



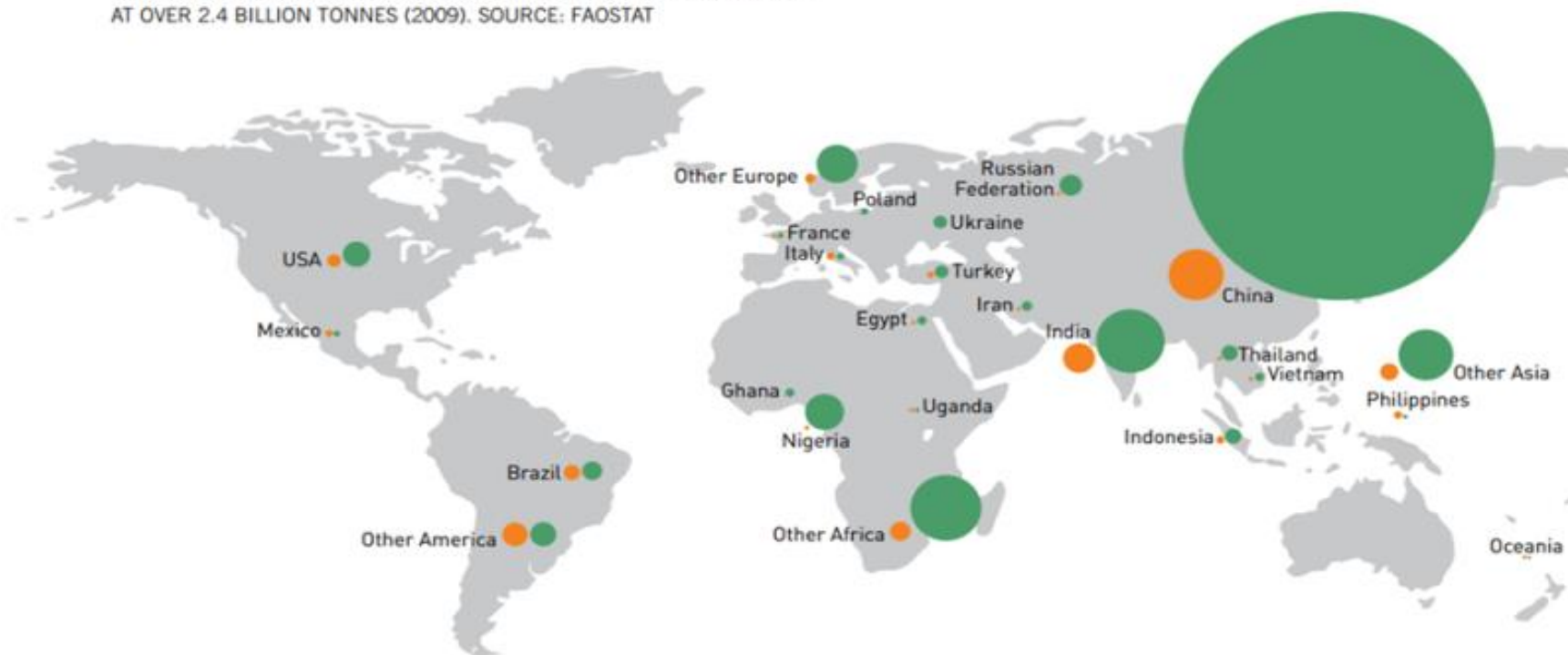
Single Color LED

for Agriculture and Horticulture

World Production of Fruits and Vegetables

World production of fruit and vegetables

TOTAL PRODUCTION OF WORLD FRUIT AND VEGETABLES IS CALCULATED AT OVER 2.4 BILLION TONNES (2009). SOURCE: FAOSTAT



COUNTRIES IDENTIFIED WHERE FRUIT AND VEGETABLE PRODUCTION COMBINED EXCEEDS 20 MILLION TONNES (2009)



Why ? (Smart Farm)

