Philips LED Lighting in horticulture

There's more to light

PHILIPS

sense and simplicity

Philips LED Lighting in horticulture

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.

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.

Content

Royal Philips Electronics

Royal Philips Electronics 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 'sense and simplicity'.

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 41st most valuable brand in the world in 2011.
- We came 13th in the annual global Top 100 of most sustainable companies in the world, particularly by increasing the energy efficiency of our products. Philips Electronics North America is a subsidiary of Royal Philips Electronics of the Netherlands, and is headquartered in Andover, MA. Philips opened its first US office in 1933, and today, the United States is the company's single largest market in the world, with more than 23.800 employees, operations at 50 major facilities in 22 states, and 2011 sales of EUR 6.322 billion, 28,8% of total company revenue.

For more information, visit: www.philips.com

Philips Lighting 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, for example, 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 installation and implementing fase 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 HPS 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, 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.

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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 approach
Step by step to your solution

Our know-how and network for your solution

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

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

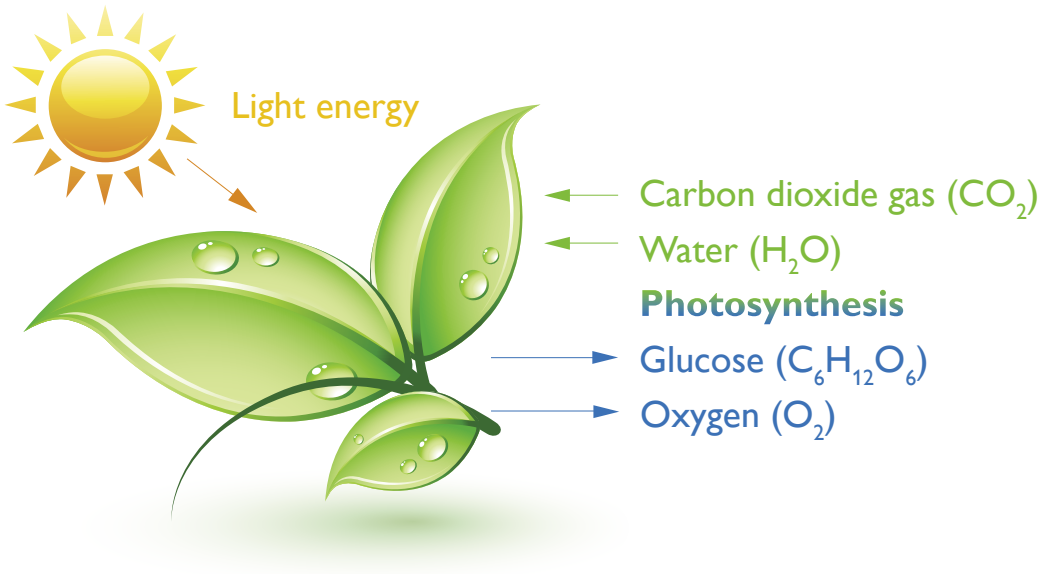
Step 7 ➜ Follow up

Light and plant growth

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.

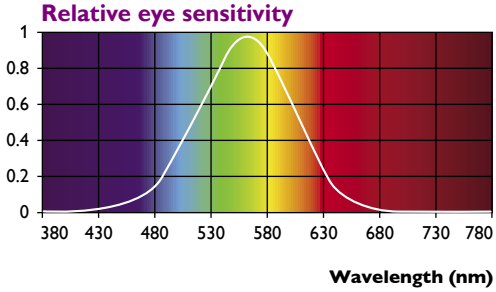
Plants have a completely different sensitivity to light colors than humans. With regard to plant growth, light is defined in terms of small particles, also called photons or quantum. The energy content of photons varies, depending on wavelength (light color spectrum). For one optical energy, almost one 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 a 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 and 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 (µmol)). 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 (CO_2) and water, which are taken up by leaves and roots. This process can be represented as follows:

