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Can you increase trichomes using light?

Trichomes are hair-like outgrowths found on the epidermis (skin) of many species of plants. Cannabis plants produce and accumulate cannabinoids and terpenes in trichomes that are abundant on the surface of the female flowers[1]. Cannabinoids have psychoactive properties while terpenes are responsible for the scent and flavor qualities of cannabis products[1]. Trichome number and size is, in part, regulated by light. This article will discuss the characteristics of light, such as intensity and spectral quality that correlate with trichome development.

What do we know about trichomes?

Trichomes are found all over a plant: on the tops and bottoms of the leaves, on stems, on flowers, and even on seeds[2]. Trichomes have many different roles. On leaves and stems, they can deter herbivores via physical and chemical means. On seeds, they can help carry the seed away via the wind. On carnivorous plants, they can catch insects, and on moss, they can function like roots to absorb water. On aquatic plants, they can act like life jackets that keep the plant's leaves afloat. Trichomes can also modulate the temperature of a plant, it's rate of gas exchange, and even alter the amount and type of light that can reach the leaves[2].

Leaf trichomes are reflective. They can reflect visible, UV, near-infrared, and infrared radiation away from a plant[2]. Inside a trichome, there are additional light-absorbing compounds such as flavonols, that further shield the plant from light[3]. How much light the trichomes can reflect depends on density. On a slightly "furry" plant, trichomes can cut light penetration by ~9%[2]. A very furry plant can experience light reductions of ~40%[2].

Trichomes are either glandular or non-glandular (Figure 1). This article will focus on the glandular form because this is where a cannabis plant produces and store cannabinoids and terpenes (Figure 2)[1]. There are two ways to increase trichomes on a plant. The first is to increase the size of individual trichomes, and the second way is to increase the density (amount) of trichomes. There is limited research into the relationship between cannabis trichome production and light. For this reason, our discussion about trichomes will also include other plant species, such as mint, thyme, and olive, which have trichomes with high terpene content.

Can you increase trichome number or size using light?

In the 1980s, scientists surveyed wild and cultivated cannabis populations with varying THC content. Higher levels of THC were found in plants originating from the equator and high-altitude regions[4]. Intense UV radiation was hypothesized to encourage cannabis plants to produce trichomes as UV defenses[4]. In cannabis, increased UV-B radiation results in increased THC levels in flowers[5]. High-THC strains also have

larger glandular trichomes compared to low-THC strains[6]. The heads of glandular trichomes in high-THC strains are four times larger in diameter than that of low-THC strains[6]. A similar relationship between light intensity and trichome diameter exists in tomato. Tomato plants exposed to higher light levels have increased trichome head diameter[7]. Therefore, increased light intensity may be one way to make cannabis trichomes bigger and increase THC content.

Increased light intensity or day length increases trichome density. For example, in wild and cultivated tomatoes, longer day lengths increase trichome density[7,8]. This increased trichome density had the added benefit that more spider mites got trapped in the sticky leaf hairs[7]. If day length increases from 12 hours to 16 hours, trichome density increases by ~30%[7]. In thyme, increased day length increases thymol yield (the main terpene in thyme)[9]. In mint, increased light intensity from 140 to 410 μmol/m2s-1 increases glandular trichome density by 120% and essential oils (including terpenes) by 75%[10]. Therefore, increasing light intensity or day length may be another method to increase the number of trichomes on your cannabis plants.

UV-B light is particularly effective at increasing trichome density in a number of species. Trichomes can block harmful UV-B rays from reaching the sensitive photosynthetic tissues of the leaves. Trichomes are thought to function as "sunblock" for plants, similar to the way that melanin protects the skin from UV-B damage. In olive, the intensity of UV-B light is strongly correlated with trichome density and terpene content[11]. In mustard, UV-B light increases trichome density, but also decreases overall plant height and leaf size, and delays flowering[12]. Other types of harmful radiation and chemicals can induce trichome formation. For example, mustard plants irradiated with large doses of gamma rays have double the trichome density compared to non-irradiated plants[13]. When that same species of mustard is treated with the widely used herbicide methyl viologen (paraquat), trichome density also increasess[13].

Trichomes play many roles, including protection from light stress. For this reason, increased light intensity or duration, especially harmful UV-B light, can increase trichome size and number. If a cannabis grower wishes to increase trichome size or number, one method may be to use small amounts of UV-B. A grower should take safety precautions if he or she decides to go this route. UV-B light is equally harmful to humans and negatively affects plant health at even moderate levels. URSA Lighting's most popular grow light, the Optilux, is a high-intensity LED light that can provide high light intensity without the harmful UV-B wavelengths.