

EFFECT OF DEFICIT IRRIGATION ON YIELD AND VEGETATIVE GROWTH IN ENGLISH WALNUTS

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ABSTRACT

Many walnut growers believe that tree water stress must be avoided to maximize yields; however this can cause excessive vegetative growth. The project goal is to reduce vegetative growth, by regulated deficit irrigation (RDI), without decreasing productivity. Pruning is an annual and expensive operation in most commercial walnut orchards. Decreasing growth will allow larger time intervals between prunings. Based on using midday stem water potential (SWP) as a measure of tree stress, the questions being asked are: 1) will imposition of mild or moderate stress reduce yield, and 2) if yield is reduced, where in the growth cycle does the decrease in yield come from?

In 2002, three levels of stress, low, mild, and moderate, were imposed on two 'Chandler' orchards: a young, 8th leaf hedge row, with 30' by 18' spacing (Black Butte site), and a mature, standard diamond with 32' by 32' spacing (San Joaquin site). The grower's cultural practices were maintained. Individual tree stress, as midday stem water potential (SWP), was recorded twice weekly, immediately prior to irrigation, using a pressure chamber to ensure target plant-based stress levels were maintained. Stress was applied by different size sprinkler nozzles and manipulation of irrigation set duration. Trunk circumference, canopy light interception and multiple shoot growth measurements are all used to quantify changes in the growth patterns of the orchards. Individual tree yields were monitored and samples were collected for quality grading. In a sample volume of the upper canopy, all shoots were tagged to trace the development of flowers to nuts, shoot growth, and dormancy / shoot death.

At the Black Butte site there was a clear decrease in trunk circumference after 2 years of RDI, with those in the more severe RDI having the smallest circumference. 2004 Black Butte SWP was close to target levels, and showed clear treatment differences. Information for the San Joaquin plot was unavailable. The Black Butte 2003 seasonal SWP treatment averages were: Low -3.2a, Mild -6.2b, and Moderate -7.3c, compared to San Joaquin at Low -7.1a, Mild -8.7a, and Moderate -9.8b. At Black Butte, the low stress treatments had the highest nut numbers, 56 nuts, and the moderate stress had the fewest nuts per sample area, 39 nuts on 7/22. At San Joaquin differences were not correlated with treatments. In 2003, yields at Black Butte were significantly higher on low stress averaging 2.82 T/A, compared with moderate stress averaging only 2.07 T/A. Yields at San Joaquin showed a similar pattern, but differences were not significant. Much of 2004's data is still pending harvest in September.

The plant based RDI treatments have been applied for three seasons. Yield in 2003 was significantly decreased with increasing stress at the Black Butte site, but not at the San Joaquin site. Growth in 2004 has also been significantly decreased at the Black Butte site, also there are significantly fewer nuts on the mild and moderate treatments compared to the low stress treatment. The relationship between yield and sample nut numbers will be investigated this fall. The strong differences in yield between the two sites are believed to be related to the tree age and

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planting / growing style of the two orchards. The San Joaquin site has higher stress, higher overall yields, and less sensitivity of yield to water stress. Theories for this include mature trees being less sensitive to water stress, and / or mature trees having more stored carbon reserves, causing the RDI effects to be delayed by several years.