Using Far Red & UV Spectra for the Highest ROI

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SpecGrade

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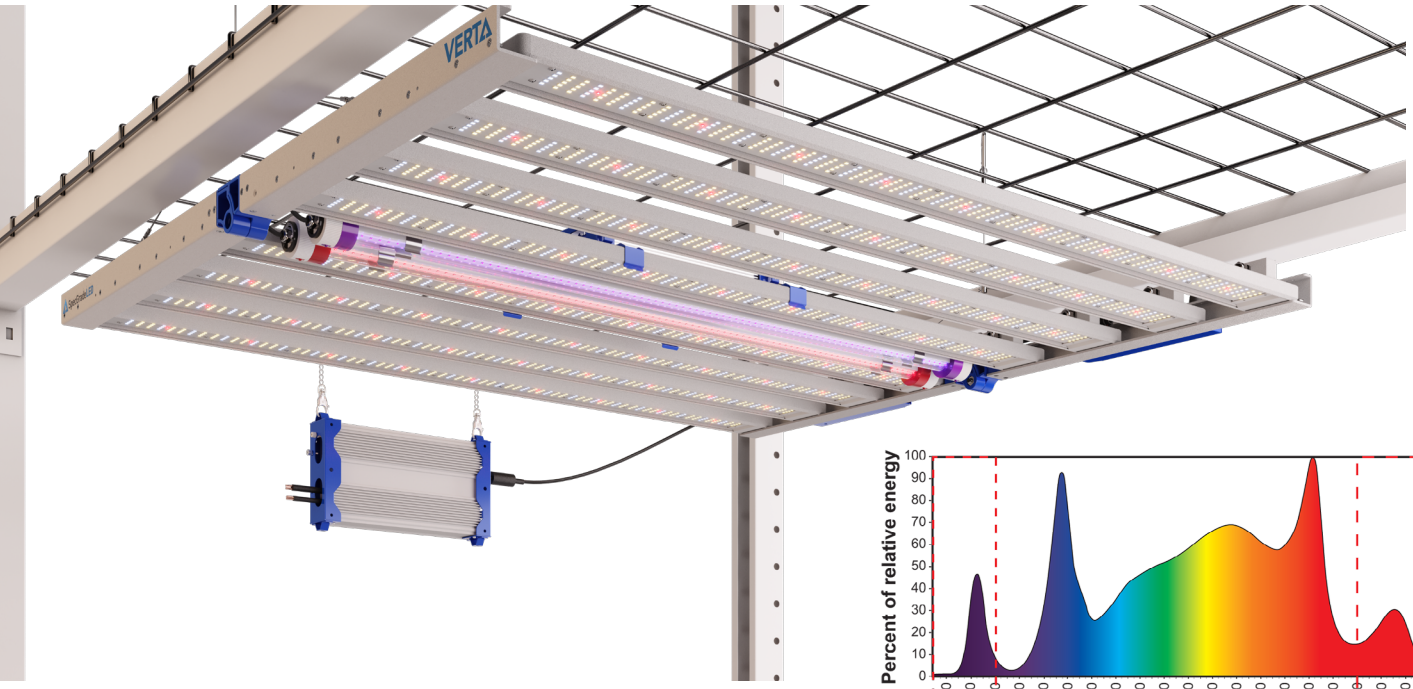
Spectral Control

As indoor and greenhouse cultivation continue to develop as critical methods of growing crops, LED technology affords cultivators a level of spectral control not previously experienced in artificial environments. Like all technology, unless it is properly utilized in terms of genetics, intensity, and timing it can be counterproductive.

Although it is well known in the cannabis space that that blue, green, and red light are critical for robust growth Far-Red light and UV light are emerging as important variables as well.



Far-Red Light (FR)

A study of 14 different crop species by Zhen and Bugbee (20201) found that an increase in canopy photosynthesis efficiencies occur when far-red photons or wavelengths between 700nm to 750nm are combined with a Photosynthetic Active Radiation (PAR) range of 400-700nm. This results in a boost to the flowering stage of plant growth.

Another study by Ji et al.(20192) demonstrated that tomatoes grown in a greenhouse (i.e. with the presence of sunlight) with supplemental LED lighting enriched with FR allocated 15–35% more biomass to fruits.

