

# Can Blue Light Mitigate the Effects of High Temperature on Lettuce Growth?

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## Introduction

Lettuce, the major crop in vertical farming, is a cool-season crop, and it has been known that lettuce grows well in cooler temperatures. Higher temperatures can promote extension growth and bolting in lettuce, potentially decreasing its yield, quality, and marketability. Electricity for cooling is one of the major operational costs for vertical farming, especially during the summer in a warm state, such as Arizona. In a wide range of plants, blue light inhibits extension growth.

Objective: To investigate if increasing blue light can mitigate the effects of higher temperature on extension growth in lettuce.

## Materials and Methods

### Plant Materials

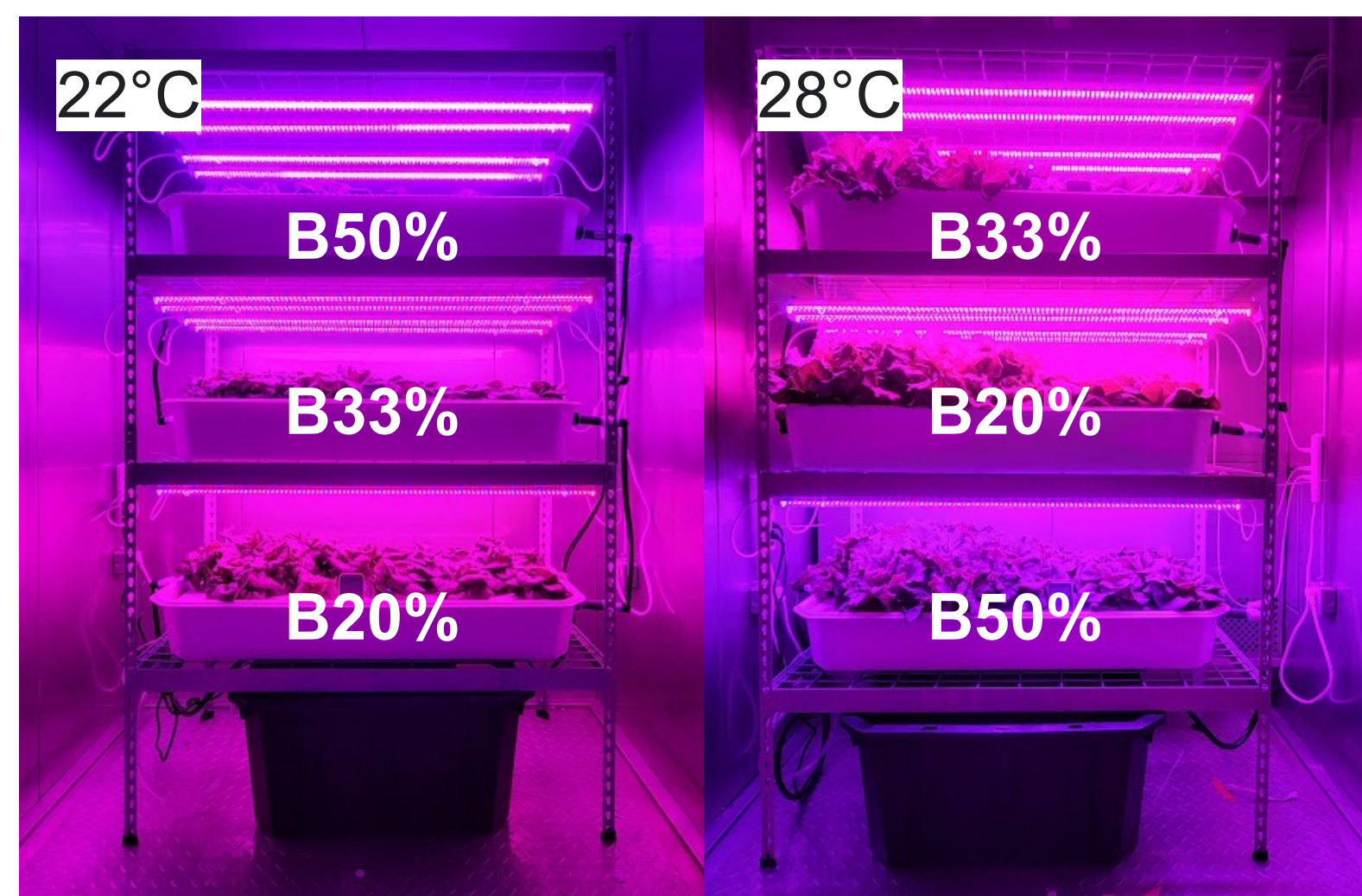
- Lettuce (*Lactuca sativa*) 'Rex' and 'Cherokee'

