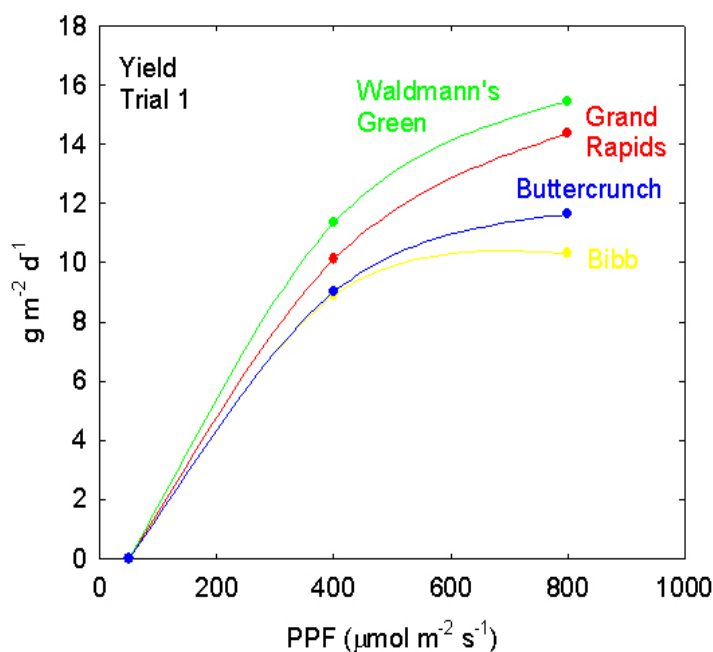


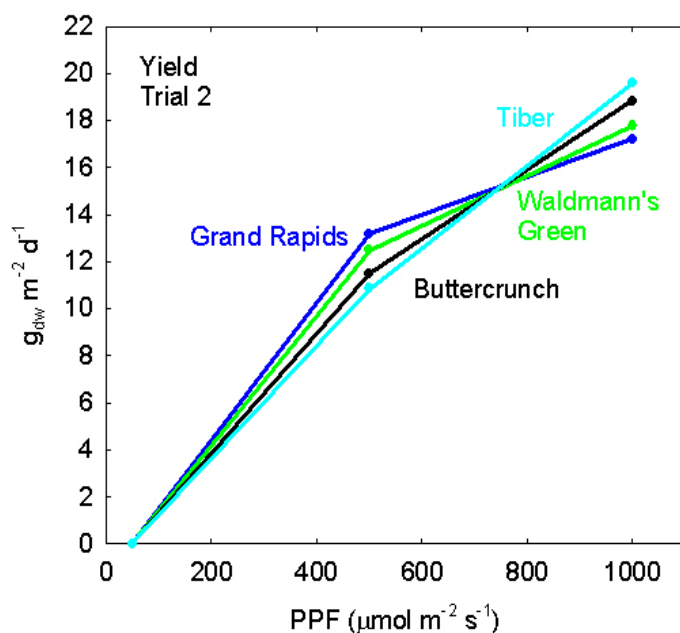
Exploring the Limits of Crop Productivity: High Light Studies with Lettuce

There are many different leaf lettuce cultivars and they range in color from light green and yellow to deep green as a result of higher concentrations of chlorophyll in the leaves. We tested four cultivars in high light to explore the limits of lettuce productivity.



Yield was improved with high light, but a doubling of light did not double yield. Lettuce, at high growth rates, is susceptible to tip burn, or calcium deficiency, afflicting the meristem. Tip burn decreases lettuce quality, but also impairs new leaf growth and total yield. Genetic selection for tip burn resistance has not eliminated the problem in controlled environments wherein the problem is exacerbated due to optimized conditions designed to accelerate growth. Nevertheless, in the second trial, we added the lettuce 'Tiber', which has reduced incidence of tip burn in the field, and eliminated 'Bibb' from consideration. We also increased the wind speed to boost transpiration in the meristem, and

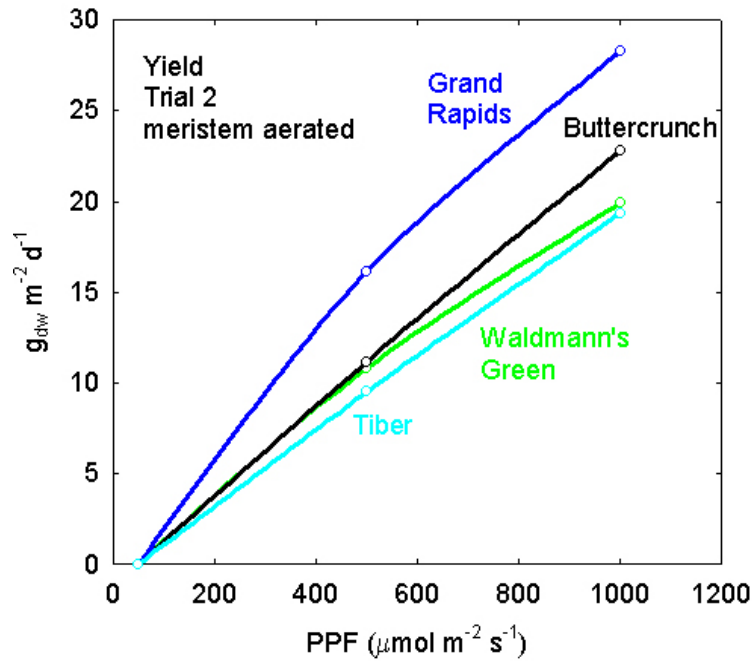
increased the light.



Tip burn was still a problem in the second trial, but 'Buttercrunch', a highly susceptible cultivar, had improved yield suggesting the better environmental control in the second trial could reduce the impact of tip burn. All cultivars had tip burn, but the development of it was delayed in 'Tiber' by five days compared to 'Buttercrunch'. Tip burn in 'Waldmann's Green' and 'Tiber' occurred on the same day. Yield did increase at higher light, but there was not a doubling of yield with twice the light.

Another method to eliminate tip burn is by supplying air with small hoses pointed directly at the meristem.

This greatly improves transpiration and therefore calcium content of the meristem.



Supplying air to the meristem at 1 L min⁻¹ completely eliminated tip burn. The response to light became linear and resulted in nearly a doubling of yield for a doubling of light. Interestingly, 'Buttercrunch' outperformed both 'Waldmann's Green' and 'Tiber' when tip burn was eliminated, but yielded less than those cultivars when the environment favored tip-burn development. Currently, we are testing 'Waldmann's Green' and 'Buttercrunch' at 1000 F mol m⁻² s⁻¹ in canopies with the meristems aerated and not aerated to confirm these results. These studies show that lettuce productivity can be pushed with extremely high light.