PHILIPS

Horticulture
LED Solutions

Tissue culture

Create **the best light recipe** for tissue culture

Helping your business to blossom

“Lighting designed to meet the **unique needs of tissue culture.**”

Light is an indispensable horticultural production tool and a key factor in plant research. As the world leader in lighting, Philips offers a wide range of state-of-the-art lighting products designed to meet the unique needs of tissue culture producers.

But perhaps even more importantly, we offer our unrivalled know-how in using light to maximize plant growth. It is know-how that has been accumulated by working closely with horticultural leaders from across the globe.

It is expertise that - together with our advanced product technologies - **can significantly improve results for tissue culture producers.**

Welcome to the world of LED lighting

LEDs (light-emitting diodes) are set to play a major role in horticultural lighting in general, and tissue culture in particular. With LED lighting, the spectral output – growth light – can be tuned, which makes it possible to apply the optimum ‘light recipe’ at every stage of a crop’s growth.

LED lighting also produces an extremely uniform light distribution. This means that all plants, whether at the edge of the shelf or the center, receive the same light, and all plants grow at the same rate and to the same shape. Thanks to the quality of Philips LEDs, light output is maintained at a very high level, even after years of use.

In addition, LED lighting uses very little electrical energy compared to fluorescent (TL) systems – up to 70% less. And because it produces hardly any heat, the lamps can be placed very close to the plants, reducing the shelf-light height, which means that more growing layers can be stacked in the same space. What’s more, its long lifetime – 25,000 hours – and extreme reliability mean less relamping and no breakage concerns.

Benefits of LED for tissue culture at a glance

- Proven recipes for different crops
- Higher multiplication factor
- Energy saving
- Better rooting quality
- Higher survival rate in rooting
- Improved/controlled stretching process
- Speeding-up of hardening phase
- Improved survival rate in greenhouse due to more hardened plants
- Shortening of total growth cycle

Of course every crop and situation has its own specific needs. Our plant specialists will help you to get the best results out of your setup.

“Philips offers us the best approach for our situation. **Every plant gets a unique light recipe.”**

Understanding **your needs**

Philips offers know-how and support, not just products. 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, as well as after-care in the form of answers to technical and crop related questions, light measurements, and help if you are experiencing problems with the installation.

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

Philips plant specialists near you, wherever you are

Our global team of plant specialists is one of the key pillars in our approach to helping growers find the best light recipe for their crop.

Their knowledge and expertise range from tissue culture to tomato production, and from cut flowers to bedding plants.

Different regions, plants and markets call for a wide range of plant knowledge. That is why our Philips plant specialists – all of whom have an extensive horticultural background – are based all over the world.

Exactly the right light

“Different plants need different types of light, **and in different quantities.**”

That’s why Philips has developed an entire database of ‘light recipes’, which define the ideal lighting profile to optimally grow specific crops. These light recipes have been researched, developed, tested and perfected in collaboration with leading horticulturists. And, of course, this database is expanding with each new project.

Each Philips light recipe defines

- ✓ Optimum lighting level and spectrum for the crop
- ✓ Best lighting position and illumination times
- ✓ Parameters for which the recipe is valid, such as climate conditions
- ✓ The expected results in addition to energy savings

Binning; **a decicive quality factor**

To get the very best light quality, you need to have the very best LEDs. Our high-quality LEDs are all specially selected through a process known as ‘binning’.

LED manufacturers sort their production of LED dies into light, color and sometimes voltage bins. This allows luminaire manufacturers to select only those LEDs that meet their performance criteria. The most critical bin criteria that impact product performance are light output and color temperature. We choose the very best LED dies (best bins) to get the right – and stable – spectrum.

This way we are 100% sure that the LED products we deliver all share the same high-quality performance characteristics. So there will be no unpleasant surprises – and you always get the LEDs that are optimal for your crop. It also means you don’t have to repeat the initial tests you performed together with Philips when you replace the LEDs.

Our GreenPower
LED solutions

Philips GreenPower LED lighting is ideal for tissue culture applications. Because it is LED-based it can be controlled extremely accurately to generate the exact amount of light, in the exact spectrum that's required. This way we are able to create the best light recipe for your crop.

Philips GreenPower LED research module

This module 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. With the module available in white, red, blue and far-red versions, it is perfect for doing research and finding the ideal light recipe for your crop.

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 potential energy savings are enormous, up to 75% at comparable grow light levels (µmol/J). 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 TLED

GreenPower TLED (25-100 µmol/m^2/s) offers an extremely effective and efficient alternative to traditional fluorescent lamps, delivering energy savings of up to 70%. GreenPower TLED is available in six different versions and with its t8 form factor, in many occasions even suitable for retrofit.

For more detailed information about our products, visit our website www.philips.com/horti

On the following pages you will find examples of practical applications.

Propagation
Philips GreenPower LED production module

Grower
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

Philips LED Horti partner
Hort Americas, LLC

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

Shanghai Dadi

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."

