

A Perspective on Marijuana Legalization from Washington State

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Contents

- Plant Education
- Grower Tour
- Grower Hurdles
- Banking
- Utilities
- Questions/Discussion

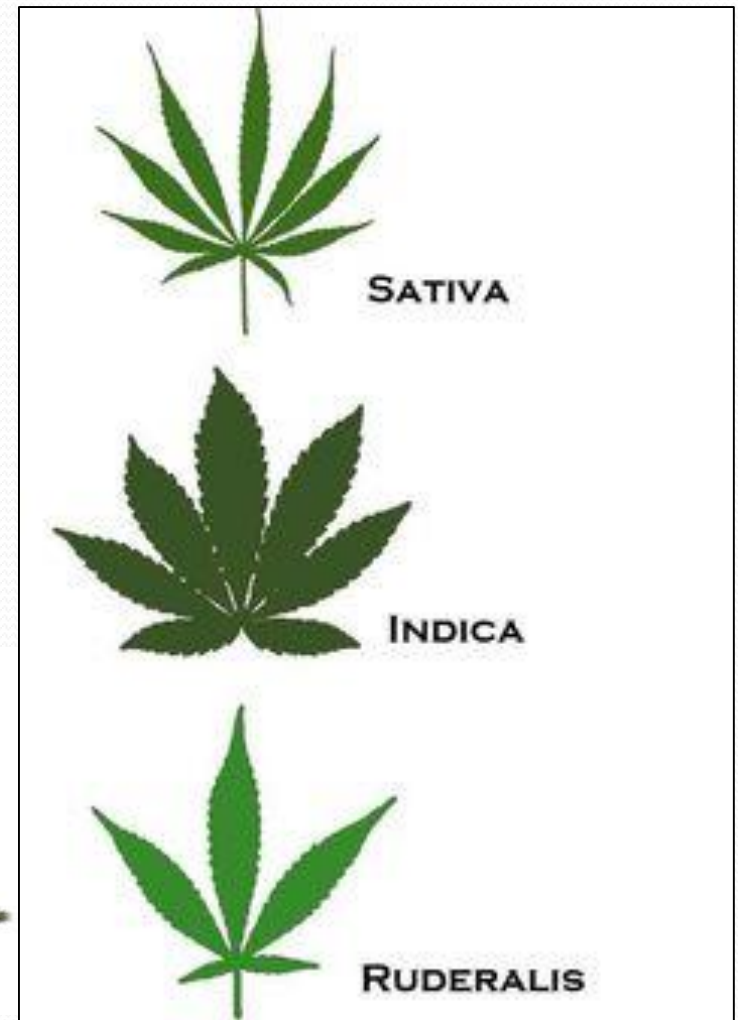


Plant Education

- Species and Sexes
- Female Cannabis
- Fertilized Cannabis

CANNABIS

- Male and Female Plants
 - Grow from seeds
 - Year growing cycle in nature
 - Pre-Equinox: Vegetation
 - Post-Equinox: Flowering
 - Three species
 - Sativa -> Indica
 - Indica -> Afghanica
 - Ruderalis -> Sativa



