Spectral characteristics of lamp types for plant biology

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1. Biologically weighted UV using weighting of sunlight, since the PPE is greater than 0.72. According to the PPE, the radiation from all lamps is low in UV radiation, although measurement of the weighted UV is recommended to quantify the UV effects, but this measurement must be made with a UV calibrated spectro-radiometer capable of accurate measurements to 280 nm.

2. Blue light is low in HPS lamps. Mixing of HPS and MH lamps, or using Ceramic Metal Halide lamps is necessary to provide adequate blue light with high intensity and efficiency.

3. The ratio of YPF to PPF ranges from 0.89 to 0.91 for most light sources. Higher values for this ratio (0.95; HPS lamps) indicate that plant growth might be slightly better than the PPF as measured by a standard quantum sensor.

4. The spectrum of the Philips Agro Ceramic Metal Halide lamp (3100K) is shifted toward the red wavelengths. This change increases the YPF/PPF ratio from 0.892 to 0.898.

5. The PPF/kilolux ratio can be used to interconvert between visible light and PPF. This conversion is based on the new luminous efficiency function (CIE 2006).

6. The red/far-red ratio varies widely because there are only trace amounts of far-red radiation from many lamps. The measurement of Phytochrome Photoequilibria (PPE) may provide a more comprehensive measurement of the effects of phytochrome on plant development, but PPE still underestimates the effects of blue light. According to the PPE, the radiation from all common lamps would be perceived as bright sunlight, since the PPE is greater than 0.72.

Footnotes:
2. Phytochrome Photo-Equilibrium, also called PPS (Phytochrome Photo-Stationary State).
3. Measured with a Skye Instruments Red/Far Red Sensor, which has two bell-shaped curves with 655 and 735 peaks. Each curve is ±20 nm.
4. Calculated from spectrometer to approximately match Skye Sensor; square wave with equal weighting of photons.
5. Filtered through a glass barrier.
6. LICOR model 1800-02 Calibration Lamp.