

THE PROGRAMMABLE SPECTRUM GUIDE BOOK



THE ULTIMATE GUIDE TO PROGRAMMABLE **SPECTRUM**

AVICI!

PHOTOMORPHOGENESIS

What is it?

What does each color do?

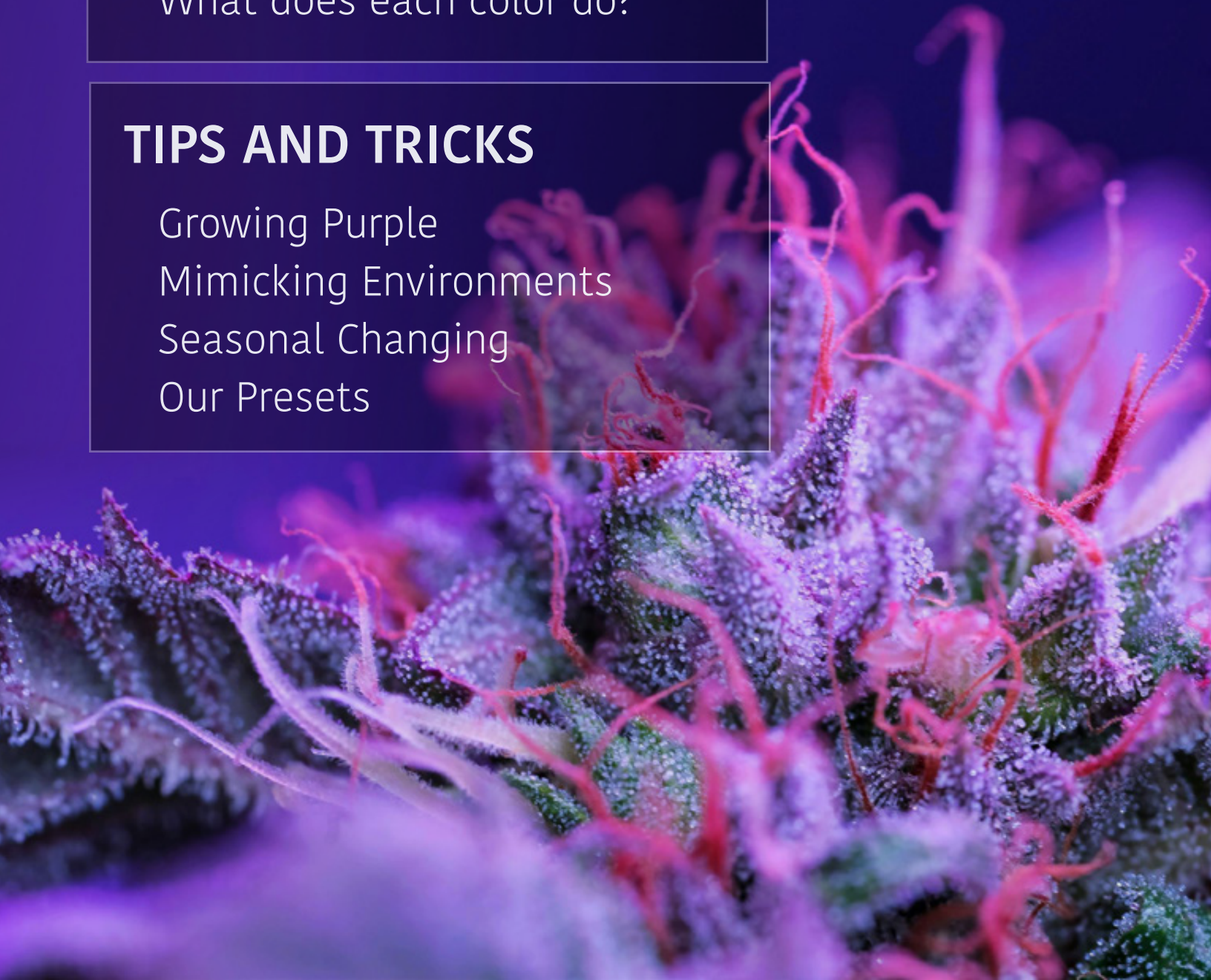
TIPS AND TRICKS

Growing Purple

Mimicking Environments

Seasonal Changing

Our Presets



THE EFFECT OF **COLOR** ON **CANNABIS**

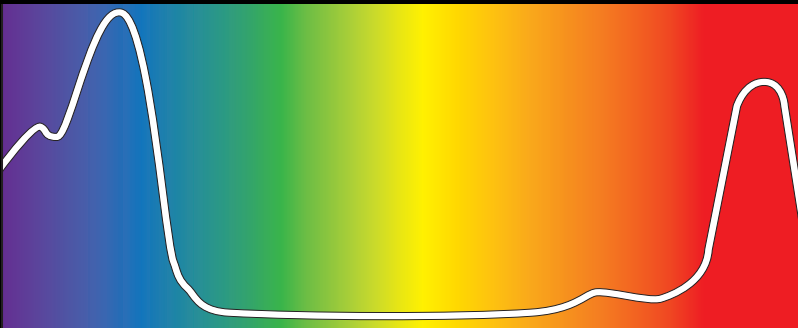


PhotoMorphoGenesis

Photo - Light *Morpho* - Change *Genesis* - Create

How a plant changes its growth pattern in response to spectrum.

Efficiency of **Photosynthesis** by Color



Plants absorb red and blue with the highest efficiency, but just because orange, yellow and green are not as efficiently absorbed doesn't mean they lack importance. Far red and ultraviolet similarly are not absorbed, yet they still play an important role in photomorphogenesis.

Effect of **Photomorphogenesis** by Color



Spectrum influences everything from plant shape and size to the level of protective chemicals it creates. Protective compounds such as anthocyanins and terpenes give plants their color, aroma, flavor and many medicinal effects.

(Image by: Controlled Environment Systems
Research Facility, University of Guelph)

THE EFFECT OF **BLUE** ON **CANNABIS**



Terpene and Cannabinoids



Blue light has been documented in several cases to increase cannabinoid and terpene production and retention. Dialing up the amount of blue on a programmable spectrum LED throughout the cycle is a great way to boost terpene percentage.

Colorful and Flavorful Buds

Plants respond to short wavelength (blue and UV) light by producing protective compounds, just like how humans tan! Called Anthocyanins, these flavonoids (From the Latin word for yellow, not flavor) give cannabis purple and red tones.