- Increase production and resource efficiency



- Less diseases / better opportunities for biological control



- High product quality and food safety



Level of Technology



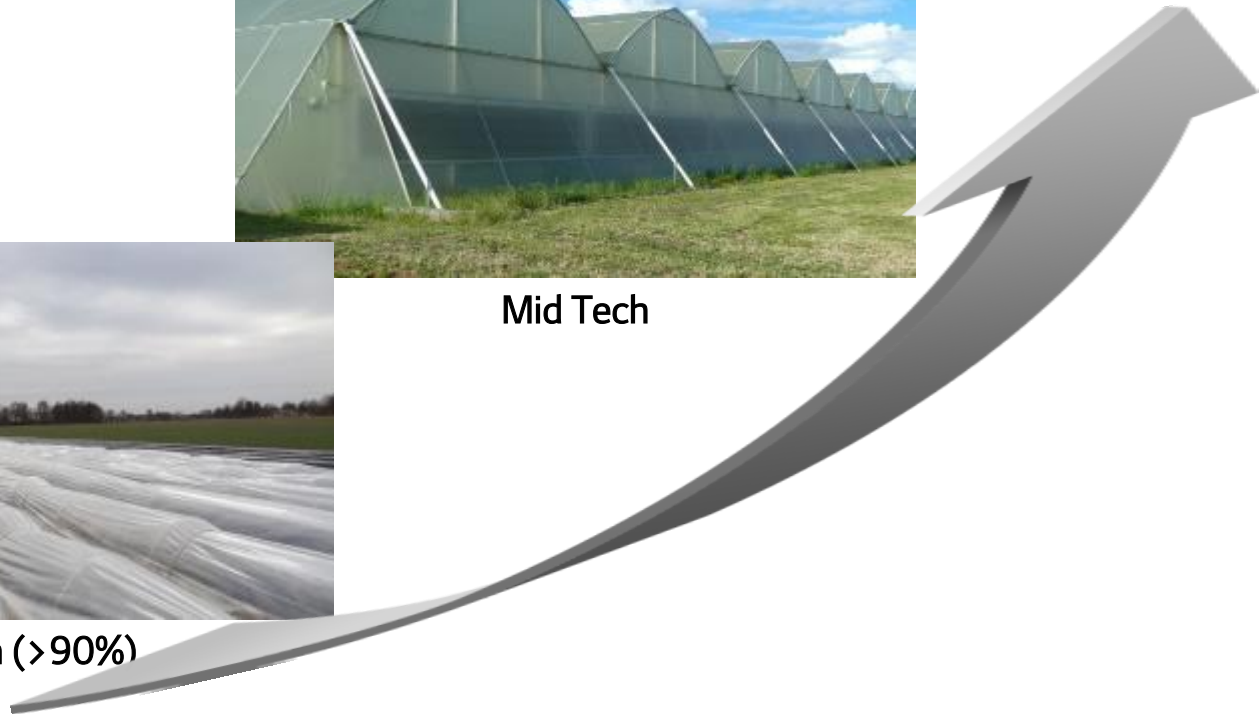
Low Tech (>90%)



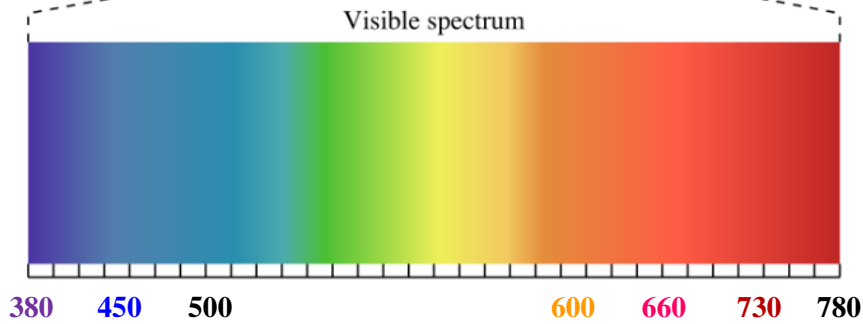
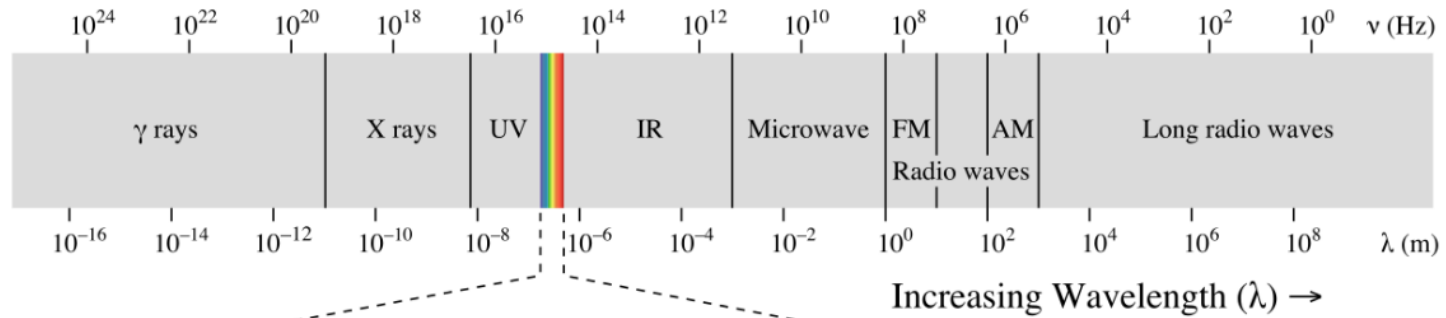
Mid Tech



