

TRACY® HORTICULTURE

APPLICATION OF CONFIGURATION FOR LARGE PRODCUTION AREA – 9X32.5 METERS



TRACY® Horticulture is a linear panel integrated with growth light LEDs. Each panel supplies lots of lifegiving light for any type of plant - from baby sprouts to harvest. With a market-leading lifespan and low power consumptions.

The lightweight aluminum and 6mm slim design are robust and highly water resistant. It can easily be installed into any set-up due multiple mounting options. enable multiple horticulture applications and various configurations.

This application note illustrates the configuration and specification of TRACY® Horticulture for large area production facility with the following performance requirements:

- Light of up to 200 $\mu\text{mol}/\text{m}^2/\text{s}$
- Homogeneity better than $\pm 10\%$ around average PPFD (200 $\mu\text{mol}/\text{m}^2/\text{s}$).

TRACY® Horticulture Growth Light Panel

Requirements:

The production facility has set out the following requirements for the growth light:

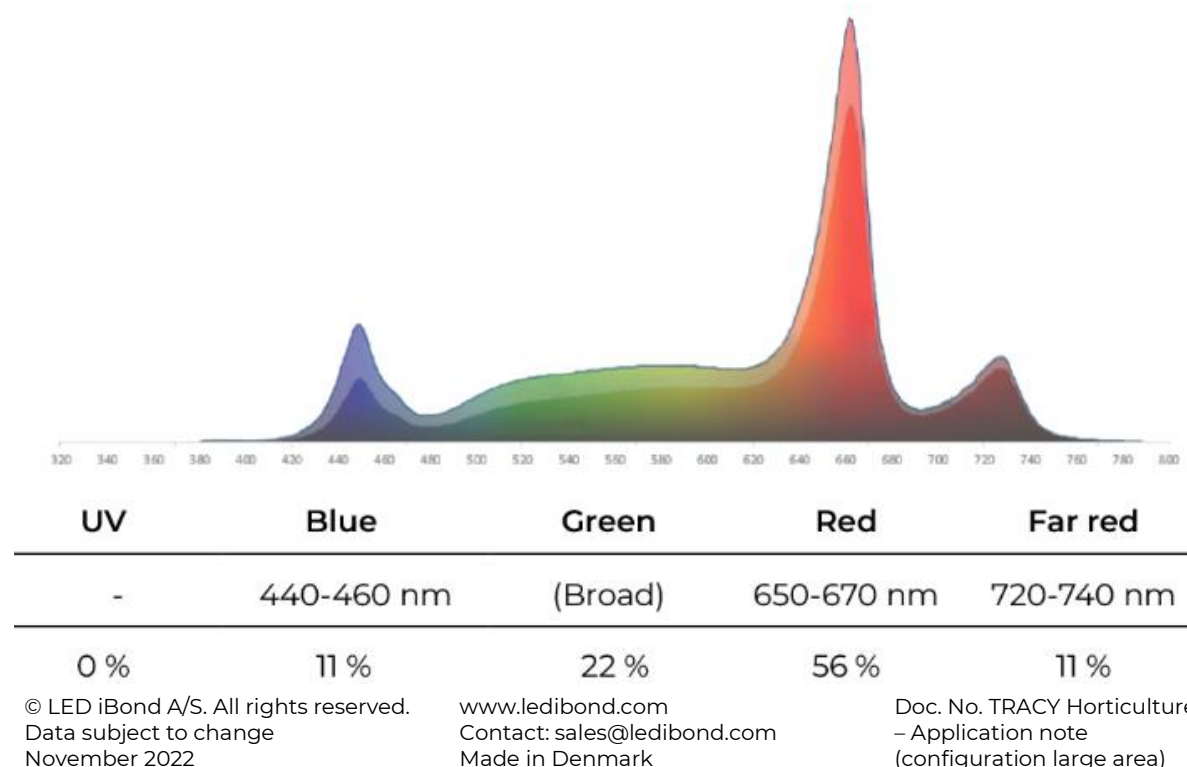
- Size of each growth area is 9 x 32.5 meters (each layer in a moving gutter system)
- PPF^{*} of up to 200 $\mu\text{mol}/\text{m}^2/\text{s}$ measured at the top of the crops (final height)
- Homogeneity – better than $\pm 10\%$ around average PPF (200 $\mu\text{mol}/\text{m}^2/\text{s}$) - measured across growth area excluding 35 cm from edge of growth area.
- Dimmable light and on/off function for daily cycle control
- Spectrum – Broad for growth phase (Growth Light Drive)