Compact and Dense Plants

Blue shortens internodal spacing and creates thicker stalks with denser foliage. This is great in racking applications or any other application with a vertical limitation.



Cooler Light
Causes
Shorter
Internodal
Spacing



THE EFFECT OF **RED LIGHT** ON **CANNABIS**



Stretch and Elongate

Red is the strongest driver of photosynthesis. It creates tall, reaching plants with large leaves.



Influence Flowering

Red also signals to plants that it is time to flower. Red can hasten flowering, shortening cycles and increasing harvests per year.

FAR RED TO RED VISUALIZED

The shade avoidance response is a great example of how to use photomorphogenesis in crop steering.

Example 1

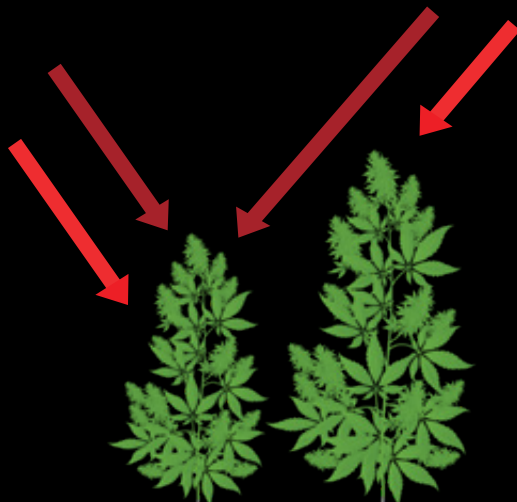
The ratio of R:FR here tells the plant that it is in the sun, unshaded by other plants.



Example 2

This plant is receiving more FR than R, as FR isn't absorbed by plants like R is.

It knows which way to grow by sensing the ratio of Red to Far Red in its environment.





THE EFFECT OF **COLOR** ON **CANNABIS**

Full Spectrum

When Blurple is Bad

Cheap and efficient, 'Blurple' can be fine in some cases, such as greenhouses that receive supplemental spectrum from the sun, but it's not always the best solution. Because plants learn about their environment by looking at the spectrum and photoperiod of light they receive, a fuller spectrum is better for fully developing plants.

Get Full Genetic Expression

In general, a fuller spectrum means better development, though strategic elevations in blue and red can increase the energy efficiency of the cultivation room without compromising development.



