

# Evaluating the Effectiveness of Surface Renewal and Other Technologies to Determine Almond Tree Water Use and Water Stress



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- Objective:**
- 1) Evaluate the effectiveness of new surface renewal (SR) methods to accurately quantify almond water use
  - 2) Continue efforts to develop measurements of ET in almonds using the infrared (IRT) SR technique
  - 3) Compare stress index and water use methods to determine the best combination for almonds

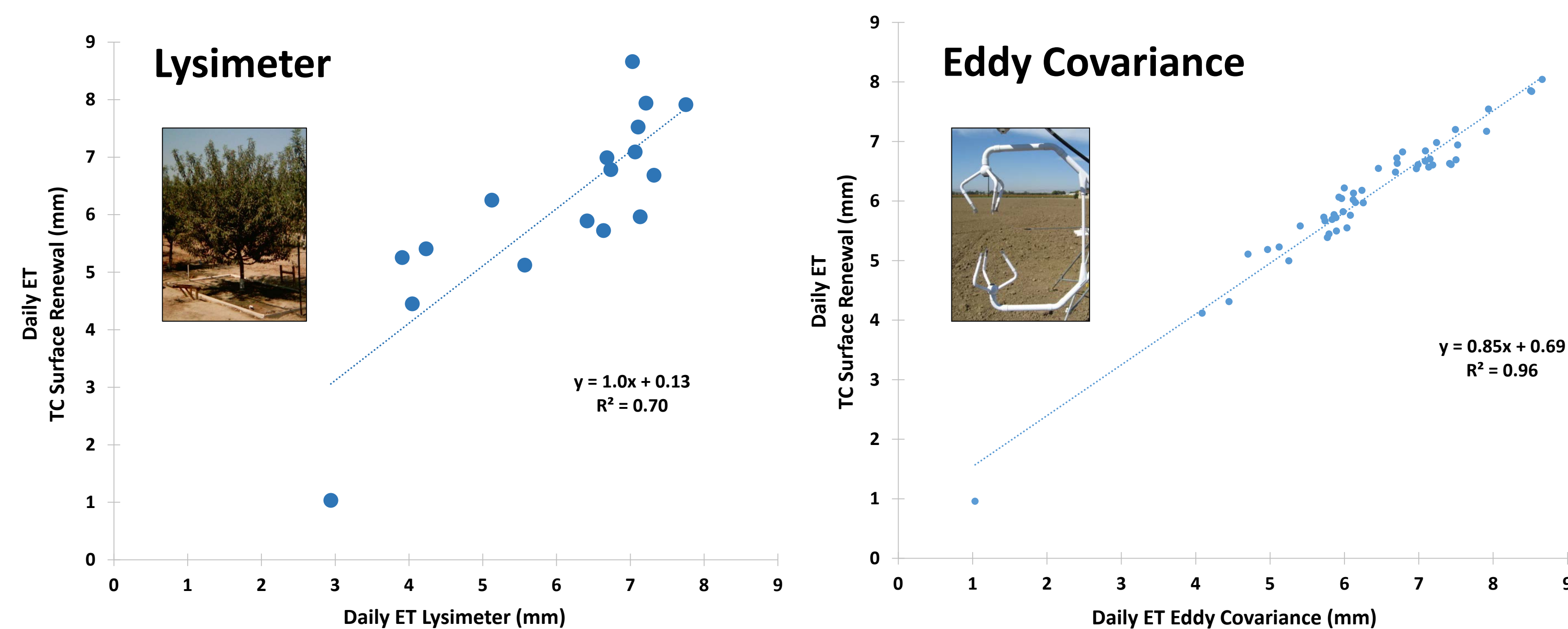
## Stand-alone Surface Renewal Method

The surface renewal (SR) method measures sensible heat flux density (H, energy available to warm the air) which is placed into the energy balance equation:

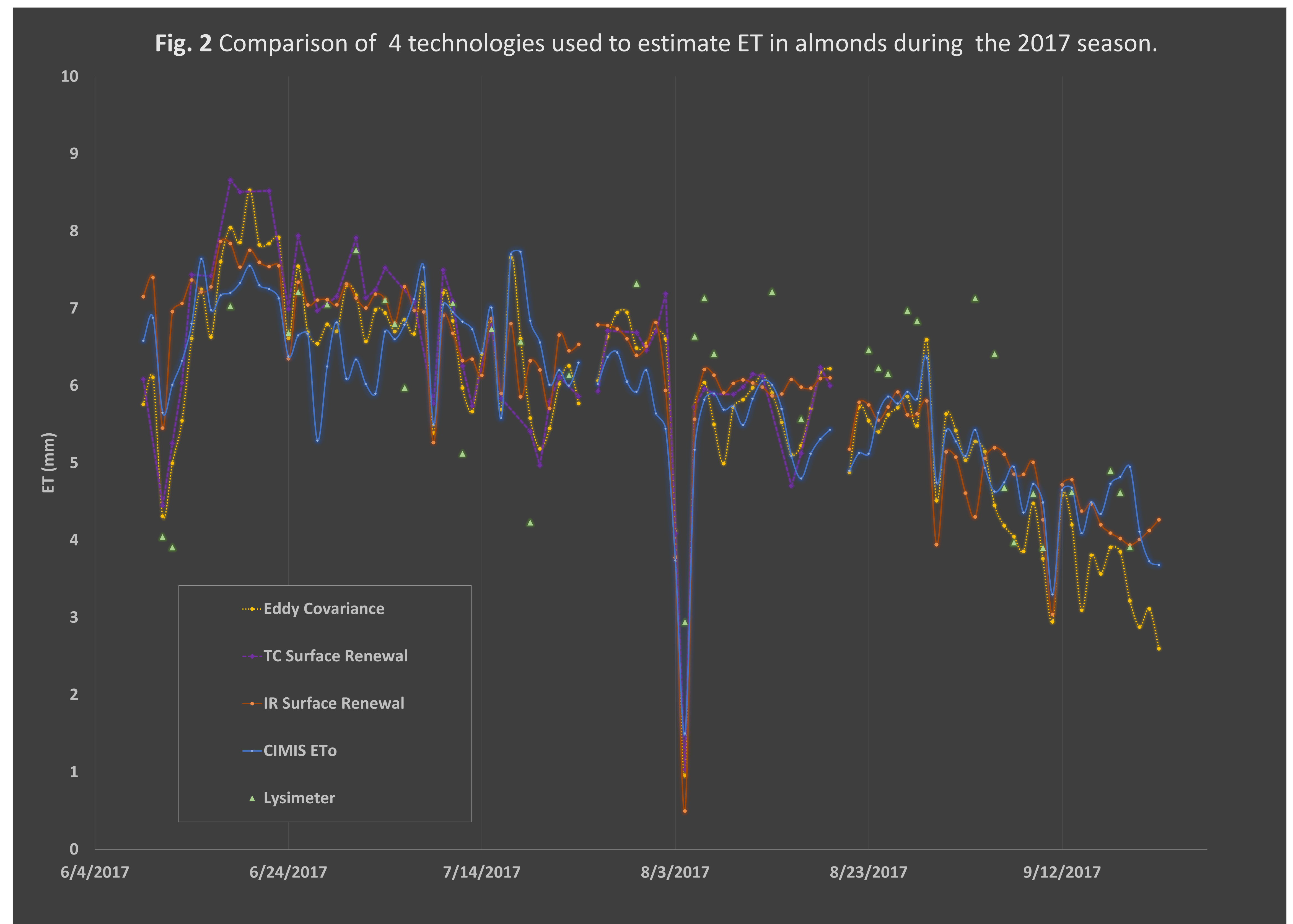
$$R_N = H + G + LE$$

where LE is the latent heat flux density (energy available to evaporate water),  $R_N$  is net radiation, G is soil heat flux density (energy available to warm the soil). Once energy fluxes are determined, LE - responsible for evaporating water from the surface - is calculated as the residual of the energy balance equation, then converted into a volume of water as ET.

The improved SR technique is more user-friendly and cost-effective relative to other methods, however, **it needs to be evaluated against weighing lysimetry and other techniques under field conditions for almonds, Fig. 2.**



**Fig. 1** Relationship between daily ET measured with thermocouple SR technique (left,  $R^2=0.70$ ) and ET measured with Eddy Covariance (right,  $R^2=0.96$ ) and ET measured with a lysimeter in almonds in 2017 at the weighing lysimeter at Kearney Agricultural Center in Parlier, CA.



## IRT Surface Renewal & Stress Estimates

Until now, the surface renewal method has used air temperature measured by thermocouple temperature sensors, while infrared temperature (IRT) measurements have been used to estimate crop water stress. We are currently working with IRT measurements & the surface renewal method to obtain ET estimates in almonds. If the IRT sensor can replace thermocouples in the surface renewal method, estimates of both water use (ET) and water stress could be obtained simultaneously with one sensor.