All About the Female Plant



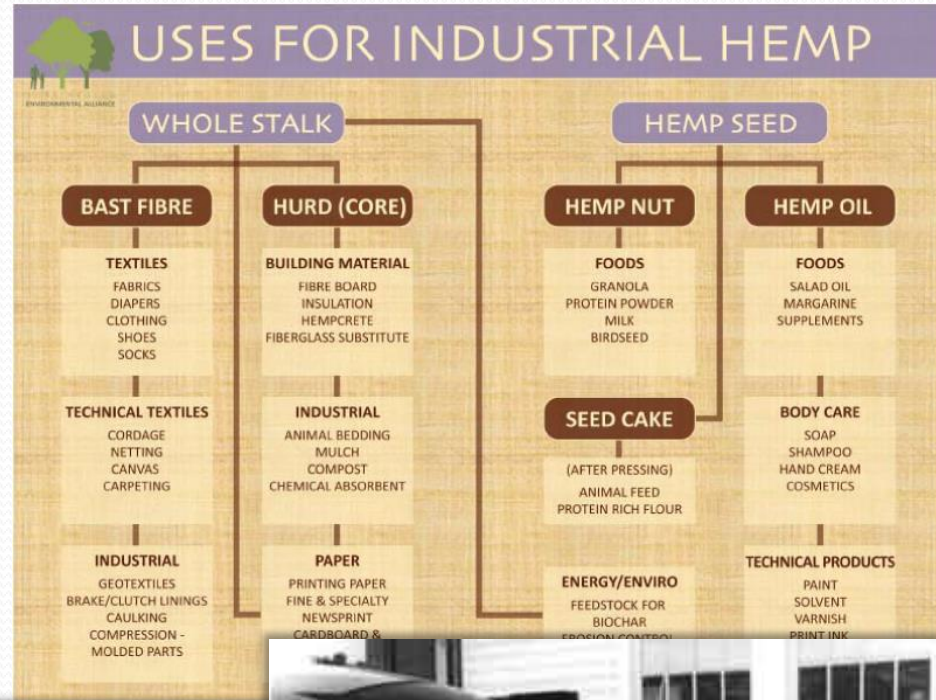
Maximize Flowering Mode

- Equinox moves Cannabis from veg to flower
- Held in flowering stage to maximize THC content
- Not pollinated



Fertilized Cannabis = Hemp

- Essentially no THC
- Energy goes to seed growth
- Wide variety of uses



Grower Tour

- Mother Room
- Clone/Veg Room
- Flowering Room
- Drying Room
- Processing Room
- Extraction
- Quarantine Room

Mother Room

18-24 Hours of Light

- Perpetual Veg State
- Mother plants
- All Strains



Clone/Veg Room

18-24 Hours of Light

- T-5 Lighting
- 8-10 Weeks



Flowering Room

12 Hour Light

- Triggers Flowering
- HID Lights
- 8-10 Weeks
- High Energy



Drying Room

