



LEDs for **Crop Science**



Optimized Wide Spectra

Wide, finely balanced spectra that incorporate wavelengths from UV-A to far red and represent a close match to natural sunlight.

They have been tested on more than 200 plant species/varieties within over 500 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**.

This enables the researcher to reach plant breeding targets faster meaning more production and faster cycles.

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.

Valoya has created a spectrum quality standard which defines the minimal permitted spectral variations across production batches, generations and over the lifetime of a luminaire.

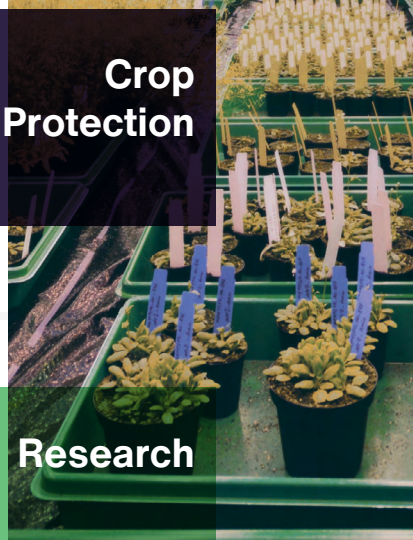
This serves as a guarantee that a replacement luminaire will come with the same spectrum or with a minimal variation inevitable due to technology development yet not big enough to affect the validity of trial data negatively. Valoya is the only LED manufacturer to give such a guarantee.

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 5 spectra for crop science applications, starting with the general use, white LED light spectra (Solray and NS1/NS12) and 3 spectra for specific growth stages.

Solray®

UV	B	G	R	FR	PAR	CCT	CRI	B:G	R:FR
1%	24%	34%	38%	3%	96%	4600	95	0.7	13
2%	19%	36%	40%	3%	95%	4500	90	0.7	13

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

NS1 NS12

UV	B	G	R	FR	PAR	CCT	CRI	B:G	R:FR
1%	22%	36%	37%	4%	95%	4800	90	0.7	10.0
1%	20%	36%	38%	6%	94%	4500	90	0.6	5.0

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	R:FR
0%	10%	19%	63%	8%	92%	2000	60	1.8	6.0

Suitable for: seedling stage and vegetative growth.

AP67

UV	B	G	R	FR	PAR	CCT	CRI	B:G	R:FR
0%	12%	16%	57%	16%	84%	2500	70	1.2	3.0

Suitable for: tissue culture, vegetative and strong generative growth.

G2

UV	B	G	R	FR	PAR	CCT	CRI	B:G	R:FR
0%	7%	2%	70%	21%	80%	NA	NA	26.0	3.0

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 the tissue culture. Whether plantlets originate from callus or microspores, the process can be accelerated and improved with the correct spectrum. Uniform light distribution creates 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, reducing the time required for flowering induction. Faster flowering induction, better survival and less cooling thanks to the spectrum and advanced LED technology results in energy and cost savings.



Flowers and Seeds

Shorter SSD (Seed-to-Seed) Time. Complete Control Over the Plant 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.

Light for Speed Breeding

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 could effectively shorten the time of plant breeding, leading to more generations of crop during a year.

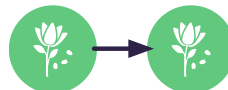
In 2014, the solutions have been successfully implemented in commercial productions for winter field crops resulting in up to 3 generations per year in greenhouses or controlled environments, compared to previously 1 generation per year in field conditions and 2 generations per year in greenhouse conditions.

The chart below shows an example of Croser et al. (2014)'s accelerated Single Seed Decent (aSSD) method using Valoya AP67.

12 months



Field conditions



Field conditions using contra-season



Greenhouse un-optimized conditions



aSSD methods applied on spring field crops

Picture:
Saatzucht Bauer
cereal breeding
site in Germany.

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@valoya.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.



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