

Using the Spectroradiometer to Evaluate LED Lamps

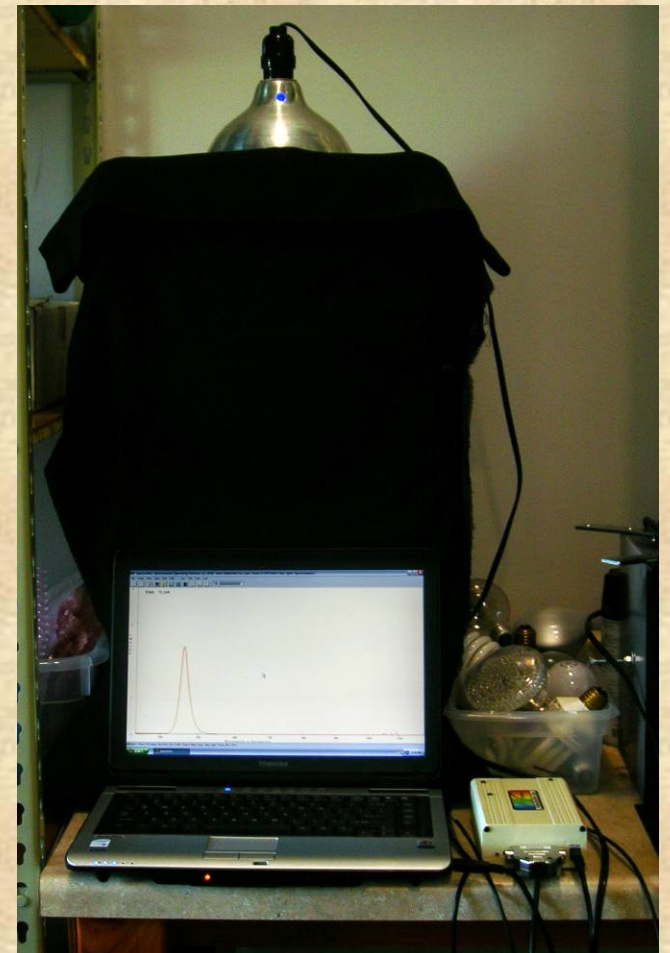
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¹ Rutgers University

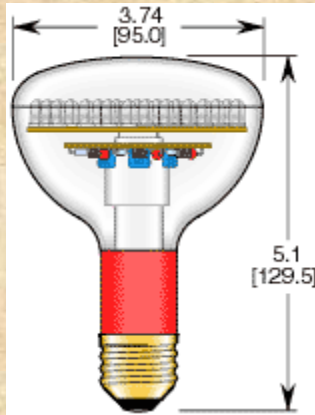
² Apogee Instruments, Inc.

³ Utah State University

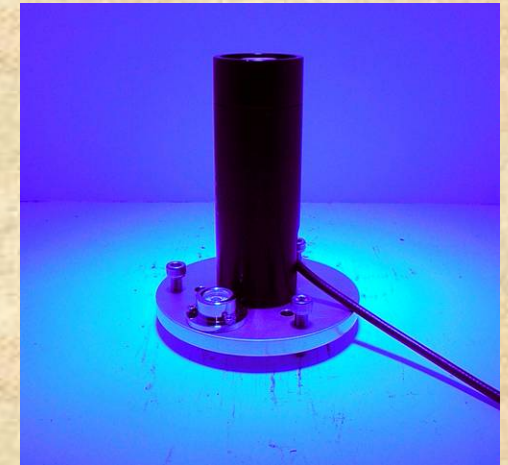
NCERA-101, April 14-17, 2007
Tuskegee University



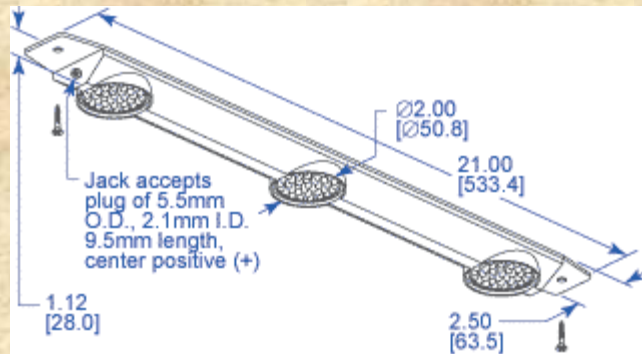
LED Lamps



Super Blue
Super Red
Infrared
Cool White
Warm White



Plant Bar



LEDTRONICS, INC.