** PPF refers to Photosynthetic Photon Flux Density or the amount of photons in the PBAR** range that reach a target point each second as expressed in micromoles per square meter per second.*

*** PBAR refers to Plant Biologically Active Radiation and designates the spectral range from 280–800 nm.*

Spectrum

The requirements can be fulfilled with TRACY® Horticulture with a standard spot spacing of 150 mm and LED iBond's Growth Light Drive spectrum.

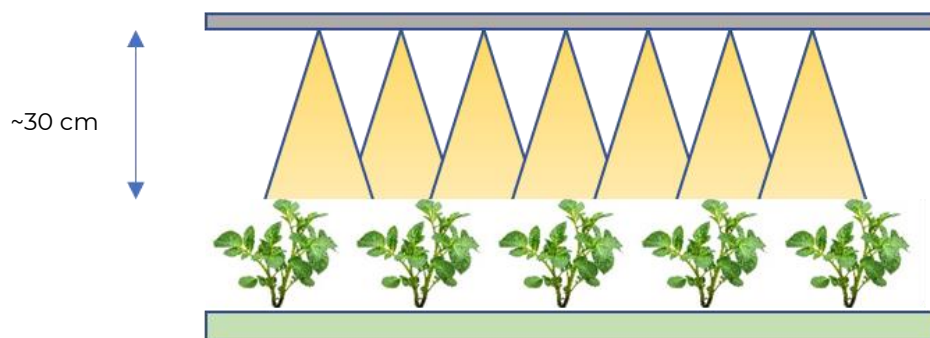


Height above crops

Due to the requirement of PPFD of $200 \mu\text{mol}/\text{m}^2/\text{s}$, the required spacing between the rows of panels (center-to-center) can be calculated to be to ~ 0.36 meter. The estimation is done by calculating the total $\mu\text{mol}/\text{s}$ generated in total by all the spots (5.400 spots in this example – see data in Table 1) over the growth area and thereafter calculate the average $\mu\text{mol}/\text{m}^2/\text{s}$ by dividing with the total area of the growth area (292.5 m^2 - see table 1 for details).

The spacing of 0.36-meter limits how close to the crops the light panels can be placed if high homogeneity is required (as in this case).

As a rule of thumb, the distance from the top of the crops (final height) should be at least 80-90% of the maximum spacing. In this case the maximum spacing is 0.36 meter, and the height over the crops should therefore minimum be ~ 30 cm.



The panels can easily be placed higher than 30 cm above the crops (final height) but it will mean that an increased amount of light energy will be wasted and the PPFD measured at the crops will drop slightly.

LED iBond recommends that light panels are always placed as close to the crops as possible with acceptable homogeneity as it will increase the production yield due to increased utilization of the light energy and reduce the power consumption needed to drive the grow light panels.

Layout of Growth Light panels

The TRACY® Horticulture growth light panels are arranged in the configuration shown in Illustration 1 seen below.

The panels are arranged in a single row covering 9 meters but based on two sections of 4.5 meters each. Each row is divided into two sections of 4.5 meters as maximum length of a single section is 5 meters due to limitation of drive current of 15A per section (see datasheet on TRACY® Horticulture for details).

Each section consists of 2 x 1800mm TRACY® panels and 1 x 900 mm TRACY® panels.

