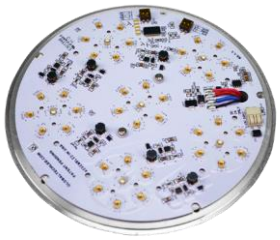
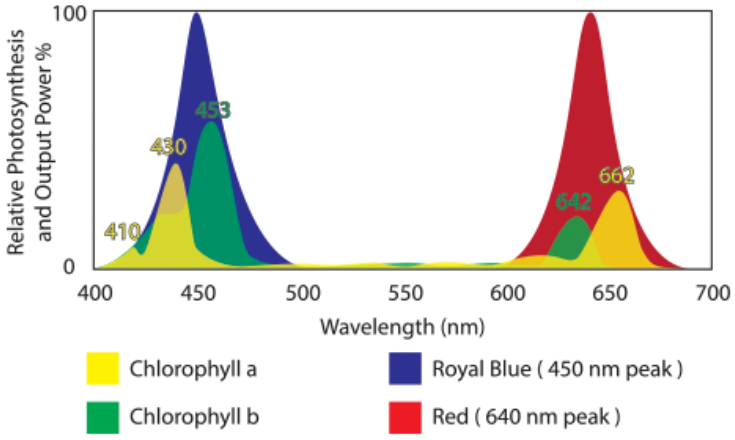
“Grow Light” Application Primer



A grow light or plant light is designed to stimulate plant growth by emitting an electromagnetic spectrum appropriate for photosynthesis. Grow lights are used in applications where there is either no naturally occurring light, or where supplemental light is required. For example, in the winter months when the available hours of daylight may be insufficient for the desired plant growth, lights are used to extend the time the plants receive light. If plants do not receive enough light, they will grow long and spindly.

Grow lights either attempt to provide a light spectrum similar to that of the sun, or to provide a spectrum that is more tailored to the needs of the plants being cultivated. Outdoor conditions are mimicked with varying color, temperatures and spectral outputs from the grow light, as well as varying the lumen output (intensity) of the lamps. Depending on the type of plant being cultivated, the stage of cultivation (e.g., the germination/vegetative phase or the flowering/fruiting phase), and the photoperiod required by the plants, specific ranges of spectrum, luminous efficacy and color temperature are desirable for use with specific plants and time periods.



Our LED light engine produces bright and long-lasting grow lights that emit only the wavelengths of light corresponding to the absorption peaks of a plant's typical photochemical processes. Compared to other types of grow lights, LEDs for indoor plants are attractive because they require significantly less energy to run and produce considerably less heat than incandescent lights. These Grow Modules usually run at around 45-60 degrees Celsius. Also, plants under LEDs transpire less as a result of the reduction in heat, and thus the time between watering cycles is longer.

There are multiple absorption peaks for chlorophyll and carotenoids, and LED grow-lights may use one or more LED colors overlapping these peaks. Recent developments in our design of tuned LED modules optimize the blue and red energy produced by the LED to closely match the plant requirements for optimum growth.

For vegetative growth, blue LEDs are preferred, where the light has a wavelength in the mid-400 nm (nanometer) range. For growing fruits or flowers, a greater proportion of red LEDs is considered preferable, with light very near 600-640 nm, the exact number this wavelength being more critical than for the blue LED.

Early LED grow lights used hundreds of fractional-watt LEDs and were often not bright enough and/or efficient enough to be effective replacements for HID lights. Our newer advanced LED grow lights may use high-brightness multiple-watt LEDs, with growing results exceeding HID lights.

Grow light LEDs are increasing in power consumption resulting in increased effectiveness of the technology. LEDs used in previous designs, by other companies, were 1/3 watt to 1 watt in power. We only use Philips Luxeon high output LED chips. Our LED Grow module runs at 95W per module. Multiple grow modules can be used in one fixture. The only limit to wattage is the amount of modules that will fit in a given fixture. However wattage is an improper comparison between traditional grow lights and LED grow lights. A much more valuable comparison is the PAR value of the light, which is a measure of the Photosynthetically Active Radiation – i.e. the actual light energy that is of value to the plant to promote growth. Typically, the PAR value of a light is measured using a precision PAR meter (Light Quantum Meter) at 24" below the light surface, approximately the optimum distance between the light and the growing tip of the plant. Measurements are in µmoles/m2/sec. Light intensity is also important, a comparison of the lumens produced by a light is indicative of the energy available for the plant, so comparing light sources with PAR and/or lumen output may be a more correct comparison between terrestrial grow lights.