

A FACT BASED COMPARISON OF HORTICULTURAL LED LIGHTING

Presented by



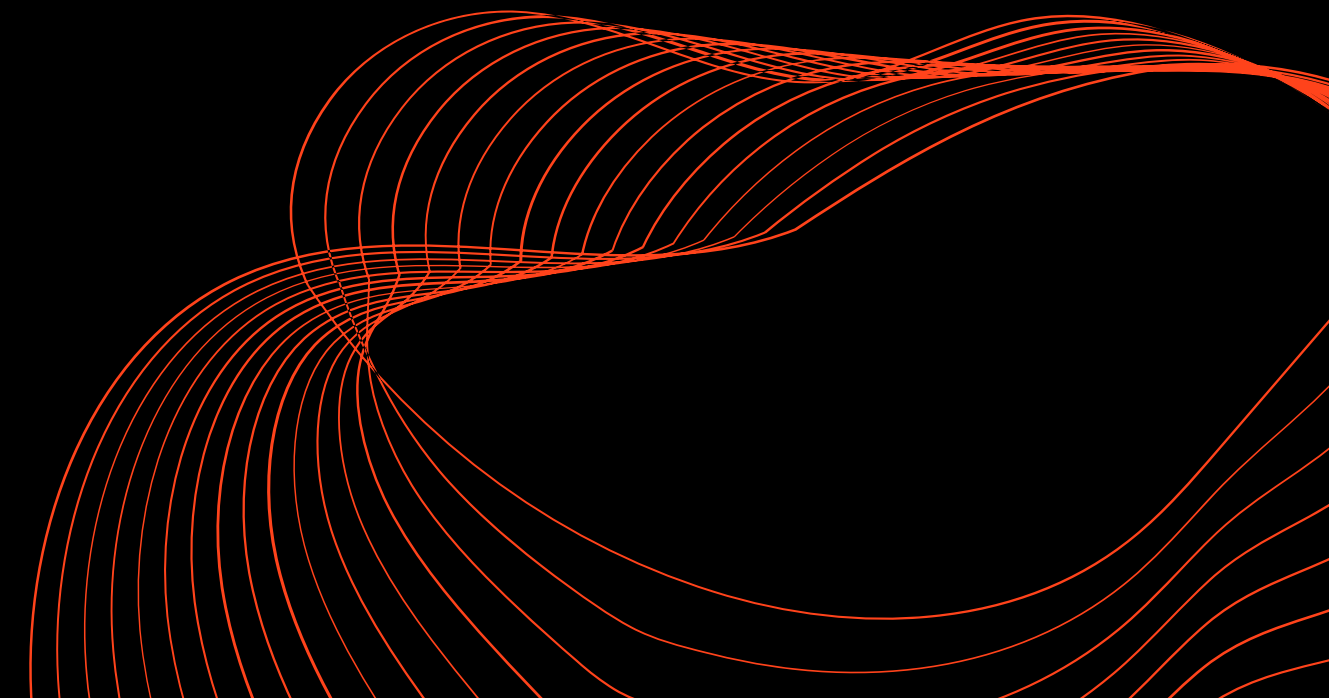
A White Paper for Evaluating Horticultural LED Lighting Performance and Value Proposition Based on
Independent Laboratory Testing Data



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SUMMARY OF VALUE PROPOSITION

03

—We had 8 commercially available LED lighting solutions tested by the most experienced independent lab in the industry, gathered the data, and derived a best-in-class winner using a weighted average scoring system.



PURPOSE

To independently test and validate the claimed performance of market available LED fixtures within the horticulture lighting sector using verifiable data, not marketing jargon.



UN-BIASED

We hired a reputable independent light testing laboratory to test these 8 indoor LED lighting solutions. We then gathered, analyzed, and scored the results.



PROOF

We created a proprietary scoring system called the Product Performance Index that weighs the efficiency, effectiveness, and value of each of the 8 LED fixtures to derive a best-in-class winner.

ITL LABS OF BOULDER

04

—The 8 commercially available LED fixtures were independently tested by Independent Testing Laboratory of Boulder, a highly respected third party testing lab, to obtain our data.



PURPOSE

ITL provides lighting manufacturers, designers, architects, the government and others an accurate, efficient and unbiased source of evaluation for virtually every type of lighting.



HISTORY

ITL, founded in 1955, was one of the first independent light testing laboratories in the country.



TOOLS USED

Testing of the horticultural lighting fixtures were performed using ITL's scientific grade integrating spheres/spectroradiometer systems and ITL type C goniophotometers.

BACKED BY HYDROFARM

05

—Hydrofarm is the largest independent manufacturer and distributor of hydroponic equipment in North America with over 4 decades of experience supporting CEA growers. Hydrofarm's mission is to provide professional service, delivery, and value by offering the right gardening products, innovation, and expertise to make your indoor, hydroponic, or greenhouse efforts easier and more productive.

40 YEARS

Hydrofarm has a 40 year proven track record of empowering growers as an experienced independent specialty gardening wholesaler and manufacturer.

GROWER CENTRIC

Our extensive network of resellers, growers, and university researchers allows us to obtain first hand knowledge of what is important to growers and how to best serve their needs.

COMMITTED

Hydrofarm is committed to providing the highest quality products in the market.



ITL REPORT RESULTS

PHOTOBIO•MX

Gavita Pro 1700e

Luxx 645w LED PRO

HLG 650 R

Fluence SPYDR 2i

Fluence SPYDR 2p

Growers Choice ROI-E680

Nextlight Mega

ITL LAB REPORT RESULTS

PHOTOBIO•MX

PHOTOMETRIC	
Total Integrated Flux (lumens)	114015 *
PAR Conversion Factor**	0.015157
SPECTRORADIOMETRIC	
Observer	CIE 1931 2 degree
Chromaticity Ordinate x	0.3913
Chromaticity Ordinate y	0.3707
Observer	CIE 1976 2 degree
Chromaticity Ordinate u'	0.2348
Chromaticity Ordinate v'	0.5005
Correlated Color Temp CCT (K)	3663
Total Radiant Flux (milliWatts)	370073 *
ELECTRICAL	
Input Voltage (Volts AC)	277.0
Input Current (Amps AC)	2.42
Input Power (Watts)	653.1
Input Power Factor (%)	97.4
Input Current THD (%)	7.6
Input Voltage THD (%)	0.2
EFFICACY (lumens/Watt)	174.6

HORTICULTURAL	
Micromoles per second*	
PPF (Φ_p) (400-700nm)	1728.15
UVPF ($\Phi_{p,uv}$) (280-400nm)	3.08
FRPF ($\Phi_{p,fr}$) (700-800nm)	37.51
PBAR (280-800nm)	1768.74
UVPF (UVA) (315-400nm)	2.59
UVPF (UVB) (280-315nm)	0.49
PF(Φ) (300-400nm)	2.85
PF(Φ) (400-500nm)	286.33
PF(Φ) (500-600nm)	716.96
PF(Φ) (600-700nm)	724.86
PF(Φ) (700-800nm)	37.51
Photosynthetic Photon Efficacy (K_p)	2.646

*See appendix for footnotes



ITL LAB REPORT RESULTS

Gavita Pro 1700e

PHOTOMETRIC	
Total Integrated Flux (lumens)	110827 *
PAR Conversion Factor**	0.015481
SPECTRORADIOMETRIC	
Observer	CIE 1931 2 degree
Chromaticity Ordinate x	0.3713
Chromaticity Ordinate y	0.3581
Observer	CIE 1976 2 degree
Chromaticity Ordinate u'	0.2266
Chromaticity Ordinate v'	0.4917
Correlated Color Temp CCT (K)	4124
Total Radiant Flux (milliWatts)	370935 *
ELECTRICAL	
Input Voltage (Volts AC)	277.0
Input Current (Amps AC)	2.37
Input Power (Watts)	649.9
Input Power Factor (%)	99.0
Input Current THD (%)	11.2
Input Voltage THD (%)	0.1
EFFICACY (lumens/Watt)	170.5

HORTICULTURAL	
Micromoles per second*	
PPF (Φ_p) (400-700nm)	1715.74
UVPF ($\Phi_{p,uv}$) (280-400nm)	2.86
FRPF ($\Phi_{p,fr}$) (700-800nm)	38.88
PBAR (280-800nm)	1757.47
UVPF (UVA) (315-400nm)	2.40
UVPF (UVB) (280-315nm)	0.46
PF(Φ) (300-400nm)	2.64
PF(Φ) (400-500nm)	326.76
PF(Φ) (500-600nm)	702.80
PF(Φ) (600-700nm)	686.18
PF(Φ) (700-800nm)	38.88
Photosynthetic Photon Efficacy (K_p)	2.640



*See appendix for footnotes

ITL LAB REPORT RESULTS

Luxx 645w LED PRO

PHOTOMETRIC	
Total Integrated Flux (lumens)	104095 *
PAR Conversion Factor**	0.015654
SPECTRORADIOMETRIC	
Observer	CIE 1931 2 degree
Chromaticity Ordinate x	0.3767
Chromaticity Ordinate y	0.3574
Observer	CIE 1976 2 degree
Chromaticity Ordinate u'	0.2306
Chromaticity Ordinate v'	0.4922
Correlated Color Temp CCT (K)	3953
Total Radiant Flux (milliWatts)	351788 *
ELECTRICAL	
Input Voltage (Volts AC)	277.0
Input Current (Amps AC)	2.40
Input Power (Watts)	651.2
Input Power Factor (%)	98.0
Input Current THD (%)	8.1
Input Voltage THD (%)	0.1
EFFICACY (lumens/Watt)	159.9

HORTICULTURAL	
Micromoles per second*	
PPF (Φ_p) (400-700nm)	1629.52
UVPF ($\Phi_{p,uv}$) (280-400nm)	2.93
FRPF ($\Phi_{p,fr}$) (700-800nm)	40.52
PBAR (280-800nm)	1672.97
UVPF (UVA) (315-400nm)	2.47
UVPF (UVB) (280-315nm)	0.47
PF(Φ) (300-400nm)	2.72
PF(Φ) (400-500nm)	300.42
PF(Φ) (500-600nm)	655.37
PF(Φ) (600-700nm)	673.73
PF(Φ) (700-800nm)	40.52
Photosynthetic Photon Efficacy (K_p)	2.502