Controlled
Humidity

- Not too fast
- Not too slow
- THC
degrades to
CBN



Processing Room

Remove Leaves

- Labor Intensive
- Little Waste
- Expensive Automation



Extraction Room

CO₂ Method

- Uses Low Quality Product
- Runs 24/7
- Expensive
- Most Profitable



Quarantine

24 Hours

- Must Not Move
- Samples Sent to Lab



Recreational vs Medical

Cannabinoids

- Mainly in sticky resin (Terpene) on trichomes
- 85 different cannabinoids-2 Main
 - Tetrahydrocannabinol(THC)
 - Cannabidiol(CBD)

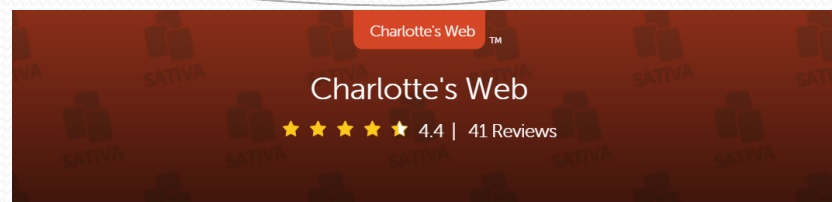
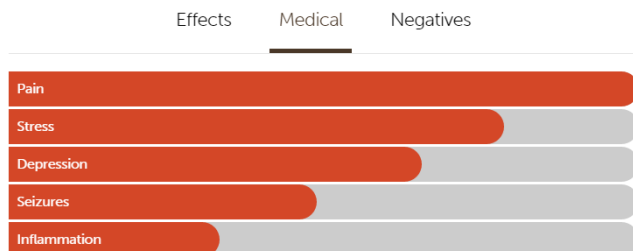
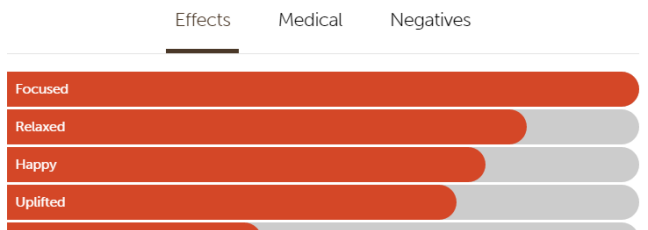
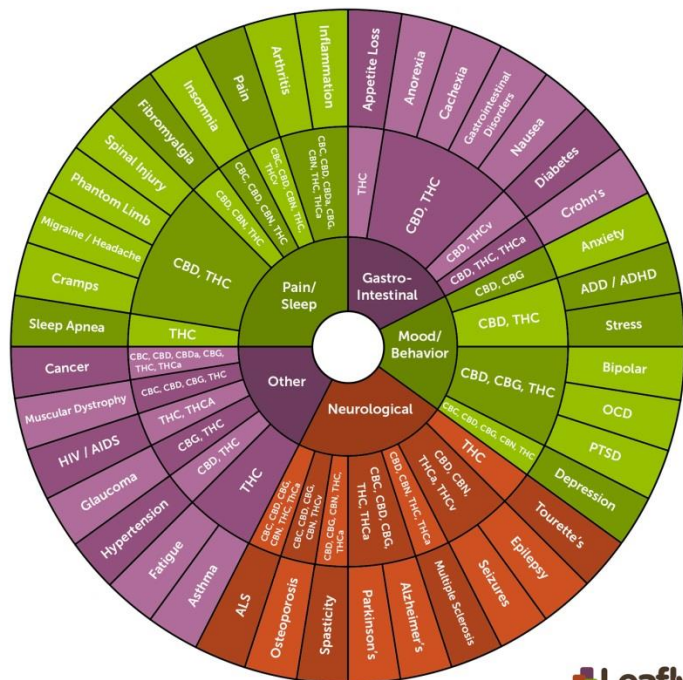
THC psychoactive ingredient

