

PAR sensors and LED technology

Michael Stasiak, TechNote 004-2011

PAR sensors, or more specifically radiation sensors that measure the 400-700 nm band of light that is considered to be most beneficial to plant growth, are ubiquitous in the field of closed environment plant research. The 'Minimum Guidelines for Measuring and Reporting Environmental Parameters for Experiments on Plants in Growth Rooms and Chambers' published by the International Committee for Controlled Environment Guidelines requires growth room radiation to be recorded in $\mu\text{mol m}^{-2} \text{s}^{-1}$ of Photosynthetically Active Radiation (PAR). For sunlight and broad spectrum radiation sources such as metal halide, fluorescent and high pressure sodium lamps, this has been a suitable method for recording radiation quantity for comparative purposes between different growing environments. For discrete wavelength LEDs which have narrow bandwidths not so much. A green LED with a wavelength between 520 and 540 would have a different photosynthetic response than a red or blue LED, even if PAR readings were identical. Different wavelengths have different responses.

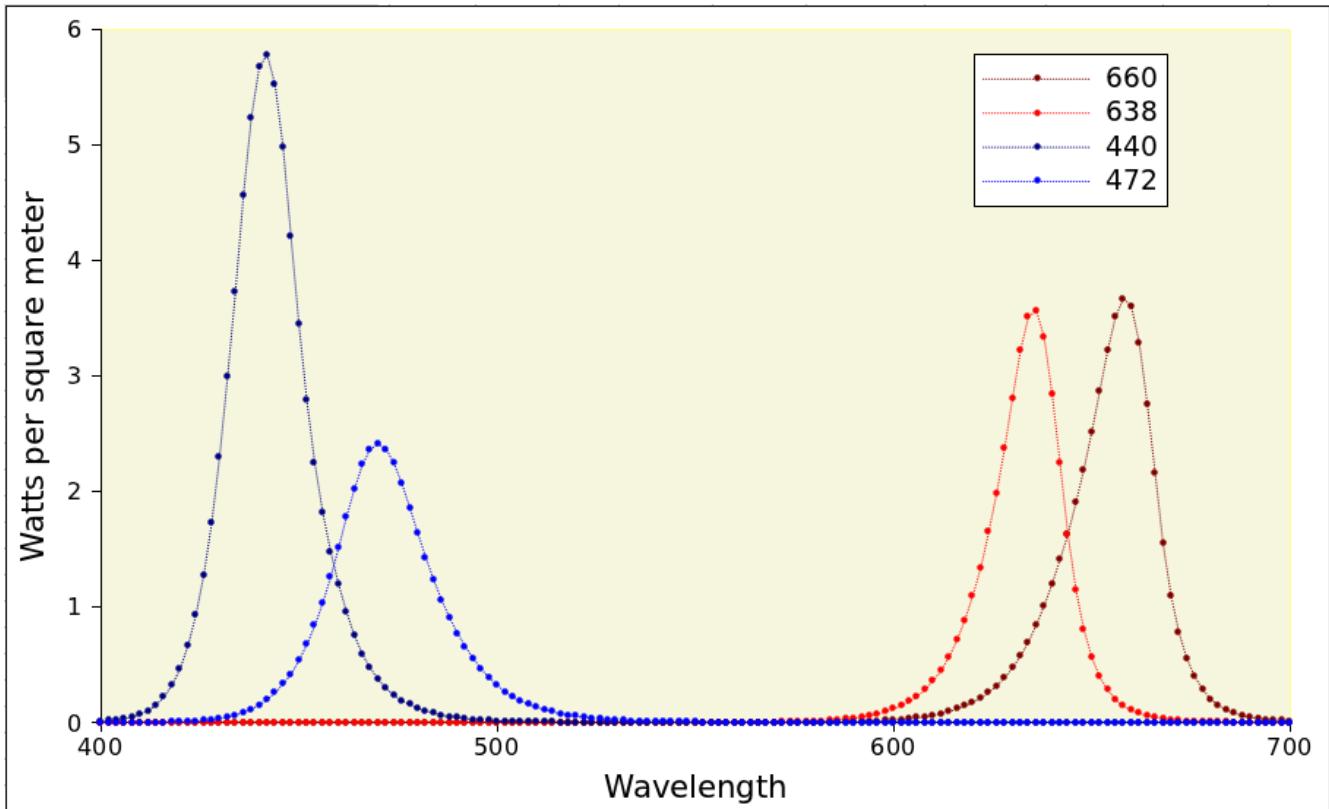


Figure 1: Wavelengths of four Philips Rebel LEDs scanned using a LI-COR LI-1800 Portable Spectroradiometer

What about the type of PAR sensor used for the measurement. Again, for broad spectrum

sources most commercial PAR sensors do a great job. Using four different Philips Rebel LEDs (Figure 1), we tested the PAR response of an Apogee Quantum sensor (SQ120) and LI-COR Quantum sensor (LI-190) at a number of different distances. As expected based on literature provided by the manufacturers, the Apogee sensor underestimated the response of the blue LED @ 444nm and the red LED @ 660nm. This is because the sensor does not respond well to wavelengths below ~450 and above ~650. If reporting radiation in a growth room or controlled environment using red and blue LEDs at these wavelengths, the PAR sensor reading will be significantly below the actual value.

