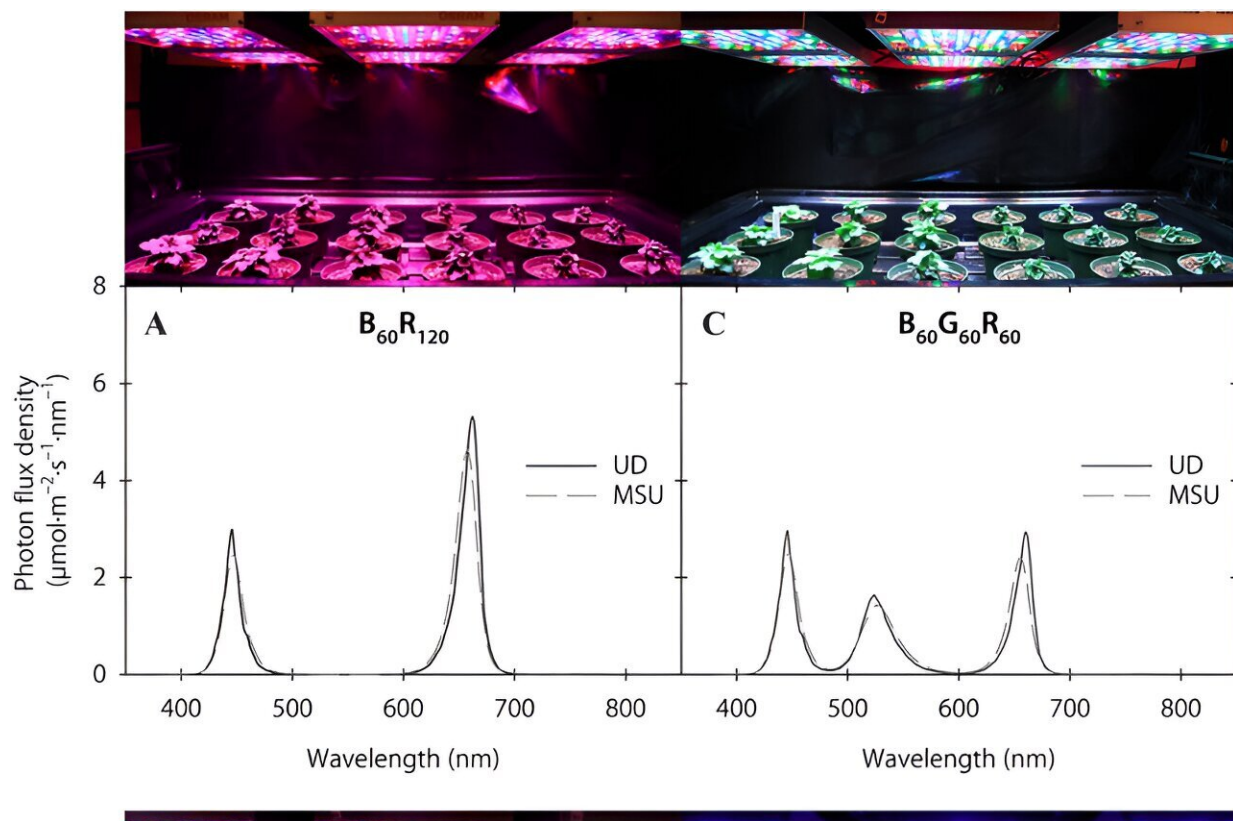


# Day-extension blue light inhibits chrysanthemum flowering when far-red light is included: Study

December 7 2023, by Jane Cerza



Distributions of four spectra from blue [B (400–500 nm)], green [G (500–600 nm)], red [R (600–700 nm)], and/or far-red [FR (700–800 nm)] light-emitting diodes at the University of Delaware (UD, Newark, DE, USA) and Michigan State University (MSU, East Lansing, MI, USA): (A)  $B_{60}R_{120}$ , (B)  $B_{60}R_{60}FR_{60}$ , (C)  $B_{60}G_{60}R_{60}$ , and (D) 4-h day-extension  $B_{60}$  ( $\rightarrow B_{60}$ ). The subscripts denote integrated photon flux densities in  $\text{m}^{-2}\cdot\text{s}^{-1}$ . Credit: *Journal of*

*the American Society for Horticultural Science* (2023). DOI: 10.21273/JASHS05294-23

Most ornamental crops can be classified as long-day, short-day, or day-neutral plants based on their flowering responses to the photoperiod (which is the day length), or the skotoperiod (which is the night length). Chrysanthemum is a common ornamental crop with an obligate short-day flowering response and only flowers when the night length is consistently longer than a critical duration.

