Impact of supplemental under canopy lighting on dry bud mass, THC concentration and terpene concentration of cannabis sativa

Introduction

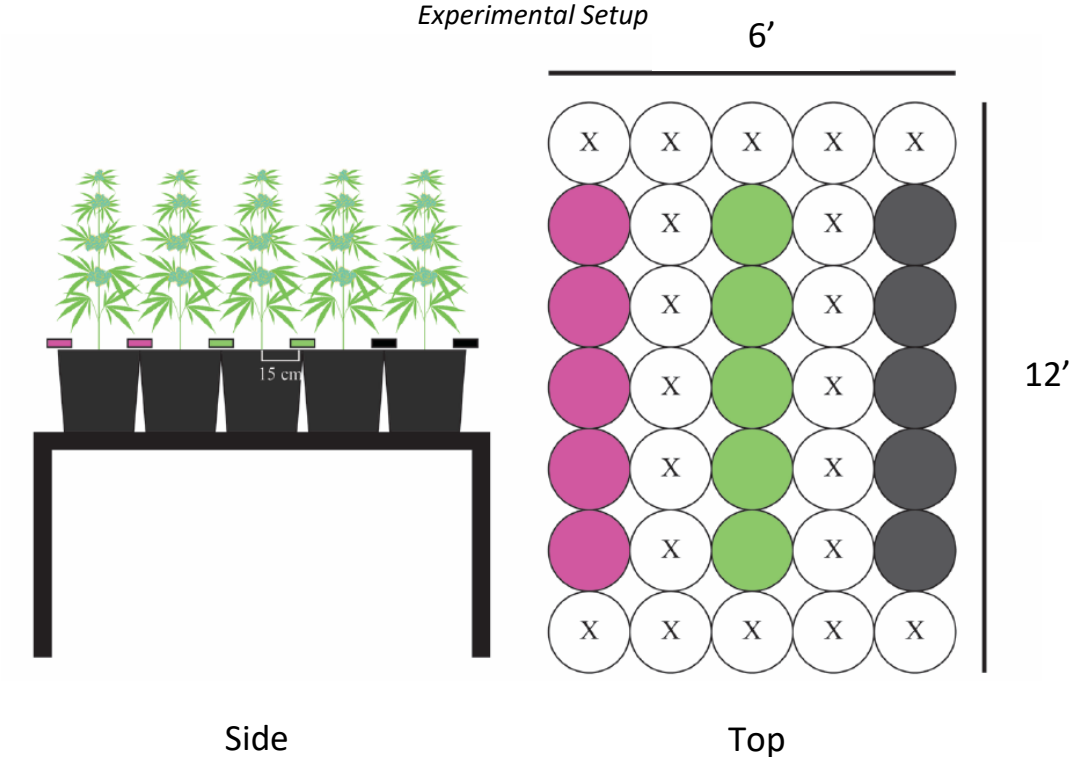
This paper summarizes results from a controlled experiment conducted at The University of Guelph[1] that investigated the influence of adding supplemental under canopy lighting in the growth of cannabis. More specifically, the study quantified how under canopy lighting affected bud yield, bud to non-bud tissue ratio, cannabinoid content and terpene content.

Experimental Setup

In a flower room, four benches with dimensions 6'x12' were each populated with 35 plants for a total of 140 plants – see figure 1. A 315W ceramic metal halide top light was used above each bench that provided an intensity of approximately 500 µmols/m^2/sec to the top of the canopy. Under canopy supplemental lighting added 95 ±5 µmols/m^2/sec below the canopy. The plants were exposed to three different light treatments below the canopy. Column 1 was illuminated with a red + blue (R+B) LED light bar (pink color in figure 1), column 3 was exposed to a Red, Green, Blue (Full Spectrum) LED light bar (green color in figure 1), and column 5 was the control group which did not use any under canopy lighting (black color in figure 1). Plants with an "X" were not included in the analysis because they were simultaneously exposed to two different spectra.

Figure 1

Experimental Setup



[1] Hawley, Dave. "The influence of spectral quality of light on plant secondary metabolism and photosynthetic acclimation to light quality", A Thesis presented to The University of Guelph, 2018.

