Case study
Purdue University

Location	West Lafayette, Indiana, USA
Philips Lighting	Philips GreenPower LED research module

PHILIPS

"With LED lighting technologies, we are able to provide light that plants can utilize for photosynthesis and potentially save on energy"

Dr. Roberto Lopez, associate professor of horticulture
Christopher Currey, Ph.D. student
Wesley Randall, M.S. student

Background

In 2010, the Department of Horticulture at Purdue University received a four-year grant from the US Department of Agriculture. The grant is to help fund research regarding how LED technologies could be used as supplemental, photoperiodic, and photomorphogenic lighting in commercial greenhouses that grow bedding plants (young and finish) and vegetables (transplants and high-wire). Currently, this $6-billion-a-year industry uses High-Pressure Sodium (HPS) lamps to supplement daylight and incandescent bulbs for photoperiodic lighting at various stages of the growing process. However, much of the energy used to power HPS lamps is wasted in producing heat – only 30% of the energy is converted to photosynthetically active radiation or PAR that the plant can utilize for photosynthesis.

The seed-propagated bedding plant project is supported by Philips and four-year USDA project is in collaboration with commercial growers, as well as by other research institutes such as Rutgers University, the University of Arizona, Michigan State University, and the Orbital Technologies Corp.

The challenge

LED technology is an ideal candidate to potentially replace HPS lamps in commercial greenhouses. LED lamps are energy-efficient, long-lasting, and can be placed close to seedlings or mature plants. However, each plant species may have its own optimum mix of light wavelengths. Hence, the challenge was to find the correct blue and red lighting ratio during seed propagation of the ten most popular bedding plants sold in the US – plants such as petunia, pansy, geranium, and marigold.

'Our research will enable specialty-crop growers to transition from HPS lamps to the much more efficient LED technologies,' says Cary Mitchell, professor of horticulture and project director of the USDA study. 'We will do this by working with industry to test and refine implementation strategies that will significantly reduce energy-related costs, maintain or increase production quality, and reduce negative environmental impacts. By developing a strong best-practice process for LED implementation, while performing a rigorous economic

By developing a strong best-practice process for LED implementation, our research will encourage the economic sustainability and growth of specialty crops in the United States

Facts

Grower
Purdue University
Sector
University research for bedding and pot plant growers
Crop
Ten most popular bedding and potted plants in the USA
Location
West Lafayette, Indiana, USA
Solution
Philips GreenPower LED research module
Philips LED Horti Partner
Hort Americas
Results
Our research will enable specialty-crop growers to transition from HPS lamps to the much more efficient LED technologies

and marketing analysis, our research will encourage the economic sustainability and growth of specialty crops in the United States.'

The solution

One of the major advantages of LED light sources is that they are dimmable and available in various colors, including deep red, blue, and far red. By testing a variety of LED lighting combinations, the project has identified the best ratio for ten plant species. Other significant observations included:

- Higher plug quality than those produced under HPS lamps;
- A combination of red and blue LEDs seem to be effective in producing compact, fully-rooted seedlings of some species;
- LEDs resulted in cuttings with growth comparable to those grown under HPS;
- Photosynthesis of cuttings was not significantly affected by supplemental light source.

Benefits

Although the four-year project started in 2010 and is currently ongoing, the energy-saving benefits are clear: to enable an HPS lamp to provide the correct amount of light in the wavelengths required, it needs 6.42 kWh per day. For the same amount of light in the correct wavelengths, an LED lamp needs only 2.83 kWh per day – a saving of 56%! In addition, future research at Purdue will determine if it is possible to propagate bedding plants in multilayer

"The energy saving is clear: a saving of 56%!"

environments without any daylight. This could mean: reduced cultivation time, better-controlled cultivation processes, better plant quality and uniformity, continuous delivery all year round, and more efficient use of space.

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