- Delta-9 and -8 mimic anandamide, neurotransmitter
- Analgesic (pain killer)
- Anti-tumor effects

CBD not psychoactive

- Relieves nausea, convulsion, anxiety.
- Anti-tumor effects
- Antipsychotic effects





Overview

Availability

Reviews (41)

Photos (9)


REVIEW

 FAVOR

Strain Highlights

Charlotte's Web is a *Cannabis sativa* L. strain with less than 0.3% THC that has gained popularity as an option for treating seizures as well as a range of other medical conditions. This medical potency is due to its high-CBD content, which was specifically cultivated by Colorado breeders The Stanley Brothers for a young epileptic patient named Charlotte. However, the thick "web" of trichomes on Charlotte's flowers are also storied to have led to the name. This strain is effective with little to no psychoactive effects, making it great for those who don't want their medication to affect their daily tasks. Charlotte's powerful web may cause dizziness for some patients, so new users should be cautious. Overall, the flowers of this strain have a fresh pine aroma.

Effects

Medical

Negatives

Dizzy

Anxious

Dry Eyes

Dry Mouth

Headache

Flavors

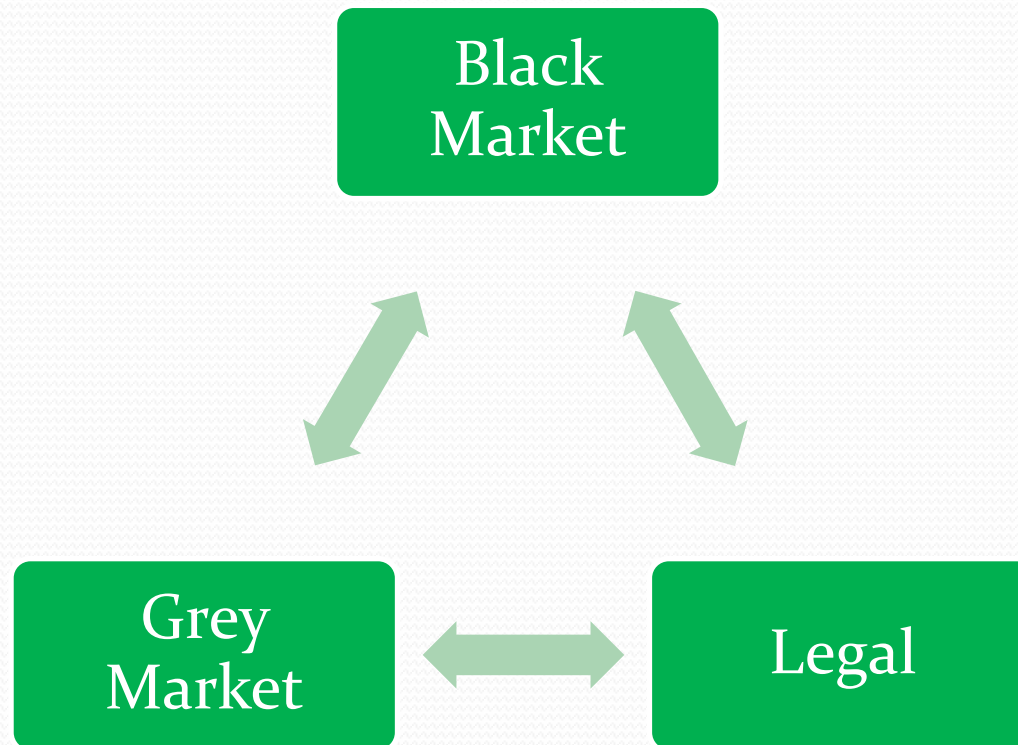


An iceberg floating in the ocean. The tip of the iceberg is above the water surface, and the much larger base is submerged. Two red lines point from text labels to the respective parts of the iceberg.

I-502
Recreational
Growers

Other
Growers

Medical Marijuana Market



- Enforcement
- Market Price
- Product Demand
- Product Availability

Grower Hurdles

I-502 Business Hurdles

- Security
- THC% Max
- Fertilizers
- Pesticides
- HVAC
- Water
- Lighting
- Smell
- Seed to Sale Tracking
- No Federal Deductions
- Banking
- Zoning



Banking

Cannabis Banking

If money accepted from illegal activity it is money laundering.

- Bank managers must personally certify they have investigated the state license for all new business accounts.
- 23 week waiting period while background checks done.
- After open, bank management personally certify all money from legal, traceable source.
- Large fees for accounts, cash processed, and cash pickup/delivery.

Utility Issues

- Customer Service
- Loss Prevention
- Utility Choices
- New Growers

Customer Service

- Cash problems
 - Security
 - Counting
 - Smell
- Account Credits
 - Limiting Overpay
 - Eliminating Payouts?



Loss Prevention

- Customer Services Identifying Potential Theft
 - Normal Usage?
 - Procedures for Identification of Customer Class
 - Interference with meter reads
 - Power diversion methods
 - Load profile
 - Tracking cash

Utility Choices



- Privacy vs. Public Good
- Worker Safety
- Relationship with growers
- Identifying Class of Customer?
- Single Point of Contact for Industry?

