TRACY® HORTICULTURE

TOPLIGHTING FOR GREENHOUSES

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 (IP67). It can easily be installed above any growth area of any size due to its modular design and a unique mounting solution which are suspended from the roof structure in any type of greenhouse.

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 80-100 µmol/m^2/s
- Homogeneity better than ±10% around average PPFD (90 µmol/m^2/s).

TRACY® Horticulture Growth Light Panel

Requirements:

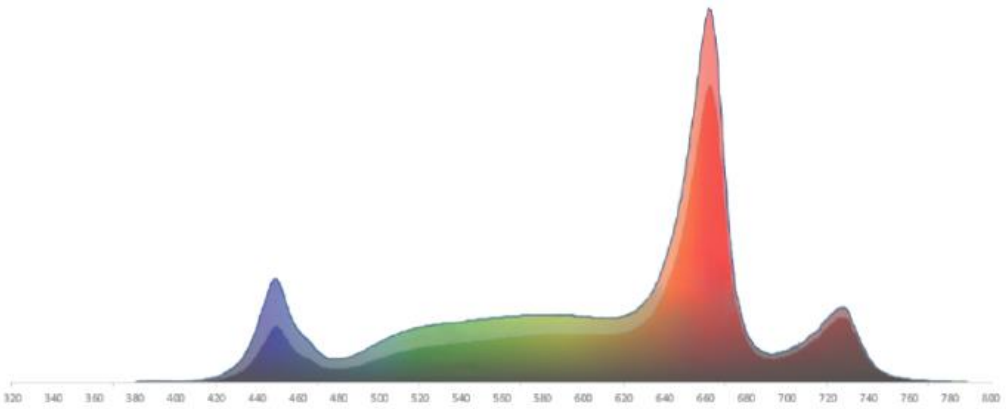
The production facility has set out the following requirements for the growth light:

- Size of each growth area is 9 x 30 meters (divided into two areas measuring 4,2x30 meters with a path in between. The size of the greenhouse is 11x32 meters
- PPFD* of up to 100 µmol/m^2/s measured at the top of the crops (final height)
- Homogeneity – better than ±10% around average PPFD (90 µmol/ m^2/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)

** PPFD 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 300 mm and LED iBond's Growth Light Drive spectrum.



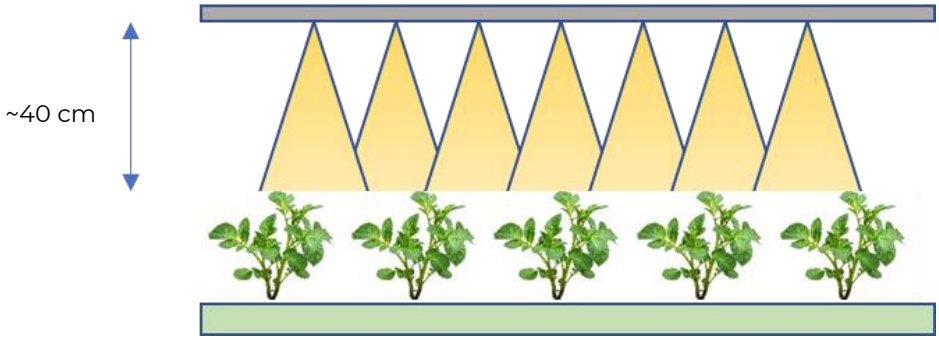
UV	Blue	Green	Red	Far red
-	440-460 nm	(Broad)	650-670 nm	720-740 nm
0 %	11 %	22 %	56 %	11 %

Height above crops

Due to the requirement of PPFD of 90 µmol/m^2/s, the required spacing between the rows of panels (center-to-center) can be calculated to be to ~0.50 meter. The estimation is done by calculating the total µmol/s generated in total by all the spots (1,680 spots in this example – see data in Table 1) over the growth area and thereafter calculate the average µmol/m^2/s by diving with the total area of the growth area (252 m^2 - see table 1 for details).

The spacing of 0.50-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 0.50 meter, and the height over the crops should therefore minimum be ~40 cm.

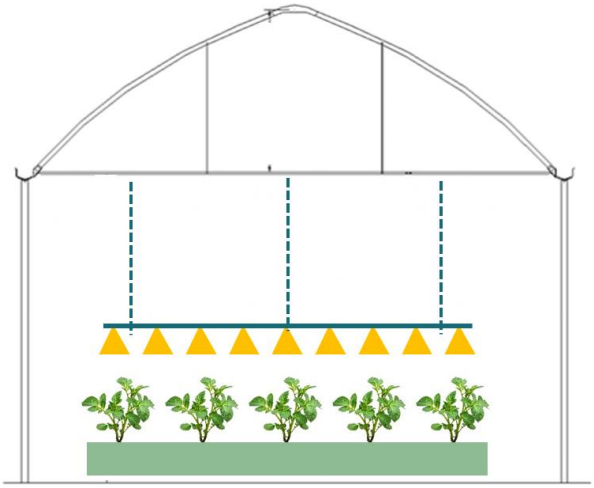


The panels can easily be placed higher than 40 cm above the crops (final height) but it will mean that an increased amount of light energy will be wasted and the PPFD measured at the crops will drop slightly.

