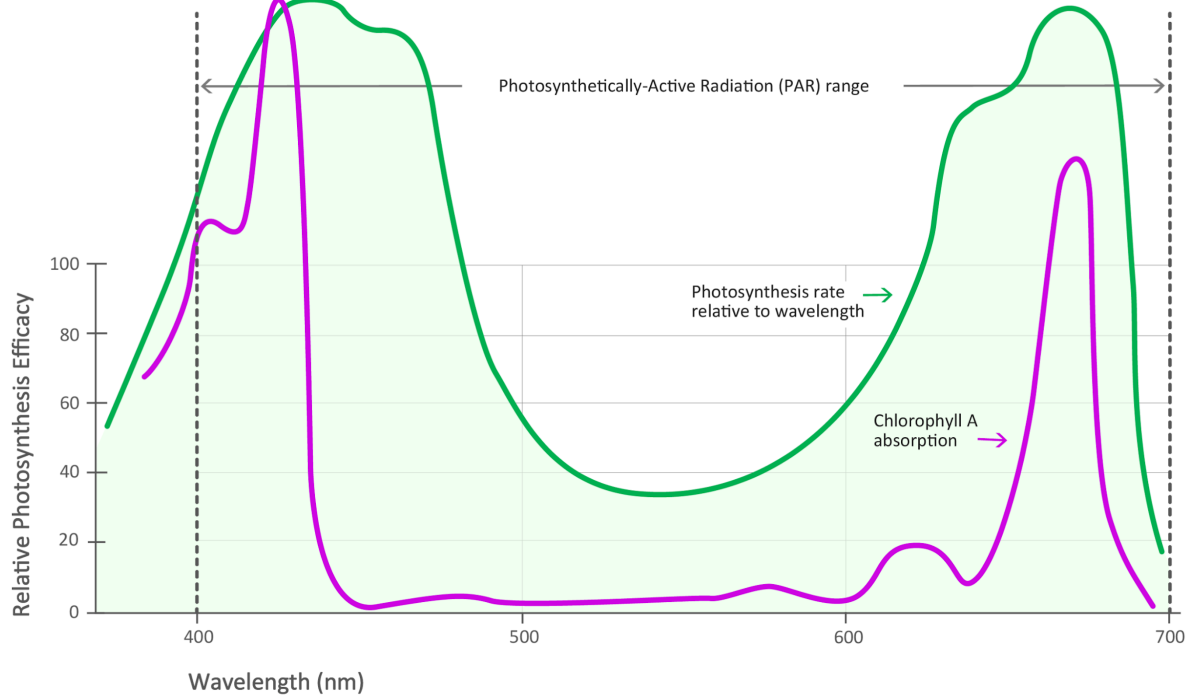


LED Grow Light Spectrum and Photosynthesis

Photosynthesis and the Light Spectrum



This graph illustrates Photosynthesis rate (efficiency) relative to the most abundant pigment, Chlorophyll a. Although highest efficiencies are around 430nm (blue) and 660nm (red), however, it shows that green and yellow lights also contribute to photosynthesis.

Photosynthesis is a process by which plants and certain other organisms transform light energy into chemical energy. During the process of photosynthesis, cells use carbon dioxide and energy from the Sun to make sugar molecules and oxygen. Photosynthetic cells contain special pigments that absorb light energy. In plants, pigment molecules absorb light wavelength ranges 400 nm to 700 nm. This range is traditionally referred to as photosynthetically-active radiation (PAR). The color of the pigment comes from the wavelengths of light that are primarily reflected. In plants, chlorophyll **a** and chlorophyll **b** are the main photosynthetic pigments but there are other chlorophyll and pigments that also respond to light.

Violet-Blue (405 nm):

405 nm is good for plants but bad for bugs and germs. Exposure to 405 nm is safe for human but it can control pests and mold, and eliminates or reduce microbial growth on surfaces and air.

Blue (420-450nm) and Red (620-680nm):

Chlorophyll **a** is the most abundant pigment in plants. Chlorophyll **a** absorbs light mostly 430nm (blue) and 662nm (red) wavelength light. It reflects green light so it appears green to us. Chlorophyll **b** molecule has a similar structure to that of chlorophyll **a**. It absorbs mostly 453nm and 642 nm wavelength light, Although Chlorophyll **b** is not as abundant as chlorophyll **a**, it helps the range of light a plant can use for energy. It is important to note that the combination of different light colors can lead to higher photosynthesis than the sum of its parts. **During the vegetative phase** plants need blue but they also need other colors as well, in particular red light. 10 to 20% blue energy is sufficient. **During the bloom and flowering phases** primarily red wavelengths in 620-680nm range promote vegetative stem growth, flowering and fruit production.

Green (495-570nm):

Chlorophyll **a** and **b** reflects most of the green light, however, research shows that green light can have a positive influence on plant growth. Plants use green light to assimilate CO₂, to promote higher biomass and yield. Green spectrum also penetrates deep into plants driving photosynthesis where other spectrum cannot.

Far Red (700-800nm):

Research shows addition of small amount of far red spectrum to white or a combination of red and blue spectrum yields more, about 10% to 20% more leafy green type of vegetables. For cannabis, more than 10% of continuous addition far red energy could have undesired effects.

UVA (320-400nm):

Addition of UVA may result in growth with short internodes and thick leaves, that is, increased biomass production. However, too much UV light energy is harmful for plants, since it negatively affects the DNA and membranes of the plant.