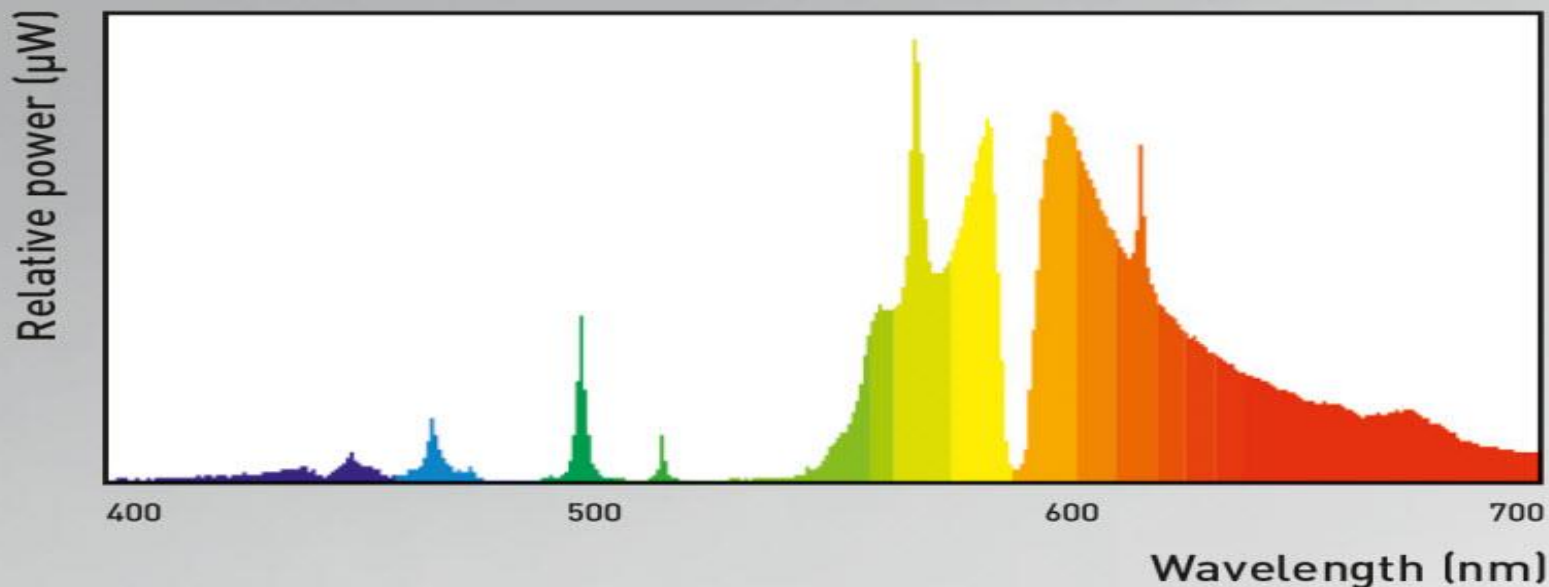


Discussion/Questions





Gavita Pro Plus 1000 W EL DE



Phosphor-Based White LED Emission Spectrum

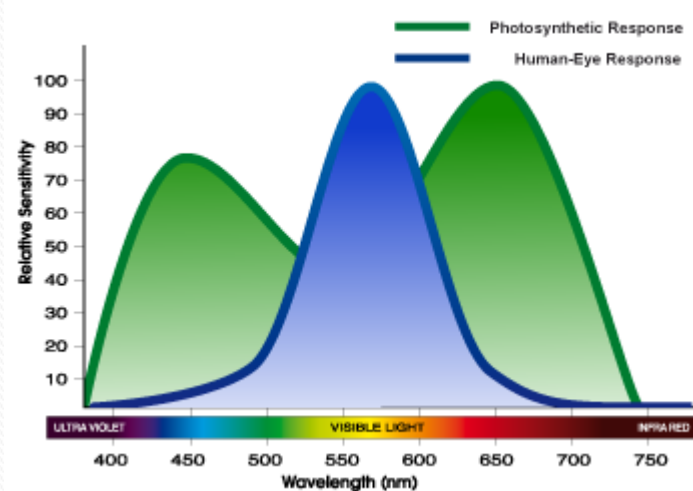
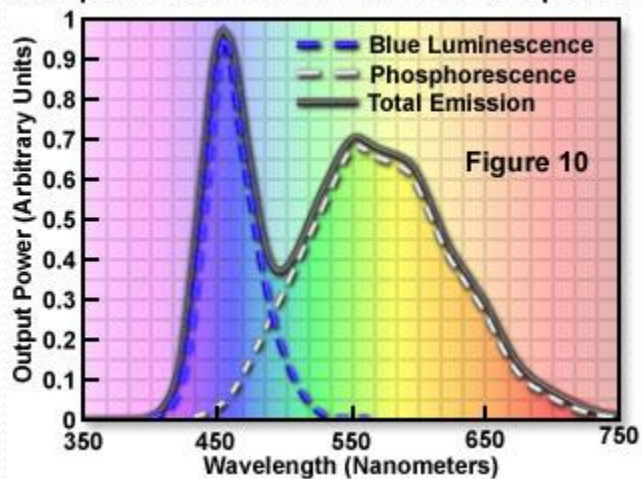


Table 1. Efficiency of individual LEDs at a drive current of 700 mA.

LED Color	Peak wavelength or color temperature	Photon efficiency ^z (μmol/J)	Electrical efficiency ^y (%)	Luminous efficiency ^x (lm/W)
Cool white	5650 Kelvin	1.52	33	111
Red	655 nm	1.72	32	47
Blue	455 nm	1.87	49	17

^z-Photon efficiency is the most appropriate measure for photosynthesis.

^y-The relationship between electrical efficiency and photon efficiency is dependent on wavelength (Planck's equation $E = hc/\lambda$).

