Increasing blue light from LEDs reduces leaf length in kale©

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Abstract

Kale (*Brassica oleracea* Acephala Group) seedlings were grown for 21 days under increasing blue light from light-emitting diodes in chambers under low or high photosynthetic photon flux density. Only leaf length was significantly affected, with leaf length decreasing as blue light increased.

INTRODUCTION

Despite years of research, the effect of light quantity (intensity) and quality (color) on plants remains poorly understood. Light-emitting diodes (LEDs) now facilitate this research because of their narrow band wavelength. Blue light (400-500 nm) has been known to reduce leaf expansion and petiole elongation is some crops (Cope and Bugbee, 2013; Cope et al., 2014; Snowden et al., 2016).

Kale is one of seven vegetables in the species *Brassica oleracea*. Kale was chosen for this study as a representative of *B. oleracea* because of its nutritional value.

MATERIALS AND METHODS

The system included 16 chambers: eight chambers at low photosynthetic photon flux density (PPFD; 200 µmol m^{-2} s^{-1}) and eight at high PPFD (500 µmol m^{-2} s^{-1}). The spectral distributions for the chambers used at each PPFD are shown in Figure 1. Kale seeds where pregerminated and then transplanted into growing media in containers. Plants were harvested 21 days after seedling emergence.

RESULTS AND DISCUSSION

Among all parameters tested, only leaf length was affected significantly by increasing blue light (Figure 2). Fresh mass and dry mass decreased, but not significantly. Percent dry mass, leaf area, and specific leaf area were not affected by increasing blue light.

Kale is less affected by blue light than other crops tested under similar conditions. Lettuce, tomatoes, and radishes are more affected by blue light than kale (Snowden et al., 2016). Wheat is less sensitive than kale to changes in percent blue light.

Our data indicate that further studies should focus on selecting wavelengths of light that enhance cell enlargement and the development of leaf area and radiation capture.

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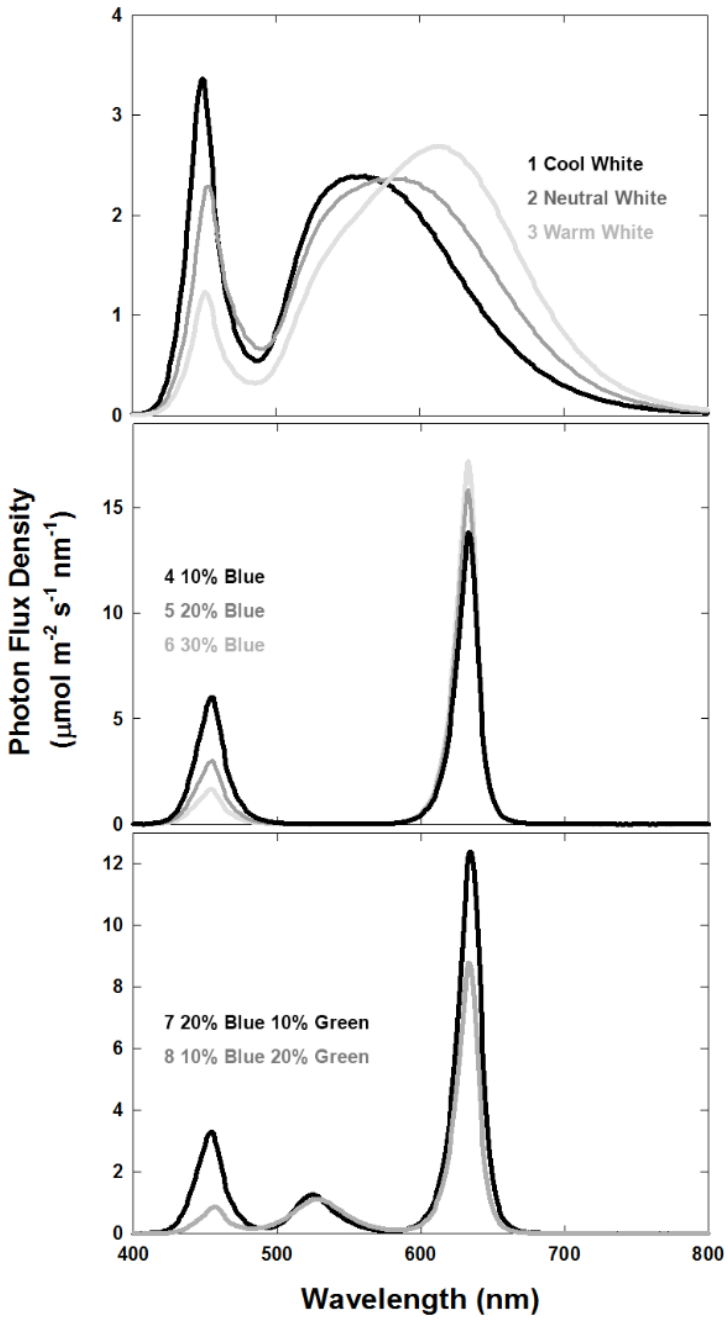

Figure 1. Spectral distributions for eight chambers used in a study examining effects of increasing blue light from light-emitting diodes on kale.

