

How to compare grow lights

Let's face it: comparing various horticulture lighting systems can be a very difficult task. This is especially true due to the amount of exaggerated marketing claims, misleading information and blatantly wrong metrics that are common in the horticulture lighting industry. Hence, we decided to publish a quick guide to help you compare the various lighting solutions on the market. By following these guidelines and asking manufacturers these questions, we believe you be in a much better position to find a horticulture lighting solution that meets your needs.

OK, in order to explain the correct method for evaluating a horticulture lighting system, let's start by highlighting the metrics you should never use when comparing horticulture lighting systems.

- 🚫 **RULE NUMBER 1:** Don't use electrical watts to compare grow lights
- 🚫 **RULE NUMBER 2:** Don't use Lumens to compare grow lights
- 🚫 **RULE NUMBER 3:** Don't be fooled by a company that claims to have a magical growth spectrum
- 🚫 **RULE NUMBER 4:** Don't just look at a single PAR (PPFD) measurement directly under the fixture
- 🚫 **RULE NUMBER 5:** Don't focus on the wattage of the LED used in the fixture (1W, 3W, 5W, etc.)

In general, if you see a company using any of the above items to promote their horticulture lights, run away and don't look back. Neither of these metrics, nor their derivatives, tell you anything about the performance of a horticulture lighting system.

Rule No. 1

Many people use total electrical watts, \$/watt or watt/square foot to compare horticulture lighting systems, but these metrics are 100% useless and will most likely lead a consumer to make a poor purchase decision. Why? Simple. Electricity doesn't grow plants. Furthermore, radiometric efficiency (how much light a fixture emits per watt of electricity) can vary by up to 200% amongst the popular LED fixtures on the market today. Hence, since light (not electricity) grows plants, you need to ask how much light a fixture emits. It sounds simple, but 99.9% of horticulture lighting companies do not advertise this metric. Instead, they focus on electrical watts. Why? Because it is very hard to design an efficient lighting system that delivers high light levels (measured in $\mu\text{mol}/\text{Joule}$), and it is very easy to build an inefficient lighting system that consumes a lot of electricity. High efficiency LEDs, power supplies and optics cost more than less efficient components, and many manufacturers use lower quality components to increase profit margins. To reinforce Rule #1, let's compare two lighting systems using a real-world example.

Let's assume fixture A consumes 333 watts and Fixture B consumes 430 watts. Fixture A costs \$1000 and Fixture B costs \$1300. By only looking at the electrical watts of each fixture, many consumers would assume Fixture B is a

better fixture. After all, the \$/Watt is \$3 for both fixtures, and many people assume higher wattage lights are better for growing plants. **(See Figure 1)**

However, since Fixture A is 100% more efficient than Fixture B, Fixture A actually delivers 54% more light to the plants, despite costing 23% less than Fixture B. While it may be hard to believe, people who purchase Fixture A actually pay 50% less per unit of photosynthetically active light (PPF) than if they had purchased Fixture B. **(See Figure 2)**

Remember... You are not buying a lighting fixture. You are buying a system that delivers light to grow your plants, so a quantitative measure of light is the only relevant metric you should use to compare horticulture lighting solutions. In this real-world example, Fixture A is our SPYDR 600 GROW-MAX product. Fixture B is an LED fixture made by a competing LED company.

Rule No. 2

This one's easy to explain. A Lumen is a rating of how bright a light appears to the human eye. However, since human vision is not correlated to photosynthetic grow rates, total lumens is a dead metric. As a rule, if someone is trying to promote lumens for a horticulture lighting system, they should not be selling horticulture lighting systems.

Rule No. 3

Many scientific papers have confirmed that all wavelengths from 400nm to 700nm (the typical PAR range) will grow plants. However, there is a myth that is widely propagated on the Internet that claims plants do not use green light. Many companies promote their magical growth spectrum by publishing the commonly-referenced Chlorophyll A and B absorption spectrum chart. Armed with this chart, they mention that plants are green, so plants reflect green light from the full-spectrum light source. Have you heard this one before? Without going any deeper into this topic, it is important to note that there is no magical spectrum that is going allow a 50W fixture to replace a 1000W fixture because it only uses the "wavelengths that plants need." While plants certainly have multiple pigments and photoreceptors across the PAR range, nothing will trump the need for delivering the required light levels of light to your plants. Spectrum has a very real effect on plant morphology, but be cautious of a company that spends too much time talking about their special spectrum (especially if they do not spend equal effort in publishing their delivered PAR measurements.) There is a short list of companies who manufacture commercial-grade LED fixtures for the professional horticulture industry, and none of them market the number of LED 'bands' in their fixture.

