

Improving Harvest Yield and Lighting Efficacy Using OSCONIQ® P 3737 Horticulture Colors



Solution Overview

LEDs offer an energy-efficient alternative for greenhouse lighting. Unlike traditional high-pressure sodium lamps, LEDs emit light in specific wavelengths, tailored to plant photoreceptors. Recent studies show that by increasing far-red photon flux, it can increase plant growth significantly. Brand new, upgraded OSCONIQ® P 3737 Horticulture high-power LED with our ams OSRAM's latest chip technology and new generation of optimized lens, delivering industry leading performance, superior robustness and long lifetime which enables growers to reduce total cost of ownership as well as offers great return of investment compared to traditional light sources.

The advantages and key characteristics

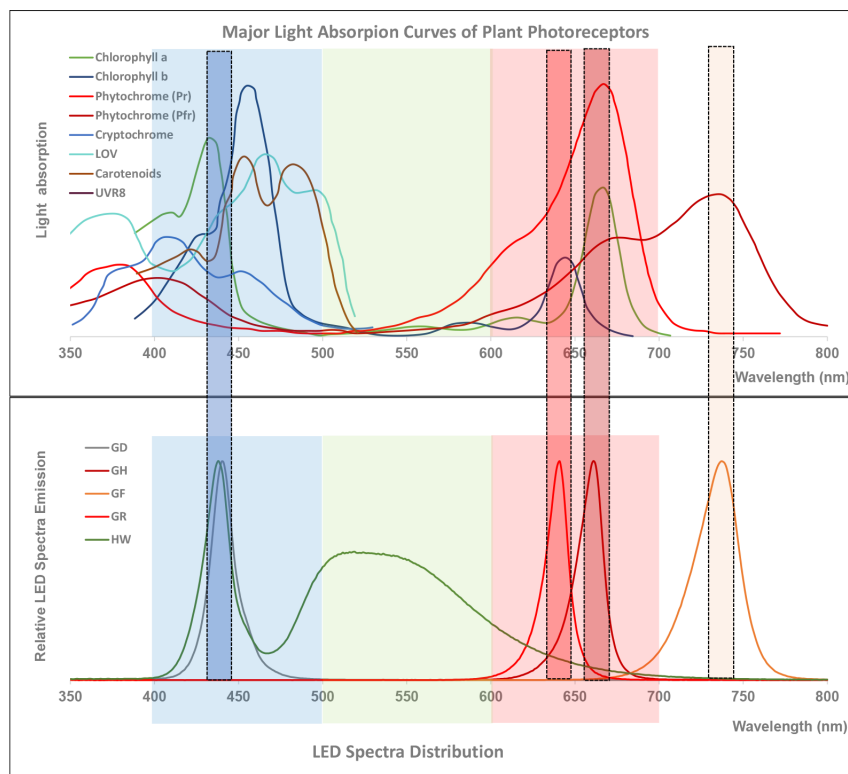
Application Advantage	LED Features
Industry leading efficacy	Industry leading hyper red LED at >82% hot wall-plug-efficacy & >4.60 $\mu\text{mol}/\text{J}$ hot photon flux efficacy at 700mA. Industry leading far red LED at >75% hot wall-plug-efficacy & >4.60 $\mu\text{mol}/\text{J}$ hot photon flux efficacy at 700mA.
IP Safe protection	Proven red chip technology designed and manufactured in Germany.
Superior Lifetime	Outstanding photon flux & color maintenance at Q90>50k hours.
Best-in-class robustness	Proven technologies under high humidity, high driving power and corrosive operating conditions.
Tailored spectra	Essential horticulture color spectrum such as Deep Blue, Super Red, Hyper Red, Far Red, as well as unique phosphor converted white (Horti White) are offered for optimizing photon flux color ratio.