This synergistic photosynthesis process occurs naturally when the sun rises and sets. At these times of day the radiation from the

sun includes more far-red wavelengths. FR also penetrates deeper into plant leaves than either blue or red wavelengths, much as the green part of the spectrum does.

It is known that green light seeps below the top of the canopy driving the maturation of flowers and leaves lower on stems. Current research shows that FR has a similar impact on these shaded areas as well. This can be easily seen in shade tolerant plants that bush up and grow larger leaves, such as lettuce.

Far-Red light triggers chemical compounds that help spark the flowering stage thereby:

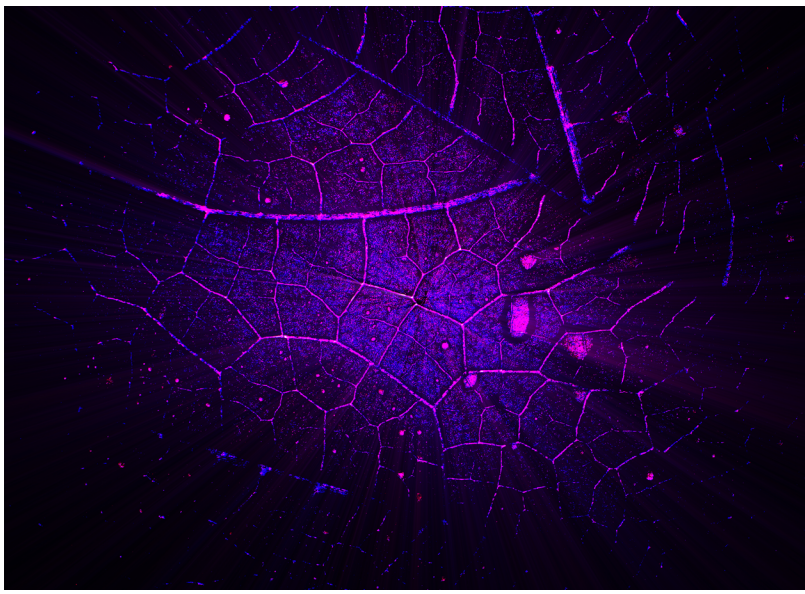
- **increasing plant biomass**
- **encouraging and prompting flowering**
- **enhancing flower size and cell expansion**
- **promoting plant stretching in non-shade tolerant species like tomatoes**