### Growth Conditions

- Growth chambers
- Air temperature: 22°C or 28°C
- Nutrient solution: N = 150 ppm, pH = 5.8

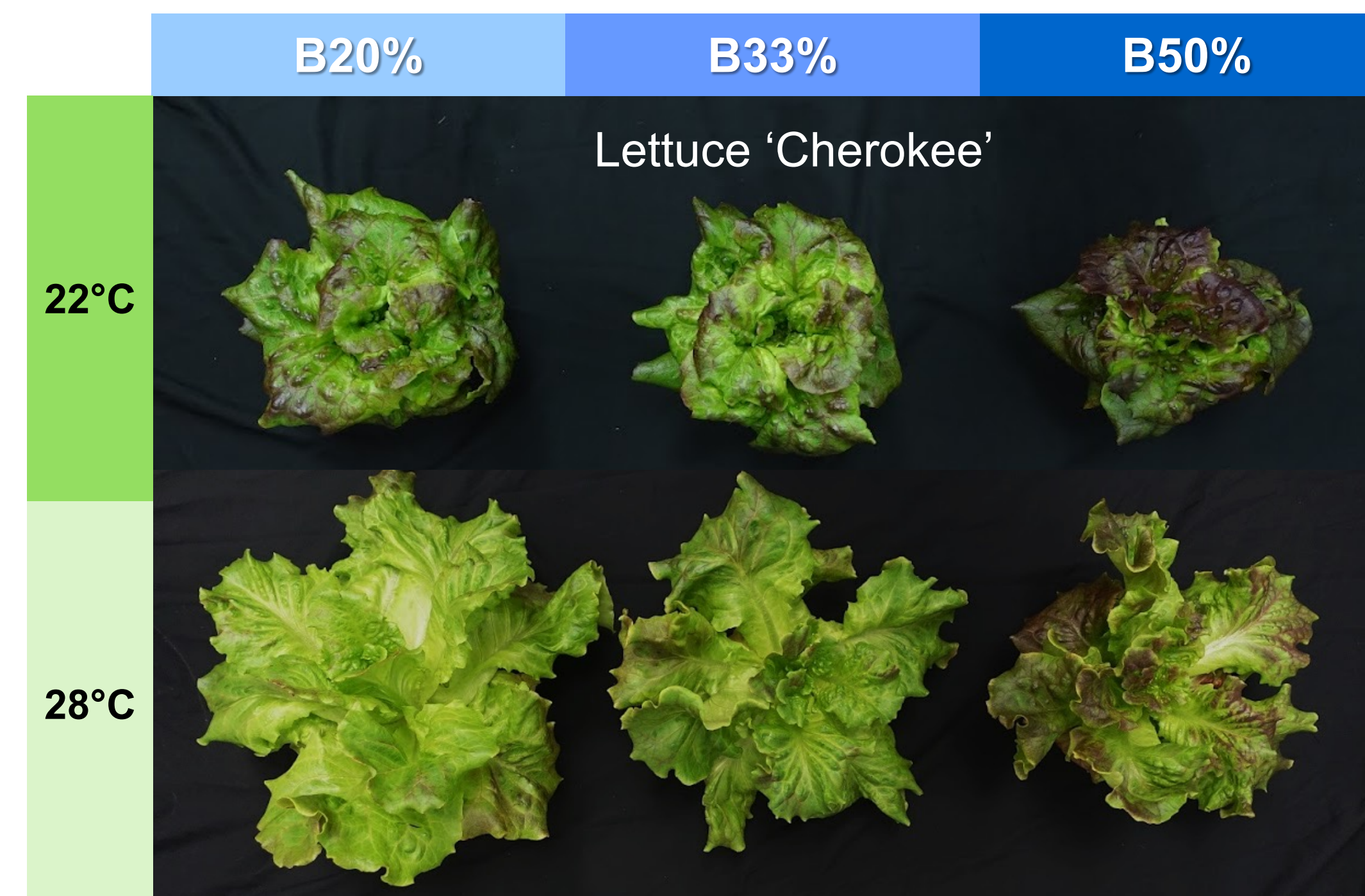
### Sole-source LED Lighting

- Blue (B, peak=450 nm) + Red (R, peak=660 nm) LEDs
- B light treatments: B20%, B33%, B50%
- Photoperiod: 24-hour
- PPFD (400-700 nm): 200  $\mu\text{mol}\cdot\text{m}^{-2}\cdot\text{s}^{-1}$

