Heliospectra AB, Gothenburg, Sweden
2019 NCERA-101 Station Report

**1. New Facilities and Equipment**

With Heliospectra AB's move to new headquarters in Gothenburg, Sweden, the Heliospectra Plant Lab now features a 14 $m^2$ propagation room and 63 $m^2$ of growth room with 12 standardized units, one Conviron A1000 climate chamber and a vertical farming system. There is also a new 15$m^2$ development lab for the helioCORE light control system and software.

Heliospectra introduced a new series of SIERA light bars which offers 50-watt, fully dimmable LED fixtures for vertical farming and tissue culture/cloning applications. The SIERA series includes five different spectra variants including Indoor Production, Propagation, High Blue, Red and Grafting/Healing light treatments.

Heliospectra is conducting commercial crop trials with SPISA in Sweden using the SIERA series for propagation of herbs and leafy greens in greenhouse and indoor environments.

In 2018 and 2019, Heliospectra continued collaborations with Chalmers University on image recognitions and crop control parameters as part of a larger research focus on spectral light sensing.

**2. Plant Response**

Ida Fällström and the Heliospectra Plant Lab team focused in-house crop trials on the effect of Far-Red on tomato seedlings, basil, mustard, and multiple varieties of microgreens and lettuce.

Comparing broad spectrum LEDs (containing blue and red) with a Far-Red enriched spectrum and end of day Far-Red treatments, the Plant Lab work demonstrates that Far-Red can 1) significantly increase plant biomass in herbs and lettuces; 2) elongate the stems in herbs and microgreens to facilitate trimming and packaging at commercial harvest; 3) enhance color or finish of produce; and 4) achieve taller plants with thicker stem diameter in tomato seedlings.

**3. Accomplishment Summaries**

Heliospectra continues work with Dr. Youbin Zheng and his research associate David Llewellyn at the University of Guelph on LED control systems, collaborating with Greenbelt Microgreens of Ontario, Canada in 2018 to develop crop-specific lighting strategies for arugula. The installation demonstrated the performance of dynamic, real-time LED light response and the helioCORE DLI and On-Target PPFD controllers in the commercial production environment.

Heliospectra also supports the work of Dr. Brande Wulff at John Innes Research Centre and Dr. Lee Hickey at University of Queensland to develop academic speed breeding protocols. John Innes Research Centre is using the helioCORE™ light control in glasshouses in Norwich, United Kingdom. The speed breeding research team established a 22-hour photoperiod with helioCORE control of supplemental lighting for seed to seed wheat generation cycles of 8 to 9 weeks.

Heliospectra's Engineering and Development teams completed simulations and analysis of both static spectrum LEDs (basic on/off function) and adjustable spectrum LEDs (supported by helioCORE control) to evidence ~24% potential reduction in energy consumption using the adjustable or tunable spectrum LED technology.

**4. Impact Statements.**

Heliospectra collaborates with leading research institutions, scientific agencies and commercial growers to further the technical development, knowledge transfer and market adoption of LED lighting technologies and light control systems.

Heliospectra's customer applications identify opportunity for businesses to standardize yields year-round, ensure highest quality crops and maintain consistent nutritional profiles and implement dynamic light control/response to reduce energy consumption by ~40%.

**Published Written Works:**

Referred Journal Articles

Ahlman, Linnéa & Bånkestad, Daniel & Wik, Torsten. (2019). Relation between Changes in Photosynthetic Rate and Changes in Canopy Level Chlorophyll Fluorescence Generated by Light Excitation of Different Led Colours in Various Background Light. Remote Sensing. 11. 434. 10.3390/rs11040434.

Presentations

Llewellyn, David, Johan Lindqvist, and Youbin Zheng. (2018) How intelligently controlled LEDs can be used to more efficiently manage supplemental lighting in greenhouse production systems. IHS2018 Innovation and New Technologies in Protected Cultivation, 3rd International Symposium (poster presentation).

Bochenek, Grazyna, Ida Fällström, and Fei Jia. (2018) The effect of far-red (FR) enriched spectrum and end-of-day FR on tomato seedling in a controlled environment. Canadian Society for Horticultural Science Symposium and Annual Meeting 2018 (poster presentation).

Jia, Fei. (2019) Sole-Source Indoor Lighting. University of Arizona, Controlled Environments and Agriculture Center Commercial Crop Production and Greenhouse Engineering Short Course 2019. (session presentation)

Bochenek, Grazyna, Marie Alminger, Karl-Johan Bergstrand, Tim Nielsen, Ida Fällström (2018) Advantages of crop production in a controlled environment with a LED sole source of lighting. Agrospace 2018.

Other Creative Works and Collaborations

Ghosh S., Watson A., Gonzalez-Navarro O. E., Ramirez-Gonzalez R., Yanes L., Mendoza-Suárez M., Simmonds J., Wells R., Rayner T., Green P., Hafeez A., Hayta S., Melton R. E., Steed A., Sarkar A., Carter J., Perkins L., Lord J., Tester M., Osbourn A., Moscou M. J., Nicholson P., Harwood W., Martin C., Domoney C., Uauy C., Hazard B., Wulff B. B. H., Hickey L. T. (2019) Speed breeding in growth chambers and glasshouses for crop breeding and model plant research. Nature Protocols. 10.1038/s41596-018-0072-z.

Jones-Baumgartner, Chase. Qinglu Ying, Youbin Zheng. (2018) Optimal light spectra for producing high quality of microgreens. Canadian Greenhouse Conference (University of Guelph session presentation)

Llewellyn, David. Jasmine Mah. Youbin Zheng. (2018) Light as a growth regulator: recipes for end-of-day lighting. Canadian Greenhouse Conference (University of Guelph session presentation)