

Effects of Monochromatic and Broad Spectrum light on Growth and Development of Six Crops



M. Chase Snowden and Bruce Bugbee
Crop Physiology Laboratory, Utah State University

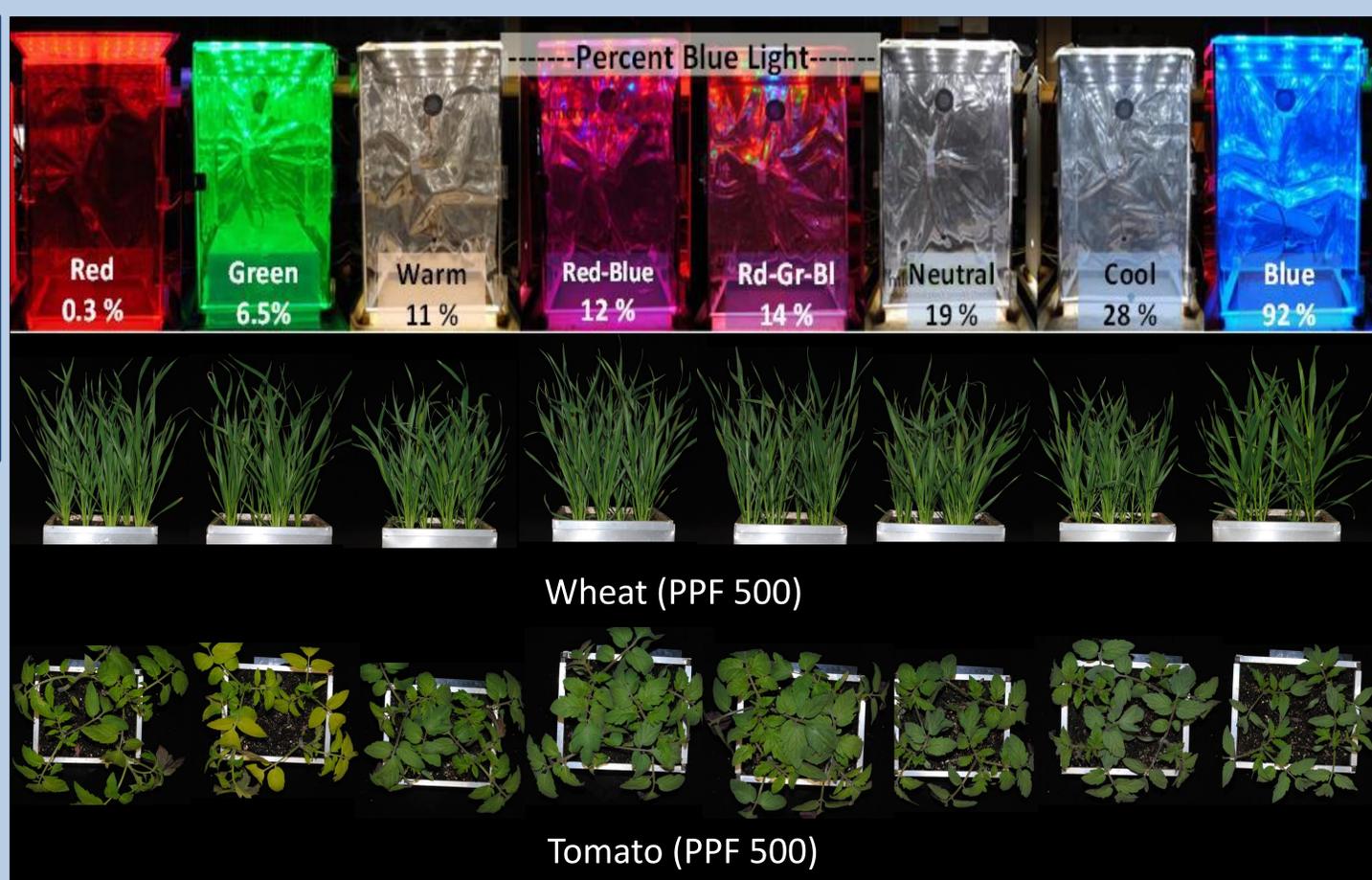
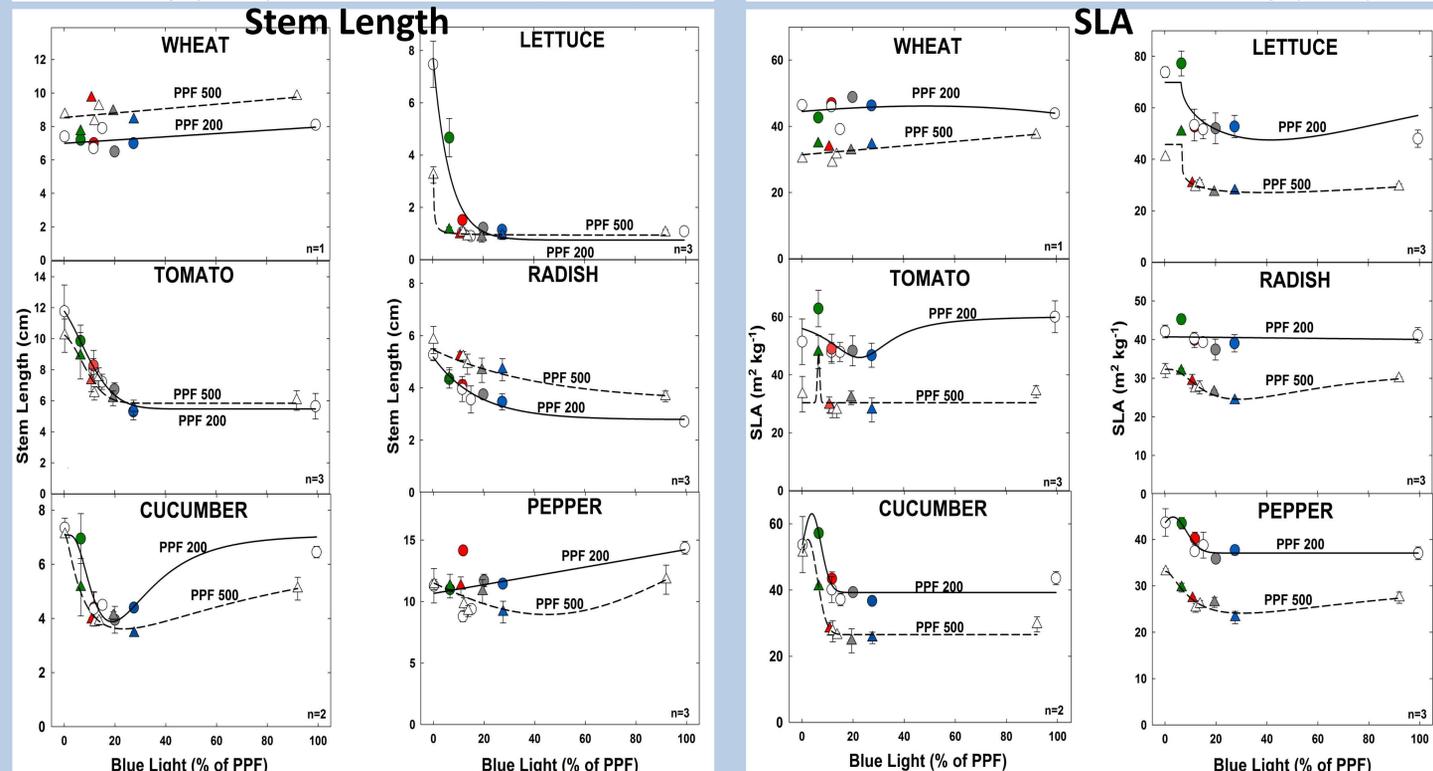
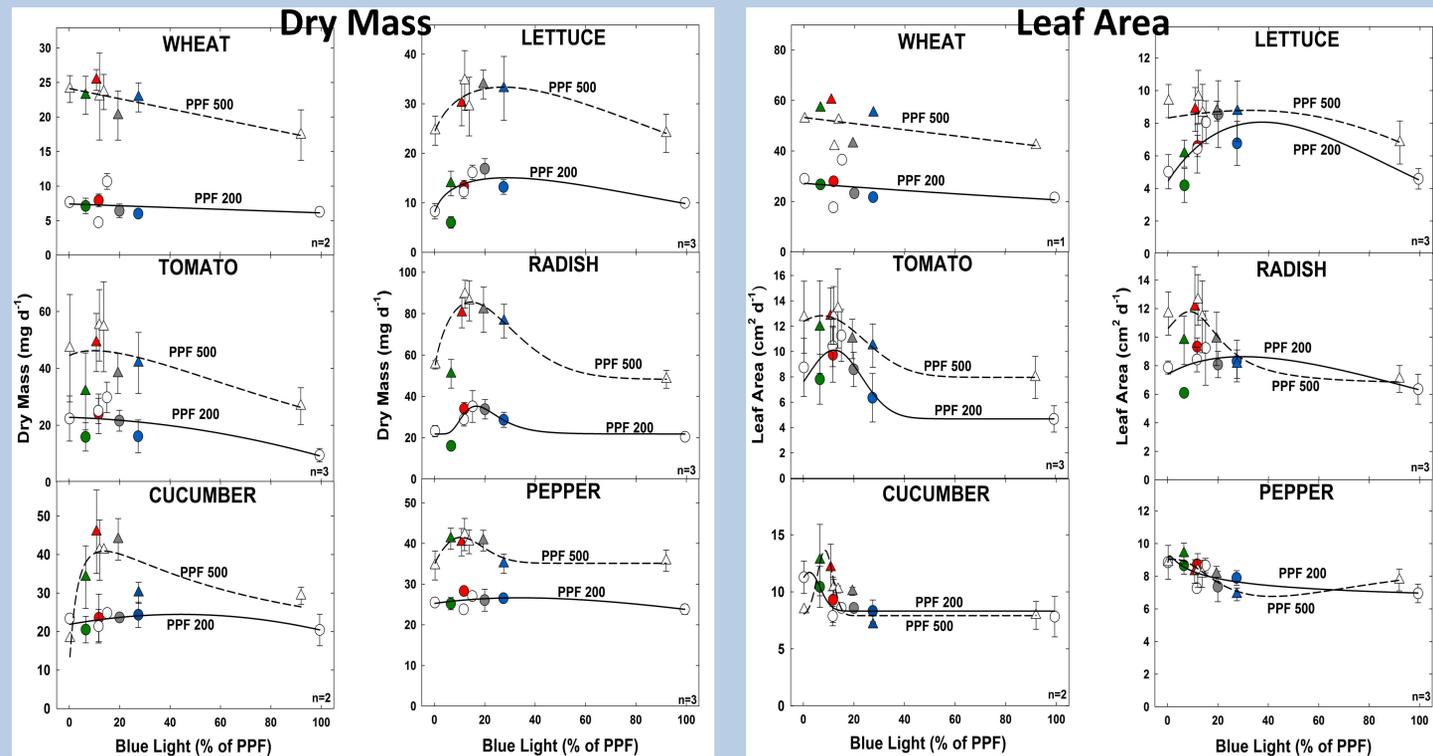