Product List

Product model number	Size	Interface voltage	Power consumption	Application scenarios
Gx PUSRAx.xx	3.7 x 3.7 x 2.37 mm ³	1.70 to 2.83V typical subjected to color at 85°C	Current: 700mA Electrical power: 1.2 W to 2W subjected to part#	Agriculture, Horticulture, Architectural, Entertainment, Medical Lighting.

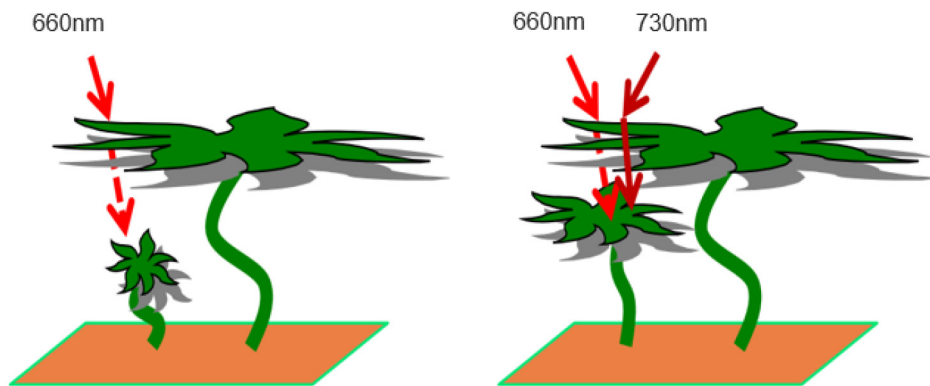
Technical principle

- Photosynthesis is a process where plants produce carbohydrates by converting water and carbon dioxide via light energy (photon). The important pigments are Chlorophyll-a & Chlorophyll-b.
- Photomorphogenesis is a process which light trigger bio-chemical processes that regulate the growth of plant in terms of size, leaves shape, color, orientation etc).
- Lights also important to regulate plant circadian rhythm and stimulate the defensive response against pests and fungus.
- Hyper Red (GH) and Super Red (GR) are important to activate red photoreceptors and chlorophyll pigments, thus improving harvest yield.
- Deep Blue (GD) is important to activate blue photoreceptors as well as chlorophyll pigments.
- Horti White (HW) acts as a supplementary light source to take care of human workers who are more comfortable with white light.
- Far Red (FR) is important to activate phytochrome which triggers flowering and regulates development of the plants.



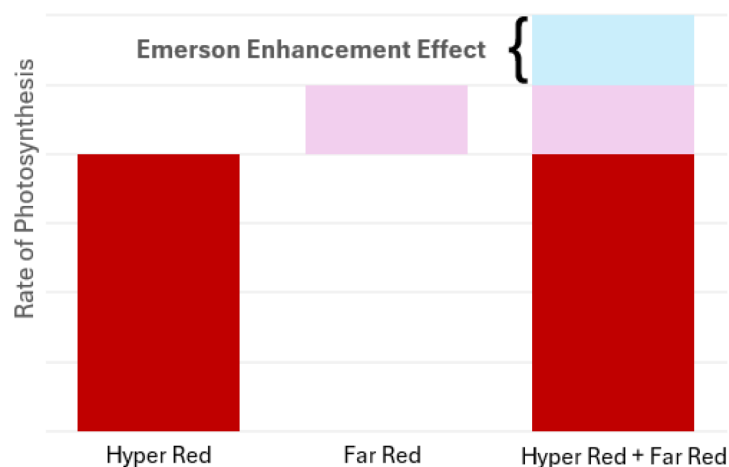
Picture 1: Major Light Absorption Curves of Plant Photoreceptors vs OSCONIQ® P Horticulture Colors Spectra Distribution.

- Small quantities of additional far-red are perceived via phytochromes (Pr & Pfr) as an early warning signal of competition, therefore triggering shade avoidance response: Plants perceive far-red light as a sign of shade, so they grow taller and increase leaf size to capture more light.
- This allows plants to increase their photosynthetic capacity, which can lead to increased growth and biomass.



