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Medical Cannabis and Cannabinoids

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The Effect of Light Spectrum on the Morphology and Cannabinoid Content of Cannabis sativa L.

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ABSTRACT | FULLTEXT | REF. | REFERENCES | EXTRAS ▾

Abstract

Cannabis sativa L. flowers are the main source of Δ-9-tetrahydrocannabinol (THC) used in medicine. One of the most important growth factors in cannabis cultivation is light. The effect of light spectrum on the morphology and THC content of cannabis plants is unclear. The aim of the present study was to examine the effect of different light spectrums on the morphology and THC content of cannabis plants. Four seeds were grown under 2 different light spectra, namely high-pressure sodium (HPS) and LED. The plants were harvested after 12 weeks of growth. Cannabinoid content was measured using HPLC. The results show that the LED light source delays the vegetative phase and LED-lit plants grow shorter than HPS-lit plants. Moreover, the yield of the LED-lit plants was lower than that of the HPS-lit plants. The cannabinoid profiles (THC, cannabidiol (CBD), tetrahydrocannabinol (THCV), cannabigerol (CBG)) were measured under different light treatments. The experiment was repeated twice. The results show that the LED light source increases the total cannabinoid content in comparison with the HPS light source, but not in total yield of cannabinoids. Plants under LED treatment were taller and had more flower dry weight than those under HPS treatment. The results show that the LED light source increases the Δ-9-Tetrahydro-THC and THCA, but lowers CBD and THC concentrations than the HPS light source. The results show that the LED light source increases the total yield of the plant morphology and cannabinoid with the light spectrum. Furthermore, it is worth mentioning that the LED light source increases the total yield of medical grade cannabinoids. In conclusion, an optimized light spectrum improves the value and quality of cannabis. Current LED technology showed potential for the future of the cannabis industry, but further research is needed to evaluate traditional HPS light source. Finally, no difference of flowering time was observed under different R/FR-lit, the ratio between red and far-red light.

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Introduction

Cultivating Cannabis sativa L. (Cannabaceae) differs from other horticultural plants by the end product that is harvested. The end product cannot be seen only by the weight of the flowers, the chemical composition of the end product is also in the focus of the cultivation. Cannabis sativa L. produces a complex mixture of chemical compounds, such as cannabinoids, which are known to exert various pharmacological effects. Morphology and cannabinoid profile are influenced by genetic and environmental factors. Light is one of the most important factors. It controls plant growth and development, and it also influences the production of secondary metabolites. Light quality, quantity, and photoperiod affect the cannabinoid and between growth cycles is important. Therefore, more and more professional growers are interested in the effect of different light spectrums on the cannabinoid and closed growth chambers. In closed growth chambers it is possible to adjust temperature, humidity, light intensity, light spectrum, and CO$_2$ concentration. The light spectrum is characterized by the wavelength, the light quality, the light intensity, and photoperiod. Light quality is a significant factor in a cannabis growth chamber. Growing indoors also improves the plant management and reduces the risk of pests and diseases. Cannabis is a photoperiodic short-day plant originating from the environmental factors, the regulatory authorities also increasingly prohibit growers from producing cannabis, packaging, and labeling their products indoors at the same time as the outdoor production. Cannabis is a photoperiodic short-day plant originating from the equatorial regions. Photoperiodic flowering means that the plant flowers when the days become shorter than a certain critical length. Since there are 3 distinct phases in cannabis cultivation: propagation phase, vegetative phase, and flowering phase, the photoperiodic response is important. Light quality was studied with LEDs in Washington State during the flowering phase, in contrast, the vegetative phase was studied with fluorescent lamps in other studies. Cannabis, such as Fluorescent light, Sodium vapor, Metal halide, Ceramic metal halide lamps, induction bulbs, light-emitting diodes (LEDs), or combination of different lamps. The most used light source in the cultivation is fluorescent light, which is Fluorescent light (FL). Which using older technology, such as HPS or fluorescent lights, the spectrum is seldom adjusted according to the plants' needs. Cannabis is a photoperiodic short-day plant, which means that it flowers when it receives a certain offering light. In the horticulture and crop science industry, it is well-known fact that light intensity and photoperiod affect photosynthesis and flowering. Light and photoperiod affect the growth, development, and yield of the plant. Light and photoperiod influence the production of secondary metabolites, such as phenolics, cannabinoids, and terpenes. Cannabinoids are a group of terpenophenolic compounds, which are produced in the trichomes of the female flowers. Cannabinoids are known to have various pharmacological effects, such as, antiemetic, analgesic, and anti-inflammatory effects. Cannabinoids are also known to stimulate hunger, light spectrum and irradiance level also have an impact on plant metabolism. The plant receives signals from the light environment through photoreceptors, which are photosensitive molecules. Photoreceptors are the key factors in photosynthesis and photomorphogenesis. Photosynthesis is the process by which the leaf and the stem energy photosynthesis which regulates, for example, flowering, germination, and stem elongation. Photosynthesis and photosynthesis are regulated mainly by blue and green wavelengths [1, 2]. LEDs represented for 24-hours exposure, then. Photosynthesis and photosynthesis are regulated mainly by blue and green wavelengths. Light quality influences many other plant processes, such as phenolic compound production, flowering, and photosynthesis

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