Physiological Changes in Avocado Leaves During Water-Deficit Stress

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Due to the high cost of water for irrigation in San Diego County, many avocado growers reduce the number of irrigations applied later in the season. The effect of this cultural practice on tree physiology is not known.

Hass avocado trees on clonal Duke 7, 9 months from budding, were grown under 12-h days (310 µE/m^2 • sec) at 24°C (75°F) and 12-h nights at 19°C (66°F) with and without irrigation. Preliminary results demonstrated that well-watered control trees maintained a water potential of -3.0 +/- 1.2 bars over the 40-day experiment. The water potential of droughted trees decreased gradually to a minimum of -29 +/- 11 bars at the end of 30 days. In the well-watered trees, stomatal conductance was 0.025 +/- 0.015 cm/sec, photosynthesis was 0.55 +/- 0.3 mg $C0_2$ fixed/dm^2 h (this value is low due to the low light intensity of the chamber), and transpiration was 0.09 +/- 0.06 g H_2O/dm2 h. Maximum photosynthesis and transpiration occurred 2 h after the chamber lights came on and remained high for approximately 2 h.

Two weeks after water was withheld, stomatal conductance, photosynthesis, and transpiration were significantly reduced 98%, 85%, and 94%, respectively, in leaves of the water-stressed avocado plants compared to the well-watered controls. At this time, leaf water potential was -23 bars in the stressed plants.

Changes in carbon and nitrogen metabolism occurring in response to stomatal closure and reduced photosynthesis and transpiration are being investigated. Observations made with growth chamber-grown plants will be tested this summer with field-grown trees in commercial production.