High Tech



Wavelength for Agriculture & Horticulture



Phytochemical

Photosynthesis

Anti-Bug

Photoperiodicity
Anti-blossom

Wavelength for Agriculture & Horticulture

Color	Wavelength [nm]	Function
Near UV	380	Phytochemical
Royal Blue	450	Photosynthesis (Chlorophyll)
Red-orange	615	Anti-Bug
Red	630	Photosynthesis (Chlorophyll)
Deep Red	660	Photosynthesis (Chlorophyll)
Far Red	730	Photoperiodicity /Anti-blossom

Single Color LED Line-up

● Single Color LED Line-up

Color		Royal Blue	Blue	Cyan	Mint	Green	Yellow	Amber	Red-orange	Red	Deep Red	Far Red	
Wavelength (nm)		450	475	500	-	520	590	595	615	630	660	730	
Company	Osram	0	0			0	0	0		0	0	0	80°/150°
	Nichia	0	0	0		0		0		0			
	Cree	0	0			0		0	0	0			
	Lumileds	0	0	0	0	0		0	0	0	0	0	
	Edison		0					0 (PC)		0			
	LGIT	0	0			0		0 (PC)	0	0	'16, 4Q	'16, 4Q	

Plant perform photosynthesis using two types of chlorophyll ;

- Chlorophyll-A : 410 ~ 435nm (Blue) + 642nm (Red)
- Chlorophyll-B : 453nm (Royal Blue) + 662nm (Deep Red)




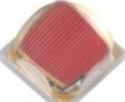
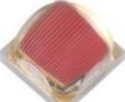
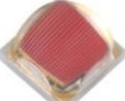
Single Color LED Line-up

- Single Color LED Line-up

Model	PKG	Image	Wavelength (nm)	PKG Characteristics				
				Vf (V)	If (A)	Flux (lm) / Po (mW)	Rth (°C/W)	Viewing Angle (°)
3535 1W (3.40x 3.40 x 2.37)	3535 Royal Blue		449 ~ 460	3.05	0.35	570mW	7	120
	3535 Green		515 ~ 530	3.20	0.35	109 lm	14	125
	3535 Red		610 ~ 632	2.21	0.35	89 lm	7	125
	3535 Deep Red		650 ~ 660	Preparing (Feasibility test will be completed end of Aug)				
	3535 Far Red		720 ~ 740	Preparing (Feasibility test will be completed end of Aug)				