LED iBond recommends that light panels are always placed as closed 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.

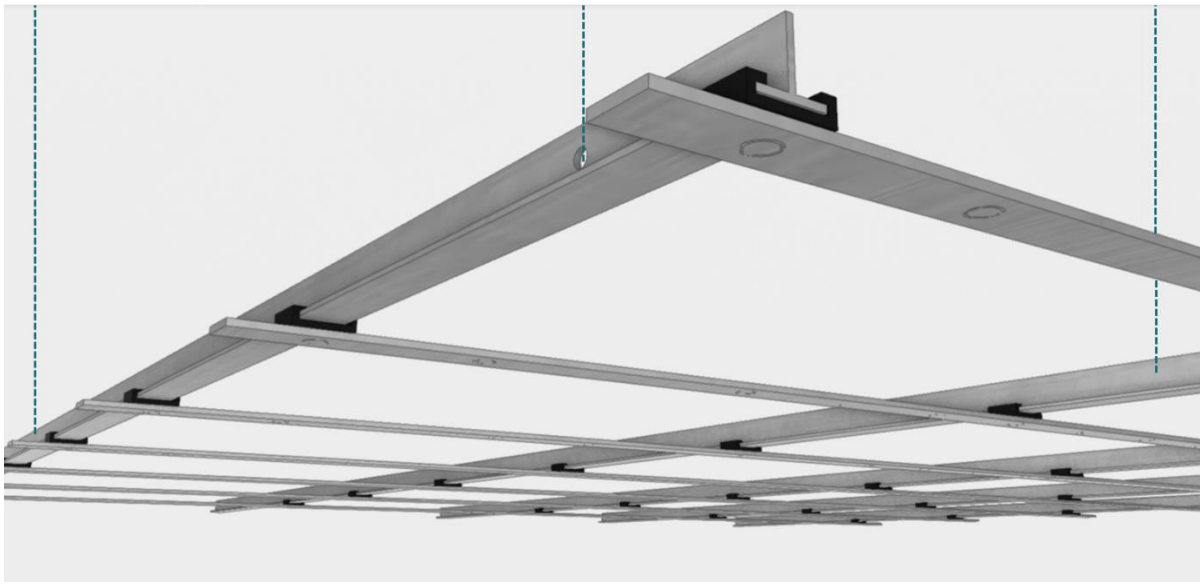
Mounting – Suspended rails

The TRACY® Horticulture growth light panels are mounted on suspended rails connected to the greenhouse roof structure with wires in a flexible configuration adaptable to any greenhouse dimensions and spacing between trusses.



The rails are light weight (aluminum) and allow for flexible configurations in terms of size (growth areas to cover) and spacing between the TRACY® Horticulture growth light panels. The TRACY® panels are mounted fast and easily with click-on brackets attached on the rails.

Rails system:



Layout of Growth Light panels

For the specific example, 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 4.2 meters due to the requirement of walking path in between the two grow areas.

Each row of 4.2 meters consists of 2 x 1800mm TRACY® panels and 1 x 600 mm TRACY® panels.