*See appendix for footnotes

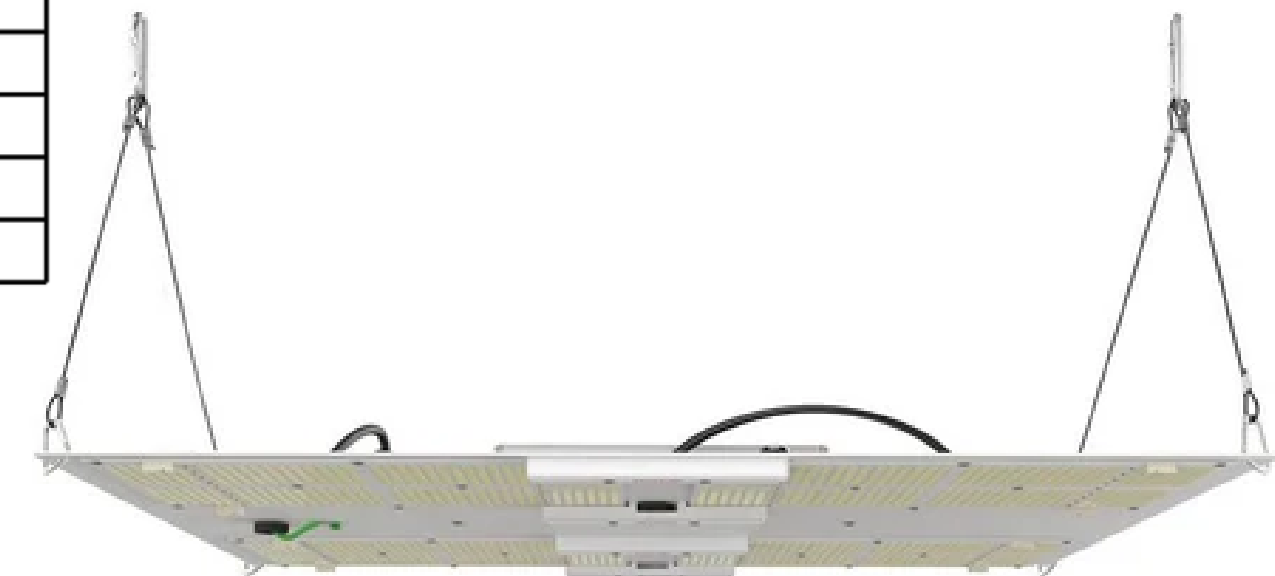


ITL LAB REPORT RESULTS

HLG 650 R

PHOTOMETRIC	
Total Integrated Flux (lumens)	99769 *
PAR Conversion Factor**	0.015806
SPECTRORADIOMETRIC	
Observer	CIE 1931 2 degree
Chromaticity Ordinate x	0.3937
Chromaticity Ordinate y	0.3715
Observer	CIE 1976 2 degree
Chromaticity Ordinate u'	0.2361
Chromaticity Ordinate v'	0.5012
Correlated Color Temp CCT (K)	3610
Total Radiant Flux (milliWatts)	336710 *
ELECTRICAL	
Input Voltage (Volts AC)	277.0
Input Current (Amps AC)	2.24
Input Power (Watts)	612.3
Input Power Factor (%)	98.7
Input Current THD (%)	7.7
Input Voltage THD (%)	0.1
EFFICACY (lumens/Watt)	162.9

HORTICULTURAL	
Micromoles per second*	
PPF (Φ_p) (400-700nm)	1576.95
UVPF ($\Phi_{p,uv}$) (280-400nm)	2.82
FRPF ($\Phi_{p,fr}$) (700-800nm)	38.38
PBAR (280-800nm)	1618.15
UVPF (UVA) (315-400nm)	2.41
UVPF (UVB) (280-315nm)	0.41
PF(Φ) (300-400nm)	2.65
PF(Φ) (400-500nm)	248.67
PF(Φ) (500-600nm)	623.17
PF(Φ) (600-700nm)	705.11
PF(Φ) (700-800nm)	38.38
Photosynthetic Photon Efficacy (K_p)	2.575



*See appendix for footnotes

ITL LAB REPORT RESULTS

Fluence SPYDR 2i

PHOTOMETRIC	
Total Integrated Flux (lumens)	104085 *
PAR Conversion Factor**	0.015318
SPECTRORADIOMETRIC	
Observer	CIE 1931 2 degree
Chromaticity Ordinate x	0.3765
Chromaticity Ordinate y	0.3640
Observer	CIE 1976 2 degree
Chromaticity Ordinate u'	0.2276
Chromaticity Ordinate v'	0.4952
Correlated Color Temp CCT (K)	4015
Total Radiant Flux (milliWatts)	344175 *
ELECTRICAL	
Input Voltage (Volts AC)	277.0
Input Current (Amps AC)	2.30
Input Power (Watts)	624.2
Input Power Factor (%)	98.0
Input Current THD (%)	0.1
Input Voltage THD (%)	6.4
EFFICACY (lumens/Watt)	166.7

HORTICULTURAL	
Micromoles per second*	
PPF (Φ_p) (400-700nm)	1594.37
UVPF ($\Phi_{p,uv}$) (280-400nm)	3.14
FRPF ($\Phi_{p,fr}$) (700-800nm)	37.25
PBAR (280-800nm)	1634.77
UVPF (UVA) (315-400nm)	2.51
UVPF (UVB) (280-315nm)	0.63
PF(Φ) (300-400nm)	2.86
PF(Φ) (400-500nm)	290.40
PF(Φ) (500-600nm)	660.09
PF(Φ) (600-700nm)	643.88
PF(Φ) (700-800nm)	37.25
Photosynthetic Photon Efficacy (K_p)	2.554

*See appendix for footnotes



ITL LAB REPORT RESULTS

Growers Choice ROI-E680

PHOTOMETRIC	
Total Integrated Flux (lumens)	95939 *
PAR Conversion Factor**	0.015145
SPECTRORADIOMETRIC	
Observer	CIE 1931 2 degree
Chromaticity Ordinate x	0.3823
Chromaticity Ordinate y	0.3637
Observer	CIE 1976 2 degree
Chromaticity Ordinate u'	0.2317
Chromaticity Ordinate v'	0.4960
Correlated Color Temp CCT (K)	3844
Total Radiant Flux (milliWatts)	314008 *
ELECTRICAL	
Input Voltage (Volts AC)	277.0
Input Current (Amps AC)	2.63
Input Power (Watts)	673.3
Input Power Factor (%)	92.4
Input Current THD (%)	15.3
Input Voltage THD (%)	0.2
EFFICACY (lumens/Watt)	142.5

HORTICULTURAL	
Micromoles per second*	
PPF (Φ_p) (400-700nm)	1452.96
UVPF ($\Phi_{p,uv}$) (280-400nm)	2.49
FRPF ($\Phi_{p,fr}$) (700-800nm)	39.30
PBAR (280-800nm)	1494.75
UVPF (UVA) (315-400nm)	2.13
UVPF (UVB) (280-315nm)	0.36
PF(Φ) (300-400nm)	2.32
PF(Φ) (400-500nm)	255.60
PF(Φ) (500-600nm)	606.71
PF(Φ) (600-700nm)	590.65
PF(Φ) (700-800nm)	39.30
Photosynthetic Photon Efficacy (K_p)	2.158

*See appendix for footnotes



ITL LAB REPORT RESULTS

Fluence SPYDR 2p

PHOTOMETRIC	
Total Integrated Flux (lumens)	94003 *
PAR Conversion Factor**	0.015574
SPECTRORADIOMETRIC	
Observer	CIE 1931 2 degree
Chromaticity Ordinate x	0.3781
Chromaticity Ordinate y	0.3589
Observer	CIE 1976 2 degree
Chromaticity Ordinate u'	0.2309
Chromaticity Ordinate v'	0.4931
Correlated Color Temp CCT (K)	3925
Total Radiant Flux (milliWatts)	316598 *
ELECTRICAL	
Input Voltage (Volts AC)	277.0
Input Current (Amps AC)	2.32
Input Power (Watts)	629.4
Input Power Factor (%)	97.9
Input Current THD (%)	6.6
Input Voltage THD (%)	0.1
EFFICACY (lumens/Watt)	149.4

HORTICULTURAL	
Micromoles per second*	
PPF (Φ_p) (400-700nm)	1464.02
UVPF ($\Phi_{p,uv}$) (280-400nm)	2.52
FRPF ($\Phi_{p,fr}$) (700-800nm)	38.75
PBAR (280-800nm)	1505.29
UVPF (UVA) (315-400nm)	2.09
UVPF (UVB) (280-315nm)	0.44
PF(Φ) (300-400nm)	2.33
PF(Φ) (400-500nm)	268.32
PF(Φ) (500-600nm)	590.43
PF(Φ) (600-700nm)	605.26
PF(Φ) (700-800nm)	38.75
Photosynthetic Photon Efficacy (K_p)	2.326



*See appendix for footnotes

ITL LAB REPORT RESULTS

Nextlight Mega

PHOTOMETRIC	
Total Integrated Flux (lumens)	97033 *
PAR Conversion Factor**	0.013982
SPECTRORADIOMETRIC	
Observer	CIE 1931 2 degree
Chromaticity Ordinate x	0.3878
Chromaticity Ordinate y	0.3797
Observer	CIE 1976 2 degree
Chromaticity Ordinate u'	0.2288
Chromaticity Ordinate v'	0.5040
Correlated Color Temp CCT (K)	3827
Total Radiant Flux (milliWatts)	295875 *
ELECTRICAL	
Input Voltage (Volts AC)	277.0
Input Current (Amps AC)	2.35
Input Power (Watts)	617.1
Input Power Factor (%)	94.8
Input Current THD (%)	9.0
Input Voltage THD (%)	0.2
EFFICACY (lumens/Watt)	157.2

HORTICULTURAL	
Micromoles per second*	
PPF (Φ_p) (400-700nm)	1356.72
UVPF ($\Phi_{p,uv}$) (280-400nm)	2.40
FRPF ($\Phi_{p,fr}$) (700-800nm)	44.54
PBAR (280-800nm)	1403.66
UVPF (UVA) (315-400nm)	2.01
UVPF (UVB) (280-315nm)	0.39
PF(Φ) (300-400nm)	2.22
PF(Φ) (400-500nm)	229.96
PF(Φ) (500-600nm)	620.34
PF(Φ) (600-700nm)	506.42
PF(Φ) (700-800nm)	44.54
Photosynthetic Photon Efficacy (K_p)	2.199



*See appendix for footnotes

PRODUCT PERFORMANCE INDEX

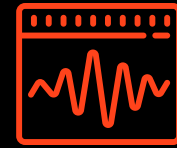
KEY METRICS

—Many factors came into play in determining the best LED fixture. PPF, PPE, Price, PBAR, Wattage, and Warranty were used to score the fixtures.