TIPS AND TRICKS TO GROWING PURPLE

Purple is from Anthocyanins



Anthocyanins are flavonoids* that plants produce to protect themselves from radiation, like a suntan in humans. They give cannabis their purple, red and pink tones, and are also pH reactive.

*This is from the latin word for yellow and is unrelated to flavor.



25% 50% 100%

In this study, lettuce was given end of day supplemental lighting with a varying **percentage of blue** light, and a dramatic difference in color was noticed.

Blue Light for Better Color



Anthocyanins are triggered by short wavelength light such as blue and UV. Simply dial up the % of blue in your programmable spectrum LED and start seeing a difference.

Environmental Factors



Some growers also drop temperature to enhance color and terpene content. This is an example of mimicking a strain's environment, which we go into detail in a bit further down.

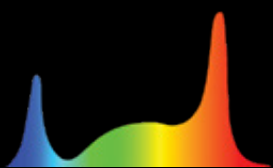
HOW TO USE **SPECTRUM** TO CONTROL **GROWTH**



Now that you've learned how color affects growth, here are some tips and tricks for using programmable spectrum LEDs, starting with our presets as a jumping off point.

GET STARTED WITH EASY TO USE **PRESETS**

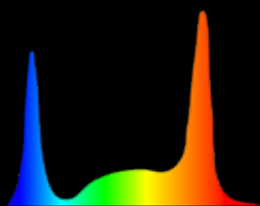
These are our presets to get you started.



Clone

5 Blue
10 White
5 Red

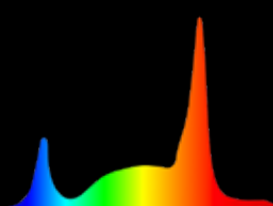
We boost blue to shorten internodal spacing initially, but if you have a naturally dense plant, more red would speed up growth.



Veg

10 Blue
10 White
10 Red

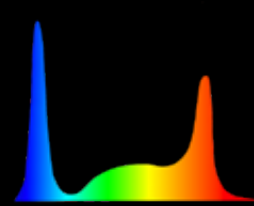
Here we heighten everything to drive growth, although some strains of cannabis might benefit from slightly higher blue or red depending on their natural morphology.



Flower

5 Blue
10 White
10 Red

Red becomes more abundant in the fall and signals plants that it is time to flower. We boost red during this stage to hasten flowering and shorten cycles for more harvests per year.



Finish

10 Blue
10 White
5 Red

Towards the end, we boost blue for a richer terpene profile and purpler buds. Some cultivators have slowly increased blue throughout production with great results.

4.88% Terpenes

Avici client Green
Care Collective
harvested 4.88%.

MIMICKING A STRAIN'S ORIGIN FOR PEAK **GENETIC EXPRESSION**



Select

Choose a strain that exhibits the traits desired such as color, terpene expression, and cannabinoid content.



Research

Research the strain and follow it back to its original habitat to learn the optimal environment for growth.



Mimic

Mimic the conditions by tuning the spectrum, temperature, and humidity to get full genetic expression.

Low Altitude Strains

Higher Humidity

Higher Temperature

A slightly redder spectrum might be necessary.

High Altitude Strains

Lower Humidity

Lower Temperature

Bluer Spectrum to mimic the reduced Rayleigh scattering*

High altitude strains have been found to produce higher levels of terpenes, which serve as protection against the higher intensity sunlight.

*More on this on the next page

THE REASON FOR THE SEASON...AL PRESETS

Rayleigh Scattering

Light scatters as it passes through the atmosphere, like light bending when it hits glass, water, or any other medium. Short wavelengths scatter easier, which is why sunsets are warmer colors and the high noon sky is blue.

Blue Means Spring

In the spring and summer, the sun is higher in the sky, and doesn't have to pass through as much atmosphere to reach Earth. The spectrum of light that reaches Earth is therefore bluer.

Spring/Summer

Much of the UV range present in sunlight, especially UV-C, is reflected by the atmosphere.

