



**PHILIPS**

Horticulture  
LED solutions



Light recipes for horticulture

There's  
more  
to light

Solid-state LED lighting offers a number of benefits to the horticulture industry, including increased yields, earlier flowering, faster root growth/germination, better control of plant growth, and more economical use of space. LED lighting is also highly energy-efficient, helping horticultural producers to lower electricity consumption, especially during the high consumption periods of autumn and winter.



# Philips Horticulture **LED Solutions**

Having completed hundreds of projects, Philips Lighting has many years of experience investigating the effects of LEDs (light-emitting diodes) on a range of crops. In every project we are on the lookout for the optimum light recipe. A Philips light recipe is an instruction based on knowledge of how to use light to grow a certain crop under certain conditions. A light recipe indicates:

- Lighting aspects: light level, spectrum, required uniformity, position and time
- Parameters for which the recipe is valid, e.g. climate conditions
- Expected results besides energy saving

Our light recipes are suitable for different segments within horticulture, e.g. vegetable production, tissue culture and young plant production, cut flowers, seedlings and nurseries. Philips Lighting is offering knowledge of horticultural LED lighting around the world to you.

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# Royal Philips

innovation ✨ you



Royal Philips of the Netherlands is a diversified health and well-being company, focused on improving people's lives through meaningful innovation. As a world leader in healthcare, lifestyle and lighting, Philips integrates technologies and design into people-centric solutions, based on fundamental customer insights and the brand promise of 'innovation and you'.

Our Lighting sector is dedicated to introducing innovative end-user-driven and energy-efficient solutions and applications for lighting, based on a thorough understanding of customer needs in both professional and consumer markets. We address lighting needs in a full range of environments – indoors (homes, shops, offices, schools, hotels, factories, and hospitals) as well as outdoors (public places, residential areas and sports arenas). We also meet people's needs on the road, by providing safe lighting in traffic (car lighting and street lighting).

In addition, we deliver light-inspired experiences through architectural and city beautification projects. Our lighting is also used for specific applications, including horticulture, refrigeration lighting and signage, as well as heating, air and water purification, and healthcare.

With the rise of new lighting technologies, such as LED, and the increasing demand for energy-efficient solutions, Philips will continue to shape the future with ground-breaking new lighting applications.

## Philips is a global leader across its healthcare, lighting and lifestyle portfolio:

- We are number one in lamps in Europe, Latin America and Asia Pacific, and number two in North America. In Automotive lighting, we are leading in Europe, Latin America, Japan and Asia Pacific.
- Philips was ranked by Interbrand as the 40<sup>th</sup> most valuable brand in the world.
- We came 7<sup>th</sup> in the Forbes global Top 100 of most sustainable companies in the world, particularly by increasing the energy efficiency of our products.

**For more information, visit: [www.philips.com](http://www.philips.com)**

# Philips Light recipes in horticulture

**Philips has been developing light sources for horticulture for many years and continues to invest heavily in horticultural lighting.** In R&D for Lamps, Lighting Electronics and LED, a team of engineers works full-time to improve existing lamp and gear concepts and to develop new lighting systems for horticultural lighting. Specialists such as plant physiologists and technical engineers have been trained in the key horticultural countries to provide full support to growers and breeders.

In order to gain a deeper understanding of what is required in greenhouses, Philips maintains close contact with commercial growers, breeders, universities and research institutes. In order to meet the specific requirements for horticulture, we have our own laboratories and test stations. And, to further advance our overall knowledge, we contribute to independent research and field testing. We have established **close partnerships** with globally recognized agricultural research institutes and universities such as Wageningen University, Purdue University, and University of New Hampshire. We also work closely with a number of internationally acclaimed horticulture companies to

provide complete solutions. We have a network of certified Philips LED Horti Partners to collaborate with us during the development of light recipes. Our certified complementary partners that collaborate with us during the testing and implementing phase include BVB Substrates, Duchefa, and GreenQ/Improvement Center. This approach has led to the development of highly efficient lighting solutions that are **tailor-made for growers**.

We brought our first specific horticultural light solution to the market in 1995 after an intensive period of research. This was a High Pressure Sodium lamp

specially designed for greenhouses. In the following years we expanded the Philips GreenVision/ GreenPower range. In **2008** we introduced our first horticulture GreenPower LED solution to the market. Today, our LED range has been extended to a complete family comprising multiple solutions. Philips GreenPower products are designed specifically for applications in horticulture. Besides stable and reliable quality, they display characteristics including long life, low light fading, high waterproof and dustproof factors. Philips is supplying both HID as well as LED technology, including drivers. This allows us to develop the most suitable and sustainable lighting solution, sometimes combining different lighting technologies, for each application.

Anyone who goes into partnership with Philips gets much more than just a product. Thanks to the studies we have conducted into light and plants we now have an improved light recipe database, based on years of practical experience and close cooperation with the horticulture industry. Our **plant physiologists** – we have five based in different locations throughout the world – play a major role in this. They listen to the needs of horticultural users, participate in the development of lighting solutions, follow up on the progress of projects,

A Philips light recipe is an instruction based on knowledge of how to use light to grow a certain crop under certain conditions.


## A light recipe indicates:

- Lighting aspects: light level, spectrum, required uniformity, position and time
- Parameters for which the recipe is valid, e.g. climate conditions
- Expected results besides energy saving

and offer timely advice. Ultimately, together with clients they pinpoint the ideal **'light recipes'** for plant production. Our application engineers are responsible for the design of lighting solutions, the installation and implementation of products, and technical support and consultancy during the application process. Moreover, they cooperate with our plant specialists to ensure the best feasible and optimal of lighting solutions.


Through **field tests with growers** we have gained a deep understanding of the light required by various plants at different growth phases. But also a great understanding of the grower's business which differs between countries, crops and people. This enables us to offer each grower a customized lighting solution, with precisely the composition of light that their plants make best use of. And not only that: Philips takes work off your hands by providing support during the subsidy application process, and after-care in the form of answers to technical and botanical questions. The result? Greater control over growing conditions and the growth process, better results, and **higher yield**. The effort put in by Philips means one worry less for you and the certainty of a balanced and customized approach to your company and your plants.

# “Our approach. Step by step to your solution”


 Step 1 → What is your need?