Manipulation of the night length allows greenhouse growers to control flowering time precisely. In [summer](#)–fall garden chrysanthemum production, growers can use an opaque black cloth to truncate the natural [day length](#) and lengthen the night length, thereby inducing flowering under otherwise long days. Another method is extending a short day with moderate blue [B (400–500 nm)] [light](#). This inhibits flowering in greenhouse conditions with sunlight but not indoors (without sunlight) under B + red [R (600–700 nm)] light or [white light](#).

The researchers postulated that the contrasting responses to B light as a day extension depended on far-red [FR (700–800 nm)] light during the day, which is plentiful under sunlight but lacking indoors under B+R or white light-emitting diodes, whereas green [G (500–600 nm)] during the day would not play a role. To study this response in three chrysanthemum cultivars, they delivered indoor lighting treatments at two locations with an 11-hour main photoperiod of B<sub>60</sub>R<sub>120</sub> B<sub>60</sub>G<sub>60</sub>R<sub>60</sub>, or B<sub>60</sub>R<sub>60</sub>, Fr<sub>60</sub> light.

Subscript values indicate the light intensity of each waveband (in  $\mu\text{mol}\cdot\text{m}^{-2}\cdot\text{s}^{-1}$ ). After each short main photoperiod, plants received 0 or 4 hours of day-extension lighting of B light (B<sub>60</sub>).

In this study, all chrysanthemum cultivars showed flowering and morphological adaptations to lighting treatments. Leaf node number at flowering was proportional to flowering time for "Gigi Gold" and "Gigi Yellow," indicating that photon spectra did not influence the leaf development rate. In this study, under all treatments except  $B_{60}R_{60}FR_{60}$  with day-extension  $B_{60}$ , it took "Chelsey Pink," "Gigi Gold," and "Gigi Yellow" 13 to 17 days to reach the first visible inflorescence and 42 to 51 days to the first open flower.

In contrast, plants grown under  $B_{60}R_{60}FR_{60}$  with day-extension  $B_{60}$  took 41 to 67 days to reach the first visible inflorescence with few plants developing open [flowers](#). Plants were tallest at the first open flower and after 9 weeks of treatments when grown under  $B_{60}R_{60}FR_{60}$  with day-extension  $B_{60}$ . These results indicate that the inclusion of FR light, but not G light, in the main photoperiod is necessary for day-extension B light to inhibit flowering in chrysanthemum.

In conclusion, floral inhibition of chrysanthemum by day-extension B light requires the inclusion of FR light in a short main photoperiod of B+R light. Without FR light in the daytime light spectrum, chrysanthemum cannot perceive subsequent B light as an effective long-day signal. In contrast, G light during the day did not influence photoperiodic control of flowering by B light.

These results can reconcile discrepancies in previous chrysanthemum studies, in which the effects of day-extension or night-interruption B light on flowering depended on the preceding light conditions. Although the researchers cannot exclude possible roles of cryptochromes, phytochromes are likely involved in long-day signaling perception of B light based on daytime R/FR reversibility of flowering responses, which requires further research to elucidate.

The research is [published](#) in the *Journal of the American Society for*

*Horticultural Science.*

**More information:** Annika E. Kohler et al, Day-extension Blue Light Inhibits Flowering of Chrysanthemum When the Short Main Photoperiod Includes Far-red Light, *Journal of the American Society for Horticultural Science* (2023). [DOI: 10.21273/JASHS05294-23](https://doi.org/10.21273/JASHS05294-23)

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