

# Refond Horticulture Lighting



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- Applications of Horticulture Lighting
- Comparison of horticulture light sources
- Refond Products & Solutions
- Horticulture Lighting Examples



# Common Applications of Horticulture Lighting

Layered/Vertical lighting



Inter lighting

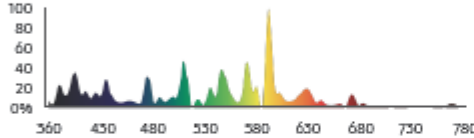
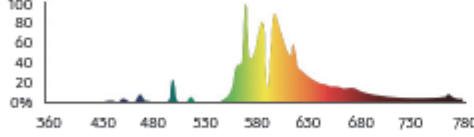
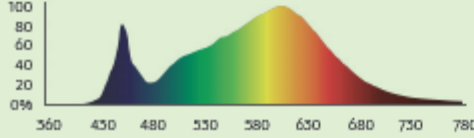


Top Lighting



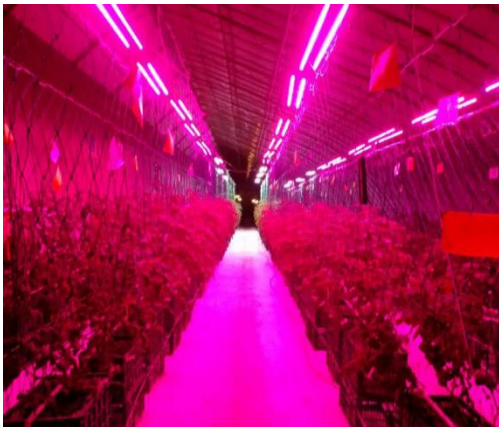
# Comparison of horticulture light sources



	Spectrum	Controllability	Design Flexibility	Efficacy ( $\mu\text{mol/J}$ )	Warm-up Time	Heat	Lifetime (hrs)
Fluorescent		Low	Low	1.0	Short	Low	< 20,000
MH		Low	Low	1.4	Long	High	< 20,000
HPS		Low	Low	1.8	Long	High	< 30,000
LED		High	High	> 2.5	Short	Low	> 50,000

Fluorescent lamp

HPSL(high pressure sodium lamp)



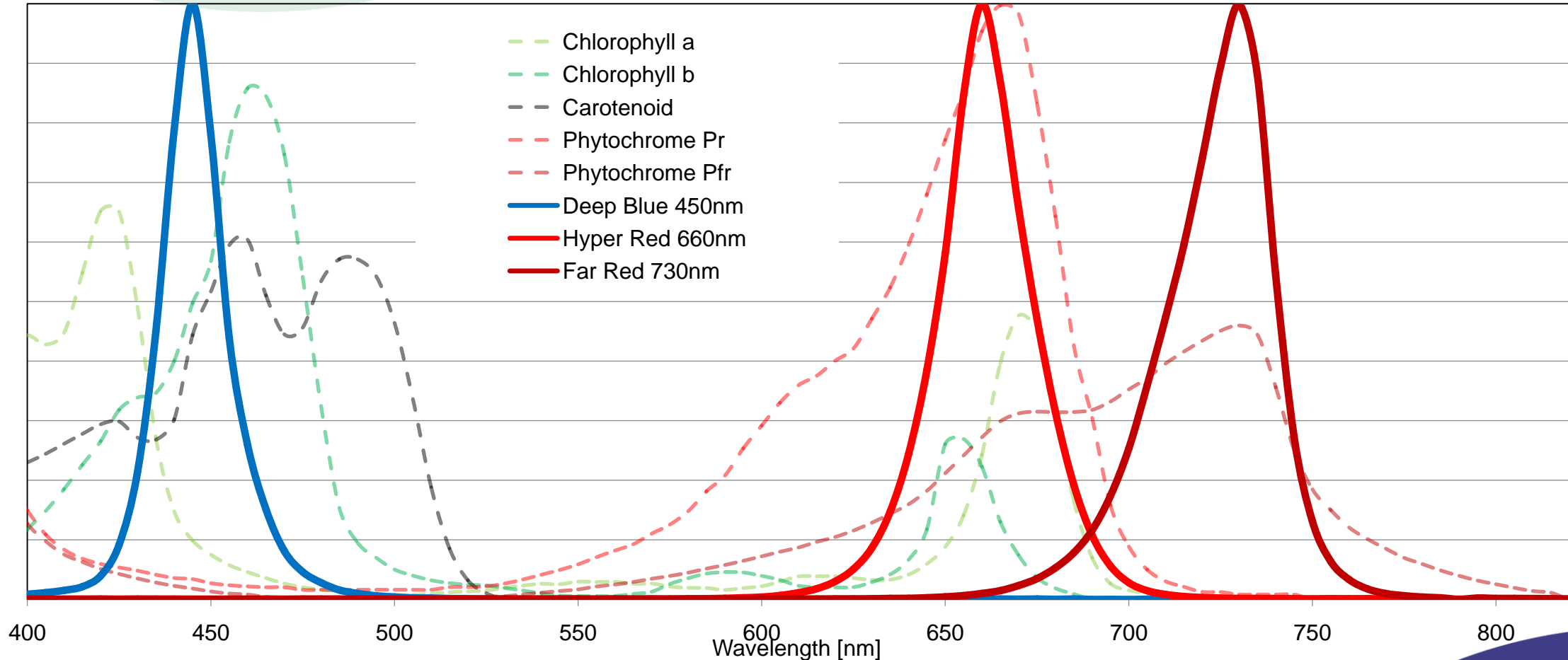
MG(metal halide)