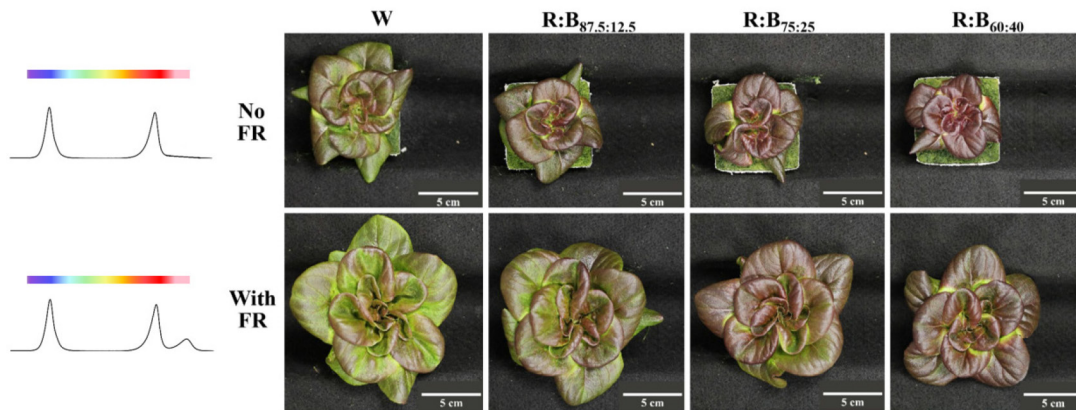
Picture 2: Shade Avoidance Response

- Emerson enhancement effect demonstrated that photosynthesis is more efficient when plants are illuminated with both red and far-red light simultaneously than when they are exposed with either light alone, which provides evidence for two distinct photosystems involved in photosynthesis: Photosystem I (PSI) and Photosystem II (PSII).
- When plants are exposed to both red and far-red light, PSII can efficiently process the red light and PSI can efficiently process the far-red light, leading to a higher overall rate of photosynthesis, and hence increase overall harvest yield.



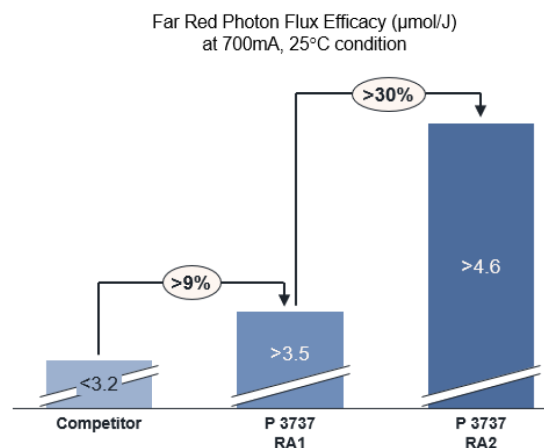
Picture 3: Emerson Enhancement Effect

- Recent study shows by supplementing far-red light can improve lettuce biomass more than 2x and yet support accumulating greater concentration of non-photosynthetic pigments, sugar, starch and certain key nutrients.



Picture 4: Far-red and red: blue ratios independently affect yield, pigments, and carbohydrate production in lettuce, *Lactuca sativa*. Image credit: Front. Plant Sci., 30 April 2024, Sec. Crop and Product Physiology volume 15 - 2024 | <https://doi.org/10.3389/fpls.2024.1383100>

- OSCONIQ® P 3737 Horticulture Colors high power LEDs enable superior system efficacy and low operational costs at similar photon flux output.
- ams OSRAM is the only LED supplier who offers far-red LED with photon flux efficacy comparable to hyper red LED, enables supplementing far-red spectrum without decreasing overall fixture photon flux efficacy.



Picture 5: Comparison far-red photon flux efficacy

Potential Application Scenarios

- Greenhouse Top-lighting
- Greenhouse Inter-lighting

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