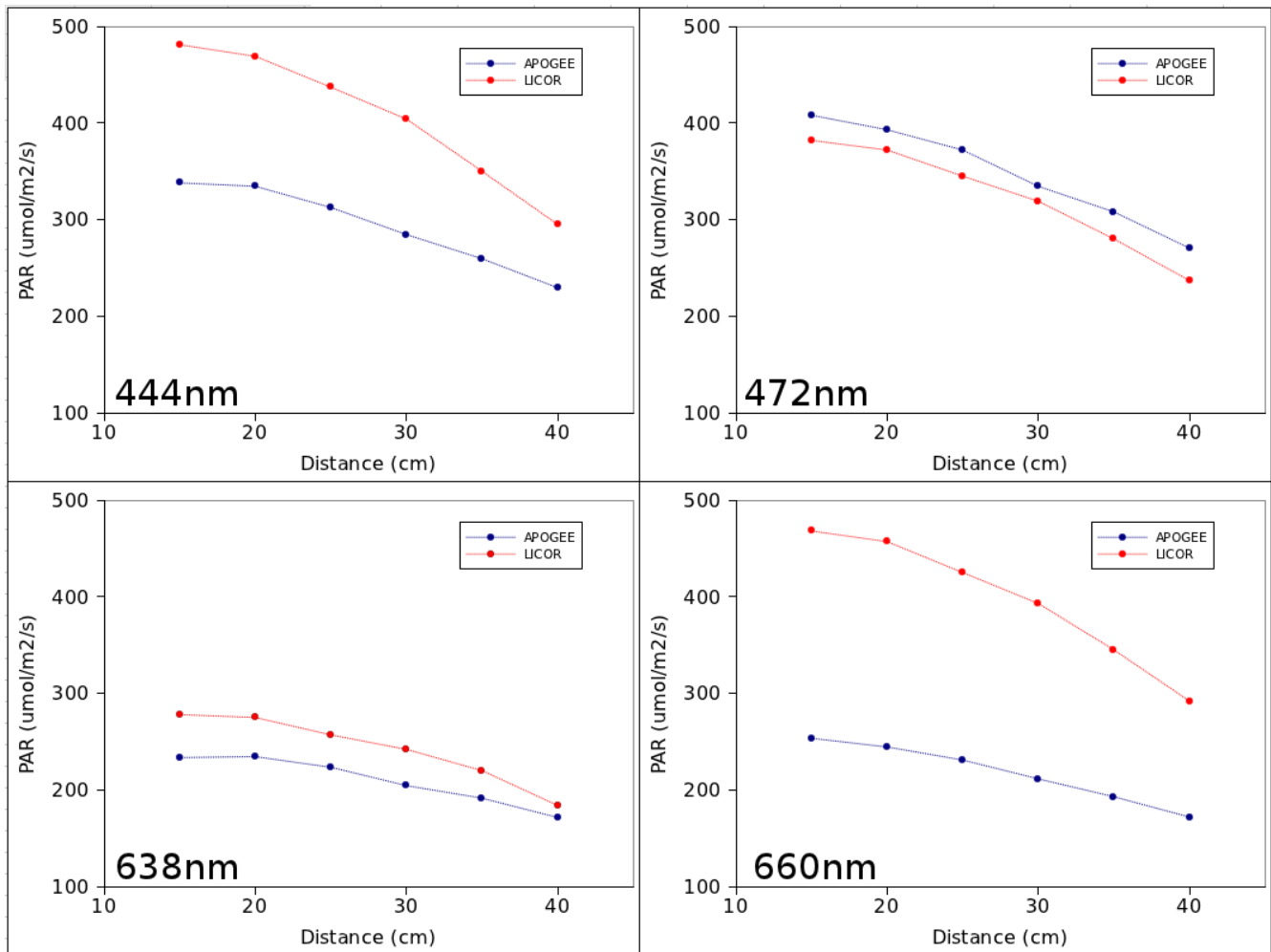


Figure 2: PAR vs. distance with four Philips Rebel LEDs and comparing response of a LI-COR quantum sensor with an Apogee quantum sensor

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