LED lamp



## The advantages of Refond LED for horticulture lighting

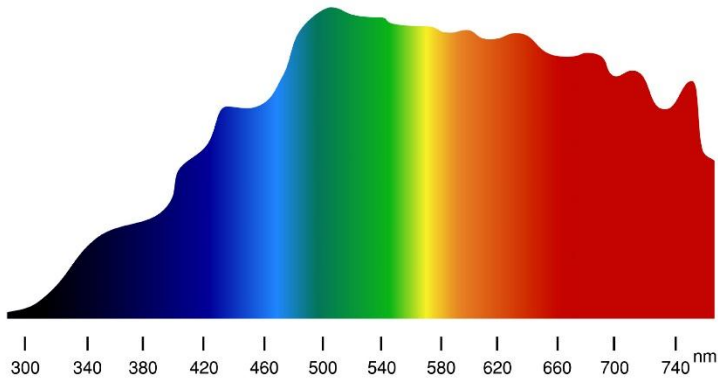
- More wavelength options and can be absorbed by plants more efficiently
- We are focusing in horticulture lighting on the 450nm, 660nm and 730nm LEDs



# The advantages of Refond LED for horticulture lighting

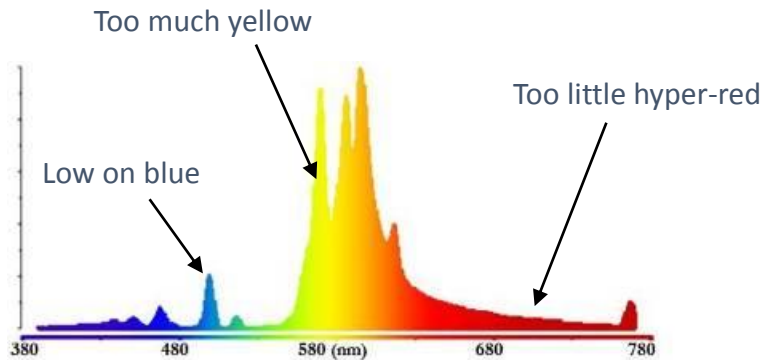
Compared with traditional light sources, it can output the most efficient spectrum

## Sunlight

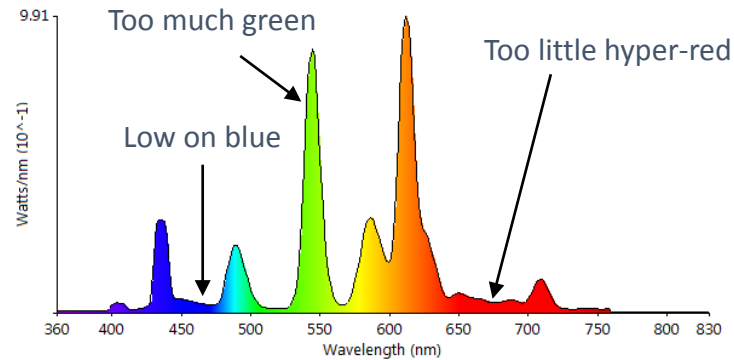


- Sunlight has spectral characteristics and release various wavelengths at the same time
- But plants can only absorb specific wavelengths through specific pigments
- Full spectrum is not really needed by plants or even organisms

