curves for 12 houseplant cultivars showing variation in light requirements. *Calathea* species reached photosynthetic saturation at relatively low light levels, whereas several *Philodendron* and *Syngonium* cultivars exhibited higher light saturation points and greater photosynthetic capacity. FIGURE BY CLINT TAYLOR

increased, well beyond what winter greenhouses in Oregon typically provide.

Goeppertia species were the most shade-adapted. They saturated photosynthesis at lower light levels and maintained modest photosynthetic rates, reinforcing why they tolerate dim interior environments so well. From a production standpoint, this suggests that pushing light much beyond moderate levels may offer limited returns for these crops.

Philodendron and *Monstera* cultivars occupied the middle ground. They tolerated low light, but many did not saturate photosynthesis until moderate irradiance levels were reached. Darker *Philodendron* showing higher light requirements than some of the other green counterparts, helping explain why these plants often struggle to maintain quality under dim production conditions.

Syngonium stood out as the most light-responsive group. These cultivars achieved the highest photosynthetic rates of any plants we tested. In practical terms, *Syngonium* may survive under low light, but it is poorly matched to low-light production systems if speed and efficiency are the goal.

Taken together, these results reinforce an important distinction: tolerance is not the same as optimization. For several popular taxa, photosynthesis remains light-limited at intensities commonly delivered during winter production in Oregon greenhouses.

When curiosity turns into commitment

Those early conversations at Little Prince weren't happening in isolation. Similar questions were surfacing across Oregon greenhouses. Growers weren't asking whether LED lighting worked — that much was becoming clear — but whether it worked for their crops, their systems, and their timelines.

Some operations had already crossed that bridge. Long-established greenhouse producers in Oregon, such as **Peoria Gardens** (Albany, Oregon), made the transition to LED lighting years ago as part of broader investments in greenhouse modernization and energy efficiency. What stood out in those early adopters wasn't dramatic winter growth under dark skies, but something more subtle — and more valuable: control. Take a look at the DLI chart. Just two weeks of persistent cloud cover can cut daily light in half (from 4 to 2 $mol \cdot m^{-2} \cdot d^{-1}$) slowing plant growth and potentially creating plant health issues if irrigation and fertility are not adjusted accordingly.

At **Oregon Flowers** (Aurora, Oregon), the decision to install LED lighting wasn't driven by novelty or trend-following. When a new greenhouse was constructed several years ago, the operation relied on familiar high-pressure sodium systems. What changed wasn't just economics — it was information.

Energy prices climbed. Incentive programs through Energy Trust of Oregon lowered the upfront barrier to adoption. And lessons from Europe demonstrated that the LED learning curve was manageable.

A similar story has unfolded at **Al's Garden & Home** (Woodburn, Oregon), where LED lighting was introduced not to chase winter growth, but to shave time off early spring production.

Across these examples, a clear pattern emerges. Supplemental lighting delivers the greatest return when daily light integral is genuinely limiting growth, crops are capable of responding to additional light, and the rest of the production system is already dialed in.

The real question

For many growers, the most important question is not whether plants can grow under low winter light — they usually can. The real question is whether supplemental lighting changes the production timeline. If added light allows growers to finish crops faster, turn inventory more quickly, and hit narrow market windows more reliably, then lighting becomes less of a cost and more of a strategic investment.

Oregon remains an exceptional place to grow plants. But during winter, light is often the hidden constraint shaping greenhouse performance. Supplemental lighting, used thoughtfully, can move crops out of survival mode and into predictable, efficient growth.

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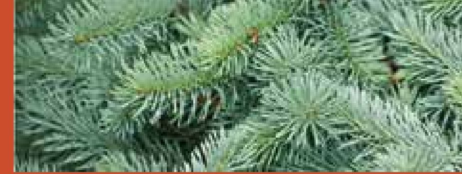
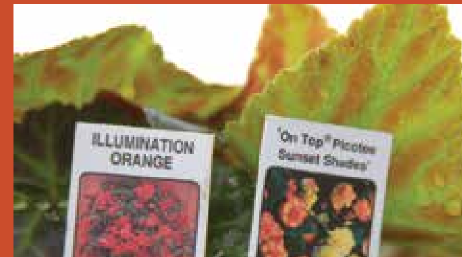

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