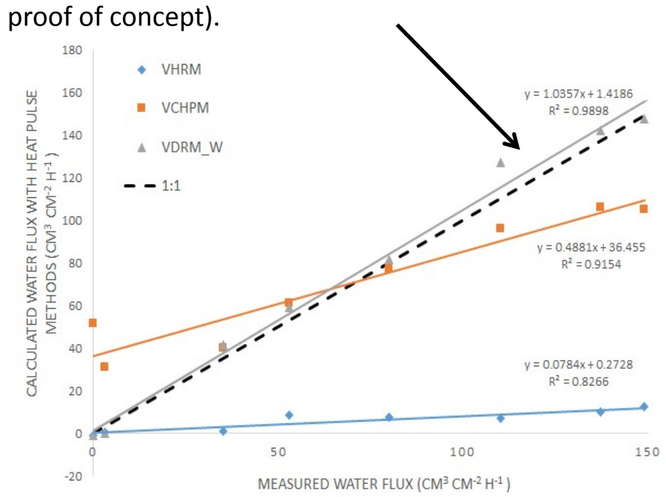
Applying an Improved Heat Ratio Method Sap Flow Sensor to Almonds to Test Variation in Water Use between Nonpareil and Pollinizers

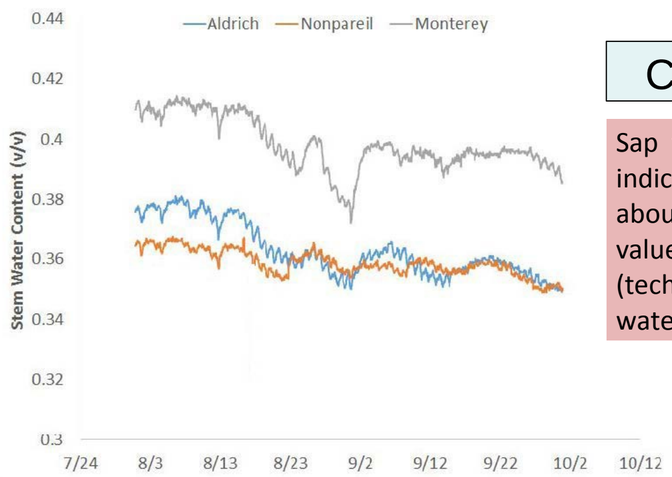
A new method for measuring sap flow

Almonds have high rates of sap flow (water flow in the stem), thus sap flow meters require technical and algorithmic improvement to function for almonds. Through collaboration with U. Sydney researcher Tom Buckley a new sap flow method (DRM) has been developed for almonds. When compared to the past methods (HRM and CHPM), the new method was better related to flow measured in a sand filled PVC pipe (a proof of concept).



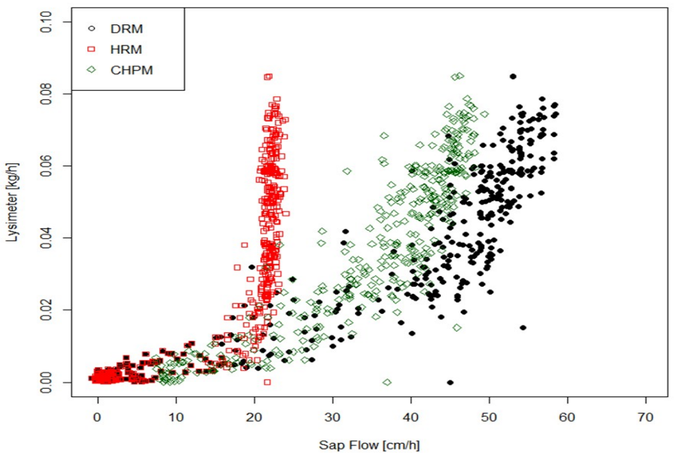
Stem Water Content

To determine the role of stem water storage in sap flow measurements, moisture content sensors were place into the trunks of 3 trees. Water content remained relatively stable throughout the season, **meaning sap flow calibrations and calculations are reliable.**



Validation using a lysimeter

Sap flow was non-linearly related to lysimeter data for the almond lysimeter at Kearney REC, although the DRM method outperformed the others. This effect seems difficult to evaluate for a number of reasons: (1) sensor placement varies with each installation, (2) there are large temperature fluctuations in the small lysimeter tree, and (3) unknown factors could be affecting the lysimeter.



