Sun or shade: Pecan leaves' photosynthetic light response evaluated

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Optimal fruit development for pecan is guaranteed only with good canopy management and adequate water and nutrient supply. Credit: Photo by Leonardo Lombardini

Pecan, the most valuable nut tree native to North America, is native from northern Illinois and southeastern Iowa to the Gulf Coast of the United States, where it grows abundantly along the Mississippi River, the rivers of central and eastern Oklahoma, and Texas. Popularity and consumer demand for pecans has increased the cultivation of pecan trees to other areas, while commercial production has expanded into many regions of the United States and Mexico.

Effective management of the tree canopy is of vital interest to pecan growers. Pecan trees require careful canopy management to avoid self-

shading and to maintain productivity. Leaves of pecan trees typically intercept 65% to 70% of available sunlight with up to 95% light interception in overcrowded, unpruned orchards; less light naturally affects photosynthesis. To improve the amount of light penetration, pecan growers commonly use pruning techniques to increase photosynthesis and flowering on trees. To date, however, little information has been available to growers about the change in photosynthesis activity of pecan leaves throughout the growing season.

Leonardo Lombardini, Hermann Restrepo-Diaz, and Astrid Volder of Texas A&M University's Department of Horticultural Sciences published the results of an experiment using pecan tree cultivars in a recent issue of the *Journal of the American Society for Horticultural Science*. According to Lombardini and collaborators, the objective of the experiment was to quantify the effects of differences in light intensity on the "morphological characteristics and seasonal physiological performance of sun and shade leaves of field-grown pecan trees".

The experiment was conducted during the 2007 growing season at Texas A&M University. The cultivars used for the research, 'Pawnee' and 'Stuart', were chosen because of their rank as two of the most important pecan varieties for commercial growers.

Treatments were established according to the leaf type (sun or shade leaves) and cultivar. Sun leaves were growing on exterior portions of the tree canopy and were exposed to full sunlight for most of the day (southern exposure). Shade leaves were growing in interior parts of the tree canopy.

The study revealed that pecan shade leaves exposed to saturating radiation are about half as effective as sun leaves in assimilating CO2. Light saturation points were lower for shade leaves and steadily increased as the season progressed for both leaf types. The research

showed that late-season photosynthetic capacity was maintained in shade leaves, whereas it was reduced to about 60% in sun leaves.

The authors noted that the results of the research may explain why pecan trees can tolerate severe hedging-type pruning and still maintain high productivity in areas characterized by relatively high light regions (such as the southwestern United States and east-central Australia). The authors explained that "the reduction of canopy size caused by hedging likely increases the ratio of sun-exposed leaves to shaded leaves, thus boosting carbon gain per unit leaf area".

Especially noteworthy is the autumn assimilation drop in sun leaves, without a corresponding assimilation drop in shade leaves, which the authors call "a significant finding".

This study provides baseline information relevant to improving management of the orchard light environment, and can be used by commercial pecan producers for developing new, effective canopy and crop management practices.

Source: American Society for Horticultural Science