Posted by Vanessa Nielsen, PhD on March 14, 2018

Choosing the best lighting for growing cannabis can be intimidating, especially when there are so many factors to consider, like spectrum, lumens, PPFD, CRI, CCT, and more! Don't know what those terms mean? We've already covered the basics of horticultural lighting, so read that first if you haven't already. We are going to dive deeper into one of those factors, and that's spectrum. The spectrum of light used by a plant is called photosynthetically active radiation (PAR). PAR was first defined in the 60s as the wavelengths from 400 to 700 nm. Today we now understand PAR to encompass wavelengths outside of this range, to include UV and far-red light. This article is part of a series covering all the colors of light, including **UV, blue, green, red, and far-red light**! This focus of this article will be on **green light**. Green light is radiation with wavelengths between 520 and 560 nm and it affects photosynthesis, plant height, and flowering.

Green Light and Vegetative Growth

Green light plays a role in photosynthesis and vegetative growth because it falls within the range of photosynthetically active radiation. However, its effect on plant growth and development is not as well understood as red or blue light. Plants reflect green light, and this is why they appear green to our eyes. This may lead us to think that green light is not used by plants, but it's simply not true! Only around 5-10% of green light is reflected from a plant and the rest (90-95%) is absorbed or transmitted to lower leaves[1]. Chlorophyll and carotenoid pigments capture green light and use it for photosynthesis. Chlorophyll absorbs low amounts of green relative to red and blue light, so it's best to provide a plant will at least all three types of light. When combined with red and blue light, green light further enhances plant growth[1,2]. But too much green light (more than 50% of the total light) reduces plant growth[2]. At this time, the ideal ratio of green, red, and blue light (as well as other colors of light) is not yet known for many species, including cannabis. For one tomato variety, the ideal ratio is 1:2:1 for G:B:R[3]. Likely, the ideal spectrum for cannabis vegetative growth will be strain-dependent. When choosing a horticultural light, choose one that that has high amounts of blue and red light and moderate amounts of green and other colors of light.

Green light is easily transmitted through leaves. When sunlight or another source of full-spectrum light reaches a plant, the leaves transmit high amounts of green light and low amounts of red and blue light. This means that the leaves at the bottom of the canopy receive a modified spectrum that is low is blue and red light and enriched in green (Figure 1). Green light is absorbed by photoreceptors. One type of photoreceptor is cryptochrome, and this photoreceptor controls stomatal opening and stem elongation. Depending on the species, green light can either cause stomata to open and close and stems to stretch or stay short. In some species, like mustard and fava bean, green light closes stomata[4]. In other species, like sunflower, green light opens stomata[4]! At this time, it's not clear whether green light opens or closes stomates on cannabis leaves. Green light (via the action of cryptochrome) also controls stem elongation. When a plant is shaded, the stems elongate so that the leaves can reach more light. When plants are given high amounts of green light, they think they are being shaded and their stems elongate and the leaves become larger so that the plant reaches more light[1,5].

Green Light and Seed Germination

Green light mediates seed germination in some species. Seeds use green light to evaluate whether the environment is good for growing. If a seed germinates in a shady spot, it can be detrimental to the plant because it will not get enough light to grow. A seed that senses a shaded environment may avoid these adverse conditions by staying dormant and not germinating[1]. Shade environments are enriched in green relative to red and blue light. Seeds of different species show a range of responses to green light. Green light prevents seed germination in some species like ryegrass (a grass that grows in tufts) and *Chondrilla* (a plant related to dandelion)[1,6]. Surprisingly, green light can stimulate seed germination in a number of uncommon species like *Aeschynomene, Tephrosia, Solidago, Cyrtopodium,* and *Atriplex*[1,6,7]. There are several factors that affect seed germination, such as soil moisture, soil type, temperature, photoperiod, and light quality. Light quality prevents germination at inappropriate times that could potentially compromise survival. At this point, the impact of green light on cannabis seed germination is not known.

Green Light and Flowering

When it comes to growing cannabis, many cultivators are most interested in the quality of light used for the flowering stage. In many plants, flowering is mainly regulated by two main photoreceptors: cryptochrome and phytochrome. Both photoreceptors primarily respond to blue light but can respond to green light as well, although to a much smaller degree. Green light is effective at accelerating flowering in a number of species[1,8,9]. Although no cannabis-specific experiments have been performed, increased green light may encourage flowering. Once flowering has begun, it's important to provide plants with a "full spectrum" light that has high amounts of blue and red light, and moderate amounts of green light, in order for photosynthesis to be optimized.

When used alongside red and blue light, green is important for both the vegetative, germination and flowering stages of plant growth. Green light penetrates the plant canopy, allowing light to reach the lower branches of the plant. Green light can also be used to manipulate stomatal opening and closing and plant height. In some species, green light can even regulate seed germination and flowering, although this hasn't been explored in cannabis. The addition of other colors of light (full-spectrum light) has been shown to have further benefits for plant growth.