^x-Luminous efficiency is shown to demonstrate how inappropriate it is as an indicator of lighting efficiency for plants.

doi:10.1371/journal.pone.0099010.t001

$$\text{Energy of photon } E = h\nu = h \frac{c}{\lambda}$$

Periodic Table of the Elements																		8A																	
1 H Hydrogen 1.008																	2 He Helium 4.003																		
																		13 B Boron 10.811	14 C Carbon 12.011	15 N Nitrogen 14.007	16 O Oxygen 15.999	17 F Fluorine 18.998	18 Ne Neon 20.180												
3 Li Lithium 6.941	4 Be Beryllium 9.012																	5 Al Aluminum 26.982	6 Si Silicon 28.086	7 P Phosphorus 30.974	8 S Sulfur 32.065	9 Cl Chlorine 35.453	10 Ar Argon 39.948												
11 Na Sodium 22.990	12 Mg Magnesium 24.305	13 Al Aluminum 26.982	14 Si Silicon 28.086	15 P Phosphorus 30.974	16 S Sulfur 32.065	17 Cl Chlorine 35.453	18 Ar Argon 39.948											19 K Potassium 39.098	20 Ca Calcium 40.078	21 Sc Scandium 44.956	22 Ti Titanium 47.867	23 V Vanadium 50.942	24 Cr Chromium 51.996	25 Mn Manganese 54.938	26 Fe Iron 55.845	27 Co Cobalt 58.933	28 Ni Nickel 58.693	29 Cu Copper 63.546	30 Zn Zinc 65.38	31 Ga Gallium 69.723	32 Ge Germanium 72.631	33 As Arsenic 74.922	34 Se Selenium 78.971	35 Br Bromine 79.904	36 Kr Krypton 84.798
37 Rb Rubidium 84.468	38 Sr Strontium 87.62	39 Y Yttrium 88.905	40 Zr Zirconium 91.224	41 Nb Niobium 92.906	42 Mo Molybdenum 95.95	43 Tc Technetium 98.907	44 Ru Ruthenium 101.07	45 Rh Rhodium 102.906	46 Pd Palladium 106.42	47 Ag Silver 107.868	48 Cd Cadmium 112.411	49 In Indium 114.818	50 Sn Tin 118.710	51 Sb Antimony 121.760	52 Te Tellurium 127.6	53 I Iodine 126.904	54 Xe Xenon 131.294	55 Cs Cesium 132.905	56 Ba Barium 137.328	57-71 Lanthanide Series	72 Hf Hafnium 178.49	73 Ta Tantalum 180.948	74 W Tungsten 183.84	75 Re Rhenium 186.207	76 Os Osmium 190.23	77 Ir Iridium 192.22	78 Pt Platinum 195.085	79 Au Gold 196.967	80 Hg Mercury 200.592	81 Tl Thallium 204.383	82 Pb Lead 207.2	83 Bi Bismuth 208.980	84 Po Polonium [209]	85 At Astatine [210]	86 Rn Radon 222.018
87 Fr Francium 223.020	88 Ra Radium 226.025	89-103 Actinide Series	104 Rf Rutherfordium [261]	105 Db Dubnium [262]	106 Sg Seaborgium [266]	107 Bh Bohrium [264]	108 Hs Hassium [269]	109 Mt Meitnerium [268]	110 Ds Darmstadtium [269]	111 Rg Roentgenium [272]	112 Cn Copernicium [277]	113 Nh Nihonium [284]	114 Fl Flerovium [289]	115 Mc Moscovium [288]	116 Lv Livermorium [293]	117 Ts Tennessine [294]	118 Og Oganesson [294]																		
																		57 La Lanthanum 138.905	58 Ce Cerium 140.116	59 Pr Praseodymium 140.908	60 Nd Neodymium 144.243	61 Pm Promethium 144.913	62 Sm Samarium 150.36	63 Eu Europium 151.964	64 Gd Gadolinium 157.25	65 Tb Terbium 158.925	66 Dy Dysprosium 162.500	67 Ho Holmium 164.930	68 Er Erbium 167.259	69 Tm Thulium 168.934	70 Yb Ytterbium 173.055	71 Lu Lutetium 174.967			
																		89 Ac Actinium 227.028	90 Th Thorium 232.038	91 Pa Protactinium 231.036	92 U Uranium 238.029	93 Np Neptunium 237.048	94 Pu Plutonium 244.064	95 Am Americium 243.061	96 Cm Curium 247.070	97 Bk Berkelium 247.070	98 Cf Californium 251.080	99 Es Einsteinium [254]	100 Fm Fermium 257.095	101 Md Mendelevium 258.1	102 No Nobelium 259.101	103 Lr Lawrencium [262]			
Alkali Metal			Alkaline Earth		Transition Metal				Basic Metal		Semimetal	Nonmetal	Halogen	Noble Gas	Lanthanide	Actinide																			

