EQUiTEC

LED's grow

2022

CATALOGUE

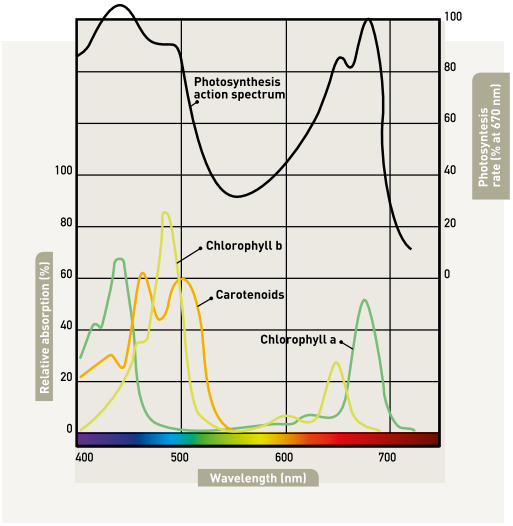
Table of contents

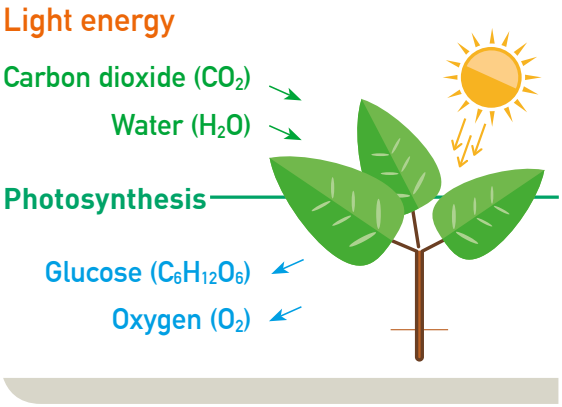
PRESENTATION

LIGHT AND PLANTS

Light is essential for the growth of plants via the photosynthetic and other regulating processes.

Natural sunlight is the most abundant and the cheapest light source, however it is difficult to control in terms of spectral composition, intensity and photoperiod.



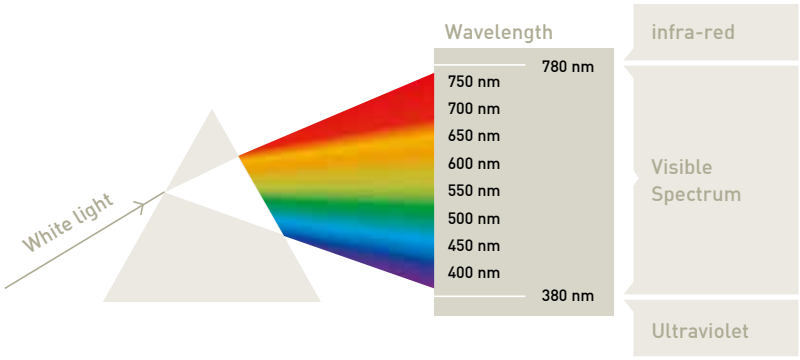


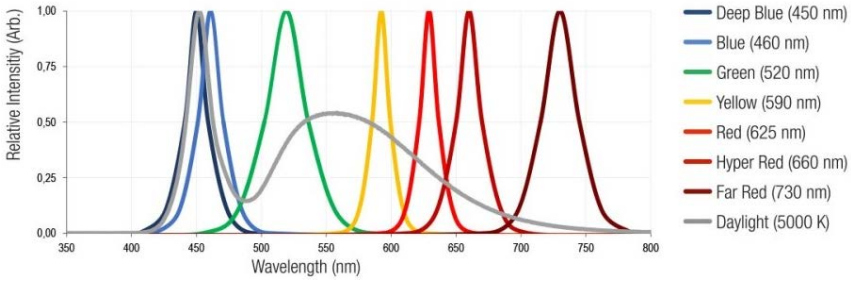
The use of artificial light has become a very common way to increase vegetal production.

The latest technical and scientific developments now allow the control of plant lighting by adjusting the light spectrum, the intensity and the photoperiod according to the project requirements.

EQUITEC LED LIGHTING FOR THE LABORATORY

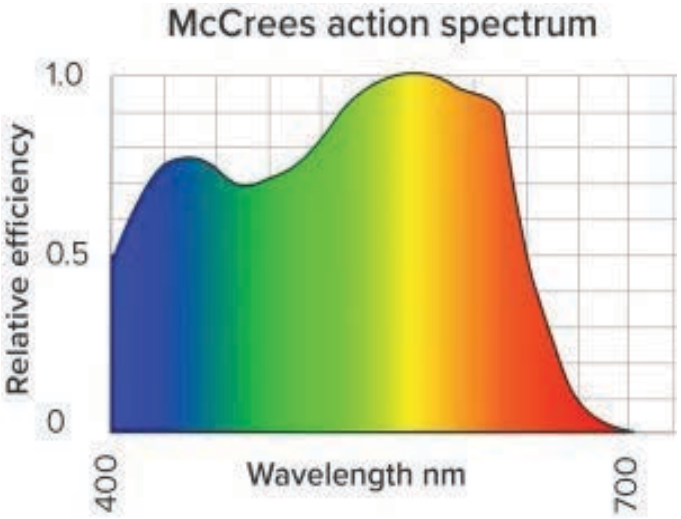
With this in mind, **Equitec** has developed a range of horticultural lighting products based on LED technology.
These products are the result of several years of research on the optimization of laboratory LED lighting aplications for plants grown in greenhouses reach-in and walk-in chambers.

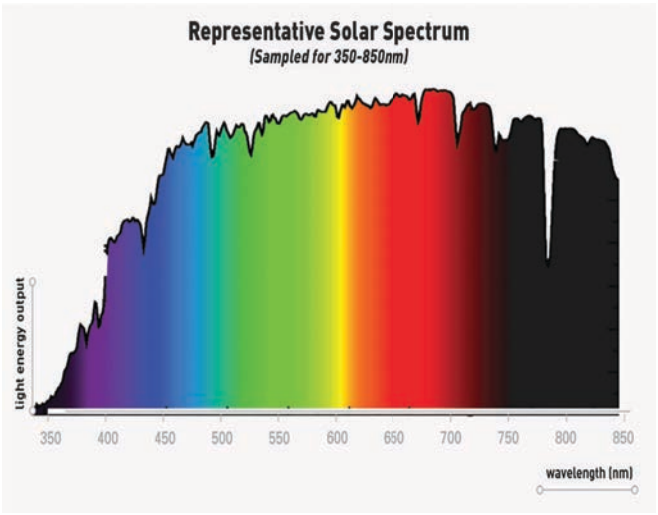


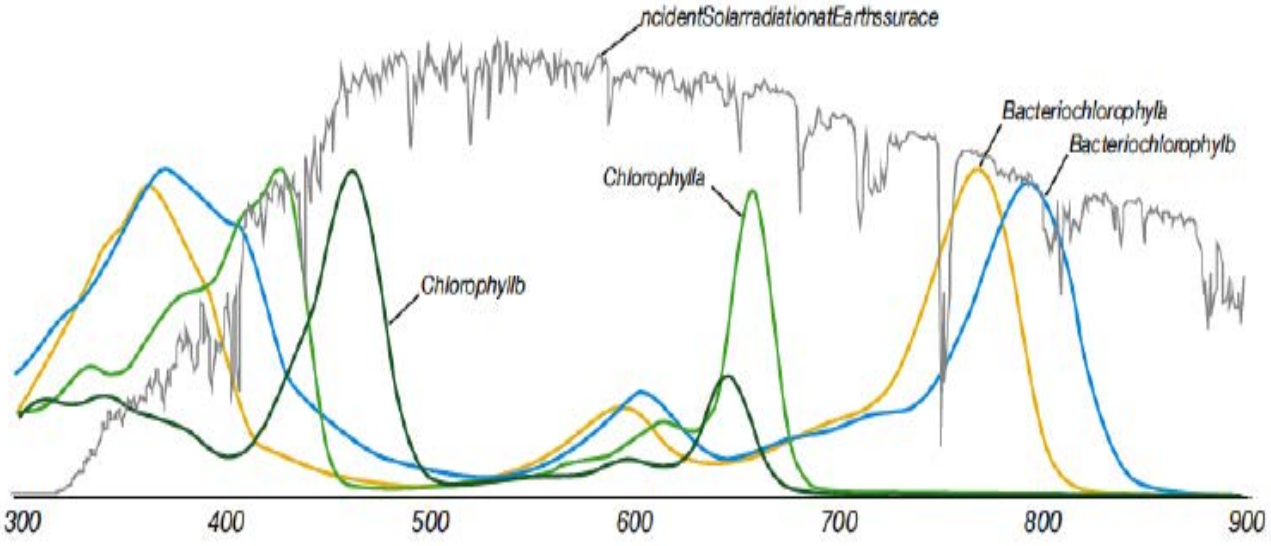


What is McCree's action spectrum and relative quantum efficiency?

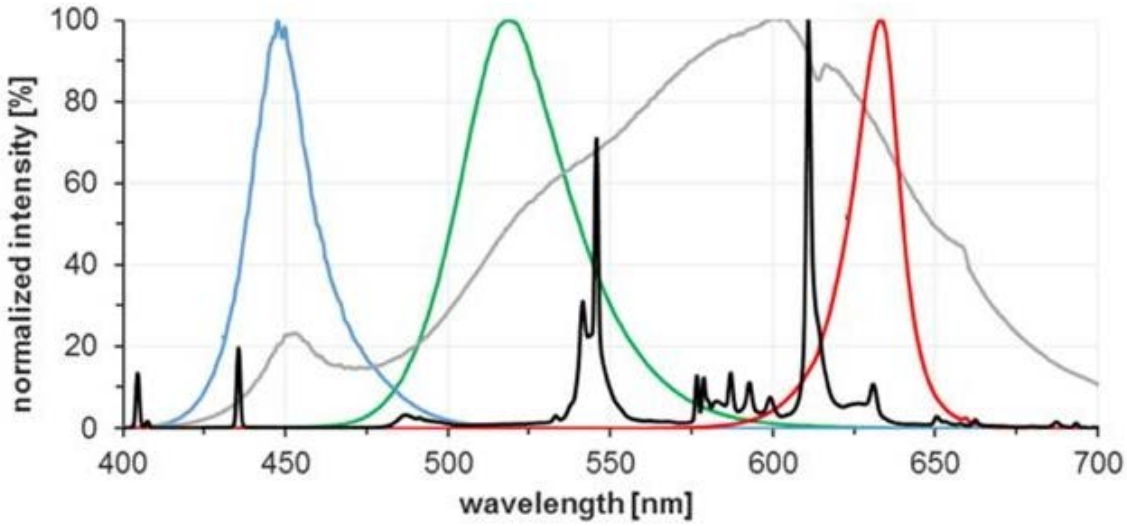
In the 1970s a scientist called McCree determined the wavelengths of light a plant can absorb. He assessed the relative quantum efficiency of different wavelengths of light on photosynthesis. In other words he recorded the rate of growth of plants exposed to each wavelength or colour of light. McCree discovered that plants use all parts of the PAR spectrum but at different rates. The quantum efficiency for red is close to 100% efficient whereas blue and green were less efficient, ranging from 65% to 75%. McCrees action spectrum identifies what colors of the visible spectrum are best for photosynthesis.







Solar Spectrum utilization in photosynthesis.
The solar spectrum incident on the earth's surface (air mass 1.5, NREL) is in gray. Absorption spectra of chlorophyll a (green), chlorophyll b (dark green), bacteriochlorophylla (yellow), and bacteriochlorophyll b (blue) are taken in methanol or ethanol (McConnell et al.).

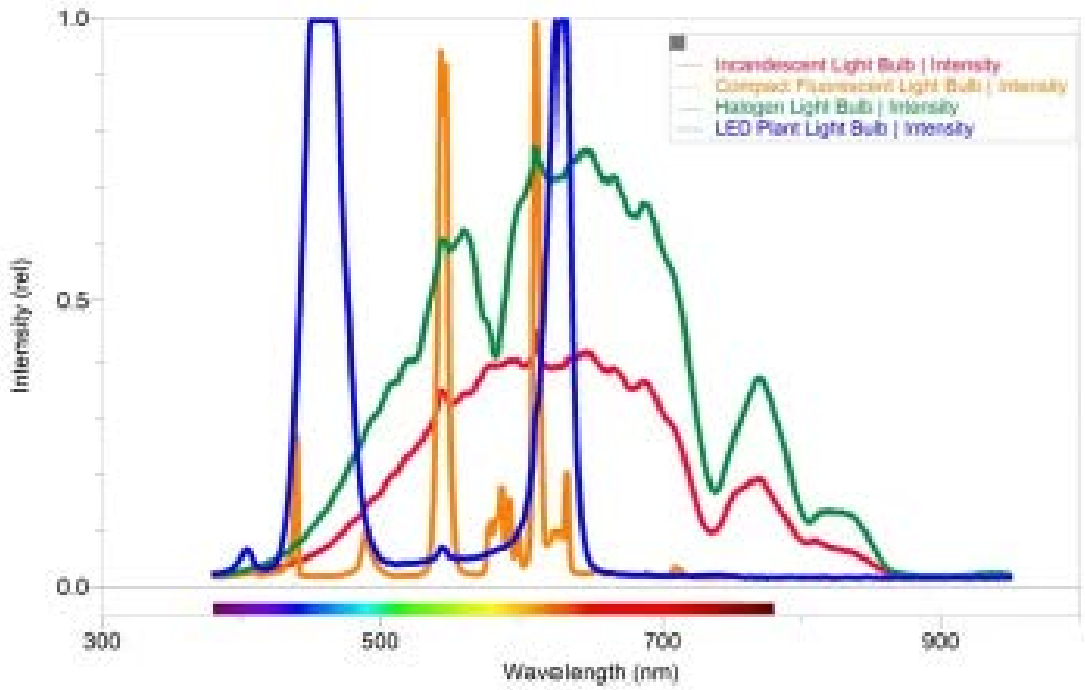


Light is electromagnetic radiation transmitted as photons.
In plants, light is absorbed by pigments and photoreceptors.
Plants use light for photosynthesis which produces a reaction in which light energy is converted into chemical energy.
The light also transmits information to the plant about its growing environment.
The definition of the color of the wavelength is not as simple as one might expect.
There are ISO standards for determining the wavelength of colors, but in photobiology, the most commonly used ranges differ from those ISO definitions. For example, according to ISO, red is 610-760 nm, but in photobiology 620-680 nm can be used.
Spectra at 650-670 and 720-740 nm are also used to calculate the ratio of photons from red to far red.
The following graph demonstrates very well the energetic and quantum properties of the light spectrum.
The units used and what is called the "solar spectrum" must be known. ASTM and IEC use the Simple Model of Atmospheric Solar Radiation Transfer (SMARTS) program to generate terrestrial reference spectra, for the evaluation of the performance of the photovoltaic system and product comparison.

Reasons why choose equipment with LED light, compared to other lighting systems

WHAT ARE THE BEST LIGHT SOURCES FOR PHOTOSYNTHESIS?

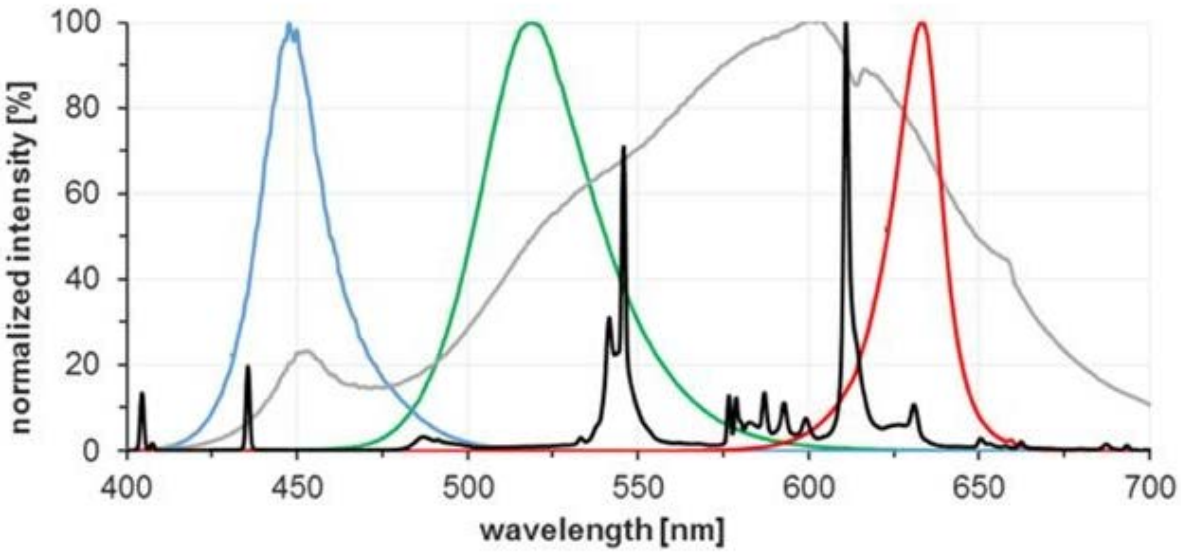
Photosynthetic organisms such as plants and algae use electromagnetic radiation from the visible spectrum to drive the synthesis of sugar molecules.
Special pigments in chloroplasts of plant cells absorb the energy of certain wavelengths of light, causing a molecular chain reaction known as the light-dependent reactions of photosynthesis.
The best wavelengths of visible light for photosynthesis fall within the blue range (425–450 nm) and red range (600–700 nm).
Therefore, the best light sources for photosynthesis should ideally emit light in the blue and red ranges. In this study, we used a Spectrophotometer to collect spectra from four different light sources. This allowed us to determine the wavelengths emitted by each source and to get an idea of their relative intensities.



Wavelengths of light outside of the red and blue ranges are not used by most plants and can contribute to heat build-up in plant tissues. This heat can damage plants and even interfere with photosynthesis. To identify the ideal light source for photosynthesis studies we compared the output or emission spectra of four different E27 type bulbs in the same desk lamp: a) 60 W incandescent bulb, b) 35 W halogen bulb, c) 28 W-equivalent LED “plant bulb” (6–9 W), and d) 13 W compact fluorescent light (CFL) bulb. Each light was measured at a standard distance of 50 cm.

Based on our results, the best light bulb for promoting photosynthesis in plants was the LED plant bulb.
This bulb produces a strong output in both the blue and red wavelengths, with very little additional light in other regions to cause heat build-up.
All the other light sources had very little output in the blue range. The halogen and incandescent bulbs had extremely broad output ranges from green to deep into the red portion of the spectrum, but with little to nothing in the blue range. The least suitable lamp for photosynthesis was the CFL bulb. While it emitted some light in both the blue and red ranges (with several peaks in between), the intensity of this bulb was the weakest when compared to all the other lamps. LED plant lights are available from a variety of online merchants and home and garden stores. They have become very affordable, and work well for experiments that investigate photosynthesis.

LED LIGHT SPECTRUM



The latest LED technology allows you to create custom light with the most suitable spectra to save energy, while using artificial light to modify the environment in which the plants grow and thus obtain the desired characteristics and improve the quality of the products. crops. Since plants have pigments that absorb wavelengths other than red and blue, and wavelengths beyond the PAR zone can significantly affect their morphology and metabolism, it is preferable to use lamps with continuous light spectra, which are adapted to the desired characteristics in each type of crop and that have been developed specifically for horticulture.

PHOTORECEPTORS

Plants can detect small changes in the spectrum, intensity, and direction of light. Photoreceptors detect these light signals, making it possible for the plant to adjust its development accordingly. Three main groups of photoreceptors have been identified: cryptochromes, phytotropins and phytochromes. In addition, the UVR8 photoreceptor is involved in the perception of UV-B radiation.