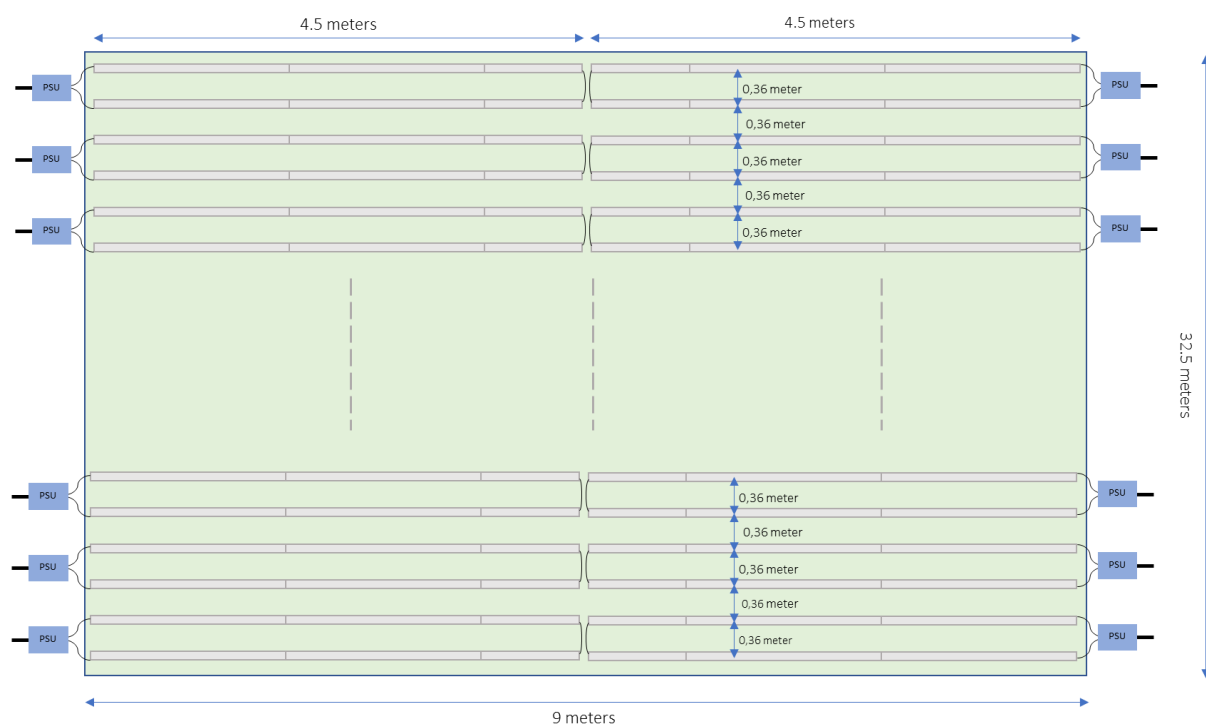


Illustration 1: Growth area with a size of 9x32.5 meters. Power supply units (PSU) are mounted on each side of the grow area for easy access and installation.

Configuration data

Dimensions of growth area	Units
Length	9 meter
Width	32,5 meters
Area total	292,5 m ²
TRACY® Horticulture Configuration	
Total length of connected panels (2x4,5 meter)	9 meters
Panel spacing (center-to-center) - length	0,36 meters
Number of rows	90 rows
Total length of all TRACY® panels	810 meters
Spot configuration	
Spot spacing (center-to-center) - width dim.	0,15 meters
Spot spacing (center-to-center) - length dim.	0,36 meters
Spots pr length (12 spot pr 1,8m panel)	60 spots
Spots pr width (1 per row)	90
Total spots in growth area	5400 spots
Electrical configuration	
Power consumption pr spot (incl. Driver)	4,2 Watt
Power consumption total for growth pr area	22,68 Kw
Power consumption pr m ²	78 Watt
Drive voltage - DC	20 V
Optical configuration	
Spectrum - Growth Light Drive	
Efficiency (incl driver)	2,70 umol/J
Radiation* pr spot @ 4.6W drive	11,2 umol/s
Radiation* total/max for total growth area	60.480 umol/s
Radiation* total/max per m ² - (zero cm from panel)	207 umol/s/m ²
Radiation* per m ² - (30 cm from panel)	198 umol/s/m ²

