PHILIPS

Horticulture
LED Solutions

Case study
Chiba University

Chiba, Japan

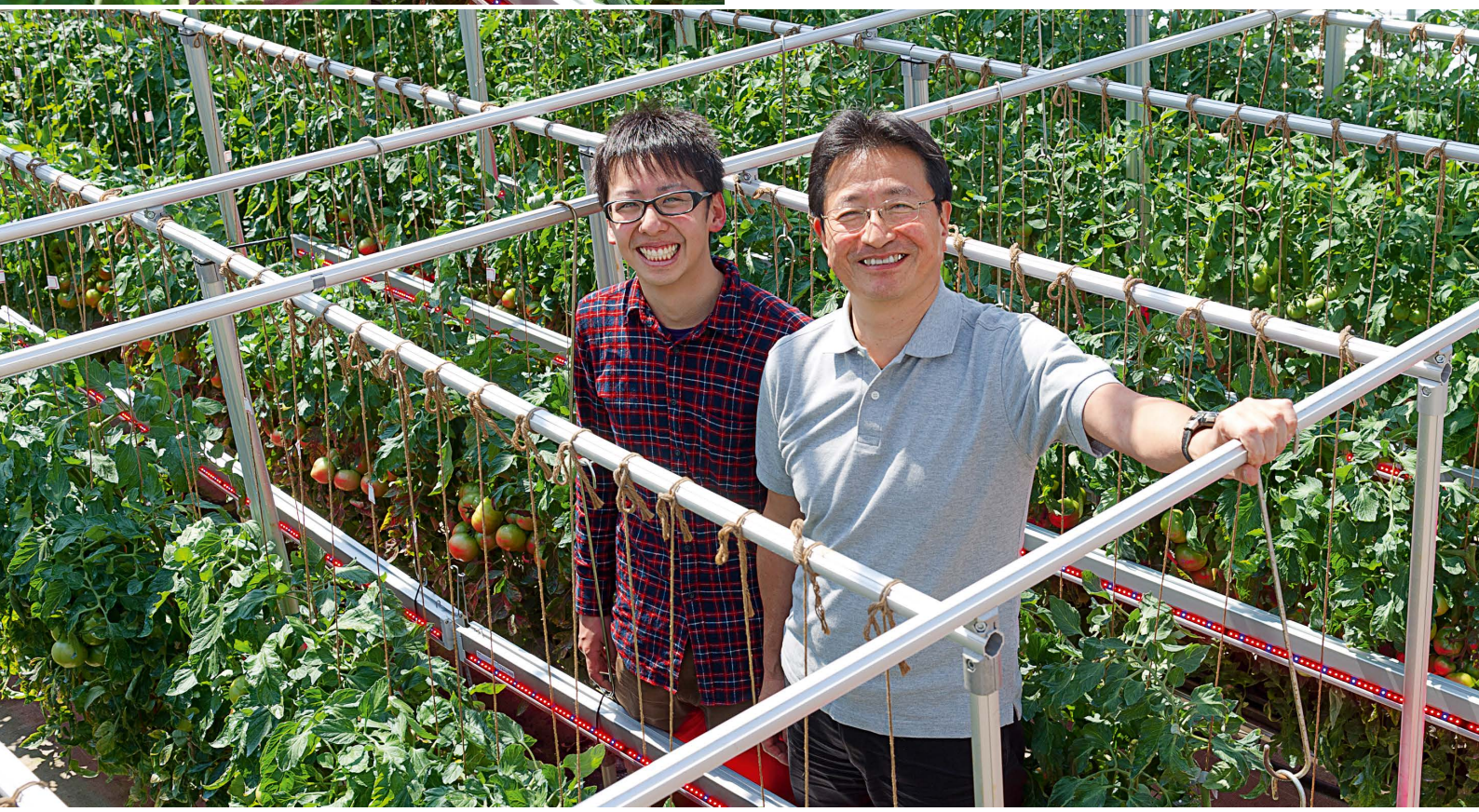
Philips GreenPower LED interlighting

The results demonstrate the effectiveness with regard to **both yield and fruit quality**.