Rule No. 4

Let's take a quick look at Rule 4. Unless you are growing a really small plant directly under your light, a single PPFD measurement doesn't tell you much. By clustering the LEDs closely together and using narrow beam optics, it is very easy for a manufacturer to show an extremely high PAR measurement directly under the fixture. However, unless you are only growing one plant in this exact location, you need to know how much PAR is being distributed across the entire grow area. Since most LED lighting systems centralize the LEDs into a small fixture footprint, these systems naturally produce very high PPFD levels directly under the fixture. However, these light levels will drop significantly as you move the PAR sensor just a small distance from the main fixture housing. Let's take a look at this example. If you are growing over a 4' x 4' area, you need to review the PPFD levels over the expanded footprint to calculate the average light level the lighting system is providing. If you only had the measurement point from figure 3, you may assume this fixture is extremely powerful. However, you would need multiple measurements across the 4x4 grow area to calculate the average amount of PAR that is provided by the fixture. (See Figure 4) Some companies rely on extremely narrow optics to provide sky-high PPFD numbers, but if your plants are bigger than a few square millimeters (the average sensor size on a PAR meter), then this number does not tell you much about the complete coverage area. Light uniformity across the grow area varies greatly from fixture to fixture, and unfortunately, most manufacturers do not publish complete PAR maps. It is easy to produce high PPFD numbers directly under the fixture, but it takes a very powerful light to deliver high PPFD values to the outer edges of a 4x4 grow area. Compared to fixtures costing less than \$2,000, the SPYDR 600 was developed to provide the industry's best uniformity over a 4' x 4' grow area. **(See Figure 3 and Figure 4)**

This is where a properly calibrated PAR meter is extremely useful. Coupled with a watt meter, these tools are invaluable when comparing the true performance of various lighting systems. If you would average the 400 measurement points in Figure B, you would have the true average light level in your grow area.

As another real-world example, let's study the PAR maps in Fixture 5 and 6. Our SPYDR 600 PAR map is seen in Figure 5, while the PAR map of one of our competitor's fixture is seen in Figure 6. Both fixtures cost approximately \$1,000 and they both consume approximately 300 watts. If you only considered the PPFD value directly under the fixture, you would assume the competitive fixture delivers more light than the SPYDR 600. However, since the

SPYDR 600 covers a much bigger area, the SPYDR 600 actually delivers 66% more light to the 4×4 grow area.

Rule No. 5

Do you use 1W, 3W, 5W or 10W LEDs? We are asked this question on a frequent basis, but the wattage of the LED does not tell you anything meaningful about the lighting system’s performance. Since LED and fixture efficiency varies widely, the wattage of the LED is not a meaningful metric. Remember, the LED wattage is a system Input, and growers care about the system Output. Hence, the LED wattage doesn’t tell us anything about the system’s ability to deliver light to your plants.

As a simple analogy, the LED inside a lighting system is equivalent to the engine in a car. By itself, the horsepower rating of the engine doesn’t tell you how fast the car will go. Pair a high-horsepower engine with a poorly designed transmission, and the car will not go very fast. Hence, as far as the driver is concerned, the relevant metrics for a car are related to the performance the car actually delivers (i.e. 0-60 mph time, top speed, miles per gallon, etc.). Any reference to a component inside the car is irrelevant to the driver. It is the same situation with lighting systems. The amount of light delivered to your grow area, the electrical watt consumption and the light distribution pattern are the important metrics, so ask for more information if a manufacturer wants to focus on the type of LED they use.

Note: Since LED quality varies by a very wide margin, it is important to know the brand of LEDs used in the lighting system. There are a handful of world-class LED manufacturers, so make sure you find out what type of LEDs are used in the lighting system. Assuming the fixture manufacturer has developed a reliable fixture design, higher quality LEDs should last longer if they are not being over-driven to achieve higher light levels.

Again, you are buying **light** to grow your plants. In our opinion, you want to buy a lighting system that delivers the required amount of light to your plants for the lowest initial cost while consuming the fewest electrical watts possible. Ask the fixture manufacturer to provide the following pieces on information: PPF, Input watts and PPFD Maps for your intended coverage area. With this information, you can calculate the most important metrics these metrics: PPF/\$, μmol/J, light distribution patterns and uniformity levels.

If you have any questions about this process, feel free to contact us or call us at 512-212-4544.

NOTE:

If you are not familiar with the differences in PAR, PPF and PPFD – please read our article first to get the most out of the rest of the information provided here.