PRODUCT PERFORMANCE INDEX 'PPI'

The Product Performance Index is a weighted scoring system created by PHOTOBIO to measure the efficiency and effectiveness of LED fixtures. It includes metrics such as total PPF, PPE, PBAR, wattage, warranty, and total suggested retail price. This PPI indicator puts an emphasis on what we consider matters most to growers — performance, efficiency, and cost. For more details on how the PPI was formulated, see pages 37-38.



PPF

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Photosynthetic Photon Flux. Photosynthetic photon flux (PPF) is a measurement that determines the total amount of photosynthetically active radiation (PAR) a light gives off. Plants depend on light in order to perform the crucial function of photosynthesis. Additionally, plants depend on particular wavelengths of light to make photosynthesis possible. Plants primarily use wavelengths of light between 400 to 700 nanometers with an emphasis on red and blue light to achieve successful photosynthesis or PAR. The light within this range is called Photosynthetic Active Radiation. PPF represents the measurement of all the photons in this range ($\mu\text{mol}/\text{m}^2/\text{s}$).



PPE

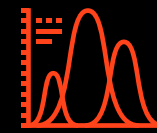
Photosynthetic Photon Efficacy. Efficacy is a measurement of how effective a grow light is at converting electrical energy into PAR. This is calculated by taking the PPF value and dividing it by the measurement of wattage (Joules per second). Therefore, efficacy measures exactly how much usable light a fixture produces every second per watt used ($\mu\text{mol}/\text{J}$).

KEY METRICS

—Many factors came into play in determining the best LED fixture. PPF, PPE, Price, PBAR, Wattage, and Warranty were used to score the fixtures.

PRICE

Pricing is important to consider since it defines the value vs. performance of the fixtures you are purchasing, as well as determining your initial investment of infrastructure for your grow. Price also is a big variable in determining your ROI after your crops are harvested.



PBAR

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Plant Biologically Active Radiation. Plant Biologically Active Radiation (or PBAR) is the wavelength of light between 280nm and 800nm, which plants can detect. It is similar to Photosynthetically Active Radiation (PAR) in that it plays a role in the biological processes of plants, but differs in that it affects more than just photosynthesis.



WATTAGE

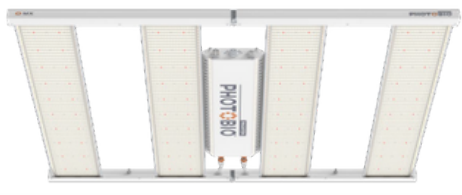







Wattage is a measure of electrical power. Higher wattage indicates higher energy to be consumed in a given time, but also more light generated. Higher wattage fixtures with a high PPE (efficacy) can be viewed as beneficial, due to overall cost savings since fewer fixtures would be required to light a room to a desired PPFD.



WARRANTY

Rest assured you are buying a quality product from a company that stands by their product and will guarantee that it will work for years to come.

PRODUCT PERFORMANCE INDEX RESULTS

DIRECT COMPETITION - LED FIXTURES - INDEPENDENT TESTING LAB RESULTS													
	VENDOR	Description	Overall Rank	Warranty	DLC	Tested PPE	Wattage	Tested PBAR	Tested PPF	\$\$SRP	SRP \$/W	SRP \$/PPF	Data Source
	Hydrofarm	PHOTOBIO•MX	1	5 Years	Yes	2.65	653.1	1768.7	1728.2	\$999.00	\$1.53	\$0.58	Source: Lab Test Results
	GAVITA	Gavita Pro 1700e	2	5 Years	Yes	2.64	650.0	1757.5	1715.7	\$1,399.00	\$2.15	\$0.82	Source: Lab Test Results
	Luxx Lighting	Luxx 645w LED PRO	3	5 Years	Yes	2.50	651.0	1673.0	1629.5	\$1,099.00	\$1.69	\$0.67	Source: Lab Test Results
	Horticulture Lighting Group	HLG 650 R	4	3 Years	No	2.58	612.3	1618.2	1577.0	\$1,099.00	\$1.79	\$0.70	Source: Lab Test Results
	FLUENCE	Fluence SPYDR 2i	5	5 Years	Yes	2.55	624.2	1634.8	1594.2	\$1,500.00	\$2.40	\$0.94	Source: Lab Test Results
	Growers Choice	Growers Choice ROI-E680	6	3 Years	Yes	2.16	673.3	1494.8	1452.9	\$999.00	\$1.48	\$0.69	Source: Lab Test Results
	FLUENCE	Fluence SPYDR 2p	7	5 Years	Yes	2.33	629.0	1505.3	1464.0	\$1,350.00	\$2.15	\$0.92	Source: Lab Test Results
	NextLight	Nextlight Mega	8	3 Years	No	2.20	617.1	1403.7	1356.7	\$1,735.00	\$2.81	\$1.28	Source: Lab Test Results

PRODUCT PERFORMANCE INDEX

The Product Performance Index is a weighted scoring system created by PHOTOBIO to measure the efficiency and effectiveness of LED fixtures. It is calculated using the independently tested lab data for PPF, PPE, PBAR, wattage, along with warranty and total suggested retail price. We then applied the weighting of each category metric to derive an overall fixture score.

The index puts an emphasis on what matters most to growers — performance, efficiency, and cost. Honesty, transparency, and data-backed claims are what make PHOTOBIO a brand growers can trust.

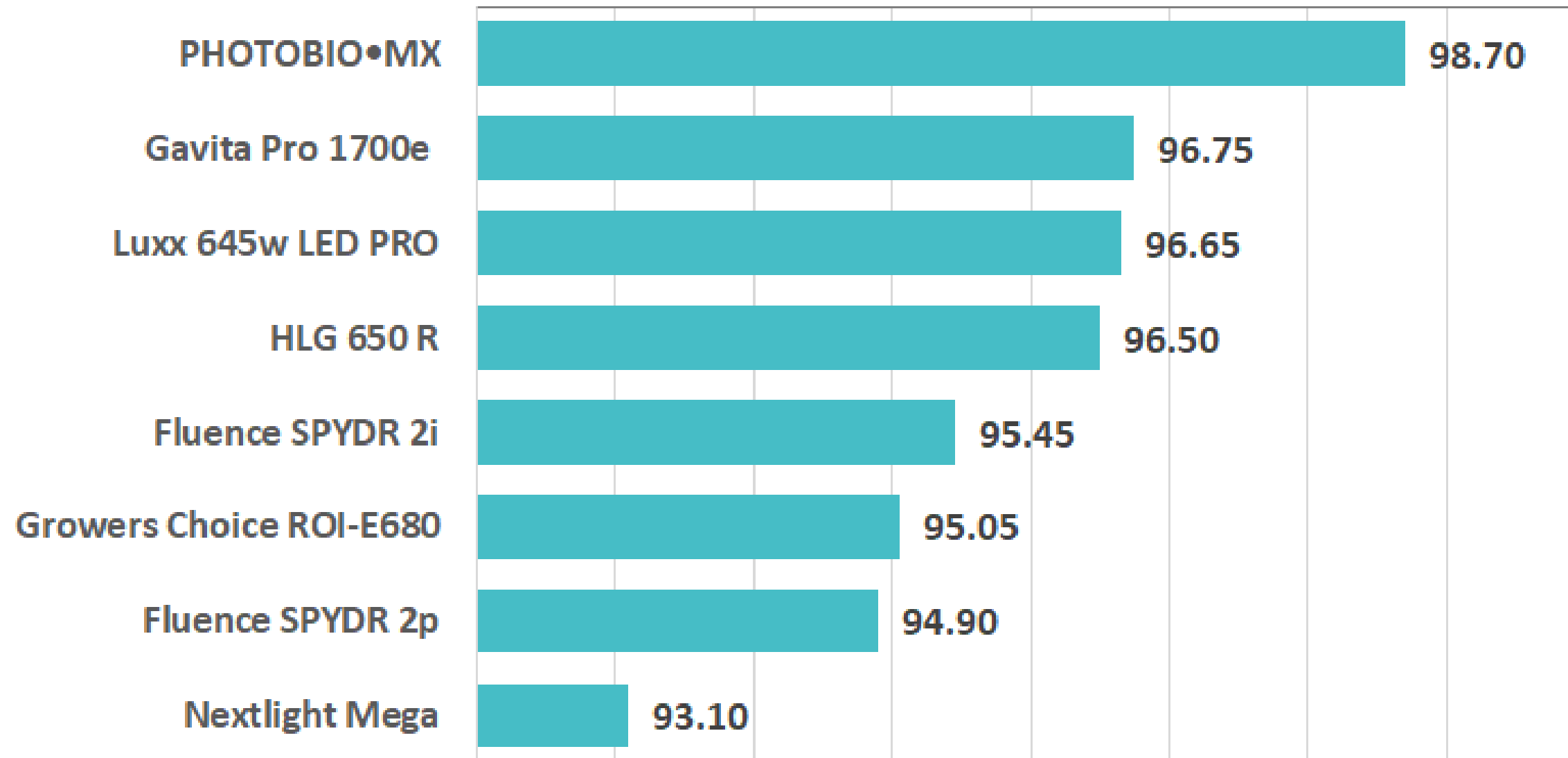
**Extraordinary performance.
Extreme efficiency.
Exacting design.**



PRODUCT PERFORMANCE INDEX - TOTAL SCORE

Below are our findings. The PHOTOBIO•MX reigns supreme as the best performance LED fixture at the best value for customers with a total score of 98.70.