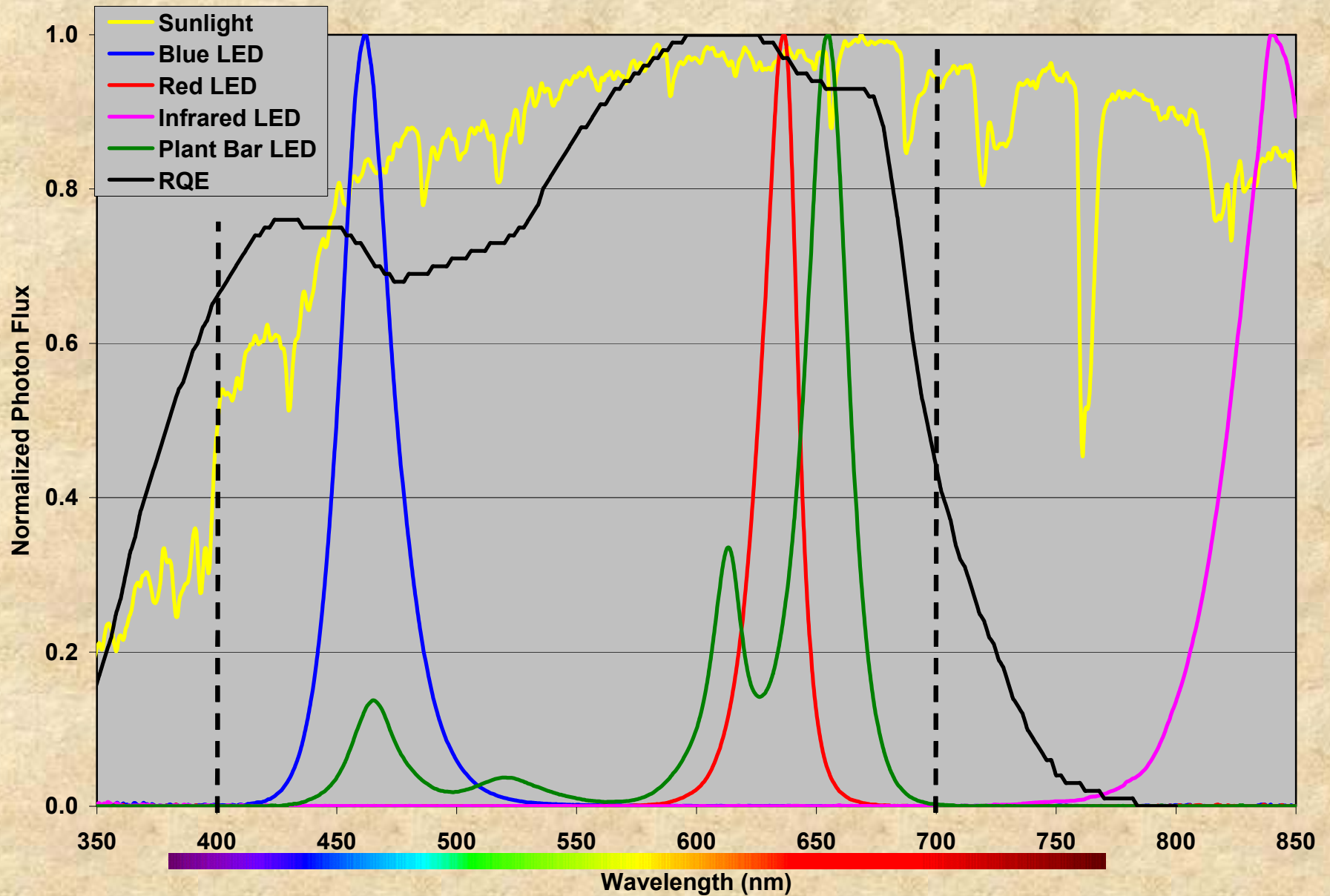
38 LEDs

Unit Price of LED Lamps

LED Lamp	Model Number	Unit Price*
Super Blue	R30-123-0PB-120AN	\$119
Super Red	R30-123-0ER-120AN	\$83
Infrared	R30-123-851-120AS	\$129
Cool White	R30-123-0WW-120AS	\$83
Warm White	R30-123-2IW-120AS	\$83
Plant Bar	LED-PLANTBAR-001	\$160
Compact FL	Various models	<\$5

