EOS LightPulse

EOS LightPulse is a manufacturer of LED grow light fixtures for horticulture and is currently the only LED grow light manufacturer to have successfully integrated supplemental UVC into LED Grow Light fixtures.

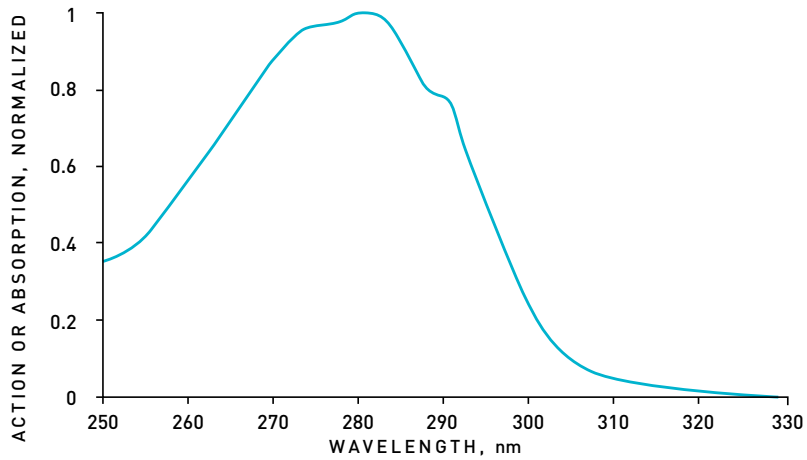
CHALLENGE

EOS LightPulse was interested in using UVC in their grow light fixtures to optimize the concentrations of secondary metabolites such as alkaloids, terpenes and plant phenolics and prevent mildew formation without damaging the plant.

A common goal in cannabis growth is to maximize the production of secondary metabolites such as THC or CBD, depending on the type of use and terpenoids. While a plant's genetics set the "upper limit" on the amount of secondary metabolites a plant can produce, multiple factors need to be optimized during growth in order to maximize the concentration of these compounds.

Empirically, it has also been observed that the concentration of secondary metabolites is impacted by growth at higher altitudes, presumably due to the greater intensity of UV light. A study on the effect of wavelengths found that the use of a UVB lamp with a broad spectrum between 280 nm and 320 nm increased THC concentration in the leaf and flower of cannabis[1]. The response to UV is thought to be mediated through the UV R8 photoreceptor, which is most effectively triggered by a narrow spectrum of wavelengths centered around 270-280 nm (Figure 1). However, no systematic studies have been conducted to examine the effect of specific UVC wavelengths on the concentration of cannabinoids. A key reason has been the concern that too much UVC may stunt plant growth and unavailability of narrow spectrum UVC LEDs.

FIGURE 1



[1] UVB radiation effects on photosynthesis growth and cannabinoid production of two cannabis sativa chemotypes, Photochemistry and photobiology, vol. 46, No. 2, pp 201-206, 1987

Use of UVC in the growth of cannabis can also prevent mildew. The high humidity and moderate temperatures required for growing cannabis indoors and in greenhouses, and the lack of UV provides a favorable environment for epidemics of powdery mildew. Botrytis cinerea is the fungi responsible for powdery mildew and outdoor fungal spores are brought inside primarily through air. Air filtration and UVC disinfection has been proposed to remove Botrytis. Latorre et al[2]. tested the effectiveness of UVA, UVB, and UVC irradiation on spores of Botrytis cinerea isolated from blueberries and found UVC radiation at 254 nm to be more effective than UVB and UVA wavelengths.

