

AES/CE MAR 84

Workgroup/Department:

Pomology

PROJECT PLAN/RESEARCH GRANT PROPOSAL

University of California  
Division of Agricultural Sciences

Project year 2008

Anticipated Duration of project: 2<sup>nd</sup> year of 2

Project leader:  
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Project Title: Walnut production and quality as influenced by orchard and within tree canopy environment

Keywords: walnut quality, midday stem water potential

Commodity : Walnut

**Problem and its Significance**

Walnut quality can vary within the tree canopy. The differences are likely related to both water relations and light distribution. Outer, exposed nuts can be susceptible to sunburn related damage. In addition to these more easily visible, outer canopy nuts, many walnut quality problems also occur in inner canopy, shaded positions. The authors have observed that these problems tend to be most severe in productive orchards with a high percentage of midday canopy light interception. Examples of the problems that have been observed in these inner canopy shaded positions include shriveled kernels, oilless nuts, the black Chandler problem and more recently kernels with yellow pellicles. All of these problems can have significant impacts on walnut yield and/or quality.

The relationship between orchard design, light interception and the potential impacts of these factors on nut quality is largely unknown.

The goal of this project is to investigate the role of orchard structure, tree physiology and microenvironmental conditions within the tree canopy on resulting nut quality. The intent is to use this information to aid in orchard layout, tree training and canopy management in order to maximize productivity and quality.

**Objectives**

Walnut sizing occurs during the first 14 weeks after bloom. Kernel filling begins about 8 weeks after bloom and continues until about 20 weeks after bloom. Interruptions in carbon availability, which could be caused by lack of water, excess water, excessive heat, etc. during the first 14 weeks after bloom can result in smaller sized nuts while interruptions from 8 to 20 weeks after bloom can result in kernel filling and or quality

problems. Any of these stresses likely would have more severe impacts on nuts in interior, shaded positions.

The goal of this project is to monitor conditions throughout the tree canopy during the kernel filling period and attempt to relate these conditions to resulting kernel development and quality. Midday stem water potential will be measured periodically during the kernel filling period with a plant pressure chamber. In addition, conditions throughout the tree canopy will be assessed by attaching thermocouples and/or light sensors to individual nuts (and/or adjacent leaves) during the kernel filling period and following these nuts through to harvest to determine what conditions in the canopy lead to problems such as kernel shrivel, kernel darkening, yellow kernel, etc. Finally, temperature and relative humidity will be monitored within the canopy.

The first year results from this project confirmed results from previous projects showing that nut color and monetary return as measured by Diamond Foods Inc. quality analysis can be improved across a range of mild to moderate water stress levels (Fig. 1). The relationship at the two sites was very similar for the 2007 season. The reason for this relationship, which goes against the common wisdom that nut color is adversely impacted by water stress, is unclear. However, we have now observed this relationship in at least three different orchards over several years. We will investigate this phenomenon further in 2008.

### **Plans and Procedures**

Measurements will continue in the nine and thirteen year old San Joaquin County Chandler orchards where the studies were done in 2007. The plan is to follow the 1000 tagged spur locations to investigate how the light conditions and cropping patterns in 2007 as well as in 2008 influence spur survival and cropping in 2008. Sensors will be placed on the same trees and spurs as in the 2007 season. Tree water potential will be monitored approximately every one to two weeks.

We will also concentrate our investigations in 2008 on the areas where the problems were found to occur in 2007. This includes the lower positions where shrivel and color problems occurred as well as in low positions over the drive row where the yellow pellicle problems were found.

We have good data on shrivel and darkening of pellicles associated with shaded positions in the inner canopy although most of the data has not yet been processed. In general, nuts in shaded positions which had a darkening of the hull (but not the mushy hull described above in association with yellow pellicles) tended to have darkened pellicles and/or shriveled kernels. Further analysis of this data set will help to clarify the level of light required to prevent these problems from occurring. Please see Walnut Research Reports 2007 for details on results from the 2007 field season.

In summary, we have made significant progress on understanding the role of canopy position and light exposure on quality related problems in walnut. It appears that shading related pellicle darkening and shrivel is associated with low light levels. In addition, it

appears that orchards running near the fully watered baseline (in the -4 to -5.5 bar midday stem water potential range) may have a decrease in nut quality although the mechanism is not yet known. Finally nuts with yellow pellicle occurred on branches that were in full sun early in the season but became shaded as the season progressed due to higher limbs coming down on top of them.

The goal of this project in the 2008 season will be to finish analyzing the large dataset on light and nut quality that we collected in the 2007 season and use this information to both guide further field studies for the 2008 season on the areas in the canopy which are likely problematic for nut quality and to begin to design an orchard layout and management regime that minimizes potential for these problems.

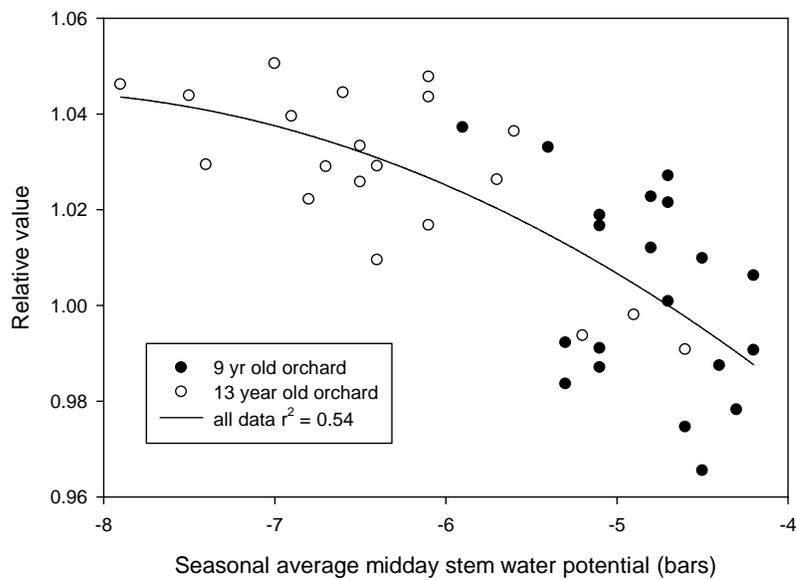


Fig. 1. Relationship between 2007 seasonal average midday stem water potential and relative value of the nuts.