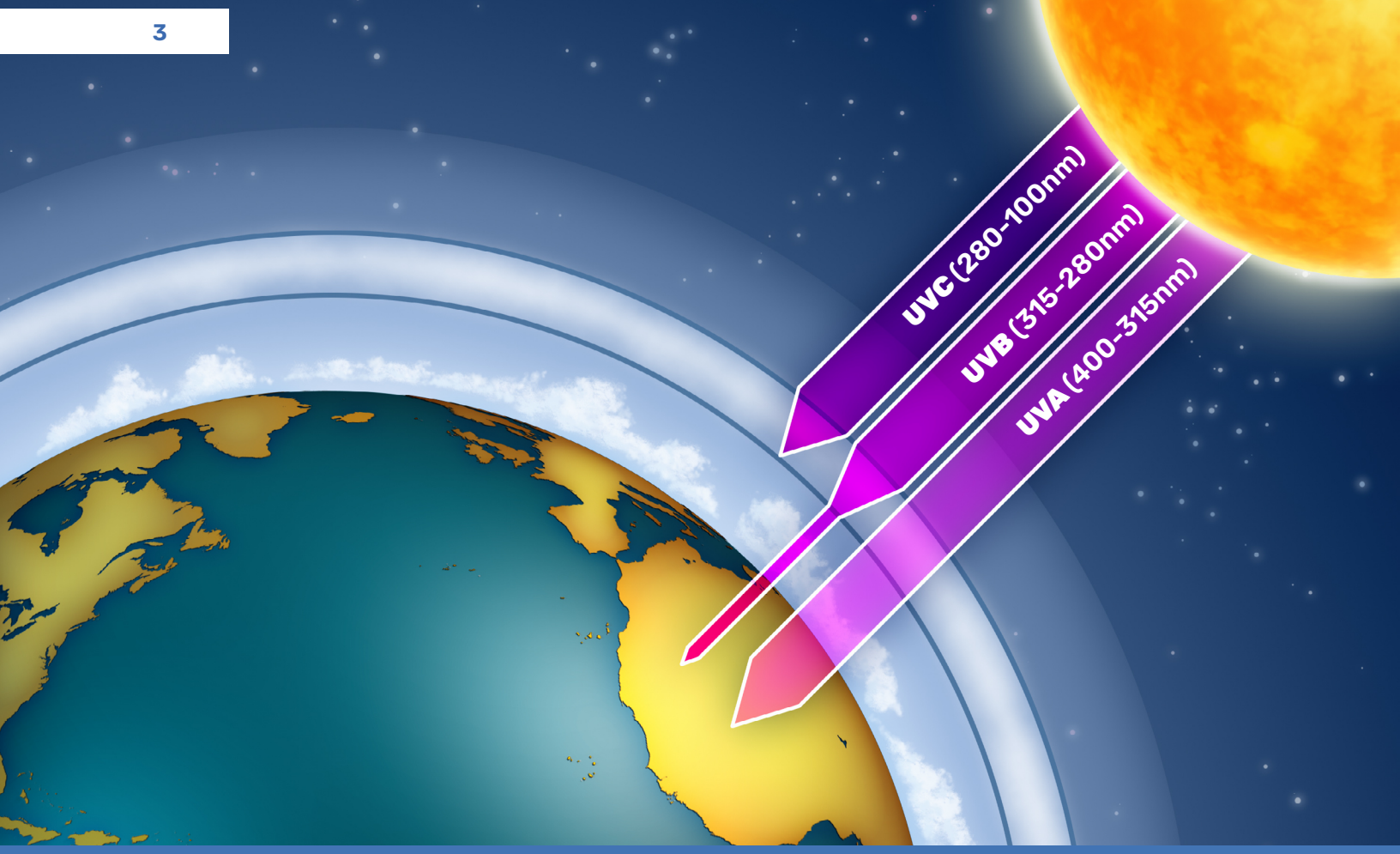
However, timing is critical. New research indicates plants will thrive when adding far-red light only during the flowering stage of growth (never in veg) for as little as 10-minutes before and after the regular photoperiod begins and ends. This will result in shortening the flower period by as much as 15% resulting in a quicker crop turn-over. Consequently, your far-red light should be controlled independently of the PAR range of 400-700nm.

By properly applying FR cultivators can artificially shorten the photosynthetic period and increase the number of crop cycles over time.

Ultraviolet Light (UV)

Research into the impact of Ultraviolet light (UV) is an evolving science. Early results using LED technology indicate that UV reduces the impact of pests, increases THC content in cannabis, improves overall crop quality, and accelerates the germination growth process without adding expensive synthetic chemical fertilizers. The use of ultraviolet light will also prepare plants for higher light intensities, reducing the shock time for the plant while quickening the photosynthesis process.





Ultraviolet light is a type of electromagnetic radiation that comes from natural sunlight. This light is broken up into three different sections of different wavelengths:

UVA (400nm-315nm) can increase the content of CBD and THC, accelerate germination, and make seeds adapt better to high-intensity lighting as well as increase the nutrients in vegetables. 95% of the UVA from the sun reaches the ground.

UVB (315nm-280nm) can damage cell membranes and can negatively affect basic plant metabolic processes such as photosynthesis, respiration, growth and reproduction. Over exposure is directly linked to sunburn in plants and animals. Only 5% of the sun's UVB reaches the ground.

UVC (280nm-100nm) is not naturally present on Earth due to our atmosphere and is not safe, UVA and UVB are both a key part of life. UVC radiation is used as a disinfectant in air and water filtration. It is a useful tool for reducing the spread of bacteria and certain viruses because of its ability to destroy microbes. Direct exposure can cause severe burns and eye injuries and is linked to cancer in humans.

