INTERLIGHTING FOR TOMATOES
ACCORDING TO PHILIPS

Over the past years, positive results have been booked using LED as intermediate lighting for tomatoes. And other cultivation sectors have also started using LED. According to Koos de Wit, Key Account Manager LED/Horti, with Philips, LED has the future.

In the horticultural world, you won't make yourself popular if you say you believe in LED. Many objections are raised, among which: 'Too expensive', 'Doesn't work', 'You need PAR light', and 'We have seen enough of that'. However, anyone who is taking his business seriously and who keeps himself abreast of the developments by reading the professional literature, will not stop here.

Red LEDs are most efficient in light production; however, to achieve a good plant morphology, red light alone is not enough. Koos: 'A fitting comprises a collection of red, blue, and sometimes far-red LEDs. The exact composition depends on the particular crop and the purpose of lighting. Of course, I am also aware of the stories told by manufacturers who claim that a much broader spectrum should be used than just red, blue, and far red; however, it is a fact that plants consume red and blue most efficiently. Sometimes, white LEDs are used; the advantage being that these LEDs can also be used as worklight. After all, underneath these LEDs it is possible to properly observe the crops. White light is not always the most efficient light to make; in addition, white light is not always essential for the plant. In addition to the spectrum, it is important to be able to provide continuity. We know, down to the very LED, what its exact wavelength and performance is. Any couple of nanometres wrong could have detrimental effects on production. This is important for the eventual light recipe. After all, the light recipe does not just include the spectrum of the LEDs, but also the way in which the LEDs are used. For example: the way they are installed, at what distance from the crop, how many LEDs are used on a certain surface area, and how often and when they are switched on by the horticulturist. Every crop has its own specific light recipe. This recipe is always optimised in consultation with the horticulturist and geared to the specific crops and circumstances. That is why each recipe is unique.

DIFFERENT VISION

According to Koos, discussions about the point of using LEDs are often conducted in the wrong way. 'Take, for example, a tomato plant: it can "consume" between 250 and 280 micromoles in light. In the Netherlands, such light levels are not reached during the major part of the year. With SON-T it can be achieved; however, the plants would be charred. The amazing thing about LED is that (in combination with Son-T) these 280 micromoles can indeed be directed towards the plant, because the heat development of a LED is many times smaller than that of high-pressure sodium lamps. A horticulturist making use of these lighting values could generate summer production levels in winter. And just to be complete: I am talking about a hybrid lighting solution, i.e. a combination of SON-T in the roof and LEDs among the crop. At this moment, this basic heat requirement on the head of the plant is most efficiently obtained by means of Son-T lighting. It is impossible to compensate this (basic) radiation heat by an extra growth tube.

INPUT PER GRAM

Agro Care in Rilland, the Netherlands, features a complex of three tomato greenhouses, covering nearly 25 hectares. Of these 25 hectares, over two thirds are lit, while the remainder is unlit. The tomatoes receive around 125 micromoles on their heads, coming from electrical SON-T fittings. Nic van Roosmalen, operational director at Agro Care Rilland, has been orienting himself on LED for some time: 'I have been to Finland to look at intermediate lighting projects. Here, intermediate lighting was the trend. At the time, one compartment in one of the greenhouses in Rilland was receiving only 50% of the amount of light compared to the rest of the complex. The idea to install intermediate lighting appealed to us, in order to bring the lighting up to the same level as the rest. Koos came up with the suggestion to equip a trial area with his fittings.' In the place where 50% of the lighting level occurred, the LED systems by Philips were installed. Three rows were provided with intermediate lighting, whereby the centre row would be the experimental row. Nic: 'The rows on the outside could be receiving some light from the double quantities of SON-T installed next to them. For the centre row, we arrived at 62 micromoles of SON-T light from above and 55 micromoles through intermediate lighting. The

starting point of the test was to have the experimental row produce at least as many kilos as the regular rows. Since from 1 Watt of SON-T you can get 1.72 micromoles of light, and from 1 Watt of LED 1.93 micromoles, the energy input per gram of tomato could be reduced if LED intermediate lighting were used.' Next to his job in Rilland, Nic has been closely involved in the test using intermediate lighting on tomatoes at the Improvement Centre in Bleiswijk. Here, it has since been demonstrated that an addition of 1 micromole of LED light is 1.46 times more effective than adding 1 micromole of SON-T light. 'These are major differences in a positive sense', Nic believes. 'During the test, which is almost concluded now, we have observed that a factor of 1.38 can be reached. Lower than in the test greenhouse, admittedly, but still much higher than with the use of SON-T.'

OPTIMAL

For the test at Agrocare, a light recipe was applied on the basis of experiences with other tomato tests.

Nic: 'Where morphology is concerned, the differences with crops that received no intermediate lighting was quite apparent. The leaves in the experimental rows were narrower, somewhat more curled, and slightly more bluish. It seemed as if the plants were growing less vegetatively; however, such things are difficult to define. The production was good, quite a lot better even than had been our intention; however, it was lower than in the Improvement Centre. This difference could be the result of the variety used; in the Improvement Centre they used the large vine tomato Komeett. We are working with the smaller cherry vine tomato.'

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The only variable compared to the experimental rows in Agrocare was the lighting. 'This way, we can average out all side effects', Koos says. However, it also raises the question whether the other variables (temperature, CO_2, RH, etc.) had the most optimum values in order to get the most out of the intermediate lighting. 'I look at it this way,' Koos says, 'if it is possible to obtain more produce, or achieve energy savings, while using the standard settings, you could obtain even better results if these settings were optimum. Thing is, if you adjust more than one variable, you will never know which variable caused the changes observed.'

COOLING

Philips manufactures lighting solutions that are air cooled. And with reason, Koos states: 'A chip functions optimally at a certain temperature: its operational temperature. Therefore, the art is to create lighting for a specific location. While doing so, the fitting must be constructed in such a way that the LEDs will achieve their operational temperature within the band width of the ambient temperature. For horticulture, we make LED solutions that function optimally at a room temperature of 25 degrees Celsius or less. If you can do that, you definitely have the edge, because there isn't a single horticulturist who would welcome the prospect of installing a complete cooling system in the greenhouse. Nor would anyone, for that matter. Imagine a traffic tunnel with LED, and a liquid cooling system as well. Through the whole tunnel? And just imagine a minus twenty degrees frost! No, that wouldn't work at all. Moreover, a non-water cooled (Philips) LED solution is regarded as moveable property and can be leased. That is why Philips LEDs are the only ones that can be financed. We have created a special financing programme for horticulturists: Philips Lighting Capital. This system allows horticulturists to gain access to the most innovative lighting without having to invest a great deal in advance. And there is another reason why it is important to indicate the ambient temperature, and that is the estimated lifespan and expected output during this lifespan. Most brochures will tell you about lifespan and output, but fail to give information about the ambient operational temperature.'

More info: www.philips.nl/horti