EARTH
HORTICULTURAL LIGHTING SYSTEM

Horticultural Lighting in nurseries

from the ground up!

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Your speaker, a horticultural lighting designer and head of R&D

Anthon Human from

energywise

Better Light
Through Research.

ISO9001 CERTIFIED

Manufacturing and servicing clients from Durban, KZN

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Why Horticultural Lighting? What is the primary focus?

1. EXTEND THE GROWING SEASON

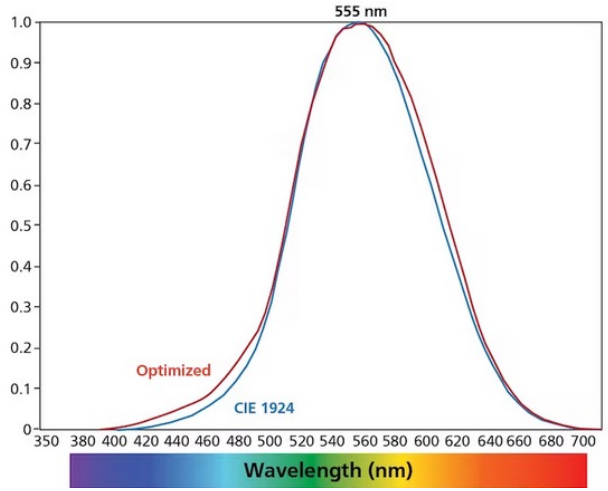
2. PROMOTE HEALTHY PLANT GROWTH

3. INCREASE YIELDS

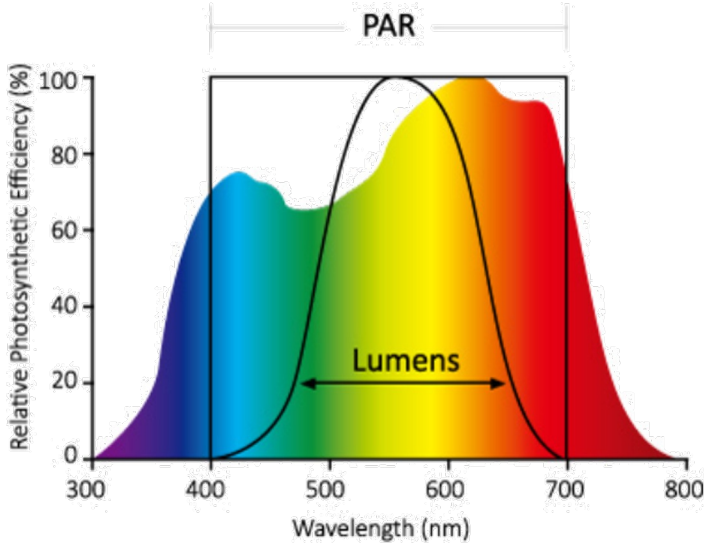
What is light?

Light is an electromagnetic wave that induces an ability

- **To Humans**
  - Between 380nm and 750nm
  - Human eye sensitivity curve
  - Sensitivity to different wavelengths
  - The ability see in 20/20 vision



- **To Plants**
  - Between 400nm and 700nm
  - PAR region
  - Blanket use of all wavelengths
  - The ability to feed itself and grow



What is horticultural light made up of?
Spectrum

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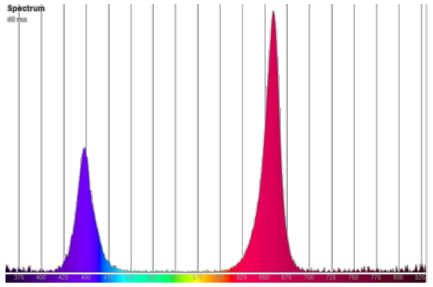
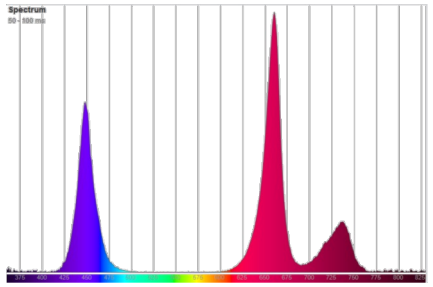
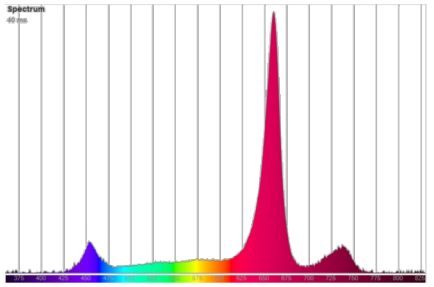
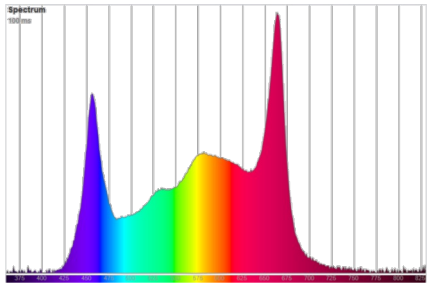
Monochromatic