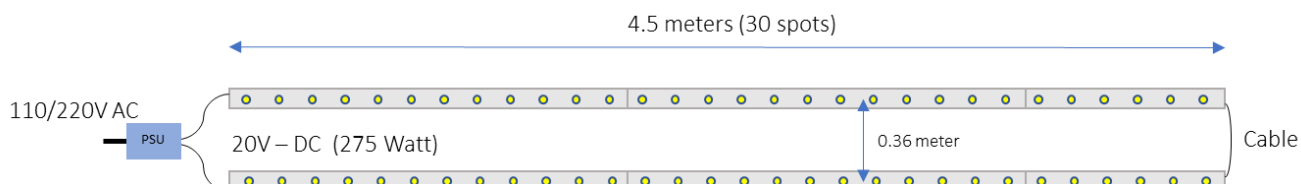
*PBAR 320-800nm

Table 1: Configuration data

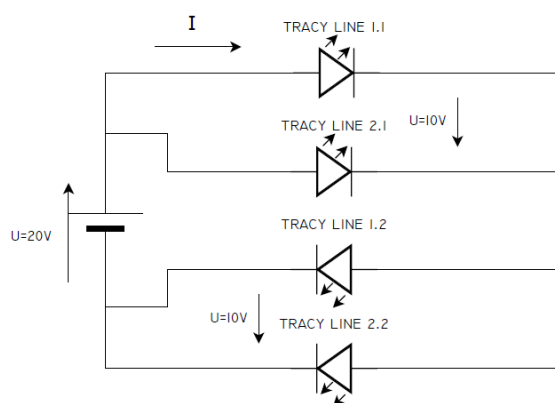
Driver configuration:

A single 20V (300W) power supply unit is used to drive two panel sections of 4.5 meter each. The sections are connected at the end with a single wire cable to form a 20V system.

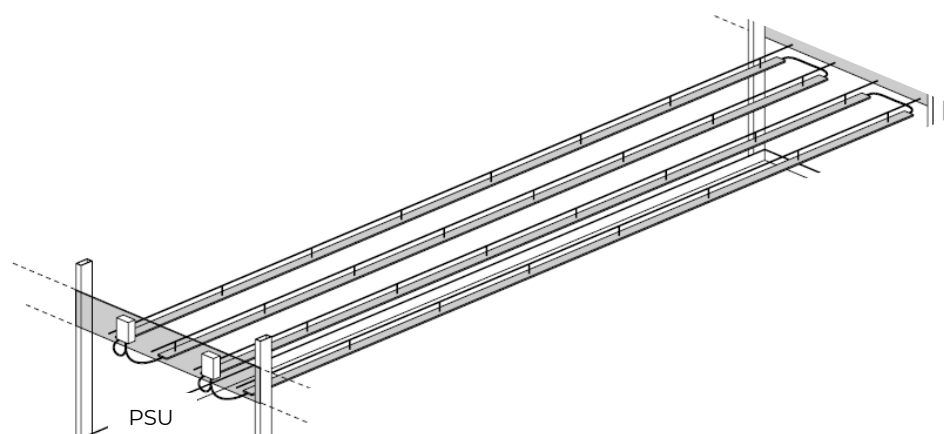
The power supply units (PSU) are all mounted on each side of the grow area for easy access and installation.



Electrical schematic (20V):



Power supply configuration & Installation:



Photosynthetic Photon Flux Density (PPFD):

Distance below panel	PPFD Avg. [$\mu\text{mol/s/m}^2$] @4.2 W/spot (typical drive)	PPFD Avg. [$\mu\text{mol/s/m}^2$] @5.1 W/spot (Max drive)	PPFD [relative]
5 cm	207	242	100%
20 cm	201	235	97%
30 cm	198	232	96%
40 cm	196	229	95%
50 cm	194	227	94%