Total PPI Score Results

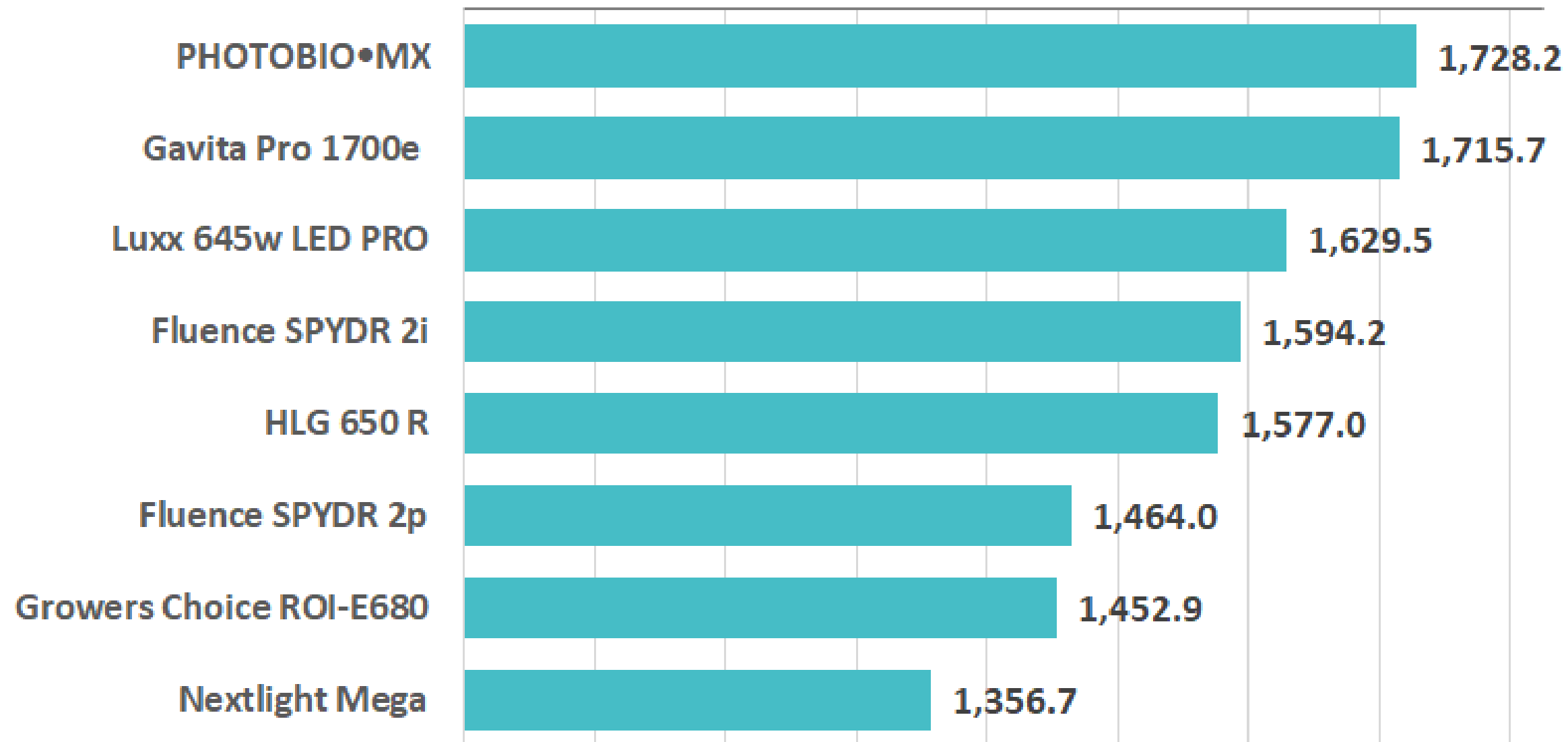


The PPI index puts an emphasis on what matters most to growers.

PPF - PHOTOSYNTHETIC PHOTON FLUX

PPF measures the photosynthetically active photons emitted between 400-700nm (PAR) by a lighting system per second. PPF does not tell us how much of the measured light actually lands on the plants or any other surface, but is an important metric to consider since it measures the total amount of light that is produced by an LED fixture each second.

PPF Testing Results

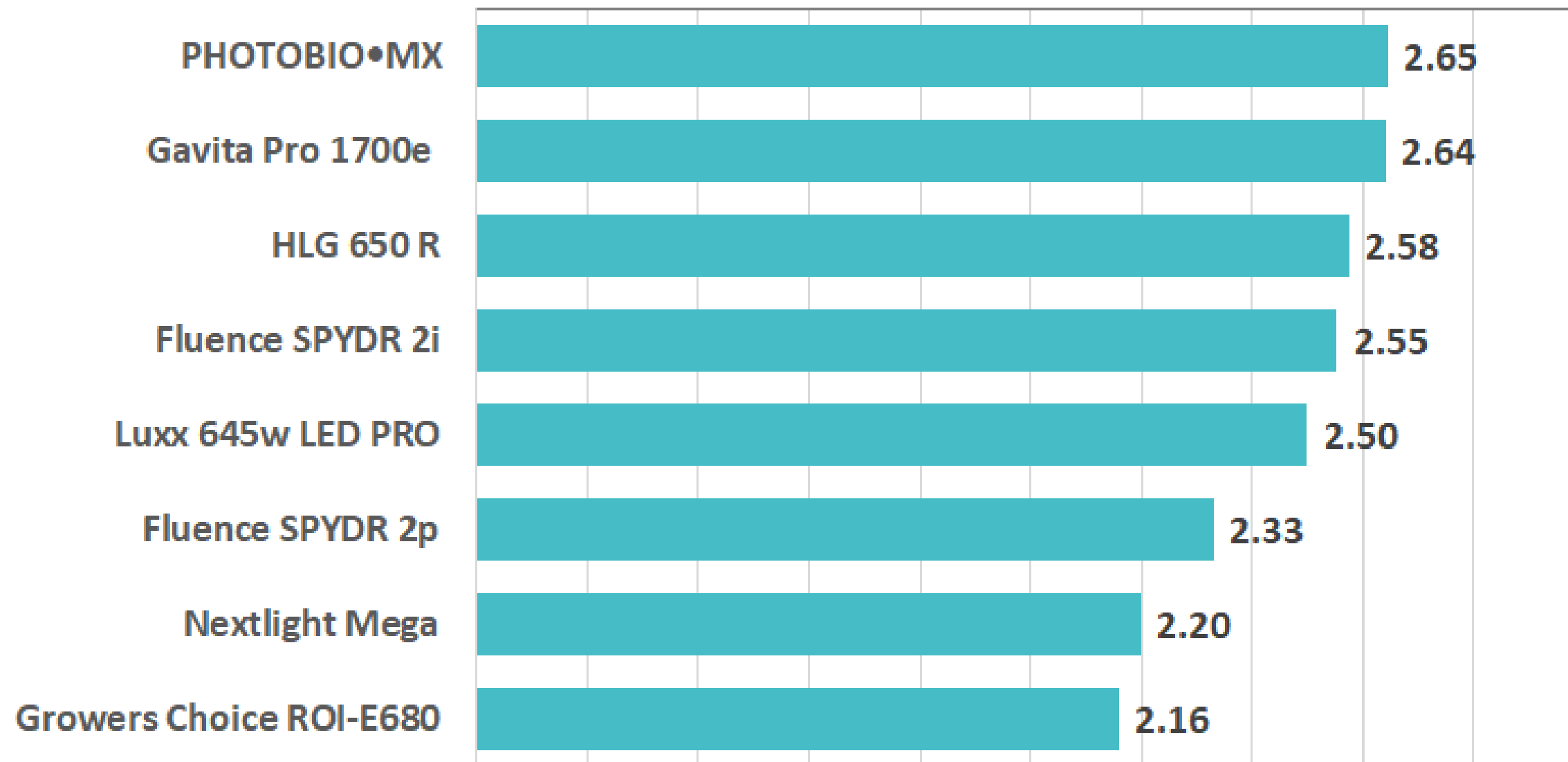


The higher the PPF, the more light produced.

PPE - PHOTOSYNTHETIC PHOTON EFFICACY

Efficacy is a measurement of how effective a grow light is at converting electrical energy into photosynthetically active radiation. This is calculated by taking the PPF value of the fixture and dividing it by the measured wattage of the fixture (Joules per second). Therefore, efficacy measures exactly how much usable light a fixture produces every second per watt used ($\mu\text{mol}/\text{J}$). The higher the PPE, the more usable light the LED fixture produces for your crop.

