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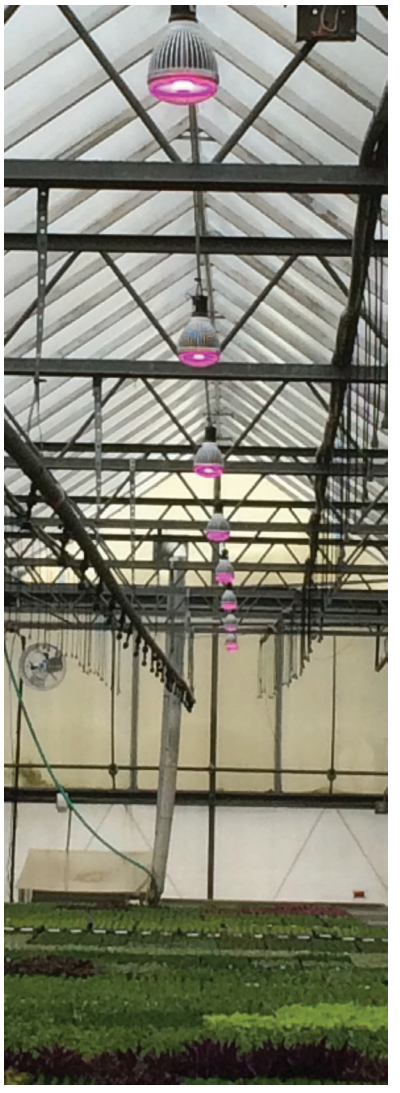
An Overview of Long-Day Lighting

Long-day lighting refers to the delivery of long photoperiods, or day lengths, to regulate the flowering of plants. More specifically, when the days are naturally short, the delivery of electric lighting can delay or prevent flowering of short-day plants and accelerate flowering of long-day plants.

There are a lot of factors to consider for effective and efficient long-day lighting. This article provides a brief overview of when and how to deliver lighting to create long days inside greenhouses.



Seasonal operation: The "biological" photoperiod inside a greenhouse is approximately 20 to 30 minutes longer than from sunrise to sunset. For most short-day plants, flowering is triggered when the photoperiod is less than 12 to 12½ hours. Many long-day plants flower earlier when the photoperiod is at least 13 to 14 hours. Therefore, identify when the period from sunrise to sunset is less than 11½ hours (for short-day plants) or 13 hours (for long-day plants) and operate lamps accordingly. In the spring, most growers can stop long-day lighting in late March or early April.

Daily operation: Generally, lighting during the night [night-interruption (NI) lighting] is as effective as lighting at the end of the day [day-extension (DE) lighting]. There are a few instances, such as with petunia, when flowering is slightly earlier with DE lighting. For NI, operate fixtures for three to four hours during the middle of the night (for example, from 10 p.m. to 2 a.m.). For DE lighting, turn on lamps around sunset, and turn them off once your desired photoperiod is achieved.

Light intensity: When lighting is operated continuously during the NI or DE period, the recommended minimum light intensity is 1 to 2 $\mu mol \cdot m^{-2} \cdot s^{-1}$, which can be measured using a quantum sensor. If you only have a footcandle meter, aim for a minimum of 10 foot-candles if delivering a whitish light, and at least 5 foot-candles if using a pinkish light from LEDs.

Some crops, especially some short-day plants like poinsettia, are very sensitive to light. Plants can perceive as little as 0.1 $\mu mol \cdot m^{-2} \cdot s^{-1}$ of light (and sometimes even less). If one is concerned about maintaining short days, then virtually complete blackout is needed. There are instances in which lighting from an area nearby can "contaminate" plants and unintentionally regulate the photoperiod. This phenomenon is referred to as "light pollution."

Lighting fixtures: When light is not limiting (for example, when the average daily light integral is at least 10 $mol \cdot m^{-2} \cdot d^{-1}$), most fixture types emit an effective spectrum. However, during the late winter and early spring, fixtures that emit some far-red light are more effective at promoting flowering of some long-day plants (petunia and snapdragon, for example) than those that don't. Therefore, Northern growers are encouraged to use fixtures that emit both red and far-red light, such as red+far-red LEDs. Several companies manufacture these "flowering lamps" including Philips/Signify, TotalGrow and GE. More information on the efficacy of different lamp types can be found online in this article: tiny.cc/floweringlamps.

Boom lighting: A relatively inexpensive way to deliver long-day lighting is operating booms that contain lighting fixtures at night. There is little research-based information for successful use of boom lighting, but there are three guidelines: 1) operate boom lighting for at least four hours during the night, 2) set a boom speed so that plants are lighted at least every 15 to 20 minutes, and 3) the light sum delivered to plants should be at least 3,600 $\mu mol \cdot m^{-2}$. See this article for more information: tiny.cc/boomlighting.

The proper delivery of long-day lighting can stimulate early flowering on a wide range of annual bedding plants as well as herbaceous perennials. It is also useful to delay flowering of chrysanthemum, poinsettia, and other short-day plants. For it to be effective, the intensity, timing, and spectrum of light should be considered, as well as costs to purchase and operate the lighting fixtures. gpn

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