- Often the most energy efficient
- Supplemental light option
- Often more costly

Full Spectrum

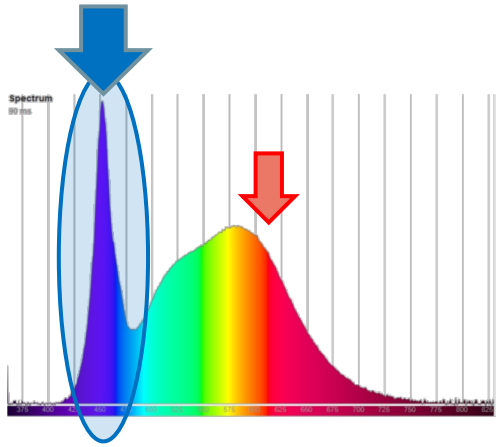
- More in tune with the Sun's (full) spectrum
- Sole source lighting / supplemental light option

What is horticultural light made up of?
Spectrum

Full, Blue-rich spectrums

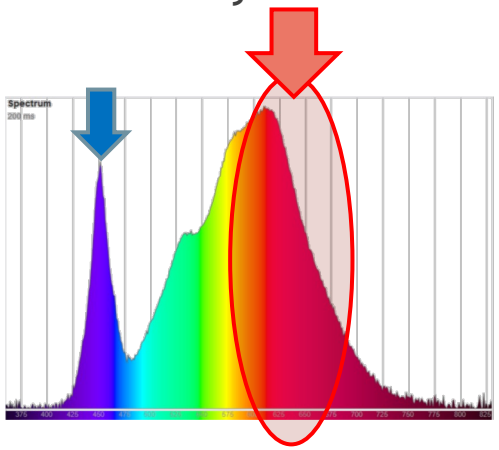
- Promoting seedling roots & vegetative leaf growth
- Short inter-nodes



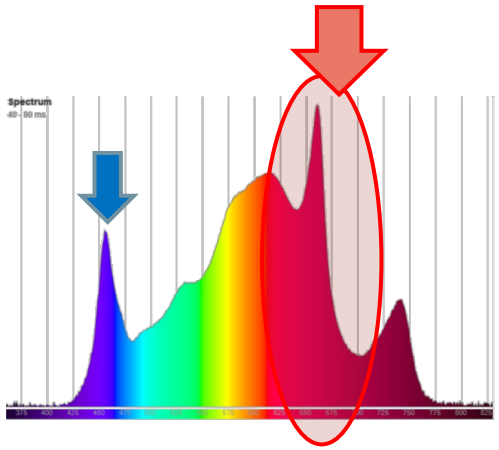
1,5:1 (blue : red)

Full, Red-rich spectrums

- Stem growth, flowering and fruit production
- Increased photosynthesis , leaf count & yield



0,45:1 (blue : red)



0,3:1 (blue : red)
3,6:1 (Red : Far Red)

What is horticultural light made up of?
Spectrum – *important take-aways*

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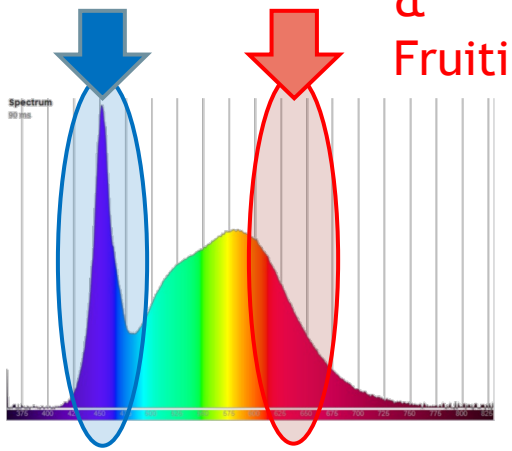
Easily identify spectrums

