

Indoor Vertical Farming for High-Value Leafy Greens and Herbs

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BACKGROUND

Indoor vertical farming (aka plant factory) is a thermally-insulated and multi-shelf plant production system using artificial lighting (e.g. incandescent light, fluorescent lamps, and LEDs). Compared to conventional field production, growing plants under indoor controlled environment uses little water, less arable land, and little or no pesticides. Meanwhile, indoor vertical farming can be built near consumers since it is soilless production using artificial light, even in traditionally non-farming areas like deserts, polar regions, outer spaces, and megacities, which provides year-round fresh food and reduces food mileage. However, there are challenges such as high initial investment, high operation costs, and little technique information regarding vertical farming system. Light is one of the key factors affecting plant yield and nutritional quality, and electricity for lighting accounts for approximately 30% of the operation costs. Recent development in LED technology now provides the horticultural industry with an energy-saving light option and the flexibility of customer-based spectrum. However, limited information is known on the effects of different quantities and quality of LEDs on plant growth and nutritional quality.



OBJECTIVES

- Identify the minimum amount of light required for leafy greens and herbs without comprising crop yield and nutritional values.
- Evaluate how different light spectra/colors and their combinations affect plant growth and nutritional quality.

EXPECTED RESULTS AND BENEFITS

- Reduced production cost by characterizing the minimum daily light integral required for each crop;
- Improved energy use efficiency and enhanced nutritional quality without comprising yield through optimizing light quality and by supplemental light irradiation, e.g. UV-B, green, and far-red light;
- Demonstrate to farmers, growers, and researchers with clear decision-making guidelines in terms of the ideal light environment for crop production under indoor controlled environment.