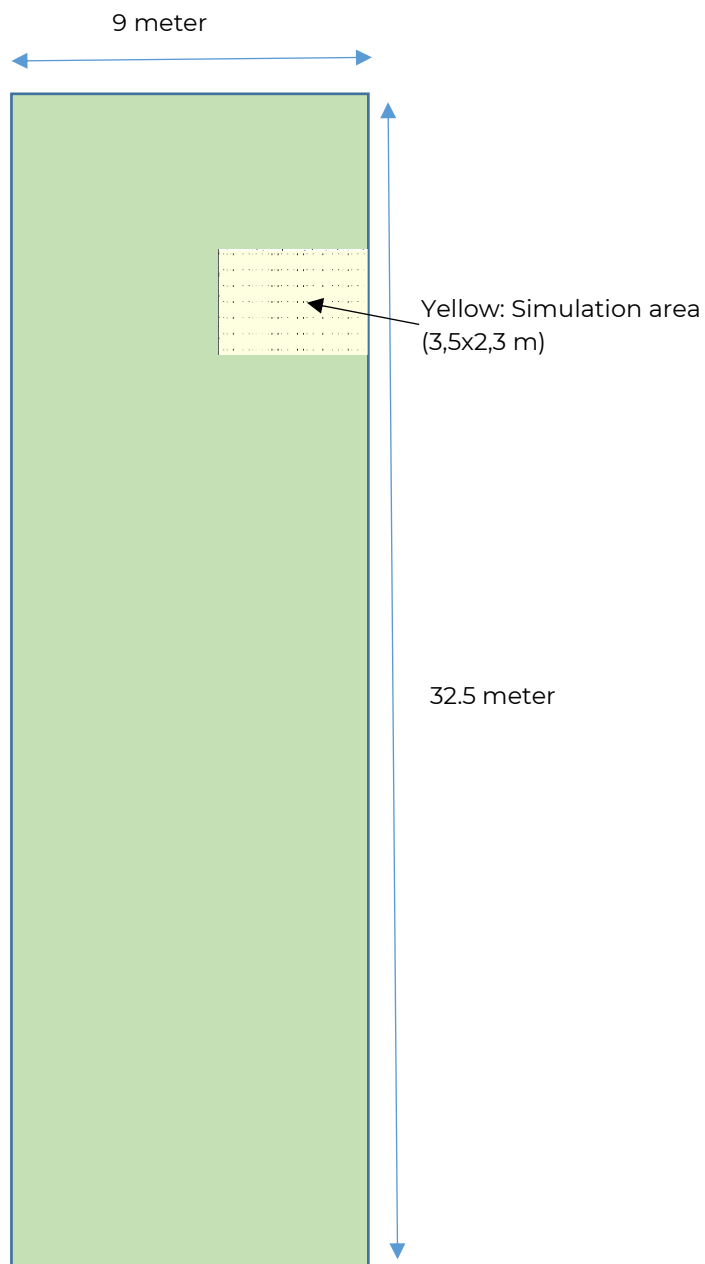
Table 2: PPFD versus distance below panels. Data is for the simulated configuration.

Homogeneity - Minimum/Maximum.

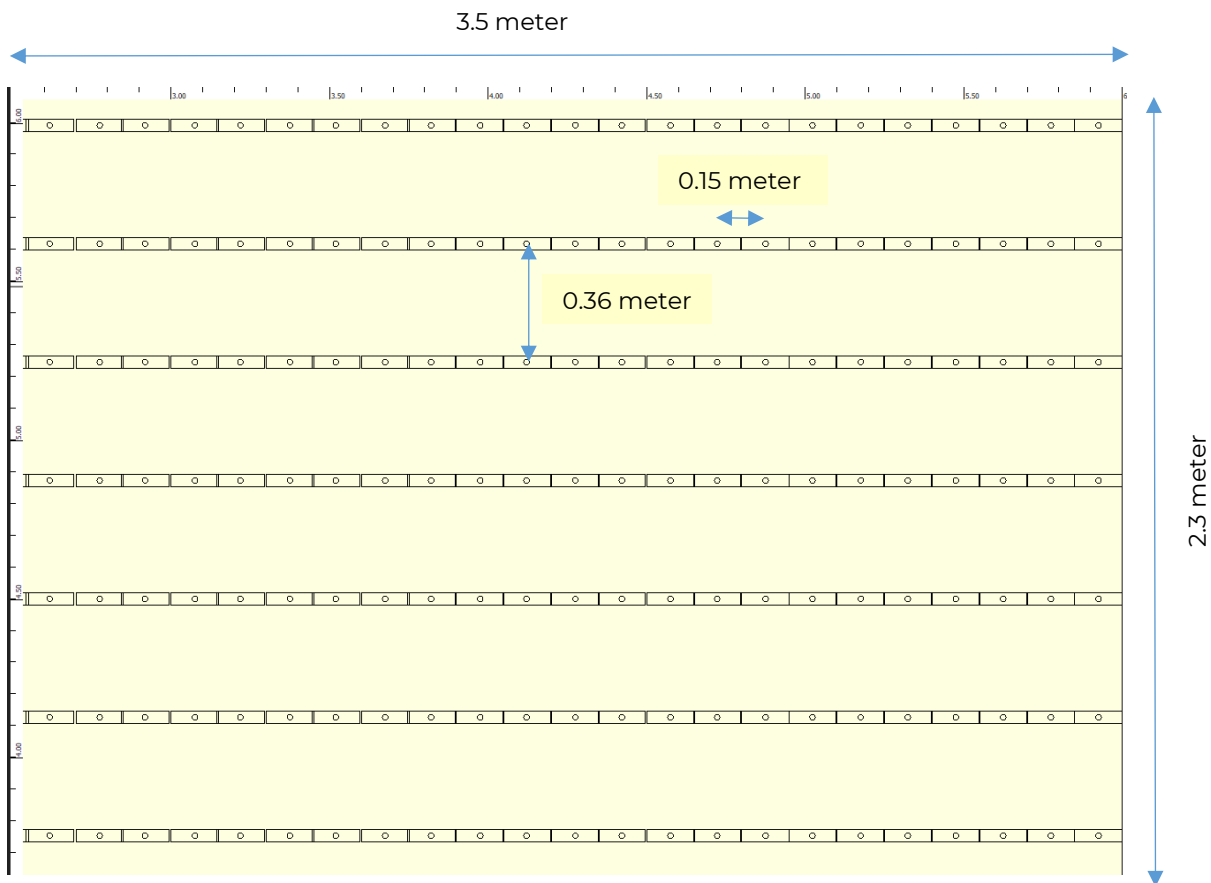
Distance below panel	PPFD Avg [$\mu\text{mol/s/m}^2$] @4.2 W/spot (typical drive)	PPFD [$\mu\text{mol/s/m}^2$] Minimum*	PPFD [$\mu\text{mol/s/m}^2$] Maximum*	Homogeneity measure* Min./Avg.
5 cm	207			
20 cm	201	165	205	82%
30 cm	198	195	205	98%
40 cm	196	200	205	>98%
50 cm	194	200	200	>98%

