



**Effect of Lamp Type and Placement on PPF and Uniformity
In Conviron E15 Chambers**

The following study was conducted at Utah State University Crop Physiology Laboratory in Logan, UT in March 2012. Under the direction of Bruce Bugbee, PhD it was completed after a Conviron E15 reach-in chamber operating T12 fluorescents was upgraded with six of Cycloptics All-Bright® luminaires installed onto the movable light rack.

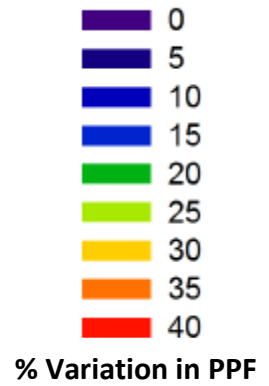
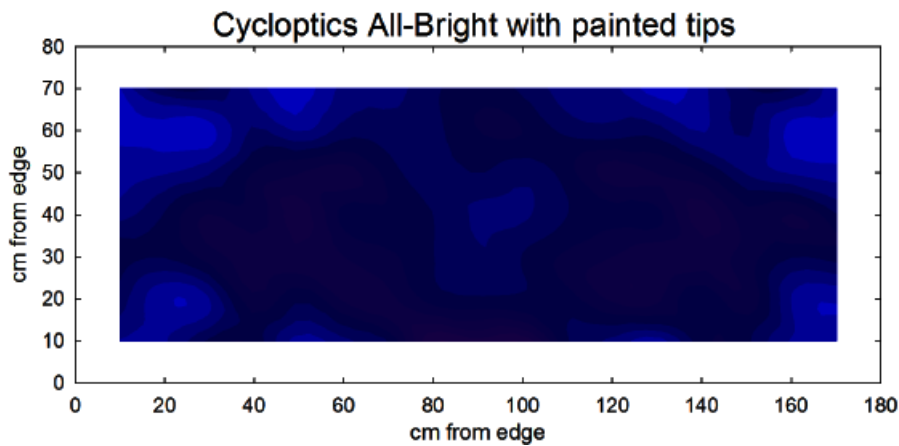
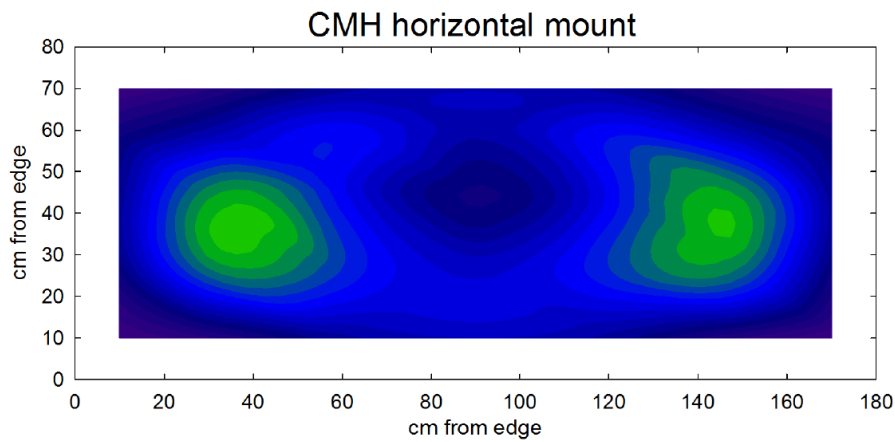
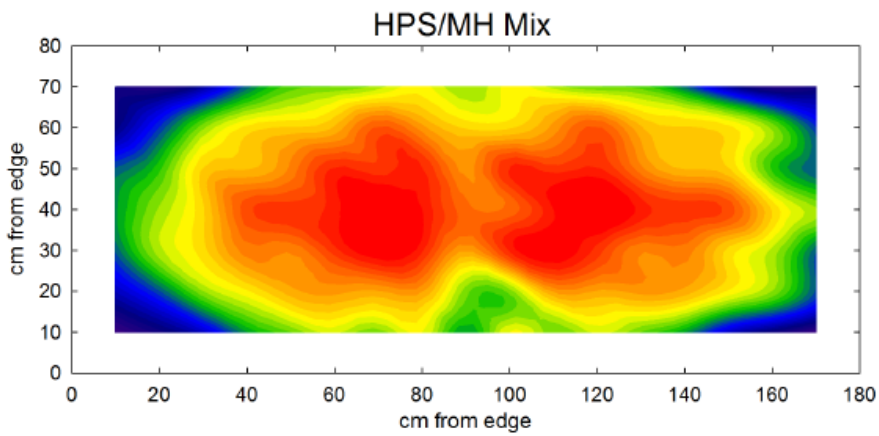
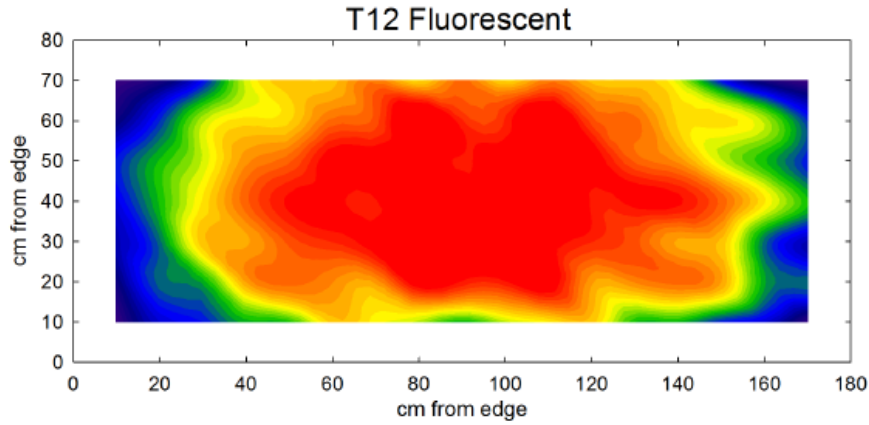
The following chart summarizes the comparative PPF and Uniformity of four 15 chambers operating:

