

## Introduction

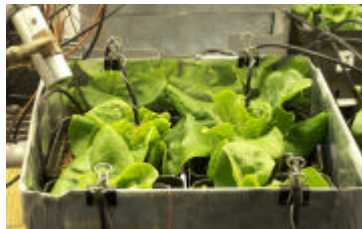
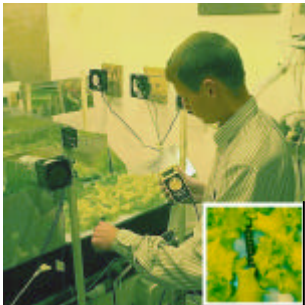
Lettuce is typically grown at 25/20 C day/night and a PPF of 300 to 400  $\mu\text{mol m}^{-2} \text{s}^{-1}$ . Warmer temperatures are thought to increase tipburn and bitterness, while higher light increases tipburn and photo-bleaching without increasing growth rate.

We sought to determine the limits of lettuce productivity in high PPF with elevated  $\text{CO}_2$ . We studied four diverse cultivars at temperatures from 21 to 33 C and PPF levels from 400 to 1000  $\mu\text{mol m}^{-2} \text{s}^{-1}$ . The growth temperature optimum was 27 to 30 C. The PPF for maximum productivity was 1000  $\mu\text{mol m}^{-2} \text{s}^{-1}$ . We eliminated tipburn with air blown on the meristem. Air blown on the meristem improved fresh mass and quality, but not dry mass.



## Materials and Methods

- Trail 1. Five temperatures (21, 24, 27, 30, and 33 C) with five-degree difference in day/night using 'Grand Rapids'.
- Trail 2. Cultivars 'Grand Rapids', 'Waldmanns Green', 'Buttercrunch', and 'Tiber' were evaluated at 500 and 1000  $\mu\text{mol m}^{-2} \text{s}^{-1}$ .
- Trail 3. Cultivars 'Waldmanns Green' and 'Buttercrunch' were evaluated at 1000  $\mu\text{mol m}^{-2} \text{s}^{-1}$  with and without air blown on the meristem.



### Radiation capture

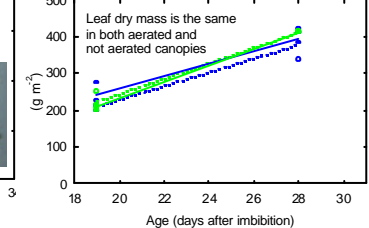
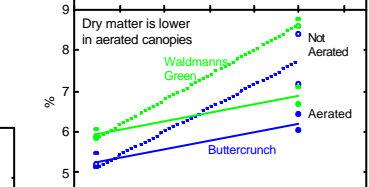
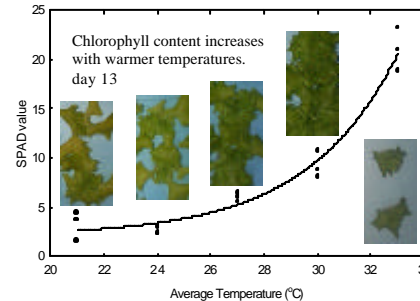
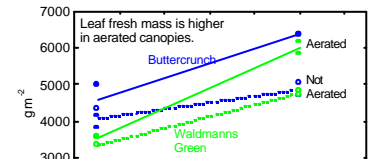
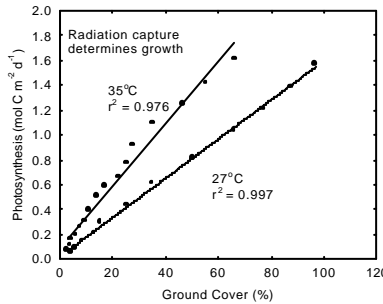
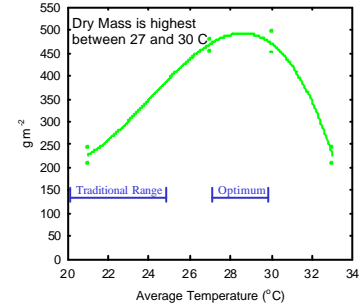
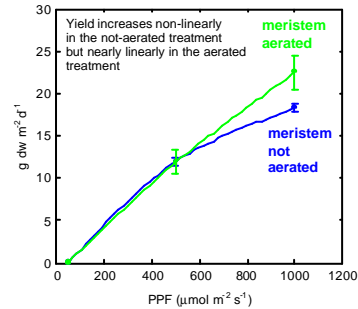
- Percent ground cover was determined daily with digital camera from above the canopy.
- Radiation capture measured daily with a line-quantum sensor.

### Aeration of meristems

Lettuce was grown with and without air blown directly on the meristem (thin black tubes) continuously at a rate of 1 liter per minute. Canopies were surrounded by reflective Mylar.

- Planting density was 80 or 100 plants per  $\text{m}^2$
- $\text{CO}_2$  was 1200  $\mu\text{mol mol}^{-1}$  in all studies.
- HPS lamps were used in all trials because growth is superior to MH lamps (Dougher and Bugbee, 2000).
- Relative humidities were maintained between 60 to 80%.

## Results



## Conclusions

1. Optimum temperatures in a high- $\text{CO}_2$  environment are 5 degrees above those typically used for lettuce production.
2. Higher light maximizes yield, but the quality is greatly reduced unless tipburn is eliminated.
3. Tipburn can be completely eliminated in high light by blowing air on the meristem.