Using Light Emitting Diodes for Early Development of Flowering Plants©

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Abstract
Panels of light emitting diodes (LED) designed for plant growth often provide spectral peaks centered on blue (450 nm) and red (630 to 660 nm) wavelengths. The primary reason for using a spectral profile of this type is the observed high rates of photosynthesis. Although red and blue irradiance may effectively drive photosynthesis, most plants have developed in a continuous natural light spectrum. Flowering and morphological development may be altered in a mono-chromatic spectrum compared to daylight conditions. In addition, plant pigments readily absorb the red and blue wavelength energies resulting in limited transmission through leaves and canopies. A balanced spectrum may, therefore, be more beneficial for overall crop growth and development. Using white LED or adding orange, orange-red and white LED to traditional red/blue grow light LED may be beneficial for fast production of high-quality crops. Studies are needed to identify crop production applications where LED of limited as well as more balanced spectral energy distribution offer advantages. Four types of LED panels were evaluated for use during early development of the sunflower 'Sunny Smile'. The panels consisted of red LED (peak at 665 nm) supplemented with 10% blue LED (peak at 455 nm), blue LED (455 nm), white LED (3700 K), or a combination of 50% red (660 nm), 10% orange-red (635 nm), 10% orange (600 nm), 20% blue (450 nm) and 10% white (3700 K) LED. In addition, red (peak 635 nm) with 10% blue LED (peak 455 nm) in a fluorescent style arrangement and T5 fluorescent tubes were included. The sunflowers were propagated from seeds and transplanted 10 days later into 10-cm diameter containers. The plants were grown under the distinct light sources for 16 daily hr, during a limited 14-day period initiated at transplant for the first set of plants and 14 day following transplant for a second set of plants. Photosynthetic photon flux (400 to 700 nm) at plant height was approximately 150 μmol $m^{-2}s^{-1}$. The plants were compared to sunflowers grown in a greenhouse of natural light supplemented with high-pressure sodium irradiance. Preliminary results suggest the various light sources to support proper growth and development with minor differences in rate of development and morphology. On average, flowering was recorded 8 weeks following transplant at a plant height of 25 cm and 20 leaves below the flower.