PPE Testing Results

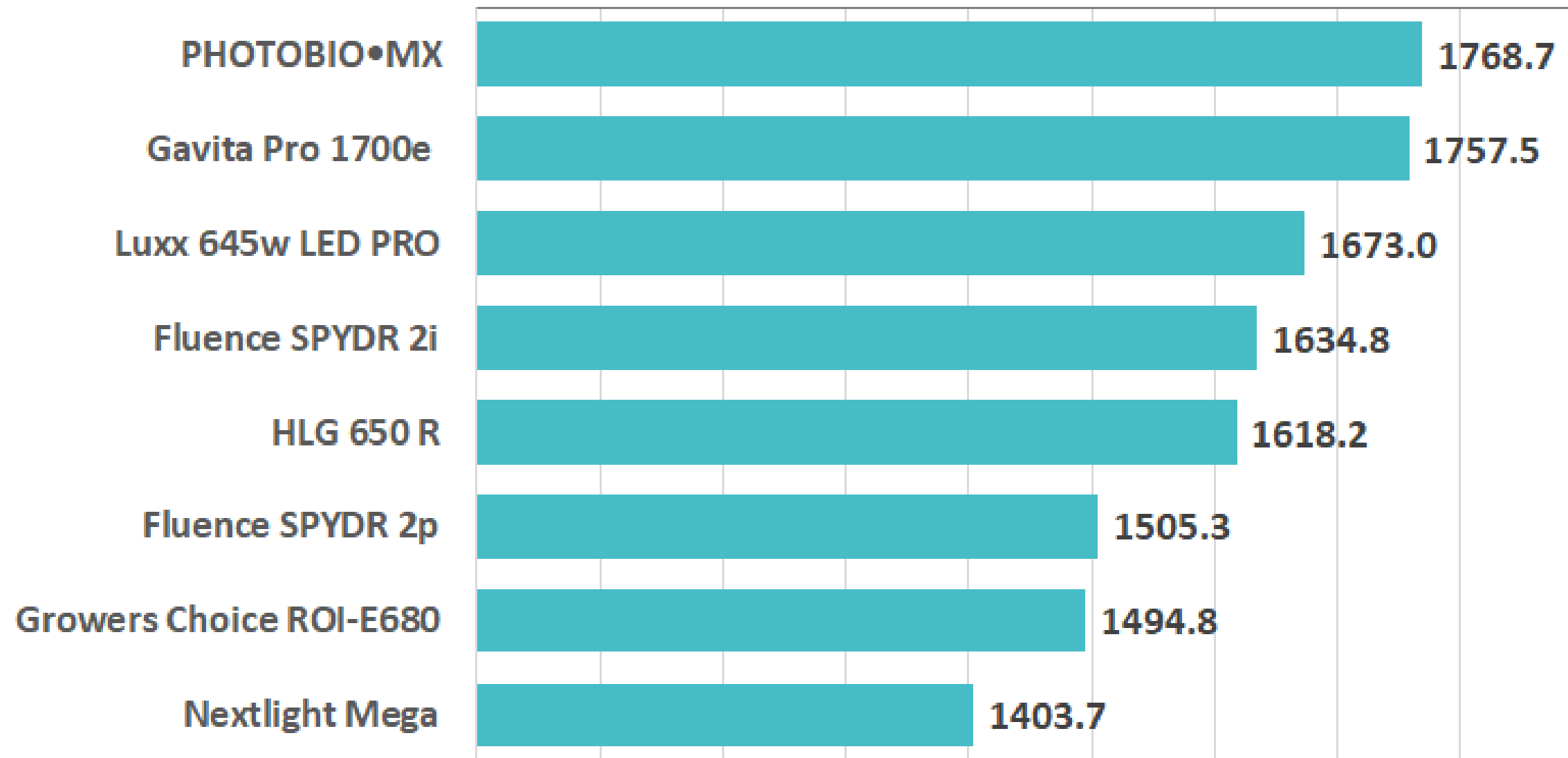


Efficacy measures exactly how much light a fixture produces every second per watt used ($\mu\text{mol}/\text{J}$).

PBAR- PLANT BIOLOGICALLY ACTIVE RADIATION

Plant Biologically Active Radiation (or PBAR) is the spectrum of light between 280nm and 800nm, which plants use for photosynthesis and other biological processes. It is similar to Photosynthetically Active Radiation (PAR) in that it plays a role in the biological processes of plants, but differs in that it affects more than just photosynthesis. PBAR is measured in $\mu\text{mol}/\text{sec}$, and includes UVA, UVB and Far Red light—which are important to consider as these impact germination, flowering, and yield quality of your crop.

PBAR Testing Results



PBAR includes PAR, UV, and far-red energy—important for crop yield and quality.

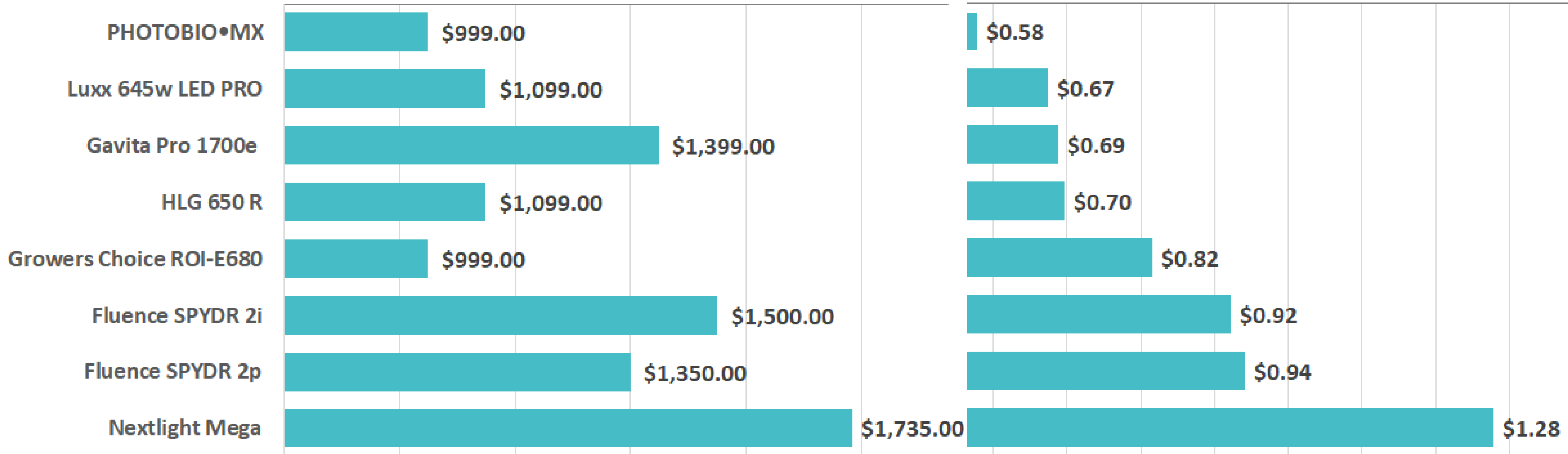
PRICE

Pricing is important to consider since it defines the value vs. performance of the fixtures you are purchasing, as well as determining your initial investment for infrastructure as it relates to your grow. PHOTOBIO has proven that being the most expensive fixture does not mean being the best performing. PHOTOBIO offers the best value per dollar invested. Period.

Price/PPF Results

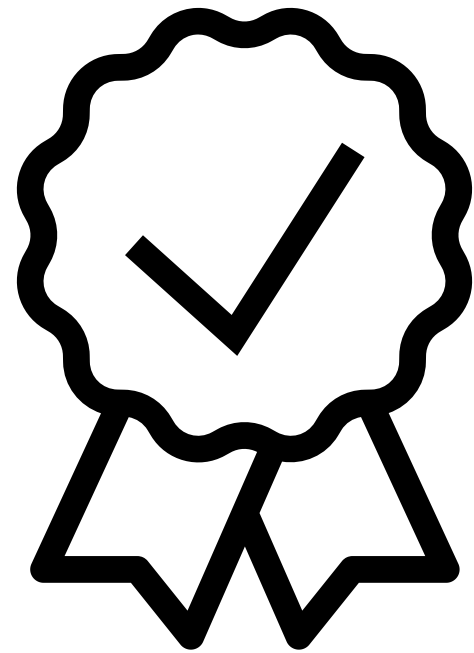
PRICE PER PPF

Price/PPF is a Value indicator. Get more light production with less dollars invested by looking at the Price/PPF ratio. (Calculated using Tested PPF)



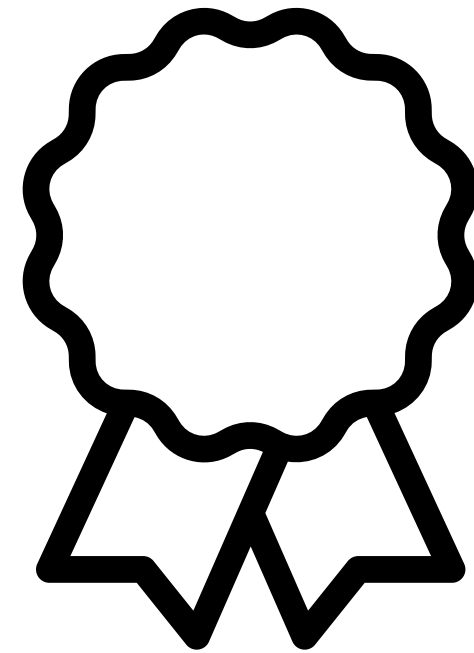
WARRANTY

Rest assured you are buying a quality product from a company that stands by their product and will guarantee that it will work for years to come.



5-YEAR WARRANTY

PHOTOBIO•MX
Gavita Pro 1700e
Luxx 645w LED PRO
Fluence SPYDR 2i
Fluence SPYDR 2p



3-YEAR WARRANTY

HLG 650 R
Growers Choice ROI-E680
Nextlight Mega

WINNER: PHOTOBIO•MX

—Many factors came into play in determining the best LED fixture. PPF, PPE, Price, PBAR, Wattage, and Warranty were used to score the fixtures.



BEST PERFORMANCE

Photobio•MX offers the highest PPE, PPF, PBAR among its competitors—meaning this LED system offers the most powerful light output and is the most efficient LED fixture within this form factor test group. Specifications of +1700 $\mu\text{mol/s}$ and +2.55 $\mu\text{mol/J}$ keeps your crops thriving throughout the plants life cycles.

26

BEST PRICE

Photobio•MX offers a complete LED system for \$999 including your choice of power cord with an included dimming cable. This LED tied in ranking as the most affordable unit within the testing group, but surpasses similarly priced fixtures in performance.



