

LEDs for
**Medical
Plants**

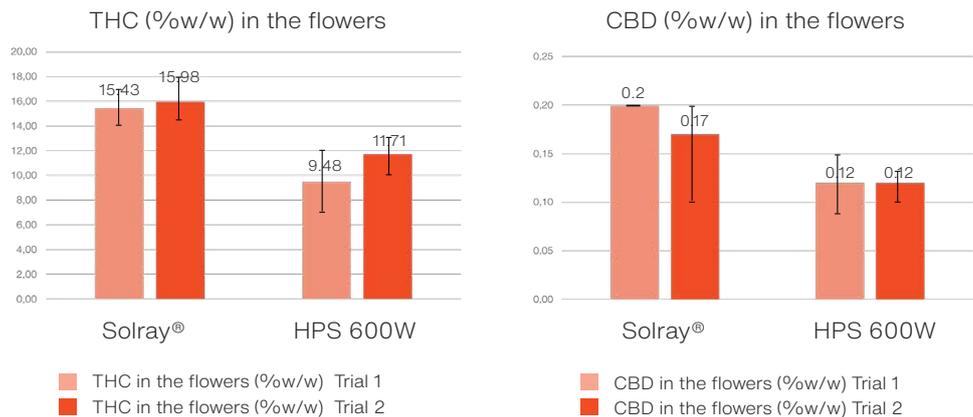
Spectrum for High THC/CBD Content



Picture: Comparing the effects of HPS and LED on the morphology and cannabinoid profile of cannabis.

Cannabinoid (THC & CBD) Accumulation

A two year long, independent study in Italy compared the effects of HPS vs. LED for cannabis. In a trial series, Valoya Solray® and HPS lamps were compared to each other by their ability to produce THC and CBD in flowers. Trial was repeated twice (Trial 1 and 2). Plants were grown under 450 $\mu\text{mol}/\text{m}^2/\text{s}$.



The results of this trial have been published in the first academic article on HPS vs. LED for cannabis:

The Effect of Light Spectrum on the Morphology and Cannabinoid Content of Cannabis sativa L.

This data is publicly available and has been presented at several prestigious medical cannabis conferences around the world.

Results:
Improved Cannabinoid Profile



26-38 % more THC under Solray®

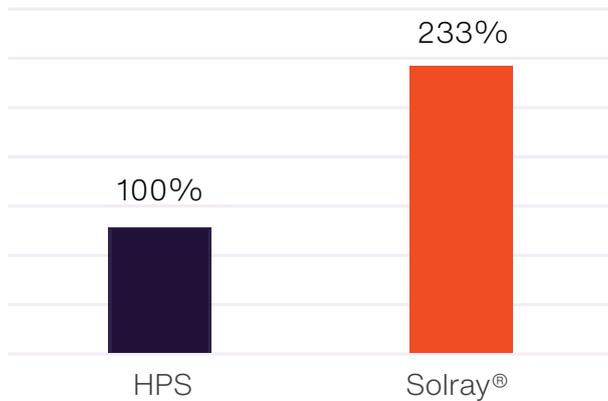


29-40 % more CBD under Solray®

Greater Yields Than With HPS

Dry Flower Weight

In a grow in Boulder, CO the performance of HPS was compared against the Valoya Solray® spectrum during the flowering phase. Light intensity in the experiment was set to **800 $\mu\text{mol}/\text{m}^2/\text{s}$** .



With Solray®, the flower yield was more than 100% higher compared to the HPS reference.

The plants were more compact due the portion of blue and UV-A light in the LED spectrum. The compact cannabis plant is stronger and can support the development of heavier flower formations.

Furthermore, the shorter wavelengths create a balanced amount of lighting induced stress, resulting in a more resinous, cannabinoid rich plant.



Valoya

Solray®



HPS

∴ Picture:
Drying of the cannabis plant. LED has produced a more compact plant with denser and heavier flower formations.



133% more flower yield compared to the HPS reference



More uniform crop than under HPS



More compact plants compared to HPS with a higher cannabinoid yield

Lighting the Cultivation Process



∴ Complete solution: Valoya provides lighting solutions for the entire cultivation cycle of cannabis, from seed to sale.

Mother Plants



- Strong vegetative growth with good branching, enabling higher production of high quality cuttings
- Minimized losses due to healthy, resistant plants

Tissue Culture



- Less mold, pest, and bacteria during the micropropagation process due to the blue and UV-A wavelengths
- Higher survival rate and stronger plants, uniform plants resulting in even development in further stages

Cloning



- Fixtures resistant to conditions of high humidity and dust
- Optimal light distribution resulting in uniform clones which reach further growth stages simultaneously

Vegetative Stage



- Compact and slim plants, perfect for vertical farming
- Even though smaller, the plants are strong thus able to produce large flowers

Flowering



- High amount of dry flower weight
- Consistent flower quality and chemotype, cycle after cycle
- Increased concentration of cannabinoids (THC, CBD, etc.)