 Step 2 → Light recipe

 Step 3 → Product, installation and application

 Step 4 → Business case and Financing

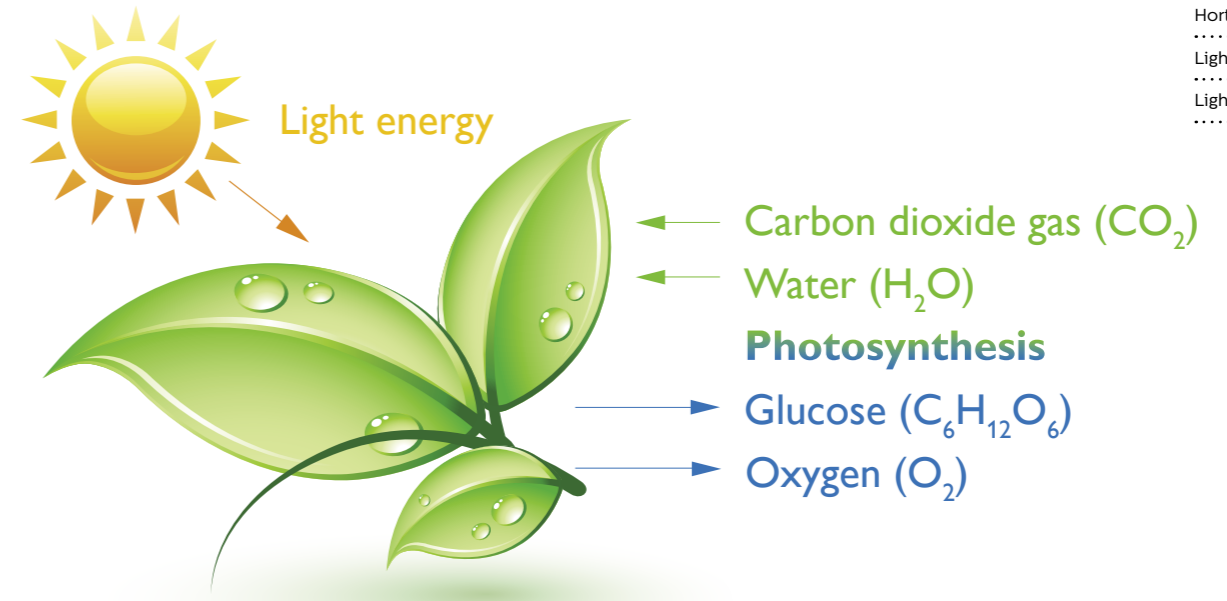
 Step 5 → Agreement, delivery and installation

 Step 6 → Implementation check

 Step 7 → Follow up

## Our know-how and network for your solution

The Philips horticulture Lighting Team originated in Eindhoven, the Netherlands, and has since expanded worldwide.



## Light is essential for plant growth

Natural sunlight is the cheapest source available, but for horticulture it is not always attainable in sufficient quantities. Therefore, the use of artificial light has become very common in order to increase production and quality.

Plants have a completely different sensitivity to light colors than humans. With regard to plant growth, light is defined in terms of small particles, also called photons or quantum. The energy content of photons varies, depending on wavelength (light color spectrum). For one optical energy, almost one and a half as many red photons can be produced compared with blue. This means that often red light sources produce more efficient light photons than blue light sources. However the plant has also various sensitivity for various colors of light, and that influences different light-sensitive activities as well. Using the efficient light sources for plants, effective light recipes are important to obtain the optimal results in plant production.

**Plant sensitivity curve for growth light:** The only part of the global radiation spectrum which can be used by a plant for its photosynthesis is between 400-700 nm, this is called the PAR-light (Photosynthetically Active Radiation). The amount of photons in the PAR region are called growth light (indicated in micromol ( $\mu\text{mol}$ )).

So, around 45% of global radiation is PAR light. Photosynthesis is the basic process that leads to growth of a plant and light is an essential part of this. This energy is used to form glucose from carbon dioxide gas ( $\text{CO}_2$ ) and water, which are taken up by leaves and roots. This process can be represented as shown above.



### Example calculation

DLI = Daily light integral  
(in mol/m<sup>2</sup>)

DLI = Average light intensity  
(μmol/m<sup>2</sup>/s) \* time (s) /  
1,000,000 = mol/m<sup>2</sup> (/day)

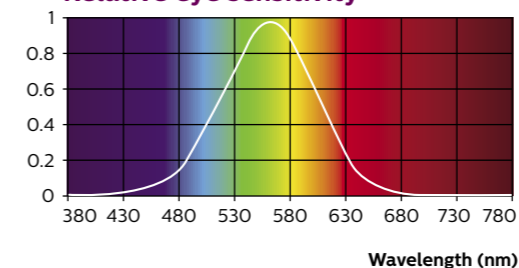
Time in seconds = hours \* 3600

200 \* 14 \* 3600 / 1,000,000 =  
10 mol/m<sup>2</sup>/day

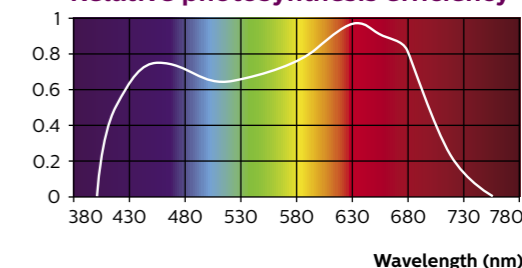
“

Constant quality of artificial lighting is very important to increase the quality of crop production”

Relative eye sensitivity



Relative photosynthesis efficiency



An efficient lamp for plant growth must convert as much electrical energy as possible into PAR energy. The term 'daily light integral' (DLI) refers to the number of light particles, or photons, received during one day in the PAR region (400-700 nm). The DLI specifically refers to the amount of photosynthetic light received in an area of 1 square meter (10.8 square feet) each day. The DLI can have a profound effect on root and shoot growth of seedling plugs, root development of cuttings, and finish plant quality attributes such as stem thickness, plant branching and flower number. The average DLI received outdoors ranges roughly from 5 to 60 mol/m<sup>2</sup>/day and depends on location and time of year. Inside a greenhouse, light transmission is usually reduced by 35-50%, so it is not uncommon to have an average DLI inside a greenhouse of less than 3 mol/m<sup>2</sup>/day during the darkest periods of the year. In general, 4-6 mol/m<sup>2</sup>/day is recommended for propagation of cuttings, and at least 10-12 mol/m<sup>2</sup>/day is recommended for most bedding plants, perennials and potted crops.

DLI is measured in mol/m<sup>2</sup>/day, which means the number of moles of light (mol) per square meter (m<sup>2</sup>) per day. What is a mole of light? A mole is a very large constant number (6022 x 10<sup>23</sup>, which equals 602,200,000,000,000,000,000,000).

What DLI is needed to grow high-quality transplants and finish plants? The answer depends on the crop, but a common target minimum DLI inside a greenhouse is 10-12 mol/m<sup>2</sup>/day. Plant quality generally increases as the average DLI increases. In particular, as the DLI increases, branching, rooting, stem thickness and flower number increase, and sometimes plant height decreases. There are some exceptions: shade crops such as African violets and Phalaenopsis orchids grow well under an average DLI of 4-6 mol/m<sup>2</sup>/day. In addition, some crops flower earlier when grown under a high DLI compared to a low DLI.



The main properties of light that make the plant grow well/flower:

#### Light quantity / intensity

The growth of a plant is strongly determined by the total number of photons that it absorbs in the PAR region. In winter there is often too little natural light for plants to grow and continue to produce good flowers and fruits.

#### Day length

With many plants, the time of flowering is influenced by the photoperiod. For example, a chrysanthemum plant will only bloom when the night is long. We call them 'short day plants'. However when you apply long day light to them, the flowering will be suppressed.

#### Spectrum

The mix of colors in the light (spectrum) also strongly influences the development of a plant.

#### Light uniformity

When using artificial lighting, uniformity and constant quality of the light spectrum is very important for a constant quality of crop production.