## HPS lamps



## Fluorescent (CFL)



**Main disadvantage of traditional :** fixed spectrum, which cannot be adjusted according to plant needs

# The advantages of Refond LED for horticulture lighting

Light can affect plant nutrients

## □ Increase the proportion of blue light (380-500 nm)

Increase the content of vitamin C

When the ratio of red to blue is 8:2, the growth is good and the anthocyanin content is high

## □ Reduce the proportion of blue light (380-500 nm)

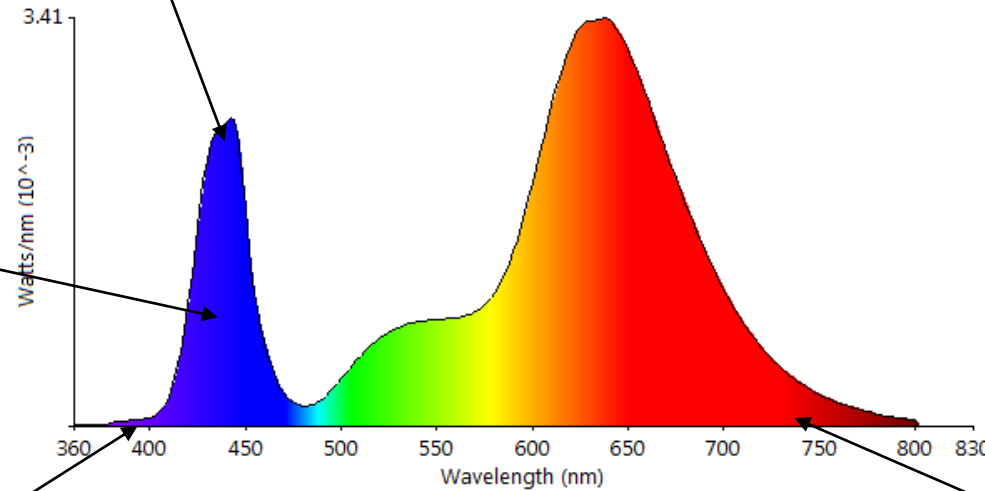
Antioxidant capacity and secondary metabolism decreased significantly

## □ UV-A (<400 nm)

Improved phenolic content and antioxidant capacity  
The plant is more fragile

## □ Photosynthesis accelerated significantly

When the red to blue ratio is 3:7, the antioxidant capacity and secondary metabolism increase significantly.



lettuce

### Good Taste



Ingredients of plants can be steered with specific wavelengths.

Voice of the customer: **"My end customer only buys tomatoes from greenhouses with artificial LED-Lighting"**

### High Yield



LEDs can offer every spectrum which is necessary to offer the most efficient growth of plants.

**Between 25-40% more biomass with LED lighting**

### Perfect Flexibility



Greenhouses can be built significantly lower with artificial LED light due to much lower heat radiation.

**Interlight can be realised which simplifies luminaire installation**

### Best Energy-saving

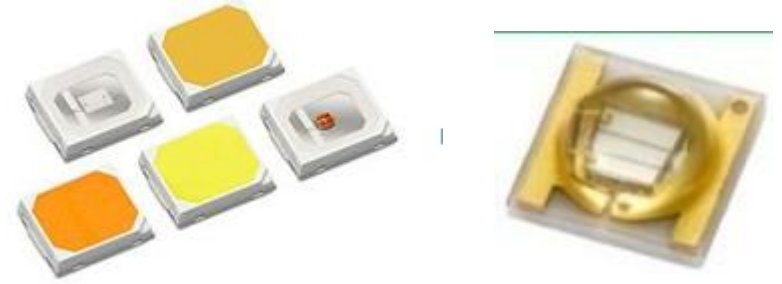


LEDs luminaires consume **50 % less energy than HPS**, which offers an environment friendly production of fruits and vegetables.



