Valoya 2019 Station Report
NCERA-101: Committee on Controlled Environment Technology & Use

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1. New Facilities and Equipment

Valoya's headquarters in Helsinki are equipped with a growth chamber where our plant biologists have ongoing trials to further develop our capacity in photobiology.

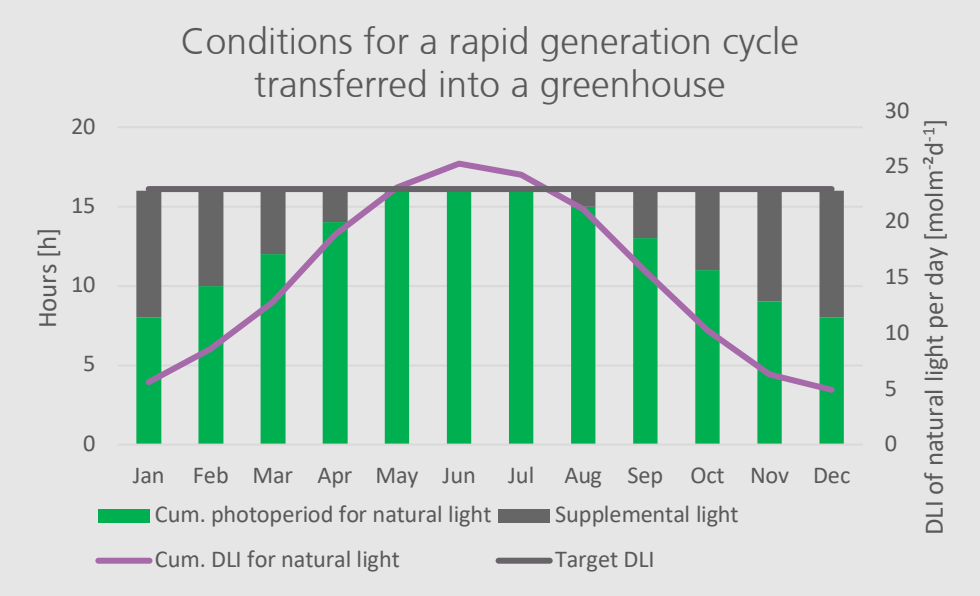
2. Unique Plant Responses

Up to 2019 Valoya has conducted more than 500 plant trials, either independently or in collaboration with various research institutes and universities. The most prominent recent research points to unique plant responses in *Cannabis sativa L.* Next to morphological and developmental plant responses, the light spectrum and light intensity also regulates the extent of protective plant responses. Those responses are linked to stress inducing conditions, which activate the biosynthesis of secondary metabolites. Plants sense stressful light environments, such as short wavelength irradiation or high photon flux, respectively through photoreceptors, which activate the defense response by complex signal transduction pathways.

Our research suggested a close link between the expression level and profile of certain secondary metabolites and the proportion of blue photons in an ultra-wide (380-780nm) light spectrum. A direct comparison between spectra with and without supplemented blue photons showed that in medicinal cannabis a higher content of secondary metabolites (THC) was obtained in light conditions with elevated amounts of blue photons *. Next to the spectrum response, the effect of light intensity was investigated. In medicinal cannabis an increase in yield and flower yield was correlated to increasing irradiation levels during flowering phase. The light spectrum had a larger effect on secondary metabolite accumulation and profile than light intensity.

**Magagnini, G., Grassi, G. & Kotiranta, S. The Effect of Light Spectrum on the Morphology and Cannabinoid Content of Cannabis sativa L. 10, 3–8 (2010).*

Another noted success for Valoya in 2018 was the promotion of the speed breeding technique. Recently, scientists have published new breeding methods such as aSSD and speed breeding to increase the genetic gain per year*. Both methods have in common utilizing light conditions (spectrum and photoperiod), to push crops toward a faster generative growth. This enables them to double generation cycles per year for important spring crops. The shared lighting conditions including spectrum and daily light integral (DLI) provide important data to exploit the approach in winter crops or to transfer the methods into a greenhouse setting. Thereby, the natural light needs to be supplemented with a flowering inducing spectrum until DLI and photoperiod of the spedicified light conditons are achieved.



** Croser, J. et al. Accelerated Single Seed Descent (aSSD) – a novel breeding technique to speed attainment of homozygosity Janine Croser, Federico Ribalta, Maria Pazos Navarro, Christine Munday, Karen Nelson, Kylie Edwards, Marieclaire Castello, Richard Bennett and William . 1–4 (2014).*
** Watson, A. et al. Speed breeding: a powerful tool to accelerate crop research and breeding. bioRxiv 161182 (2017).*

3. Accomplishment Summary

Valoya's continued focus on plant biology research and collaboration with the scientific community has resulted in 12 academic articles being published in 2018 which used Valoya's LED solutions to advance our collective understanding of the field. One of these papers was the first comparative study of effects of HPS versus LED lighting on morphology and cannabinoid content of *Cannabis sativa L.*

Additionally Valoya hosted its first *LEDs & Innovators Conference 2018* during the GreenTech exhibition which aimed to disseminate knowledge to the wider public on the latest implementations of the LED technology in crop science, vertical farming and professional cannabis cultivation fields.

4. Impact Statements

Valoya's goal is to advance the field of photobiology and bring superior quality LED grow lights to growers and researchers worldwide. We were one of the first companies to introduce wide (full / continuous) spectra to the market and continue to build our brand around high quality light which has thus far resonated with customers in more than 50 countries including 8 out of 10 world's largest agricultural companies.

5. Published Written Works

A complete Cannabis chromosome assembly and adaptive admixture for elevated cannabidiol (CBD) content (Grassa et al.2018)

Blue light advances bud burst in branches of three deciduous tree species under short-day conditions (Brelsford and Robson, 2018)

Do UV-A radiation and blue light during growth prime leaves to cope with acute high-light in photoreceptor mutants of Arabidopsis thaliana? (Brelsford et al.2018)

Exploring the potential of high-density cultivation of cyanobacteria for the production of cyanophycin (Lippi et al.2018)

LED-enhanced dietary and organoleptic qualities in postharvest tomato fruit (Najera et al.2018)

Light emitting diodes (LEDs) affect morphological, physiological and phytochemical characteristics of pomegranate seedlings (Bantis et al.2018)

Molecular basis for the production of cyclic peptides by plant asparaginyl endopeptidases (Jackson et al.2018)

Purification and functional characterization of the vacuolar malate transporter tDT from Arabidopsis (Frei et al.2018)

Terpene Composition Complexity Controls Secondary Organic Aerosol Yields from Scots Pine Volatile Emissions (Faiola et al.2018)

The Effect of Light Spectrum on the Morphology and Cannabinoid Content of Cannabis sativa L. (Magagnini et al.2018)

The invasive duckweed Lemna minuta Kunth displays a different light utilization strategy than native Lemna minor Linnaeus (Paolacci et al.2018)

Tree seedling response to LED spectra: implications for forest restoration (Montagnoli et al.2018)

6. Other Relevant Activities or Information

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