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When it comes to choosing a light for growing cannabis, there are 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. In our education section, we've been detailing the effects of different wavelengths of light on plant growth and development. This series has covered all the colors of light, including violet, blue, green, yellow, orange, red, and far-red light! One "color" that we don't often think about is ultraviolet (UV) light.

UV light is radiation with wavelengths between 100 nm and 400 nm and it's not visible to the human eye. UV light makes up about 10% of the total light output of the sun and is divided into several subtypes. The three subtypes that this article will focus on are UV-A (315 – 400 nm), UV-B (280 – 315 nm), and UV-C (100 – 280 nm). UV radiation affects many aspects of plant growth, including the development of defense compounds and structures, prevention of insect and fungal attack, and DNA damage.

UV Light and DNA Damage

Plants sense UV light through specific UV photoreceptors called UV Resistance Locus 8 (UVR8). It's important for a plant to be able to sense UV wavelengths because they can cause damage to DNA. UV-C light is especially damaging and can alter DNA methylation patterns[1]. Upon sensing UV light, UVR8 photoreceptors send signals to other parts of the plant that causes changes in growth and development. What kinds of changes? The plant will begin to make DNA repair enzymes (to fix damaged DNA) and "sunscreen" (to prevent more damage)[2]. Together, these protective mechanisms prevent further damage to plant cells.

UV Light and Plant "Sunscreen"

Plants can produce many different types of "sunscreens". Some of these sunscreens are physical, like trichomes, and some of them are chemical, like anthocyanins and beta-carotene. Trichomes are hair-like outgrowths found on the epidermis (skin) of many species of plants. Trichomes are reflective and can shield the plant from harmful UV rays. For this reason, UV radiation can increase the trichome density. Since THC is produced and stored in cannabis trichomes, UV light also increases THC content. If you want to learn more, we have a whole article dedicated to trichomes. Growers can use this response to their advantage by providing cannabis plants with small amounts of UV light to encourage their plants to grow more and larger trichomes.

The second type of "sunscreen" is chemical sunscreen. UV-A light increases anthocyanin content while UV-B light increases the amount of lycopene, beta-carotene, glycosides, and hydroxycinnamic acid derivatives[3–5]. While these sciency-sounding chemicals can act as sunscreens, they also play other roles. For example, anthocyanins give many plants a red-purple-blue color (think of blueberries and raspberries). Beta-carotene gives plants an orange color (think of carrots and yams). And many glycosides are responsible for giving our foods flavor and smell (think of wine!) Growers can capitalize on these plant

responses to make vegetables look, smell, and taste better. For example, applying UV-A light to tomato fruits enhances the smell, acidity, and overall flavor of the ripe tomatoes[6]!

UV Light Prevents Insect Herbivory

We mentioned above that UV light can increase the production of plant compounds like glycosides, which can make a plant smell and taste better. While many glycosides taste delicious to us humans, they can be toxic to some insects. Plants with increased levels of these toxic compounds are less likely to get eaten by bugs! For example, when broccoli is grown with UV radiation, it produces more glucosinolates and other metabolites that deter insects[7]. As a result, these UV-broccoli plants had fewer aphids on them compared to control plants (with no UV light given)[7]. We see a similar effect in other plant-insect relationships. Soybean is an important legume crop that is often attacked by two types of stink bug[8]. UV-B light increases glycoside production in soybean and as a result, there is less damage to the seeds (the part that we eat)[8]. In tobacco plants, UV-B light increases phenolic acid concentration which improves the plant's defense against the tobacco hornworm moth[9]. Thus, the use of UV-B light in outdoor cultivation facilities has a strong potential for improving crop yields by reducing insect damage.

UV Light Reduces Fungal Growth

UV light can alter the DNA of all organisms – plants, humans, animals, and even fungi. Organisms exposed to UV light on a regular basis develop mechanisms for preventing and treating DNA damage, such as "sunscreens" and DNA repair enzymes. Some fungal pathogens have reduced or lost activity of these DNA repair enzymes[10]. Upon exposure to UV light, some fungal pathogens will accumulate so much DNA damage that they are incapable of reproducing and spreading. As growers, we can use this to our advantage, as plants are often the victims of fungal attack! For example, treating rose plants with a couple of hours of UV-B light reduces powdery mildew (PM) infection by up to 90%[12]! Researchers found that UV light prevented PM spores from germinating and surviving[12]. And it's not just in roses: UV-B light also reduces the severity of PM in both strawberry and rosemary – by up to 99% compared to untreated controls[11]! UV-B light is effective against other types of fungal pathogens, such as Botrytis (Grey Mold)[13], which commonly affects cannabis plants. UV light, particularly UV-B light can cause DNA damage to many organisms, including fungi. As growers, we can use UV-B light to our advantage to reduce the spread and severity of fungal invasions on cannabis plants.

UV light affects plant growth and development in many ways. Because UV light has a strong potential for damaging DNA, plants can defend themselves via physical and chemical "sunscreens". These "sunscreens" include trichomes, anthocyanin, lycopene, beta-carotene, and glycosides. Many of these "sunscreens" also happen to be beneficial traits for cannabis plants, and growers can use this to their advantage to improve the quality of their product. Trichomes and glycosides also happened to be deterrents for herbivores like aphids. Thus, UV radiation may also be effective for preventing and controlling insect populations in a grow facility. Lastly, there is strong evidence that UV light prevents the spread and severity of fungal spores. Fungi

and molds can reduce cannabis yields by attacking roots, leaves, and flowers. In grow rooms with high humidity, UV light might be one solution for controlling the spread of spores.