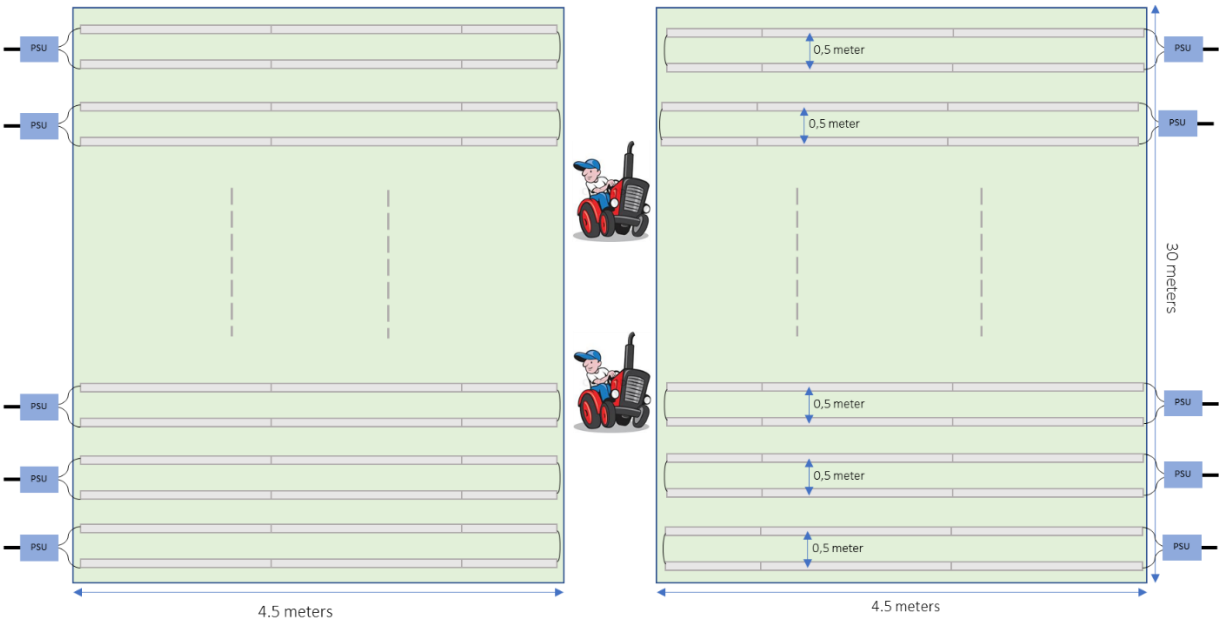


Illustration 1: Growth area with a size of 4.2x30 meters (two areas). Power supply units (PSU) are mounted at each side of the grow area for easy access and installation. The power supply units and electrical wiring are mounted directly on the suspended mounting rail system and will not interfere with crops.

Configuration data

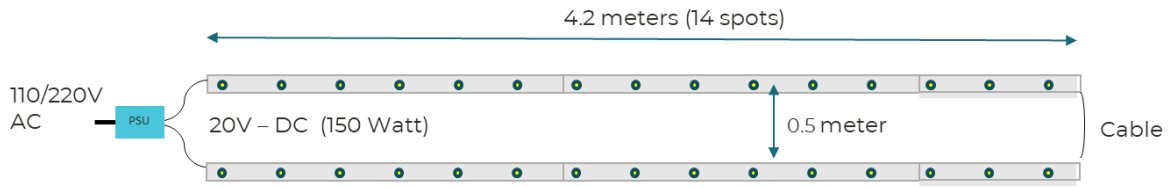
Dimensions of growth area		Units
Length	4,2	meter
Width	30	meters
Number of areas	2	
Area total	252	m2
TRACY Horticulture Configuration		
Total length of connected panels (2x4,2 meter)	4,2	meters
Panel spacing (center-to-center) - length	0,5	meters
Number of rows	60	rows
Total length of all TRACY panels	504	meters
Spot configuration		
Spot spacing (center-to-center) - width dim.	0,3	meters
Spot spacing (center-to-center) - length dim.	0,5	meters
Spots pr length (6 spot pr 1,8m panel)	14	spots
Spots pr width (1 per row)	60	
Total spots in growth area	1680	spots
Electrical configuration		
Power consumption pr spot (incl. Driver)	5,1	Watt
Power consumption total for growth pr area	8,57	Kw
Power consumption pr m2	34	Watt
Drive voltage - DC	20	V
Optical configuration		
Spectrum - Growth Light Drive		
Efficiency (incl driver)	2,70	umol/J
Radiation* pr spot @ 5.1W drive	13,0	umol/s
Radiation* total/max for total growth area	21.840	umol/s
Radiation* avg. per m2 - (with zero reflection from walls/surfaces)	87	umol/s/m2
*PBAR 320-800nm		

Table 1: Configuration data

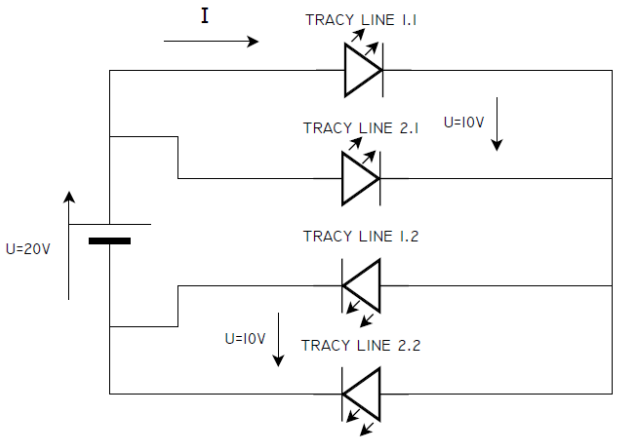
Driver configuration:

A single 20V (200W) power supply unit is used to drive two panel sections of 4.2 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):



Photosynthetic Photon Flux Density (PPFD):