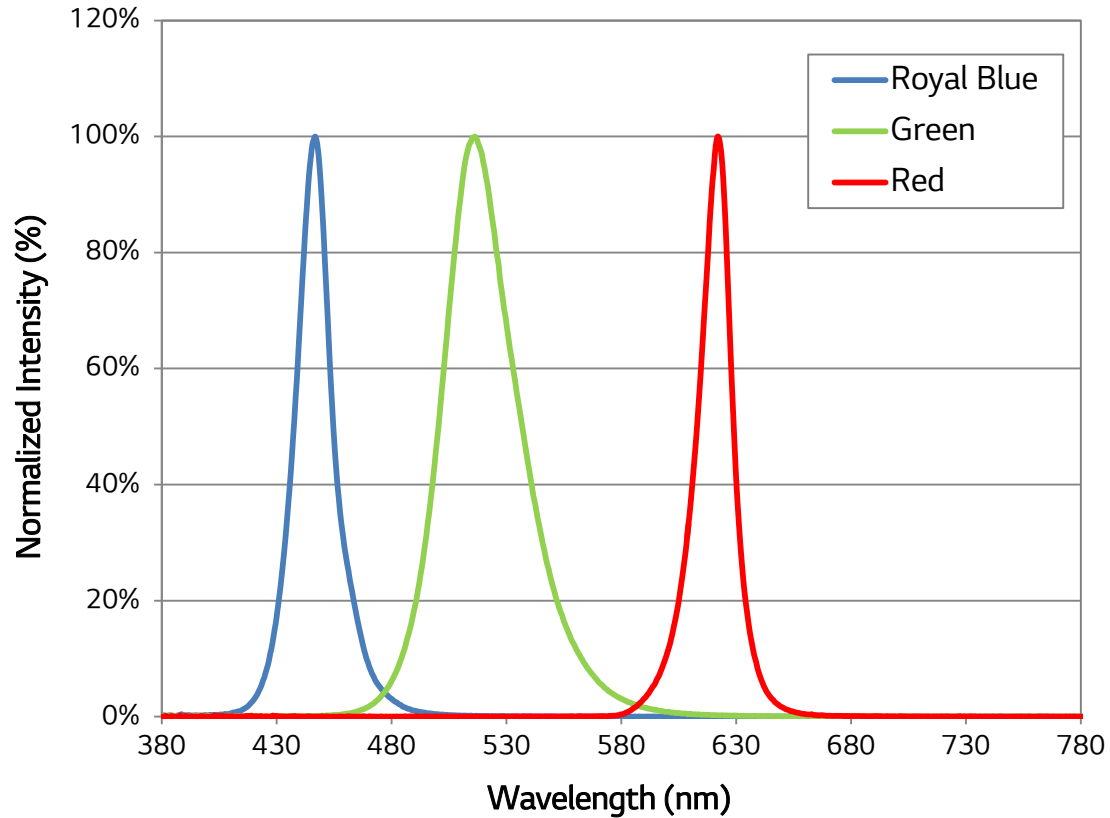
Single Color LED Line-up

● Single Color LED Line-up

Model	PKG	Image	Wavelength (nm)	PKG Characteristics				
				Vf (V)	If (A)	Flux (lm) / Po (mW)	Rth (°C/W)	Viewing Angle (°)
3535 3W (3.40x 3.40 x 2.11)	3535 PC-Amber		585 ~ 595	3.30	1.00	225 lm	6	120
3535 >3W (3.45x 3.45 x 2.68)	3535 Royal Blue		449 ~ 460	2.90	1.00	1550 mW	T.B.D	130
	3535 Green		515 ~ 530	3.18	1.00	340 lm	T.B.D	135
	3535 Red		615 ~ 630	2.08	1.00	170 lm	T.B.D	135
	3535 Deep Red		650 ~ 660	Preparing (Feasibility test will be completed end of Aug)				
	3535 Far Red		720 ~ 740	Preparing (Feasibility test will be completed end of Aug)				

Spectrum of Single Color LEDs

● Single Color LED Line-up



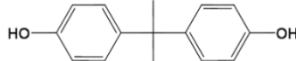
Items	Blue	Green	Red
WD	450	521	615
WP	446	516	620
FWHM	18	36	16

Phytochemical of Plant

Phytochemical

- Secondary metabolite
- Color and flavor of the plant
- Improving health functions

Polyphenol

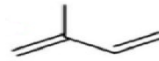


Flavonoid

Anthocyanin

Phenol

Terpenoid



Zeaxanthin

β -carotene

Lycopene

ETC








Flavonoid

Anthocyanin

Phenol

Color Foods & Super Foods !

Phytochemical of Plant

Color	Phyto Chemical		Benefits
RED	Lycopene		Strong Antioxidant Cut prostate cancer risk
ORANGE	β -carotene		Supports immune system Powerful Antioxidant
YELLOW-ORANGE	Vitamin C, Flavonoid		Inhibit tumor cell growth Detoxify harmful substance
GREEN	Folate, Indole, Lutein		Builds healthy cells and genetic materials Eliminate excess estrogen and carcinogens
BLUE	Anthocyanin		Destroy free radicals
VIOLET	Resveratrol		May decrease estrogen production
WHITE	Allyl sulfides		Destroy cancer cells Reduce cell division Support immunes system

Light Saturation Point & Light Compensation Point

Color	LED			
	Light Saturation Point		Light Compensation Point	
	lx	PPFD	lx	PPFD
Tomato, Watermelon	9,317	947	396	36
Cucumber	7,315	665	264	24
Pea	5,324	484	264	24
Lettuce, Bell Pepper	3,322	302	198	18
Grape	5,324	484	55	5
Mandarin	5,324	484	28	3
Pear	5,324	484	40	4
Peach	5,324	484	55	5
Fig	5,324	484	132	12
Santpaulia	660	60	66	6
Orchid	1,331	121	40	4
Cyclamen	1,991	181	40	4
Ginseng	1,595	145	66	6

* PPFD (Photosynthetically active radiation Flux Density, $\text{Umol}/\text{m}^2\text{s}$) ; photosynthesis of volume at $1\text{m}^2/1\text{sec}$