# We are experienced in your segment. Find out below what LED light can do for you!



## Floriculture (Cut flowers, potted plants, bedding plants & perennials)

- Provides a safe and reliable supplement or replacement to natural light
- Improves the plant quality and uniformity
- Adjustable and controllable photoperiod to control the vegetative and reproductive growth of plants
- Fully utilizes greenhouse space and the production transportation line
- Effective heat management



## Propagation (Tissue culture and seedlings, cuttings & young plants)

- Due to high luminous efficiency, high-power fluorescent lamps can be replaced
- Maintains uniformity of illumination and reduces distance between layers
- Light recipe achieves higher quality to fulfill plant growth needs
- Improves high-quality seeding rate and shortens the production cycle
- Effective heat management, saves on air conditioning costs and extends the service life of the electrical system



## City Farming (Leafy vegetables & soft fruits)

- With high and stable yields, reduces production costs and continuously stabilizes supply
- Improves quality, nutrient content and flavor
- Shortens delivery time and provides fresh vegetables from a local supply
- Improves land use rate and increases the yield per unit area by multilayer cultivation
- Energy savings



## Vegetables & Fruit (high wire vegetables, leafy vegetables, herbs & soft fruits)

- High wire vegetable production (cucumber and tomato) with interlighting
- Effectively complements natural light with a spectrum and light intensity combination designed to promote plant growth
- Stabilizes and improves plant quality and yield, enabling growers to increase their profits
- The scientifically designed illumination angle and light position allow plants to make maximum use of the light
- Interlighting among vegetables and flowers, by utilizing the low-heat characteristic of LED, to increase production
- Efficient use of energy can effectively reduce the electrical system load and energy costs and many more applications. Every day we are getting new experiences. If your application is not in the list, don't hesitate to contact us or our partner and hear what we can do for you.

## Benefits of LEDs

Light is an important horticultural production tool and a key factor in plant research. LEDs (light-emitting diodes) are set to play a major role in horticultural lighting. With LED lighting, the growth light – spectral output – can be tuned, which makes it possible to apply the optimum ‘light recipe’ at every stage of a crop’s growth. This capability, together with effective heat management, long lifetime, high luminous efficiency and energy efficiency, opens up tremendous opportunities for growers and breeders. For the commercial horticulture market this means increased yield, early flowering, faster (root) growth, and more economical use of space.

Philips can design a tailored LED growth light which is the most suitable for the growth of a particular plant. In addition, while producing light, LEDs generate less heat, making temperature control in the plant space easier and more economical. At the same time, LEDs can be installed near plants, to increase planting area in limited spaces.

### LED lighting - bringing new opportunities to horticulture

#### Light spectrum

Provides the best ‘light recipe’ at each growth phase

#### Long lifetime

Reduces the need to replace lamps

#### Light intensity

Provides the illumination intensity that crops need

#### Energy efficiency

Lowers energy costs and helps protect the environment

#### Effective heat management

Enables greater control over the climate in the greenhouse or climate chamber and reduces the need for cooling

#### Robust

Dustproof and moisture-proof, and no risk of glass in your crops

#### High luminous efficiency

As LEDs produce only a little radiant heat, it is possible to position the light source close to the crop without burning the leaves

#### Optical design freedom

Since a LED is only a micro-chip, it fits easily into any application and can increase uniformity

# Our products

## Philips GreenPower LED production



Philips GreenPower LED production module is specifically designed for multilayer cultivation in conditioned environments with little or no daylight. The module (50–250  $\mu\text{mol}/\text{m}^2/\text{s}$ ) can replace conventional fluorescent lighting, reducing energy consumption by up to 60%. Low radiative heat emission also allows the light source to be installed closer to the plants, thus improving space utilization. Several spectrum versions are available, so the light intensity and color ratio can be selected and reproduced.

## Philips GreenPower LED string



Philips GreenPower LED string is used in tissue culture of Low light intensity (5–30  $\mu\text{mol}/\text{m}^2/\text{s}$ ) and in seedling storage. The flexible 20 m light belt can be arranged for long tissue-culture shelves. Red, blue, far-red, and white strings are available. Small lamps are connected by a flat-band cable. Even with shelf heights of up to 25 cm, the light distribution on the optical surface is guaranteed to be even. Thanks to LEDs characteristics of low power consumption and low heat, the GreenPower LED string offers significant energy savings.

## Philips GreenPower TLED



Philips GreenPower TLED (25–100  $\mu\text{mol}/\text{m}^2/\text{s}$ ) offers an extremely effective and efficient alternative in tissue culture to traditional fluorescent lamps, delivering energy savings up to 70% compared to fluorescent lighting. GreenPower TLED also improves tissue culture growth parameters, resulting in a higher multiplication factor, better rooting quality and a shortening of the total growth cycle. On top of energy savings these parameters brings more profit! To improve growth performance dedicated recipes are needed. GreenPower TLED is available in six different versions.

## Philips GreenPower LED research module



Philips GreenPower LED research module is specially designed for doing research with light. It allows the use of light as a tool to control plant growth and development. The module's dimming capability allows you to set exactly the level of light you require. It is available in white, red, blue and far-red versions. Red and blue are the most important colors for crop growth, while far-red (barely visible to the human eye) influences the development of specific plant characteristics. With modules in these four colors, it is now possible to apply the optimum light recipe at every stage of a crop's growth.

## Philips GreenPower LED flowering lamp



Philips GreenPower LED flowering lamp is the energy saving alternative for extending day length when cultivating, e.g. bedding plants, producing cuttings from chrysanthemums, kalanchoes and other plants sensitive to the photoperiod. It is also used to break the dormancy state of plants. Compared to traditional incandescent lamps, this flowering lamp saves up to 80% on energy costs. Based on successful field tests, Philips has developed three different lamps with specific light recipes for different plants.

## Philips GreenPower LED interlighting



Philips GreenPower LED interlighting is an unique bi-directional lighting solution. It can be applied as an interlight supplement for tall plants (such as tomatoes, peppers, cucumbers and roses) in a greenhouse, encouraging previously shaded leaves to photosynthesize and stimulating the plant's growth potential and efficiency. The interlighting module has a specially designed aluminum shell with a length of 2.5 m. The combination of LED interlighting and HID creates a flexible lighting system. This results in more efficient plant production and considerable energy savings.

## Philips GreenPower LED toplighting



The Philips GreenPower LED toplighting solution is a new step in realizing light recipes for crop growth in the greenhouse. The modules offer a wide variety of opportunities to increase your production and improve crop quality during the year. LED toplighting can offer typical light levels ranging from typically 40–300  $\mu\text{mol}/\text{m}^2/\text{s}$  in a highly efficient way. Finding your X-factors in crop growth and improving your business lead to more earnings than the energy savings only.



# Case Studies

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## Marjoland Floriculture



**Project**  
Marjoland

**Sector**  
Ornamental plant cultivation

**Crop**  
Roses (Passion)

**Location**  
Waddinxveen,  
the Netherlands

**Solution**  
Philips GreenPower LED  
interlighting

**Results**  
Increased development and  
more efficient production

Marjoland is one of the most progressive nurseries in the rose world. Marjoland has been conducting tests with Philips for several years and has achieved good results with the interlighting of Passion roses with GreenPower LED modules. Several lighting variants were installed at Marjoland rose nursery in Waddinxveen. During the tests the LED modules were combined with HID lamps. The modules were positioned in the crop so as to also light the plant base, where the development of new shoots is

stimulated, and where the leaves that normally receive little light can now also actively take part in photosynthesis. One of the most important advantages of LED interlighting for roses is that faster shoot development can be achieved by using the spectrum and positioning intelligently. What was also found is that not only was more light introduced, but the plants handled the light, more efficiently. In this way the tests showed that the LEDs contribute to greener and more economical production.

