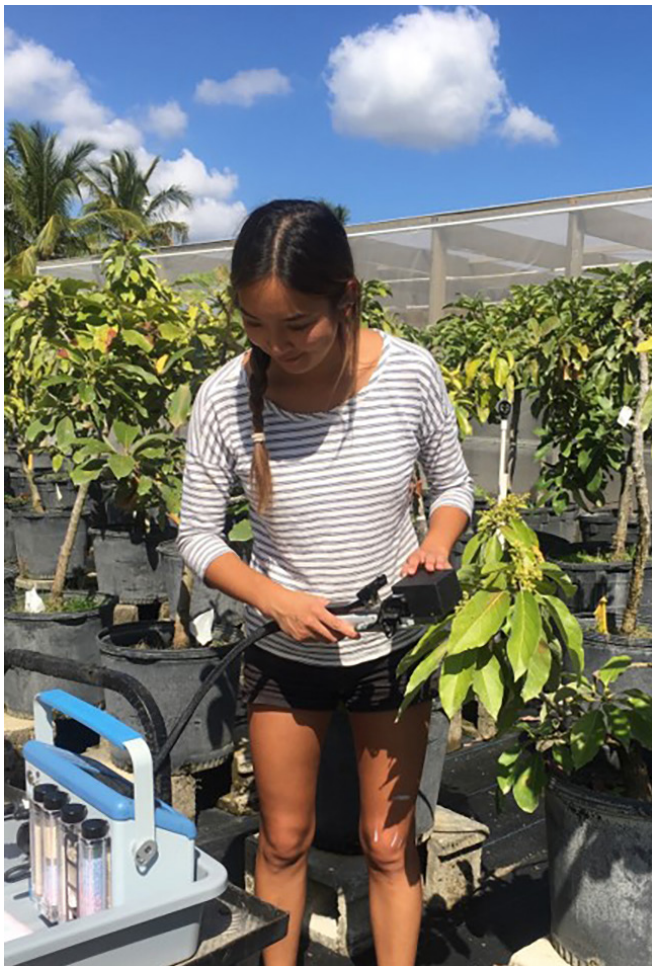
Measuring Avocado Responses to Environmental Stresses in South Florida

Research in Dr. Elias Bassil's lab at the University of Florida's Tropical Research and Education Center in Homestead, FL (UF-TREC) spans a variety of plant species but all projects focus on identifying the molecular mechanisms that contribute to enhanced tolerance to environmental stresses, such as drought, salinity, and flooding.



Graduate student Melinda Yin measuring leaf gas exchange.

While only grown on 5,500 acres in Miami-Dade county, avocado (*Persea americana* Mill.) is a high-value horticultural crop in Florida, with fresh fruit valued at more than $24 million annually (State Agriculture Overview, 2017). Florida is one of the few places in the United States that has the mild, warm subtropical climate necessary to grow the large, green-skinned West Indian type avocados, as opposed to California that grows the more familiar 'Hass' type avocados. Though south Florida has abundant sunlight, warm temperatures, and adequate humidity to grow avocados, agriculture in the region is highly susceptible to periodic flooding, largely due to threats from sea level rise, storm surges, severe precipitation events, hurricanes, and water management decisions affecting the southern half of the state.

Avocado is considered very flood-sensitive, with short periods of flooding resulting in notable reductions in plant growth and even tree death (Schaffer et al., 2013). Like many tree crops, commercial avocados are usually grafted onto rootstocks, which largely affect the entire tree's nutrient and water acquisition ability, as well as resilience to environmental stresses. Prolonged flooding also increases the incidence of root diseases, such as phytophthora root rot.

Plants respond rapidly to fluctuations in the surrounding environment, but the immediate effects of abiotic stress on plants, such as changes in water potential, stomatal closure, and photosynthetic inhibition, are not apparent to casual observation. By the time wilting, leaf drop, or color change are visible, large shifts in physiology have occurred.

At the Bassil lab at UF-TREC, we aim to identify the molecular mechanisms that help avocados respond to and better tolerate flooded conditions. Because root and cellular functions are difficult to observe and quantify, we rely on

the CIRAS-3 to track changes in CO_2 assimilation, stomatal conductance, and transpiration to determine when cellular and leaf-level changes might occur. By tracking changes in important photosynthetic parameters, we can more precisely pinpoint physiologically important time points after the onset of stress. Identification of these time points allows the sampling at critical moments needed to capture molecular changes that might lead to important insights into mechanisms that allow plants to acclimate to stress conditions. For example, we can examine what changes in gene expression and metabolites occur immediately before changes in CO2 assimilation or stomatal conductance.

In plant biology research, there is an important need to bridge the whole-plant physiological responses to specific molecular events that might trigger or otherwise play key roles in dictating how plants can adjust to changes in their environment. The identification of such key molecular events, and more importantly the genetic basis that govern these, is the foundational information that plant breeders need to develop improved cultivars that are better suited to adverse growing environments. The CIRAS-3 is an important tool that helps researchers better understand when plants are modulating two critically important physiological functions — photosynthesis and water use.

Literature Cited:

Schaffer, B., P.M. Gil, M. Mickelbart and A.W. Whiley. 2013. Ecophysiology. In: *Avocado: Botany Production and Uses, 2nd Edition*. B. Schaffer, B.N. Wolstenholme and A.W. Whiley (eds.). CAB International Press, Wallingford, U.K. pp. 168-199.

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Learn more about Dr. Elias Bassil's lab at the University of Florida's Tropical Research and Education Center: https://trec.ifas.ufl.edu/

If you would like to learn more about this application or speak with one of our experienced technical staff, please feel free to get in direct contact with us via any of the contact information listed below:

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