1. T12 Fluorescents on the movable light rack from Conviron
2. A 50/50 mix of eight, 400W HPS and MH lamps mounted to the moveable light rack from Conviron
3. Two sets of three bare-bulb Philips Elite Agro 315W ceramic metal halide (CMH) lamps horizontally mounted to the ceiling of the Conviron chamber
4. Six, All-Bright luminaires mounted onto the Conviron movable light rack and operating Philips Elite Agro 315W CMH lamps in a vertical position.

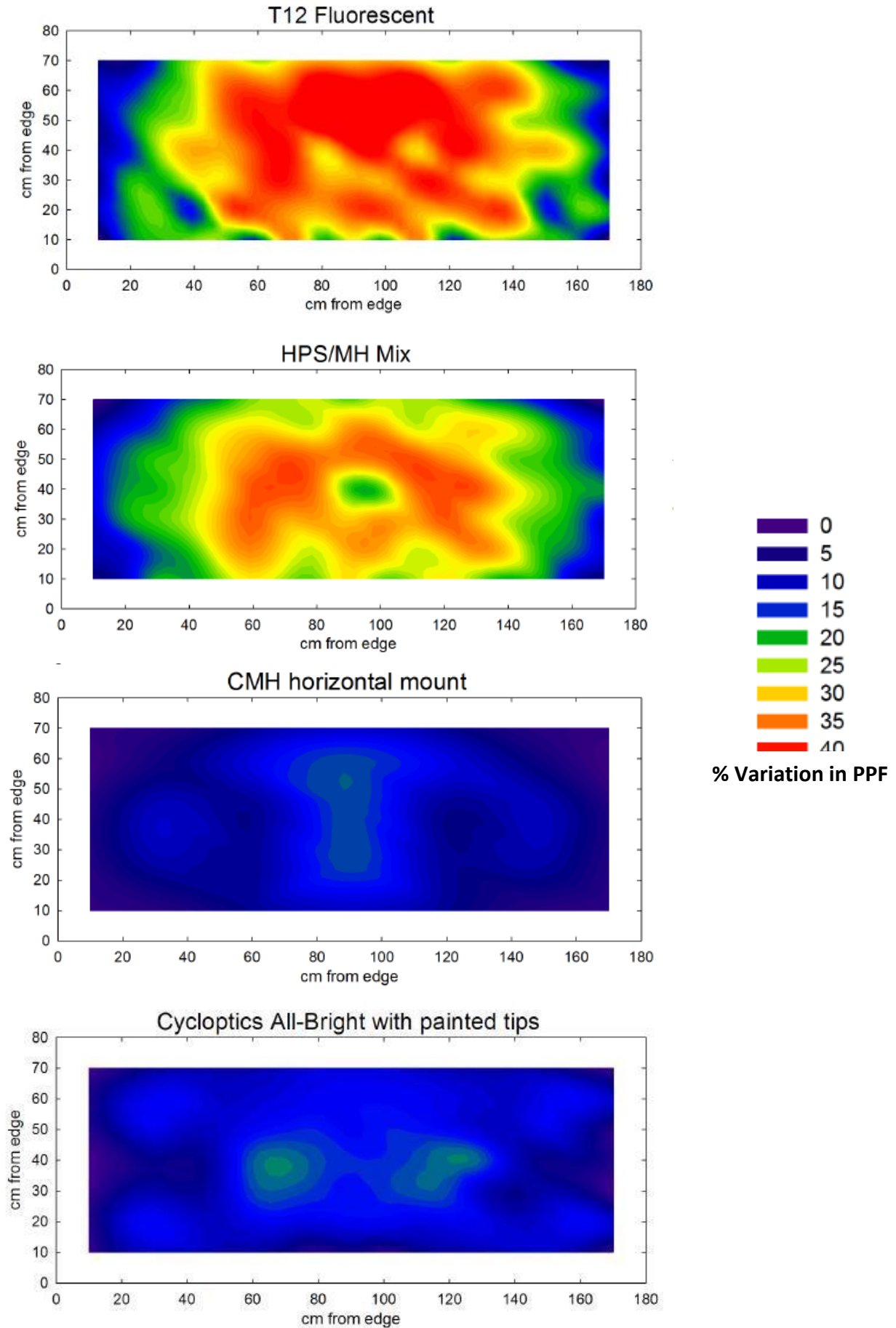
The PPF and Uniformity of each lighting method was measured at distances of 50 cm and 80 cm below the lights.

| Utah State University Crop Physiology Laboratory Study Effect of Lamp Type and Placement on PPF and Uniformity in Conviron E15/PGR15 Chambers | | | | | | | | | |
|--|--|-------|-------------------|-------|------------------------------|-------|-------------------------|---------|-------|
| Distance Below Lights | Average PPF | | Max/Min Variation | | Coefficient of Variation (%) | | Average of Both Heights | | |
| | 50 cm | 80 cm | 50 cm | 80 cm | 50 cm | 80 cm | Average | Max/Min | CV % |
