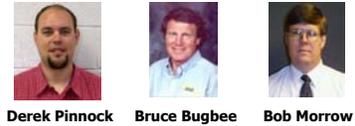


Leaf Temperature: Applying the CWSI to Controlled Environments



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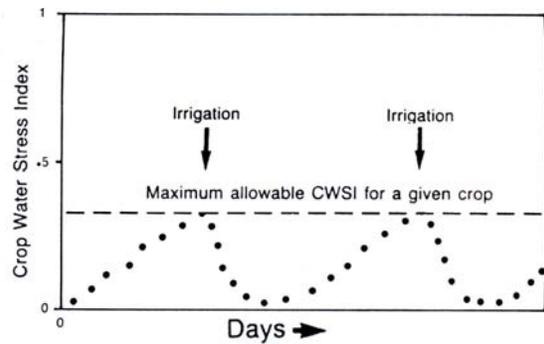
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Introduction

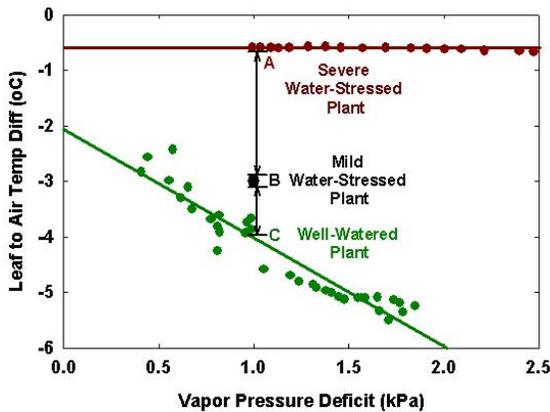
Controlled environments are characterized by highly restricted root-zone volumes. Irrigation in controlled environments is usually excessive and thus inefficient. Root-zone moisture sensors often fail to represent water status due to poor contact with the coarse media. Watering based on a measurement of plant water status would increase irrigation efficiency and decrease water-stress.

Crop Water Stress Index

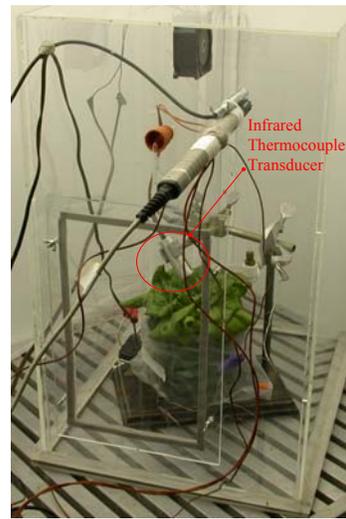
The Crop Water Stress Index (CWSI) couples leaf to air temperature difference (ΔT) and the vapor pressure deficit (VPD) to determine water-stress. Plants are watered when a predetermined level of stress is reached, for example when CWSI = 0.3. The CWSI, however, needs to be modified for controlled environments where incoming radiation and CO₂ concentration are adjusted to optimize crop growth.



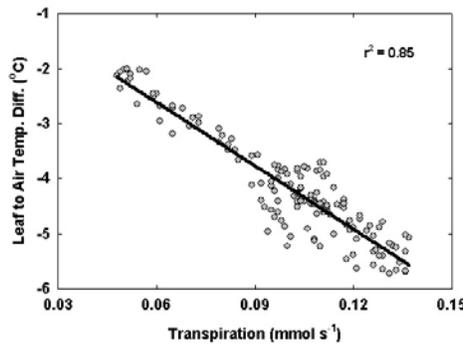
An example of irrigation timing based on the CWSI.



The ΔT versus VPD obtained from a well-watered and a severely water-stressed lettuce plant grown in the open-chamber system shown above-right. The CWSI for the mildly water-stressed plant (Point B) is the ratio BC/AC. The CWSI is 1/3.5 or 0.28.



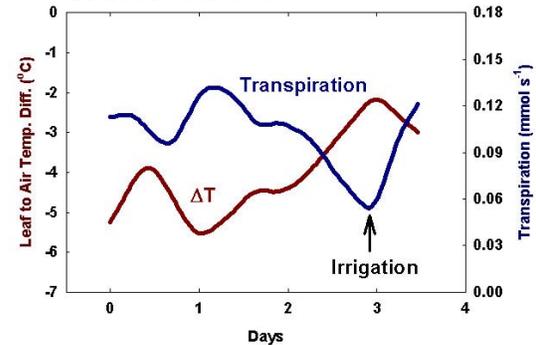
Open-chamber system used to measure real-time transpiration and leaf temperature.



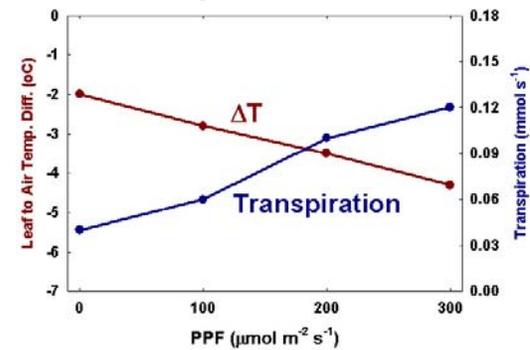
The relationship between transpiration and leaf to air temperature for lettuce.

Factors Affecting Leaf Temperature and Transpiration

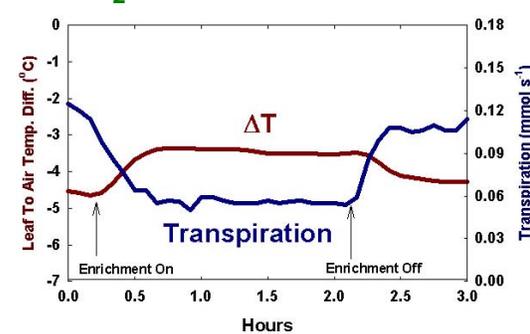
Water-Stress



Incoming Radiation



CO₂ Enrichment



Conclusions

- CO₂ concentration and incoming radiation affect leaf to air temperature.
- To be used in controlled environments, the CWSI should be modified to include CO₂ concentration and incoming radiation.