NOT ONLY VISIBLE GROWTH

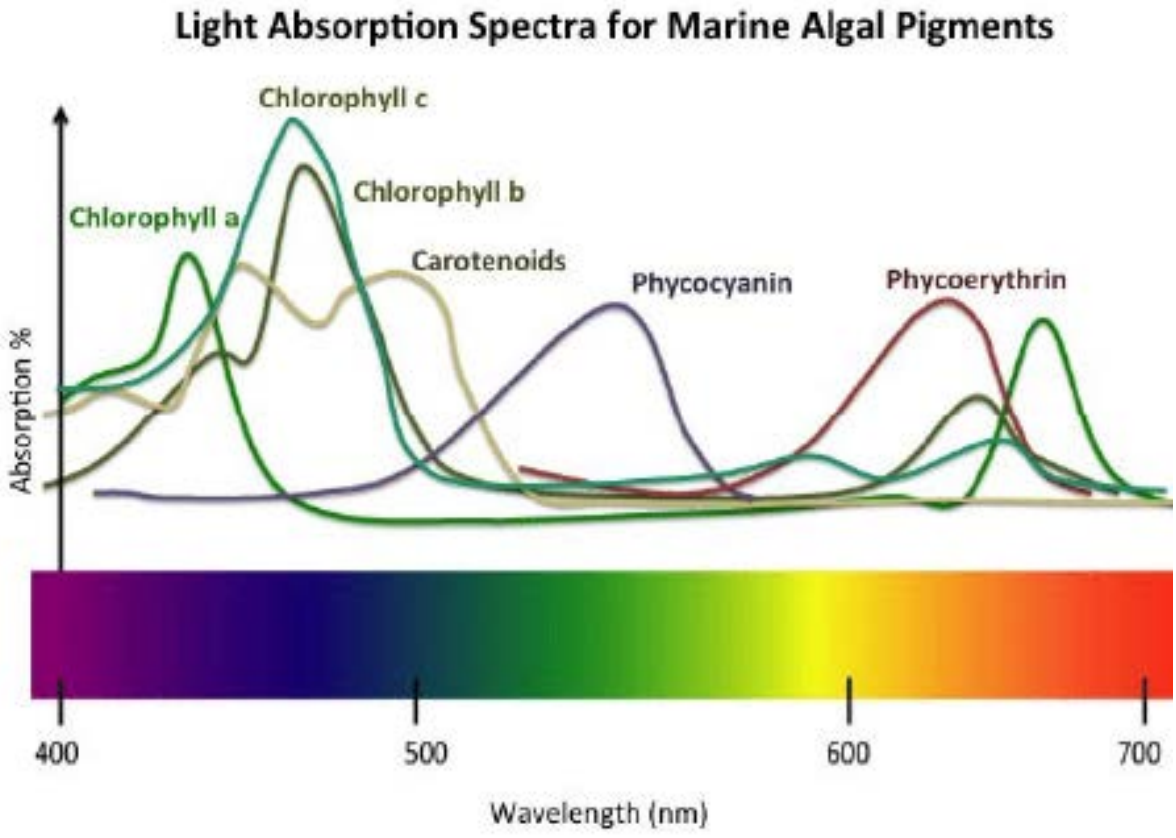
Cryptochromes absorb the wavelengths of UV-A, blue and green and participate in photo morphogenetic responses. Cryptochrome-mediated responses are, for example, cell elongation, inhibition of stem elongation, and photoperiodic flowering. Cryptochromes work together with phytochromes that absorb red and distant red.

Green light can excite phytochromes, cryptochromes, and phytotropins. Green light has also been shown to transmit efficiently and drives photosynthesis in deeper leaf layers and enhances growth

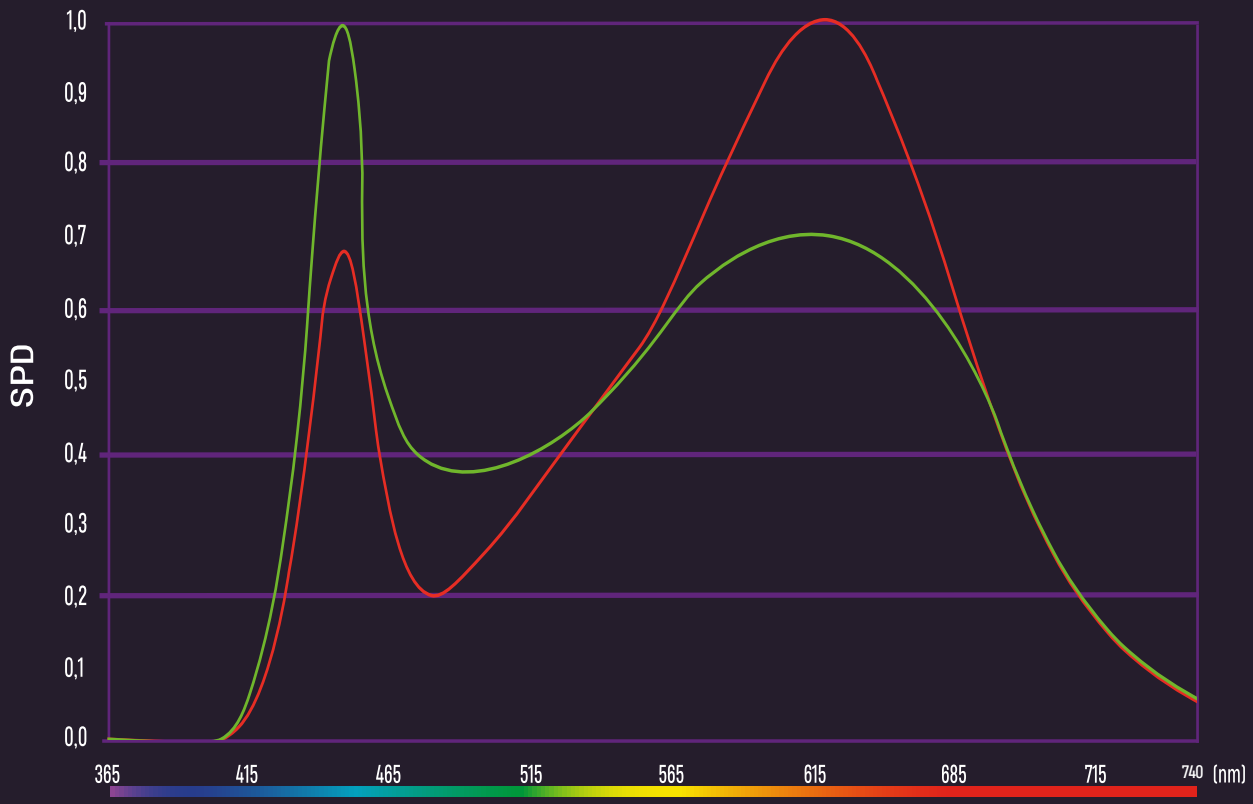
ALSO GREEN LIGHT HELP

Green light has also been shown to reverse some blue light-induced responses. The variety of different phytochrome responses is extensive. Phytochromes absorb the red, blue, far red, and ultraviolet wave bands of the spectrum.

Phytochromes affect stem elongation, leaf expansion, and alter plant structure in response to overcrowding, i.e., avoidance of shade, which involves the plant's perception of changes in the ratio of red to far red. Phytochromes also contribute to flowering.



LUMINIC SPECTRUM



Far red
It controls the photoperiod of the plants, an intensive use allows to increase the internodal distance.

Deep red
Increases photosynthetic performance, increases flower production.

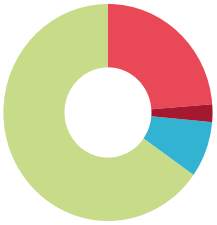
Green
Helps secondary metabolic processes such as anthocyanins.

Royal blue
Increases the root system of plants and reduces the internodal distance

Ultraviolet
It increases the production of resin and with it the generation of cannabinoids and terpenoids.

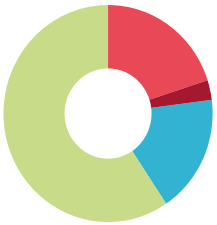
LEGEND
GROWTH
FLOWERING

WARM WHITE 3.500 k



- Deep red 24,58%
- Far red 2,18%
- Royal blue 8,52%
- Green 64,72%

COLD WHITE 5.000 k

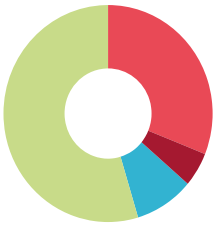


- Deep red 20,20%
- Far red 3,13%
- Royal blue 17,57%
- Green 59,10%

Growing Stage

- Deep red 28,03%
- Far red 4,94%
- Royal blue 15,71%
- Green 51,27%

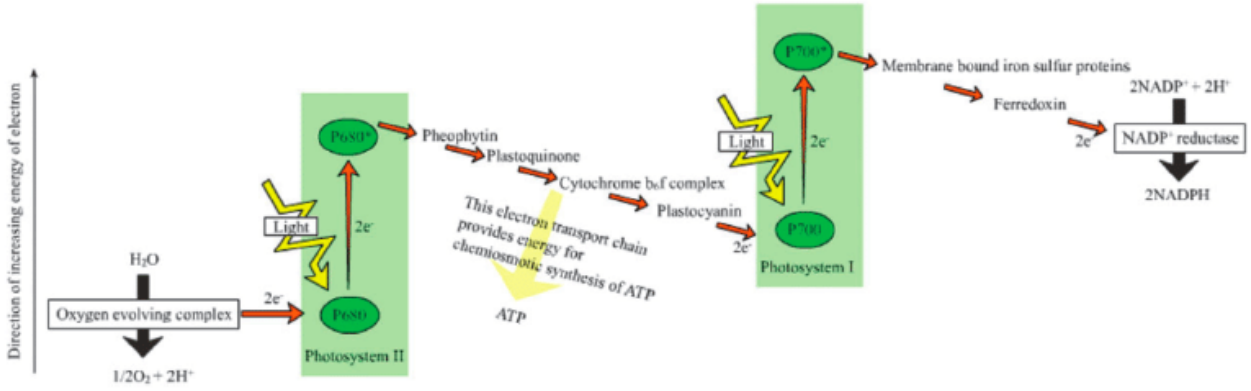
Flowering Stage



- Deep red 31,76%
- Far red 4,39%
- Royal blue 9,13%
- Green 54,72%

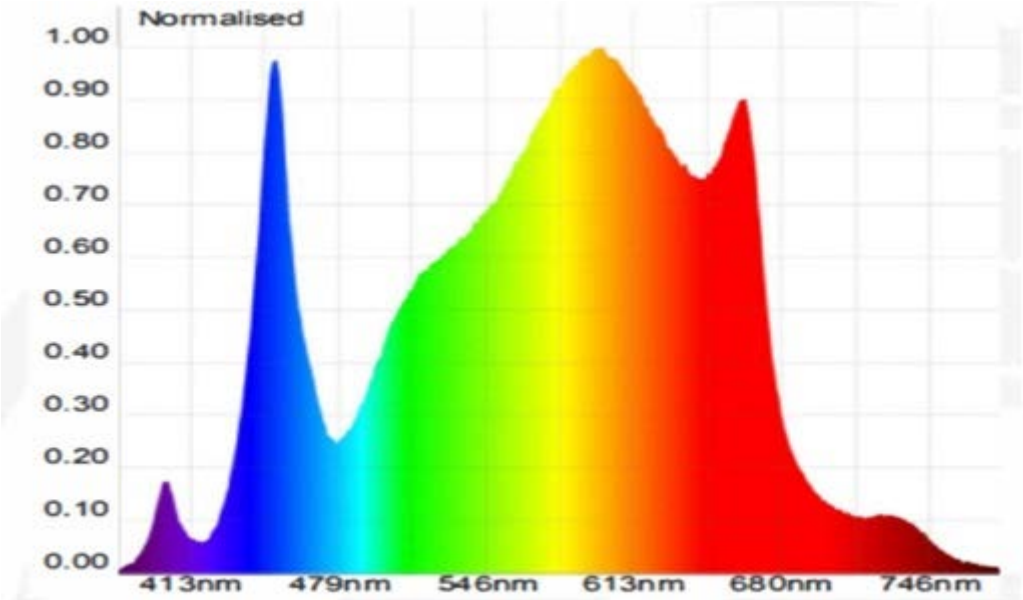
UV 400nm

- UV 100%



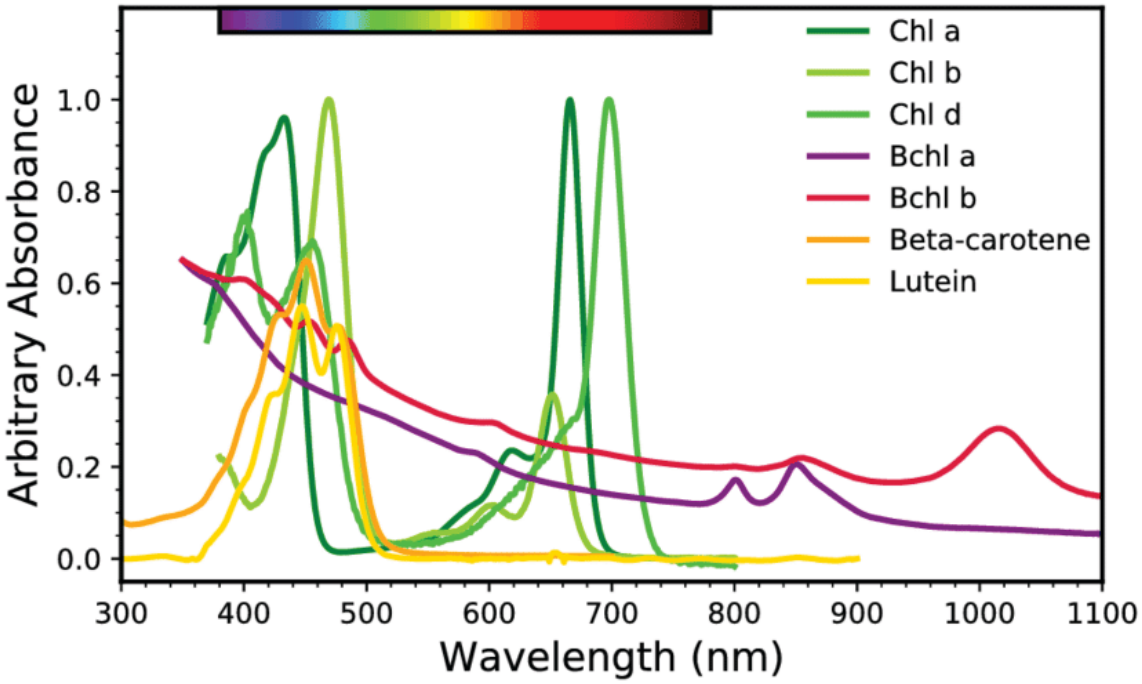
PHOTOSYNTHESIS

Photosynthesis involves transforming chemical energy (assimilated/sugars) from the energy provided by light.
All wavelengths between 400 and 700 nm contribute to the photosynthetic system, in addition, wavelengths carry information that affects the chemistry and morphology of plants.
However, photons at longer wavelengths (far red) also contribute to photosynthesis, this so-called Emerson effect.
The rate of photosynthesis is higher when red and far red light occur together than the sum of the rates when given separately.
This evidence the presence of two photochemical systems working together with slightly different wavelengths. These are currently referred to as photosystem I and photosystem II.
Using current PAR limits may lead to underestimation of photosynthetic carbon gain.
Photochemical quantum efficiency measures the fraction of absorbed photons involved in photochemistry.

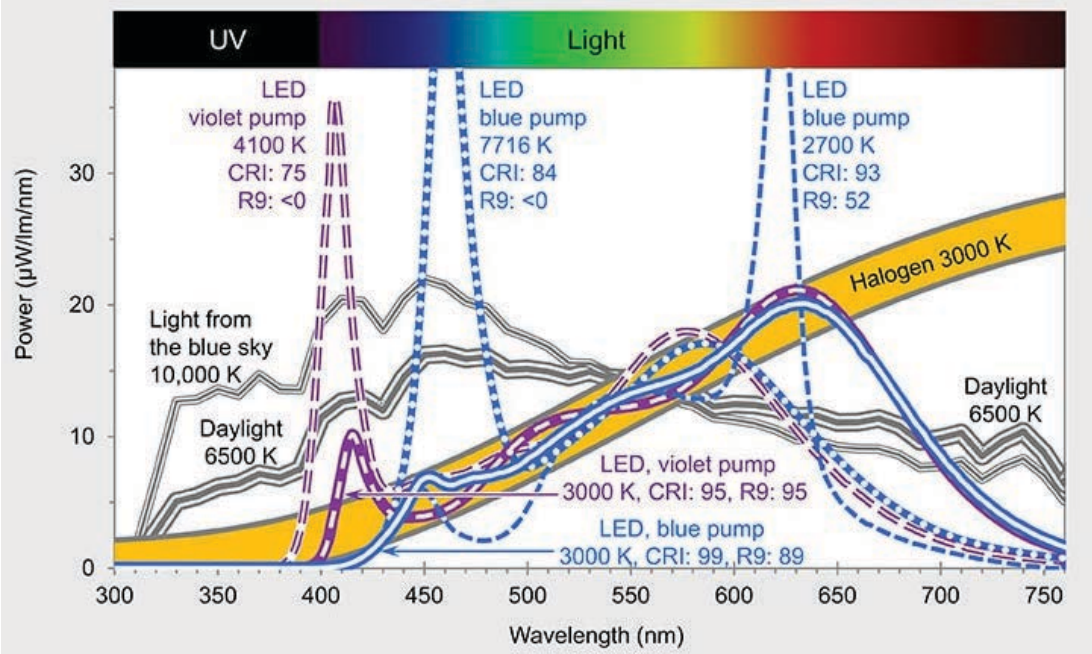


Our typical PAR chart

Energy efficiency is different, as only about a quarter of the energy is stored in each photon, the rest is converted into heat.
Plants typically convert only 4% to 6% of the available energy into radiation into biomass.
By exposing plants responses, to elevated CO2, such as increased photosynthesis, it can be estimated that it could be obtained by improved photosynthesis in seedbeds or by genetic manipulation.
Through experiments, it is estimated that the improvements in photosynthesis, in the presence of a high CO2, are approximately 30%.
However, in studies related to increased CO2 levels, the 30% improvement in photosynthesis has been found to increase the relative growth rate by only about 10%.
Increased photosynthesis does not proportionally increase the relative growth rate, as increased carbohydrate availability can exceed the ability of many plants to fully utilize them. This is due to nutrients or internal limitations inherent in growth. Likewise, focusing only on photosynthesis can give unreliable indications of spectrum performance, as measurements provide results only for a short period of time.

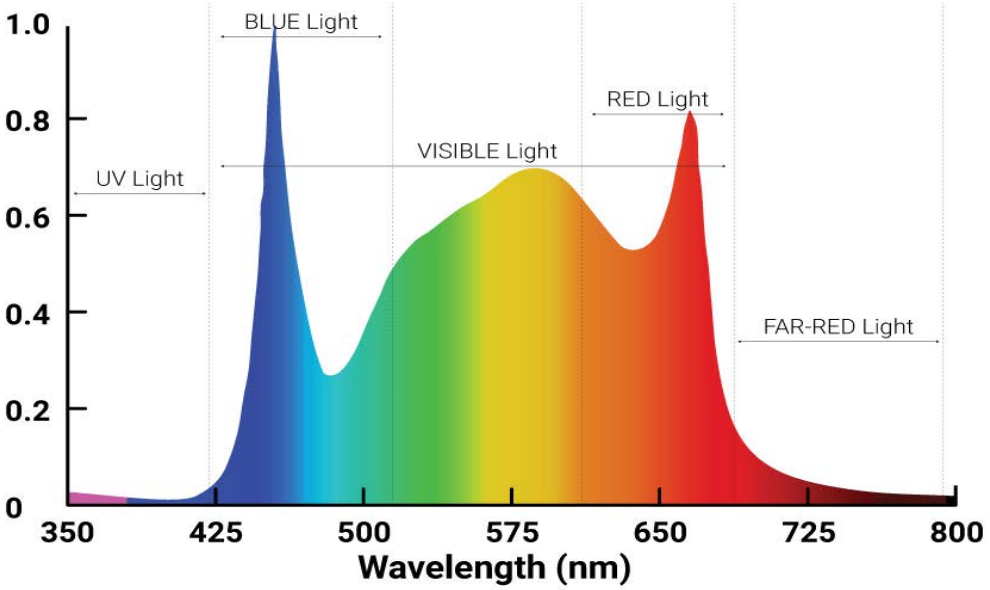


Photosynthetic and other light-absorbing pigments.
Absorbance spectra of selected chlorophylls (Chls), bacteriochlorophylls (Bchls), and carotenoids showing the wavelengths of absorption peaks.
A visible spectrum colorbar is shown at the top. The y-axis scaling is arbitrary. The Chl absorbance data are of extracted pigments in methanol solution .
The Bchl a and Bchl b data are of whole cells .
The beta-carotene (carotenoid) spectrum is of pigment extract in hexane and the lutein (carotenoid) .
Pigments dissolved in solvents have absorption peaks slightly shifted from those in cells.
These data are publicly available on the Virtual Planetary Laboratory Biological Pigments Database (http://vplapps.astro.washington.edu/pigments).



PAR (Photosynthetically Active Radiation)

Active photosynthesis radiation (PAR) designates the wave bands of solar radiation of 400 to 700 nanometers that photosynthetic organisms can use in the process of photosynthesis. All wavelengths between 400 and 700 nm contribute to photosynthesis, plus wavelengths include information about the plant environment.



UV Light (10nm-400nm)

While it won't contribute to photosynthesis and is still under research, UV light has been shown in studies to increase production of terpenes and anthocyanins which can enhance the color profile, aroma, and flavor of your flowers.

