

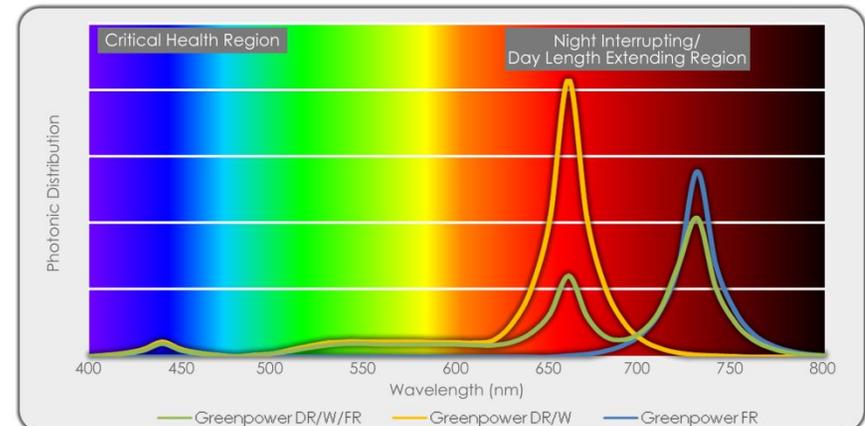
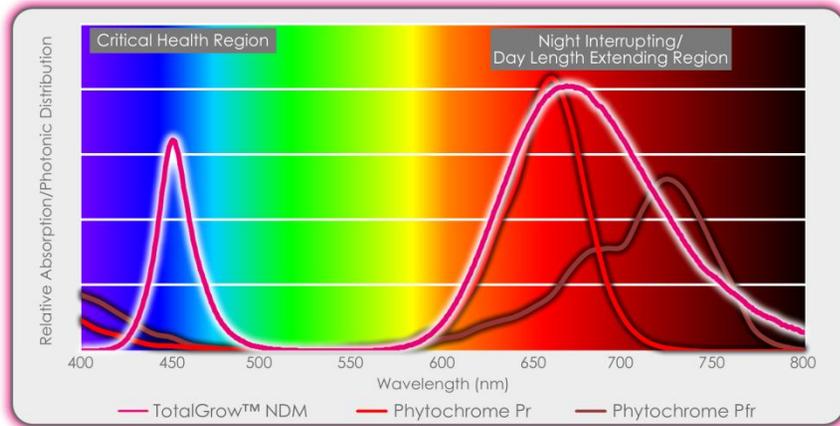
TotalGrow™ Night & Day Management Light vs. Typical LED Flowering Lights

Key Advantages

- The most efficient method of generating the far red light critical for day length/flowering control
- Optimized spectrum for the most reliable and efficient control of the timing of flowering while inhibiting stretching
- High uniformity potential with complete color mixing



Spectral Comparison and Science



- The heart of effective, reliable long day simulation for flowering control is deep red and far red light absorption by phytochrome photoreceptors. A proper balance of light stimulating **Pr** and **Pfr** phytochrome states is vital.¹
- Providing predominantly far red light to a plant induces undesirable stretching. This is prevented with a balance of red and far red light favoring red output² and, independently, with blue light output.³ Blue light is also vital for proper nutrient stimulation, gas exchange and other gross morphological functions.⁴

TotalGrow™ Night & Day Management Lights output a unique broad red/far red spectrum to provide the ideal balance of red and far red light for flowering control while minimizing stretching. Additional blue light improves total plant health and appearance.

As demonstrated by the spectral outputs of Philips GreenPower LED flowering lamps shown above, typical LED flowering lights generally use combinations of deep red, far red and white LEDs. Only the DR/W/FR spectrum shown above includes both necessary red components, but includes wasteful green-yellow light output and too little red and blue light to minimize stretching. It also relies on inefficient far red LEDs.

¹ Craig, D. S., & Runkle, E. S. (2013). A Moderate to High Red to Far-red Light Ratio from Light-emitting Diodes Controls Flowering of Short-day Plants. *JASHS*, 138(3), 167-172.

² Cerdán, P. D., & Chory, J. (2003). Regulation of flowering time by light quality. *Nature*, 423(6942), 881-885.

³ Runkle, E. S., & Heins, R. D. (2001). Specific functions of red, far red, and blue light in flowering and stem extension of long-day plants. *JASHS*, 126(3), 275-282.

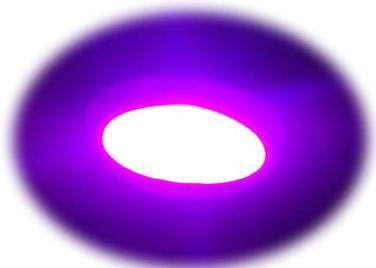
⁴ Folta, K. M., & Childers, K. S. (2008). Light as a growth regulator: controlling plant biology with narrow-bandwidth solid-state lighting systems. *HortScience*, 43(7), 1957-1964.

...Exactly and only the light plants need for efficient, effective flowering control and healthy growth.

Efficiencies

TotalGrow™ Night & Day Management Lights have three significant advantages for maximum efficiency:

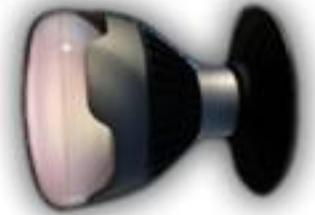
- All light generation is done by blue LEDs which have the photon-generating efficiency among LEDs. Down-conversion using the unique Solid State Volumetric Lighting (SSVL) technology results in the most efficient source of far red light.
 - Typical LED lamps use red, white and far red LEDs. Each of these is less efficient than blue LEDs; far red LEDs are drastically worse.
- Green-yellow light has minimal impact for controlling the timing of flowering and is therefore avoided.
 - White LEDs used by typical LED lamps for broad spectrum benefits require the inclusion of substantial wasteful green-yellow output.
- SSVL light packages emit light omni-directionally. A diffuse reflector shapes this light into an ideal pattern for uniformly distributing light over grow areas.
 - LEDs emit light very directionally. At best, a diffuse globe has a limited ability to spread this light out evenly over a grow area, resulting in areas with excessive, wasted light output.



TotalGrow™ Spectral Uniformity

All TotalGrow light packages produce fully mixed light spectra to eliminate color separation.

Typical LED grow lights like the Philips GreenPower lamps emit their distinct colors of light from distinct sources, potentially creating grow areas receiving different light spectra with different growth effects.



Typical LED Color Separation

Specifications Comparison

Lamp	Color Designation	Watts	Photon flux (μmol/s)	Efficiency (μmol/J)
GreenPower LED flowering FR	Far Red	16	12	0.8
GreenPower LED flowering DR/W	Deep Red/White	18	22	1.2
GreenPower LED flowering DR/W/FR	Deep Red/White/Far Red	18	15	0.8
TG Night & Day Management Light	Broad Deep Red/Far Red + Blue	11	14	1.3



www.totalgrowlight.com