Propagation
Philips GreenPower TLED

Grower
Shanghai Xinghui Vegetable Group

Sector
Tissue Culture

Crop
Gerbera

Location
Shanghai, China

Solution
Philips GreenPower TLED

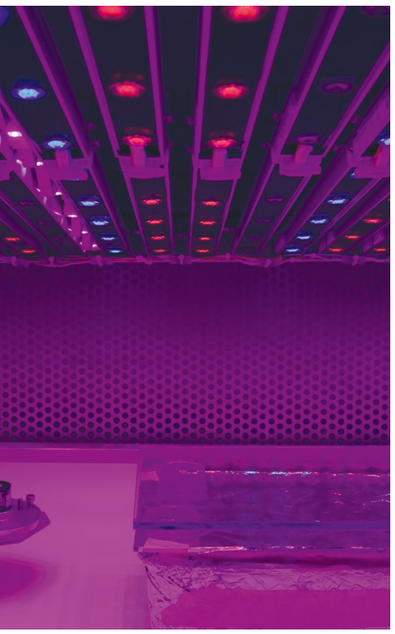
Result
Energy saving of more than 50%, and better control of environmental temperature

Shanghai Xinghui Vegetable Group

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^2 tissue culture building and 10,000 m^2 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."

Research
Philips GreenPower LED
research and production module



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 and production module

Research institutes / Universities

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.

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

Propagation
Philips GreenPower LED
production module

Grower
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

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."

A fast return **on your investment!**

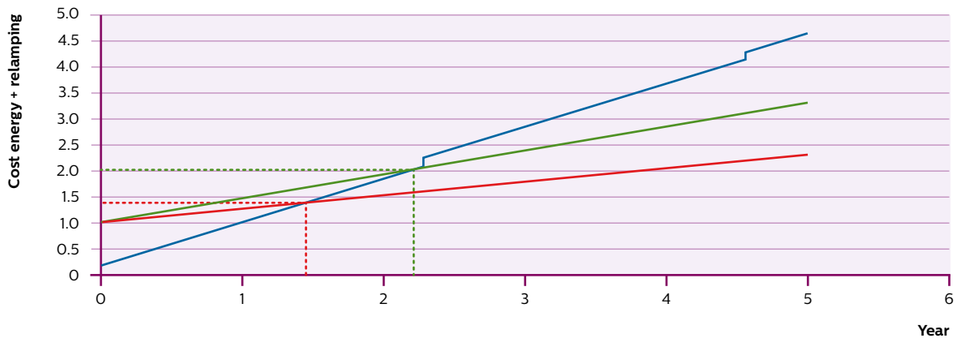
Generating all the light that in vitro plants need is essential for good production. But making certain you do not generate unnecessary extra light – more than needed by the plants – is essential for good profits. After all, artificial lighting requires electrical energy, and it makes simple business sense to consume only as much as is needed. By ensuring the right type and amount of light, tissue culture producers will minimize their lighting energy costs.

Furthermore, our LED solutions keep cooling costs to a minimum. By producing only the right amount of light they minimize the amount of heat that the light source produces.

Switch to LED and increase your earnings
LED-based lighting may require a higher initial investment than traditional fluorescent (TL), but it will quickly pay for itself – by reducing running costs and increasing productivity, quality and profitability.

Take a look at the typical scenario below in which we show a comparison between the conventional TL-lamps and our TLED lamps.

Payback time analysis



Conventional TL
Philips GreenPower TLED*
Philips Greenpower TLED + x-factor (extra production)**

If the production would remain the same while using our TLED modules, after a little more than two years, the TLED would already be more cost efficient then the conventional TL.

If you would take the x-factor (the higher growing rate that our TLED lamps establish) into account, cost savings would already start to appear at as early as one and a half years.

Our network – **your support**

Philips has built up a global network of reputable partners who have specialist experience and have been exclusively trained by Philips. This training is provided by our plant physiologists for light recipes, and by our application engineers for the design and supervision of projects. This innovative partnership program has created a worldwide network and allows growers to work with a certified partner in their own region.

Depending on your preference, you can connect to:

- **Philips LED Horti Partners**
  Certified Philips LED Horti Partners, trained in engineering, light recipes and programs.
- **Complementary Partners**
  Business/plant recipe partners who have earned our trust in joint projects in specific areas.
- **Philips account managers** or **plant specialists**

Interested in what Philips Horticulture can do for you?
To get in contact, simply visit www.philips.com/horti

More than a product, it's a complete solution

The Philips Tissue culture lighting options offer all the proven benefits of LED technology and – as a complete solution – much more besides.

- Quick and easy installation
- Support and advice from technical experts
- Advice on which lighting strategies are best for your situation

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For more information about Philips Horticulture LED Solutions visit:
www.philips.com/horti

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Or tweet us:
@PhilipsHorti