# The advantages of Refond LED for horticulture lighting

High reliability - Robust even in humid environment



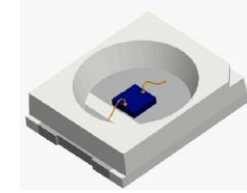
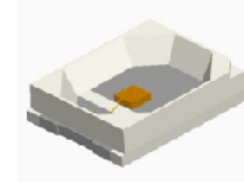
## The advantages of LED for horticulture lighting

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1. **Customizable Spectrum** – design the most suitable spectrum for different plants and output the most efficient spectrum
2. **Low Heat Release** – can be close to the plants and do not burn plants
3. **Tunable Optical** – can simulate the changable sunlight intensity
4. **Flexible Design** – compact package, can be placed in anywhere you like to reduce light loss and increase light usage
5. **Low power dissipation** – compared with other horticulture light source, it can save 10%~20% of electricity
6. **Long life time** – save maintenance costs

# Refond Horti lighting LED series

## 2835 PACKAGE 0.2W

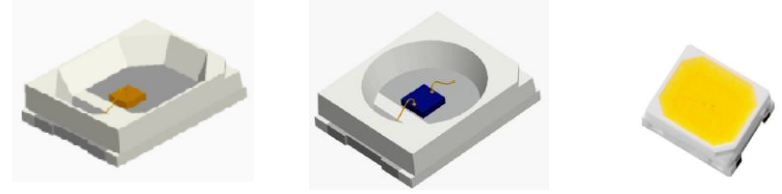


Description	Color	Part Number	Product Type	Product Stage	Test current	Wavelength (nm)	Declared lumen@IF 25°C	VF(V)
Horti 2835 0.2W	Blue	RF-BNRI35TS-CK-N	HORTICOLTURE LED	Mass production	60mA	465-475	3-6lm	2.8-3.5
	Blue	RF-BNRI35TS-EE-N-Y	HORTICOLTURE LED	Mass production	60mA	450-455	2-4lm	2.8-3.2
	Green	RF-GNRI35TS-CK-N	HORTICOLTURE LED	Mass production	60mA	515-530	16-22lm	2.8-3.5
	Orange	RF-OURI35TS-CH-N	HORTICOLTURE LED	Mass production	60mA	615-630	8-13lm	1.8-2.4
	Red	RF-OURI35TS-EE-N-Y	HORTICOLTURE LED	Mass production	60mA	635-640	3-6lm	2.0-2.4
	Yellow	RF-YURI35TS-AF-N	HORTICOLTURE LED	Mass production	60mA	585-595	5-10lm	1.8-2.6



# Refond Horti lighting LED series

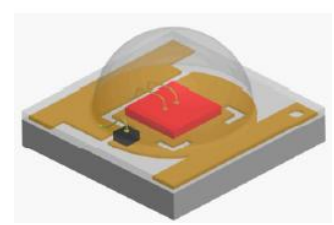
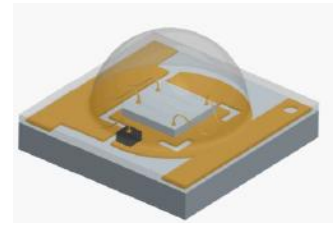
## 2835 PACKAGE 0.5W



Description	Color	Part Number	Product Type	Product Stage	Test current	Wavelength (nm)	Declared lumen@IF 25°C	VF(V)
Horti 2835 0.5W	Far Red	RF-AL-T28352H0FR-00	HORTICULTURE LED	Samples satge	150mA	730-740	≥90mW	1.8-2.6
	Far Red	RF-AL-T28352H0FR-01	HORTICULTURE LED	Samples satge	150mA	730-740	90-140mW	1.8-2.6
	Deep Red	RF-AL-A28352H0DR-01	HORTICULTURE LED	Samples satge	150mA	655-670	110-200mW	1.8-2.6
	Red	RF-OURI35TS-EK-J	HORTICULTURE LED	Mass production	150mA	620-630	14-24lm	1.8-2.4V
	PC Amber	RG-PARI35DS-EF	HORTICULTURE LED	Samples satge	150mA	/	40-60lm	2.8-3.4V
	PC Amber	RF-WYRI35DS-DF-J-Y	HORTICULTURE LED	Mass production	150mA	/	50-65lm	2.8-3.4V
	Mint	RG-MIRI35DS-EF	HORTICULTURE LED	Samples satge	150mA	/	75-95lm	2.8-3.4V
	Lime	RG-LIRI35DS-EF	HORTICULTURE LED	Samples satge	150mA	/	75-95lm	2.8-3.4V
	Green	RF-GNRI35TS-DK-J	HORTICULTURE LED	Mass production	150mA	520-530	33-55lm	2.8-3.5V
	Cyan	RF-CYRI35TS-EF	HORTICULTURE LED	Samples satge	150mA	490-510	25-45lm	2.8-3.4V
	Blue	RF-BNRI35TS-DK-J	HORTICULTURE LED	Mass production	150mA	465-475	8-18lm	2.8-3.5V
	Royal Blue	RF-AL-A28352H0RB-00	HORTICULTURE LED	Samples satge	150mA	440-460	typ 200mW	2.8-3.6V
	White	RF-W57HI35DS-FH-J	HORTICULTURE LED	Mass production	150mA	5700K	65-80lm	2.8-3.4V
	White	RF-W30HI35DS-FH-J	HORTICULTURE LED	Mass production	150mA	3000K	65-80lm	2.8-3.4V
	White	RF-W40HI35DS-FH-J	HORTICULTURE LED	Mass production	150mA	4000K	65-80lm	2.8-3.4V

