

Optimising site-specific solar radiation modelling for its application in the horticultural, agricultural and photonics industries

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Improving the use of sunlight in plant production environments

WHAT AND WHY?

Recent breakthroughs improve our understanding of how plants sense the spectral composition of sunlight and our ability to measure these changes. This information allows growers to filter sunlight in such a way as to improve the yield, taste and value of the plants they grow, reducing energy use in greenhouses while enhancing plant production.

HOW AND WITH WHOM?

Titta Kotilainen (LUKE) worked with growers to measure the spectrum of sunlight in production greenhouses and polytunnels in Finland & around the world under the full variety of horticultural glass and plastics provided by manufacturers. This database was combined with climate data from FMI to model the sunlight plants would receive anywhere in the world. We consulted with Kauppapuutarhaliitto ry and Yrityssalo Oy to put these data into the most digestible form for growers, and are developing an interface to achieve this streamlining with Pedro Aphalo (YH) & Leonardo Cerliani (Agronomous.ai, Netherlands)

RESULTS, IMPACT AND RECOMMENDATIONS

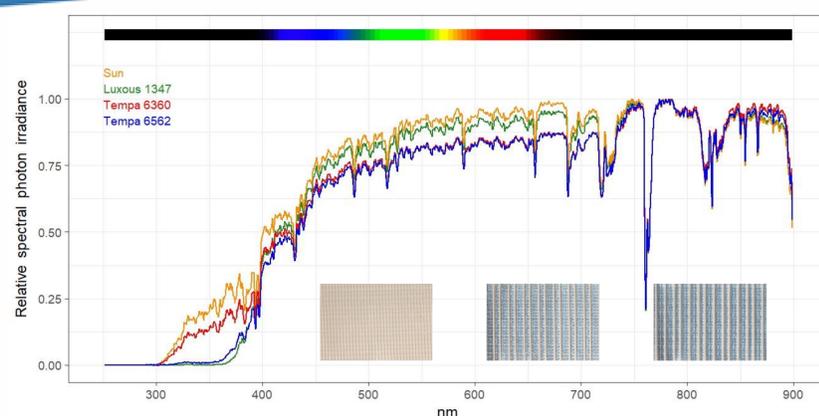
Improving growers' access to knowledge about photobiology enables them to make wise choices when replacing their greenhouse glass and plastics. This is a cost-effective solution to improve the yield, taste & nutrition of plant produce. Feedback to manufacturers will encourage them to develop materials more transparent to UV and blue light, benefitting growers in Finland. The role of sunlight in the breakdown of materials and chemicals in controlled environments, as well as selective filtering of excessive sunlight, are new research challenges.

We need to publicize this knowledge so information reaches growers, and environmental policy encourages them to optimize their plants' light environment.

What next?

We plan to produce an app available to growers allowing them to compare greenhouse materials and structures to choose which are best for their plants and locations using climate data and modelling sunlight received.

We have published our first findings: Kotilainen, PLoS ONE 13(6) e0199628 <https://doi.org/10.1371/journal.pone.0199628> and will release our database of spectra for the community to utilise.



Capturing the solar spectrum in production greenhouses & polytunnels

The measured solar spectrum filtered through three types of climate screen.

Titta Kotilainen measuring vertical gradients in light in a Finnish tomato greenhouse
In the canopy of a production greenhouse with cucumbers.

Shade screens over a polytunnel

A Finnish production greenhouse in winter when snow and low sun angle affect the spectral irradiance.

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