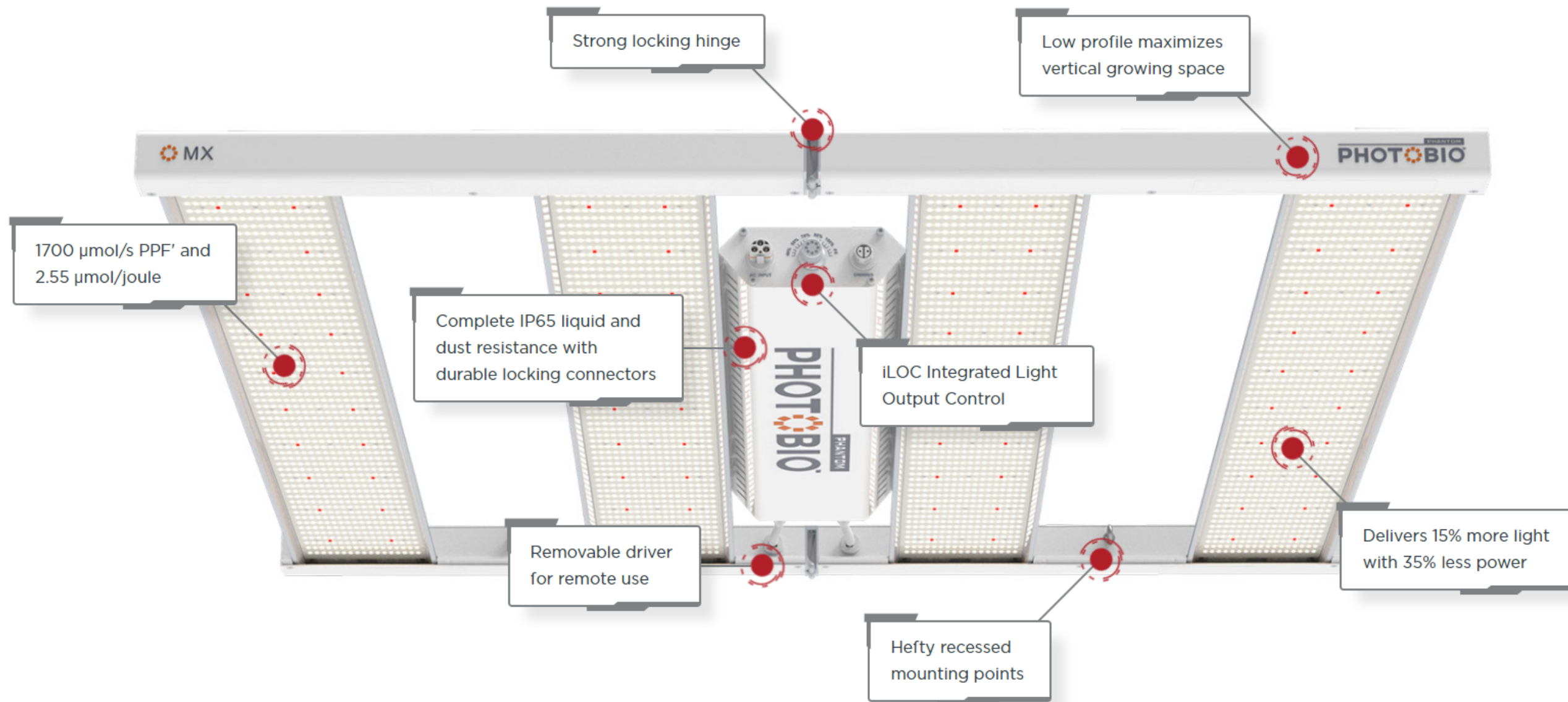
BEST VALUE

Photobio•MX offers the best value for the money among its competitors and provides growers the best light output, efficiency, and spectrum within the group — giving you higher yields per dollar invested into your grow. The Photobio•MX is also DLC listed, making the fixture eligible for further cost savings with energy rebates. Also, with a 5-year manufacturer's warranty, you can be confident in your investment.



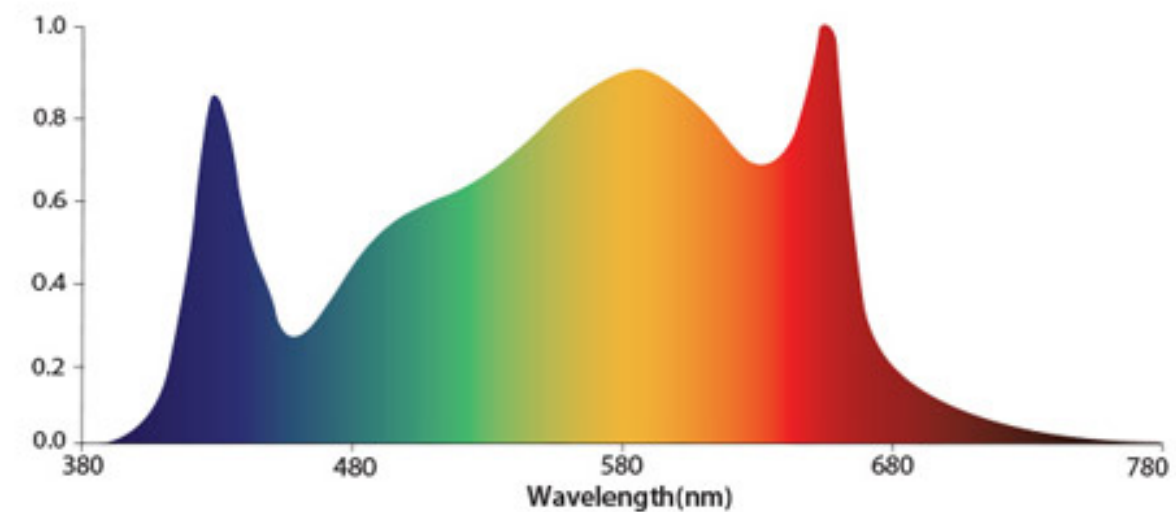
PHOTOBIO•MX

—The PHOTOBIO•MX LED with iLOC is a high efficiency LED fixture designed for horticultural professionals looking to increase performance and yields while maximizing ROI. Robust commercial design utilizes ultra-wide bars to deliver high light levels while allowing optimal air circulation. The high efficiency S4 spectrum provides more red, far-red, and blue wavelengths to deliver vigorous growth and optimize flower development. Multi-layer vertical racks can be utilized to maximize canopy square footage within existing structure footprint.



S4 SPECTRUM

Normalized Photon Output

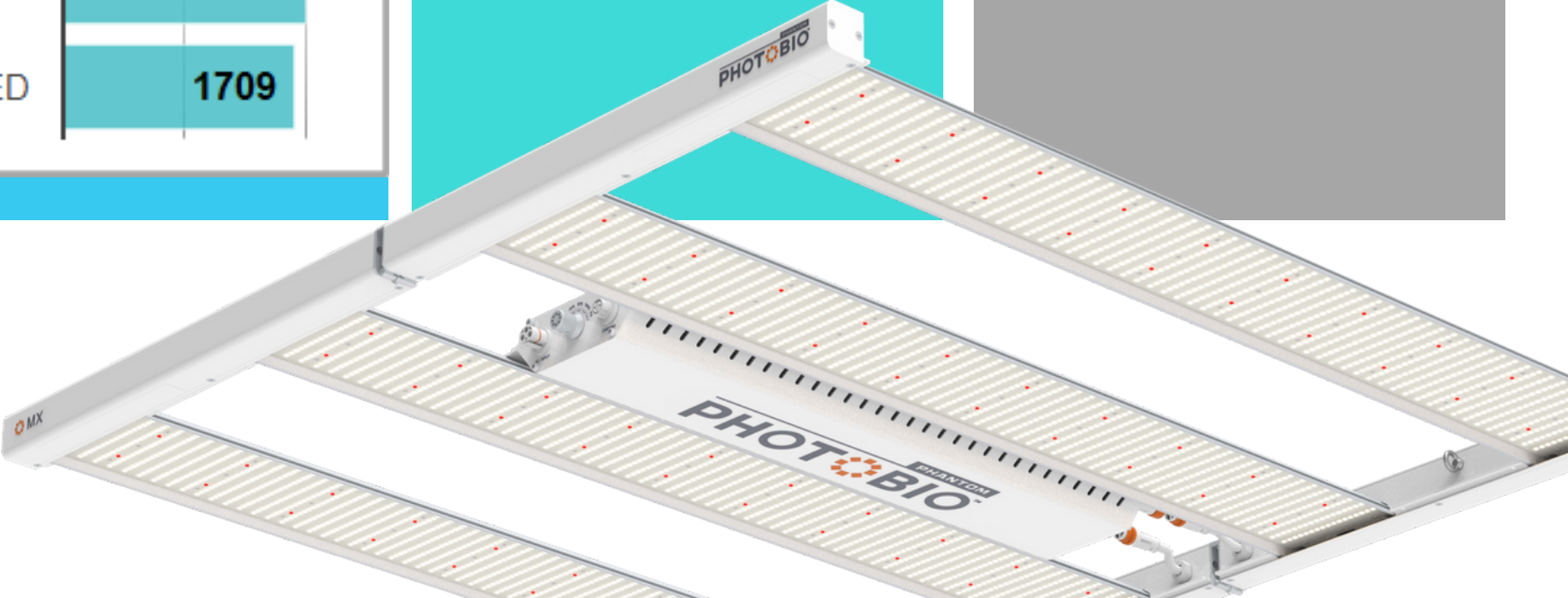


OVERALL RANKING



28

PPE	Wattage	PBAR	PPF	\$ SRP	Warranty
 #1	 #7	 #1	 #1	 #1	 #1
+3.9% PPE vs. specification claim TESTED: 2.65 CLAIMED: 2.55	Tested: 653W	Tested: 1768.70	+1.2% PPF vs. specification claim TESTED: 1728 CLAIMED: 1709	\$999.99	5 Year