Table 3. Photon efficiency and cost per mole of photons, assuming all photons (180°) are captured by plants.

Lamp type and Ballast	Fixture producer ^z	Electrical input (J/s or watts)	Photon output ^y ($\mu\text{mol/s}$)	Photon efficiency ^x ($\mu\text{mol/J}$)	Cost of one fixture ^w (\$)	Fixtures needed per millimol/s ^v	Fixture cost per mol/s \$/(mol/s)	Electric cost per $\mu\text{mol photons}^u$ \$/ ($\mu\text{mol/s}$)/yr	Five year electric cost per $\mu\text{mol photons}^t$ \$/ ($\mu\text{mol/s}$)/yr
High Pressure Sodium									
400 W magnetic	Sunlight Supply	443	416	0.94	\$200	2.40	\$0.48	\$0.35	\$0.40
1000 W magnetic	Sunlight Supply	1067	1090	1.02	\$275	0.92	\$0.25	\$0.32	\$0.33
1000 W magnetic	PARsource GLXI	1004	1161	1.16	\$350	0.86	\$0.30	\$0.29	\$0.31
1000 W electronic	PARsource GLXI	1024	1333	1.30	\$380	0.75	\$0.29	\$0.25	\$0.28
1000 W electronic	PARsource GLXII	1026	1334	1.30	\$310	0.75	\$0.23	\$0.25	\$0.27
1000 W electronic	Gavita	1033	1751	1.70	\$500	0.57	\$0.29	\$0.19	\$0.23
1000 W electronic	ePapillon	1041	1767	1.70	\$600	0.57	\$0.34	\$0.19	\$0.24
LED									
red/blue	LSG	384	653	1.70	\$1,200	1.53	\$1.84	\$0.19	\$0.54
red/white	BML	326	541	1.66	\$1,000	1.85	\$1.85	\$0.20	\$0.54
red/white	LSG	390	634	1.63	\$1,200	1.58	\$1.89	\$0.20	\$0.55
red/white	Illumitex	279	390	1.40	\$1,400	2.56	\$3.59	\$0.24	\$0.92
red/white/blue	Lumigrow (Pro 325)	304	390	1.29	\$1,000	2.56	\$2.56	\$0.26	\$0.73
red/white	California Lightworks	337	350	1.04	\$1,000	2.85	\$2.85	\$0.32	\$0.85
multiple	Black Dog	339	339	1.00	\$950	2.95	\$2.80	\$0.33	\$0.85
red/white	Apache	169	163	0.96	\$860	6.14	\$5.28	\$0.34	\$1.35
red/blue	Lumigrow (ES330)	318	284	0.90	\$1,200	3.52	\$4.22	\$0.37	\$1.16
red/white	Hydrogrow	423	378	0.89	\$1,300	2.64	\$3.44	\$0.37	\$1.01
Ceramic Metal Halide									
315 W 3100 K	Cycloptics	337	491	1.46	\$640	2.04	\$1.30	\$0.23	\$0.46
315 W 4200 K	Cycloptics	340	468	1.38	\$640	2.14	\$1.37	\$0.24	\$0.48
2@315 W 3100 K	Boulderlamp	651	817	1.25	\$1,000	1.22	\$1.22	\$0.26	\$0.47
Fluorescent									
400 W induction	iGrow	394	374	0.95	\$1,200	2.68	\$3.21	\$0.35	\$0.94
60 W	T8	58	48	0.84	\$40	20.77	\$0.83	\$0.40	\$0.51