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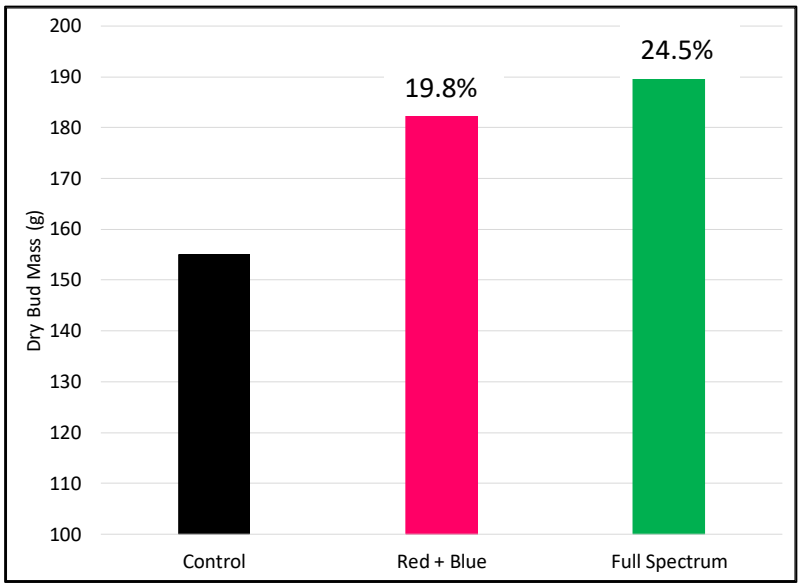
Results

Bud Yield

The addition of under canopy lighting significantly increased dry bud yield as compared to the control group that did not receive supplemental light. The R+B under canopy LED light increased dry bud mass by 19.8%, while the Full Spectrum LED light increased yield by 24.5% - see figure 2.

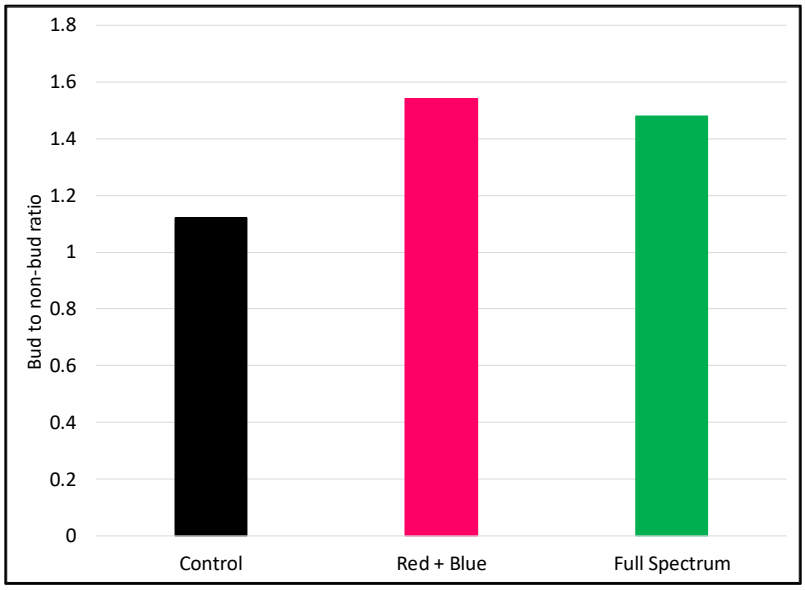
Figure 2 – Dry Bud Mass



Bud to non-bud tissue ratio

As seen in figure 3, both R+B and Full Spectrum under canopy treatments significantly increased the ratio of bud to non-bud tissue. This is advantageous to the commercial grower since a lower density of leafy tissue results in better air circulation, and better access and monitoring of buds.

Figure 3 – Bud to non-bud ratio



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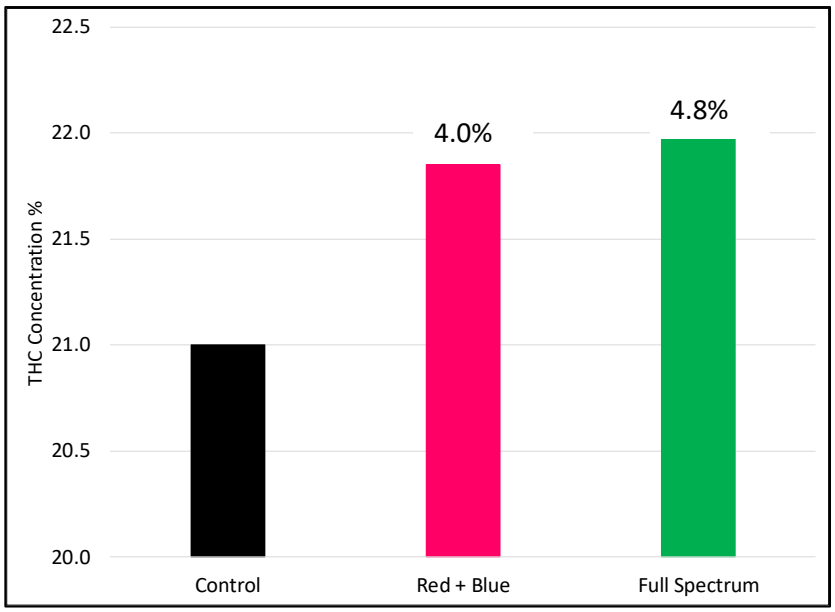
THC Cannabinoid Content