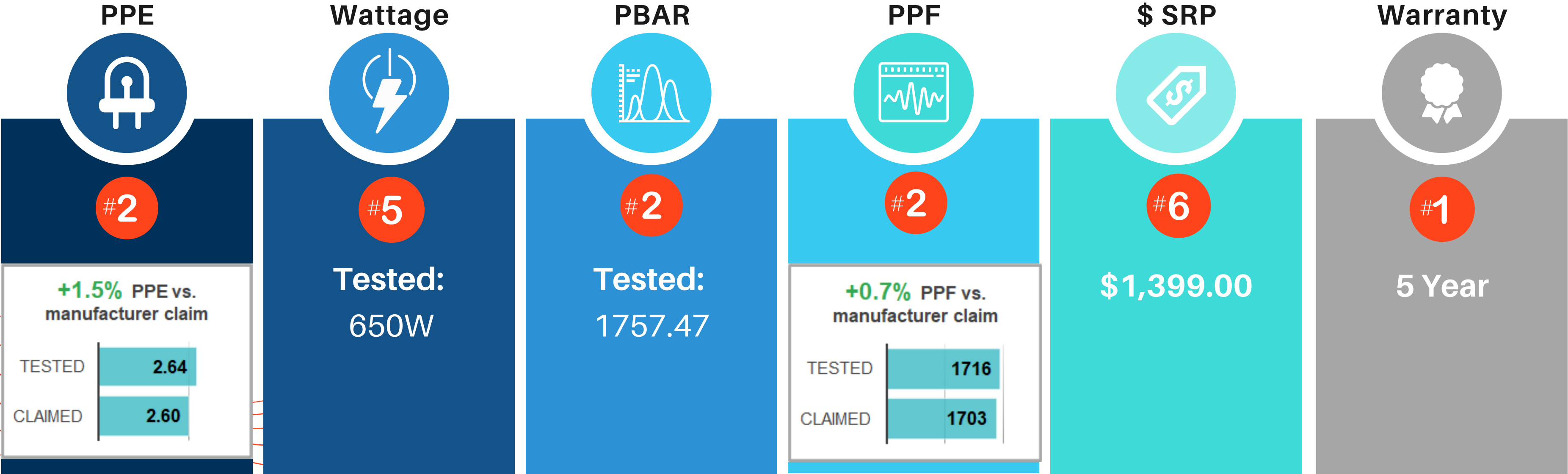


GAVITA PRO 1700E

OVERALL RANKING

#2

29



LUXX 645W LED PRO

OVERALL RANKING

#3

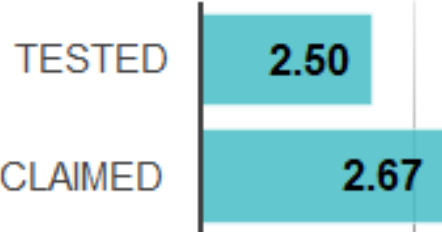
30

PPE



#5

-6.4% PPE vs. manufacturer claim



Wattage



#6

Tested:
651W

PBAR



#3

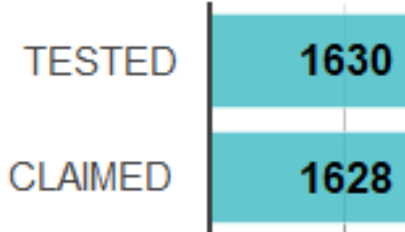
Tested:
1673.00

PPF



#3

+0.1% PPF vs. manufacturer claim



\$ SRP



#3

\$1,099.00

Warranty



#1

5 Year

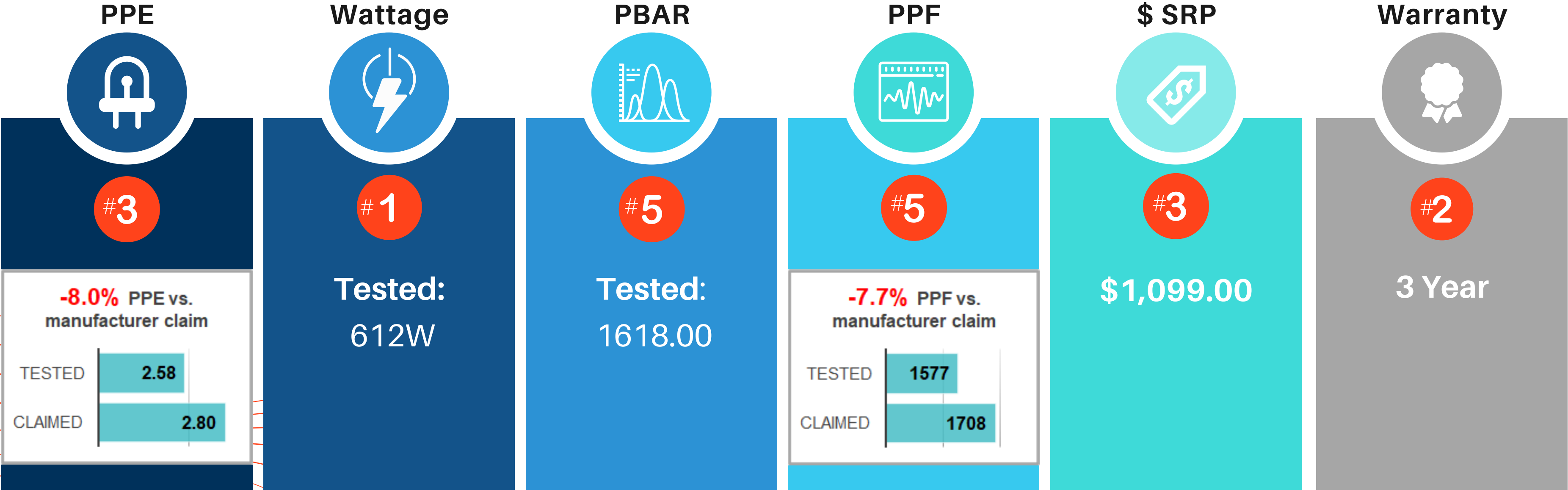


HLG 650 R

OVERALL RANKING

#4

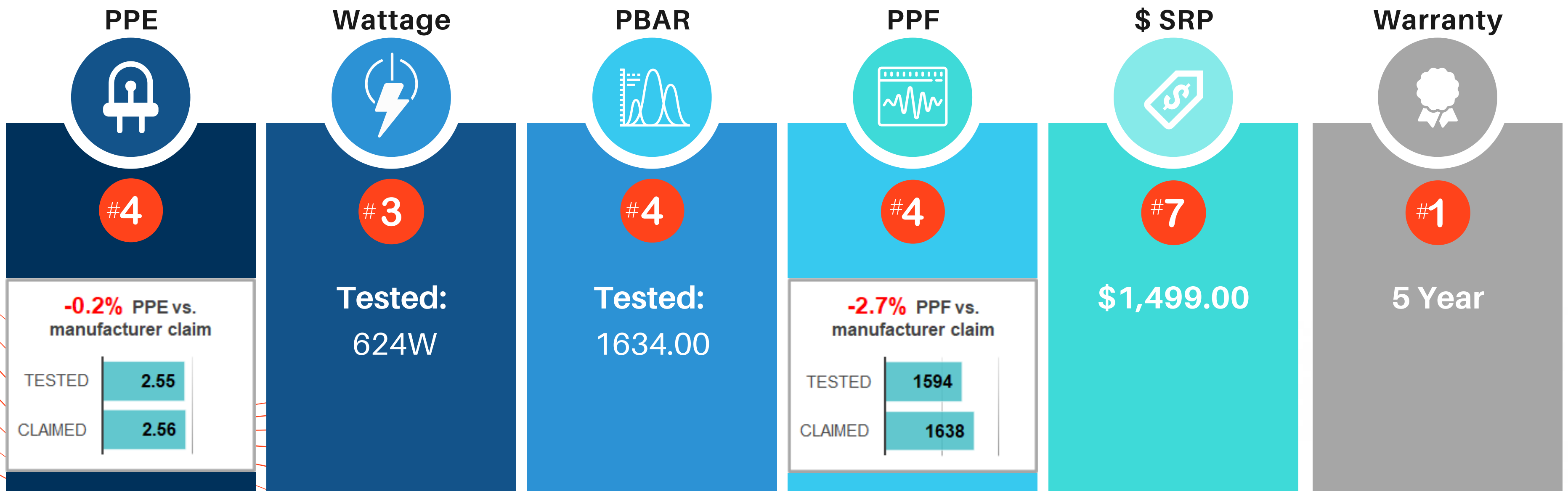
30



FLUENCE SPYDR 2I

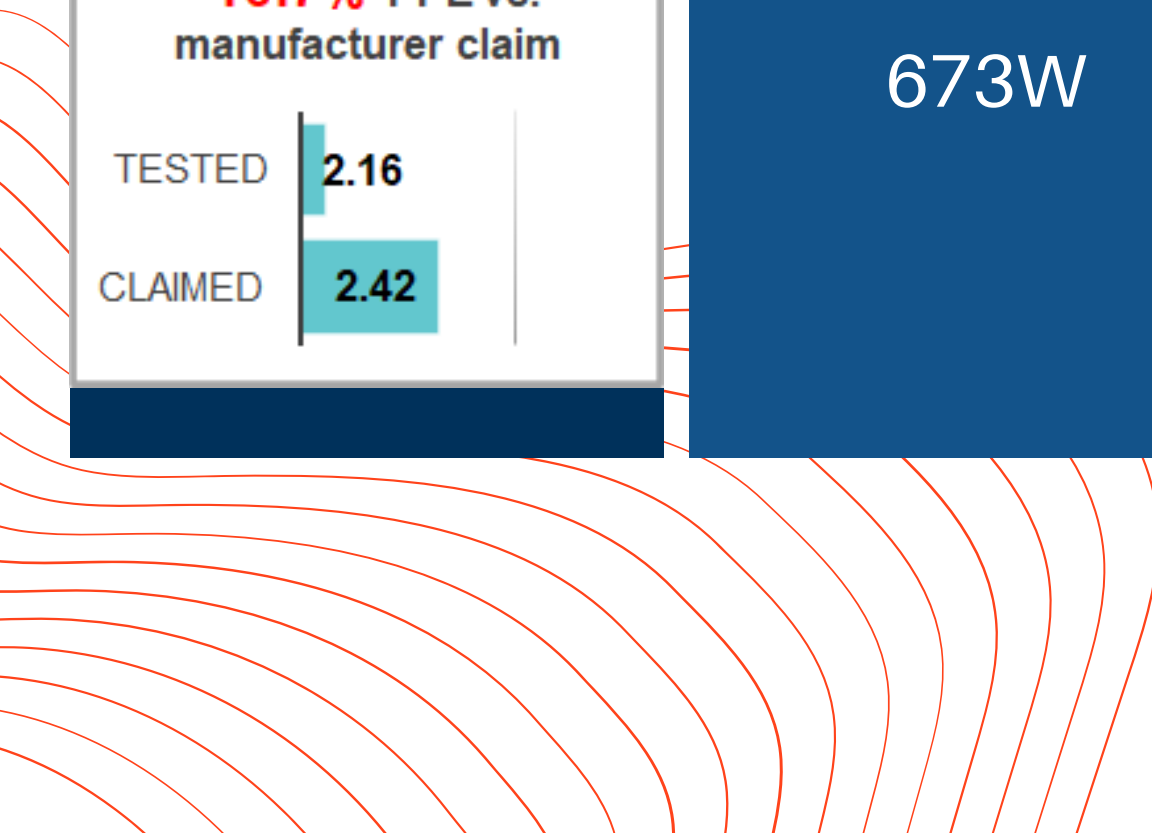
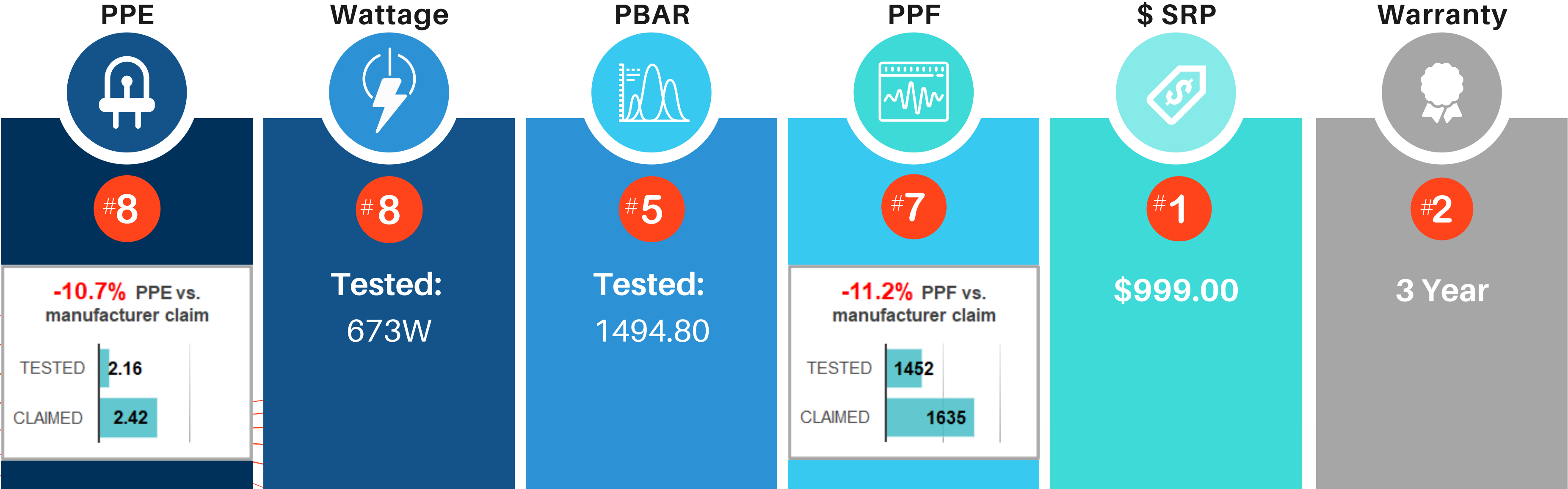
OVERALL RANKING #5

