# Red, green, blue or white – growth light quality affects plant sensitivity to UV and photoinhibition

AARHUS UNIVERSITY
ÖREBRO UNIVERSITET
Carolina Falcato Fialho Palma, Victor Castro Alves, Eva Rosenqvist, Luis Orlando Morales, Carl-Otto Ottosen, Åke Strid

## INTRODUCTION

With the development of light emitting diode (LED) technology, the use of LED lighting for horticultural production is increasing. Production systems that rely on the **sole use of LED lighting** (e.g. multilayer systems) provide a unique environment for investigating new opportunities of LED lighting use, such as in **monochromatic** illumination, with regards to plant growth and development.

We **aimed** to investigate the effects of **UV-B**-enriched light on growth, morphology and physiology of cucumber plants grown under different light quality backgrounds. We also **investigated** the effects of four different monochromatic lights regimens on growth and physiology of cucumber plants.

## METHODS

We grew cucumber plants under four different light treatments (at 220 µmol $m^{-2}$ $s^{-1}$) and exposed them to **UV-B**-enriched light for 14 days (0.912 ± 0.074 kJ $m^{-2}$ $day^{-1}$ for 6h/day).

**Broadband White** (33%B, 40%G, 27%R), **Blue** (448nm), **Green** (528nm), **Red** (660nm)

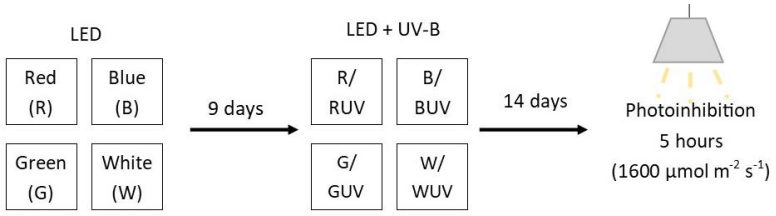


**Figure 1**: Experimental design

To investigate whether the acclimation of photosynthesis to different color PAR regimes induced a difference in the ability to cope with photoinhibition, we exposed the plants to a saturating light for 5 hours at 1600 µmol $m^{-2}$ $s^{-1}$ after 14 days **UV-B** treatment.

## PLANT GROWTH AND DEVELOPMENT

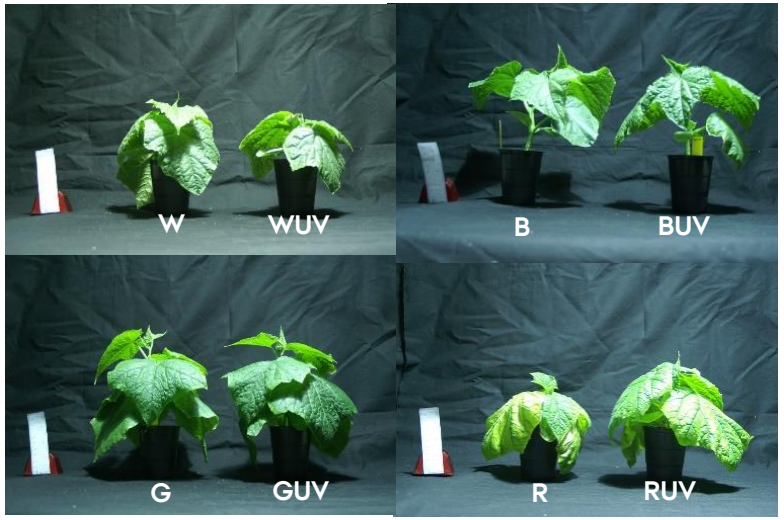


**Figure 2:** Monochromatic light qualities within the PAR spectra differentially regulate plant growth and development and **UV-B** induced effects are dependent on PAR background

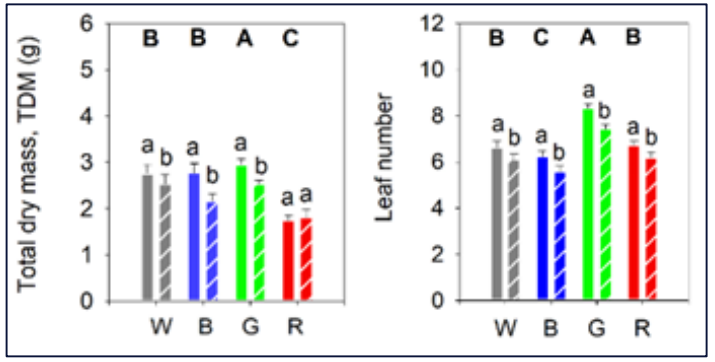


**Figure 3:** Total dry mass (g) and leaf number of cucumber plants grown under **white**, **blue**, **green** or **red** light and exposed to **UV-B**-enriched light

## PHOTOSYNTHESIS

Monochromatic **green** and **blue**, but not **red** growth light had a normal photosynthetic functioning of leaves without compromising biomass accumulation.
Signs of dysfunctional photosynthesis were observed in plants grown under **red** light. **UV-B**-enriched light on a **red** light background boosted numerous photosynthesis parameters, increasing the potential carbon gain. The benefits were further enhanced after the photoinhibitory light treatment.

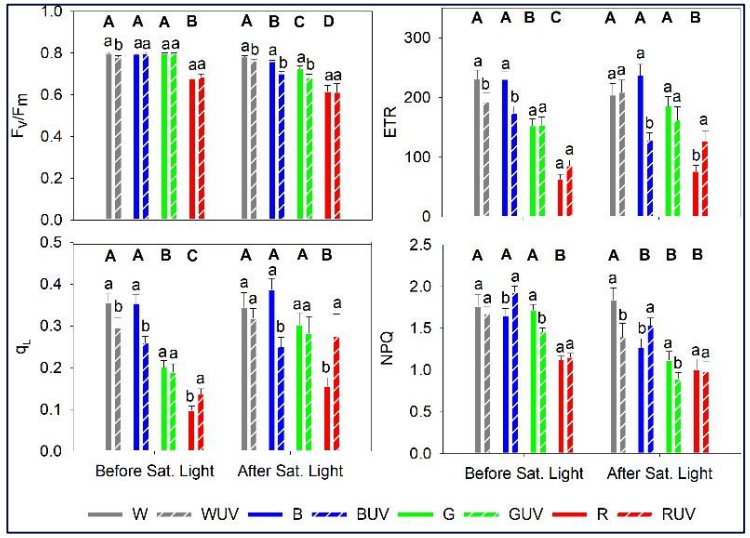


**Figure 4:** Chlorophyll fluorescence data prior to and after photoinhibitory treatment at 1600 µmol $m^{-2}$ $s^{-1}$ for 5 hours.

## MAIN POINTS

- **Green** light accelerates plant *development* in cucumber
- **UV-B** induces an "*early alert*" state of the *antioxidant* system, which is beneficial in the presence of other stressors.