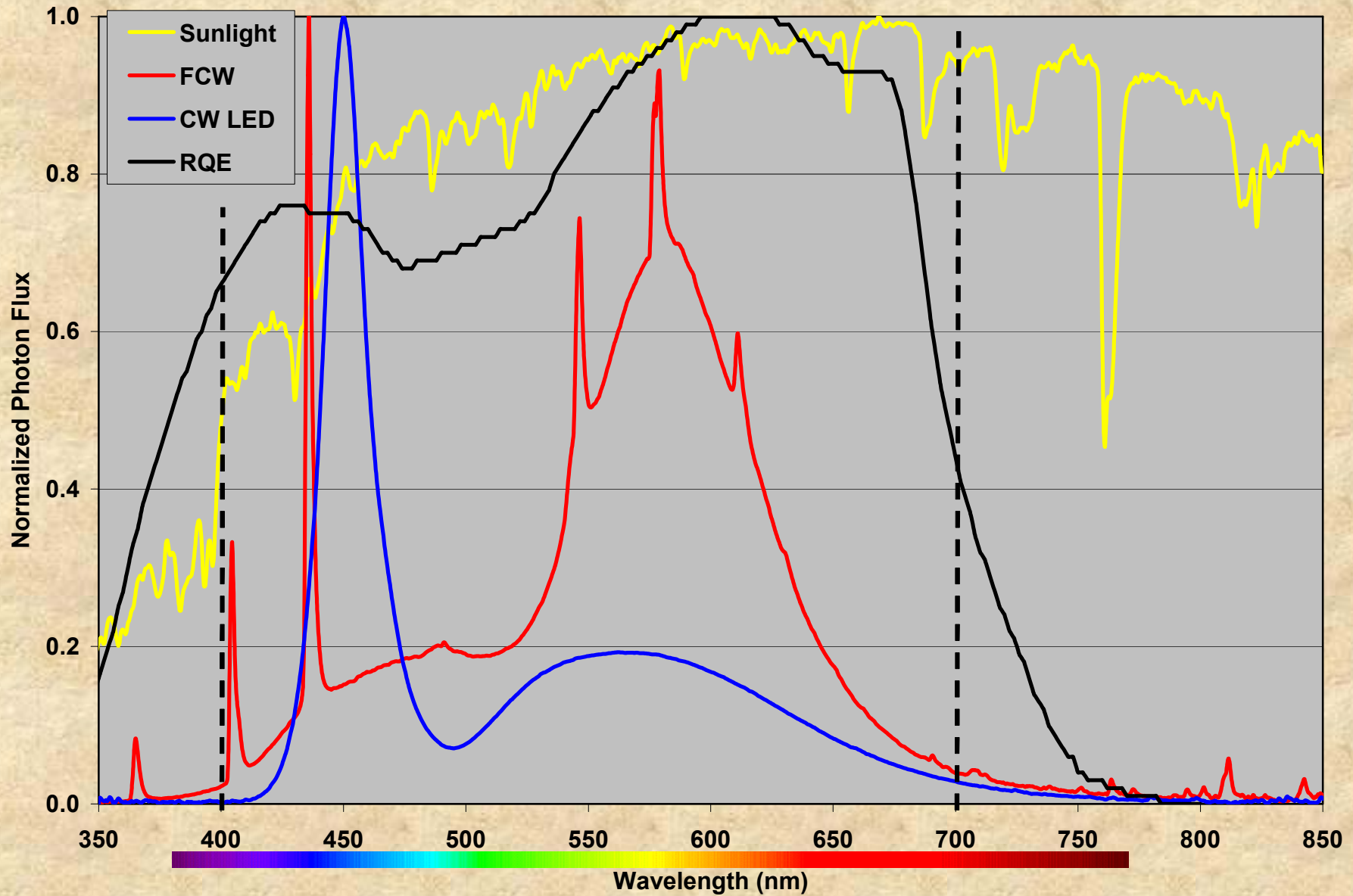
* Excluding shipping; purchased as single units (no volume discount)