32



GROWERS CHOICE ROI-E680

OVERALL RANKING #6

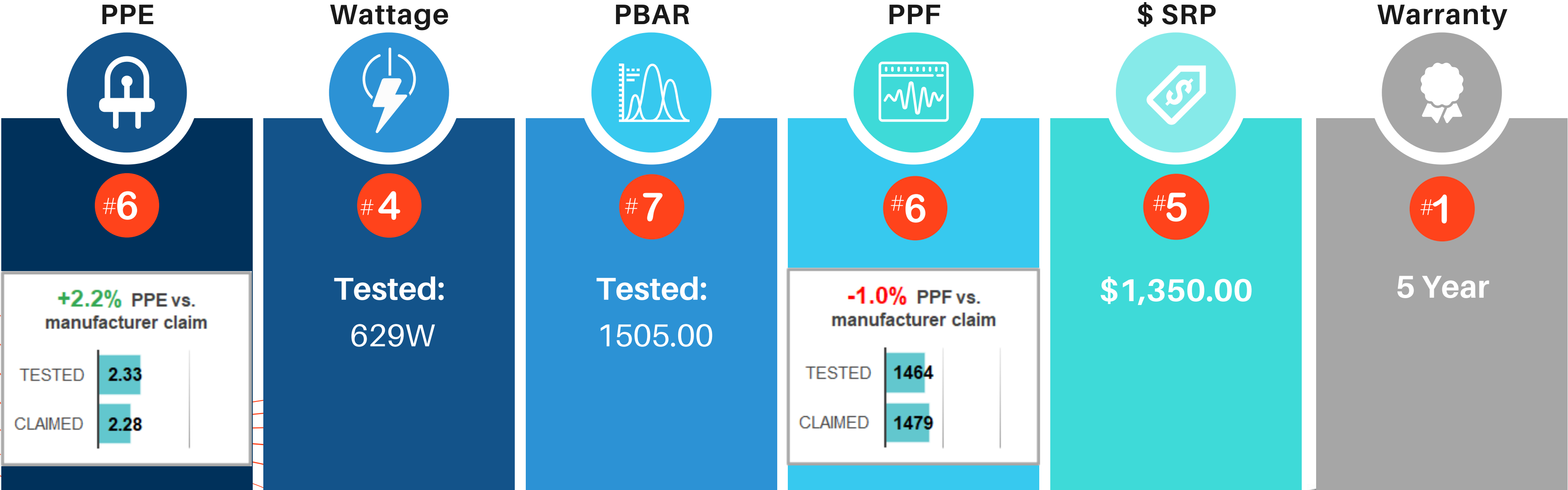


FLUENCE SPYDR 2P

OVERALL RANKING

#7

34

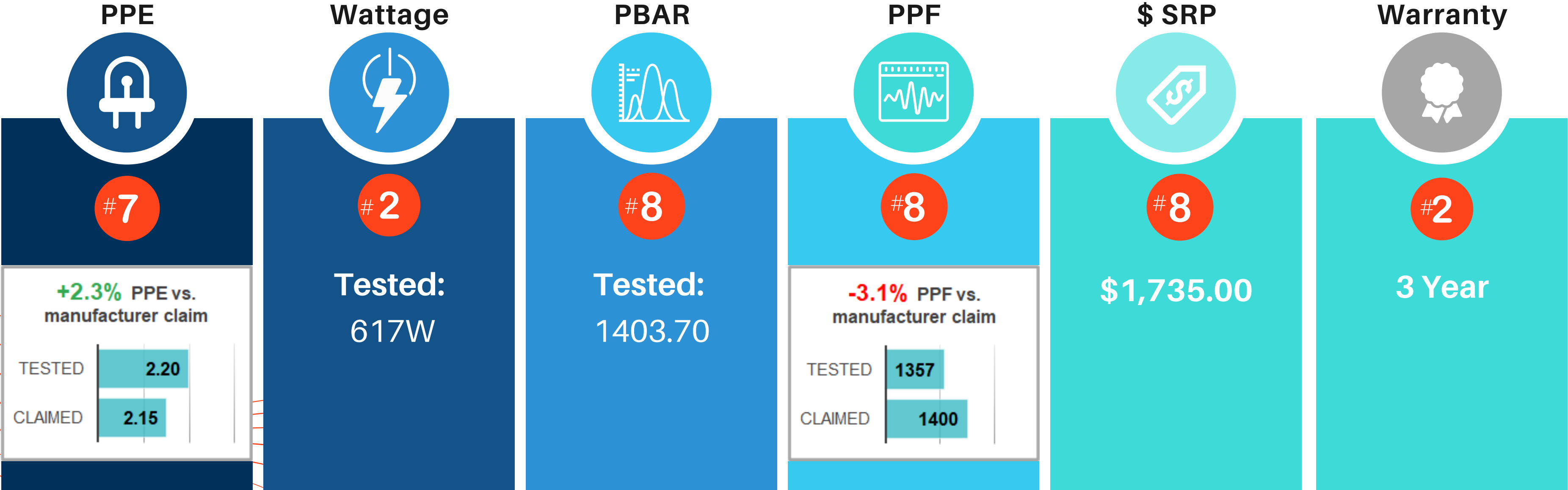


NEXTLIGHT MEGA

OVERALL RANKING

#8

35



APPENDIX

PRODUCT PERFORMANCE INDEX

—We weighed each key metric internally based on what we considered important to growers. We emphasized our weighting on performance metrics using PPF and PBAR, PPE for an efficiency metric, and price and product warranty for cost and quality metrics.



WHY WE DESIGN THE INDEX THIS WAY

—We understand there could be different opinions in designing and allocating the weights of metrics when calculating the index. Our approach is grower centric, industry focused, and research oriented.

GROWER CENTRIC

We utilized our network of seasoned commercial growers and hydroponic store owners to understand the factors that matter the most to growers.

INDUSTRY FOCUSED

Hydrofarm has been empowering growers since 1977 with our in-house knowledge and our network of industry experts.

RESEARCH ORIENTED

We referenced multiple research studies conducted by industry professionals and academic researchers.

DISCLOSURE & ACKNOWLEDGEMENTS

- Independent Testing Laboratory of Boulder is an independent NVLAP listed laboratory that is not affiliated with Hydrofarm, LLC or its subsidiaries.
- All samples submitted for testing were purchased through regular retail channels during 2020.
- Claimed manufacturer data was sourced from the DLC listing if applicable, or the manufacturer's website.
- All fixtures were tested at 277 volts.
- The PHOTOBIO trademark is owned by Hydrofarm, LLC.
- ITL Lab Report footnotes:

PHOTOMETRIC:

- *The total lumen output shown on the report was obtained from a photometric test on the fixture model noted.
- **PAR Conversion Factor (400-700nm): The PAR Conversion Factor is for converting lm/m² (lux) to micromoles per second per square meter ($\mu\text{mol} \cdot \text{s}^{-1} \cdot \text{m}^{-2}$). To obtain conversion factors from lm/ft² (footcandles) to micromoles per second per square meter ($\mu\text{mol} \cdot \text{s}^{-1} \cdot \text{m}^{-2}$), multiply the above factor by 10.764

HORTICULTURAL:

- *Micromoles per second
- PBAR: Photobiologically Active Radiation is the total $\mu\text{mol/s}$ from 280-800nm.
- Photosynthetic Photon Efficacy (Kp): $\mu\text{mol/joule}$



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