SOLUTION

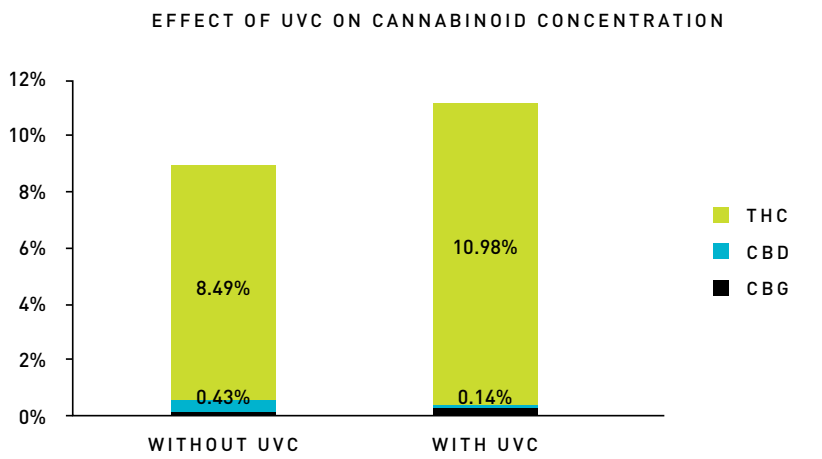
EOS LightPulse has developed grow light luminaires (Figure 2) for horticultural applications that include an array of multi-wavelength visible LEDs for the photosynthesis of plants. All the LEDs can be controlled with a smartphone application which allows growers to easily create customized lighting recipes. EOS added Crystal IS UVC LEDs to the grow light fixture to understand the effect of UVC on cannabis plant growth.

FIGURE 2

Factors evaluated in this study include the effect of UVC wavelength, duration & intensity of exposure, and the life cycle of the plant during UVC exposure. By using a proprietary light recipe of low doses of UVC light, EOS was able to increase THC concentration over plants which were not exposed to UVC (Figure 3). This increase in THC is mediated by the triggering of the UV R8 photoreceptor in UVC wavelengths, and the use of a pulsing mode (instead of a continuous one) avoids any detrimental effects of continuous UVC exposure. In addition, the terpene and flavonoid concentrations also changed after UVC exposure.

[2] Germicidal effect of UV light on epiphytic fungi isolated from blueberry, *Ciencia e Investigacion Agraria*, 39(3):473-480, 2012

FIGURE 3



LED lights enable EOS to increase control over the light conditioning. Unlike UV lamps, the UVC LEDs can be turned on and off as needed to match the growth and flowering cycle of the plant and operated in a pulsed mode to avoid damage to plants from excessive UV exposure. In contrast, repeated switching of UV lamps drastically reduces the plants' lifetime.

No mildew formation was observed in more than one year of growing experiments with UVC LEDs. This result is consistent with the killing effect of UVC on Botrytis cinerae, the fungus responsible for mildew on cannabis. UVC is believed to disrupt the reproduction capability of the fungus. With the ever-increasing consumer concerns about the overuse of pesticides and insecticides, UVC light can be an especially attractive solution for pest management, particularly for organic products.

EOS also found that UVC light is a promising solution in curing and storage of cannabis. Tight humidity control in a narrow range is required in curing and storage to prevent mold formation. By using UV to prevent mold formation, the humidity restrictions can be relaxed. In this regard, UV is a better option than chemical sprays which leave a residue.

"Crystal IS offers the most effective combination of light output and UVC wavelength for targeting the R8 photo-receptor," said Juan Carlos Herranz, R&D Manager at EOS LightPulse. "This makes their LED ideal for triggering generation of secondary metabolites in a variety of plants."

The EOS data shows UVC light can play a beneficial role in multiple stages of harvesting cannabis. Since the UV sensing mechanism through the R8 photo-receptor or similar photoreceptors is widely present, UVC light has potential for use in plant harvesting to increase the concentration of compounds ranging from flavonoids in blueberries to resveratrol in grapes and other medicinal compounds in plants. In addition, the mildew prevention capability of UVC has a wider applicability for maximizing yield in pesticide-free, organic plant agriculture.

Crystal IS **Advantage**

Crystal IS UVC LEDs are compact and environmentally friendly. Compared to traditional light sources, they offer precise spectrum control of UVC. Our LEDs provide:

- Superior performance (UVC output and lifetime)
- Instant, on-demand illumination
- Scalable and flexible duty cycles

WE INVITE YOU TO LEARN MORE ABOUT OUR UVC LEDs.

Crystal IS™

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