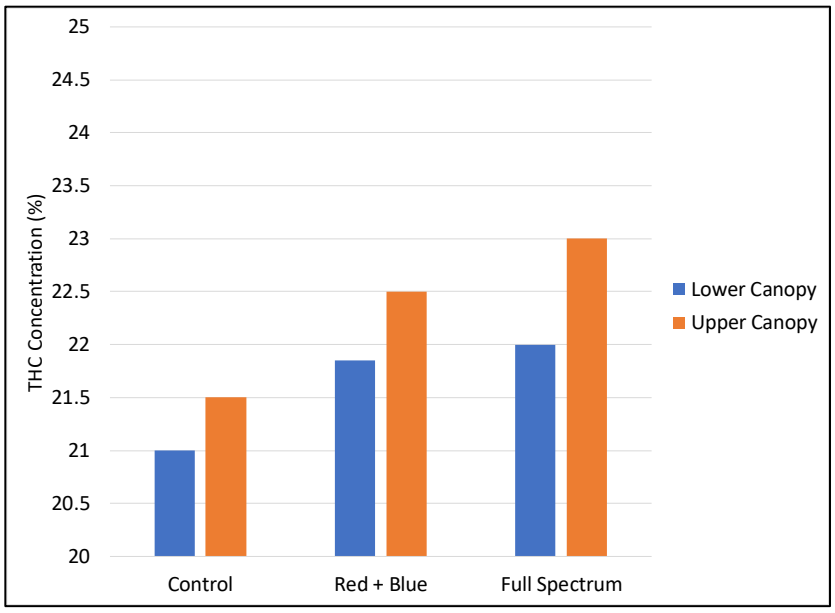
Under canopy lighting provided a local stimulus to the production of Δ9-Tetrahydrocannabinol (THC). As shown in the figure below, lower canopy concentrations of Δ9-THC were markedly increased when the plants were illuminated with under canopy supplemental lighting treatments.

Figure 4 – THC Concentration, Lower Canopy



A comparison of THC concentration between the top of the canopy and the lower canopy is shown in figure 5. The figure demonstrates that under canopy lighting not only increased THC concentrations in the lower canopy, but in the upper canopy as well. Further, THC concentrations in the lower canopy were comparable to the concentrations in the upper canopy.

Figure 5 – THC Concentration, Lower vs Upper Canopies



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Terpene Content

Supplemental under canopy lighting significantly increased the concentrations of select terpenes including alpha pinine, borneol and cis-nerolidol in both the lower and upper canopies – see figures 6 & 7.

Figure 6 – Lower Canopy

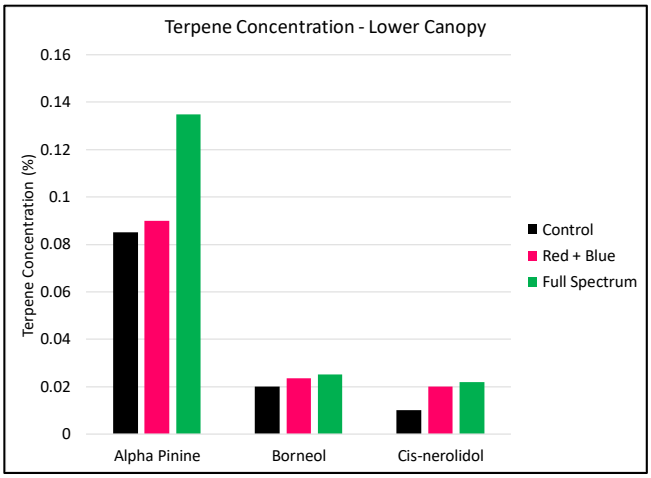
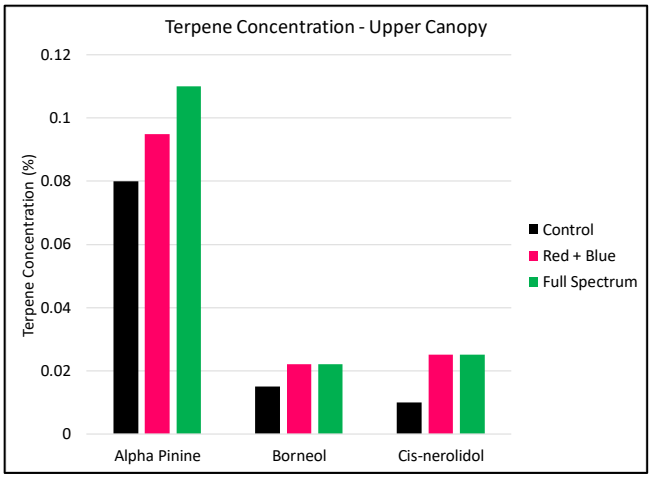


Figure 7 – Upper Canopy



Conclusions

Results from the investigation conducted at The University of Guelph indicate that supplemental under canopy lighting can increase bud yield, bud to non-bud tissue ratio, THC concentration and selected terpene concentrations. Beneficial increases were observed both in the upper and lower canopies.