BLUE Light (400nm-525nm)

Contributes to photosynthesis and has effects on the plants morphology, causing it to grow stockier and more dense. Many HID lighting technologies are weak in producing these spectrums.

VISIBLE PAR Light (400nm-700nm)

This is the spectrum range which can be used by the plant for photosynthesis and thus is the most important range of light for growth. 400nm-700nm is the currently accepted range, many scientist have conducted tests showing far-red light also contributes to photosynthesis and advocate expanding it to 400nm-750nm.

RED Light (600nm-700nm)

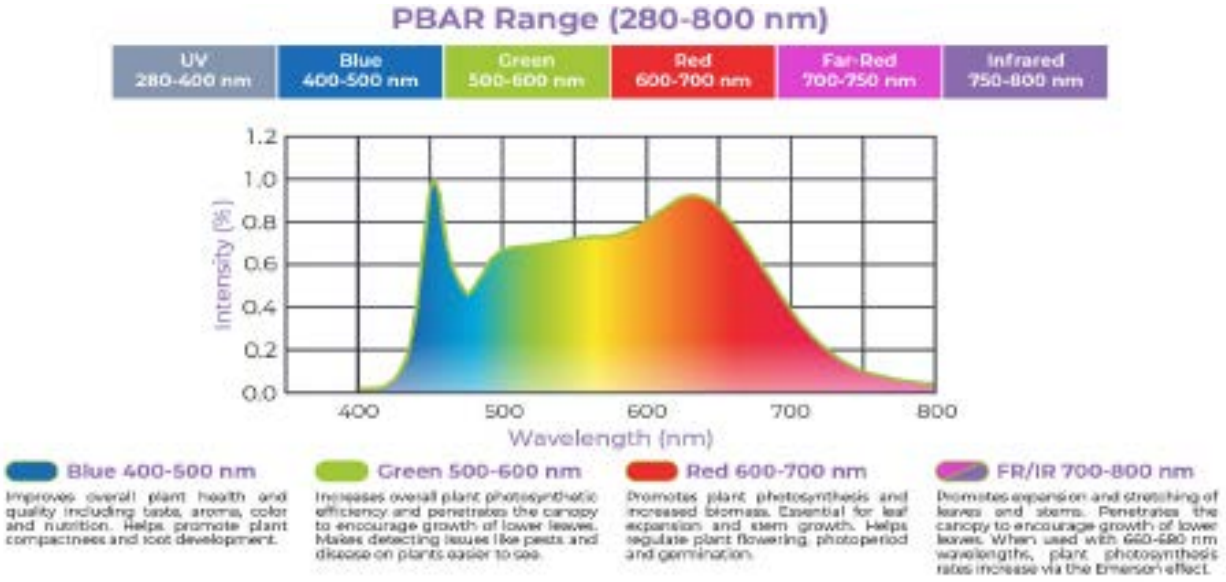
Contributes to photosynthesis and has effect on the plants morphology, causing the plant to stretch. Red light is particularly useful as it is the most efficient light to produce using LEDs, meaning you will get the most light per watt of power used.

FAR-RED Light (700nm-750nm)

Recent research has shown this previously ignored section of the spectrum can have immense benefits for plant growth. It has been seen to increase leaf size which can increase a plants ability to absorb light ultimately increasing overall growth. Contrary to prior belief, it has also been shown to contribute to photosynthesis.

PBAR (Photobiologically Active Radiation)

There is critical information for plants in addition to the PAR area, in the UV range below 400 nm and in the far-red region above 700 nm.
These areas and their relative proportions significantly affect plant growth.
Therefore, it is necessary to refer to photobiologically active radiation from 280nm to 800nm.



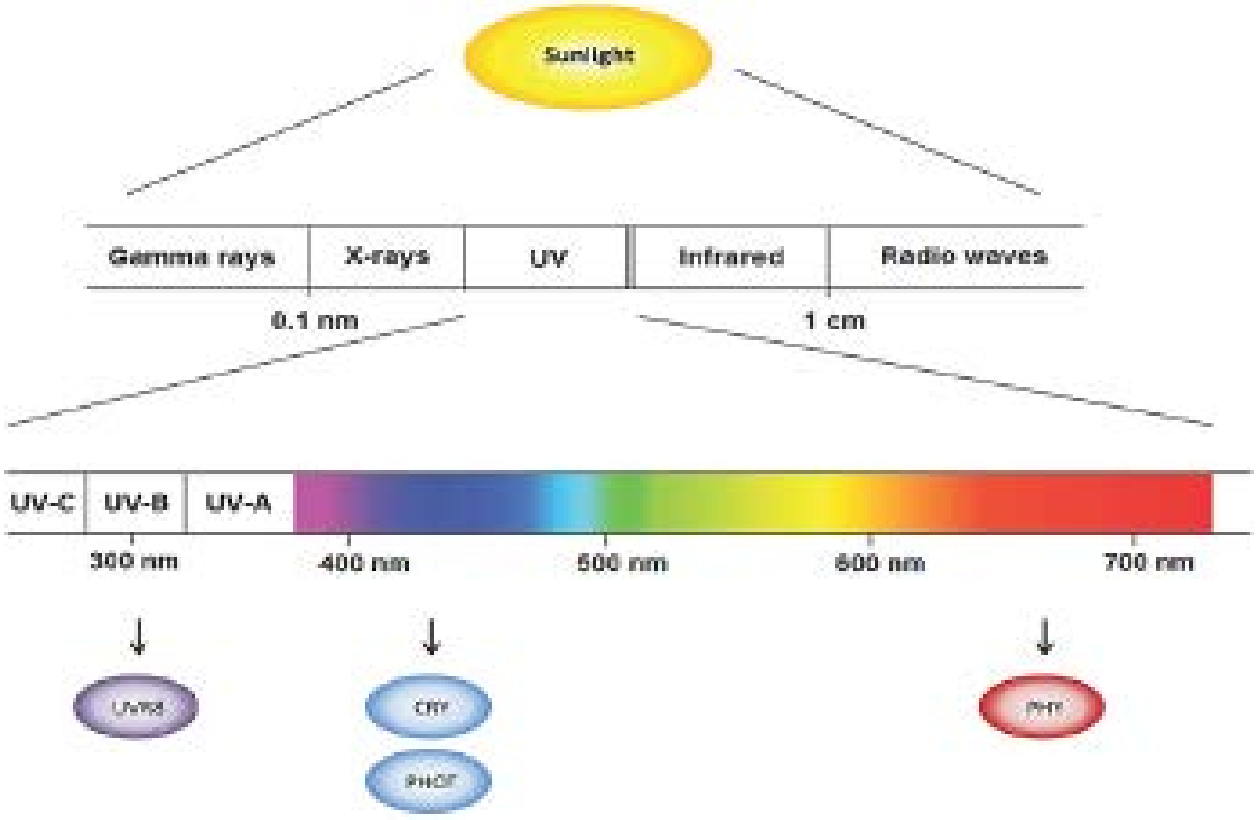
R:FR (Red: Far Red)

The R:FR ratio of a spectrum determines the relationship between active phytochromes (Pfr) and inactive phytochromes (Pr).
The R:FR ratio is the basic information for plants about their environment.
Plants grown in shady conditions try to lengthen the stem and leaves to achieve a better position in the canopy (capture more light intensity) and produce seeds quickly (premature flowering).
Sunlight has an R:FR ratio of 1.2 and light under a leaf canopy has an R:FR ratio closer to 0,1

The lower the R:FR ratio, the higher the Pfr portion of total phytochromes, therefore the stronger the shadow avoidance response.
Photon ratios R: FR can be calculated: R: FR = (650–670 nm) / (720–740 nm).

B: G y CRY effect. Energy radiation

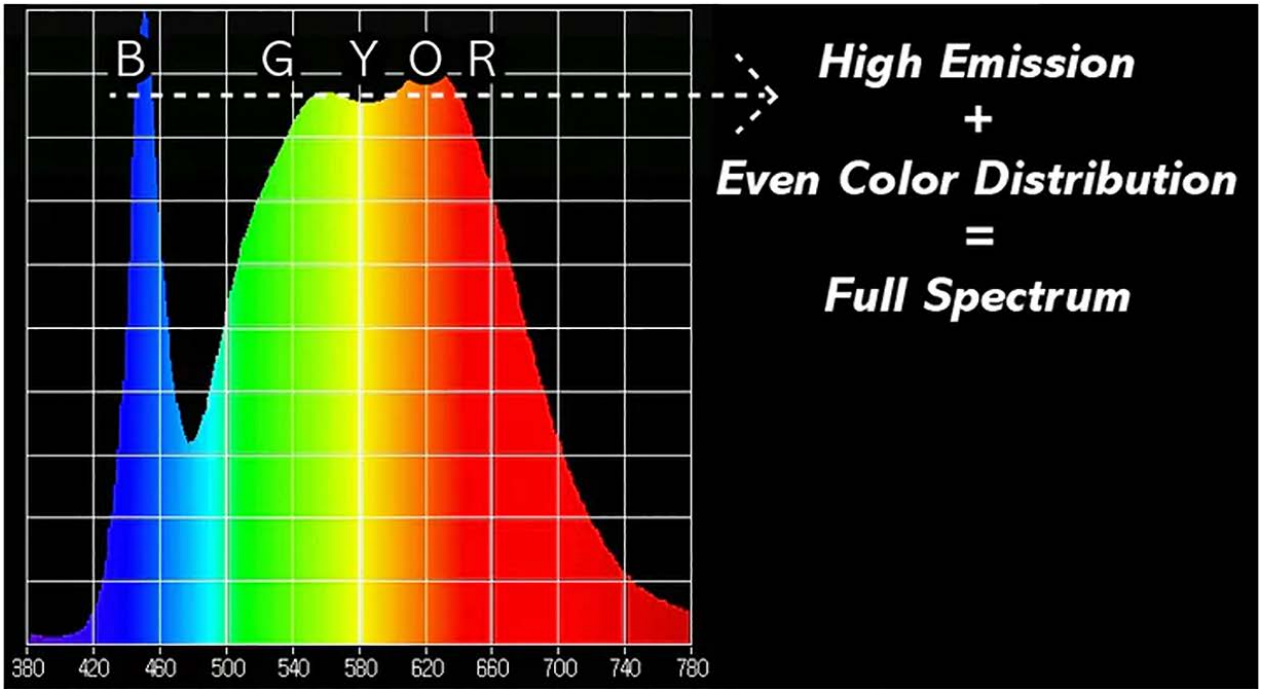
The B:G ratio (Blue: Green) determines the effectiveness of responses to blue light. The B:G ratio is also related to the response to avoid shade (elongation of the stem and leaf).
If the B:G ratio is high, the plants have short leaf internodes, stomate and pistils.
By increasing the green light portion of a spectrum, responses to blue light become "lighter"; plants are not as compact and leaf temperature increases slightly, due to the partial closure of stomata.
Photon ratios B: G are calculated according to definitions for different colors of light. B: G = (420–490 nm) / (500–570 nm).
The activity of cryptochrome (CRY2, the blue light receptor) can also be calculated, when blue light decreases and green light increases, the value is lower.



The spectrum of solar radiation reaching from gamma rays to radio waves with closer view on visible wavelengths and plant photoreceptors absorbing specific wavelength regions. Cry, cryptochromes; Phy, phytochromes; Phot, phototropins; UV, ultraviolet; UVR8, UV-B photoreceptor.

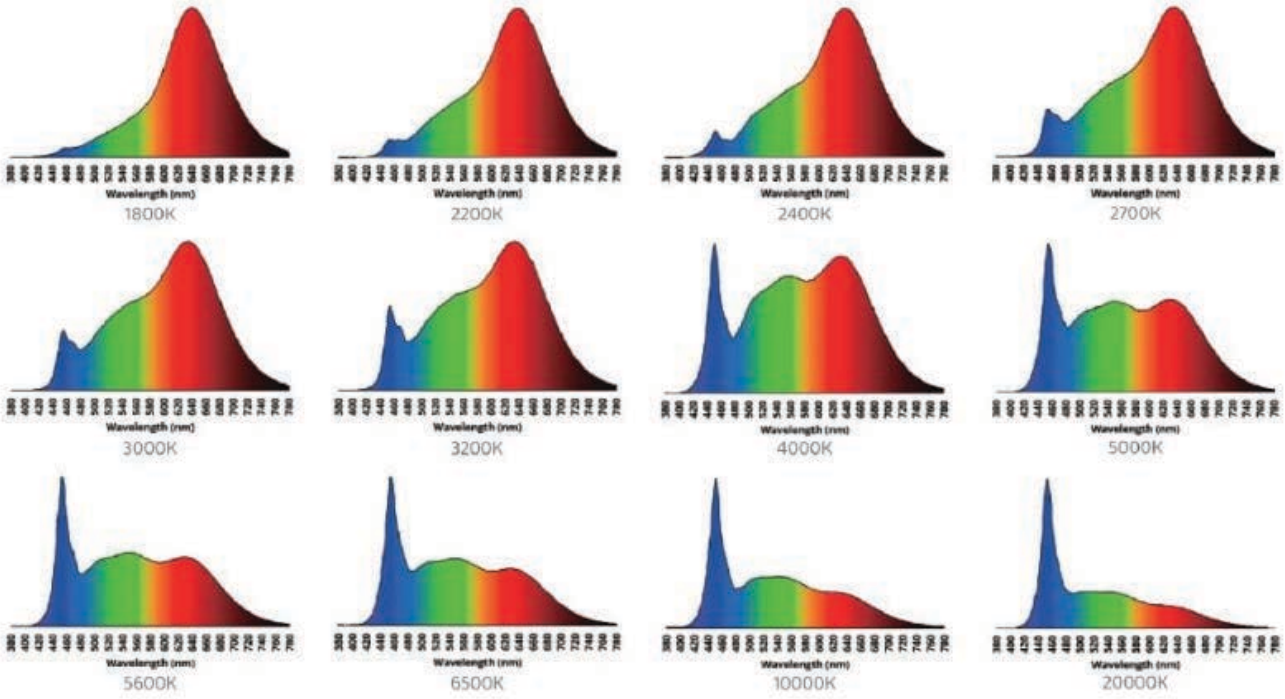
Pr : Ptot (Photobalance)

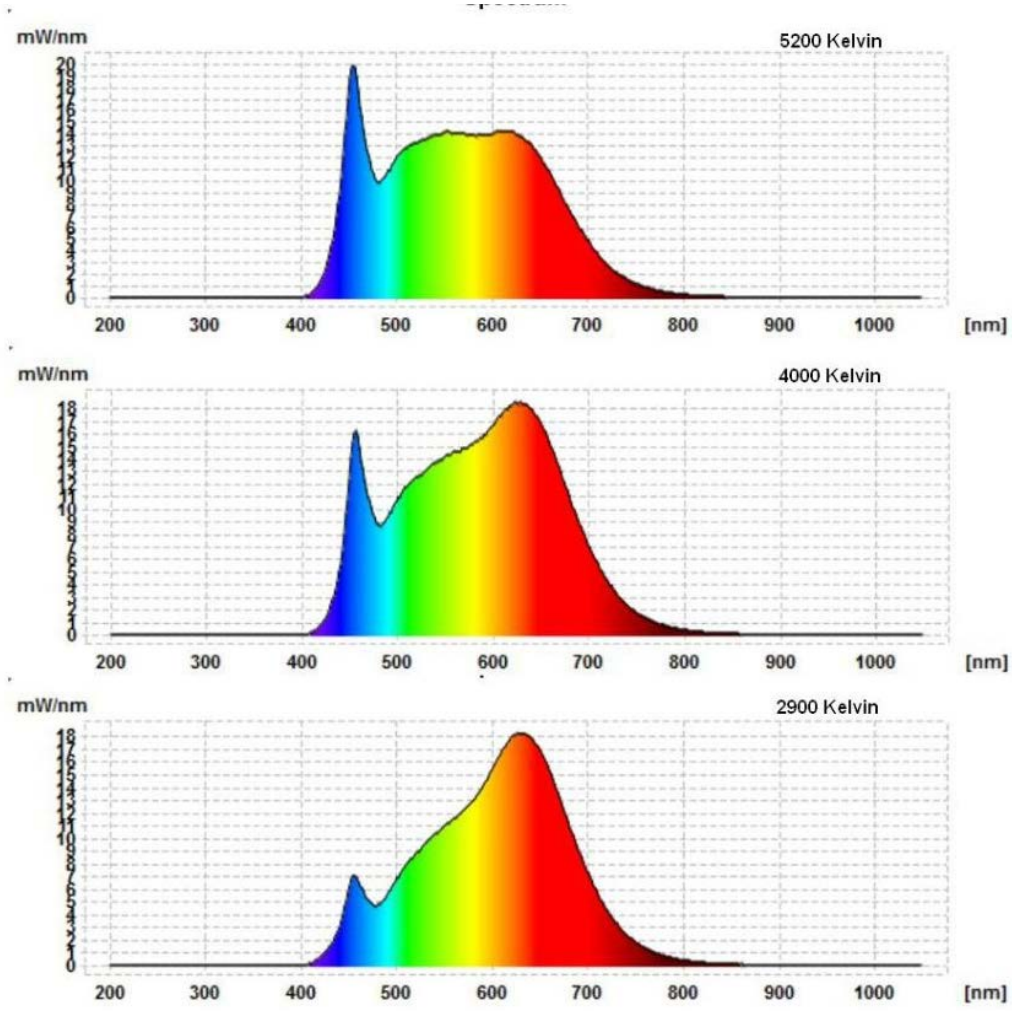
Relationship between Pr and Ptot (photobalance), is the relationship Pr: Ptot reports the relationship between phytochromes that mainly absorb red light (Pr) and all phytochromes (Ptot), measured from a given spectrum (equal to the PSS value).
Pfr absorbs some red light, so in red light there is an equilibrium of 85% Pfr and 15% pr Pr absorbs very little distant red light, so in distant red light there is an equilibrium of 97% Pr to 3% Pfr. CCT (degrees Kelvin) The CCT value (Kelvin) is used to describe the color of a light spectrum.
Generally, the value is only used to describe different white light color schemes, i.e., those on a line that goes from reddish/orange through yellow and more less white to bluish white. Color temperatures above 5000 K are called cool colors (bluish white), while lower color temperatures (2700-3000 K) are called warm colors (from yellowish white to red).



CRI (Color Rendering Index)

The color rendering index (CRI or IRC) is a quantitative measure of the ability of a light source to reveal the colors of various objects compared to an ideal or natural light source.
CKD can be used to estimate the suitability of light adaptation of the human eye; it is considered difficult to work with values below 50 for prolonged periods.



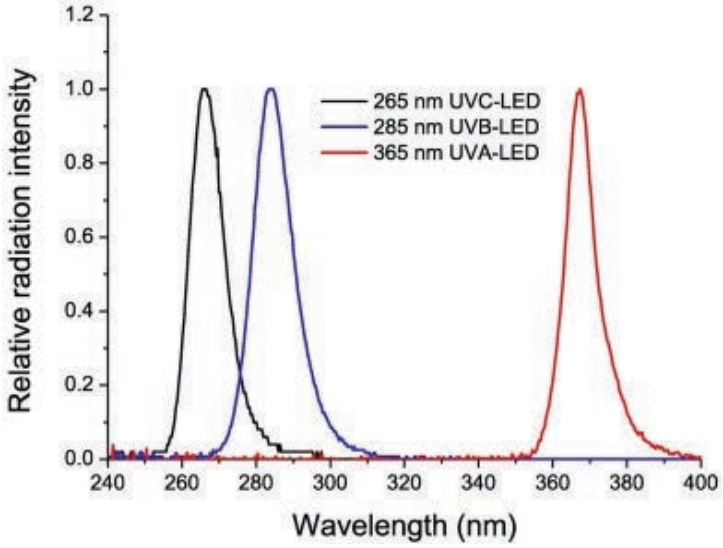


TheCRI value for traditional red-blue LEDs is zero! ICRI values for spectra a vary between 60 and 90, ensuring a comfortable working environment

How UV-C technology works

Ultraviolet light of the UV-C type operates in the wavelength range between 260 and 285 nanometers.
At the base of the technology used by the LED, there is a gallium-aluminum nitride film (AlGaN) that can emit the UV wavelength.
These form a semiconductor alloy on a silicon carbide substrate. The use of these materials allows for greater efficiency and a less expensive production process.
The result is UV-C light which, when used at shorter wavelengths, can destroy the DNA or RNA of bacteria and viruses, leaving them unable to perform some vital cellular functions. The ultraviolet spectrum, in fact, is divided into three different wavelengths, depending on the biological impact of violet radiation on biological materials:
UV-A: 400-315 nm
UV-B: 315-280 nm
UV-C: 280-100 nm

Various wavelength combinations, including simultaneous and sequential exposures, in different UV ranges such as UVC, UVB and UVA, were examined. These combinations were applied to the inactivation of indicator bacterium E. coli and coliphage MS2 in water.
The results showed the effect of UV-LEDs multiple wavelengths depends on which wavelengths (UVC, UVB and UVA) are combined and the manner that different wavelengths (simultaneous, sequential) are used
Also, different microorganisms (bacteria, virus) respond differently to wavelength combinations.
Combinations of UVC/UVB always achieved additive effect on microorganisms inactivation due to the same photochemical reaction induced by UVC/UVB on DNA.