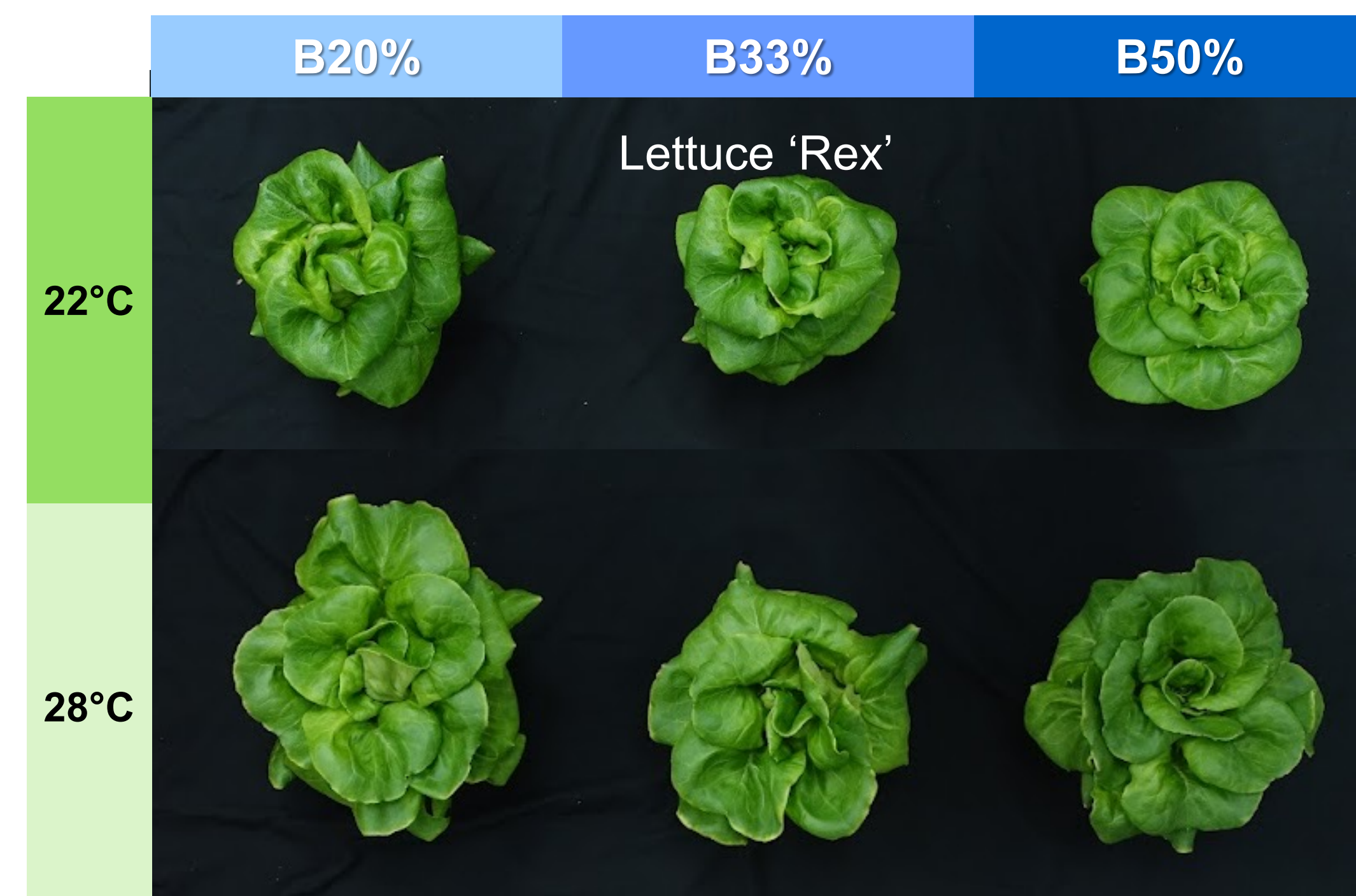


**Fig 1.** Three blue (B) light treatments were delivered at the air temperature of 22°C (left) or 28°C (right) inside growth chambers.