“Interlighting is good for the development of rose shoots.”



## Valley View Floriculture



**Project**  
Valley View

**Sector**  
Perennials, potted and  
bedding plants

**Crop**  
Tuberous Begonia,  
Dragon Wing Begonia,  
New Guinea Impatiens

**Location**  
South Salem,  
NY, USA

**Solution**  
Philips GreenPower LED  
flowering lamp

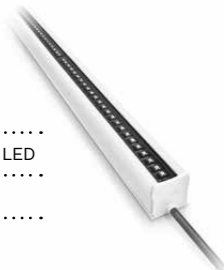
**Philips LED Horti Partner**  
Fred C. Gloeckner & Company  
Inc.

**Results**  
Uniformity, consistency, and  
early bloom time on all crops

Valley View sells high quality finished products to local retailers and landscapers. Beginning in early spring with crops like Hydrangea, moving into mid-season with annuals, perennials and nursery stock, then on to the fall production of Chrysanthemums and other late season crops, and finishing up with Poinsettias, Valley View runs a year-round operation. Additionally, Valley View is a rooting station supplying the Northeast region with rooted cuttings for the Winter months. Valley View installed Philips LED flowering lamps in certain areas of the greenhouses. Portions of the crops of non-stop Begonias (95%), Dragon Wing Begonias (25%) and New-Guinea Impatiens (20%) were placed under the

new lights to run a comparison of growth against the same types of plants not placed under the flowering lamps. The lights were a combination of Deep Red and White which were chosen specifically for the crops being grown. The lights were turned on automatically at 7 PM and shut off automatically at midnight during the growing phase of the crops. There were no other changes made in terms of substrate, fertilization, or irrigation during this trial. The begonia baskets and larger pots were lit until March 18th, the 4.5” pots were lit until March 25th. Frank planned the lighting schedule around their ‘market ready’ date, which for Valley View is early/mid May.

“Philips LED lights managed to save us time and money while improving our plant quality.”



## Maatschap Kreuk Floriculture



**Project**  
 Maatschap Kreuk

**Sector**  
 Flower bulbs

**Crop**  
 Tulips

**Location**  
 Andijk,  
 the Netherlands

**Solution**  
 Philips GreenPower LED  
 production module

**Philips LED Horti Partner**  
 Van der Laan

**Results**  
 Efficient use of space through  
 multilayer system. Improved  
 plant quality and energy  
 savings

Maatschap Kreuk has a cultivated area of 3400 m<sup>2</sup> in a greenhouse covering 1500 m<sup>2</sup> due to their multilayer set up. About 9 million stems of cut flower tulips are produced. Kreuk's greenhouse now has three layers, the lowest one fitted with Philips GreenPower LED production modules, the deep red/white type. 'This light combination was selected because the red light provides excellent growth for the tulips while the white light increases visibility of the

crops for the employees. It has a clearly positive effect on the crop, the tulips have a deeper color green and greater elongation.' explains Kreuk. 'The operating costs per square meter are lower because LEDs have a much longer lifespan than a fluorescent solution. It also provides a tremendous difference in energy costs. One 35 W LED module replaces the normal situation with two fluorescent tubes of 58 W each. This represents electricity saving of 65%.'

“Efficient use of space through multilayer system, improved plant quality and energy savings.”



## Ter Laak Floriculture



**Project**  
 Ter Laak Orchids

**Sector**  
 Orchids, potted plants

**Crop**  
 Phalaenopsis

**Location**  
 Wateringen,  
 the Netherlands

**Solution**  
 Philips GreenPower LED  
 toplighting

**Philips LED Horti Partner**  
 Arend Sosef

**Results**  
 Keeping the number and  
 quality of the branches and the  
 growing period under LEDs at  
 least the same as under HPS  
 lighting. Both with a lighting  
 level of 250 μmol/s/m<sup>2</sup>

Ter Laak Orchids – owned by brothers Eduard and Richard ter Laak – have been working with orchids since 1980. Their modern pot-plant nursery in Wateringen covers an area of 78,500 m<sup>2</sup>, with an extra 16,500 m<sup>2</sup> tier of cultivation above the processing area, and produces 4 million Phalaenopsis plants of pot size 12 cm every year. The use of LED toplighting was prompted by the increased need, at the dark time of year, for more efficient light to ensure healthy and constant plant growth. Thanks to their lower heat emission and the options they offer in terms of light spectrum, LEDs can make a significant contribution to this goal. Philips GreenPower LED toplighting is the next step in the development and application of light recipes for crop growth in the greenhouse. They offer considerable opportunities to increase

production and improve crop quality during the year. LED toplighting can offer light levels typically ranging from 40–300 μmol/m<sup>2</sup>/s in a highly efficient way. The plants in this project were grown in the greenhouse under HPS lighting and are being cooled in the trial greenhouses. On 5 November 2013 the plants were placed in the two separate compartments; the first day was also the first cooling day (necessary for branch induction). It is assumed that if the plants grow well in the LED-only compartment, there is not likely to be a problem in combination with HPS (hybrid) lighting. If this is the case, it will be possible to install efficient grow light in the form of LEDs in an existing situation. According to Ter Laak Orchids, the project will have been a success if the company can produce the same quality of plants using this configuration.

“Philips’ statement about providing only the light that a plant needs – the light recipe – really appealed to us.”

## Leo van der Harg BV Floriculture



**Project**  
 Leo van der Harg BV

**Sector**  
 Ornamental plant cultivation

**Crop**  
 Kordana pot roses

**Location**  
 Vierpolders,  
 the Netherlands

**Philips LED Horti Partner**  
 Light Interaction Agro BV

**Solution**  
 Philips GreenPower LED  
 toplighting and  
 Philips GreenPower  
 GreenVision 1000 W (HPS)

Leo van der Harg BV produces 5 million pot roses every year, which translates into a market share of approximately 10% of the European market. In 2013 van der Harg started using a new 7000 m<sup>2</sup> greenhouse for blooming. Van der Harg wants to be recognized for the superior and consistent quality of its plants. In order to realize this ambition, the new greenhouse is illuminated using a hybrid lighting system based on a combination of 1000 W HPS and LED toplighting. 'Other projects have already proved that the installation of LED solutions facilitates management,' explains Leo van der Harg. 'This combination makes it easier to control the growing Conditions.' A plant specialist from Philips was closely involved in the realization of the project in order to ensure the best

possible lighting design. The energy savings achieved by using a combination of LED and HPS amounts to more than 10% compared with illumination based solely on HPS. It is precisely because the plants are illuminated for so long that the pay-back time for the investment made by Van der Harg is relatively short and the savings on production costs are substantial. Another advantage is that, because LEDs are being used, the existing electricity connection is perfectly adequate and there is therefore no need for additional investment in the CHP system. 'The investment will pay for itself straight away, not just because of the energy savings but also because of the improvement in plant quality,' van der Harg says.

