Decreasing blue light increases growth of four diverse species©

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Abstract

Light quality (wavelength) and quantity (intensity) play an integral role in plant growth and development. It is understood that both red and blue light are necessary for plant growth, and it is thought that green light may be beneficial for lower leaf photosynthesis. Photobiology studies using LEDs are primarily executed at low light levels (photosynthetic photon flux (PPF) lower than 200 µmol m^2 s^{-1}). This was because of the inefficiency of LEDs at high light levels. In this study, we investigated the effects of decreasing blue light on lettuce and kale, and the interactions between high light (PPF; 500 µmol m^2 s^{-1}, 11.5 mol m^2 d^{-1}) and low light (200 µmol m^2 d^{-1}, 28.5 mol m^2 d^{-1}). Eight treatments with varying levels of blue light where used to analyze the effect of decreasing blue light on lettuce. The treatments included: cool, neutral, and warm broad-spectrum LED lights; 30, 20, and 10% blue light (red light as a background); 20% blue with 10% green light and 10% blue with 20% green light (red light as a background). 'Siberian Dwarf' kale growth (fresh mass, dry mass, and leaf area) increased with decreasing blue light, but the effect was not statistically significant. Leaf length was the only parameter in lettuce that significantly increased with decreasing blue light. Growth of 'Red Salad Bowl' lettuce increased significantly with decreasing blue light. Lettuce leaves were very sensitive to changes in light quantity, and showed a foliage color change at high light. 'Boston' cucumbers were sensitive to both light quality and quantity. These results suggest that increasing blue light has a negative effect on plant growth, and that there are interactions between high and low light levels.

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