## Results

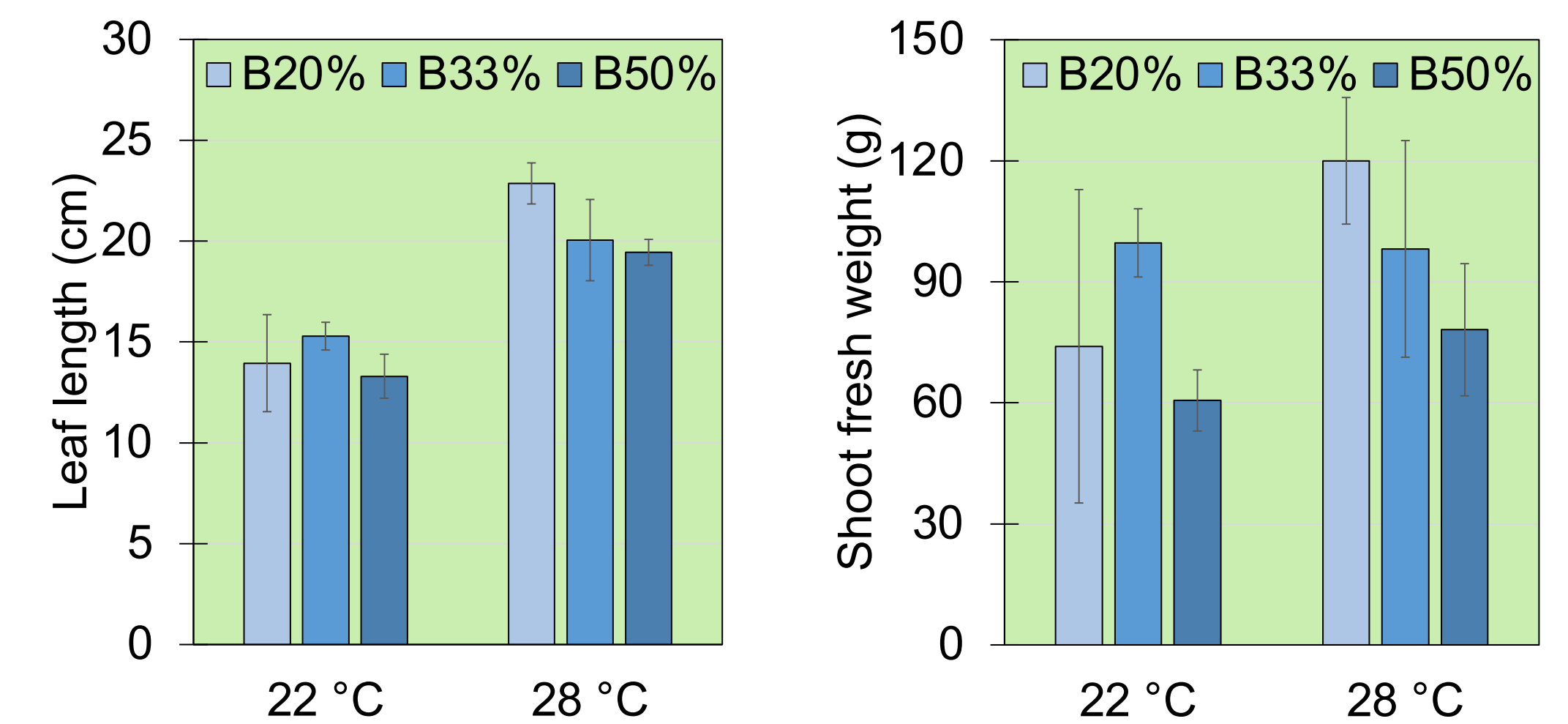


**Fig 2.** Lettuce 'Cherokee' grown with three blue (B) light treatments at the air temperature of 22°C (top) or 28°C (bottom) for 25 days after transplanting.