Spectrum for a Superior Cannabisoid Expression

Next to nutrition, temperature and CO₂, light plays a crucial role in the efficient development of the cannabis plant. So, it does make a big difference whether the spectrum is an HPS, MH or LED spectrum. Furthermore, LED spectra vary greatly, ranging from simple red / blue combinations recognizable by their intense, highly unpleasant pink color to high quality, high CRI white LEDs. There are differences among the high quality, white LED spectrums as well e.g. the numbers of peaks, the amount of green, the amount of UV-A etc.

Spectrum Data

Valoya has performed trials with more than 60 LED spectra over the past 10 years. Solray® has been optimized to trigger high cannabinoid accumulation and an increase in flower yields compared to HPS and competitor's LED products, consistently, harvest after harvest.

	UV	B	G	R	FR	PAR	CCT	CRI*	B:G	R:FR
Solray®	1%	24%	34%	38%	3%	96%	4600	95	0.7	13
Solray385 (DLC certified)	2%	19%	36%	40%	3%	95%	4500	90	0.7	13

* highest in the industry.

* CRI (color rendering index = the degree to which objects' colors render naturally under a light source)

Effects of the Solray® Spectrum on the Absorption Curves in Cannabis sativa

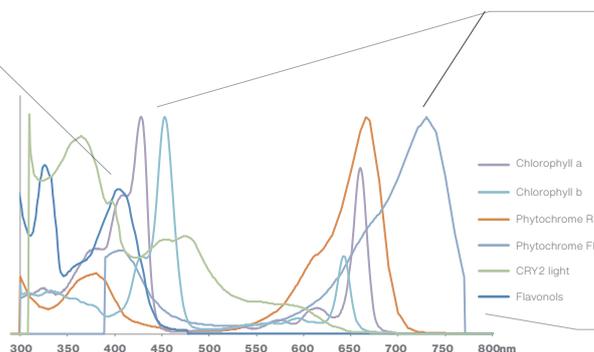
Compact plant with a high cannabinoid content

- deep blue radiation creates healthy stress for the plant which prevents excessive stretching (as with HPS or red / blue LEDs)

- the result is a more compact plant, ideal for multitier cultivation. Even though smaller, the plant is capable of developing more and bigger flowers with a higher THC/CBD build-up

More cannabinoids and less pathogens

- small amount of UV-A triggers the development of more cannabinoids as a defense mechanism
 - UV-A suppresses microbial development thus drastically reducing the possibility of powdery mildew and similar problems



Efficient photosynthesis

- the red and blue wavelengths drive basic photosynthesis (most LED spectra are made up of only these two peaks)

Increased plant biomass

- a high R:Fr triggers rapid development of biomass

Better penetration of the lower parts of the canopy

- green light enables plant development at the lower parts of the canopy
 - the light appears white to human eyes

* Valoya Solray® spectrum is the only spectrum in the market with these features

How Many Fixtures are Needed?



Our luminaires are built for the most demanding cultivation environments. An industry leading, patented spectrum will accelerate growers' bench turns with cannabis plants with industry leading chemical expressions.

What the Growers Get



Easy to clean & sterilize with chemicals



Durable luminaires, resistant to dust & humidity

We provide comprehensive, state-of-the-art light plans for our customers, free-of-charge. Below are samples of installations in different growth stages.

Mother Plants



PPFD 400 $\mu\text{mol}/\text{m}^2/\text{s}$
4' x 8' (1,2 x 2,4 m) area
1' (0,30 m) height
4 pcs of BX120 Solray385



PPFD 400 $\mu\text{mol}/\text{m}^2/\text{s}$
4' x 8' (1,2 x 2,4 m) area
7' (2 m) height
2 pcs of RX600 Solray385

Tissue Culture



PPFD 80 $\mu\text{mol}/\text{m}^2/\text{s}$
4' x 2' (1,2 x 0,6 m) area
2' (0,6 m) height
2 pcs of L28 tubes

Cloning



PPFD 120 $\mu\text{mol}/\text{m}^2/\text{s}$
4' x 2' (1,2 x 0,6 m) area
1' (0,3 m) height
2 pcs of L28 tubes

Vegetative Stage



PPFD 400 $\mu\text{mol}/\text{m}^2/\text{s}$
4' x 8' (1,2 x 2,4 m) area
1' (0,3 m) height
4 pcs of BX120 Solray385



PPFD 400 $\mu\text{mol}/\text{m}^2/\text{s}$
4' x 8' (1,2 x 2,4 m) area
7' (2 m) height
2 pcs of RX600 Solray385