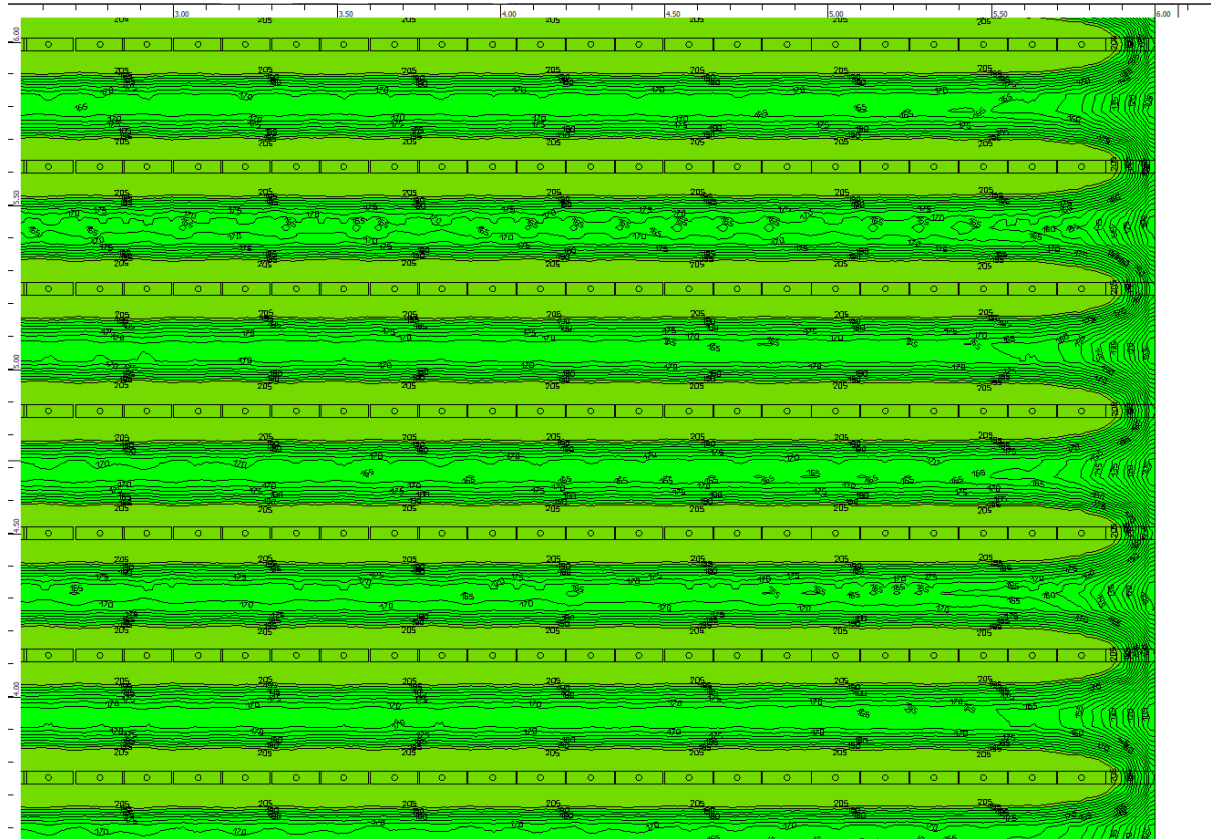
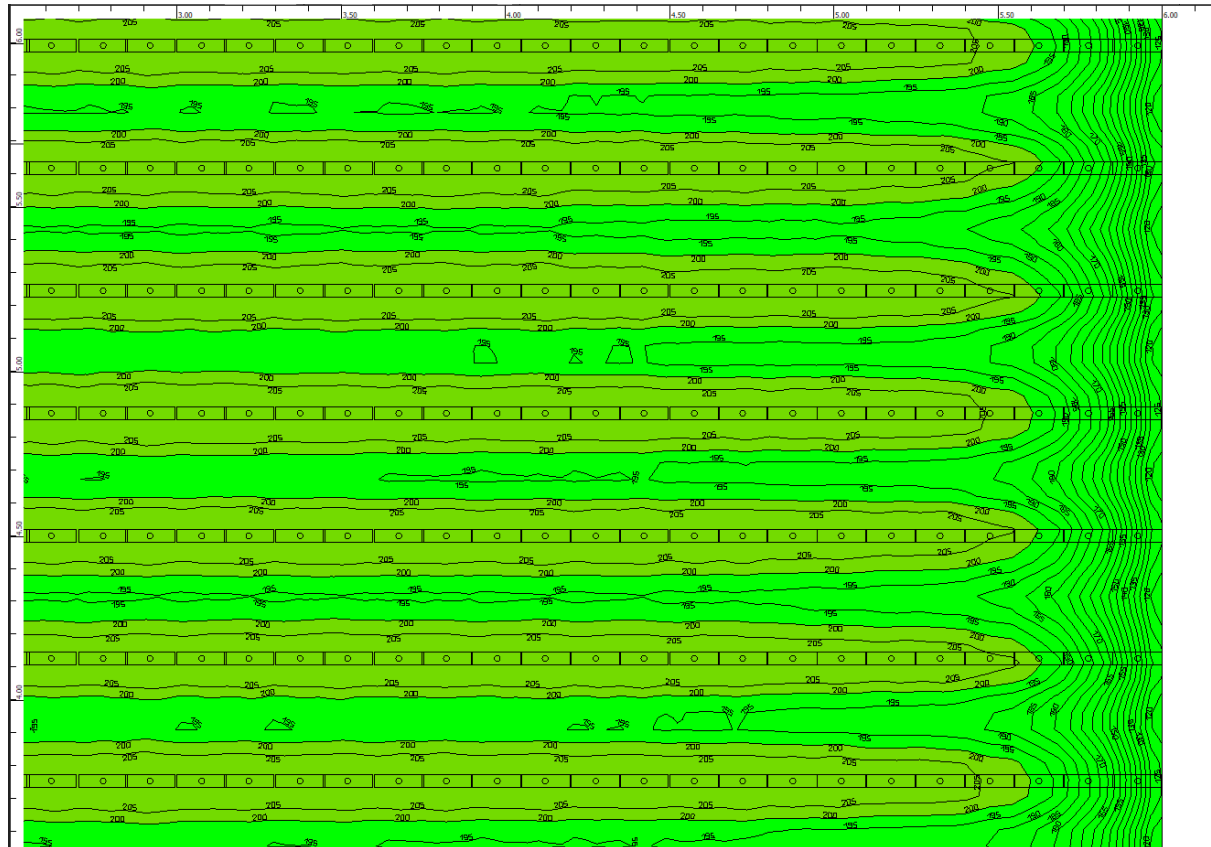
Table 3: PPFD. Across growth area excluding 35 cm from edges of growth area*.