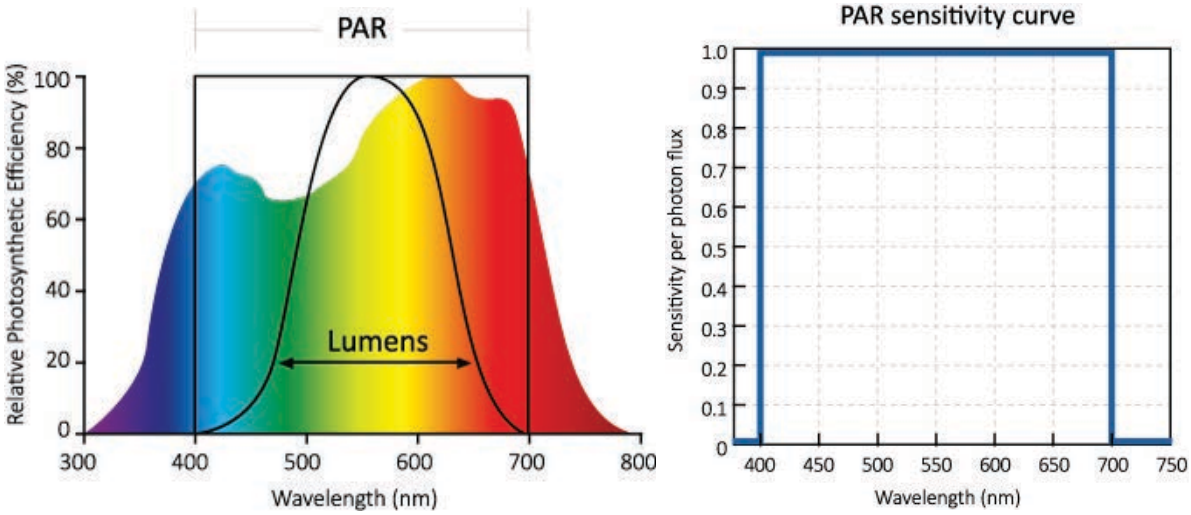


Combining UVA with UVC/UVB simultaneously or applying UVA after UVC/UVB reduced the inactivation of bacterium E. coli due to DNA repair and photoreactivation effect of UVA.
However, applying extended UVA exposure before UVC significantly improved E. coli inactivation. For virus MS2 inactivation, only additive effect was observed under various wavelength combinations. A comprehensive work on UV-LEDs wavelength combinations, which is of significance on the application of UV-LEDs for water disinfection

What is PPF (Photosynthetic Photon Flux)?

PPF is the term used to define the measurement of PAR. It stands for photosynthetic photon flux and its value determines how much PAR is being produced by anyone lighting system over the period of a second. PPF is the second essential ingredient in your recipe to the perfect lighting for your grow space. This is what helps you to establish exactly how much of the light your grow lighting system is producing can be used by your plants for photosynthesis.

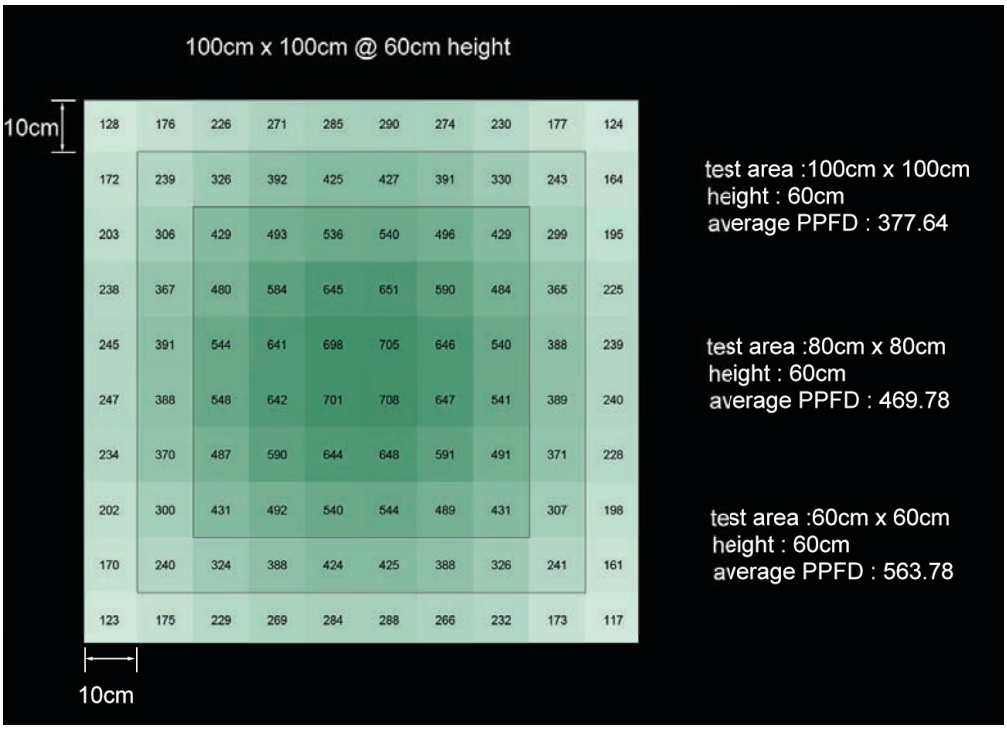
For the grower, measuring PPF requires equal parts understanding of the process and mathematical patience. There are PPF measurement tools available on the market, but you can work with a trusted partner who can help you create a lighting system that's efficient enough to deliver the PAR and PPF you need. PPF is measured in micromoles per second (µMol/S) – one micromole is around 602 quadrillion photons.



What is PPFD (Photosynthetic Photon Flux Density)?

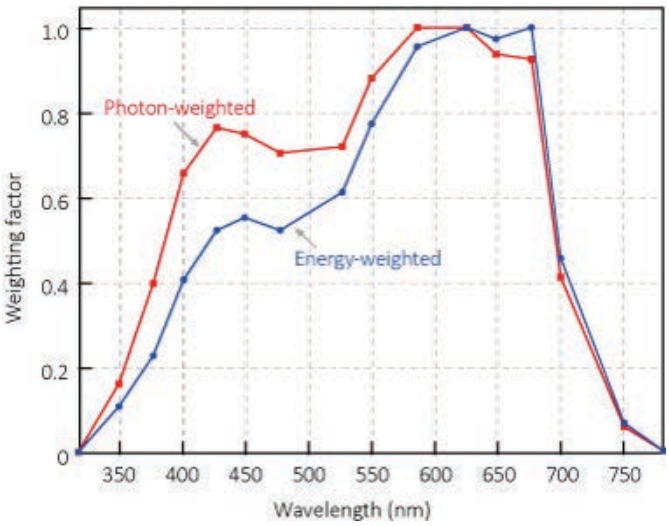
The third part of the PAR equation is PPFD. This stands for photosynthetic photon flux density, and it does more than just measure the PPF, it also measures the surface area. PPFD is measured in micromoles per square metre per second (µMol/m2/S) which establishes exactly how many PAR photons are landing on a specific area. PPFD is all about how many of those essential, photosynthetic photons are impacting the grow area and how well those lights are working when it comes to their output.

For the grower, it's important to make sure that the PPFD data you get from your grow light manufacturer is accurate and covers the entire area of the light. It's relatively easy to massage this information, so consider factors such as distance from the light source, several measurements that account for the average, and the minimum/maximum ratio before you buy. This is another great reason why you should work with a trusted grow light partner who can offer you relevant metrics and the right tools to fully benefit from PAR, PPF, and PPFD.



Whats is Yield Photon Flux (YPF) ?

The Yield Photon Flux YPF weights photons in the range from 360 to 760nm based on plant's photosynthetic response.
So it goes further than the PAR region of 400 to 700nm and also extrapolates the photons to the plant sensitivity curve per crop.
When the exact spectrum of the grow light is known, the Photosynthetic Photon Flux (PPF) values in µmol/s can be modified by applying different weighting factor to different wavelengths and colours.
This results in a quantity called the Yield Photon Flux (YPF).
The red curve in the graph shows that photons around 610 nm (orange red) have the highest amount of photosynthesis per photon.
However, because short-wavelength photons carry more energy per photon, the maximum amount of photosynthesis per incident unit of energy is at a longer wavelength, around 660 nm, what is also called deep red.
The YPF curve as shown below was developed from short-term measurements made on single leaves in low light.



What is the Daily Light Integral (DLI)?

The Daily Light Integral (DLI) measures the total amount of light that is delivered to a plant every day. DLI is a cumulative measurement of the total number of photons that reach the plants and algae during the daily photoperiod.
The DLI measures the number of "moles" of photons in the Par region per square meter per day and is expressed as mol/d.m².
The DLI is a good way to implement in the light strategy in greenhouse project with supplemental lighting.
For most crops you can define what is the ideal total light sum per day they can efficiently use. The total light sum is the sum of the light perceived from the sun + the sum of the artificial light per day.
Of course your climate computer doesn't tell you much about mols per day.
Therefore you have to calculate back from the solarimeter values in J/cm² to mols to make a total sum per day insight.
Keep in mind the solarimeter is on the roof, so you have to deduct the transmittance of the greenhouse glass from this value.
From solarimeter to DLI from the sun - J/cm² to mol/dm² conversion:
DLI from the sun = ((measured J/cm²)/100) x 2.15 x glass transmittance %
What the plants receive extra from the grow lights can also be calculated – therefore you convert your PPFD light level to DLI with the numbers of lighted hours
From PPFD to DLI conversion – µmol/sm² to mol/dm²:
DLI from the grow lights = (hours x PPFD x3600)/1.000.000

What light level for what type of crop?			
Plant	**Min (µmol/s.m²)**	**Max (µmol/s.m²)**	**Typical (µmol/s.m²)**
Tomato	170	350	270
Pepper	120	300	230
Cucumber	120	350	230
Cannabis Vegetative growth	280	550	350
Cannabis Flowering	650	1,500	1,000

Calculation from DLI to PPFD

12 moles / 16 hr photoperiod / 60 minutes / 60 seconds = 0.000208 moles
(This gives us the amount of moles delivered per second per square meter)
0.000208 moles x 1,000,000 = 208 µmols per second per meter squared (µmol/sm²)
As a rule of thumb below values can be taken when your crops are not specified

Greenhouse

Vegetative Growth (Leafy Greens/Herbs): Minimum 17 mol/m²/d
Flowering Crops (Peppers/Tomatoes): 20-40 mol/m²/d

Indoors

Microgreens: 6-12 mol/m²/d
Vegetative Growth (Leafy Greens/Herbs): 12-17 mol/m²/d
Flowering Crops: 15-40 mol/m²/d

What light level for what potted plant?			
Plant	**Min (µmol/s.m²)**	**Max (µmol/s.m²)**	**Typical (µmol/s.m²)**
Orchid / Phalaenopsis	80	230	160
Dendrobium	130	350	230
Bromelia	40	120	90
Anthurium	60	130	90
Kalanchoë	60	120	90
Potted chrysanthemum	40	80	50
Potted rose	40	120	50
Geranium	40	90	50

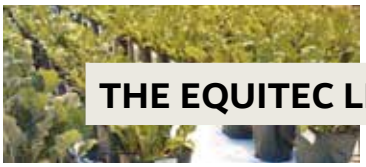
What light level for what cut flower?			
Plant	**Min (µmol/s.m²)**	**Max (µmol/s.m²)**	**Typical (µmol/s.m²)**
Chrysanthemum	105	220	140
Rose	170	350	220
Lily	80	130	90
Lisianthus	170	350	230
Alstroemeria	60	160	120
Anthurium / Orchid - cut	80	160	120
Freesia	70	140	90
Gerbera	80	120	90
Tulip	25	90	60

Photon Efficacy

Photon Efficacy refers to how efficient a horticulture lighting system is at converting electrical energy into photons of PAR.
With the PPF and the input wattage, you can calculate the efficiency.

Expressed in µmol/J.

The higher the number, the more efficient a lighting system is at converting electrical energy into photons of PAR.
But remember this number doesn't tell us anything about the effectiveness of the light on your crops and doesn't count the light frequencies above 700nm.



THE EQUITEC LED MARKET

The range includes LED lamps, LED strips. lights banks and accessories which very efficiently meet the needs of any type of horticultural customer, whether they be fruit or vegetable growers, research units or individuals.

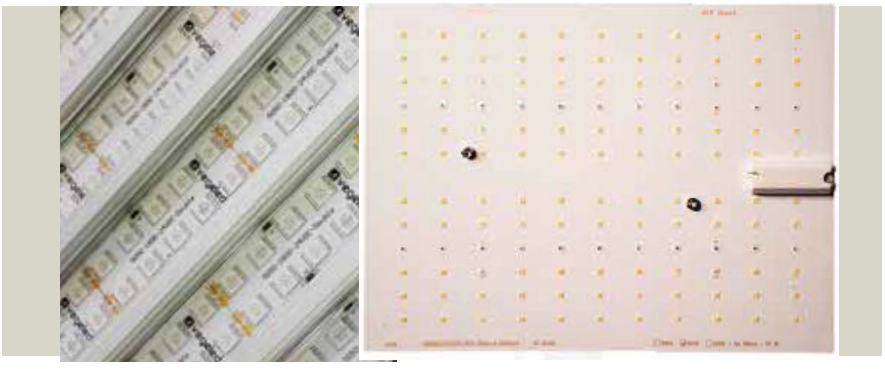
With our desire to best serve our customers and to develop long-lasting partnerships with them, EQUITEC provides all our know-how so as to establish the most appropriate solutions. In order to do this, ,we offer ranges from just supplying LED lighting components, to the installation on-site with the collaboration of approved partners, and design office services.

Light is electromagnetic radiation transmitted as photons.
In plants, light is absorbed by pigments and photoreceptors.
Plants use light for photosynthesis which produces a reaction in which light energy is converted into chemical energy.
The light also transmits information to the plant about its growing environment.
The definition of the color of the wavelength is not as simple as one might expect.
There are ISO standards for determining the wavelength of colors, but in photobiology, the most commonly used ranges differ from those ISO definitions. For example, according to ISO, red is 610-760 nm, but in photobiology 620-680 nm can be used.
Spectra at 650-670 and 720-740 nm are also used to calculate the ratio of photons from red to far red.
The following graph demonstrates very well the energetic and quantum properties of the light spectrum.
The units used and what is called the "solar spectrum" must be known. ASTM and IEC use the Simple Model of Atmospheric Solar Radiation Transfer (SMARTS) program to generate terrestrial reference spectra, for the evaluation of the performance of the photovoltaic system and product comparison.

BENEFITS

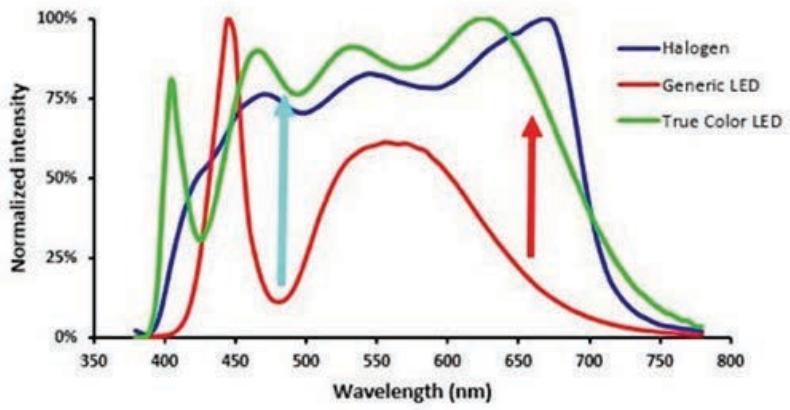
ADAPTABLE LIGHTING FOR EVERY APPLICATION

EQUITEC LED products cover a very large range of spectral combinations through our total control of the manufacturing process. **We can produce customized arrays of**
LEDs and LED strips and thus recreate practically any light spectrum, uniformly.



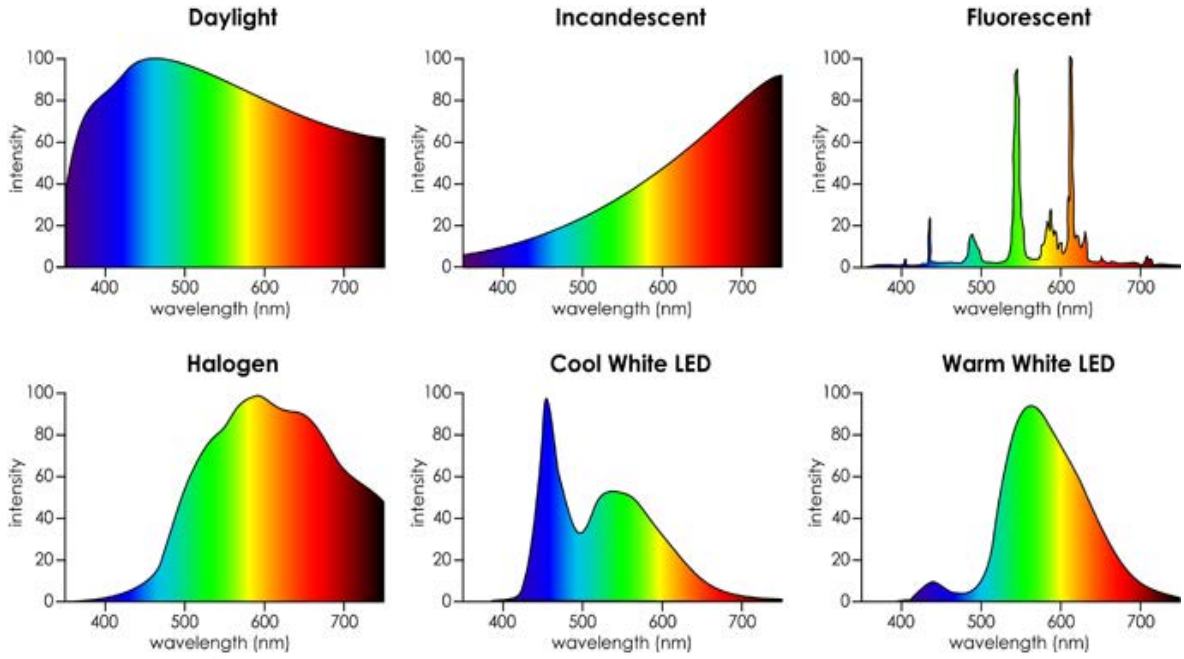
BETTER LIGHTING EFFICIENCY THAN DISCHARGE LAMPS

Because of the higher light flux /watt yield and the possibility of optimizing the spectrum, **horticultural LED lighting systems have a much greater energy efficiency than discharge lamps.** The gains are on the order of a factor of 5 with respect to an HPI lamp (mercury discharge lamp), 3.5 with respect to a horticultural neon tube, 2 with respect to an HPS lamp (sodium discharge lamp)



CONTROL OF THE LIGHTING RHYTHM

All of Equite LED equipment is available in dimmable versions.
The light intensity of the products can thus be modulated upon request.
The control system is adapted to the situation in order to facilitate its use.
The use of digital commands allows you guarantee that your chosen lighting conditions will be reproducible.



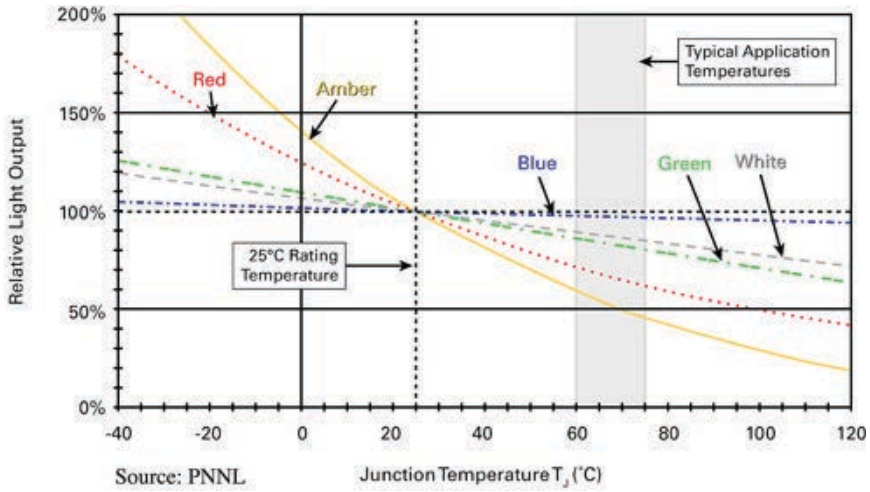
FLUX AND SPECTRAL STABILITY OVER TIME

Particular attention is given to quality control and to reliability of the LEDs that we select. We also make sure of the proper cooling of the LEDs by the use of heat sinks in the form of aluminium fins. This allows us to maintain the LEDs at the best operating conditions so as to preserve their service life. This extends from **30,000** to **50,000** hours depending upon ambient temperature.