'Single' Wavelength LED Lamps



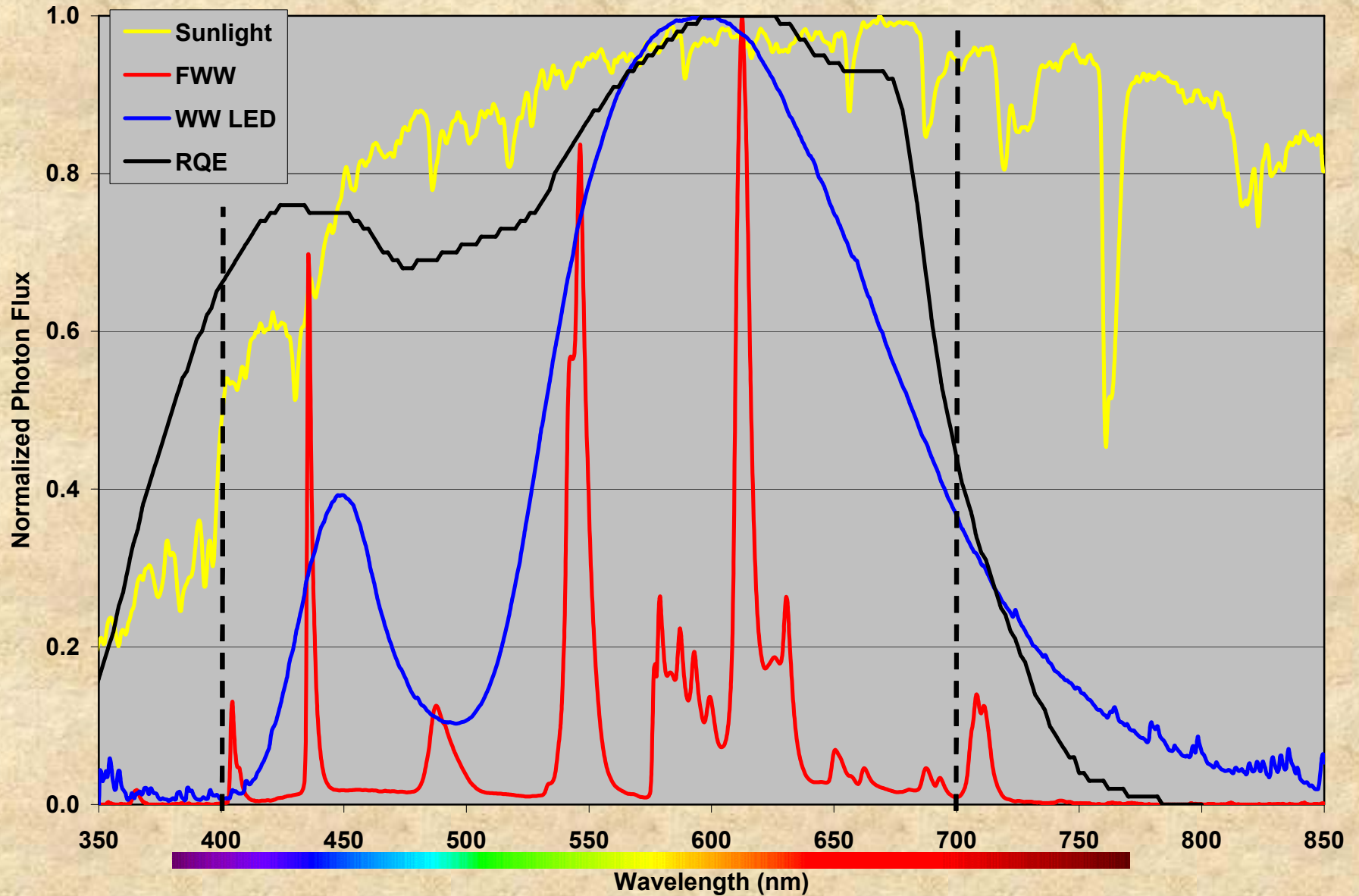
RQE: Relative Quantum Efficiency (McCree, 1972; Sager et al., 1988)