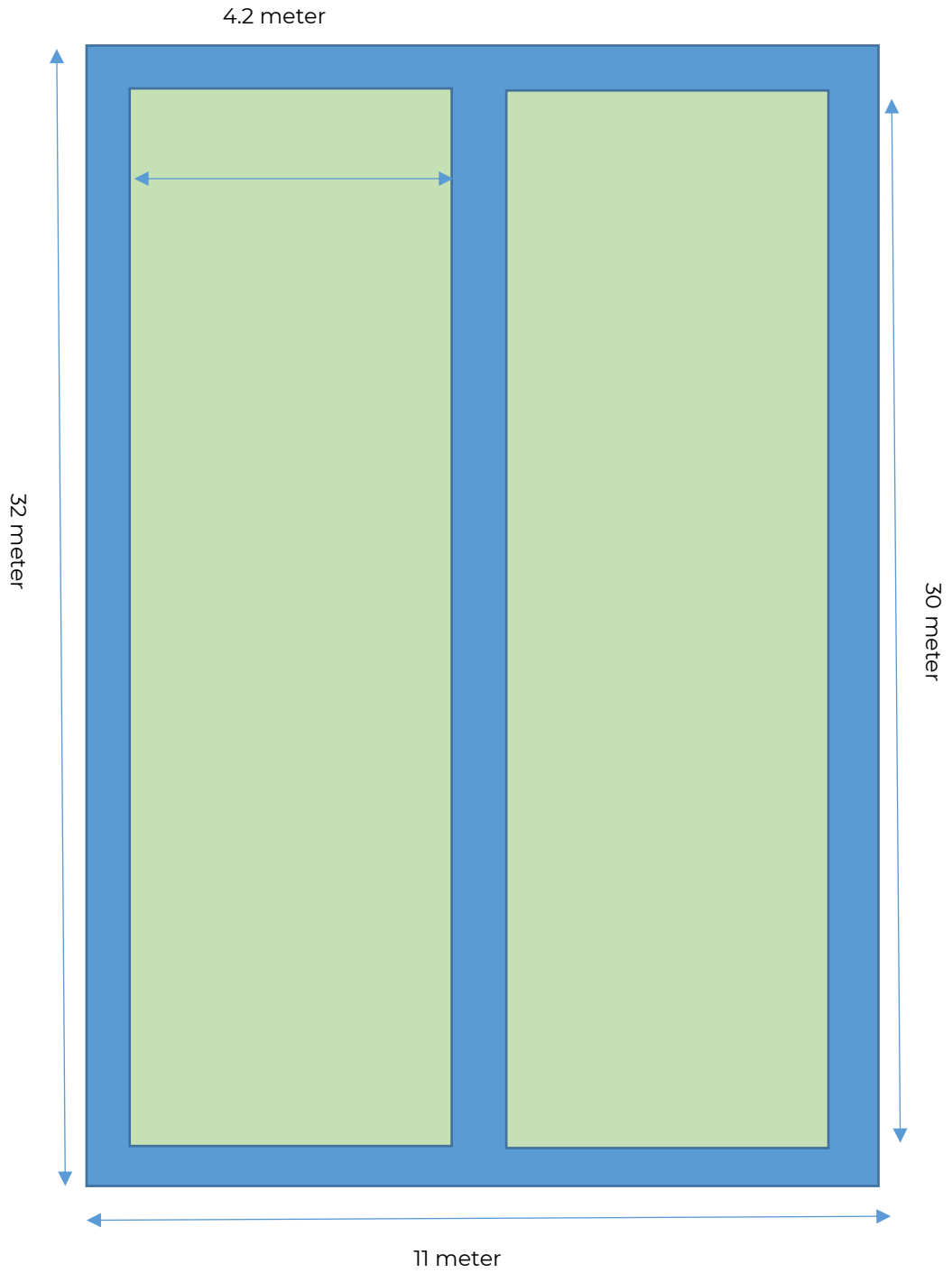
In greenhouses the required light intensity (flux density) highly depends on the type of crop to be produced. Table 1 below lists the typical requirements set by typical growers around the world. The table includes data listed by three different units.

The TRACY® Horticulture growth light panels are flexible in configuration and any flux density between 0-600 µmol/s/m^2 can be generated coving any size of growth area.

	LUX	Micromoles	Foot Candles
	(Lumen/m^2)	(µmol/s/m^2)	(10,76 lumen/m^2)
Tomatoes/Cucumbers	12-15,000	160-200	1100-1400
Lettuce	6-8,000	80-105	550-750
Herbs	7-7,500	90-100	650-700
Propagation/Nursery	6-6,500	80-85	550-600
Daytime extension	3,5-3,800	45-50	325-350

Table 2: Required Flux density depending on type of crop.

DIALux Simulation – configuration:



DIALux Simulation – 68 cm below panels (crops final height is ~30 cm)