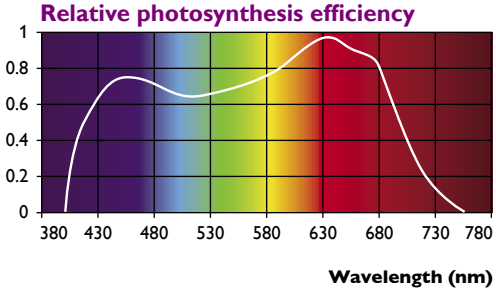


An efficient lamp for plant growth must convert asmuch electrical energy as possible into PAR energy. The term 'daily light integral' (DLI) refers to the number of light particles, or photons, received during one day in the PAR region (400-700 nm). The DLI specifically refers to the amount of photosynthetic 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^2/day and depends on location and time of year. Inside a greenhouse, light transmission is usually

Relative eye sensitivity



Relative photosynthesis efficiency



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 surpressed.

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.

reduced by 35-50%, so it is not uncommon to have an average DLI inside a greenhouse of less than 3 mol/m^2/day in the northern United States and Canada during the darkest periods of the year. In general, 4-6 mol/m^2/day is recommended for propagation of cuttings, and at least 10-12 mol/m^2/day is recommended for most bedding plants, perennials and potted crops.

DLI is measured in mol/m^2/day, which means the number of moles of light (mol) per square meter (m^2) per day .What is a mole of light? A mole is a very large constant number (6.022 x 10^{23}, 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^2/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^2/day. In addition, some crops flower earlier when grown under a high DLI compared to a low DLI.

Example calculation

DLI = Daily light integral (in mol/m^2)
DLI = average light intensity (µmol/m^2/s)* time (s) / 1.000.000 = mol/m^2 (/day)
Time in seconds = hr of hours * 3600

200* 14* 3600/1.000.000 = 10 mol/m^2/day

Application fields

We are experienced in your segment - find out below what LED light can do for you!

Potted, bedding and young plants in greenhouse/climate chambers

- Provides a safe and reliable supplement or replacement to natural light
- Improves the quality of seeding and cultivates healthy seedlings
- 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

Young plants (tissue culture, seedlings, cuttings)

- 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 farms (leafy vegetables and herbs)

- 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

Vegetable production in greenhouse

- 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

Light intensity
Provides the illumination intensity that crops need

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

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

Long lifetime
Reduces the need to replace lamps

Energy efficiency
Lowers energy costs and helps protect the environment

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

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

Our products

Philips has extensive expertise and experience of using both conventional lighting and state-of-the-art LED technology for horticultural purposes. Together with growers, breeders and partners we can provide optimum light recipes to save energy and make production more profitable. The light recipe depends on a great many factors, such as the specific strain of plant, the geographical location, the type of greenhouse, the overall energy and heat balance, etc. All of these factors have to be taken into account when determining the right light recipe and will also influence the type of lighting installation required. Light recipes will continue to develop in the years ahead and need to be tailored to suit the type of business and the setup in which the plants are grown. Our account managers and specialists will therefore be pleased to come and advise you on what will work best in your specific circumstances.

Philips GreenPower LED production module

Philips GreenPower LED production module is specifically designed for multilayer cultivation in conditioned environments with little or no daylight. The module (50-250 µmol/m²/s) can replace conventional fluorescent lighting, reducing energy consumption by up to 60%. It can also be installed for single-row multilayer cultivation. Low radiative heat emission also allows the light source to be installed closer to the plants, thus improving space utilization. The production modules have a built-in driver, and an automatic temperature-sensing and overheating-protection device. 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 µmol/m²/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 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 module

Philips GreenPower LED interlighting module is an unique bi-directional lighting module. 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 High Pressure Sodium creates a flexible lighting system. This results in more efficient plant production and considerable energy savings.

Bailey Nurseries Inc.

Grower
Bailey Nurseries Inc.

