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Artificial lighting with LED in horticulture greenhouses; How to successfully implement LED to raise yields in commercial crop growth

Maarten Klein
University of Amsterdam, Netherlands

Statement of Problem: Scientists and advisors in the agricultural sector now consider light emitting diode (LED) lighting as a new lighting source in greenhouse horticulture. Where high pressure sodium (HPS) streetlights are common practice, LED is quite a spectacular change; LED lights have the ability to offer plants several light colors in different spectra. Researchers have reported that blue and red are crucial for plant growth. LED is low on energy usage; it can save up to 50% of the energy costs compared to HPS; and where HPS produces 40% of radiant heat, LED produces almost no radiant heat. These factors have a huge impact on the greenhouse climate, plant morphology; form and generative impulse. However, the advantages mentioned of using LED do not automatically lead to better quality or crop yields.

Methodology & Theoretical Orientation: Several large sized trials have been carried out to test the use of LED in combination with HPS lighting solutions (hybrid systems).

Findings: Hybrid systems with LED and HPS combined gave the best results. The plant response on the radiant heat of the HPS was significantly better. And after having a certain level of micromoles of HPS, LED can have a perfect added value in spring and autumn. LED Lighting can be applied when outside temperatures are high, so this leads to a higher day-sum in Joules during quite high outside temperatures. Next to that the importance of far-red is proven. In crops like cucumbers far-red has a great impact on fruit forming, due to the presence of Gibberellic acid (GA), which is stimulated by the 730 nm LED Chip, which activates the phytochrome. This leads to an increase of 6% in yield with only 3 micromoles/m2/sec.

Conclusion & Significance: LED lighting has great significance for commercial greenhouse crops; however, there is a need for radiant heat from the HPS lights to activate the plant and greenhouse climate. Far-red can have a great addition to the generative impulse on fruit bearing crops like cucumbers. Recommendations are made for growers to increase their productivity and to reach great CO2 emission savings, with the right use of LED.

info@mklein.nl

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