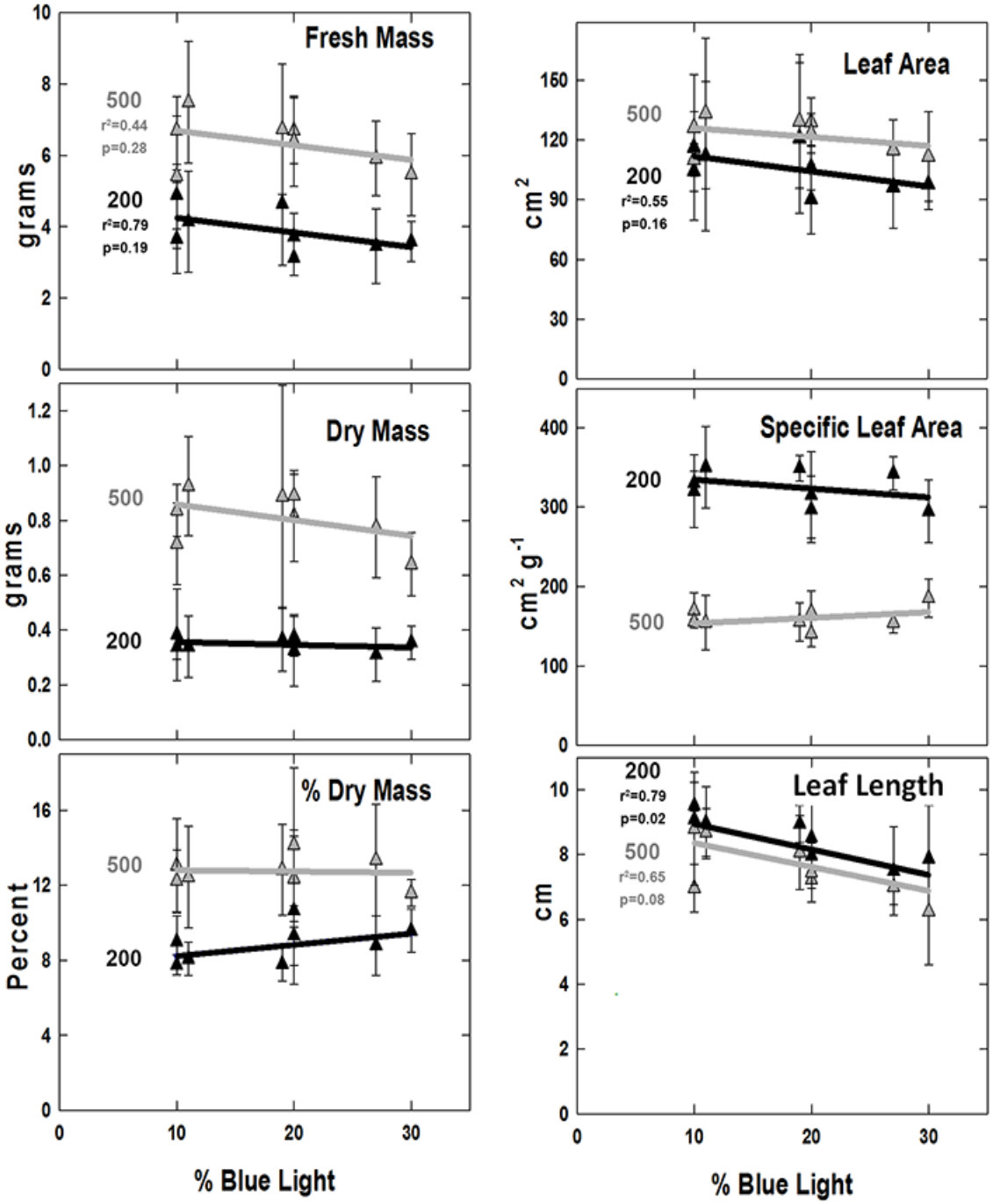

Figure 2. Responses of kale to increasing blue light from light-emitting diodes at low photosynthetic photon flux density (PPFD; 200 µmol m^{-2} s^{-1}) and high PPFD (500 µmol m^{-2} s^{-1}).

Literature cited

Cope, K.R., and Bugbee, B. (2013). Spectral effects of three types of white light-emitting diodes on plant growth and development: absolute versus relative amounts of blue light. HortScience *48*, 504–509.

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Snowden, M.C., Cope, K.R., and Bugbee, B. (2016). Sensitivity of seven diverse species to blue and green light: interactions with photon flux. PLoS ONE *11* (*10*), e0163121.http://dx.doi.org/10.1371/ journal.pone.0163121 PubMed