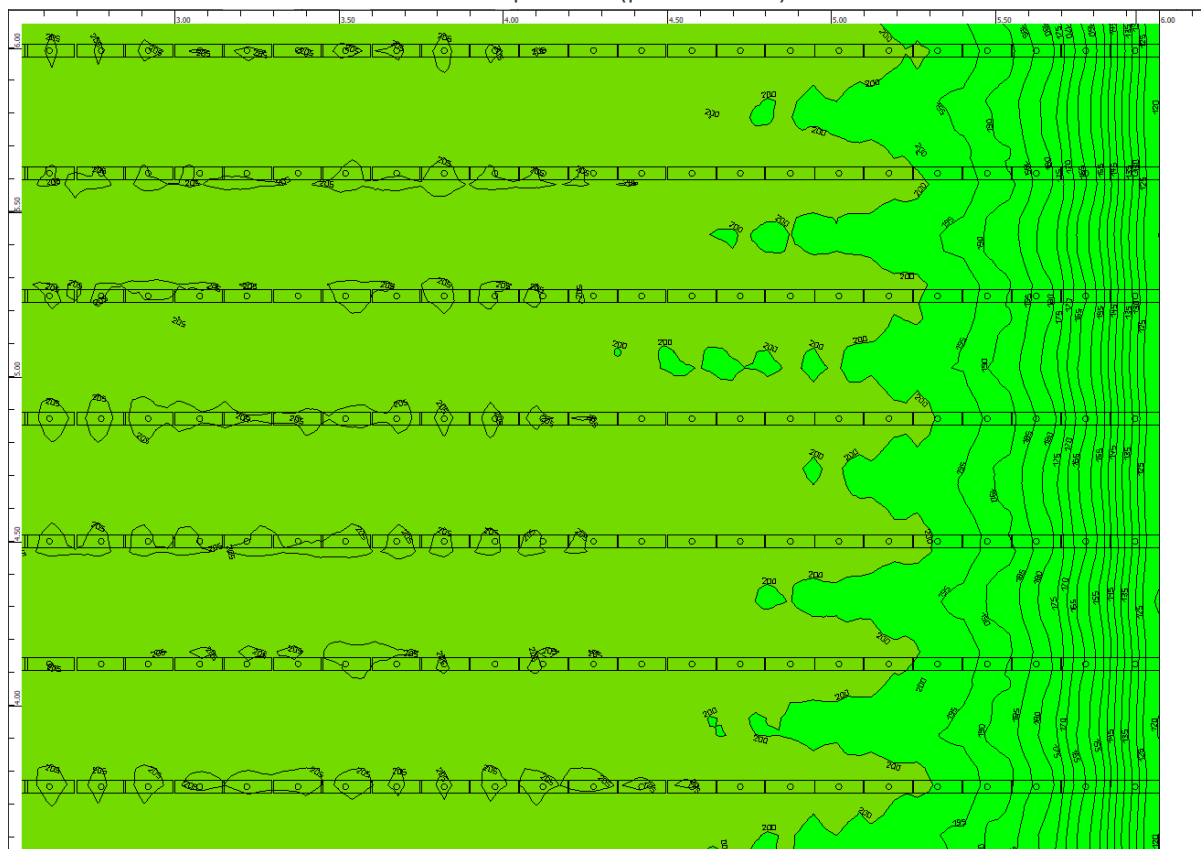
DIALux Simulation area within Growth area (yellow 3,5x2.3 m)



DIALux Simulation area – Close up:



DIALux Simulation – 20 cm below panels ($\mu\text{mol/s/m}^2$):DIALux Simulation – 30 cm below panels ($\mu\text{mol/s/m}^2$):

DIALux Simulation – 40 cm below panels ($\mu\text{mol/s/m}^2$):DIALux Simulation – 50 cm below panels ($\mu\text{mol/s/m}^2$):