



LEDs for Crop Science



Optimized Broad Spectra

Finely balanced spectra that incorporate wavelengths across a broad range from UV-A to far red and represent a close match to natural sunlight.

They have been tested on more than 300 plant species/varieties within over 600 trials and illuminate the greenhouses and chambers of some of the world's leading research institutes, universities and agricultural companies.

Achieve Outdoor Phenotypes, Indoors

The optimized portion of UV-A and blue light in our spectra provide a balanced amount of stress to the plant resulting in a compact, outdoor-like phenotype and more pest resistant plants.

Fluorescent, metal halide and other suppliers' white LED lights typically contain very little blue and no UV light resulting in stretched out plants.

Highest
**CRI Value
Light
(95/100)***
in the
Industry



**100% safe for the
eyes and pleasant
to work under**



**Natural looking and
enables doing visual
inspection of the
plants**

CRI (Color Rendering Index) is the degree to which objects' colors render naturally under a light source, the value of 100 being natural sunlight.

** Solray spectrum. Specific spectra data on page 4.*

Spectra for Research

Valoya's luminaires enable uniform light distribution in plant breeding, creating outstanding growth conditions, even when the light source is placed extremely close to the plants.

The finely balanced, wide spectra result in **high quality seedlings and low mortality rates**.

Tailored spectra enable researchers whether to speed up breeding projects by shortening the life cycle or increase seed production of individuals plants or plant groups.

The spectrum is a close match to high noon sunlight, resulting in compact and resilient plants ideal for crop protection research purposes.

Additionally, the spectrum will result in quick plant biomass accumulation enabling you to expedite your trials.

Researchers need a light spectrum that is consistent from lamp to lamp and year after year so as to ensure validity of their trial data.

At Valoya we created a spectrum quality standard; this defines the minimal amount of variation we allow in our luminaires over the course of their lifetime.

This serves as a guarantee that a replacement luminaire will come with the same spectrum or with a minimal variation. Valoya is the only LED manufacturer to give such a guarantee.

Additionally, our daylight spectrum decays equally in all its parts, unlike other lighting sources whereby the spectrum changes over time, as is most notably the case with fluorescent lighting.

This is due to the phosphor coating technology we use in the manufacturing of our LED chips.



**Plant
Breeding**



**Crop
Protection**



Research

... Pictures:
Chambers and
greenhouses
of more than
100 universities,
research institutes
and companies
around the world
are illuminated
with Valoya.

Lighting the Seed to Seed Process

Valoya Spectra for Crop Science Applications

Valoya offers unique spectra for crop science applications, starting with the general use, white LED light spectra (SolrayX/Solray385 and NS1/NS12) and 3 spectra to support plant breeding activities.

SolrayX Solray385

| UV | B | G | R | FR | PAR | CCT | CRI | B:G | B:R | R:FR |
|----|-----|-----|-----|----|-----|------|-----|-----|------|------|
| 0% | 19% | 37% | 42% | 2% | 98% | 4500 | 95 | 0.5 | 0.46 | 26.0 |
| 2% | 19% | 36% | 40% | 3% | 95% | 4500 | 90 | 0.5 | 0.47 | 12.9 |

Suitable for all growth stages. Table expresses data for SolrayX (upper row)/Solray385 (lower row).

NS1 NS12

| UV | B | G | R | FR | PAR | CCT | CRI | B:G | B:R | R:FR |
|----|-----|-----|-----|----|-----|------|-----|-----|------|------|
| 1% | 21% | 36% | 38% | 4% | 95% | 4800 | 90 | 0.6 | 0.56 | 9.1 |
| 0% | 20% | 38% | 36% | 6% | 94% | 4500 | 90 | 0.5 | 0.57 | 6.1 |

Suitable for all growth stages. Table expresses data for NS1 (upper row)/NS12 (lower row).

AP673L

| UV | B | G | R | FR | PAR | CCT | CRI | B:G | B:R | R:FR |
|----|-----|-----|-----|----|-----|------|-----|-----|------|------|
| 0% | 10% | 19% | 63% | 8% | 91% | 2000 | 60 | 0.6 | 0.16 | 7.9 |

Suitable for all growth stages. Favours the development of lateral shoots (tiller, branching) and biomass.

AP67

| UV | B | G | R | FR | PAR | CCT | CRI | B:G | B:R | R:FR |
|----|-----|------|-----|-----|-----|------|-----|-----|------|------|
| 0% | 12% | 16 % | 57% | 15% | 85% | 2500 | 70 | 0.8 | 0.21 | 3.7 |

Suitable for: tissue culture, vegetative and strong generative growth. Favours fast flowering and shortened plant life cycle.

G2

| UV | B | G | R | FR | PAR | CCT | CRI | B:G | B:R | R:FR |
|----|----|----|-----|-----|-----|-----|-----|-----|------|------|
| 0% | 9% | 2% | 66% | 23% | 77% | NA | NA | 3.6 | 0.13 | 2.8 |

Suitable for: vernalization.



Tissue Culture

Uniform Growth and More Production with Vigorous Sprouts and Faster Cycles. Suitable for a Range of Tissue Culture Applications such as Embryo Rescue or Anther and Microspore Culture.

Plant growth can be guided throughout the breeding cycle, starting from tissue culture. Whether plantlets originate from callus or microspores, the process can be improved with the correct spectrum. Our fixtures provide uniform light distribution creating enhancing survival rate in lab-generated plantlets and good growth conditions, even when the light source is placed very close to the plants.