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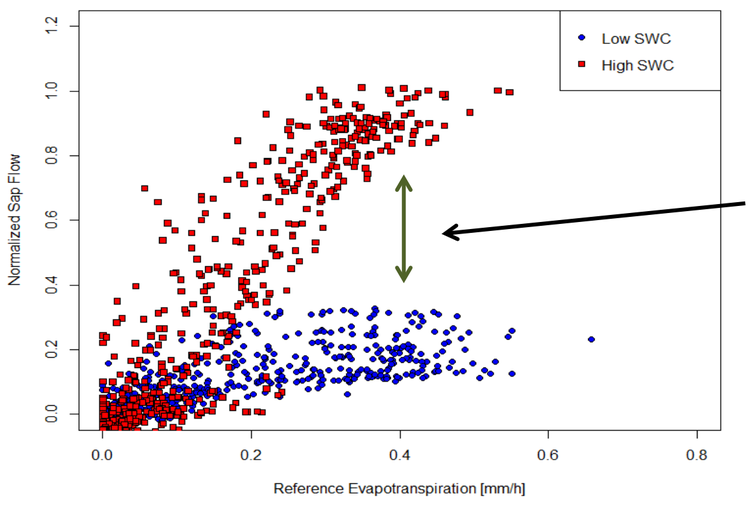
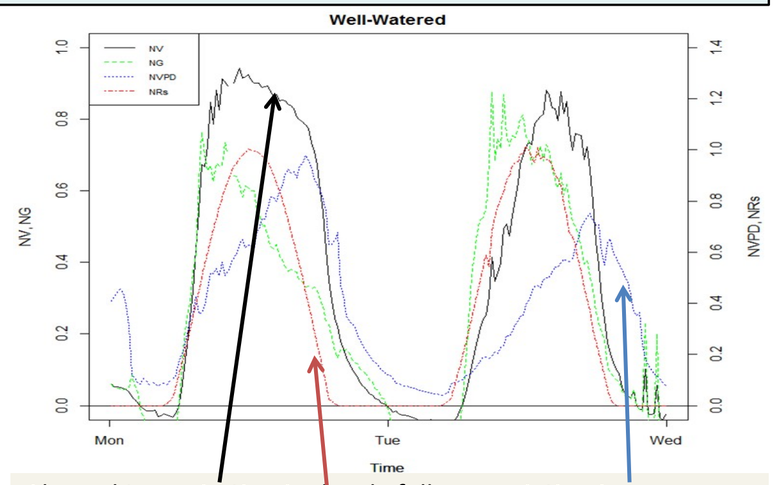
Objectives

1. How well does the new DRM sap flow method work in almonds?
2. Using sap flow can we evaluate the use of water potentials for scheduling irrigation? Do different varieties respond differently?
3. What most controls transpiration in almonds? Does the DRM compare to CIMIS ETo, stem water potentials, soil moisture?

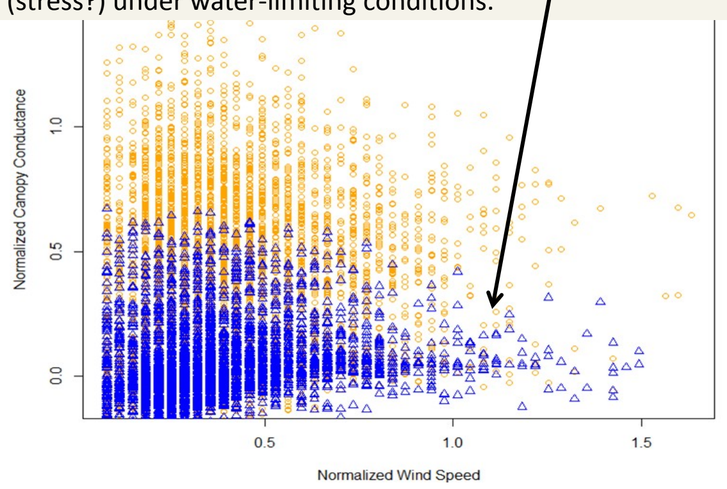


Water deficits during harvest led to a considerable decrease in sap flow in spite of high ETo.
Thus, sap flow can detect when trees undergo stress from soil water depletion and environmental demands.

What controls almond transpiration?