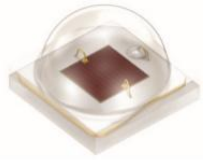
# Refond Horti lighting LED series

## Ceramic 3535 PACKAGE 1W

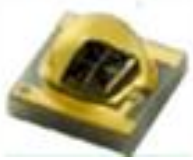


Description	Color	Part Number	Product Type	Product Stage	Test current	Wavelength (nm)	Declared lumen@IF 25°C	VF(V)
Horti Ceramic 3535 1W	White	RF-IMXC35LT-AB	HORTICOLTURE LED	Samples satge	≤700mA	2750-3200k	>90lm	2.8-3.4V
	White	RF-WNXC35LT-AB	HORTICOLTURE LED	Samples satge	≤700mA	3700-4250k	>100lm	2.8-3.4V
	White	RF-WMXC35LT-AB	HORTICOLTURE LED	Samples satge	≤700mA	5500-6850K	>120lm	2.8-3.4V
	Royal Blue	RC35E1-SBE-FR	HORTICOLTURE LED	Mass production	350mA	440-450nm	560mW	2.8-3.6V
	Blue	RC35E1-BNE-FR	HORTICOLTURE LED	Mass production	350mA	450-470nm	460mW	2.8-3.4V
	Red	RC35E1-RUD-FR	HORTICOLTURE LED	Mass production	≤700mA	615-630nm	>40lm	1.8-2.6V
	Deep Red	RC35G1-RBD-FR	HORTICOLTURE LED	Mass production	≤700mA	655-665nm	>224mW	1.8-2.6V
	Far Red	RC35E1-IRD-FR	HORTICOLTURE LED	Mass production	≤700mA	730-740nm	>224mW	1.8-2.6V
	Royal Blue	RF-C35R1-SBE-FR(45mil)	HORTICOLTURE LED	Mass production	≤700mA	435-450nm	>710mW	2.8-3.6V
	Deep Red	RF-C35H1-RBD-FR(45mil)	HORTICOLTURE LED	Mass production	≤700mA	655-670nm	>620mW	1.8-2.6V
	Far Red	RF-C35H1-IRD-FR(45mil)	HORTICOLTURE LED	Mass production	≤700mA	730-740nm	>560mW	1.8-2.6V
	Cyan	RC35E1-PGE-FR	HORTICOLTURE LED	Mass production	≤700mA	500-510nm	>224mW	3.2-3.6V
	Green	RF-C35E1-GNE-FR	HORTICOLTURE LED	Mass production	≤700mA	520-530nm	>224mW	3.2-3.6V
	Amber	RC35E1-AUD-FR	HORTICOLTURE LED	Mass production	≤700mA	600-610nm	>110mW	3.2-3.6V