Sector
Young plants and cuttings

Crop
General nursery propagation (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, higher succes rate and energy savings

Philips GreenPower LED production module

"LEDs bring a win-win for the nursery and our customers"

Bailey Nurseries is one of the United States' largest wholesale nurseries. They offer a complete line of nursery stock that includes deciduous trees and shrubs, evergreens, fruits, perennials, annuals and roses. Bailey Nurseries wanted to improve the rooting of hard-to-root crops, reduce losses during propagation, and shorten rooting time. Bailey's trialed Philips GreenPower LED Production Modules in a separate propagation room. This allowed better control of the plant growth cycle, compared with the greenhouse, resulting in higher rooting percentages. Quality improved dramatically 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. Jean Marc Versolato, from Bailey's Plant Health Department, enthused: 'They do work! 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.'

Maarten Bloemen

Grower
Sierteeltkwekerij Maarten Bloemen v.o.f.

Sector
Tree nursery

Crop
Production of plant material for various acidophilous shrubs such as pieris, leucothoe and pernettya

Location
Venhorst, the Netherlands

Solution
Philips GreenPower LED production module

Philips LED Horti Partner
Lights Interaction Agro b.v.

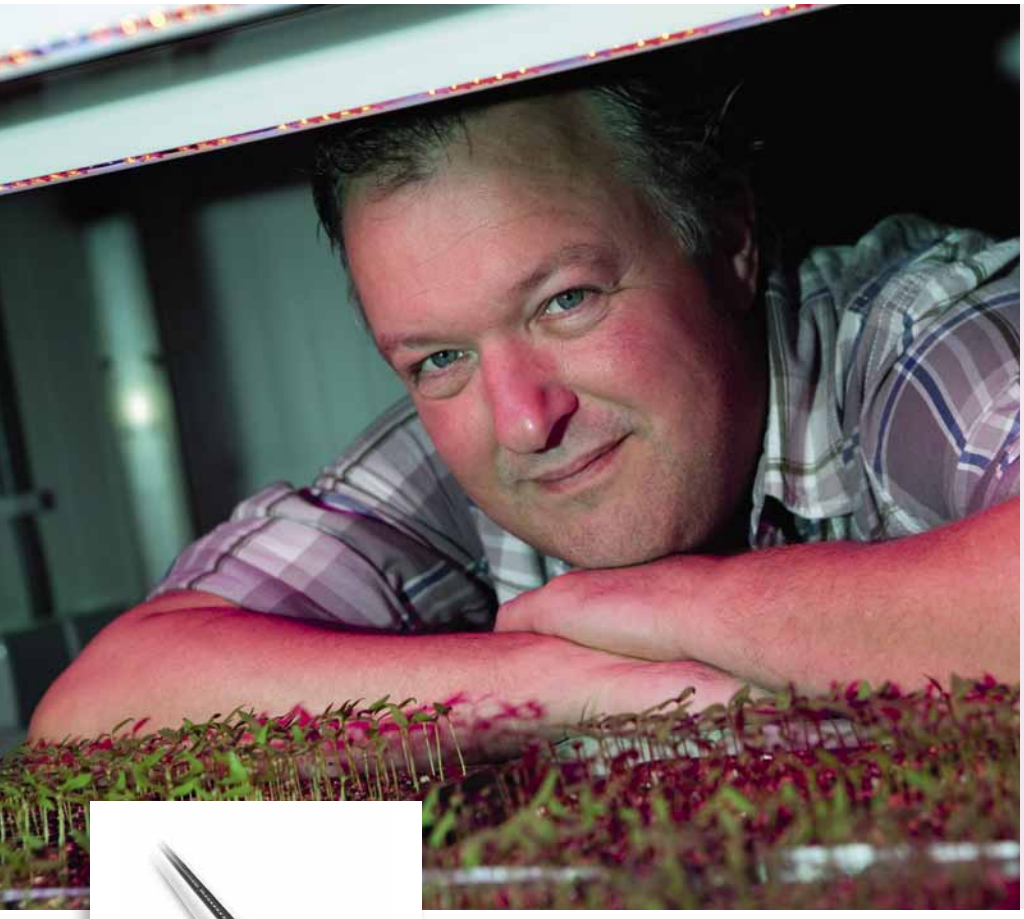
Results
Quality improvement of the crop and reduced production costs