“The investment will pay for itself straight away, not just because of the energy savings but also because of the improvement in plant quality”



## Florensis Floriculture



**Project**  
 Florensis Kenya Ltd

**Sector**  
 Rooted and unrooted cuttings of bedding plants and Pelargoniums

**Crop**  
 Bedding plants, Pelargonium and Poinsettia

**Location**  
 Naivasha,  
 Kenya

**Solution**  
 Philips GreenPower LED  
 flowering lamp

**Philips LED Horti Partner**  
 UFO Supplies BV

**Results**  
 Better plant quality and  
 substantial energy savings

Florensis supplies professional growers with young plants propagated from both seed and cuttings. The company's head office and primary production site are located in the Netherlands. Its three sites outside the Netherlands – in Kenya, Ethiopia and Portugal – play a major role in the production of unrooted cuttings. The farm in Kenya has developed rapidly in recent years and currently covers 14 ha. The modern production facilities here are used to produce cuttings for the farm's range of bedding plants, including Pelargonium, Impatiens, Phlox, and Poinsettia. Florensis Kenya is located on the equator, where the natural conditions are daylight-neutral. Florensis Kenya wanted to improve the internal quality of its cuttings whilst at the same time reducing its carbon footprint. They trialed Philips GreenPower LED lights for various crops and varieties on

a semi-commercial scale. After only one season optimum results had been achieved and the decision was made to invest in Philips GreenPower LED lighting for the entire Poinsettia production. The existing 150 watt bulbs were replaced with 17 watt Philips GreenPower LED bulbs. The energy saving was significant. 'We are now consistently producing more uniform and stronger plants,' says Eddy Verbeek, General Manager of Florensis. 'Our cuttings are better and, thanks to the improved internal quality, we are enjoying higher success rates in rooting. At the same time, we have reduced our impact on the environment. In short, this is a win-win situation. Following our first successful full production season of Poinsettia at the Kenyan site, we are now investigating the possibility of using LED lighting for other crops and converting to production under Philips GreenPower LEDs.'

“We are now consistently producing more uniform and stronger plants.”



## Vitro Plus Propagation



**Project**  
 Vitro Plus

**Sector**  
 Tissue culture

**Crop**  
 Ferns

**Location**  
 Burgh-Haamstede,  
 the Netherlands

**Solution**  
 Philips GreenPower LED  
 production module

**Results**  
 Increased production by 33%,  
 better plant quality and  
 substantial savings on energy

Vitro Plus is a fern propagation company, which is responsible for 70% of all ferns that are supplied to stores throughout the world. Using LEDs brings the distance between each shelf closer, and has enabled Vitro Plus to increase production by 33%. In addition to this, the company is making substantial savings on energy. This is partly because the LEDs consume significantly less energy than the fluorescent lighting previously used, but also because the substantially lower amount of heat

generated by the LEDs means less cooling is required. The quality of the tissue culture has improved as well. ‘We harden off 20,000 plants each week. The quality of the plant growth is constant. We are achieving much better results now than we did with conventional fluorescent lighting,’ said Ard. ‘The plants grow much faster and the growth is much bushier. The measurable results have convinced me that LED lighting is the future.’

“Fern propagator Vitro Plus convinced by added value of production-line LEDs.”



## Sierra Gold Nurseries Propagation



**Project**  
 Sierra Gold Nurseries

**Sector**  
 Trees

**Crop**  
 Propagation of fruit and nut  
 trees, including almonds,  
 pistachios, walnuts, apples,  
 cherries, pears, peaches and  
 prunes

**Location**  
 Yuba City,  
 California, USA

**Solution**  
 Philips GreenPower LED  
 production module  
 Deep Red/Blue

**Philips LED Horti Partner**  
 Hort Americas, LLC

**Results**  
 More efficient tree propagation

Sierra Gold Nurseries was founded as a bare-root fruit and nut tree propagator in 1951 in Yuba City, California. The company now produces both bare-root and containerized trees on about 200 acres. Most of the millions of trees produced annually are shipped to nut and fruit growers in California, Washington and Oregon. Some are sold to growers in the Mountain States and along the East Coast. Most of the trees are produced as 1-year-old trees. To meet the increasing demand for its trees, Sierra Gold opened a 10,000-square-foot tissue culture lab. Before the decision was made as to the type of lights that were going to be installed in the tissue culture lab, a lot of information was collected from other labs, researchers and consultants from around the world. After determining the options available and conducting a cost

analysis of LEDs vs. fluorescent lights, company officials were so confident in choosing LEDs that no trials were conducted between LEDs and fluorescent lights. The company did do some trials with different LED lights. Working with Hort Americas, Sierra Gold Nurseries installed Philips GreenPower LED production modules Deep Red/Blue in its lab. According to Cliff Beumel, Vice President of Sierra Gold Nurseries, even if LEDs only operated equally to fluorescent lights in terms of plant growth, the energy savings alone provided by the LEDs convinced him they were the right choice for the lab. The fact that the payback was only a few years made the decision that much easier. Another energy-related factor that influenced Beumel’s decision to install LEDs is the amount of heat given off by the lights.

“The payback in only a few years made the decision much easier.”



## Shanghai Xinghui Vegetable Group Propagation



**Project**  
 Shanghai Xinghui Vegetable Group

**Sector**  
 Tissue Culture

**Crop**  
 Gerbera

**Location**  
 Shanghai, China

**Solution**  
 Philips GreenPower TLED

**Result**  
 Energy saving of more than 50%, and better control of environmental temperature

Shanghai Xinghui Vegetable Group is located in Fengxian District, Shanghai, adjacent to Hangzhou Bay. Xinghui is one of the four organic vegetable farms recognized by the city of Shanghai. The Group was named a Leading Organization in Adopting International Standard in Shanghai and a National Model Enterprise for Horticultural Product Exports. Xinghui has also obtained the ISO9001 and HACCP accreditation. The Group continues to innovatively improve horticulture technology, based on a development strategy centering on expansion in both domestic and foreign markets. The Group's Bio-Technology Center provides important technical support for the Group's progress, focusing on tissue cultures for flowers and nursery plants. The Center produces as many as 10 million

plants per year with its 10,000 m<sup>2</sup> tissue culture building and 10,000 m<sup>2</sup> greenhouse. Currently, the Center is focusing on Gerbera cultures. After initial meetings with Philips, Shanghai Xinghui Group's Bio-Technology Center expressed intense interest in Philips GreenPower TLED. The Group wanted to record and analyze a test of this technology for a given period, and evaluate the potential of adopting of this technology in all of the Center's tissue culture rooms. Gerbera is the primary product of Xinghui Group's Bio-Technology Center, so the Center performed the test in the Gerbera culture room. At the beginning of this year, Philips horticulture specialists assisted in installing and testing a considerable quantity of GreenPower TLEDs.

“The energy savings are incredible. We will continue testing in order to learn even more about the positive effects of LED on the plants.”