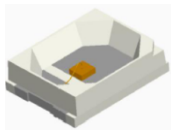
# Horti led Roadmap



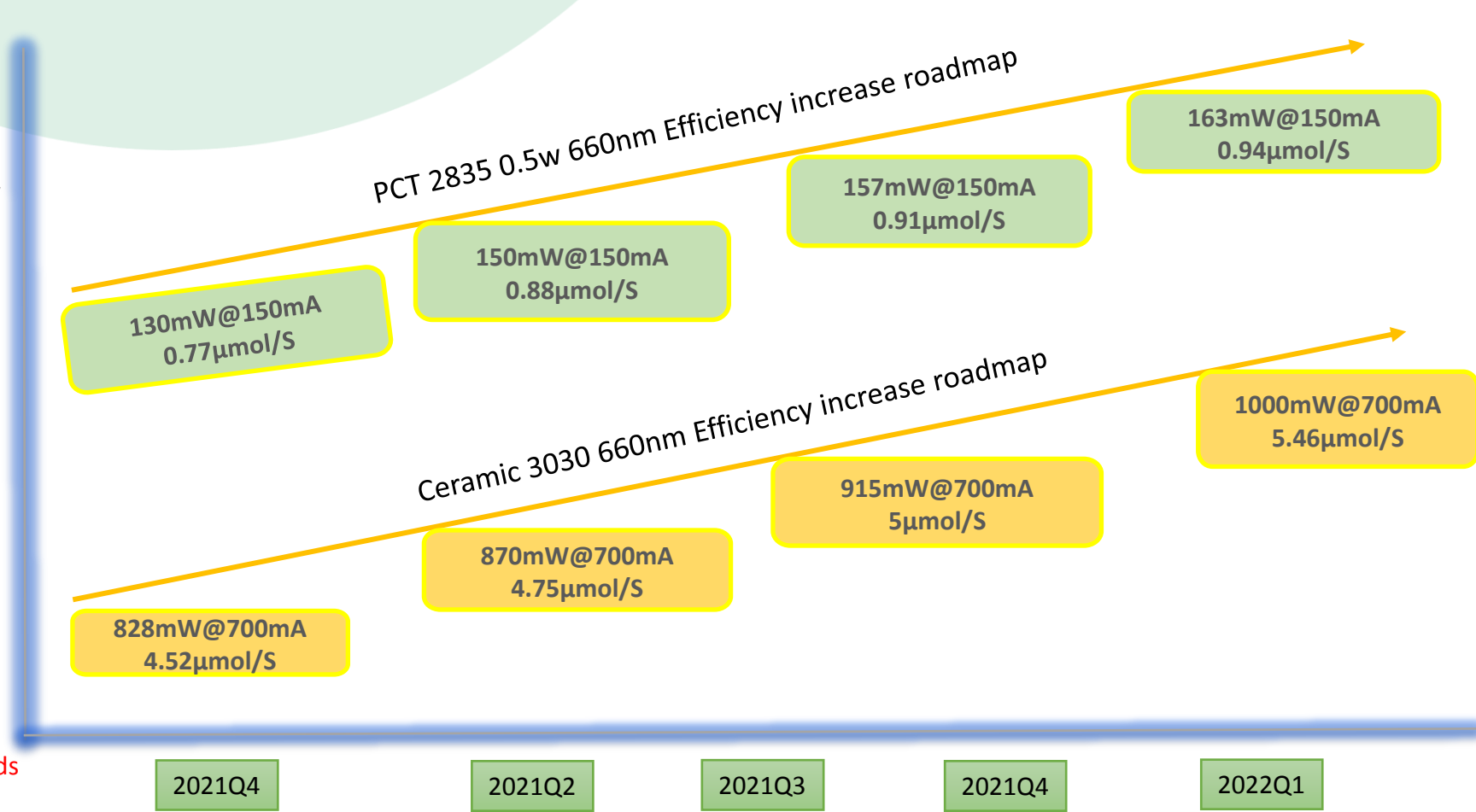
Ceramic **3030** 1-3W  
Benchmark Osram



Ceramic **3535** 1-2W



PCT **2835** 0.5W  
Benchmark Lumileds



## Features:

Different package sizes: 2835, 3030, 3535

From low-Mid power to High power LEDs

Several different light colors/wavelengths

ROHS Compliant

## Application:

Horticultural TOP lighting (Greenhouse)

Interlighting

Vertical Farming



## What are typical $\mu\text{mol/s.m}^2$ values for horticulture lighting?

### What light level for what type of crop?

Plant	min $\mu\text{mol/s.m}^2$	max $\mu\text{mol/s.m}^2$	typical $\mu\text{mol/s.m}^2$
Tomato	170	200	185
Pepper	70	130	100
Cucumber	100	200	150