Philips GreenPower LED production module

"Both the quality and the success rate of my cuttings have improved"

Maarten Bloemen's nursery in Venhorst specializes in propagating acidophilous crops, including several varieties of pieris, azalea, leucothoe and vaccineum. Since 2009 he has, in conjunction with Philips, been looking for the best lighting options for his cuttings. And now, the most important objective was achieved by using LEDs: Bloemen's range of pieris cuttings are of better quality. The percentage of rejects fell during the cutting period from 7 to 2%. During the potting phase this figure was reduced from 5 to 2%.
'The lamps are energy-efficient and less harmful to the environment and cause much less heat radiation. This means I have greater control over the processes in my greenhouses. In addition, the life of the LEDs is 25.000 operating hours. So they last much longer than conventional lamps. It is absolutely a step forward in every respect.' said Maarten.

Kieft-Pro-Seeds/PanAmerican Seed



Grower
Kieft-Pro-Seeds/PanAmerican Seed

Sector
Seeds and young plants

Crop
Floriculture seeds

Location
Venhuizen, the Netherlands

Solution
Philips GreenPower LED production module and LED string

Philips LED Horti Partner
Lights Interaction B.V

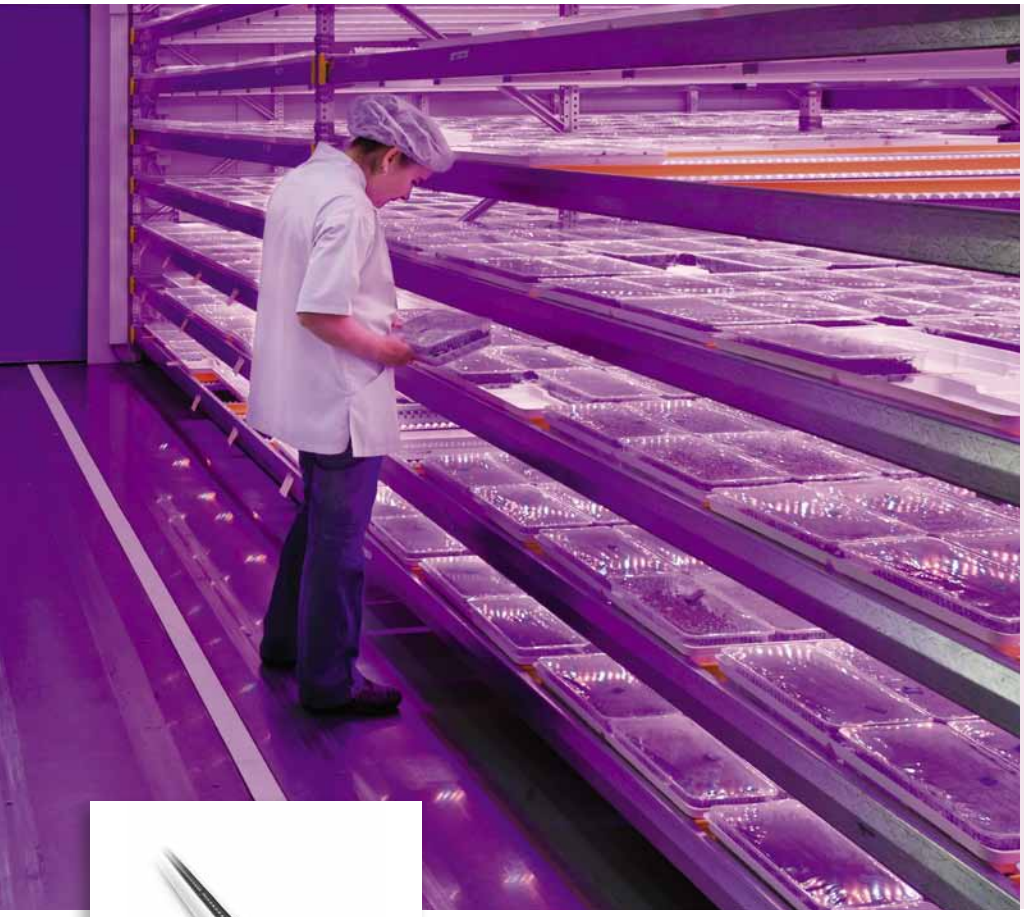
Results
Better germination rate, more control, less water, less labour and less space