Flowering



PPFD 800 $\mu\text{mol}/\text{m}^2/\text{s}$
4' x 8' (1,2 x 2,4 m) area
1 (0,3 m) height
8 pcs of BX120 Solray385



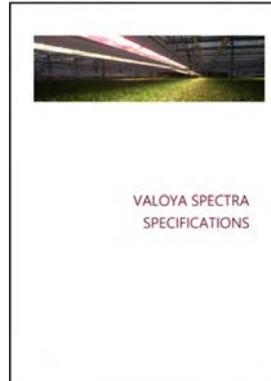
PPFD 800 $\mu\text{mol}/\text{m}^2/\text{s}$
4' x 8' (1,2 x 2,4 m) area
4' (1,2 m) height
2 pcs of RX600 Solray385

Quality in Manufacturing

Valoya is committed to preserving the consistency of its spectrum from one manufacturing batch to the next and from one product generation to another.

Due to the constant evolution of the LED technology, small variations in wavelengths can be expected, however not significant enough to create inconsistencies in growers' results.

Furthermore, Valoya is the first LED manufacturer to publish a Spectrum Quality Standard (available under an NDA) strictly defining bounds within which our spectra are guaranteed to be.



**Spectrum
Quality
Standard**

Manufacturing is done in ISO 9001:2015 and ISO 14001:2015 certified facility in Finland (Valoya C, BX, BL, RX-series)

Spectra follow Valoya standards i.e. specifications for each spectrum (tolerances, ratios)

Each fixture is subject to spectra test in contrast to relying on component specifications only

Each fixture is subject to burn in test in contrast to random samples typical in the industry

Each series is subject to long-term burn in tests to measure true burn-in

Fixtures (down to component level) are traced through out the whole manufacturing process

List of all the standards applied on Valoya products is available on the back page of this brochure.

**Manufacturing
Quality**

::: Pictures:
A cannabinoid rich plant under the Solray™ spectrum

STANDARDS

NORTH AMERICA

UL1598: Luminare safety.
UL8750: Light Emitting Diode (LED) equipment for use In lighting products.
UL2108: Standard for Low Voltage Lighting Systems.
UL 8800: Standard for Horticultural Lighting Equipment
CSA C22.2 No.9.0: General Requirements for Luminaires.
CSA C22.2 No. 250.0: Luminaires
CSA C22.2 No. 250.13: Light Emitting Diode (LED) equipment for use in lighting products.

EUROPE

EN60598-1: Luminaires. General requirements and tests.
EN60598-2-1: Luminaires. Part 2: Particular requirements. Section one – Fixed general purpose luminaires.
EN62031: LED modules for general lighting. Safety specifications.
EN 62493: Assessment of lighting equipment related to human exposure to electromagnetic fields.
EN55015: Limits and methods of measurement of radio disturbance characteristics of electrical lighting and similar equipment.
EN61547: Equipment for general lighting purposes. EMC immunity requirements.
EN61000-3-2: Electromagnetic compatibility - Limits - Limits for harmonic current emissions.
EN61000-3-3: Electromagnetic compatibility – Limits - Limits for Voltage Fluctuations and Flicker.
IEC EN 61000-4-2: Electromagnetic compatibility (EMC)- Part 4-2: Testing and measurement techniques - electrostatic discharge immunity test.
IEC EN 61000-4-3: Electromagnetic compatibility (EMC)- Part 4-3: Testing and measurement techniques - radiated, radio-frequency, electromagnetic field immunity test.
IEC EN 61000-4-4: Electromagnetic compatibility (EMC) - Part 4-4: Testing and measurement techniques - Electrical fast transient/burst immunity test.
IEC EN 61000-4-5: Electromagnetic compatibility (EMC) - Part 4-5: Testing and measurement techniques - Surge immunity test.
IEC EN 61000-4-6: Electromagnetic compatibility (EMC) - Part 4-6: Testing and measurement techniques - Immunity to conducted disturbances, induced by radio-frequency fields.
IEC EN 61000-4-8: Electromagnetic compatibility (EMC) - Part 4-8: Testing and measurement techniques - Power frequency magnetic field immunity test.
IEC EN 61000-4-11: Electromagnetic compatibility (EMC) - Part 4-11: Testing and measurement techniques - Voltage dips, short interruptions and voltage variations immunity tests.
IEC 61347-2-13: Lamp controlgear. Particular requirements for d.c. or a.c. supplied electronic controlgear for LED modules.
IEC 61347-1: Lamp controlgear - Part 1: General and safety requirements.
IEC 62384: DC or AC supplied electronic control gear for LED modules. Performance requirements.
EN62471: Photobiological safety of lamps and lamp systems.
EN62560: Self-ballasted LED-lamps for general lighting services by voltage >50V - Safety specifications.
EN62776: Double-capped LED lamps designed to retrofit linear fluorescent lamps - Safety specifications.



Get in touch with Valoya

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