### What light level for what potted plant?

Plant	min $\mu\text{mol/s.m}^2$	max $\mu\text{mol/s.m}^2$	typical $\mu\text{mol/s.m}^2$
Orchid/Phalaenopsis	80	130	105
Dendrobium	130	260	195
Bromelia	40	60	50
Anthurium	60	80	70
Kalanchoë	60	105	82,5
Potted chrysanthemum	40	60	50
Potted rose	40	60	50
Geranium	40	60	50
Orchid/Phalaenopsis	80	130	105

### What light level for what cut flower?

Plant	min $\mu\text{mol/s.m}^2$	max $\mu\text{mol/s.m}^2$	typical $\mu\text{mol/s.m}^2$
Chrysanthemum	105	130	117,5
Rose	170	200	185
Lily	80	100	90
Lisianthus	170	200	185
Alstroemeria	60	105	82,5
Anthurium / Orchid – cut	80	105	92,5
Freesia	70	105	87,5
Gerbera	80	105	92,5
Tulip	25	40	32,5

## Examples

### Product feature

**Material :** Alu + Lens

**Size :** L602 x W108 x H46mm

**Power:** 80W

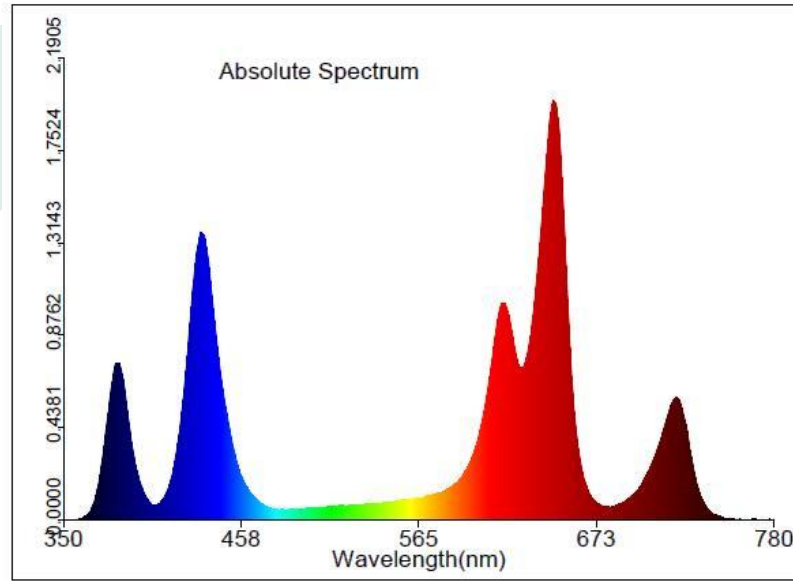
**Input voltage:** 100-277VAC

**Light Source :** Refond LEDs

**Usage Environment :** Indoor Farming for MMJ

**Emitting Color :** Red 660nm /Blue 440nm/  
White 2700K/UV/Far Red 730nm

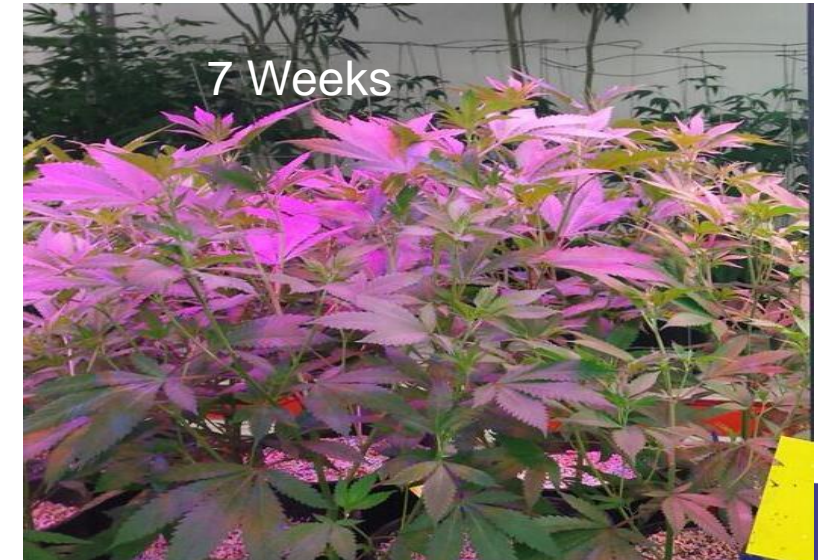
## Spectrum:



## PPFD:

● 0		
● 0.1m	1171.765	umol/ (m <sup>2</sup> .s)
● 0.2m	798.76	umol/ (m <sup>2</sup> .s)
● 0.3m	625.59	umol/ (m <sup>2</sup> .s)
● 0.4m	550.77	umol/ (m <sup>2</sup> .s)
● 0.5m	448.27	umol/ (m <sup>2</sup> .s)
● 0.6m	353.01	umol/ (m <sup>2</sup> .s)

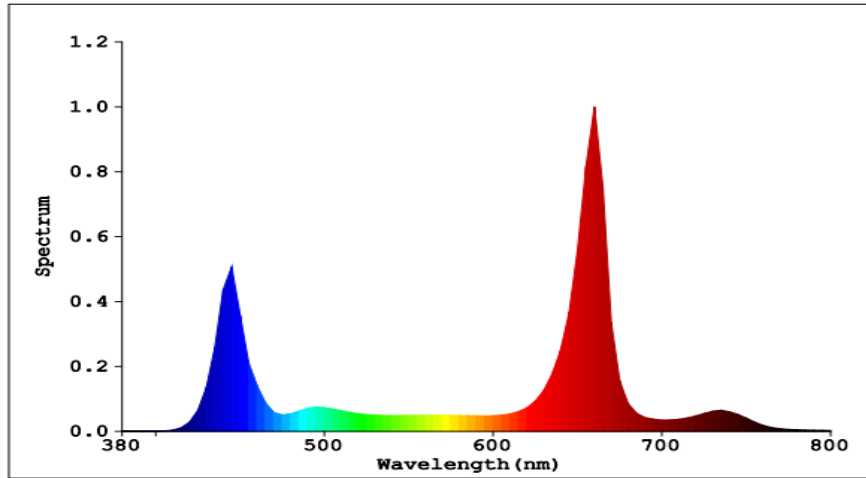
## Effect picture



# Examples

## Fruit plant lamp specifications

### 2.Specifications:



Linear light

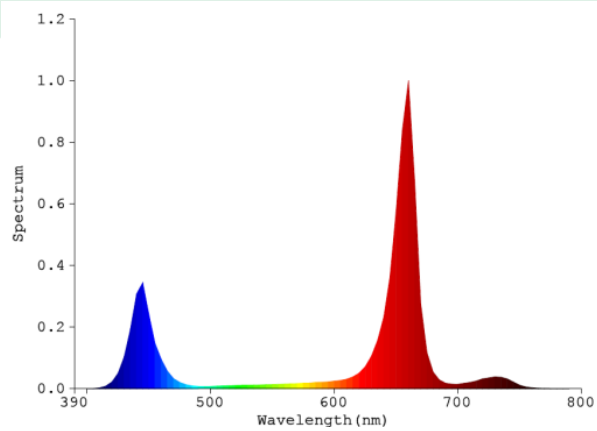
Material	Material Model	QTY	Unit
LED	RF-W65QI35DS-EF-N-Y E2 6500K full spectrum LED	24	PCS
LED	RA32E1-RUT-FR 660nm red LED	66	PCS
LED	RA32A1-BNU-FR 450nm blue LED	12	PCS
LED	RA32E1-IRT-FR 730nm infrared LED	6	PCS
Shell parameter	Aluminum & PC cover dimension: L510mm*W30*H10.5mm		
Power parameter	175-265V 50-60HZ 20W		
BOM	RF-MTPN2A2N48E-R1		



# Examples

## Cannabis cultivation

### 2.Specifications:



Linear light

Material	Material Model	QTY	Unit
LED	RF-P3HI32DS-FF-J 55-70lm 2.8-3.4V white light LED	6	PCS
LED	RA32E1-RUT-FR 655-665nm red LED	60	PCS
LED	RA32A1-BNU-FR 440-455nm blue LED	12	PCS
LED	RA32E1-IRT-FR 730-740nm infrared LED	6	PCS
Shell parameter	Aluminum & PC cover dimension: L510mm*W30*H10.5mm		
Power parameter	175-265V 50-60HZ 20W		
BOM	RF-MTPTXA3N36M-R1		

# Examples

## The role of light radiation in plant growth

### Plant Growth Spectrum - Customer Case