Philips GreenPower LED production module and LED string

"Philips is miles ahead in terms of horticultural LED lighting"

Kieft-Pro-Seeds/PanAmerican Seed is one of the world's leading breeders and producers of F1 and open pollinated flower seed for perennials. 'For many years we have been trying to find a solution to reduce the heat load in our germination chambers due to the use of heat fluorescent lamps, HFLs,' says Willem Koopman, Manager of Seed Operations at Kieft-Pro-Seeds. The LED lighting installation will save up to 30% of the energy consumed by the previous lighting in the germination testing chambers. The total energy saving is expected to be around 14.000 kWh per year. Willem believes that in multi-layer production, LEDs can maximize available space. 'Currently, HFLs are fixed onto trolleys, of which only two can be placed in the germination chambers. By using LEDs, you can easily put four trolleys in the chambers and build taller racks, as the LEDs can be brought much closer to the seedlings. We've been in contact with other suppliers and have come to the conclusion that Philips is miles ahead in terms of horticultural LED lighting.'

Vitro Plus



Grower
Vitro Plus

Sector
Tissue culture

Crop
Ferns

Location
Burgh-Haamstede, the Netherlands

Solution
Philips GreenPower LED production module

Results
The use of LEDs enables savings on energy and space, whilst also improving the quality of the light. Furthermore, thanks to the specific light recipe that is applied, the lighting is only required for shorter periods

"Fern propagator Vitro Plus convinced by added value of production-line LEDs"

Philips GreenPower LED production module

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.'

Vreugdenberg

Grower
Kwekerij Vreugdenberg

Sector
Potted plants, multi-layer cultivation

Crop
Kalanchoe

Location
De Lier, the Netherlands

Solution
Philips GreenPower LED production module

Philips LED Horti Partner
BVB Substrates

Results
Leds with a specific light recipe provide a noticeable acceleration, uniformity in plants and better space utility in the greenhouse

"Proven added value of LEDs with specific light recipe makes for gains on all fronts"

Philips GreenPower LED production module

Kwekerij Vreugdenberg is a large grower of kalanchoe. Substrate supplier BVB Substrates wanted to find out, together with the grower, what combination of substrate, fertilizer and light makes for optimal control over the development of the plants. The objective of the tests: consistent, fast production with consistent quality.
The plants benefited most from the light recipe of the specially developed modules during the winter. But in summer too, the quality of the kalanchoes under the LEDs was better than that of the plants in the control group. Now, and extra layer underneath the original growing bed is set inside his greenhouse. 'I want to see whether young plant cultivation in multiple layers using LEDs can be successful. I am currently using 7300 m^2 for young plant cultivation and that could then be reduced by half by setting up multilayer production. On my farm that would represent 16% greater space utilization. And therefore higher sales and lower energy consumption.'

Deliscious

Grower
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

"In-house propagation of lettuce plants in closed climate-controlled cell"

Philips GreenPower LED production module

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.

