

LED EVENT 2016

Design en engineering trends voor LED-applicaties



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BE WOENSDAG 30 NOVEMBER 2016 TECHNOPOLIS, MECHELEN NL DONDERDAG 1 DECEMBER 2016 CONGRESCENTRUM 1931 BRABANTHALLEN, DEN BOSCH

Evolution has tuned plant survival mechanism to sunlight For billions of years over 300,000 species of plants adapted to this single light source





Human evolution

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Human species has only just emerged; LED technologies have been developed to appeal to the eye sensitivity



Spectrum for humans

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Human species has only just emerged; LED technologies have been developed to appeal to the eye sensitivity, like cool white:



Spectrum for humans

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Human species has only just emerged; LED technologies have been developed to appeal to the eye sensitivity, like RGB:





Spectrum for humans

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Human species depends on more wavelengths for Vitamin D, Human Centric Lighting, warmth, etc



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- There is no single 'next best' light source to sunlight
- Every plant may have slightly different needs and every farmer may have different views on the best recipe. Let the grower be the cook: the lighting industry merely present the most relevant ingredients

The following options can be found:





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Photosynthesis requires:



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Photomorphogenesis and Photoperiodism require:



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The action spectrum with UVA to defend against diseases





Source: Leo Ledgrow



Spectral plant preference

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The action spectrum resembles sunlight except infrared



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The action spectrum resembles sunlight except infrared



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There is no single 'next-best' source to sunlight: **Blue-Red**



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There is no single 'next-best' source to sunlight: **Blue-DeepRed (660nm)**



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There is no single 'next-best' source to sunlight: **Blue-DeepRed (660nm)-FarRed (740nm)**



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There is no single 'next-best' source to sunlight: Violet-Blue-DeepRed (660nm)-FarRed (740nm)



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There is no single 'next-best' source to sunlight: Violet-Blue-Cyan-Green-Amber-DeepRed-FarRed



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There is no single 'next-best' source to sunlight: Violet-Blue-Cyan-Green-Amber-DeepRed-FarRed + UV (365nm) + IR (850+940nm)



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Available high brightness LED 1-die assigned to horticulture:



Greenhouse Farming

XLamp	XF	р-Е	XP-E2			XT-E	XP-G3
Footprint (mm)			3.45 x 3.45				
Color	Photo Red	Far Red	Royal Blue	Royal Green Red		Royal Blue	White (6500K - 2700K)

Vertical Farming

XLamp				XQ-E						
Footprint (mm)					1.6 x 1.6					
Color	Royal Blue Green Red (6500K - 2700K)				Royal Blue	Green	Red	Photo Red	White (6500K - 2700K)	

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Available high brightness LED 1-die assigned to horticulture:



OSLON® family

ColorHyper RedFar RedDeep BlueDeep BlueEQ whiteWave length [nm]660730450-



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PRODUCT	COLOR	PE WAVELEN	AK IGTH (NM)	PPF (MMOL) (400 TO 7	/S) IN PAR /00NM)	PPF/W TYPICAL (MMOL/S)	
		MINIMUM MAXIMU		MINIMUM	TYPICAL	TYPICAL (MINIOL/S)	
	Far Red	720	750	1.10	1.37	2.26	
	Deep Red	655	670	1.60	1.72	2.56	
LUXEON SunPlus 20 Line	Royal Blue	445	455	1.90	2.04	2.11	
	Lime	-	-	1.50	1.59	1.66	
	Cool White	-	-	1.40	1.51	1.57	
	Purple (2.5% Blue)	-	-	0.45	0.51	1.80	
	Purple (12.5% Blue)	-	-	0.50	0.58	2.02	
SunPlus 35 Line	Purple (25% Blue)	-	-	0.55	0.63	2.24	
	Royal Blue	440	455	0.55	0.61	2.00	
	Lime	-	-	0.60	0.65	2.13	





LUXEON SunPlus Series for Horticulture

The LUXEON SunPlus Series is purposebuilt to enable ease of system design for Horticulture applications.

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Direct Colours

UV 365nm UVA UA 400nm Violet (in 5 nm bins) B1 436nm Deep Blue B2 450nm Royal Blue **DB 460nm Dental Blue** CY 500nm Cyan G1 523nm Green A1 590nm Amber R1 623nm Red R2 660nm Deep Red R3 740nm Far Red R4 850nm Infra Red R5 940nm Deep Infra Red

White CCTs

WW 3000K Warm White GW 3000K CRI98 Gallery White NW 4000K Neutral White CW 5500K Cool White CW 6500K Cool White

Phosphor-based specialty colours:

SS 2200K Sunset

PC Green



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Available high brightness LED 1-die assigned to horticulture:

		dimension	If max	UVA	Violet	Blue	Green	Red	Deep Red	Far Red	White
				365-	385-	450-	515-	610-	660-	730-	
			mA	370nm	410nm	260nm	530nm	630nm	670nm	740nm	wide
	Cree - Xlamp XP-E	3.5x3.5mm	1000						x	x	
	Cree - Xlamp XP-E2	3.5x3.5mm	1000			х	x	x			
	Cree - Xlamp XT-E	3.5x3.5mm	1500			x					
	Cree - Xlamp XP-G3	3.5x3.5mm	2000								х
OCDAM	Cree - Xlamp XQ-E	1.6x1.6mm	1000			х	x	х	x		х
Onto Semiconductors	Osram - Oslon SSL 80	3.1x3.1mm	1000			х			x	x	
opto connocinations	Osram - Dragon Plus	3.1x3.1mm	1000			х			x		
MUMILEDS	Supplus 20		700-								
· · · · · · · · · · · · · · · · · · ·	Sunplus 20	2.0x2.0mm	1225			Х			X	X	х
	SunPlus 30	3.5x3.5mm	200- 300			x					
	LED Engin - LZ1	4.4x4.4mm	1200	х	x	x	x	х	x	x	x

LumiLeds completes range with 'purple' (mix of Blue and Deep Red) and Lime LED Engin completes range with more direct colours and phosphor converted spectra



LED options – multi-die

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Available high brightness LED multi-die assigned to horticulture:

4-die mono colour



7x7m m

Standard colours: UVA, Violet, Blue, Green, Red, Deep Red, Far Red, Infra Red 850, Infra Red 940, White Custom colours: 'any' single colour





7x7m m

Colours: fully custom (e.g. Blue – Deep Red – Far Red – Violet) 12-die multi colour



Dimensions (L x W, mm): 9.0 x 9.0

Colours: fully custom (e.g. Blue – Deep Red – Far Red – Violet – Green - White)

24-die multi colour



Dimensions (L x W, mm): 12.0 x 12.0

Colours: fully custom (e.g. Blue – Deep Red – Far Red – Violet – White)



LED options – pro/cons

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Available high brightness LED multi-die assigned to horticulture:

1-die



Commodity: easy sourcing Multi-source: simple to define wavelength mix per fixture High brightness: suitable for shortmedium-distance illumination Multi-die

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Single source: more compact fixture Single source: simpler PCB Single source: good colour mix for short distance Super high brightness: high PPFD for medium-large-distance illumination



Conclusion

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There is a wide variety of options of LEDs for plants The choice is yours!



LED EVENT 2016 DEN BOSCH Back-up slides



LED Engin LZ1 Emitter Porfolio for Horticulture Lighting – Direct Colors

Color	Color Peak Wavelength (nm)		Max Drive Current* (mA)	Typical PPF @ Typ. If (umol/s)
				PPF 280-800nm @700mA
Ultra Violet	365	LZ1-00UV00	1000	3.7
Violet	385 – 410 (in 5 nm bins)	LZ1-00UB00	1000	3.9
Violet	415	Available as custom	1000	3.5
				PPF 400-700nm @1000mA
Royal Blue	436	Available as custom	1500	4.9
Blue	453	LZ1-00B202	1500	5.0
Dental Blue	460	LZ1-00DB00	1200	4.9
Cyan	500	Available as custom	1000	3.2
Green	517	LZ1-00G102	1500	2.0
Amber	593	LZ1-00A102	1000	1.2
Red	633	LZ1-00R102	1500	4.9
Deep Red	660	LZ1-00R202	1200	5.4
				PPF 280-800nm @1000mA
Far Red	740	LZ1-00R302	1200	4.3
/8/2016 *Please re	efer to datasheet specification	on for max current oper	rating condition	LED ENGIN

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LED Engin LZ1 Emitter Porfolio for Horticulture Lighting – White and Phosphor Converted Colors

Color	сст	Part Number	Max Drive Current* (mA)	Typical PPF @ Typ. If (umol/s)
				PPF 400-700nm @1000mA
Cool White	6500K	LZ1-00CW02-0065	1200	4.3
Cool White	5500K	LZ1-00CW02-0055	1200	4.8
Neutral White	4000K	Available as custom	1200	3.7
Warm White	3000K	Available as custom	1200	3.5
Gallery White (WW CRI 98)	3000K	Available as custom	1200	2.4
Warm White	2200K	Available as custom	1200	3.5
PC Green	-	Available as custom	1200	5.1



Spectrum Tool – to configure custom spectrum LED



Select the desired colours

The tool will generate the spectrum and PPF value





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LuxiGen Emitter Packages

Once the optimum colour and ratio is configured, they can be placed into one of the following packages, depending on the application demand.

		E		Conne and Conne	K	K	ALL DO
		LZ1	LZ4	LZ7	LZ9	LZC	LZP
u	Number of die	1	4	7	9	12	24 or 25
rmati	Dimensions L x W , mm	4.4 x 4.4	7.0 x 7.0	7.0 x 7.0	7.0 x 7.0	9.0 x 9.0	12.0 x 12.0
Info	Nominal Drive Current mA	1000	700	700	700	700	700
duct	Maximum Drive Current mA	1500	3000	850-1500	800	1200	1200
Pro	Thermal Resistance ^o C/W	6.0 4.2 for UV/DB	0.9	1.4	1.3	0.7	0.5

If desired, also 3A/die can be included



LQP-horti: 24 die emitter



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LQC-horti: 12 die emitter