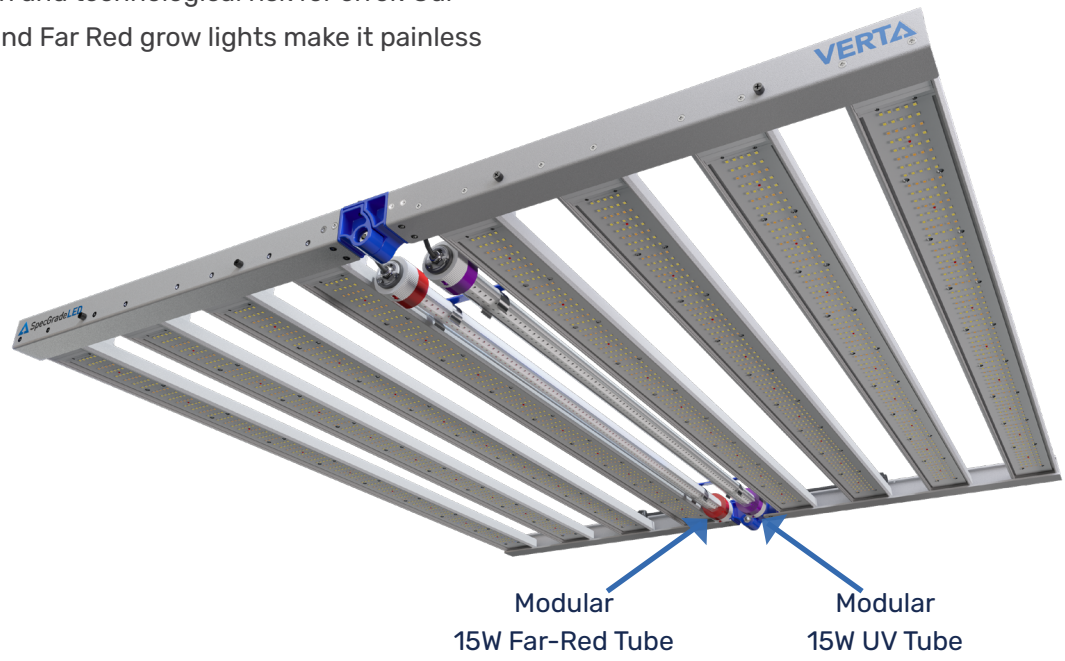
By having the perfect balance of UVA in the light spectrum in relation to other wavelengths, you can manipulate the size and biomass of your plants. The secondary metabolite activity elevates THC and terpene content in cannabis flowers as well as the development of antioxidants and phenolic compounds throughout the plant. These help a plant to protect itself at a cellular level from the abiotic stress induced by the UVA radiation. These secondary metabolites protect the plant not only from light irradiation, but also from pathogens and pests.

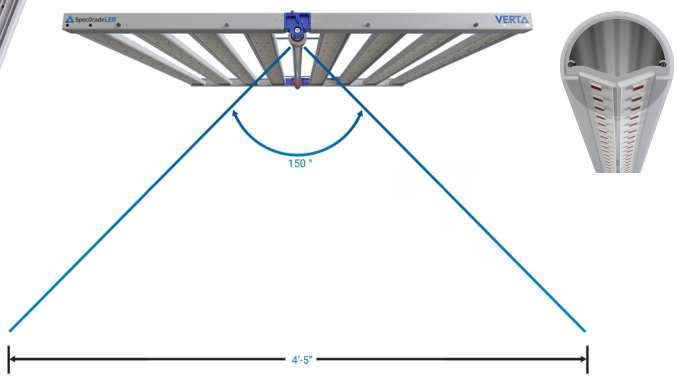
When growing cannabis, it's good to use a small amount of UV light at all times to mimic the light it learned from the mother plant---in other words, genetics. During the final 3-weeks of flower, growers might want to use an extra 2 hours of UV light a day. Many growers have found that this will result in more THC-rich trichomes which cannabis plants developed to protect themselves from the sun. A good rule of thumb is to use no more than 1-watt per square foot of UV light per day. And finally, it is important to keep in mind that UV rays can slow down and stress cannabis plants if they're used in other stages of growth, or if too much is used in a day.

Conclusion

Today's marketplace affords the cultivator less margin for error than ever. So, to have Far-Red and UV spectra integrated into a single 400-700 nm circuit board is a formula for disaster especially since UV LEDs only have a 10,000-hour life expectancy. At the other extreme, a grower ignoring the benefits of Far-Red and UV will negatively impact their return on investment. When applied correctly, both of these spectra will help generate higher quality yields from your plants while reducing the impact of pests and pathogens.

SpecGrade believes it is our responsibility to create modular spectral tools for the professional cultivator to easily dial in the optimum spectrum while minimizing both human and technological risk for error. Our UVA and Far Red grow lights make it painless to add either or both spectra to your facility. They are daisy-chain ready to simplify installation and provide independent control from your primary grow lighting.