In addition, **the decrease of luminous flux of Equitec LED products is very slow, gradual and without notable change of the spectral combination**. For example, our
white dual phosphor LEDs used in the manufacture of our Vegeled™ lighting profiles, only show a loss of flux of 1% after 6000 hours of operation.

HEAT AND DISSIPATION

The high-quality LED ligths emits from30 to 40% of its energy in the form of light and from 60 to 70% in the form of heat.
A ligths bank with insufficient dissipation will emit more than 70% in the form of heat, which contributes to the cooling expense for the growing environment.
Keeping LEDs at sufficiently low temperatures allows to maintain efficiency (high µmol/W), for which constant dissipation is required.
If the LEDs work at too high a temperature regime, the efficiency will be reduced and they will "burn" more quickly.
Dissipation can be active, using fans or water, or passive, using a heat sink. Active dissipation will allow LEDs to operate at a higher current/power, which will reduce costs, using fewer LEDs in the device.
Protection against high humidity and leak failures makes water dissipation technology difficult. Undersizing the dissipation capacity, neglecting or simply using the wrong technology increases the risk of early failures. However, if properly designed and maintained, dissipation solutions can provide long-term use and cost savings.



LOCAL MANUFACTURING FOR TOTAL QUALITY CONTROL

EQUITEC LED floodlights and strips are 100% designed and assembled in Spain on the basis of the same standards as our industrial systems. The raw materials, the manufacturing steps and the finished products undergo systematic and rigorous quality control.

TECHNICIAN COMFORT TAKEN INTO ACCOUNT

Working in a fuchsia coloured lighting environment is very disagreeable. **EQUITEC LED insallations using monochromatic LEDs** are consequently **equipped with detection**
radar which interrupts the coloured lighting when the technician is working in the room. White working lighting allows them to function in a suitable environment since the white dual phosphor LEDs are tested with respect to the standard EN62471 and are exempt from biological risk.

In addition, our white LEDs have a colour rendering index (CRI) greater than 90 which allows you to very accurately identify, possible variations in the colour of leaves.

NOT ONLY GROWTH

Our research is not limited to the optimization of plant growth.

The choice of spectral combination can also act on the shape and taste of certain plants.

In collaboration with some of our customers, we have also developed lighting systems **to ensure the development of complete ecosystems.**

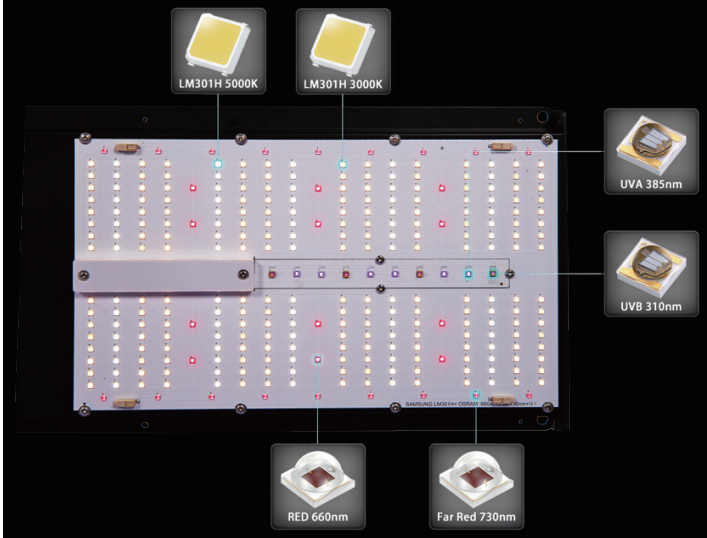
LED technology, provides great energy savings

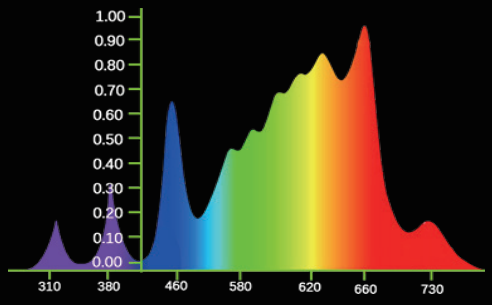
HIGH PROTECTION INDICES FOR DIFFICULT ENVIRONMENTS

Certain applications require a high degree of protection for the systems. We are able to offer floodlights with an index of IP65 and strips up to IP67 if need be.

PRODUCTS

EQUITEC Four Channel Spectrum LED Grow Light

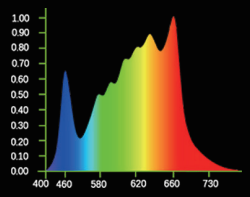




Spectrum

Full Spectrum + Red + IR + UVA + UVB
Spectrum Independently Controllable
Samsung LM301H/B &OSRAM Diodes

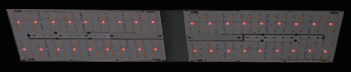
Spectrum Channel 1:
For Veg and Blooming

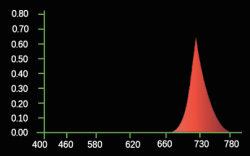


3000K+5000Knm
+660nm

Spectrum Channel 2:

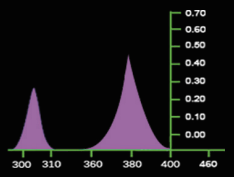
Emmerson Effect





730nm Far
Red

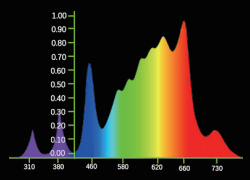
Spectrum Channel 3:
Increase THC and the
yield of plants



385nm UVA +310nm UVB

Spectrum Channel 4:

For Flowering



3000K+5000Knm+660nm
+730nm+385nm+310nm

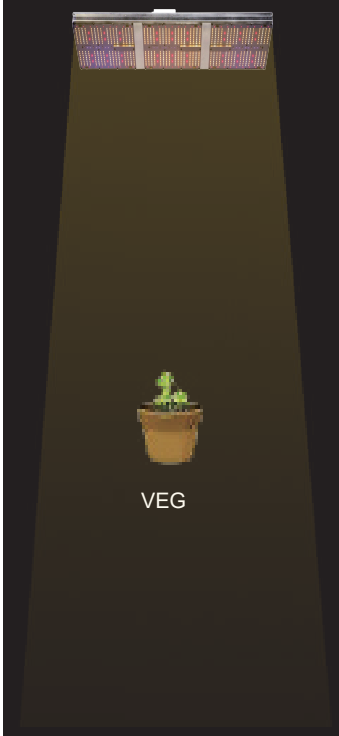
- Efficacy up to 2.8 3.0μmol/J

Hanging Distance & Spectrum Channel

Above Canopy:
1.220 mm
48"

Dimming: 40%-50%

Spectrum: White+Red

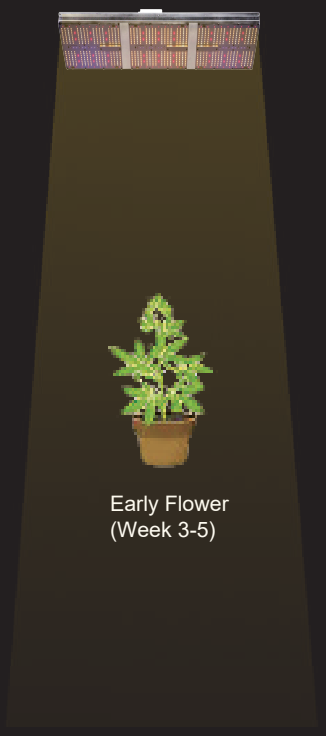


VEG

Above Canopy:
600 mm - 760 mm
24"- 30"

Dimming: 50%-80%

Spectrum: White+Red+Far Red



Early Flower
(Week 3-5)

Above Canopy:
460 mm - 610 mm
18"- 24"

Dimming: 80%-100%

Spectrum: White+Red+IR

Middle Flower
(Week 6-8)

Above Canopy:
152 mm - 460 mm
6"- 18"

Dimming: 100%

Spectrum: White+Red+IR+ UVA+

Late Flower
(Week 9-12)

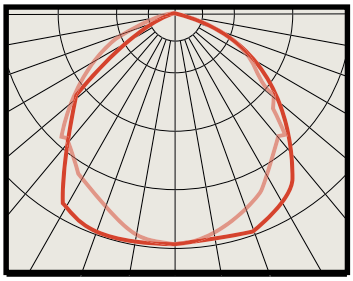
125W to 600W LED FLOODLIGHTS

The 125W to 600 W floodlight is particularly appropriate for greenhouse cultures. Its passive heat sink system avoids any worries associated with active cooling systems (fans).

The light spectrum of this product can be offered in several variants, depending upon the type of needs: growth of fresh material, development of leaves or flowers, comfort and safety of the operators, etc.

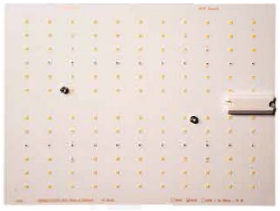
Properties	Values
LED power	125W to 600W
System power	130W to700W
Input Voltage	90-305VAC / 127-431VDC
Luminosity	200 -800 µmol/s/m^2 at 1m (in open space) Blue-Red: not available
CCT	Blue-White-Red: 11,000K
	Red-White: 4500K
Service life	50,000 h
CRI	Blue-Red: not available
	Blue-White-Red: 14
	Red-White: 85
PF	>0.96
IP	IP65
Beam angle	120°
Colour of box	White
Dimmable	1-10V dimmable on option (0 to 100%) (Replace H by D in the reference number)
Dimensions	187x298x365mm per panel
Length of wire	1.5m
Weight	4.0kg to 20 kg
Certificates	CE, ROHS
Warranty	3 yearsww

- Minimal electricity consumption
- Low heat emission
- Water and dust tight
- Service life 50,000h
- Robust product
- 3 year warranty



Photometric curve
for a 120° floodlight

Features



CULTIVATION AREA
0,60 x 0,60 m

PRODUCTION
100-140 gr

Power
65 W

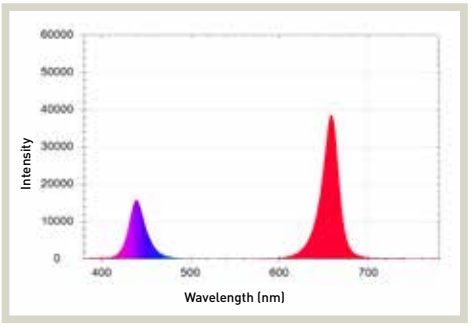
Model

Emission spectra

Blue-Red

1065-2810

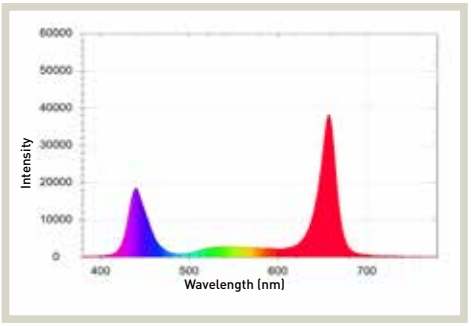
Fuchsia colour yield
R : 78%, V : 1%, B : 21%
Eye protection recommended



Blue-White-Red

1065-2820

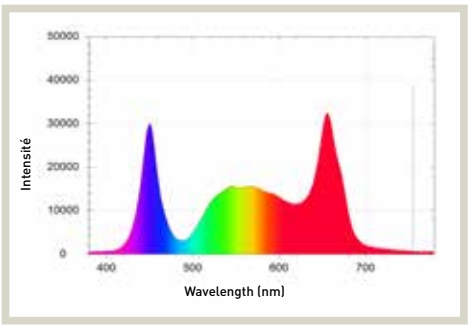
Bluish white colour yield
R : 64%, V : 13%, B : 23%
Eye protection recommended



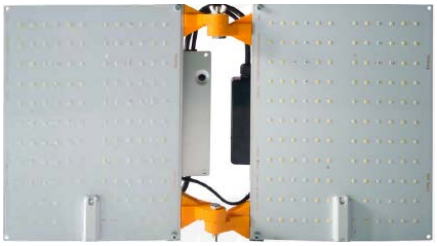
Red-White

1065-2830

White colour yield CRI 85
R : 51%, V : 32%, B : 17%
No specific eye protection necessary



Features



CULTIVATION AREA
0,80 x 0,80 m

PRODUCTION
180-250 gr

Power
125 W

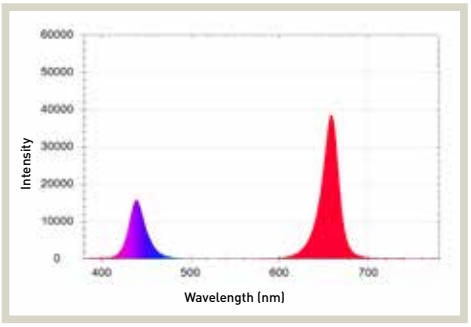
Model

Emission spectra

Blue-Red

1065-2810

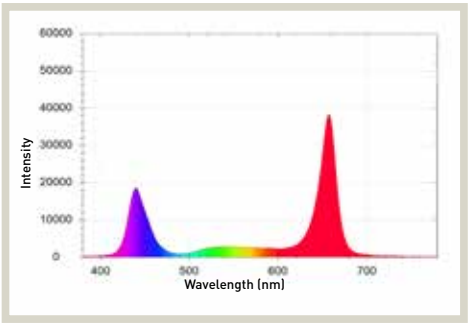
Fuchsia colour yield
R : 78%, V : 1%, B : 21%
Eye protection recommended



Blue-White-Red

1065-2820

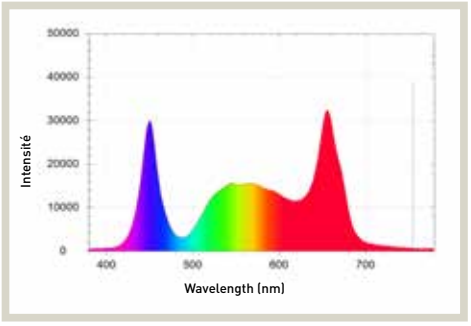
Bluish white colour yield
R : 64%, V : 13%, B : 23%
Eye protection recommended



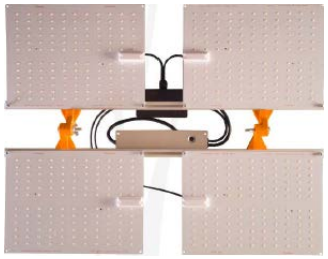
Red-White

1065-2830

White colour yield CRI 85
R : 51%, V : 32%, B : 17%
No specific eye protection necessary



Features



CULTIVATION AREA
1,10 x 1,10 m

PRODUCTION
350-480 gr

Power
240 W

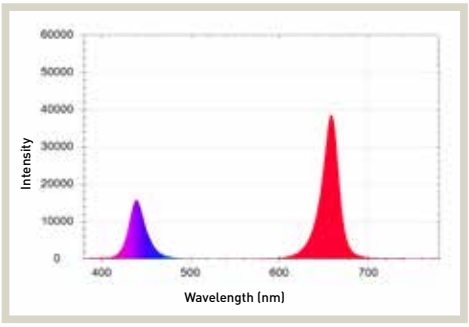
Model

Emission spectra

Blue-Red

1240-2810

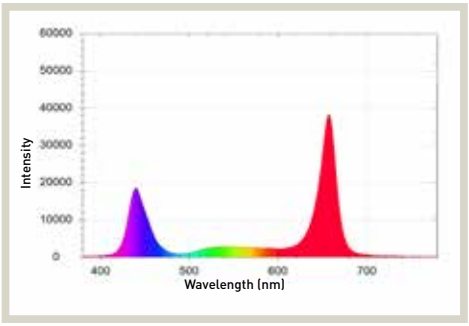
Fuchsia colour yield
R : 78%, V : 1%, B : 21%
Eye protection recommended



Blue-White-Red

1240-2820

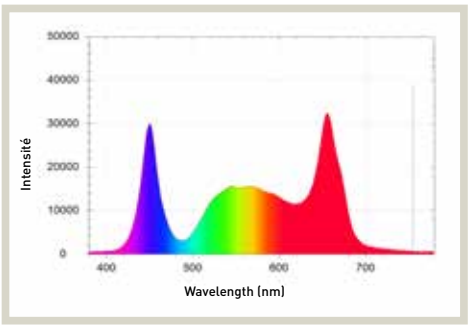
Bluish white colour yield
R : 64%, V : 13%, B : 23%
Eye protection recommended



Red-White

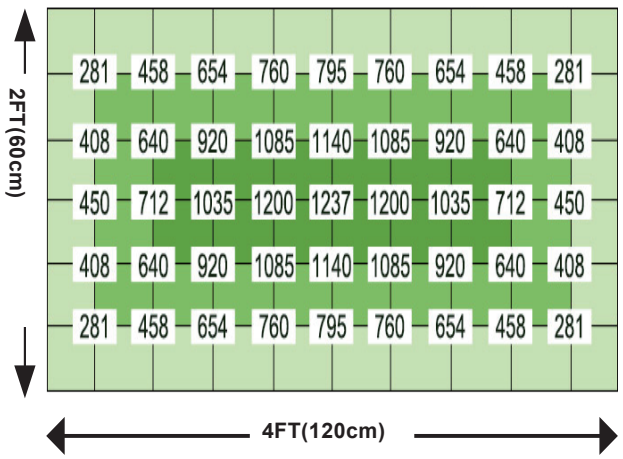
1240-2830

White colour yield CRI 85
R : 51%, V : 32%, B : 17%
No specific eye protection necessary

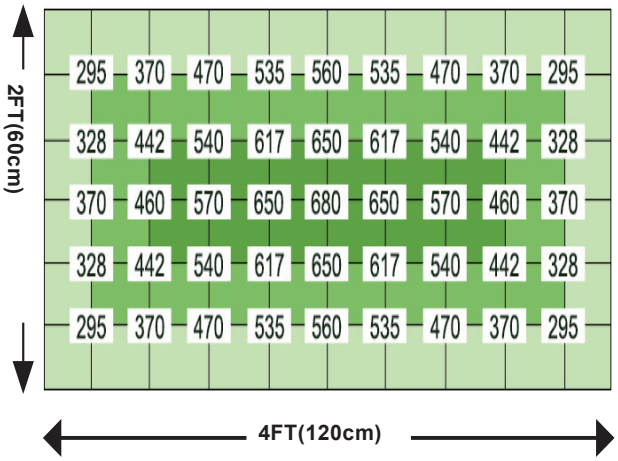


Specification	EQUITEC EXUBERANT GROW 240W
Power	240W
Efficacy	2.80 µmol/J
Total PPF	756 µmol/s
Spectrum	White + Red + Far Red + UVA + UVB
Light Source	Samsung LM301H /301B& Osram & Seoul
LED quantity	lm301h 3000K: 352 pcs. 5000K : 160 pcs Osram 660nm : 24 pcs 730nm : 36 pcs UVA 385nm :12 pcs UVB 310nm : 8 pcs
Driver Brand	Sosen Driver/ Meanwell Driver
Driver Input Voltage	AC100-277V, 50 / 60 Hz
Spectrum Controling	Dimmer & Spectrum Adjustable Remote
Optimal Height 60 x 60 cm	6" - 24" (15cm - 60cm) Above the Canopy
Veg & Flowering Footprint area	2 x 4 sq ft grow area
Dimension	L 630 x W 207 x H 31mm L 24.80in × W 8.15 in × H 1.22in
Weight	6KG / 13.2LB

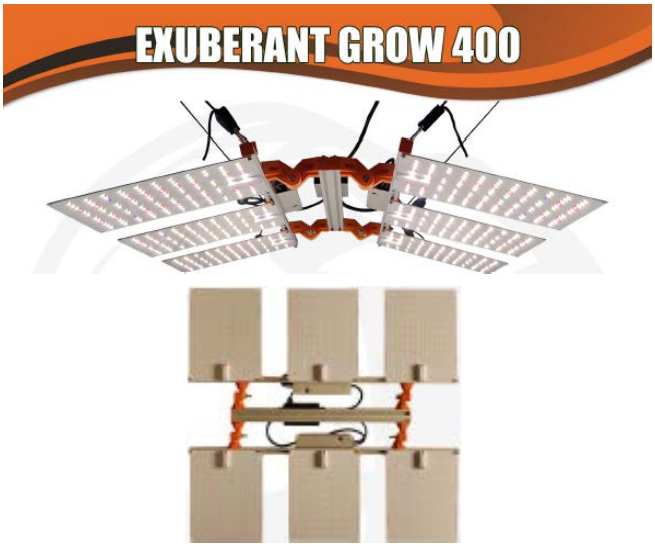
Height : 12"(30cm)



