LED Lighting for Aeroponics Agriculture

For many millenia, agricultural production has been dependent on the sun, the rain and the control of pests. New technology, though, is bringing farming indoors with aeroponic growth systems that produce crops without soil, sun or pesticides. Aeroponics agriculture, also known as “vertical farming,” promises a safe, sustainable source of food using less land and less energy. The success of aeroponics technology, however, is highly dependent on the lighting system employed.

Through the LRC’s Lighting Technology Greenhouse (LTG), a program that promotes the growth and success of lighting-related businesses, the LRC developed a prototype LED lighting system for AeroFarms, a New York-based company that develops aeroponic systems and technologies.

LEDs for Growing Veggies

Grow lights in greenhouses are common and typically use high-pressure sodium (HPS) lamps. HPS lighting has high luminous efficacy and long life, two priorities for greenhouse growers, but its spectral wavelengths and intensity cannot be optimized for different plant species. Further, its luminous efficacy is calculated based on the human visual system. Plants, on the other hand, may require a different type of lighting efficacy.

The ability of LEDs to be “tuned” can potentially produce better results. Their spectrum and intensity can be controlled and optimized for each plant species grown. Improved light uniformity and low heat radiation from LEDs, along with a timed duration of light exposure, also can improve crop yields and quality for leafy greens and other produce.

An LRC research technician measures illuminance levels of the prototype lighting system prior to field evaluations.

Prototype LED System

The project objective was to develop a prototype lighting system using LEDs that would enable AeroFarms to investigate different temporal and spectral lighting characteristics to optimize the growth of leafy greens while reducing energy costs. The prototype system built by the LRC uses LED arrays with three independently controlled wavelengths (425 nm, 625 nm and 660 nm) necessary to grow leafy greens while excluding all other spectral wavelengths. A target frequency and duty cycle (dimming) for the LED arrays were established as well. In addition, fine-tune controls allow for incremental testing of the effects of wavelength, intensity and exposure duration on plant growth. This functionality allows the grower to determine the optimal lighting conditions for indoor farming that will ultimately result in higher yields, higher quality, and reduced energy consumption.

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Lighting Research Center, Rensselaer Polytechnic Institute • 21 Union Street • Troy, NY 12180 • (518) 687-7100 • www.lrc.rpi.edu