Comparing Cool White Lamps



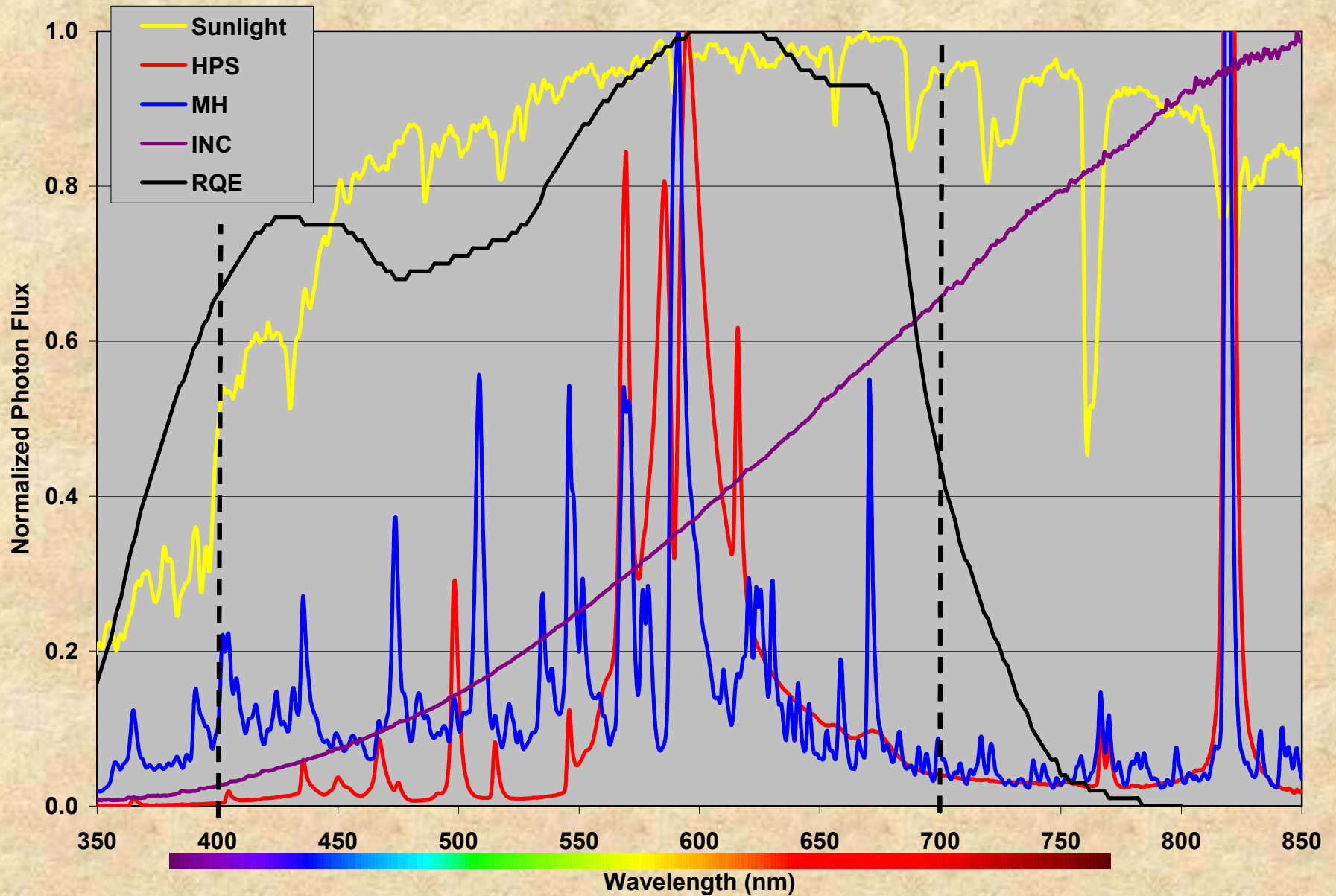
RQE: Relative Quantum Efficiency (McCree, 1972; Sager et al., 1988)

Comparing Warm White Lamps



RQE: Relative Quantum Efficiency (McCree, 1972; Sager et al., 1988)

Other Commonly Used Lamps



RQE: Relative Quantum Efficiency (McCree, 1972; Sager et al., 1988)

Spectral Efficiency

$$\text{Spectral Efficiency} = \frac{\sum[(PF)_i * (RQE)_i]_{343-800}}{\sum(PF)_{343-800}}$$

Common Lamps	Spectral Efficiency*	LED Lamps	Spectral Efficiency
HPS	0.89	Super Blue	0.72
MH	0.78	Super Red	0.98
INC	0.49	Cool White	0.80
FCW/ FWW CFL(SW)	0.86/0.87	Warm White	0.82
SUN	0.64	Plant Bar	0.92

* Bugbee, 1994: PPF Correction Factor = $\frac{\sum[(PF)_i * (RQE)_i]_{360-760}}{\sum(PAR)_{400-700}}$

LED Lamp Observations

- **Build your own spectrum**
- **Low power consumption (10 Watt/Lamp)**
- **Long lamp life (50,000-100,000 hrs)**
- **High shock/vibration resistance**
- **Cool bulb surfaces**
- **Replacement for INC?**
 - **Possibly, but may need a source of far-red**
- **Replacement for FL?**
 - **Possibly, but light distribution may be an issue**
- **Plant Bar: similar applications as light engine (lightcicle) used by colleagues at Purdue?**