# Dynamic 24h Lighting for Greenhouse Pepper Production

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## Overview

**Objective:** Identify dynamic 24h lighting strategies which do not cause leaf chlorosis and maintain or increase yield

**Main Result:** Using a 24h dynamic lighting strategy with white light during the day and blue + far-red during the night can sustain yield and increase internode length

## Introduction

- Supplemental lighting is essential for year-round greenhouse crop production during low-light months.
- Extending photoperiods beyond 17-18h can cause leaf chlorosis and yield reduction.
- Long photoperiods are more economical because they use lower light intensities, thereby requiring less fixtures.
- Continuous lighting (CL) using dynamic changes in spectrum and/or intensity during a 24h period can eliminate leaf injury and has proven viable for tomatoes and cucumbers.
- Greenhouse pepper production in Ontario has doubled since 2007, however less than 1% of are produced under lights.
- Peppers tend to get more compact and shorter internodes when grown under lights

## Materials and Methods

**Location:** Harrow Research and Development Centre
**Greenhouse:** two 50m$^2$ double-poly greenhouses divided into 4 quadrants using light abatement curtains
**Pepper cultivars:** Maureno, Gina, Eurix
**Planting date:** Exp 1: October 5th, 2021. Exp 2: April 26th, 2021
**Light fixtures:** 9 channel 100% programmable Sollum SF04
**Light treatments at Same Daily Light Integral (DLI):**
**S1:** 180 µmol m$^{-2}$ s$^{-1}$ of white light from 6:00-22:00
**S2:** 121 µmol m$^{-2}$ s$^{-1}$ of white light for 24h
**S3:** 153 µmol m$^{-2}$ s$^{-1}$ of white light from 6:00-22:00 followed by 55 µmol m$^{-2}$ s$^{-1}$ of blue light from 22:00-6:00
**S4:** 153 µmol m$^{-2}$ s$^{-1}$ of white light from 6:00-22:00 followed by 55 µmol m$^{-2}$ s$^{-1}$ of blue light + 11 µmol m$^{-2}$ s$^{-1}$ of far-red light from 22:00-6:00
**S5** (Exp 2 only): 180 µmol m$^{-2}$ s$^{-1}$ of white light from 6:00-22:00 followed by 11 µmol m$^{-2}$ s$^{-1}$ of far-red light from 22:00-6:00

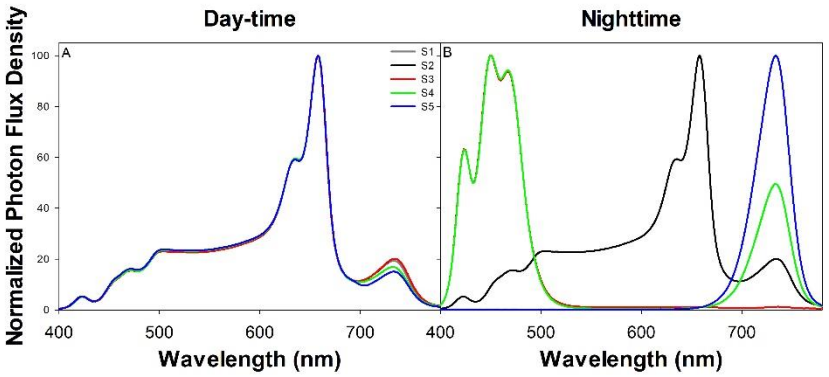


**Figure 1:** Light treatment spectra.

## Results

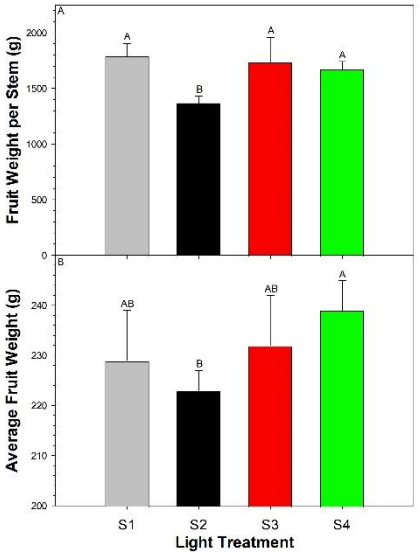


**Figure 2:** Exp 1 Maureno yield analysis.

- Both S3 and S4 produced similar fruit weight per stem compared to S1 (control).
- S2 produced the lowest fruit weight per stem.
- Average fruit weight was highest under S4.
- S3 and S4 produced similar average fruit weights to the control.
- S2 produced a lower average fruit weight than S4 but similar to S1 and S2.

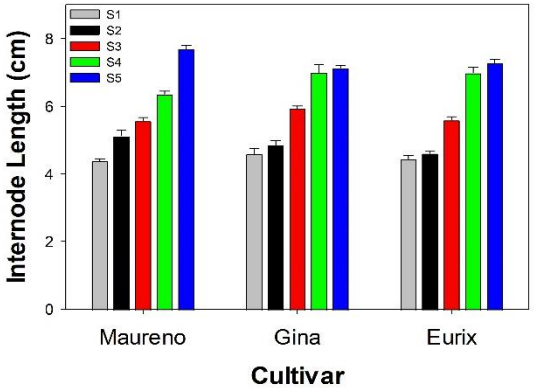


**Figure 3:** Exp 2 plant internode length.

- Using blue light at night (S3) increased internode length compared to S1.
- The use of far-red lighting during the night (S4 and S5) had the largest impact on internode length.
- S5 increased the internode length by up to 75% compared to S1.

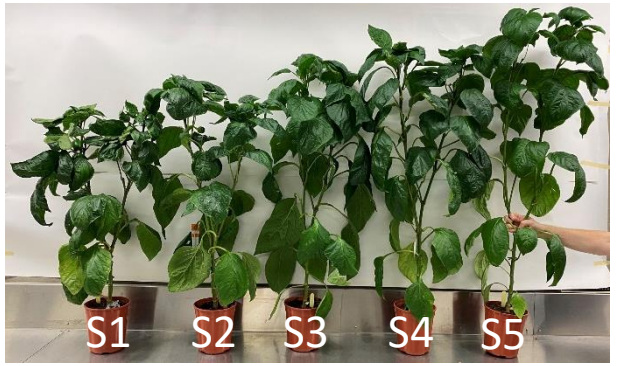


**Figure 4:** Maureno plants from Exp 2.

## Conclusions

- Dynamic 24h lighting is a viable strategy for pepper production.
- Continuous lighting can sustain yield comparable to a traditional 16h light treatment.
- Blue and far-red at night can increase internode length.

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