Figure 1. Eight LED chambers with corresponding percent blue light.



Introduction

- The effects of light quality on plant growth are often studied at low PPF conditions.
- The interacting effects of light quantity (PPF) and light quality are not well studied.
- Plant growth is defined as an increase in whole plant dry mass.
- Plant development is defined as a change in shape, or change in carbon partitioning among plant parts.
 - This includes leaf expansion rates and leaf area, specific leaf area, and stem length.
- Here we summarize the interacting effects of blue light (BL) and PPF on growth and development of six crops

Materials & Methods

- Light-emitting diode (LED) provided BL fractions from 0.3 to 92% under broad-spectrum white and monochromatic light
- Two photosynthetic photon flux (200 and 500 $\mu\text{mol m}^{-2} \text{s}^{-1}$).
- Uniformly maintained environmental conditions, other than light quality
- Figure 2 shows the colored symbols (red, gray, blue, green) indicating the three broad spectrum sources (warm, neutral, and white) and monochromatic green light

Conclusions

Except for leaf area in radish, there were no biologically significant interactions between light intensity and light quality

Plant dry mass

Adding green light to red/blue LEDs had not effect on plant growth or development.

There were no significant differences between two red/blue and three broad spectrum light sources for plant growth for any of the six species. Growth was significantly reduced by monochromatic light in lettuce, tomato, cucumber, and radish; but not in wheat or pepper.

Leaf area and specific leaf area

Increasing blue light tended to decrease leaf area and specific leaf area for all species.

Stem Length

Increasing blue light decreased stem length in tomato, cucumber, lettuce and radish, but not in wheat or pepper.

Adapted From

Cope, K. R., Snowden, M. C., & Bugbee, B. (2014). Photobiological Interactions of Blue Light and Photosynthetic Photon Flux: Effects of Monochromatic and Broad-Spectrum Light Sources. *Photochemistry and photobiology*. DOI: 10.1111/php.12233