[read article about par](#)

As a refresher, PAR (Photosynthetically Active Radiation) simply means the light a fixture emits that will promote photosynthesis in a plant. Important – PAR is not a metric; it is simply a type of light. PPF (Photosynthetic Photon Flux) is a critical metric that tells us how much light a fixture emits. It doesn’t measure the intensity at any location, but it tells us how many photos are coming out of the light every second. PPFD (Photosynthetic Photon Flux Density) tells us how much light is falling on a very specific location (i.e a specific leaf on your plant) every second. If you have a PAR meter, it is reporting PPFD (μmol/m2/s) measurements. You must understand the differences in these metrics before you can compare various horticulture lighting systems. Many manufacturers realize this can be a confusion topic, so it is very easy for companies to mislead consumers by showing a limited set of metrics. However, once you understand the differences in these metrics, you will be able to cut through all of the ‘marketing’ and ‘hype’ and ask manufacturers to provide all of the metrics you need to successfully compare lighting fixtures.

FIGURE 1:

	Fixture A	Fixture B	Difference
Electrical Watts	333	430	29%
Fixture price	1000	132	33%
\$/electical watt	\$3.00	\$3.02	1%

FIGURE 2:

	Fixture A	Fixture B	Difference
PPF	566	367	54%*

$\mu\text{mol/J}$ (electrical efficiency)	1.70	.85	100%**
\$/PPF (cost per unit of light)	1.77	3.54	101%***

*Fixture A emits 54% more light than Fixture B

**Fixture A emits 100% more light per watt than Fixture B

***Fixture B costs 101% more per unit of PAR than Fixture A

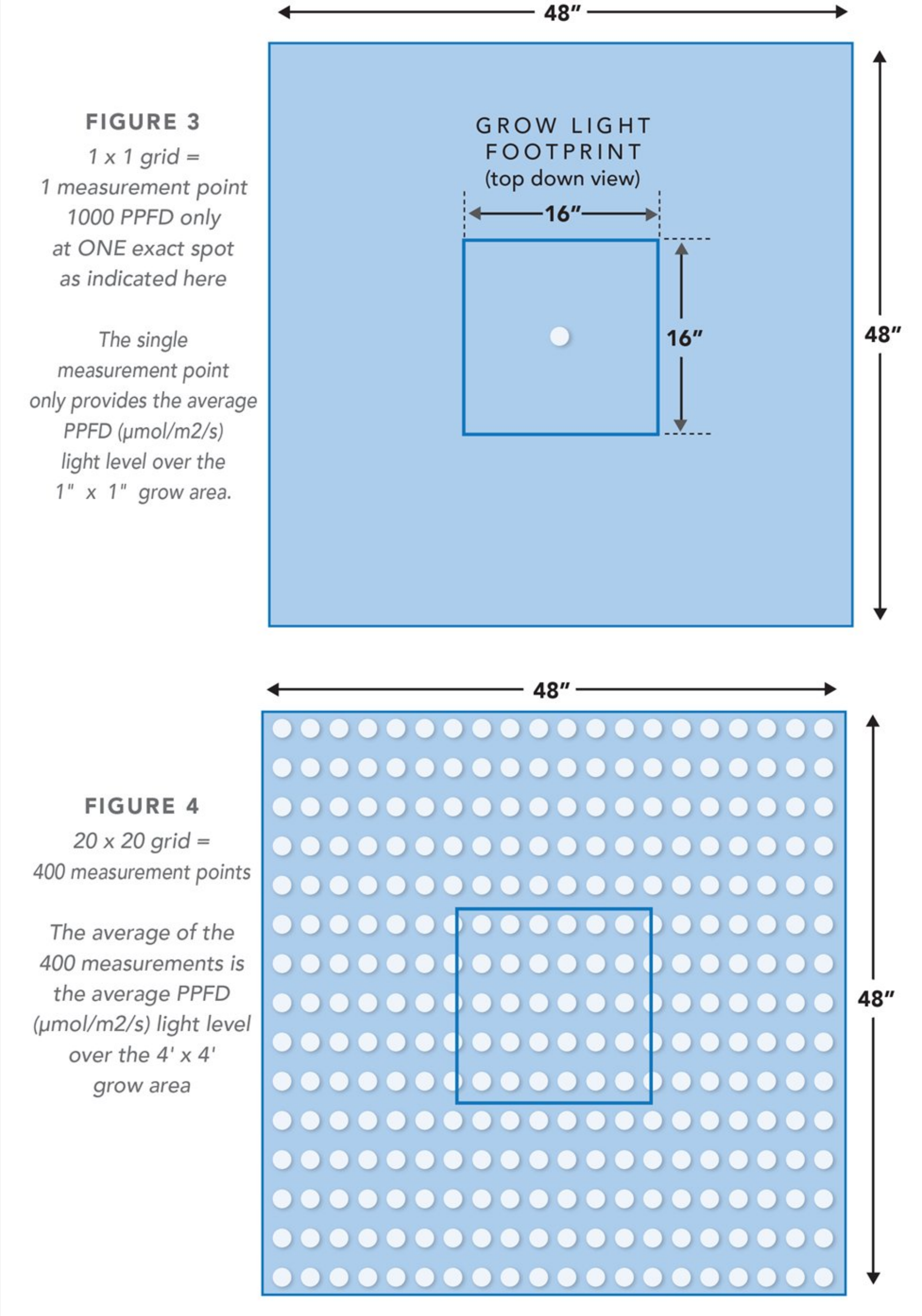


FIGURE 5:

SPYDR 1200 PAR map
light bars spread
for 4' x 4' coverage

PPFD
($\mu\text{mol}/\text{m}^2/\text{s}$)

450-600

300-450

150-300

0-150

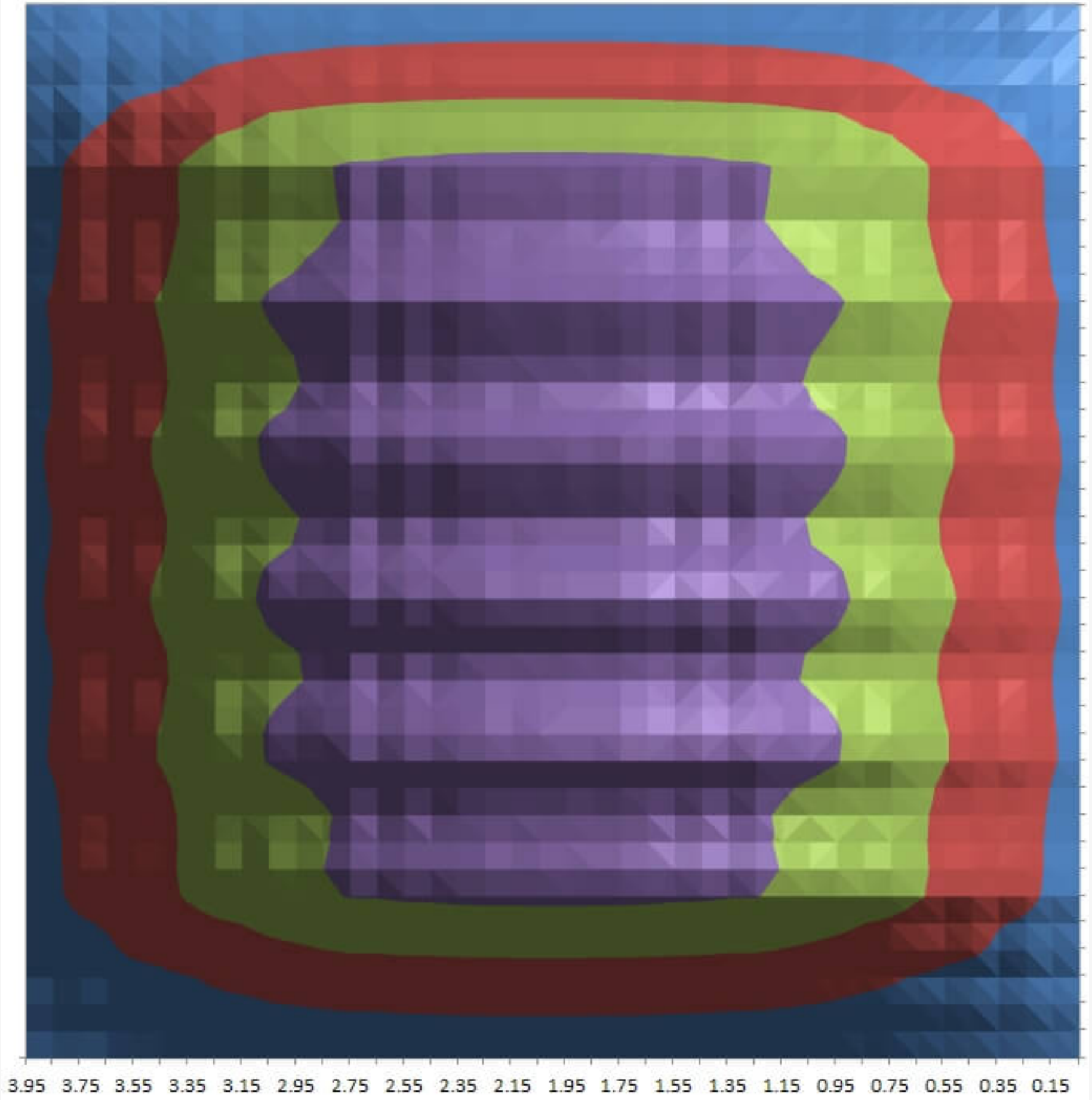


FIGURE 6:

Competitor's \$1,000 LED Light
PAR Map

PPFD
($\mu\text{mol}/\text{m}^2/\text{s}$)

750-900

600-750

450-600

300-450

150-300

0-150