SpecGrade LED's Supplemental Grow Light Tubes shown with Verta-8

About SpecGrade LED

We are a U.S. manufacturer of LED grow lighting for commercial horticulture serving cultivators throughout the United States and Canada. Our photo-biological performance & innovative engineering excellence makes our grow lights the cultivator's new first choice. We are focused on cost-effective, energy-saving illumination solutions for indoor cultivation.

Utilizing not only the most current LED technology and drivers, coupled with premium thermal management techniques, we have raised the bar to a new level. Every SpecGrade grow light seamlessly integrates the spectral, thermal, and electrical components into one sustainable investment. Our unwavering focus on innovation, reliability, and sustainability will provide the professional cultivator with the highest yields and quickest ROI.

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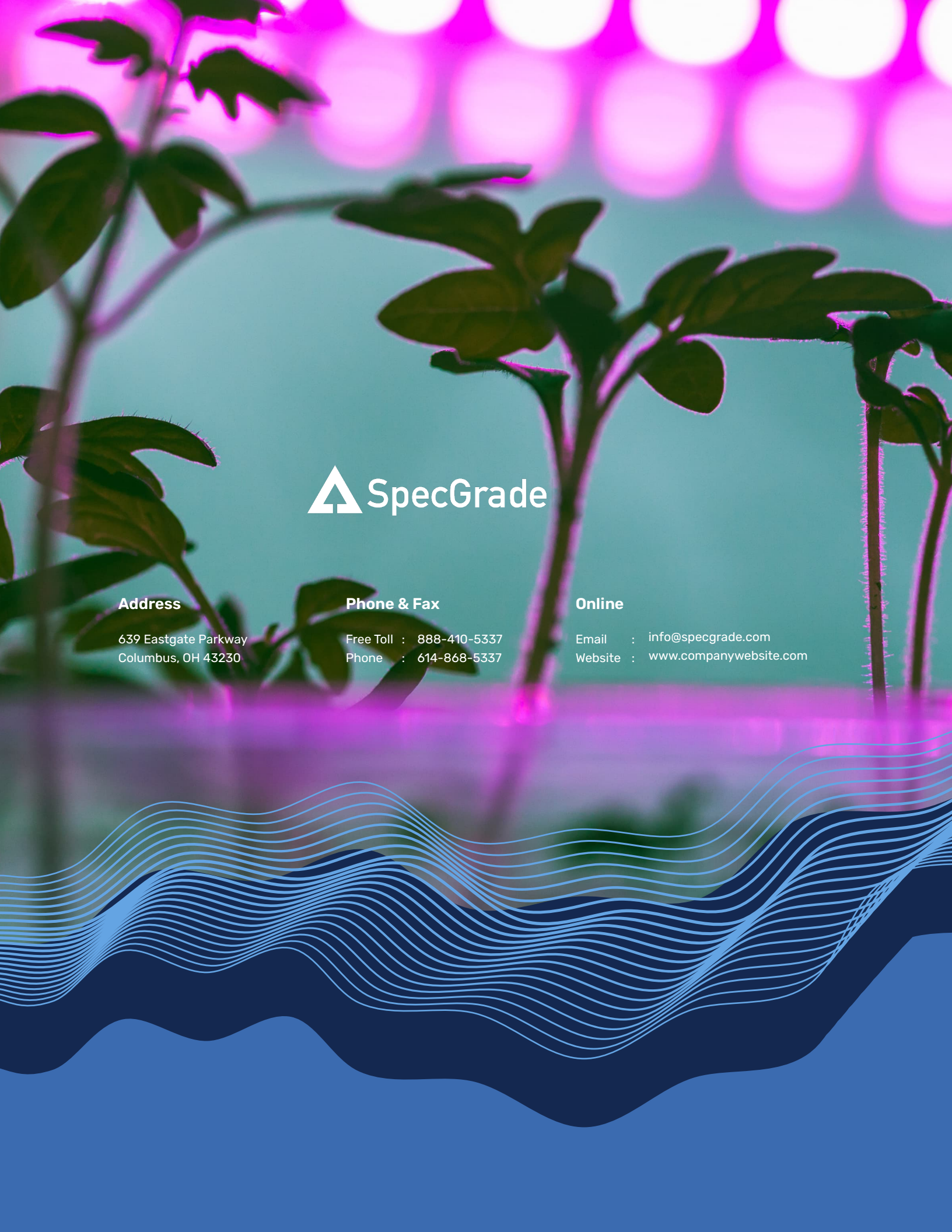

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