## Bailey Nurseries Inc. Propagation



**Project**  
 Bailey Nurseries Inc.

**Sector**  
 Young plants and cuttings

**Crop**  
 Multiple crops

**Location**  
 St. Paul, Minnesota, USA

**Solution**  
 Philips GreenPower LED production module

**Philips LED Horti partner**  
 Hort Americas, LLC

**Results**  
 Faster propagation, better plant quality, a higher success rate, and energy savings

With the shift from greenhouse to controlled environment increasing the scope for fall and winter production, the energy-saving potential of the GreenPower LED production modules is a significant asset. For most crops, the GreenPower LED production modules in the controlled environment of a growth room allowed better control of the plant growth cycle, compared with the greenhouse, resulting in higher rooting percentages. Quality improved drastically over the previous growing conditions, with more uniform and consistent growth, better roots and stronger plants. Lilacs in particular showed a much higher percentage of successfully rooted plants. Faster growth, shaving a week off the rooting schedule, was attributable to the combined effect of the LED lighting plus the climate and root zone management

strategies. The LED fixtures' lower level of heat generation also eliminated the need to apply additional water. In the winter time the LED lighting clearly freed up the grower: in the greenhouse these crops required hourly maintenance, whereas in the growth chamber the grower only needs to look at the crop once or twice a day. Jean Marc Versolato, from Bailey's Plant Health Department, enthused: 'I tested the GreenPower LED production modules this year. They do work! As an example, tissue culture lilacs rooted quickly and with minimum care under these lights. The result of this trial, amongst others, indicates to me that we will improve plant stand, reduce crop time, increase overall plant health, and also conserve energy during the winter months – a win-win for the nursery and our customers.'

“A win-win for the nursery and our customers.”

## Shanghai Dadi Propagation



**Project**  
Shanghai Mother Earth (Dadi)  
Gardening Seedling Co., Ltd.

**Sector**  
Multilayer tissue culture  
production

**Crop**  
Gerbera, Limonium Sinuatum,  
Hosta

**Location**  
Shanghai,  
China

**Solution**  
Philips GreenPower LED  
production module

**Results**  
Stronger seedlings, higher  
rooting rate, and shorter  
rooting time

After several rounds of experiments, plants grown under the Philips GreenPower LED production modules were more compact and had greener leaves than those grown under normal fluorescent lights, indicating that the plants cultivated with Philips GreenPower LED were stronger. For some plant varieties, the rooting rate, when cultivated under fluorescent lights, was not satisfactory, but increased dramatically when cultivated with Philips GreenPower LED lighting. Plant rooting times were reduced by 15%

compared with those under normal fluorescent lights, resulting in a shorter production period and increased production efficiency. Shanghai Dadi was very satisfied with these results, specifically the LED lighting's promotion of plant growth and the cooperation with the Philips horticultural LED lighting team. Cooperation between the two companies will continue in the hope of discovering more plant tissue culture applications that can be used in the large-scale industrial production of plant tissue cultures.

“The plants cultivated with Philips GreenPower LED were stronger. Beside energy saving and low heat radiation, the unique light recipes for tissue culture from Philips really help the plants to have better and uniformed quality.”

## Deliscious City Farming



**Project**  
Deliscious

**Sector**  
Leafy vegetables/young plant  
production

**Crop**  
Lettuce with root clump

**Location**  
Venlo,  
the Netherlands

**Solution**  
Philips GreenPower LED  
production module

**Philips LED Horti Partner**  
Certhon  
Lights Interaction Agro bv

**Results**  
Efficient use of space due to  
multilayer cultivation, less  
water usage, increased and  
consistent plant quality

Deliscious, a modern lettuce production greenhouse founded by the two brothers Roy and Mark Delissen, wants to find a solution to have a more flexible production in the winter. The lettuce plants are now produced - in seven layers, one on top of the other - from lettuce seed to living lettuce in a special climate-controlled room 20 m wide, 4 m long and 8 m high. The Philips GreenPower production modules with the right light recipe, were

installed inside to ensure uniform growth. By using this new lighting formula Deliscious is able to control the entire production process, from lettuce seed to fully-grown lettuce, and to minimize any adverse external effects on quality and origin. This makes it possible to produce more efficiently and enables the company to deliver lettuce of a consistent quality all year round in a reliable way.

“We produce more efficiently, and we can guarantee a consistent crop quality all year round.”

Case Studies  
 Philips GreenPower LED  
 production and research  
 module



## LED4CROPS at STC City Farming



**Project**  
 LED4CROPS at Stockbridge  
 Technology Centre (STC)

**Sector**  
 Research institute

**Crop**  
 Multiple crops

**Location**  
 Yorkshire,  
 UK

**Solution**  
 Philips GreenPower LED  
 production module and  
 Philips GreenPower LED  
 research module

**Philips LED Horti partner**  
 CambridgeHOK

**Results**  
 To deliver applied research and  
 technology transfer to growers

A number of factors are driving significant change in the world of food production. The idea of 'sustainable intensification' is a relatively simple concept aimed at maximizing production efficiency in terms of external resource input on the smallest necessary land area. LED technology can make a decisive contribution toward this goal. The STC board has invested in the development of an applied R&D facility, LED4CROPS, in partnership with Philips Lighting and Cambridge-HOK. The new LED4CROPS facility is housed within a 200 m<sup>2</sup> building and has over 40 benches with LED lights in a multitier array. This all to enable light spectrum adjustment and flexibility, for growing a

range of low level crops such as herbs, leafy salads, flowers, strawberries and plants in propagation. STC science director Dr Martin McPherson is enthusiastic: 'LED technology opens the door to the concept of urban farming. You can grow crops in multi-storey warehouses, close to point of consumption'. LEDs will offer growers great flexibility, he adds. 'You can schedule the crops. If you want to bring them on, you can do so. If you want to slow them down, you can reduce power.' According to his colleague, STC CEO Graham Ward, the prospects for growers are bright: 'A normal lettuce grower can produce five crops a year. With this system, we can grow fifteen.'

“LED technology opens the door to the concept of urban farming.”

Case Studies  
 Philips GreenPower LED  
 production module



## GreenSenseFarms City Farming



**Project**  
 Green Sense Farms

**Sector**  
 City farming

**Crop**  
 Leafy greens and herbs

**Location**  
 Portage, IL, US

**Solution**  
 Philips GreenPower LED  
 production module

**Philips LED Horti Partner**  
 Hort Americas, LLC

**Results**  
 Energy efficient year round  
 production in a sustainable  
 way

Green Sense Farms LLC is a privately held concern that employs a sustainable approach to farming. Providing consumers with organically grown pesticide/ herbicide and GMO free produce is their goal and is good for people and the planet. Conserving resources is also good for our bottom line. Everything that can be recycled, is, including water and nutrients. Produce is harvested 365 days a year with the goal- farm to table in 24 hours. At the beginning of 2014 Philips and Green Sense Farms (GSF) have partnered to develop one of the largest indoor commercial farms using LED grow lights tailored to their specific crops. This innovative farming model allows GSF to harvest 20-25 times a year by using 'light recipes' optimized for their produce, using 85 percent less energy. The result will be

an increase in crop yields and reduced operating costs, while providing consumers with locally grown, fresh vegetables throughout the year. GSF has invested firmly to renovate and equip a million cubic foot indoor growing area consisting of fourteen 25 foot tall growing towers in two climate-controlled grow rooms, which use Philips energy-efficient LED solutions tailored to their specific crops. Robert Colangelo, founding farmer/ president of Green Sense Farms: 'By growing our crops vertically, we are able to pack more plants per acre than we would have in a field farm, which results in more harvests per year. We produce little waste, no agricultural runoff and minimal greenhouse gasses because the food is grown where it is consumed, reduce the food miles and improve freshness.'

“Providing consumers locally grown, fresh vegetables throughout the year.”