Red Means Fall

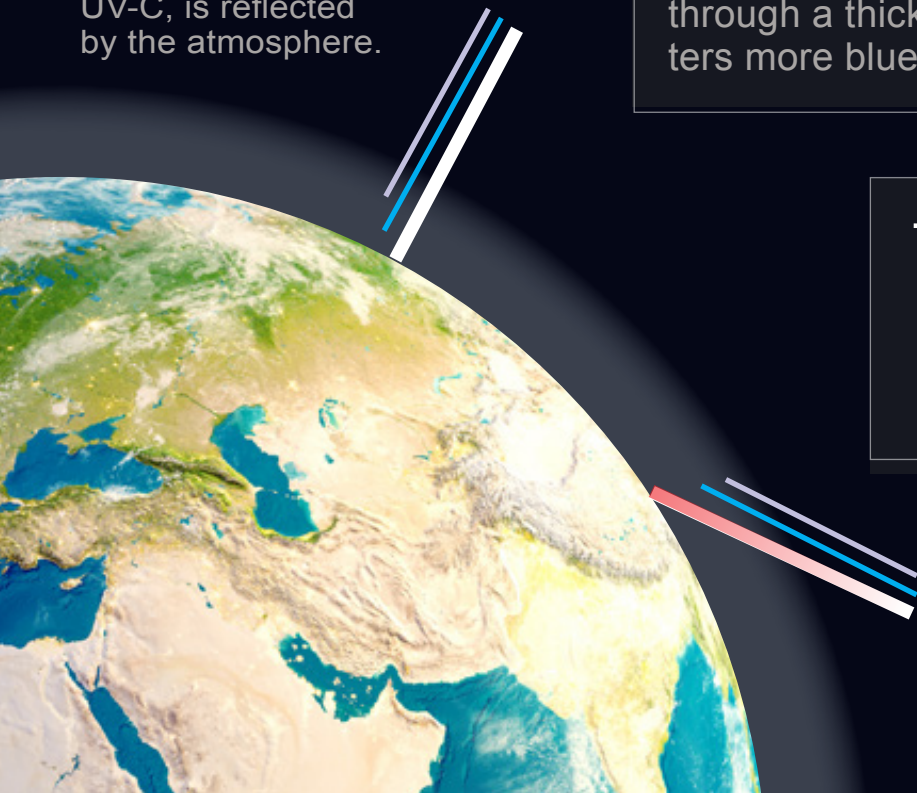
As fall and winter approach, it sinks to a lower angle, meaning that the sunlight has to travel through a thicker layer of atmosphere. This scatters more blue, making the fall sky more red.

Trick Your Plants

Mimic the seasonal spectrum to hasten flowering and increase the number of harvests per year.

Fall/Winter

The more atmosphere the light must travel through, the more short wave light gets scattered.





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BLUE LIGHT

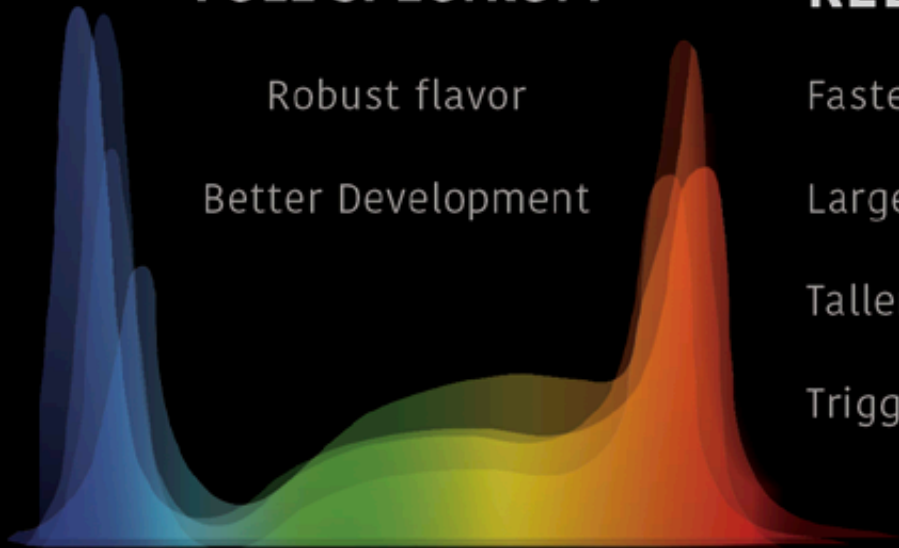
Denser Plants
More Terpenes
Purpler Buds
Higher THC

FULL SPECTRUM

Robust flavor
Better Development

RED LIGHT

Fastest Growth
Large Leaves
Taller Plants
Trigger Flowering



Tell your plant exactly how to grow.

Programmable Spectrum Changes *Everything*.

Revolution
MICRO

Call or email us with any questions.
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