Height : 20"(50cm)



Features



CULTIVATION AREA
1,30 x 1,30 m

PRODUCTION
600-850 gr

Power
400 W

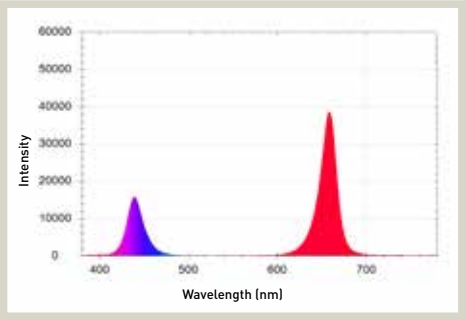
Model

Emission spectra

Blue-Red

1400-2810

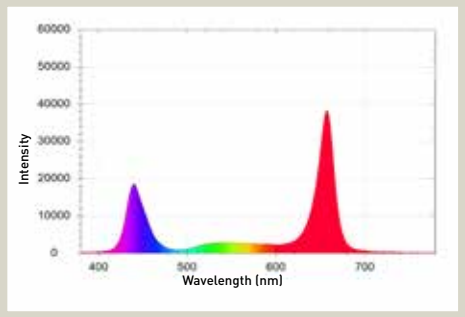
Fuchsia colour yield
R : 78%, V : 1%, B : 21%
Eye protection recommended



Blue-White-Red

1400-2820

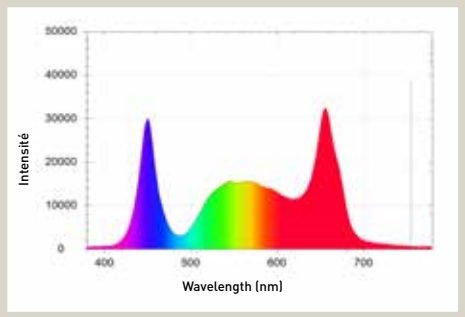
Bluish white colour yield
R : 64%, V : 13%, B : 23%
Eye protection recommended



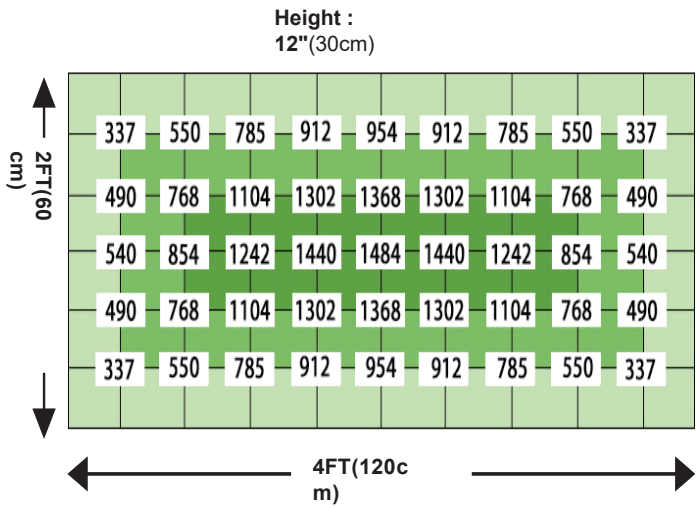
Red-White

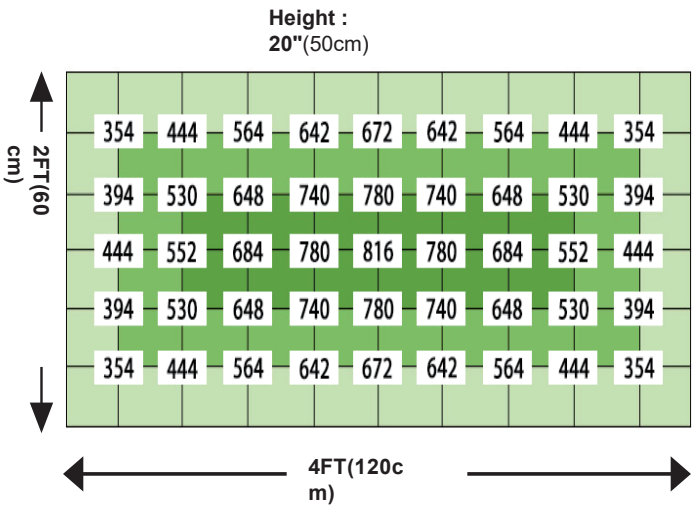
1400-2830

White colour yield CRI 85
R : 51%, V : 32%, B : 17%
No specific eye protection necessary



Specification	EQUITEC EXUBERANT GROW 400W
Power	400W
Efficacy	2.80 µmol/J
Total PPF	1008 µmol/s
Spectrum	White + Red + Far Red + UVA + UVB
Light Source	Samsung LM301H /301B& Osram
LED quantity	lm301h 3000K : 528 pcs. 5000K : 240 pcs Osram 660nm : 36 pcs 730nm : 54 pcs UVA 385nm : 18 pcs UVB 310nm :12 pcs
Driver Brand	Sosen Driver/ Meanwell Driver
Driver Input Voltage	AC100-277V, 50 / 60 Hz
Spectrum Controling	Dimmer & Spectrum Adjustable Remote
Optimal Height @60 x 60 cm	6" - 24" (15cm - 60cm) Above the Canopy
Veg & Flowering Footprint area	2 x 4 sq ft grow area
Dimension	L 930 x W 207 x H 31mm L 36.60in × W 8.15 in × H 1.22in
Weight	7KG / 15.4LB





Features

CULTIVATION AREA
1,50 x 1,50 m

PRODUCTION
800-1200 gr

Power
600 W

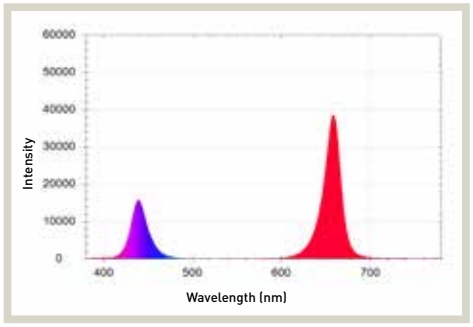
Model

Emission spectra

Blue-Red

1600-2810

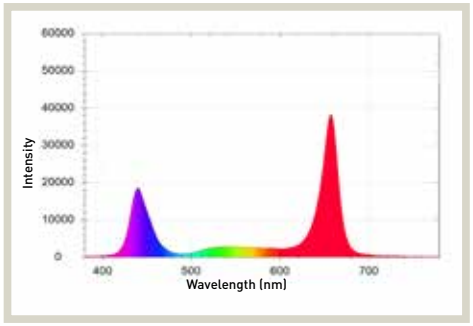
Fuchsia colour yield
R : 78%, V : 1%, B : 21%
Eye protection recommended



Blue-White-Red

1600-2820

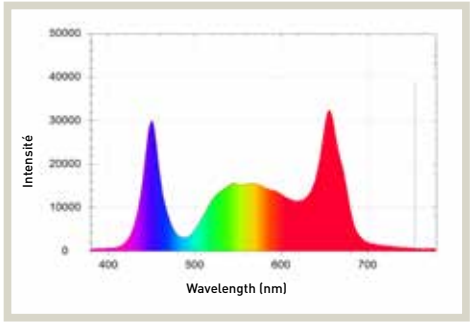
Bluish white colour yield
R : 64%, V : 13%, B : 23%
Eye protection recommended



Red-White

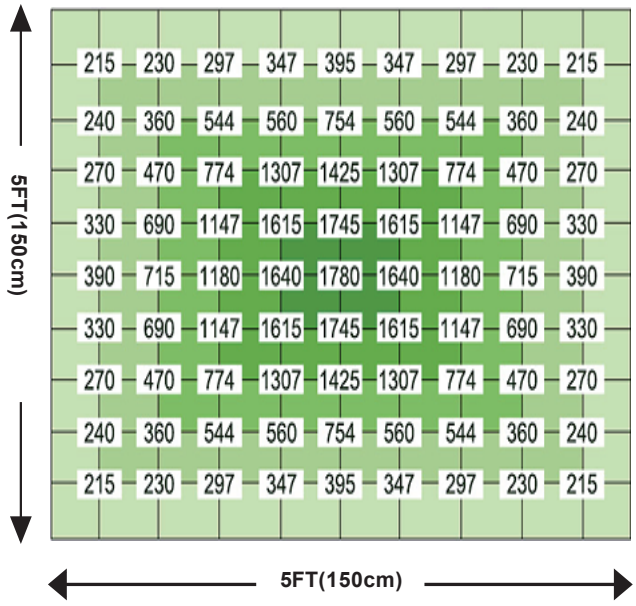
1260-2830

White colour yield CRI 85
R : 51%, V : 32%, B : 17%
No specific eye protection necessary

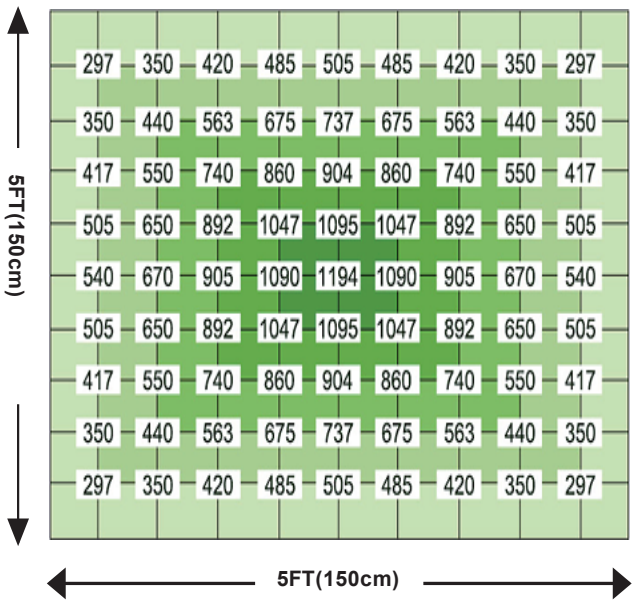


Specification	EQUITEC EXUBERANT GROW 600W
Power	**600W**
Efficacy	**2.80 µmol/J**
Total PPF	**1512 µmol/s**
Spectrum	**White + Red + Far Red + UVA + UVB**
Light Source	**Samsung LM301H /301B& Osram & Seoul**
LED quantity	**lm301h 3000K : 704 pcs. 5000K : 320 pcs Osram 660nm : 48 pcs 730nm : 72 pcs UVA 385nm : 24 pcs UVB 310nm : 16 pcs**
Driver Brand	**Sosen Driver/ Meanwell Driver**
Driver Input Voltage	**AC100-277V, 50 / 60 Hz**
Spectrum Controling	**Dimmer & Spectrum Adjustable Remote**
Optimal Height 60 x 60 cm	**6" - 24" (15cm - 60cm) Above the Canopy**
Veg & Flowering Footprint area	**4 x 4 sq ft grow area**
Dimension	**L 630 x W 600 x H 31mm L 24.80in × W 23.62 in × H 1.22in**
Weight	**12KG / 26.4LB**

Height : 12"(30cm)



Height : 20"(50cm)



LIGHTING PROFILES 600 to 1200 mm

In a restricted space such as a phytotron or a growth cabinet, Equitec LED lighting profiles are generally the solution of choice. With low power consumption and giving out little heat, they have a very reduced impact on the culture conditions and allow the free height to be maximized for the development of the plant.

The spectral composition of the product can be entirely customized, depending upon the type of plants to light and the growth and use objectives.

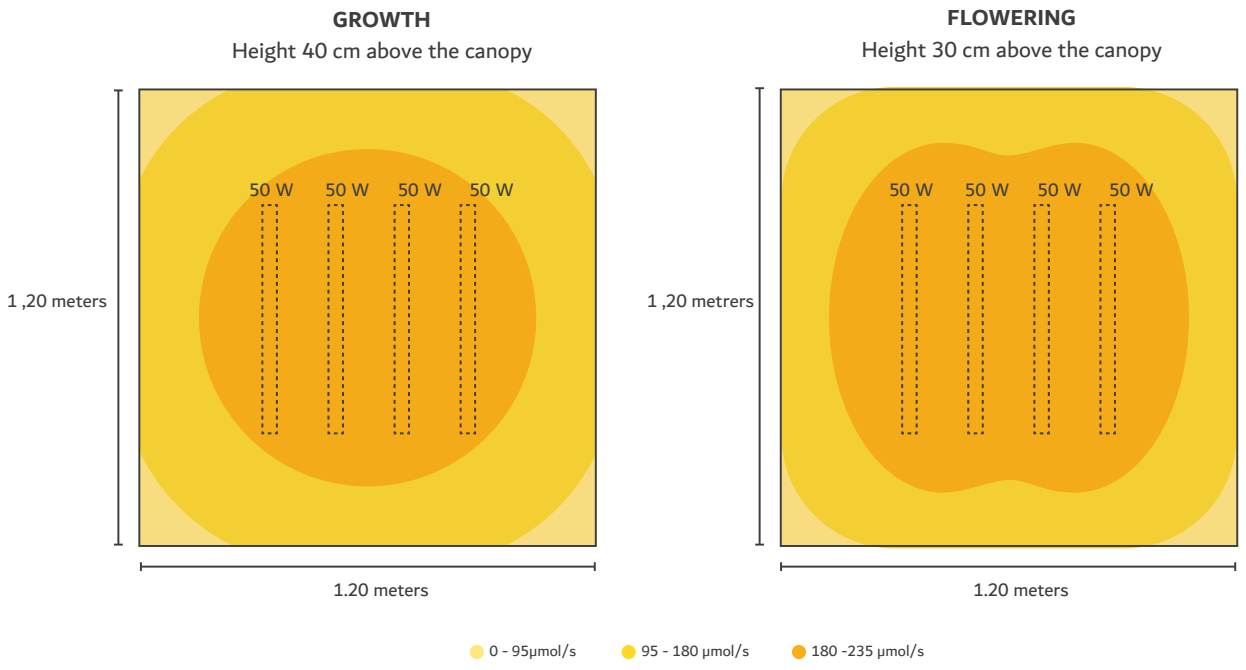
In addition, these profiles are easy to affix to an existing structure, so that the customer can install them themselves.

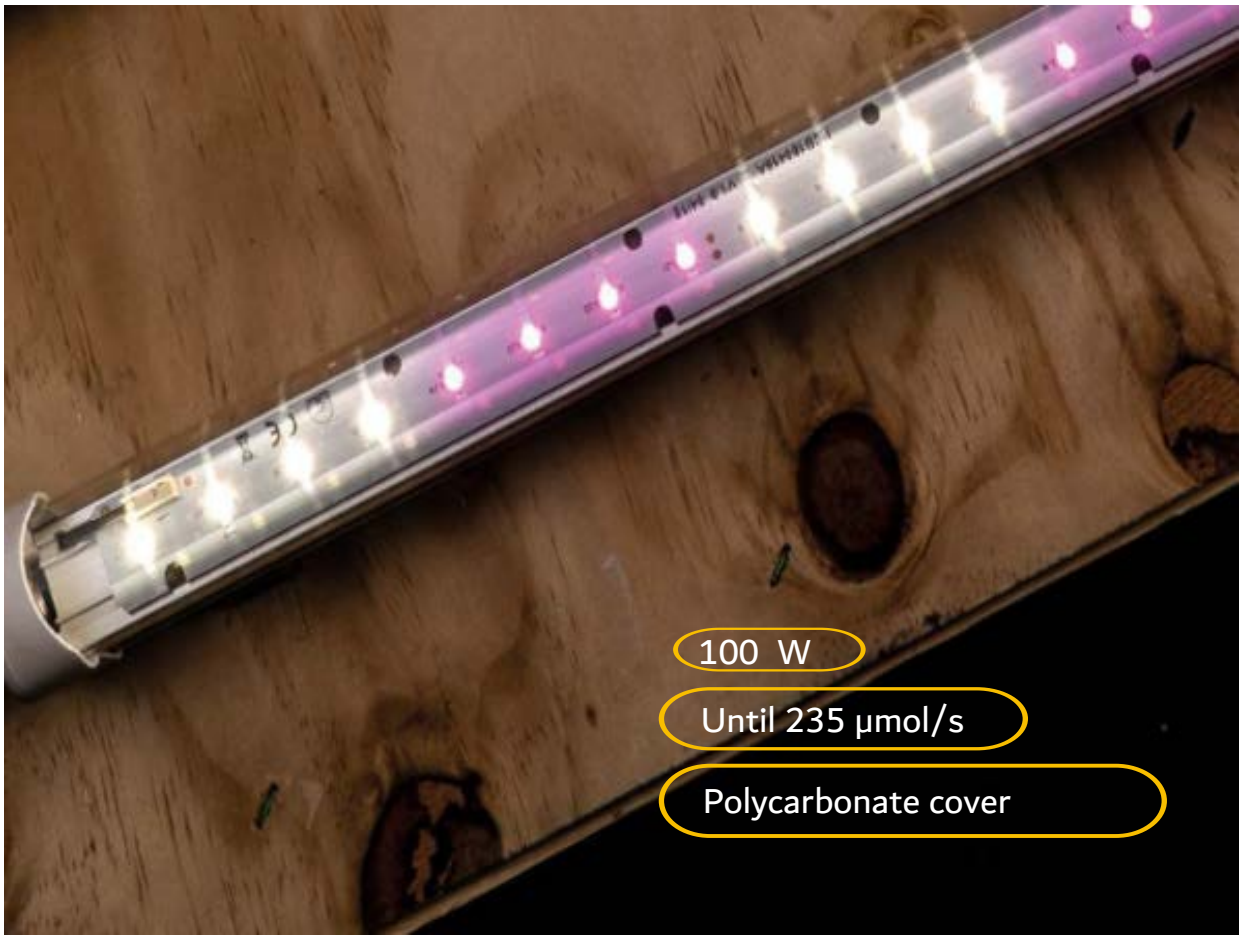
Propriétés	Valeurs
Voltage	24VDC
Type of LED	5050 / 3014
Optical properties	- Violet: 407nm - Royal blue: 450 nm - Cyan blue: 470 nm - Cherry Red: 660 nm - Far Red: 740 nm - White: 4500 K CRI 90 Wide spectrum
Beam angle	120°
Dimensions	from 19 x11x 600mm to 19x11x 1200mm
LED/m	60 LED/m 120 LED/m 180 LED/m
Warranty	2 years
Dimmable	yes

- Stable light spectrum
- Minimal electricity consumption
- Low heat emission
- Adaptable
- Easy installation
- 2 year warranty