## GreenQ Improvement Centre Vegetables & Fruit



**Project**  
 GreenQ Improvement Centre

**Sector**  
 Research/vegetable production

**Crop**  
 Tomato, Komeett

**Location**  
 Bleiswijk, the Netherlands

**Solution**  
 Philips GreenPower LED interlighting and LED toplighting

**Philips LED Horti Partner**  
 Certhon

**Results**  
 Positive effect on overall development and increased production

GreenQ Improvement Centre is a modern greenhouse complex in which new cultivation concepts and technical installations from all over the world are developed, tested and demonstrated. Last year the objective of the cultivation was to harvest 79 kg of tomatoes per m<sup>2</sup> with an energy reduction of 30%. The setup is comparable to those used by tomato growers that use lighting in practice. This year the test again shows that LED lighting in the crop has a positive effect on fruit weight and total production. The energy saving achieved

during the winter period is largely due to the intelligent use of the LED lighting in combination with the HID lighting. Interlighting with LEDs helps to supplement the light requirement deeper in the crop and in this way bring the entire crop to higher production. As a member of the supervisory committee, grower Robert Zwinkels commented 'The results have pleasantly surprised me. The LED light was used 30 to 40% more efficiently than if we had used extra HID lamps. That resulted in quite a few extra kilos.'

“GreenQ Improvement Centre achieving impressive results with interlighting for tomatoes.”



## Van Nature / Jami VOF Vegetables & Fruit



**Project**  
 Van Nature / Jami VOF

**Sector**  
 Vegetable production

**Crop**  
 Tomato, Komeett

**Location**  
 Bergschenhoek, the Netherlands

**Solution**  
 Philips GreenPower LED interlighting in combination with Philips GreenPower/Vision HID 1000 W Plus

**Philips LED Horti Partner**  
 Lights Interaction Agro b.v.

**Results**  
 Increase in production, especially rise in winter production

Jami VOF, a member of growers association Van Nature, will light 3 hectare of its tomato crop with a hybrid lighting system from Philips. The hybrid lighting system consists of a combination of Philips GreenPower Plus 1000 W top lighting (HID) and Philips GreenPower LED interlighting. This combination is ideal both for the plant and the eventual operating profit. Because in this way the temperature can be kept at the correct level even in the cold months, and optimal tomato

production can be achieved in every season. Tests with the hybrid system have demonstrated that it can increase production by means of more efficient light absorption. With LEDs you get about 1.46 times greater efficiency than with HID. Particularly in the winter months this provides the plant with better growing conditions. 'Another reason why we are very enthusiastic is the system's energy efficiency. So the Philips hybrid system is the ideal solution for us,' says Michel Zwinkels.

“We feel that this system is the future and that it will contribute to our enterprise's yield.”



## Melrow Salads / Flavourfresh Salads Vegetables & Fruit



**Project**  
 Melrow Salads /  
 Flavourfresh Salads

**Sector**  
 Greenhouse production

**Crop**  
 Tomato

**Location**  
 Landsdale Nursery,  
 United Kingdom

**Solution**  
 Philips GreenPower LED  
 toplighting and LED  
 interlighting

**Philips LED Horti Partner**  
 Cambridge HOK

**Results**  
 Achieving a high production  
 of healthy and tasty locally  
 grown tomatoes using energy-  
 efficient lighting

Lancashire-based Melrow Salads has a recognized track record of varietal development and trialling of crop production technologies. They are recognized as a leading supplier of protected salads to the retail and processing industries. There has been contact between Philips and the Flavourfresh Salads Landsdale Nursery site in Lancashire for several years. After visiting the 3 ha project of Jami in Bergschenhoek, Netherlands, they were convinced about the potential benefits of LED interlighting. As far as toplighting is concerned most of the greenhouses in the UK have lower ceilings than those in

the Netherlands, so HPS lighting is not always an option. Addressing this issue, Melrow Salads is trialling the Philips hybrid LED top/interlighting system on a small cherry-type tomato cultivar (30-35 gr fruit weight) at Flavourfresh Salads' Lansdale Nursery site the 2013/2014 winter. The aim is to learn about the opportunities and potential to extend the season, improve consistency in flavour and increase the yield of specialty tomatoes. After two days of 'hybrid-lighting' the plant already looked stronger, with darker leaves, more purple anthocyanin in the head, and a stronger truss.

“This lighting installation will allow us to extend the UK season, improving consistency in flavour and increasing the yield of speciality tomatoes.”



## Alain Lutz Vegetables & Fruit



**Project**  
 Alain Lutz

**Sector**  
 Fruit cultivation

**Crop**  
 Strawberry

**Location**  
 Melsele,  
 Belgium

**Solution**  
 Philips GreenPower LED  
 flowering lamp

**Results**  
 The LED flowering lamp proves  
 to be ideal successor to (cyclic)  
 incandescent lamp

Incandescent lamps are now being phased out so strawberry growers are having to find an alternative solution. Lutz chose the Philips GreenPower LED Flowering lamps to illuminate his 10,000 m<sup>2</sup> of strawberries. The installation was supplied by Mais and installed by Elektravon Haket. Lutz grows an early variety of strawberries and therefore uses the type of flowering lamp with a spectrum made up of deep red, white and far red. He chose this type of lamp because tests carried out on it at a number of trials showed that far red is essential to ensure good stem elongation. The specific type of LED flowering lamp with the spectrum

combination that includes far red clearly produces the desired stem elongation, and even makes it possible to achieve a higher yield of early strawberries with a low percentage of malformed fruit. Apart from being good for the plants, the flowering lamps are also much more energy efficient. They deliver an energy savings of 82-85% compared to the incandescent lamp. It was also very important to him that the light from the lamps was white, and not red or purple. This means that people can also work under this light and the light people see from outside the greenhouse is in keeping with their expectations.

“The improved results and low energy consumption compensate for the higher purchase price of the flowering lamp.”



## Kwekerij Wim Peters Vegetables & Fruit



**Project**  
 Kwekerij Wim Peters

**Sector**  
 Fruit and vegetables

**Crop**  
 Plum tomatoes

**Location**  
 Someren,  
 the Netherlands

**Philips LED Horti partner**  
 BE de Lier

**Solution**  
 Philips GreenPower 600 W  
 lamps HPS and  
 Philips GreenPower LED  
 interlighting

**Benefits**  
 All-year-round production  
 of tomatoes on site and  
 substantial energy savings

Proprietor Wim Peters is the third generation of the Peters family to grow tomatoes. The business was originally based in Loosduinen, in the Zuid-Holland province, but in 2002 it moved to Someren in the Noord-Brabant province. In 2008 Wim acquired another business close by and now has an area covering some 16 hectares. Family-run businesses often have strong traditions, but Wim manages to combine a respect for experience gained in the past with a keen eye for present-day possibilities and opportunities. Working in close consultation with the specialists from Philips, Wim Peters opted for a combination of HPS lighting with Philips GreenPower 600 W lamps and Philips GreenPower LED interlighting. The HPS

lighting provides heat and light and the LED modules provide exactly the right amount of interlighting for the tomatoes in the most efficient way. The solution delivers a good 10% more available grow light to the plant and this grow light is distributed over the entire length of the plant. As a result, the leaves in the center and at the bottom of the plant also contribute substantially to growth and production. In addition, the hybrid lighting solution produces some 12 watts per m<sup>2</sup>. This means that Wim Peters does not need to use a growth tube. The grow light at the top can be switched separately from the LEDs in between the plants. This provides additional opportunities for controlling growth.