The LED modules get light to the places where this was not previously possible

“**For Japanese people, flavour and shape are the most important criteria to select their tomatoes.** The tests show an elevated level of sugar (glucose) and vitamin C as well as an increase in yield.”

Professor Toru Maruo, Chiba University



Background

In horticulture, effective en efficient use of space is an important issue, while in the agricultural market in Japan the quality and physical appearance is determining, such as flavour, colour, shape and uniformity. Both needs (combination of raising yield and improving quality) are leading in the development of new techniques. Philips has been pushing forward with cooperative research with Chiba University of Japan, who already produced a considerable amount of cutting-edge research in Japanese horticulture. An experiment in the cultivation of tomatoes using Philips GreenPower LED Interlighting modules was carried out in the laboratory of Associate Professor Toru Maruo of the Graduate School of the Faculty of Horticulture at Chiba University. Maruo is also the organiser of the Next-Generation Tomato Production System Consortium which is being promoted as an initiative from the Ministry of Agriculture, Forestry and Fisheries.

The challenge

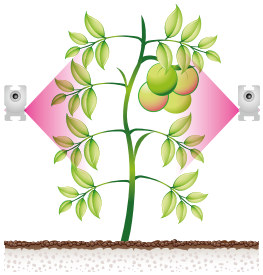
Conventional tomato cultivation use a method called ‘long-term multi-step cultivation’. But this method proves to be problematic due to the intensity of the labour. However ‘single-truss’ cultivation, which was employed in the current experiment, does not require much initial investment and uses space more efficiently (plants grow closer together) also it is possible to control the whole production cycle up to harvesting, and the amount of work involved can be reduce. There is however a drawback; the plants are growing closer which makes it harder for the sunlight to reach the lower leaves of the plants.

Supplementary lighting using artificial light sources is feasible as a way of solving this problem, but a large installation space is required for conventional light sources such as fluorescent lamps in order to avoid the plants being affected by the heat emitted from the light sources, meaning that it is not possible to fully utilise the advantages of the single-truss method. However, it is possible for lighting to be set up in close proximity to the plants when using LED lighting as they do not produce much heat. The GreenPower LED interlighting modules have a unique elongated shape, so that they can be installed in between the plants to provide extra lighting. It is thought that even greater productivity can be achieved by incorporating interlighting modules while making the most of the labour-reducing and efficiency-increasing advantages of the

single-truss method. The Philips GreenPower LED Interlighting modules consists of red and blue LED light which have a positive effect on plant photosynthesis and morphology. This means an increase in yield and fruit weight with the same or improved quality (nutrients, flavour, uniformity e.g.)

The solution

The cultivation test was conducted twice for over a month each with a successful outcome. The test was carried out twice from February to April in 2012 in the testing greenhouse at Chiba University. In both tests, moving benches were being used to reduce installation cost and to simplify the labour. 15 plants were cultivated per square metre. For a period of one month at the fruit development stage, LED light was continuously irradiated for 16 hours each day from interlighting modules installed on both sides of the plants. The size and the sugar (glucose) and vitamin C contents of the fruits were measured upon harvesting, and comparative taste tests were carried out to assess the flavour.



Benefits

Big improvements in yield and quality, LEDs may provide new ways to add value. The results of the experiment were confirmed against a control group of tomatoes which did not receive LED light.
The difference was noticeable:

- Fruit yield: 17%* increase (21% increase by dry weight)
- Sugar content: 12%* increase
- Vitamin C* content: 19%* increase
- There was an improvement in flavour (palatability)
- The fruit increased in size and weight and had firm skin

* Numerical values are average values from the two times the experiment was performed

The results demonstrate the effectiveness of Philips GreenPower LED interlighting modules with regard to both yield and fruit quality. Employing this cultivation method increases the possibility of being able to supply high-quality tomatoes at a market-competitive price. In the future, we foresee cultivation methods employing interlighting modules being widely adopted by producers, leading to greater sophistication and progress in protected horticulture.

> “The challenges of establishing **next-generation cultivation methods.**”

Facts

Grower
Chiba University

Sector
Vegetables

Crop
Tomatoes

Location
Chiba, Japan

Solution
Philips GreenPower LED interlighting

Results
Increase in yield with the same quality or better

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Data subject to change

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