FARADAY | PROTECT SLIM 120CM

Light distribution on cultivation surface 1,20 x 1,20 m with 2 kits of 2x50W

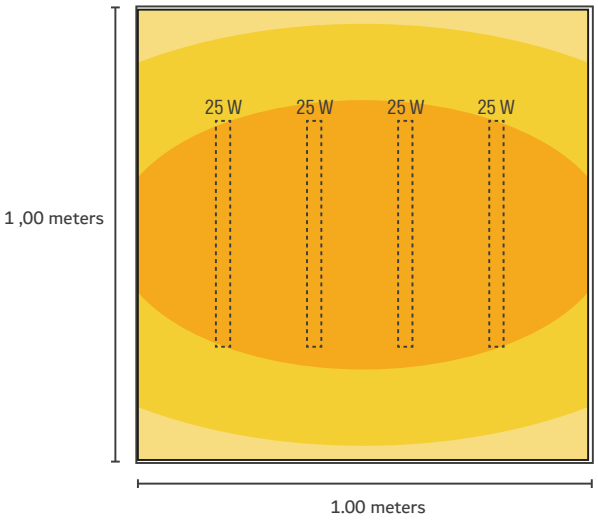




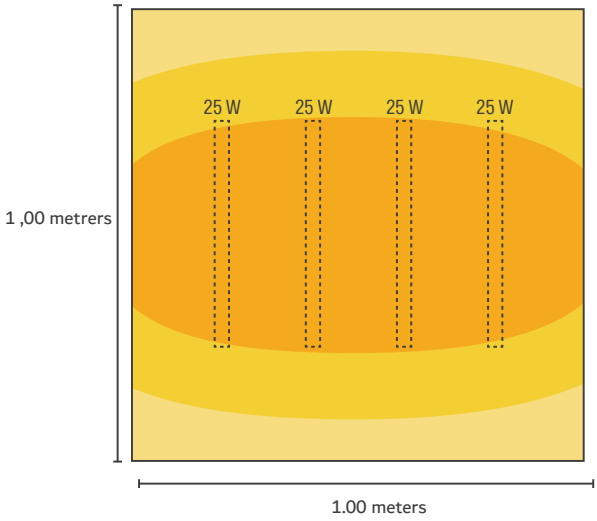
FARADAY | PROTECT SLIM 60CM

Light distribution on cultivation surface 1,00 x 1,00 m with 2 kits of 2x25W

GROWTH
Height 40 cm above the canopy



FLOWERING
Height 30 cm above the canopy



0 - 65µmol/s 65 - 130 µmol/s 130 -195 µmol/s

50 W

Until 195 µmol/s

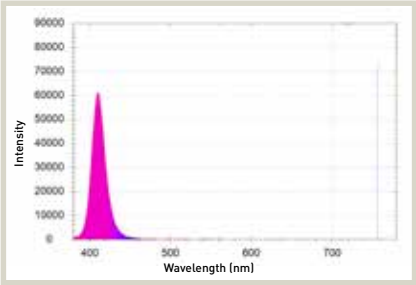
Polycarbonate cover

Models and emission spectra

Violet 407nm

FARADAY 1050-3310 : 600 mm, 50W
FARADAY 1100-3310 : 1200 mm, 100W

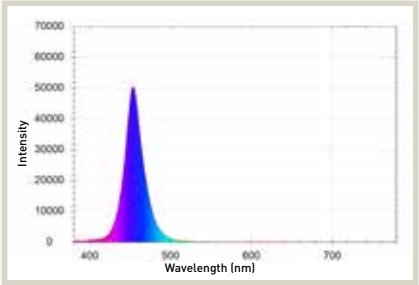
60 LED 5050/m, 1 male connector



Royal Blue 450nm

FARADAY 1050-3320 : 600 mm, 50W
FARADAY 1100-3320 : 1200 mm, 100W

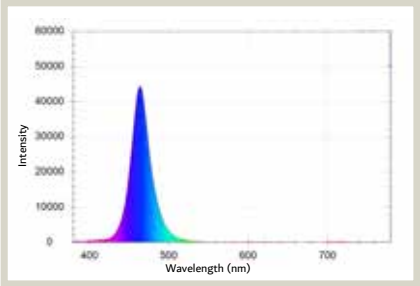
60 LED 5050/m, 1 male connector



Cyan Blue 470nm

FARADAY 1050-3330 : 600 mm, 50W
FARADAY 1100-3330 : 1200 mm, 100W

60 LED 5050/m, 1 male connector

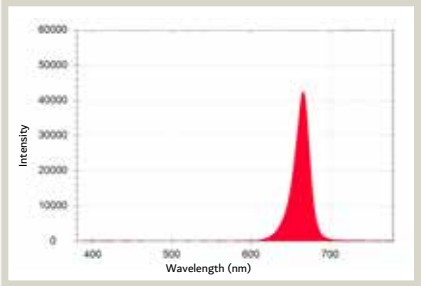


FARADAY 1050-3350 :1200 mm, 50W
FARADAY 1100-3350 : 1500 mm, 100W

Cherry Red 660nm

FARADAY 1050-3340 : 600 mm, 50W
FARADAY 1100-3340 : 1200 mm, 100W

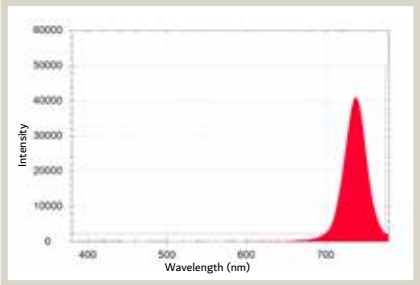
60 LED 5050/m, 1 male connector



Far red 740nm

FARADAY 1050-3350 : 600 mm, 50W
FARADAY 1100-3350 : 1200 mm, 100W

60 LED 5050/m, 1 male connector



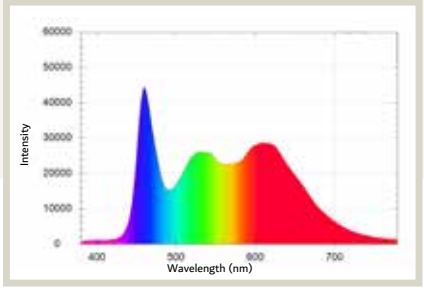
White 4500K

FARADAY 1120-3360 : 1200 mm, 1200lm, 30 W
FARADAY 1150-3360: 1500 mm, 1500lm, 40 W

120 LED 3014/m, 1 male connector

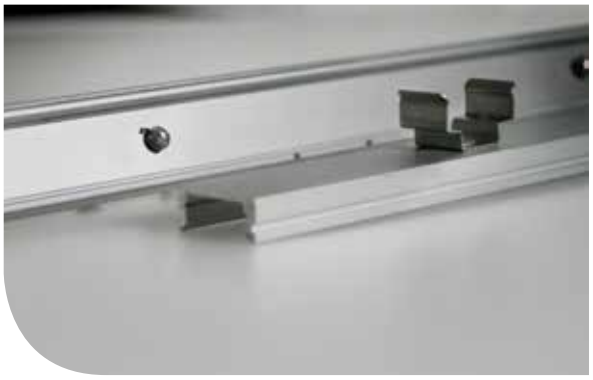
FARADAY 1120-3360 : 1200 mm, 1900lm, 40 W
FARADAY 1150-3360: 1500 mm, 2600lm, 60 W

180 LED 3014/m, 1 male connector



MOUNTING RAILS

The mounting rails are transverse profiles equipped with quick mounting clips for the EQUITEC LED lighting profiles .



References:

Model	Description
20030-2840	Transverse mounting rails 18 x 8 x 300mm with 2 clips
20060-2840	Transverse mounting rails 18 x 8 x 600 mm with 3 clips
20100-2840	Transverse mounting rails 18 x 8 x 1000mm with 4 clips
20120-2840	Transverse mounting rails 18 x 8 x 1200 mm with 6 clips
20150-2840	Transverse mounting rails 18 x 8 x 1500 mm with 6 clips

CABLE TROUGH

The power distribution troughs allow the electrical power to be distributed equitably between the strips. They greatly facilitate the installation by means of pre-wired electrical connec-tions. They can be equipped with switches to moderate the power.

References:

Model	Description
20060-2840	Power distribution trough 60x60x500mm with 6 connectors
20110-2840	Power distribution trough 60x60x500mm with 11 connectors

POWER SUPPLY KIT

Power supply kits are comprised of switched mode power supplies with a high protec-tion index, capable of transforming the grid AC current into 24 VDC current compatible with the Vegeled™ lighting profiles. The kits are available with various powers from 100 to 320 W.

They are equipped with connection boxes with quick connectors to connect efficiently and directly, a series of strips or a power distribution trough.

References:

	Model	Description
Non-dimmable	20100-2910	100W 220-240V 24V Max with connexion box, cable 2m and plug
	20150-2910	150W 220-240V 24V Max with connexion box, cable 2m and plug
	20240-2910	240W 220-240V 24V Max with connexion box, cable 2m and plug
	20320-2910	320W 220-240V 24V Max with connexion box, cable 2m and plug
Dimmable	20100-2920	100W 220-240V 24V Max with connexion box, cable 2m and plug, 1-10V Dim
	20150-2920	150W 220-240V 24V Max with connexion box, cable 2m and plug, 1-10V Dim
	20240-2920	240W 220-240V 24V Max with connexion box, cable 2m and plug, 1-10V Dim
	20320-2920	320W 220-240V 24V Max with connexion box, cable 2m and plug, 1-10V Dim
	20100-2930 110V	Rotatable Dimmer 1-10V Niko white, visible mounting with box and button

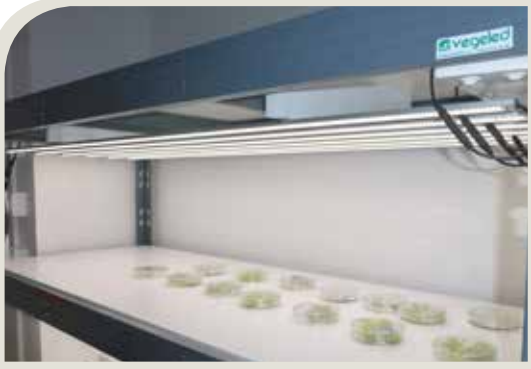
GROWING SHELF

With the goal of offering a simple solution, easy to install and controllable, whether for in-vitro plant culture or for growth room equip ment, EQUITEC LED has developed a complete shelf, delivered as a kit for self-assembly.

This standard format shelf can be configured with any existing lighting profiles, and can be powered by a simple mains socket.

Typical Configuration

- Stainless steel or coated structure
- Dimensions: 180Hx160Wx60D cm
- 3 lighted levels, adjustable in height
- 3 reinforced shelves in hard, white PVC foam
- 6 lighting profiles per level
- 4500 K CRI 90 Wide spectrum LED (20150-2840 profiles)
- Partial or complete lighting per level:
  - lighting at 33%:~70 mol/s/m2 at 20cm
  - lighting at 66%:~130 mol/s/m2 at 20cm
  - lighting at 100%:~180 mol/s/m2 at 20cm
- 1 supply per level, with plug and 2m cable



Reference :

Model	Description
20150-2160	Shelf 180Hx160Wx60D cm

SERVICES

AUDIT

In order to offer our customers, the most appropriate solution for the optimization of their artificial lighting, we offer a systematic step-by-step approach.

On-site visit

During this visit, we identify what the needs are in terms of light intensity and spectral quality depending upon the cultures envisaged. Using our portable spectrometers, we can take very accurate measurements of light spectra from the existing systems.

With a view to designing a solution for improved lighting, we also take into account the technical imperatives such as building architecture, heating and ventilation systems, etc. The safety and comfort of personnel who must work in the lighted zones, is also part of our considerations..

Report

On the basis of customer needs and technical constraints and safety, we develop a proposal for improvement. If this proposal entails an investment in terms of Vegeled™ lighting systems, a costed proposal is also drafted and presented. In collaboration with the customer, we can also perform a calculation of profitability as long as the elements of the calculation are communicated to us.

CUSTOMIZED PROJECTS

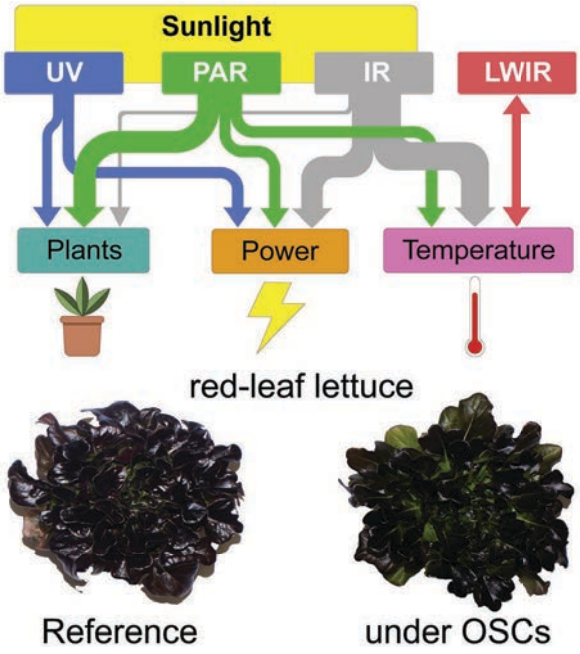
Because of its great flexibility and its abilities in terms of research and innovation, Colasse SA is able to design complete artificial lighting systems to favour growth of plants or simply to maintain their vitality.

These projects include:

- Relighting of phytotrons and culture chambers
- Implementation of supplementary greenhouse lighting
- Manufacturing of mobile lighting kits
- Co-research
- Relighting or supply of growth shelves
- Control system

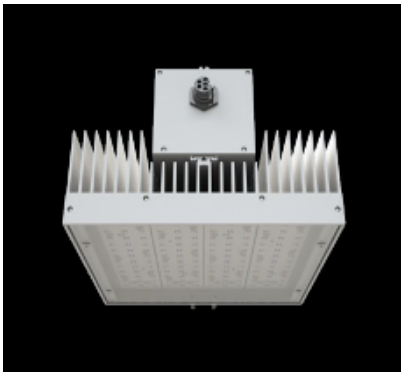
EXPERIMENTATION

Thanks to our collaboration with our customersresearch centers, attached to the Universitys , we are able to implement experiments and personnel with the goal of performing lighting test campaigns on plants of your choice in a culture cabinet with a controlled environment, phytotron or experimental greenhouse.



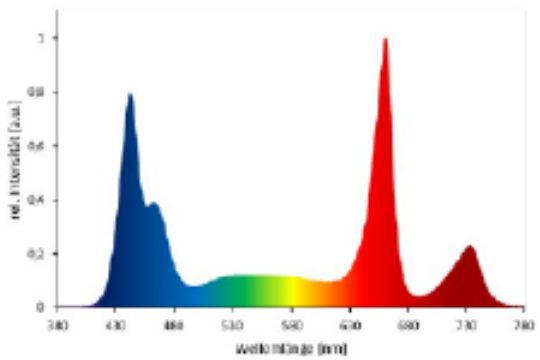
GREENHOUSE DESIGNS

GREENHOUSES GROWTH LED´S LIGHTS

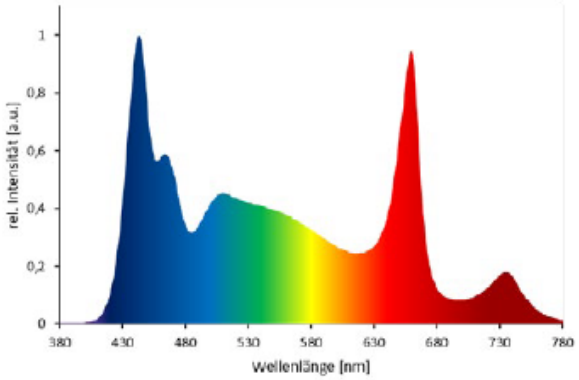


LED-luminaire with four adjustable light channels for many applications

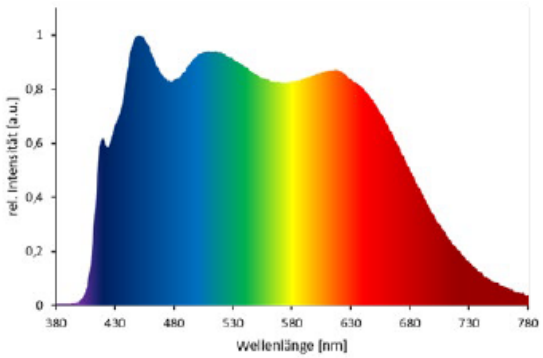
With the LED-KE 300 a total of 4 channels can be regulated independently. With a power 286 watts, the photon flux is approx. 780 µmol / s. The LED-KE 300 can be dimmed flicker-free thanks to amplitude dimming of 100 -1 % output. The LED-KE 400 THC was developed for the licensed cultivation of cannabis. With the spectrally adjustable luminaire it is possible to influence the content of THC (tetrahydrocannabinol) or CBD (cannabidiol).



Technical data*	**LED-KE 300**	**LED-KE 400 THC**
Power [W]	286	367
Voltage	230 V / 50 Hz	230 V / 50 Hz
Photon flux [µmol/s]	780	960
Protection class	IP65	IP65
Light spectrum	BB, R, FR, W	auf Anfrage */on request*
Light channels	4	4
Weight [kg]	11	11
Dimensions l x w x h [mm]	330 x 298 x 115 + 330 x 115 x 125	330 x 298 x 115 + 330 x 115 x 125
*Accessory hooks***	ZUB Haken 1 - 3 + 5 S	ZUB Haken 1 - 3 + 5 S



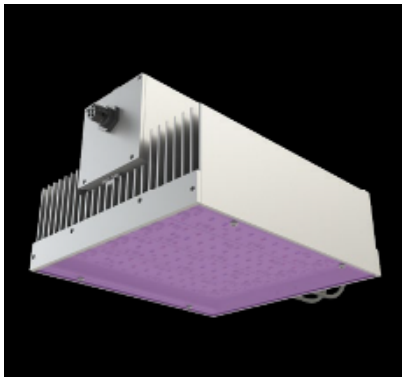
Technical data*	**LED-KE 308**
Power [W]	320
Voltage	230 V / 50 Hz
Photon flux [µmol/s]	760
Protection class	IP65
Light spectrum	Vollspektrum */ Full spectrum*
LIght channels	8
Weight [kg]	13
Dimensions l x w x h [mm]	330 x 298 x 115 + 330 x 115 x 125
*Accessory hooks***	ZUB Haken 1 - 3 + 5 S



LED-luminaire with sun-like light for many applications.

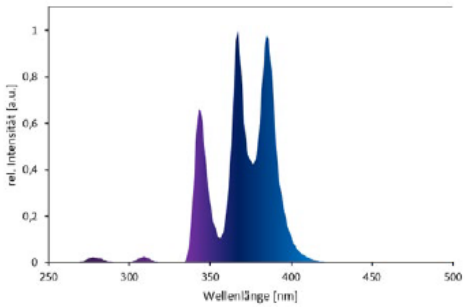
The LED-KE 400 VSP is an efficient high-performance LED-luminaire for botanical gardens, research institutes and for the horticultural industry. The luminaire generates sun-like light with a high color rendering index (CRI > 94) with a power of 360 W. The latest driver technology allows flicker-free dimming of the LEDs at 1 to 100% power through amplitude control.

Technical data*	**LED-KE 400 VSP**
Leistung */ power [W]*	360
Spannung */ voltage*	230 V / 50 Hz
Photonenfluss */ photon flux [µmol/s]*	720
Schutzart */ protection class*	IP65
Lichtspektrum */ light spectrum*	sonnenähnlich */ sun-like*
Lichtkanäle */ light channels*	1
Gewicht */ weight [kg]*	11
Maße L x B x H */ dimensions l x w x h [mm]*	330 x 298 x 115 + 330 x 115 x 125
Zubehörhaken */ accessory hooks***	ZUB Haken 1 - 3 + 5 S

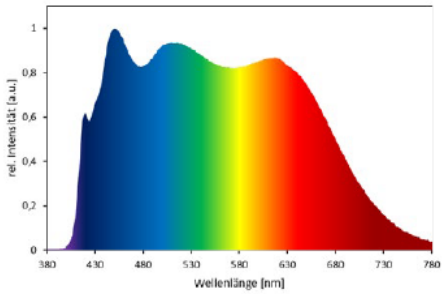


LED-luminaire with four adjustable UV channels

Ultraviolet (UV) light has a great influence on plant physiological processes.With the LED-KE 300 UVAB, a total of 4 UV-A/UV-B channels can be regulated and controlled independently of each other. Depending on the application, the luminaire can be equipped with different UV-A and UV-B LEDs. Different variants are available on request.



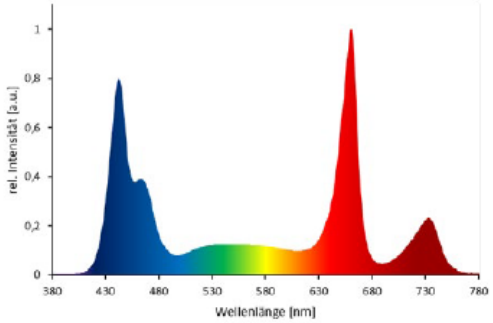
Technical data*	**LED-KE 300 UVAB**
Power [W]	250
Voltage	230 V / 50 Hz
Photon flux [µmol/s]	55
Protection class	IP65
Light spectrum	UV-A + UV-B
LIght channels	4
Weight [kg]	11
Dimensions l x w x h [mm]	330 x 298 x 115 + 330 x 115 x 125
*Accessory hooks***	ZUB Haken 1 - 3 + 5 S



AIR COOLED
Spectrally adjustable LED-luminaire for multilayered cultivation systems

The LED-LE lighting system from DH Licht cannot be surpassed in terms of flexibility and application thanks to its modular structure. Whether in production and research, in climate and phenotyping chambers, in greenhouses or multi-layer culture systems. The LED-LE can be individually adapted to your needs and always offers optimal light. The luminaire can be equipped with LED boards on one or both sides. Up to an output of 200 watts, the LED-LE is passively air cooled.