Propagation & Vegetative Growth

Flowering & Fruiting



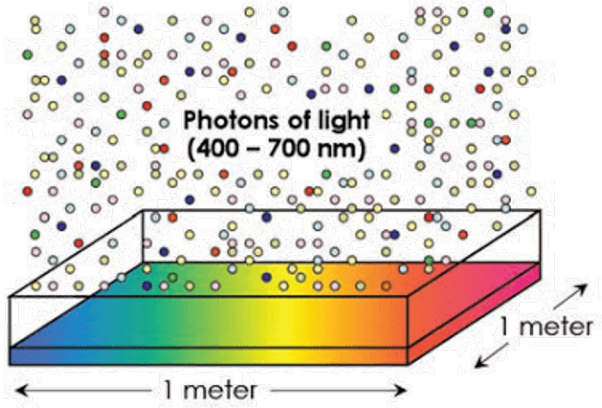
UV I BLUE I GR/Y I RED I FAR RED

Which is best?

- Spectrums are quite generalised – blue-rich / red-rich
- You are not looking for a particular perfect spectrum
- Desktop studies of internet research papers often yield their results (about spectrums) in ratios of blue to red or red to blue and often red to far red ratio – ask your lighting designer for ratio solutions

What is horticultural light made up of?

Intensity



µmol “micro Moles”

- Quantity of photons (plant food)
- Often spoken as “u-Moles” or micro Moles

The  Sees with Lumens

The  feeds with micro Moles

Both are the same electromagnetic waves – just different names

&

PPFD (µmol/m^2/s)

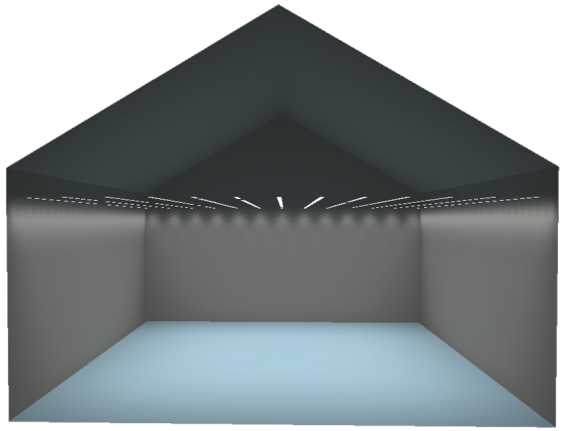
- Is the intensity value
- Is the quantity of plant food light photons, per meter squared, per second
- Used in conjunction with photoperiod to determine the Daily Light Integral (DLI)