Seedling Stage

High Biomass Seedlings With Strong Roots and a Low Mortality Rate. Short Hypocotyls as a Guarantee of a Good Start for Growth.

High quality seedlings result in low mortality rates. This applies to both sprouts retrieved from tissue culture and seedlings propagated from seeds. High biomass in the seedling stage will later on translate into balanced growth, a high number of flowers and vital seeds.



Vernalization

Earlier Flowering and Greater Plant Survival. Improved Development by Formation of Strong Rootball.

Vernalization can be enhanced with the appropriate light quality. Faster flowering induction, better survival results in energy and cost savings - all thanks to our advanced LED technology spectra.



Flowers and Seeds

Full Control Over the Plant life Cycle Length (Seed-to-Seed) and Entire Growth.

The light environment can be designed to either delay or enhance flowering induction. With the correct spectrum the plants produce more tillers and high biomass, which is reflected as higher number of flowers and seeds. Accelerated flowering can be used to shorten the plant life cycle.

Light for Speed Breeding



Picture: Saatzeit Bauer cereal breeding site in Germany.

Doubling Cycles in Plant Breeding

Since 2012, Valoya has cooperated with seed companies to learn about the effect of different spectra for individual growth phases through various trials.

It was proven that the use of correct spectrum in the growth process shortens the life cycle length of plants, leading to more generations of crops during a year. Thus, develop new varieties in a shorter time.

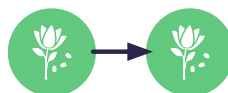
In 2014, the solutions have been successfully implemented in commercial seed companies for winter field crops resulting in up to 3 generations per year in greenhouses or controlled environments, compared to previously 1 generation per year in field conditions and 2 generations per year in greenhouse conditions.

For spring crops the number of generations per year can even be doubled. The chart below shows an example of Croser et al. (2014)'s accelerated Single Seed Descent (aSSD) method using Valoya AP67. More protocols using Valoya to create Speed breeding conditions, can be found from Watson et al. (2018)

12 months



Field conditions



Field conditions using contra-season






Greenhouse un-optimized conditions






aSSD methods applied on spring field crops

Speed Breeding Research

Solutions for SD, dayneutral crops & model plants

| Crop Examples | Applied Environment |  |  |  | Benefits |
|---------------|-----------------------------------|---|---|--|--|
| Corn | Greenhouse Controlled Environment | AP673L | Valoya Spectrum* | Valoya Spectrum* | Improved fertilization, well developed and filled cobs |
| Rice | Greenhouse Controlled Environment | AP673L | Valoya Spectrum* | Valoya Spectrum* | Saving up to 2 months for one seed-to-seed cycle |
| Soybean | Greenhouse Controlled Environment | AP67 | Valoya Spectrum* | Valoya Spectrum* | Reliable flower induction and improved fertilization and seed set |
| Lotus | Greenhouse Controlled Environment | AP67 | Valoya Spectrum* | Valoya Spectrum* | Faster flower induction and higher number of flowers and buds compare to CMH |
| Brachypodium | Greenhouse Controlled Environment | AP67 | Valoya Spectrum* | Valoya Spectrum* | Generating flowering in >30 days and seed-to-seed in 50 days |
| Arabidopsis | Greenhouse Controlled Environment | AP67 | Valoya Spectrum* | Valoya Spectrum* | Generating flowering in 27 days and seed-to-seed in 45 days |

Solutions for Spring Field Crops

| Crop Examples | Applied Environment |  |  |  | Benefits |
|-----------------|-----------------------------------|---|---|--|---|
| Barley Wheat | Greenhouse Controlled Environment | AP67 | Valoya Spectrum* | Valoya Spectrum* | Generating seed to seed in 60 days |
| Barley Wheat | Greenhouse Controlled Environment | AP67 | Valoya Spectrum* | | Speed up anthesis and obtain flowering after 5 weeks |
| Canola | Greenhouse Controlled Environment | AP67 | Valoya Spectrum* | Valoya Spectrum* | Obtain 4 generation cycles per year |
| Canola | Greenhouse Controlled Environment | AP67 | Valoya Spectrum* | | Collect microspores after 6-7 weeks |
| Lupin Fieldpea | Greenhouse Controlled Environment | AP67 | Valoya Spectrum* | Valoya Spectrum* | Generate 6 seed to seed cycles a year |
| Chickpea Lentil | Greenhouse Controlled Environment | AP67 | Valoya Spectrum* | Valoya Spectrum* | Raise the number of generation cycles per year to up to 8 |

* To know more about Valoya's recommended spectra in proven speed breeding methods as well as speed breeding solution for other crops, please contact: sales@greenlux.com

STANDARDS

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.

NORTH AMERICA

UL1598: Luminaire safety.
UL8750: Light Emitting Diode (LED) equipment for use in lighting products.
UL2108: Standard for Low Voltage Lighting Systems.
CSA C22.2: #9.0: General Requirements for Luminaires.
CSA C22.2: #250.0.8: Safety for Light emitting diode (LED) equipment for lighting applications.
CSA C22.2 No. 250.13-14: Light Emitting Diode (LED) equipment for use in lighting products.



Get in touch with Valoya

Europe and Rest of the World

T +358 29 3700 670
E sales@greenlux.com
W www.valoya.com



We are happy to announce that Valoya is now
a part of Greenlux Lighting Solutions.

Head office

Mekaanikonkatu 1B
00880 Helsinki,
Finland

Distributors

To find a local distributor, please go to
www.valoya.com/distributors