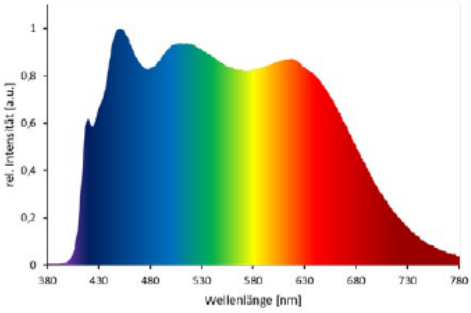
Technical data*	**LED-LE *air cooled***
Power [W]	bis zu 200 */ up to 200*
Voltage	230 V / 50 Hz
Photon flux [µmol/s]	bis zu 540 */ up to 540*
Protection class	IP65
Light spectrum	BB, R, FR, W or sun-like
Light channels	bis zu 4 */ up to 4*
Weight [kg]	nach Länge */ according length*
Dimensions l x w x h [mm]	... x 107 x 92
*Accessory hooks***	ZUB Haken 6



Water-coolable high-performance luminaire for multilayered cultivation systems

For very high light requirements, the LED-LE lighting system can be equipped with active water cooling. As a result, the system can be operated with up to 900 watts and a photon flow of over 2430 µmol/s can be generated. Active water cooling has the advantage that the heat from the LEDs can be dissipated in a targeted manner in order to ensure the longevity of the LED-luminaires and to reduce the heat impact in climatic chambers.

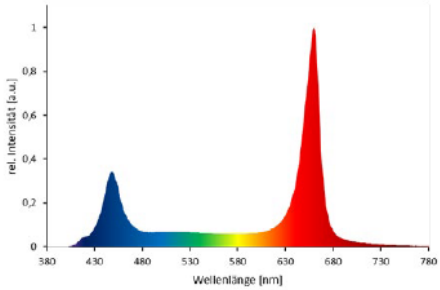
Technical data*	**LED-LE *Water cooled***
Power [W]	*up to 900*
Voltage	230 V / 50 Hz
Photon flux [µmol/s]	*up to 2430*
Protection class	IP65
Light spectrum	BB, R, FR, W or sun-like
Light channels	*up to 4*
Weight [kg]	*according length*
Dimensions l x w x h [mm]	... x 107 x 92
*Accessory hooks***	



LED-luminaire for shelving systems with sun-like light

The LED-MID system has been developed for shelves and cultivation tables with medium light intensities and is available in various versions and lengths. The drivers and LED circuit boards are integrated into a high-quality extruded aluminum profile. This allows through wiring and very easy installation. The LED-MID VSP emits a dimmable sun-like light spectrum with high color rendering index (CRI> 94). The LED-MID VSP is ideal for plant production in shelf systems for research and in-vitro cultivation.

Technical data*	**LED-MID 0600-VSP**	**LED-MID 0900-VSP**	**LED-MID 1200-VSP**
Power [W]	46	82	117
Voltage	230 V / 50 Hz	230 V / 50 Hz	230 V / 50 Hz
Photon flux [µmol/s]	68	135	203
Protection class	IP65	IP65	IP65
Light spectrum	sonnenähnlich / *sun-like*	sonnenähnlich / *sun-like*	sonnenähnlich / *sun-like*
Weight [kg]	1,3	2,3	3,1
Dimensions l x w x h [mm]	450 x 85 x 70	770 x 85 x 70	1070 x 85 x 70
*Accessory hooks***	ZUB Haken 1-3 + 5 S + 8	ZUB Haken 1-3 + 5 S + 8	ZUB Haken 1-3 + 5 S + 8
Accessory	Stecker 10514	Stecker 10514	Stecker 10514



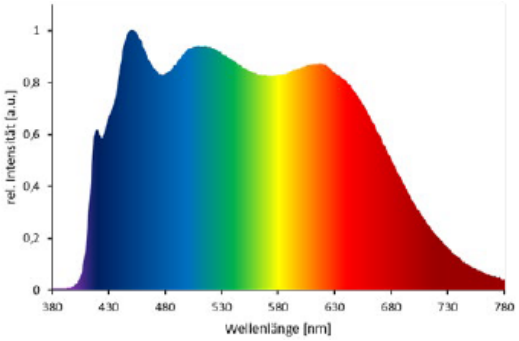
LED-luminaire for shelving systems with an efficient light spectrum

The LED-MID RBW is equipped with very efficient LED chips and emits red, blue and white light with an efficiency of up to 2.8 µmol / J. The spectrum is particularly suitable for the commercial cultivation of lettuce, herbs and microgreens in the field of vertical farming in multilayered cultivation systems. This LED-MID RBW is also well suited for the production of young plants in CC containers. The light intensity can be adjusted by a flicker-free amplitude dimming of 100-1%.

Technical data*	**LED-MID 0600-RBW**	**LED-MID 0900-RBW**	**LED-MID 1200-RBW**
Power [W]	32	63	95
Voltage	230 V / 50 Hz	230 V / 50 Hz	230 V / 50 Hz
Photon flux [µmol/s]	88	176	264
Protection class	IP65	IP65	IP65
Light spectrum	RBW	RBW	RBW
Weight [kg]	1,3	2,3	3,1
Dimensions l x w x h [mm]	450 x 85 x 70	770 x 85 x 70	1070 x 85 x 70
*Accessory hooks***	ZUB Haken 1-3 + 5 S + 8	ZUB Haken 1-3 + 5 S + 8	ZUB Haken 1-3 + 5 S + 8

LED-luminaire for in-vitro cultivation in shelf systems

The LED-REG is a high-quality LED-luminaire with a satined light cover for low light requirements. The LED-REG is suitable for the cultivation of plants in shelf systems with low light intensities, e.g., for cuttings, rooting or in-vitro areas. The LED-REG is characterized by a particularly long service life and a homogeneous, ergonomic and glare-free light.



Technical data*	**LED-REG 0600-VSP**	**LED-REG 0900-VSP**	**LED-REG 1200-VSP**
Power [W]	16	24	32
Woltage	230 V / 50 Hz	230 V / 50 Hz	230 V / 50 Hz
Photon flux [µmol/s]	22	33	44
Protection class	IP54	IP54	IP54
Light spectrum	*sun-like*	*sun-like*	*sun-like*
Weight [kg]	0,6	0,8	1,1
Dimensions l x w x h [mm]	630 x 38 x 41	880 x 38 x 41	1134 x 38 x 41
Accessory hooks	Mounting hooks are included in the scope of delivery.		

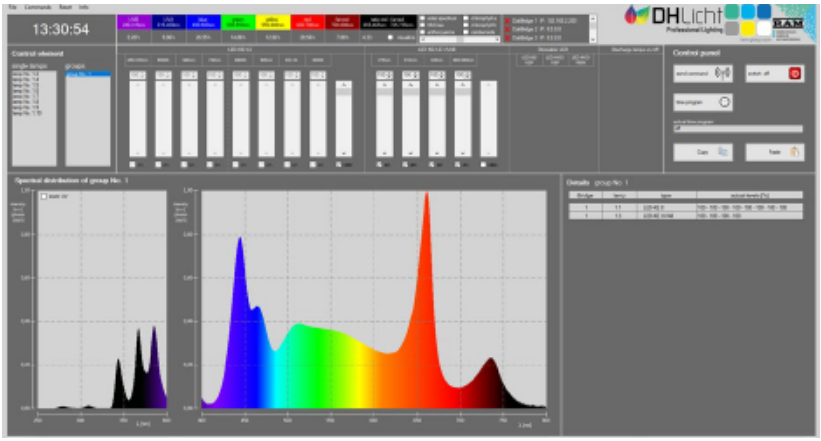
Planning of a climatic chamber

The LED-LE is one of the most flexible luminaire system for climatic chambers. The length is depending on the shelve and you can decide between several circuit boards for the spectrum. In addition to the ***LED-LE*** *.*
Our ***LED-KE*** *is mainly used for single-layer climatic chambers.*

We can simulate the new light situation already while planning your climatic chamber with tables or shelves, due to a modern visualization program. We are always in close contact to the manufacturers, so that an optimal support is guaranteed.

The LED-LE on this page, is connected to a commercial water through-flow cooler with a flow and return pipe. The active water cooling has the advantage that the heat of the LEDs is transferred outside the climatic chamber to ensure a long-life time of the LED chips. In addition, it is possible to generate very high light intensities in order to carry out light stress experiments.

Visu Spectrum

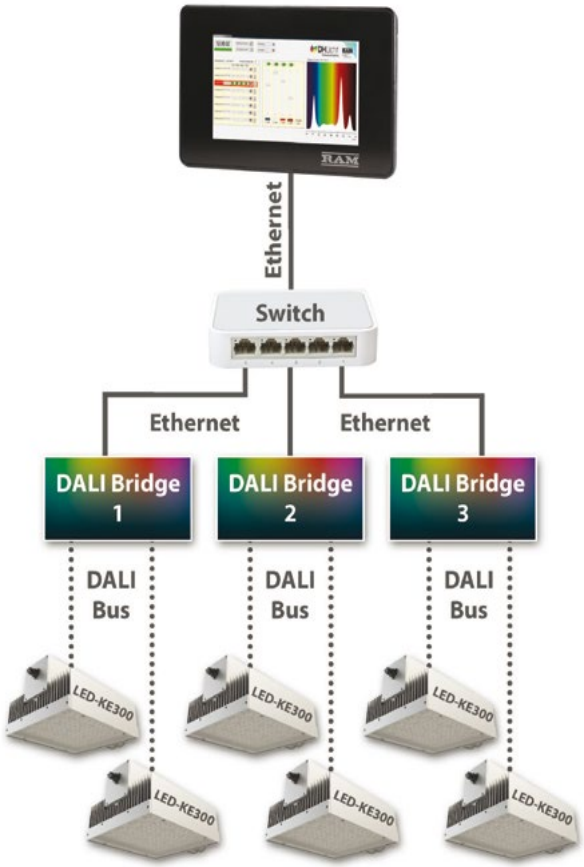


Versatile software for the spectral regulation and control of LED-luminaires

The LED-VisuSpectrum software, developed in cooperation with RAM, offers the possibility of setting an individual spectrum with the photon radiation relevant for plant development with a modern surface. The software was specially developed for the LED-KE and LED-LE luminaires and also allows control in the UV range. This gives you the option of regulating and controlling up to 12 light channels independently of one another. For a hybrid or mixed light system in which high-pressure sodium discharge-luminaire and LED-luminaires are used, the software offers switchable and controllable outputs for a variety of light luminaires. The spectra are stored and are displayed together with the LED-luminaires.

The user is able to set each of the specified wavelengths to 1% to 100% power. VisuSpectrum offers the possibility to combine luminaires individually or in groups and to integ-rate different time programs with different light settings. A commercially available PC, laptop or RAM climate computer is required to operate the software. The LED-RAM-DALI bridge is used to connect software and luminaires.
The VisuSpectrum is available in different versions for different applications.

bis zu 16 LED-KE 300 / up to 16 LED-KE 300
bis zu 8 LED-KE 308 / up to 8 LED-KE 308
bis zu 16 LED-LE / up to 16 LED-LE



bis zu 16 LED-KE 300 / up to 16 LED-KE 300
bis zu 8 LED-KE 308 / up to 8 LED-KE 308
bis zu 16 LED-LE / up to 16 LED-LE

The illustration on this page shows a scheme for integrating our spectrally adjustable and dimmable LED-luminaires. In addition to our VisuSpectrum software, the luminaires can also be controlled via a DALI-capable climate computer. For example, up to 16 LED-KE 300 or 8 LED-KE 308 can be controlled per DALI Gateway / DALI Bridge. The system can be expanded as required by increasing the number of DALI gateways and software licenses.

Technical data*	**VisuSpectrum 3.2 Lite**	**VisuSpectrum 3.2 Basis**	**VisuSpectrum 3.2 Pro**
Controllable light channels	4	8	12
Control of discharge-luminaires no		no	yes
Internal number of switching points	10	30	30
External number of switching points	no	no	1140 (via data import)
Maximal number of bridges	5	10	30
Settings	no	no	yes
Licence	VisuSpectrum 3.2 Lite Liz	VisuSpectrum 3.2 Basis Liz	VisuSpectrum 3.2 Pro Liz

APLICATIONS

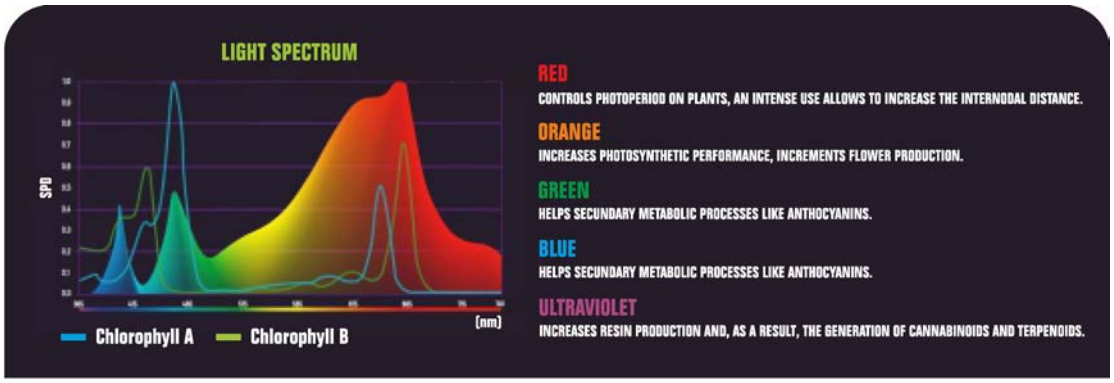
+60º

MODULAR VISITABLE GROWTH CHAMBERS

CUSTOM SPECTRA

We have a wide selection of wavelenghts for photo-biological research, for example UV-A 390 nm, 455 nm blues, 530 nm greens, 660 nm reds and 730 nm far-red.
Likewise, we have specific spectra for use in specific applications, for example for a better production of secondary metabolites, including a better coloration or lettuce production or an improvement of the specific metabolites in micro-algae.

- **Common applications: growth conditions of controlled plants:** temperature and humidity with photoperiods.
- **Light intensity in common applications:** 20-1200 µmol m^{2}/s^{1}.
- **Available spectra:** 350 to 920 nm, depending on the required luminaire.



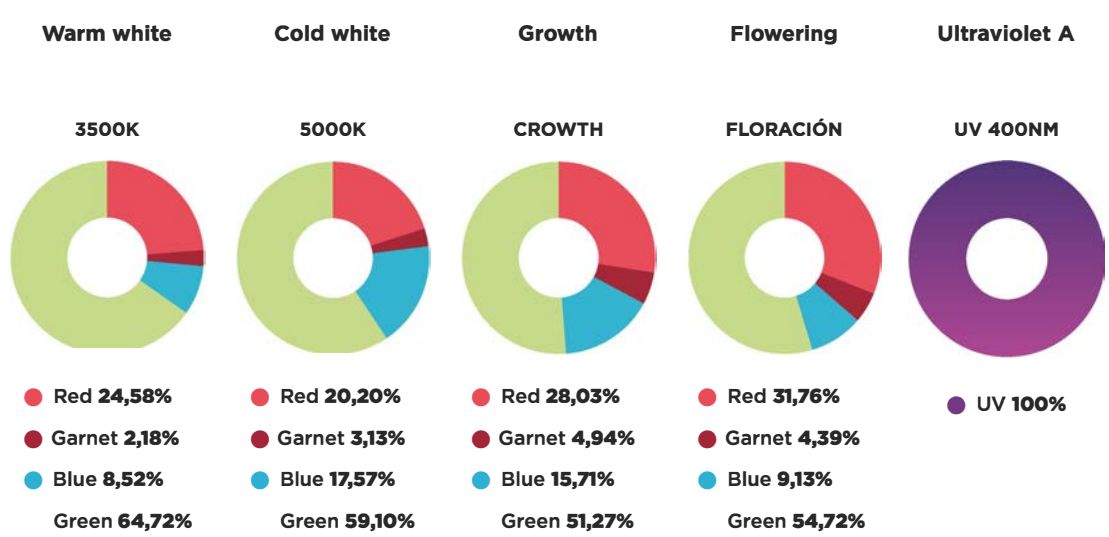
	S 60	M 90	L 120	XL 150
CONSUMPTION	25 W	40 W	50 W	80 W
DIMENSION (MM) (LENGHT/DIAMETER)	595 / Ø 26	895 / Ø 26	1.198 / Ø 26	1.498 / Ø 26
DIMENSION (INCHES) (LENGHT/DIAMETER)	23.4" / Ø 1.02"	35.2" / Ø 1.02"	47.2" / Ø 1.02"	59.0" / Ø 1.02"
CERTIFICATES	Marked CE			
SPECTRUM	Depending on the necessity: adjustable espectrum and intensity			
PPDF INTENSITY	from 5 µmol m/s to 1200 µmol m/s			
DISTANCE TO THE PLANT	100 to 400 mm			
DECAY OF LIGHT INTENSITY	Max. 10% at 35.000h in standard applications 50.000 h			
LIGHT EFFICIENCY (380-820 NM)	Up to 2,2 µmol/W (depending on the spectrum)			
AMBIENT WORK TEMPERATURE	0/+50ºC (32-100º F)			

Available with transparent or diffusive cover, G13 connecting elad, IP20 and IP64 degree of protection with Valoya socket set, according to ROHS, limited 5 years warranty.

LED LIGHT TUBES ON THE FLUORESCENT TUBE RACKS

Type T6 or T8 tubes allows series of tubes to be installed in the fluorescent tube racks without any modification (magnetic ballast fixing).
Profitable, very easy to install in terminals with IP64 for particular tests, for example.

GUIDE FOR LED TUBES APPLICATIONS

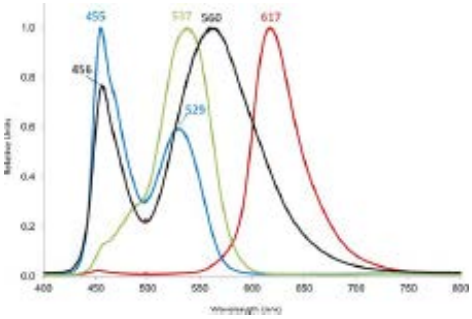


SPECIAL APLICATIONS FOR ALGAE GROW

Oceanographic Institute

ALGAE GROW
Pigment variations in Emiliania huxleyi (CCMP370) as a response to changes in light intensity or quality

The project consisted of photoacclimation examine the pigment responses to changes in light intensity, but variations in light climate in the aquatic environment are also related to changes in spectral composition. We have employed a high-performance liquid chro-matography method with improved resolution towards chlorophyll c and fucoxanthin-related xan-thophylls to examine the pigment composition of Emiliania huxleyi CCMP 370 under different light intensities and spectral qualities.



Lighting device employed for the setting of different light intensities and spectral qualities, with 6 independent LED chanels control.

The equipment supplied was designed to operate in a climatic environment. Their high protection index (IP65) allows them to be placed in a humid and dusty environment. Their wide voltage range of the supply (100-300 VAC) protects them against most of the disturbances which can happen in the electrical grid.

The project has achieved its objectives :

- **Decrease by more than 50%, the electricity consumption related to lighting in the zone**
- **Improve the vitality of the plants**
- **Improve the visible rendering of the growth**

RELIGHTING OF 1 GROWTH CHAMBER (CONTROLLED ENVIRONMENT)

Agriculture Reseach Center

Independen dimable control of 3 different growth levels and 3 independent chanels for control of the wave length

Previous installation: 16 work tables each equipped with 3 x T8 tubes of 120 cm with an electronic transformer (total power: 1820W).

New installation: 16 work tables each equipped with Equitec LED lighting profiles (combined power: 3020W). Combination of cherry red (660nm), royal blue (450nm) and neutral white (4500K) spectra.

Before relighting

After relighting

Growth lighting (with colour)

Technical lighting (without colour)

The new installation allows the growth of plants of greater dimensions to be achieved as the strips are **more compact** with respect to the previous fixtures with T8 tubes which has increased the free height by 10 cm.

The light spectrum at **high photosynthetic yield** is stable and allows long experiments to be under-taken without intermediate maintenance. The chamber is equipped with a **presence detector** which turns off the blue and red profiles while the technicians take care of the plants, which provides better working comfort. The high colour rendering index of the white LEDs allows a change of colour of the leaves to be noticed so as to rapidly identify any possible nutritional deficiency.

The project has achieved its objectives :

- **Light flux better adapted to photosynthesis**
- **Stable and dimable spectrum**
- **More compact installation: increase in free height**
- **Increased safety: Low voltage used**
- **Increase in light flux: + 350% (~ 300 mmoles/s/m² on the plants)**

Note: It is posYesble that some products have changed Yesnce the printing date of this catalog. The printing date was July 12 2022. The manufacturer is authorized to ma-ke changes in the deYesgn, color and shape between the date of the order and the date of printing.
Even so, these changes will not affect the main specifications of the units. If the seller or the owner uses symbols or numbers to name the products, you can not extract rights from them. Photographs and drawings may show accessories and instruments not included in the standard models. Colors can change in relation to photographs by the printing process. The catalog may contain products that can not be sent to certain countries due to national or international legislation. The in-formation shown on laws, legal protocols and legal requirements is valid only in Spain.

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