| T12 Fluorescent | 741 | 579 | 1.7 | 1.48 | 12.7% | 8.9% | 428 | 1.59 | 10.8% |
| 400W HPS/MH | 1638 | 1352 | 1.65 | 1.37 | 11.3% | 7.1% | 1495 | 1.51 | 9.2% |
| CMH Horizontal Mount | 1532 | 1178 | 1.27 | 1.16 | 7.3% | 4.1% | 1355 | 1.22 | 5.7% |
| All-Bright® CMH Vertical Mount | 1595 | 1161 | 1.17 | 1.17 | 3.5% | 3.7% | 1378 | 1.17 | 3.6% |
| T12 Fluorescent | Sixteen, 6-foot VHO Cool White fluorescent tubes with two, 18" tubes on each end mounted to the movable light rack. All adjusted to new tube brightness. | | | | | | | | |
| 400W HPS/MH | Four each of 400W high pressure sodium and metal halide lamps mounted to the chamber ceiling. | | | | | | | | |
| Ceramic Metal Halide Horizontal Mount | Two sets of 3 bare bulb Philips Elite Agro 315W ceramic metal halide lamps horizontally mounted to the chamber ceiling. | | | | | | | | |
| All-Bright® Reflector CMH Vertical Mount | Six commercially available All-Bright reflectors installed onto the movable light rack operating Philips Elite AGRO 315W ceramic metal halide lamp in a vertical position. The lamp tip is coated with a 16 mm circle of high heat aluminum paint. | | | | | | | | |