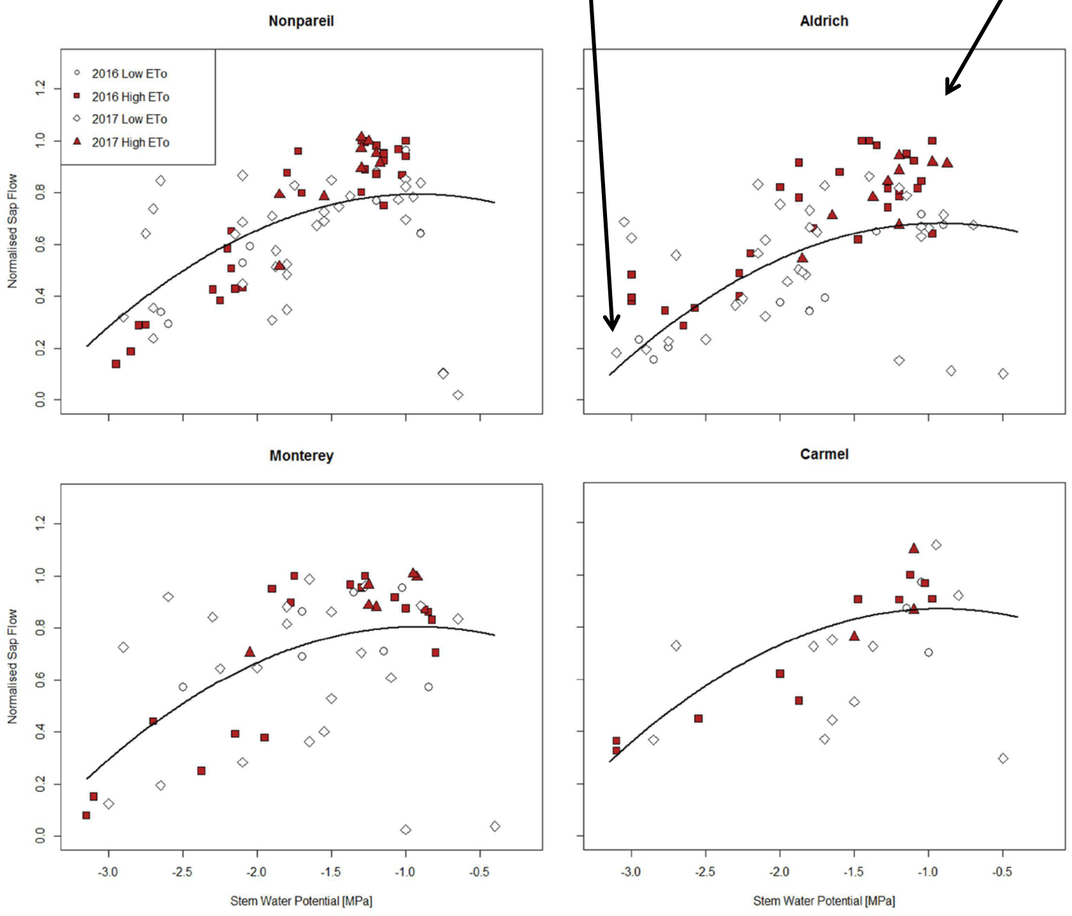


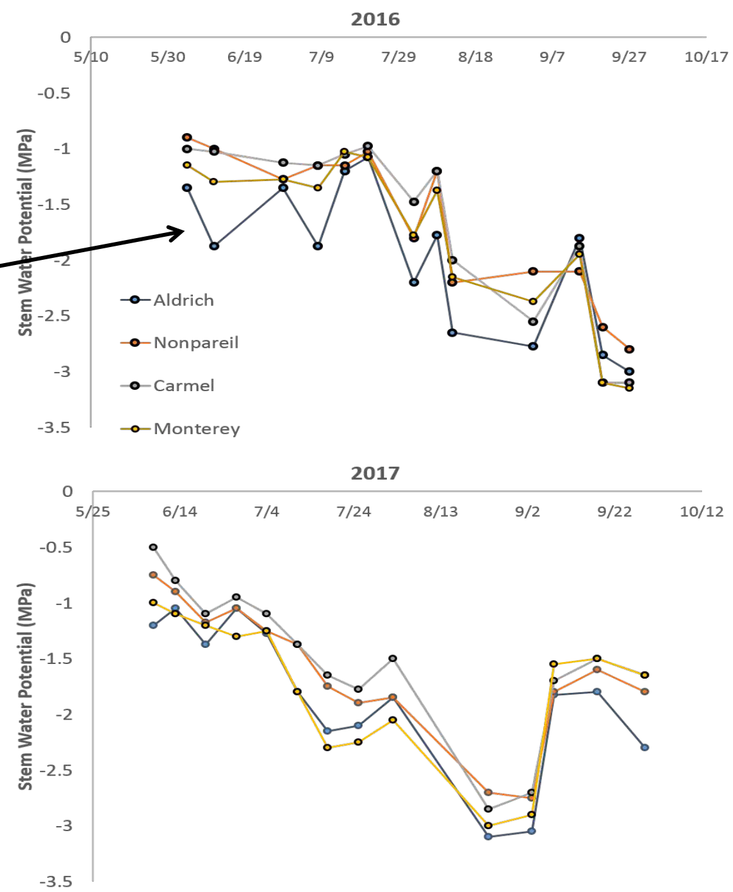
Almond transpiration is closely follows variation in vapor pressure deficit and solar radiation, with a broader daily period of water loss than predicted by ETo. Wind speed affects almond water loss minimally under well watered conditions, but does result in considerable stomatal closure (stress?) under water-limiting conditions.



Calibrating stem water potential measurements

Sap flow can be used to calibrate how much transpiration is affected by water stress as indicated by the standard stem water potential measurement. Sap flow started to decrease at about -1.5MPa stem water potential. By -3 MPa sap flow had dropped to about 33% of initial values. The decrease in sap flow can be interpreted as the crop coefficient (Kc) decreasing (technically Kstress is decreasing). These data are equivalent to sap flow decreasing when stem water potential is 0.5MPa lower than baseline water potentials. **Variety effects were small.**





Acknowledgements

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