

LED Fixture Commercial Production Evaluation BIOS *Icarus*[™]

Test Facility: Denver Relief Production Facility Team



Denver Relief is among the first legal medical cannabis dispensaries to begin operating in Colorado. Since 2009, the team has consistently provided award winning cannabis to patients and customers in the mile high city. Focusing on creating the highest quality cannabis for the medical and recreational market, great attention is paid to optimizing the cannabis production environment to offer consistently outstanding product to their customers. This expertise is relied upon with their consulting firm (Denver Relief Consulting) to provide the highest quality support to their clients who are establishing successful cultivation operations and dispensaries in the ever-expanding list of states that are legal to consume cannabis.

The growers at Denver Relief have extensive experience with using a variety of lighting technologies for cannabis production, including the use of LED fixtures in their flowering and Research and Development lab. Working directly with the team at BIOS, an LED fixture evaluation was performed on the Icarus LED product. Recognizing that most LED grow lights on the market are irrelevant for the commercial production of Cannabis, the cultivation team at Denver Relief were excited to work with this product to see how it performed against the industry standard HPS lights.

“The BIOS team has a scientific approach and the experience with LED integration into a Cannabis grow facility that is unparalleled in the market,” says Nick Hice, Principal and Master Grower at Denver Relief. “Commercial production has a unique requirement of maintaining consistent quality and yield that our patients and customers have come to expect from our dispensary. The availability of commercial grade LED technology has always been missing from this industry, and we are committed to the supporting the evolution of these types of products to advance the energy savings attribute as well as yield and quality improvements that LEDs can offer,” says Ean Seeb, Principal at Denver Relief. “Based on the results we are seeing, we have recommended the BIOS Icarus LED fixture to our consultation clients across the country and Canada who are looking to use LEDs in their grow operations” according to Kayvan Khalatbari, Principal at Denver Relief.

The test compared the 660W BIOS Icarus LED fixture to 1000W high-pressure sodium (HPS). The lighting treatments were maintained in separate rooms, so that light contamination between lights was eliminated. Additionally, air temperatures were maintained separately so that the actual plant temperatures could be held constant between light treatments. Results showed that the total percentage of THC was not affected with either lighting technology tested, significant improvements to overall yield, flower density, and most of the measured terpenes was recorded for plants grown under the BIOS Icarus LED.



Initiation of the flowering phase (Day 11 of flowering cycle)

Testing Parameters

Strain Data: One cloned strain of Gorilla Glue #4 was used in the test. 12 plants were grown either under 1000W HPS or 660W Icarus LED fixtures in flowering mode for 62 days after a veg cycle of 38 days.

Energy Consumption (lighting system): The flowering cycle was maintained for 62 days until final harvest. 62 days x 12 hr/day x 660 watts x 6 fixtures = 2,946 kWh for the LED grown crop; 62 days x 12 hr/day x 1050W x 6 fixtures = 4,687 kWh for the HPS grown crop.

Plant Containers: The plants were grown in 5 gal pots filled with Coco mix. They were watered through a table flood technique every other day.

Grow Space: 96 ft² (8' x 12')

Environment: Day: 78-85 degrees F, 45-50% humidity. Night: 67-69 degrees F, 50-55% humidity, ambient CO₂.

Nutrition: House and Garden plus additional supplements.



Left: Flower development of strain "Gorilla Glue #4" at 36 days into the flowering cycle. Impressive flower and trichome development on these young flowers.



Right: Harvested and trimmed flowers of strain "Gorilla Glue #4" drying at the Denver Relief production facility.

Results

Table 1: Yield analysis of strain "Gorilla Glue #4" grown under High-Pressure Sodium (HPS) or BIOS Icarus LED light fixtures. Plants were harvested at 62 days after initiation of the flowering photoperiod (12 hr light/12 hr dark).

Strain/Lighting	# Plants	Total Plant Fresh Weight (g)	Flower Fresh Weight (g)	Trim Fresh Weight (g)	Total Dry Flower Weight (g)	Total THC (%)	Flower Yield Increase (%)
Gorilla Glue #4 (HPS)	12	23,600	12,422	4,866	1,679	22.7	--
Gorilla Glue #4 (Icarus LED)	12	24,680	15,275	3,132	3,163	22.0	47%

Table 2: Energy consumption, production rate, and yield value of strain "Gorilla Glue #4" grown under High-Pressure Sodium (HPS) or BIOS Icarus LED light fixtures.

Strain/Lighting	Total Dry Flower Weight (g)	Electrical Consumption (kWh)	Yield (g/kWh)	Yield (g/ft ²)	Electrical Cost (\$)*	Yield Value (\$) **
Gorilla Glue #4 (HPS)	1,679	4,687	0.36	17.5	\$516	\$16,790
Gorilla Glue #4 (Icarus LED)	3,163	2,946	1.07	32.9	\$324	\$31,360

*Electricity rate of \$0.11/kWh used in this calculation.

**Retail value of \$10/g used in this calculation.

Results (continued)

Table 3: Yield analysis of all four strains tested extrapolated (calculated) for a monoculture of four plants per strain at 25 ft².

	HPS	Icarus LED (QC Duplicate)	Average Icarus LED	Icarus LED	% Difference
(-)-borneol	0.102	0.118	0.131	0.125	22
(-)-caryophyllene oxide	0.271	0.251	0.263	0.257	-5
(L)-a-terpineol	0.294	0.304	0.342	0.323	10
b-pinene	0.267	0.406	0.444	0.425	59
Geraniol	0.132	0.127	0.132	0.130	-2
Limonene	1.22	2.63	2.87	2.750	125
Linalool	0.746	0.787	0.88	0.834	12
Myrcene	1.00	3.37	4.18	3.775	278
Terpinolene	0.0801	ND	0.102	0.102	27
Trans-caryophyllene	14.4	12.7	10.6	11.650	-19



Left: Flower development of strain "Gorilla Glue #4" at 53 days into the flowering cycle. As maturation of the flowers occurs, more weight gain and density are noted.



Right: Comparison of HPS-grown and BIOS Icarus LED-grown strain "Gorilla Glue #4". Density was significantly higher for the LED-grown crop.

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