

Table 1 Comparative overview of artificial light sources used in hydroponic crop production

Technology	Advantages	Limitations
LED	Efficient, tunable spectrum, low heat, long life	High upfront cost
HPS	High light intensity, low initial cost	Inefficient spectrum, high heat; shorter lifespan
Fluorescent	Inexpensive, low heat, effective for propagation	Limited spectrum, lumen decay, not ideal for full cycle