

LED and Fluorescent Lighting Effects on Hydroponically Grown 'Tom Thumb' Lettuce

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Abstract

Food safety, environmental impact, and efficient energy usage are growing concerns for horticultural production systems. Producing lettuce under artificial lighting could be a solution to address these concerns. Light-emitting diodes (LEDs) offer the advantages of a narrow light spectrum, low power consumption, and low heat production. The objective of this study was to compare the effects of LED lighting and fluorescent lighting and the sequence of the lighting on the growth of compact 'Tom Thumb' lettuce (*Lactuca sativa* L.) in a noncirculating hydroponic system.

'Tom Thumb' lettuce seeds were started in Oasis cubes under T5 high output fluorescent lighting in a laboratory. Seedlings were then transferred to 5.1-cm net pots, which were placed in 1.9-liter containers containing a hydroponic nutrient solution of Hydro-Gardens Chem-Gro lettuce formula 8-15-36 hydroponic fertilizer with added calcium nitrate (19% Ca and 15.5% N) and magnesium sulfate (9.8% Mg and 12.9%

SO₄). One-half of the seedlings were grown under red+blue+white LEDs (110 $\mu\text{mol}/\text{m}^2/\text{s}$) and one-half were grown under T5 high output fluorescent lighting (111 $\mu\text{mol}/\text{m}^2/\text{s}$). The photoperiod was 12 hours. After 12 days, one-half of the plants under the LED lighting were moved under the fluorescent lighting, and one-half of the plants under the fluorescent lighting were moved under the LED lighting for 16 more days.

The four treatments were LED lighting (LL), fluorescent lighting (FF), initial LED lighting followed by fluorescent lighting (LF), and initial fluorescent lighting followed by LED lighting (FL).

At the end of the study, differences among treatments were significant for plant height, leaf chlorophyll content, root dry weight, total plant dry weight, shoot dry weight produced per amount of nutrient solution used, and the pH and electrical conductivity of the nutrient solution. There were no significant differences among treatments for shoot dry weight, shoot-root

ratio, percent dry weight partitioned to the shoots, percent dry weight partitioned to the roots, and the amount of nutrient solution that was used by each lettuce plant. In summary,

the sequence of LED and fluorescent lighting could be an alternative to using only LED lighting or fluorescent lighting for growing lettuce plants.