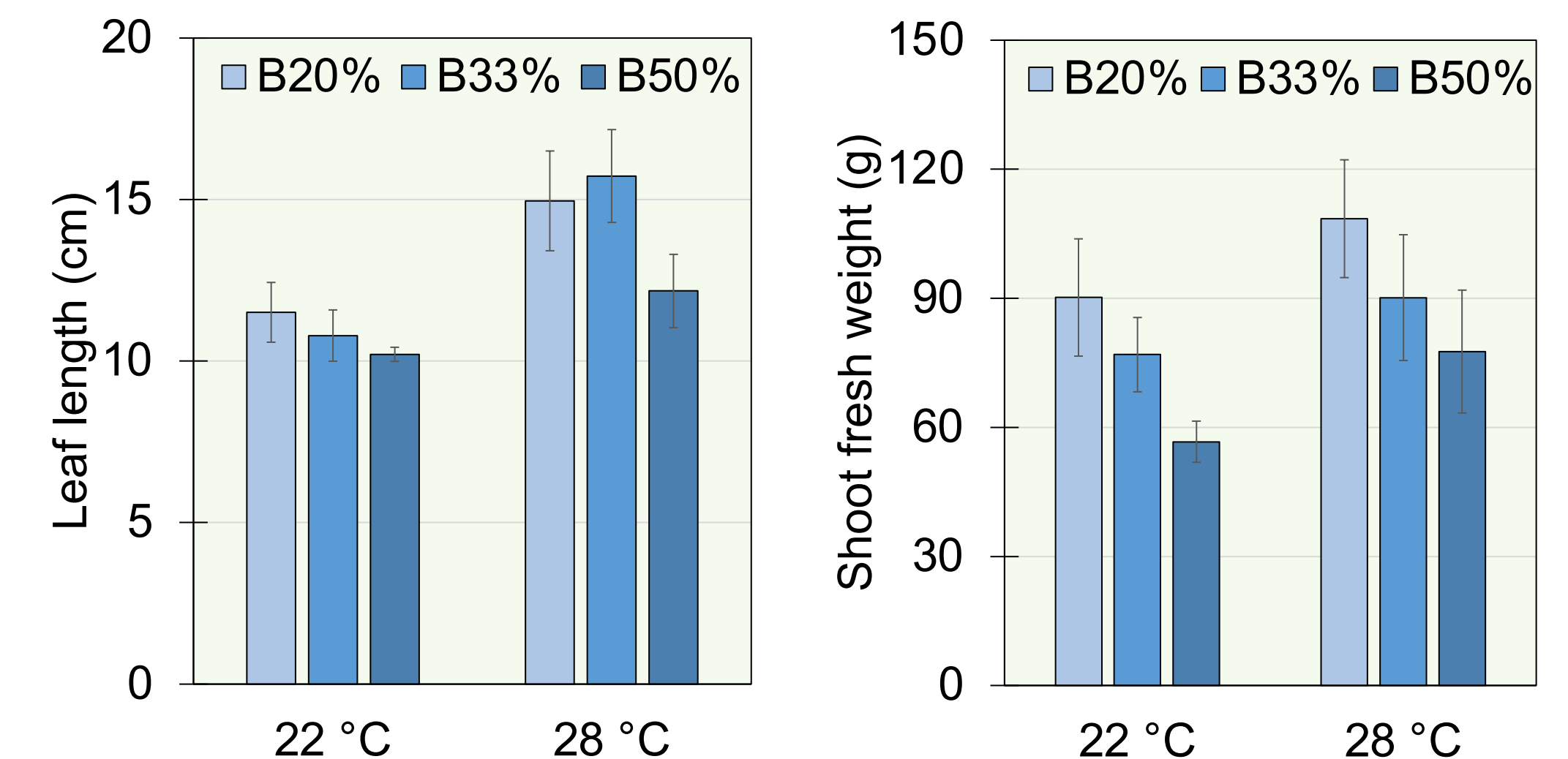


**Fig 3.** Lettuce 'Rex' grown with three blue (B) light treatments at the air temperature of 22°C (top) or 28°C (bottom) for 25 days after transplanting.

## Results



**Fig 4.** Leaf length (left) and shoot fresh weight (right) of lettuce 'Cherokee' grown with three blue (B) light treatments at the air temperature of 22°C or 28°C for 25 days after transplanting. Data represent the mean and standard deviation of one replication (n=10).



**Fig 5.** Leaf length (left) and shoot fresh weight (right) of lettuce 'Rex' grown with three blue (B) light treatments at the air temperature of 22°C or 28°C for 25 days after transplanting. Data represent the mean and standard deviation of one replication (n=10).

## Conclusions

Increasing blue light inhibited extension growth under higher temperature. However, inhibition of extension growth under higher blue light was accompanied by the decreases in fresh weight.