

Enhancement of Avocado Productivity. II. Tree Phenology, Carbohydrate Cycling and Canopy Management

Continuing Project: Year 6 of 12
Mary Lu Arpaia
Dept. of Botany and Plant Sciences,
UC Riverside
Kearney Agricultural Center,
9240 S. Riverbend Ave.,
Parlier, CA 93648

Cooperating Personnel: P. Robinson, X. Liu, D. Stottlemeyer, W. Manor, C. Reints, H. Schweitzer, M. Madore, D. Crowley, G. Thorp, S. Köhne, M. Zilberstaine, U. Kafkafi and on-farm cooperators

Benefit to the Industry

This project will supply the avocado industry with the necessary information to understand the growth and flowering behavior of the 'Hass' avocado under California conditions. The data generated from this project will aid the California grower in planning management strategies to maximize fruit productivity and help researchers examining the biology of the avocado. It is likely that an understanding of the carbohydrate status of 'Hass' avocado trees during successive seasons will lead to strategies for the control for alternate bearing. We are committed to making the data from this project available to the industry in a timely manner. Any data collected from this project will be available through the avocado home page (being developed through the breeding proposal) and other appropriate means.

Objectives

- A. To collect information on root and shoot growth, flowering and fruit set, yield; and carbohydrate partitioning for 'Hass' on selected clonal rootstocks at the University of California (UC) South Coast Research and Extension Center (REC) in Irvine CA. This information will be correlated with meteorological data.
- B. To establish additional research sites throughout the California avocado industry to collect data pertaining to shoot and root growth, flowering, yield and carbohydrate

cycling. Meteorological data will also be collected (air and soil temperature) and correlated to the timing of phenological events.

- C. To collect comparative data on 'Lamb Hass' as compared to 'Hass' on Duke 7 with relation to phenological events and carbohydrate cycling at the UC South Coast REC. Expand this to include additional varieties if necessary.
- D. To collect comparative data on stumped (rejuvenated) 'Hass' trees as compared to non-stumped 'Hass' trees on Toro Canyon with relation to phenological events and carbohydrate cycling at the UC South Coast REC.
- E. To establish a girdling project in a commercial grove where the timing, girdling width and the use of polyethylene wraps of single branch girdling on tree health, flowering and yield can be examined over multiple years.
- F. To establish a program to examine the relationship of canopy management - light distribution and micro-climate effects within an avocado free to long term effects on productivity.
- G. To destructively harvest 11 year old 'Hass' frees on either Duke 7 or G755C clonal rootstock during August/September (time of late summer shoot flush and root flush), December/January (timing of maximum carbohydrate storage) and May (fruit set and spring shoot flush) and look at total carbon and nitrogen content as well as carbohydrate partitioning in various portions of the free.

Summary

A. To collect information on root and shoot growth, flowering and fruit set, yield; and carbohydrate partitioning for 'Hass' on selected clonal rootstocks at the University of California (UC) South Coast Research and Extension Center (REC) in Irvine CA. This information will be correlated with meteorological data.

We are working to summarize the data collected from 1992 through 1996 with the goal of incorporating an analysis of climactic data in the results from the original phenology site. The hope is that by factoring in minimum and maximum air and soil temperatures in conjunction with free yield we may be able to more accurately interpret the data set. We hope to have this completed sometime during the early part of the funding cycle. Once analyzed in a meaningful manner this information will be disseminated to the CA avocado community. Dr. Heinrich Schweitzer (Dept. of Entomology) is working on this aspect of the project.

We are continuing to work with Dr. Madore (using her laboratory facilities at UCR) to elucidate the pathways of metabolism of D-mannoheptulose and perseitol. We are pursuing alternative funding sources to more adequately support this more basic research.

B. To establish additional research sites throughout the California avocado industry to collect data pertaining to shoot and root growth, flowering, yield and carbohydrate cycling. Meteorological data will also be collected (air and soil

temperature) and correlated to the timing of phenological events.

The project underwent a major restructuring during the last year. The old rhizotrons at the UC South Coast Research and Extension Center (SCREC) were removed, reconditioned and reinstalled during 1997. Only Duke 7 rootstock has been continued in this phase of the project. In order to expand our area of study, growers throughout the state have given us permission to install satellite phenology sites. All these sites have now been installed. At 3 of them, Temecula, Saticoy, and Ojai, we have collected nearly 1 year of data. The other sites are located in Carpinteria, Goleta, Exeter and Ramona. All sites with the exception of the Exeter site are 'Hass' on Duke 7. The Exeter site is 'Hass' on seedling Mexican rootstock. There are a total of 30 rhizotrons at SCREC and 35 at the outlying sites. At all sites we are collecting data tri-weekly. Using a bloom developmental rating scale developed by Dr. Samuel Salazar-Garcia (student of Dr. Lovatt) we are tracking bloom at each site. We are also measuring shoot extension and periodically taking samples for carbohydrate analysis. Data on root extension, fruit growth, yield and tree size are also being collected. We have installed small weather stations at all sites. We are collecting data on air and soil temperature, relative humidity and solar radiation.

C. To collect comparative data on 'Lamb Hass' as compared to 'Hass' on Duke 7 with relation to phenological events and carbohydrate cycling at the UC South Coast REC. Expand this to include additional varieties if necessary.

In Field 42 at SCREC, 'Hass' on Duke 7 and 'Lamb Hass' on Duke 7 have been selected for comparison. As noted in the breeding program discussion we are initiating comparative physiological studies on these two cultivars.

D. To collect comparative data on stumped (rejuvenated) 'Hass' trees as compared to non-stumped 'Hass' trees on Toro Canyon with relation to phenological events and carbohydrate cycling at the UC South Coast REC.

We are using 'Hass' on Toro Canyon rootstock for this portion of the study. Ten rhizotrons have been installed, 5 each on rejuvenated and non-rejuvenated trees. As above, tree events are monitored in an effort to determine the effect that rejuvenation might have on phenological events throughout the year.

E. To establish a girdling project in a commercial grove where the timing, girdling width and the use of polyethylene wraps of single branch girdling on tree health, flowering and yield can be examined over multiple years.

We have established 2 girdling plots in a grove in De Luz Canyon. One plot consists of trees which were stumped in Winter/Spring 1997. The other plot consists of large 'Hass' trees that have not been pruned. Due to budget restrictions we were not able to initiate the timing aspect of this project. Rather all trees were girdled in October 1997.

F. To establish a program to examine the relationship of canopy management - light distribution and micro-climate effects within an avocado tree to long term effects on productivity.

This portion of the project has been delayed due to equipment availability. We intend beginning this objective in Spring 1998. At that time we hope to initiate the international collaborative effort outlined in our research proposal.

G. To destructively harvest 11 year old 'Hass' trees on either Duke 7 or G755C clonal rootstock during August/September (time of late summer shoot flush and root flush), December/January (timing of maximum carbohydrate storage) and May (fruit set and spring shoot flush) and look at total carbon and nitrogen content as well as carbohydrate partitioning in various portions of the tree.

Trees were reserved for this part of the project from the 'Hass' rootstock trial initiated in 1986. In conjunction with objective F we will collect physiological data on the tree (Leaf Area Index, Net Photosynthesis for example) prior to the destructive harvest. The equipment for this project has been fabricated and tested. Several trials still need to be conducted to test the complexity of what is planned. The heavy rains of this winter and budget restrictions have postponed these trials. We now anticipate that the first tree removals will be made later in 1998.