“We are able to control growth perfectly throughout the entire year using the hybrid lighting system.”



## Testing station (PSKW) Vegetables & Fruit



**Project**  
 Testing Station for Olericulture,  
 Sint-Katelijne-Waver (PSKW)

**Segmentation/Sector**  
 Research

**Crop**  
 Lettuce varieties

**Location**  
 Sint-Katelijne-Waver,  
 België

**Solution**  
 Philips GreenPower LED  
 toplighting

**Philips LED Horti Partner**  
 Maïs

**Results**  
 Improved red coloration,  
 less tipburn, 37% reduction in  
 electricity consumption

During the 2013-2014 lighting season the Testing Station for Olericulture (PSKW) conducted a study into the possibilities offered by LED lighting when used on lettuce varieties grown by means of hydroculture. The Testing Station supports the production of vegetables by examining new innovations and testing them out in practice. At the start of December the trial started: HPS lighting and Philips LED toplighting were installed in two separate greenhouses. Three varieties of lettuce were grown: multicolor lettuce (combination of Lollo Rossa, Lollo Bionda and Red Oak) and Red Oak and Lollo Rossa separately. In addition to the energy savings, the results regarding plant development

were also positive: the improved red coloration of the Red Oak and reduced incidence of tip burn in the same crop were striking. ‘The trial went well,’ says Isabel Vandeveldde, who was supervising the trial together with Joris van Lommel. ‘The red lettuce varieties showed better red coloration in the LED greenhouse in the winter (December-March) than the ones in the reference greenhouse.’ The red coloration was evaluated up until March on the basis of a color chart. The color was scored on a scale of 1 to 5, with 5 being the darkest red coloration. A total of 9 cultivation rounds took place and on average the HPS lighting scored 3.7 for red coloration and the LED treatments 4.6, a very positive result.

“The better red coloration and reduced tip under LED lighting are particularly important quality improvements compared with cultivation under HPS lighting.”



## Mežvidi Vegetables & Fruit



**Project**  
 Mežvidi Greenhouse

**Sector**  
 Fruit and vegetables

**Crop**  
 Komeet tomatoes and  
 Tomawak tomatoes

**Location**  
 Mežvidi,  
 Latvia

**Solution**  
 Philips GreenPower LED  
 toplighting and LED  
 interlighting

**Philips LED Horti Partner**  
 Helle OY

**Objective**  
 Ability to produce winter crops  
 profitably: 8000 kg/week in  
 January at 0,5 ha greenhouse

Mežvidi is one of the most modern greenhouses in the Baltic States, with more than € 1.5 million invested in state-of-the-art lighting, sprinkling and heating systems. Its first tomato production started in January 2013, with 'Komeet' as the main variety; plant density was 2.5 plants per square meter over a total area of 0.5 ha. A new production strategy would enable them to capitalize on the premium prices in the darkest period of the harsh Latvian winter. Mežvidi set themselves the target of increasing the amount of light without having to spend more on energy consumption. By reducing the number of HID toplights by 282 pieces, the greenhouse could have 921 additional LED interlights. After

many calculations and various measurements, Mežvidi reached 13 mol DLI per plant. 'We looked at all possible options,' says Romanovskis. 'Philips GreenPower LED interlighting seemed ideal in terms of cost and performance - it was also backed by the system's proven track record. The results were clear. 'With the LED interlighting we can have more plants per square meter and reach the maximum plant density earlier, while at the same time maintaining optimal climate and the necessary light level during the dark winter days.' The success of LED interlighting at Mežvidi has prompted the greenhouse to investigate the advantages of LED toplighting as well.

“We thoroughly investigated all possible solutions available, and concluded that Philips GreenPower LED interlighting was by far the most beneficial.”



## Research institutes / Universities Research



**Project**  
 Wageningen University (WUR)  
 Utrecht University  
 Radboud University Nijmegen  
 Hasselt University  
 Groningen University

**Sector**  
 Research

**Crop**  
 Multiple crops

**Location**  
 The Netherlands and  
 Belgium

**Solution**  
 Philips GreenPower LED  
 research and LED  
 production module

Philips has been closely cooperating with the world's top universities and research institutes. In Europe, Philips not only jointly develops light recipes with agricultural universities and research institutions, but also provides these institutions with high-quality lighting solutions for scientific research. Wageningen University, Utrecht University and Hasselt University are some good examples. Wageningen University and its Research Center enjoy a very high reputation in the global field of agricultural research. Dr. Wim van Ieperen from Wageningen University commented on the cooperation with Philips like this 'The nature of our research projects determine

the high demand we have for our light sources. We need reliable, high-quality and convenient light sources, while horticulture lighting solutions provided by Philips meet all our needs. The GreenPower LEDs offer great controllability and freedom to our tests.' Utrecht University also installed Philips LED lighting modules in its new climate room, aimed to achieve uniform light distribution. Hasselt University, after cooperating with Philips on tests, decided to install Philips LEDs in its two new climate rooms. These two climate rooms were built to provide for students to research light and plant morphology.

“The GreenPower LEDs offer great controllability and freedom to our tests.”

# Our network

Of course, we don't do everything on our own. We work with reputable partners that have specialist experience. Philips supports its certified partners in commercial projects and field tests to find new light recipes for a wide variety of crops and applications. These partners are exclusively trained by Philips in the field of LED lighting in horticulture. This is done by our plant physiologists, for light recipes, and application engineers, for the design and supervision of projects. Our valuable experience of light plans and our installation know-how are shared with our certified partners as well. This provides them with the necessary knowledge to realize LED solutions together with Philips.



This innovative partnership program creates a worldwide network and allows growers to work with a certified partner in their own region – a partner who is trained in engineering, light recipes and programs to deliver the best results. This unique cooperation between growers, partners and Philips guarantees the best possible light solution for every growth situation.

**Depending on your preference, you can connect to:**

- Philips LED Horti Partners; certified Philips LED Horti Partners, trained in engineering, light recipes and programs. Linked to Philips technical specialists and/or account managers.
- Complementary Partners; business/plant recipe partners who have earned our trust in joint projects in specific areas.
- Philips account managers or plant specialists.



# Complementary services

Anyone who goes into partnership with Philips gets much more than just a product. Philips offers know-how and support. Our plant physiologists and application specialists know the best approach for your specific situation, and every plant gets a unique light recipe. And not only that: Philips takes work off your hands by providing support during the subsidy application process, and after-care in the form of answers to technical and botanical questions, light measurements, and help if you are experiencing problems with the installation.



We can even support you with our financing solutions. In these times when it can sometimes be difficult to obtain financing, we can offer Philips Capital. We understand better than anyone just how important it is to invest in new technology. It is the only way to stay ahead of the competition. Thanks to Philips Capital, you can benefit from innovative lighting straight away, without having to make substantial investments in advance.

Philips Capital is a cash-flow-friendly solution. It has been developed specifically to ensure growers have

access to the proven advantages of state-of-the-art lighting solutions, without having to make hefty investments upfront. The total cost of the lighting plus the installation cost are added together and spread over a period of three or five years, for example.

This means you pay a fixed sum each month until the entire project has been paid off. In the meantime, you benefit from the many advantages of the light recipe, such as energy savings, efficient use of space, and better and more consistent plant quality.



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