Lux ⟺ light intensity ⟺ PPFD

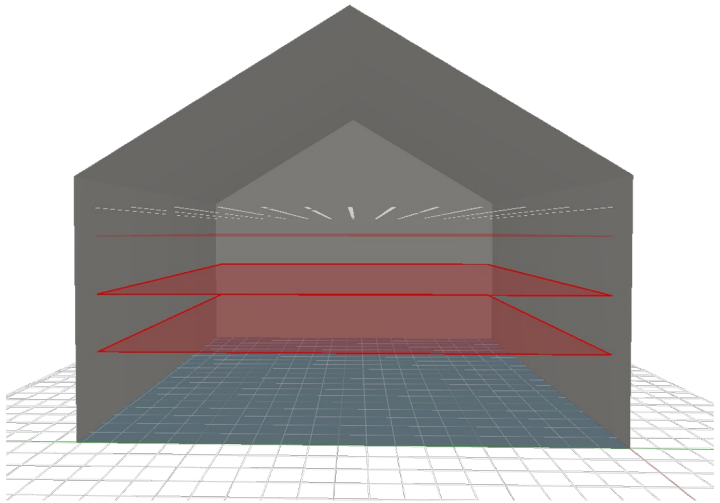
Image courtesy of HortAmericas.com

What is horticultural light made up of?
Intensity – *important take-aways*

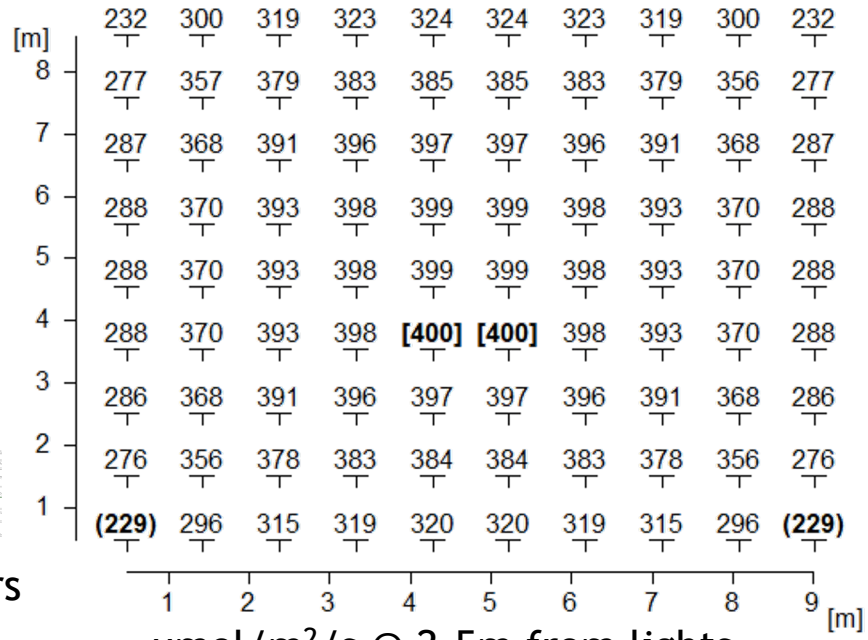
- PPFD is an intensity value required to make up a particular DLI over the photoperiod
- PPFD maps (often referred to as PAR maps) show the range of µmol/m²/s (light intensity) over a particular plant grow space – easily generated through simulation software – the map shows intensity values over the grow space at a particular distance away from the light source/s



Simulation of 9.6m wide grow tunnel – 10m section



Red rectangles are simulation answers at distances from the lights



µmol/m²/s @ 2.5m from lights

Describing the plants wants and needs - Duration of light - Photoperiod

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- The number of light hours a plant receives in 1 day – put simply, how many hours the plant is “awake” to feed and grow.
- The optimal photoperiod is given per plant, per growth cycle/ stage – so you may find propagation and vegetative growth cycles photoperiods are similar and the flowering photoperiod something else. Often simulating seasons that induce /stress the plants into different growth cycles/ stages
- Remember that under the sun’s capabilities, the photoperiod will have dawn and dusk times that do not reach the optimal light intensity

Describing the plants wants and needs - Amount of light - DLI

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- plant Daily Light Integral (DLI) is an optimal value (researched to be beneficial) of the total amount of light that should be received in 1 day.
- Optimal plant DLI's are given per growth cycle
- DLI is measured in mol/day whereas intensity is micro-moles/m^2/second
- DLI = PPFD $_{(intensity)}$ x light hours per day $_{(photoperiod)}$ x (3600/1000000)

Describing the plants wants and needs - *Important take-aways – research!*

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- Research your crop/s on the internet – try to find DLI's and/ or photoperiods for the stages of growth you are concerned with
- After some simple calculations you can produce the "magic numbers", an intensity for a particular number of hours
- There is a lot of information on the internet on how to do trials to find out optimal DLI, intensity and photoperiod – lead your field!
- P.S. – Did you see anything about spectrums? Anything worth trying?

Practical application of the theory
-now it gets really interesting!

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- Now that you know what your crop can optimally handle, its time to understand what you are giving it at the moment, and then throughout the year?
- Today in Port Edward we have just under 13 hours of daylight with fewer hours at any optimum intensity value, the first of January had just over 14 hours daylight and 21 June bottoming out at just over 10 hours daylight.
- Lets just assume, for low intensity requirements, that the first and last hour of each day equate to 1 full hour at optimal intensity – best case as I see it – so that's 13 optimal intensity hours on 1 January and 9 hours mid Winter
- What if your seedlings/ transplants could handle that intensity for 18 hours?
- 28% more time at optimum growth conditions mid Summer and 100% more time at optimum growth conditions mid Winter

Practical application of the theory
-now it gets serious!

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- An advantage can be key to success in a competitive market
- Knowledge is power! – Create your own advantage
- You need to be able to measure – installed and personal device sensors are available in the market. Personal devices can measure intensity at a moment and installed devices can measure DLI over a day
- Run trials, record data… Agriculture 4.0, it has been given a name.
- This is your time.

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LI-COR Environmental

ASENSETEK
Extend your sense

Thank you

-The Full Earth range of products

EARTHbay
Horticulture, Open areas etc

Standard
Height: 2.5m
IP: 65
Temp: 35°C

EARTHplate
Horticulture, Rack/ Under shelf etc

Standard
Height: 0.5m
IP: 65
Temp: 35°C

EARTHpod
Horticulture, Propagation, Racks etc.

Standard
Height: 0.2m
IP: 65
Temp: 35°C

EARTHaxis
Grow tent horticulture

Standard
Height: 0.2m
IP: 65
Temp: 35°C

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