

Horticultural Lighting

There has been increasing interest in supplemental lighting to improve quality and yield for plant production. The most widely used light source is high pressure sodium (HPS), but many lighting manufacturers are making claims about LED products that save energy compared with the incumbent technology. However, it can be difficult to compare light sources for horticulture because standard test methods have not yet been developed and product manufacturers rarely publish the data needed to make an accurate comparison.

Method

The LRC compared two 600W HPS horticultural luminaires with five LED horticultural luminaires that were closest in performance to the 600W HPS according to each manufacturer.

Plants make use of light differently than people do, so a plant-specific metric is needed to measure the flux from these luminaires. The unit of lumens accounts for the human fovea's response to light by wavelength, while yield photon flux (YPF) accounts for plants' relative photosynthetic response by wavelength, as determined by K. J. McCree.¹

The spectral power distribution can affect the height, flavor, and other qualities of plants. The LRC measured the spatial uniformity on the plant canopy from the luminaires to determine if different plants in a greenhouse would be exposed to different chromaticities of light depending on their location.



¹ McCree, K.J. 1972. The action spectrum, absorptance and quantum yield of photosynthesis in crop plants. *Agricultural Meteorology* 9:191-216.

Sponsor

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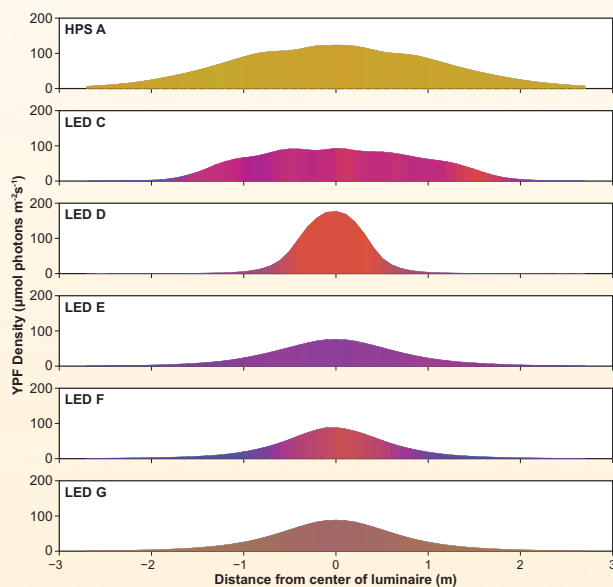


Results

The results show that two of the five LED horticultural luminaires provided a higher YPF efficacy than either HPS luminaire. However, none of the LED luminaires produced as much absolute YPF as the HPS luminaires, so more luminaires would be needed to provide an equal amount.

| Light Source | Price (US\$) | YPF ($\mu\text{mol photons/s}$) | YPF Efficacy ($\mu\text{mol photons/s}\times\text{W}$) |
|--------------|--------------|-----------------------------------|--|
| HPS A | 400 | 881.4 | 1.277 |
| HPS B | 350 | 885.6 | 1.371 |
| LED C | 1200 | 705 | 1.897 |
| LED D | 1400 | 362.3 | 1.311 |
| LED E | 1200 | 296.6 | 1.029 |
| LED F | 1000 | 337.8 | 1.135 |
| LED G | 1600 | 417.9 | 1.437 |

The results also show that the LED luminaires that use a mix of LEDs of different colors have greater spatial color variation than the tested HPS luminaire (HPS A) and the luminaire that uses phosphor-based LEDs (LED G).



Spatial variation in luminaire chromaticity. This assumes that each luminaire is mounted 1 meter above the plant canopy.

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