Maatschap Kreuk

Grower
Maatschap Kreuk

Sector
Flower bulbs

Crop
Tulips

Location
Andijk, the Netherlands

Solution
Philips GreenPower LED production module

Philips LED Horti Partner
Van der Laan

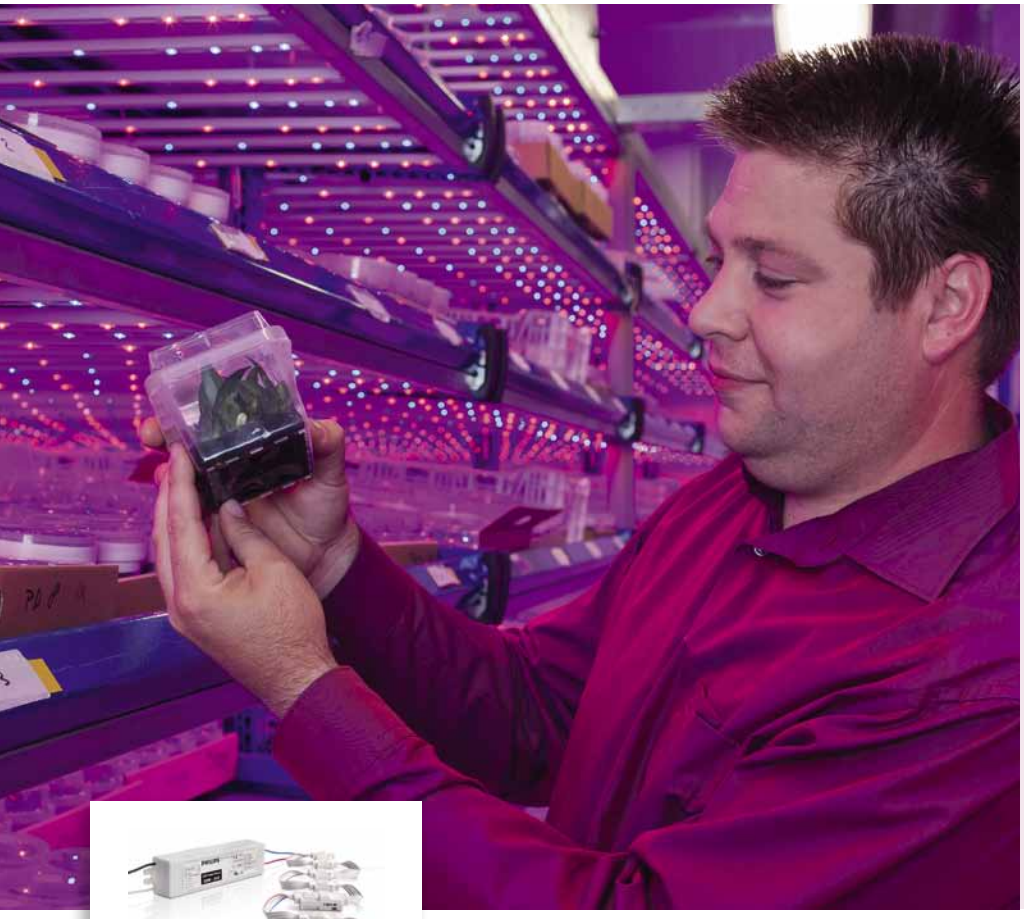
Results
Efficient use of space through multilayer system. Improved plant quality and energy savings

"Efficient use of space through multilayer system, improved plant quality and energy savings"

Philips GreenPower LED production module

Maatschap Kreuk has a cultivated area of 3400 m^2 in a greenhouse covering 1500 m^2 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%.'

Peerdeman Orchideeën



Grower
Peerdeman Orchideeën

Sector
Tissue culture

Crop
Orchids

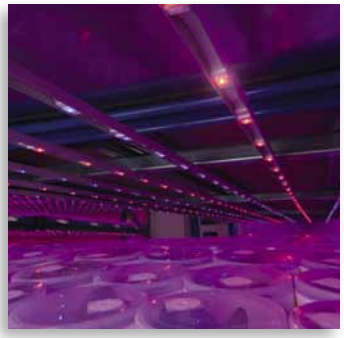
Location
Andijk, the Netherlands

Solution
Philips GreenPower LED string

Philips LED Horti Partner
Van der Laan

Results
Uniform light distribution and savings on energy and space

"We have realized both energy savings and better space utilization in cultivation in layers"



Philips GreenPower LED string

Peerdeman Orchideeën was the very first practical farm on which Philips tested LEDs on tissue cultivation. In the past 3 years the tests have resulted in excellent results. By varying light intensity and color ratio, the best recipe for the orchids was found. The company has now moved part of the process of young plant cultivation to a climate unit with LED light. This makes for a large reduction in energy consumption, better space utilization and eventually, perhaps, possibilities for controlling plant development with light colors. Peerdeman says: 'During the first test it was immediately evident that energy savings of 50% are possible compared with fluorescent lighting. In combination with the more efficient space utilization and good growth, this was the deciding factor when we were planning to build a new cultivation unit in Andijk. The choice between fluorescent and LEDs was soon made.'