Lamp Type and Placement Comparison of PPF Uniformity at 50 cm

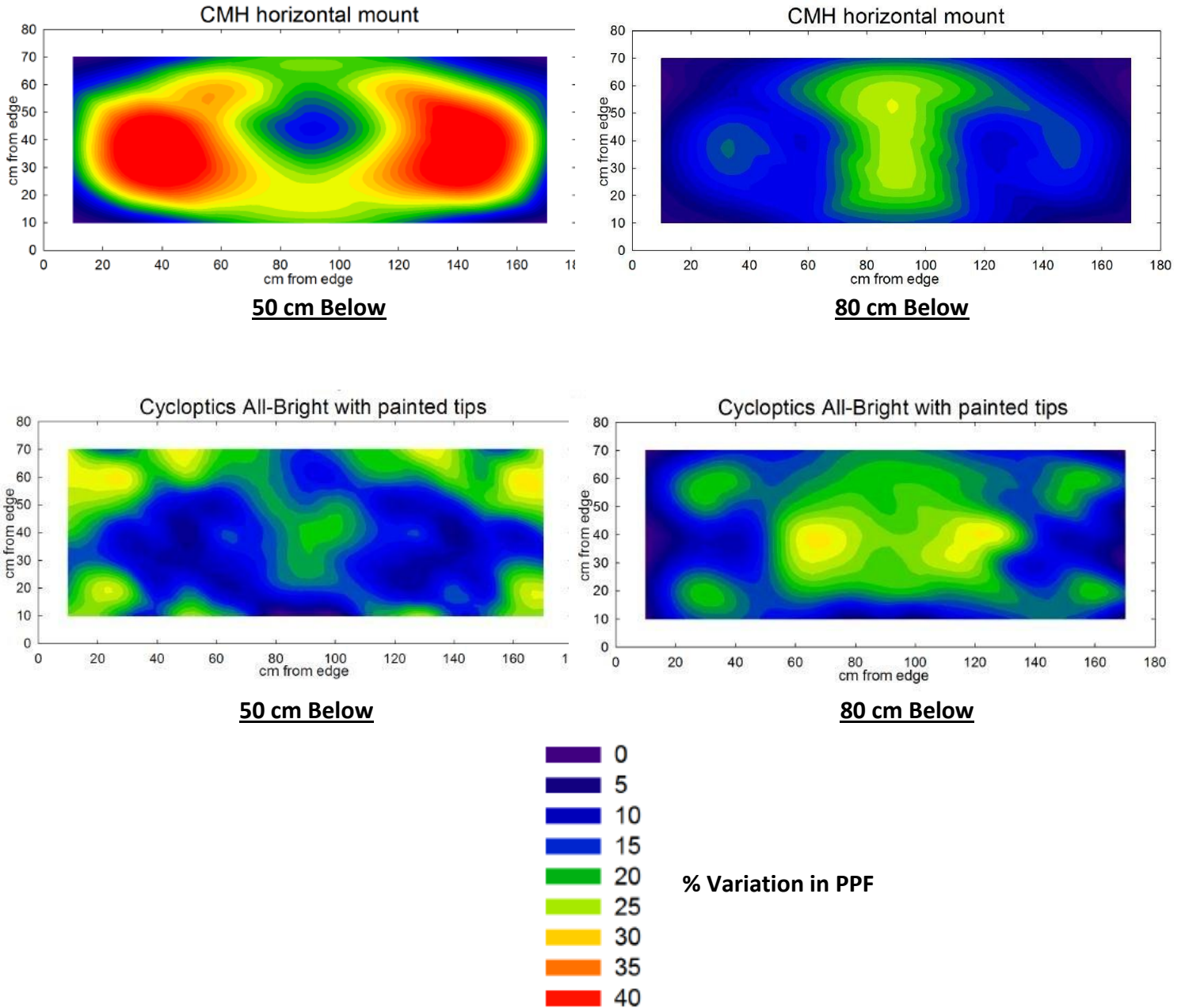


Lamp Type and Placement Comparison of PPF Uniformity at 80 cm



PPF Variation Comparison at 50 cm and 80 cm

Two Sets of Three Horizontal Mount Bare-Bulb Philips Elite Agro 315W CMH Lamps
And
Six, All-Bright Fixtures Operating Philips Elite Agro 315W CMH Lamps



*For further information about the performance improvement potential of All-Bright® lighting
In new chamber installations or upgrading T12 and HID single-tier chambers please contact:*

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