Boereboom Stekcultures

Grower
Boereboom Stekcultures

Sector
Tree nursery

Crop
Various ligneous crops

Location
Eindhoven, the Netherlands

Solution
Philips GreenPower LED research module

Philips LED Horti Partner
VTI Horst and Lights Interaction BV

Results
Rooting cuttings without daylight and efficient use of space through multilayer arrangement

Philips GreenPower LED research module

"I'm now the first tree nursery to root cuttings without daylight"

Boereboom Stekcultures is a tree nursery which specializes in propagating tree nursery crops and ornamental plants. Boereboom is aiming to find a practically applicable solution for rooting tree nursery products without daylight. He is very enthusiastic about the potential of using LEDs. 'For some time now, I have been following trials with LEDs to see how the technology can be used in the tree nursery sector. I'm so convinced by the results that I'm now the first tree nursery to root cuttings without daylight. We also have the option of keeping track of the various light colors and the reaction to the rooting. The aim is to create a concept for a variety of crops so that in the future we can root our cuttings in a production hall without daylight. This will make business operations much more efficient and ultimately more economical. The LEDs are a revolution for my way of working.'

Research institutes / Universities

Universities and Institutes
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 module

Philips GreenPower LED research module

"The GreenPower LEDs offer great controllability and freedom to our tests"

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 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 uniformed 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.

Van den Berg Roses

Grower
Van den Berg Roses

Sector
Cut flowers

Crop
Rose (Avalanche)

Location
Delfgauw, the Netherlands

Solution
Philips GreenPower LED interlighting

Results
The combination of interlighting and HPS can increase production by as much as 30%

"Pleasantly surprised by 23% increase in production"

Philips GreenPower LED interlighting

Van den Berg Roses , a cut flower rose company that cultivates an area of 120.000 m^2, started testing LEDs with Philips back in 2008. The hope and expectation was that the extra light would lead to a significant rise in the production of high-quality Avalanche roses. Van den Berg started the pilot by combining the LED interlighting with HPS lighting. And the figures say it all. From December 2010 to July 2011 Van den Berg Roses harvested no less than 23% more roses. The number of stems increased and the total weight of roses produced also rose by 17%. At higher light levels the combination of HPS and interlighting gives rise to as much as a 30% increase in production. 'The figures are so convincing that I believe in this,' says Van den Berg. 'That's why I am working with Philips to explore the possibility of applying this light recipe on a larger scale.'

Improvement Centre (GreenQ)

Grower
GreenQ/Improvement Centre

Sector
Research/vegetable production

Crop
Tomato, Komeett

Location
Bleiswijk, the Netherlands

Solution
Philips GreenPower LED interlighting

Philips LED Horti Partner
Certhon

Results
Interlighting, positive effect on overall development and increased production

"GreenQ Improvement Centre achieving impressive results with interlighting for tomatoes"

Philips GreenPower LED interlighting

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^2 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 HPS 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 HPS lamps. That resulted in quite a few extra kilos.'

Our network

PHILIPS

LED Horti Partner

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.

HORT AMERICAS
www.hortamericas.com

GOLDBIO.COM
GOLD BIOTECHNOLOGY® USA

Fred C. Gloeckner & Company, Incorporated

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 Lighting 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 Lighting Capital, you can benefit from innovative lighting straight away, without having to make substantial investments in advance.

Philips Lighting 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.

PHILIPS
LIGHTING CAPITAL

For more information about Philips horticulture visit:

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