

Enhancement of Avocado Productivity.

I. Plant Improvement – Selection and Evaluation of Improved Varieties and Rootstocks

Continuing Project; Year 5 of 20

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Benefit to the Industry

This project will help to maintain and enhance the California avocado industry by introducing consistently heavier producing, high-quality avocado varieties, better pollinizer varieties, and improved rootstock hybrids. Increasing the genetic diversity of varieties will decrease the risk of major pest and disease invasions on a susceptible monoculture.

Objectives

- A. To produce new avocado varieties, superior to ‘Hass’ in consistent productivity and postharvest fruit quality and marketability, with fruit of optimum maturity and size year-round. This includes determining the different cultural needs of each cultivar. Index trees for distribution for sunblotch viroid with assistance of Drs. Allan Dodds, Jim Heick and Deb Mathews.
- B. To collaborate with other researchers worldwide in evaluating and exchanging promising plant material. Provide material to Drs. Richard Litz and Witjaksono from the University of Florida upon request.
- C. To collaborate with Dr. Menge and Dr. Crowley on rootstock selection and evaluation for both root rot resistance and salinity tolerance.
- D. Evaluate the potential of new and established cultivars (B flower types) for use as pollinizers in collaboration with Drs. Ben Faber and Betty Fetscher; assist Dr. Mike Clegg on coordination of pollinizer research plots as requested.
- E. To assist Drs. Morse and Hoddle on identifying plant material tolerant to *Persea* mite and the avocado thrips as requested.
- F. To maintain and improve the CAS variety block and the *Persea* germplasm block located at the UC South Coast Research and Extension Center.
- G. To insure the timely and effective dissemination of information developed from this research program.

Summary

- A. To produce new avocado varieties, superior to ‘Hass’ in consistent productivity and postharvest fruit quality and marketability, with fruit of optimum maturity and size year-round.**

Field Trials. This is the primary objective of the breeding program. The following are the cooperator trials:

Topworked trials at Non-UC Sites

Santa Paula (Ventura County) - 1998

'GEM', 'Harvest', 'SirPrize', 'RT5176', 'OA184', 'Marvel', 'Hass'; 10 replicates

De Luz Canyon (San Diego County) - 1998

'Lamb Hass', 'SirPrize', 'GEM', 'OA184', 'Marvel', '5-552', 'Nobel', 'Hass', 'Harvest'; 10 replicates.

Approximately 80 'GEM' trees divided roughly into 3 groups at the cooperators site.

San Luis Obispo (San Luis Obispo County) – 1998 (Trees suffered from freeze in 12/98 necessitating re-grafting of some selections in 1999.

'RT5176', 'Hass', 'SirPrize', 'GEM', 'Harvest', 'OA184'; 9 replicates

Rainbow (San Diego County)

1997 Trial: 2 'GEM', 2 'Nobel', 2 'Harvest', 3 'Marvel', 2 'BL312'

1998 Trial: Provided budwood for 40 trees each of 'GEM' and 'Harvest' and 20 trees of 'Lamb Hass' with the plan of having 10 replicates. Actual field grafting was not done according to UC request.

Clonal trials at Non-UC Sites

Oxnard (Ventura County) – 1996 (originally known as the Newman Ranch site. This trial was flooded in 1997 and many trees died due to this, however we are now working with the new owners to collect data from the trees which survived after the winter of 1997): 'Lamb Hass', 'SirPrize', 'GEM', 'OA184', 'Marvel', 'Nobel', 'Hass', 'Harvest'

'Nobel' trees at UC South Coast REC - 1998

20 clonal trees: 8 planted in Field 4; 12 planted in Field 46. Purpose of trees is a) budwood and b) fruit source.

Topworked trees at UC, Riverside Campus - ongoing

Replacement trees in Field 10

San Joaquin Valley Variety Trial – 1999 at two sites (Porterville, Lindcove) with "new trees"

All on Thomas Rootstock; 'SirPrize', 'Lamb Hass', 'Harvest', 'GEM', 'Nobel', 'Marvel', 'Pinkerton', 'Fuerte', and 'Zutano'

Yield data from unreleased material. We have collected yield data for the third year from Field 4 at UC-SCREC (UC South Coast Research and Extension Center). Data collection for 2001 is still incomplete but preliminary data is presented (Figure 1). The 'Harvest' at this point has the largest cumulative yield over the 3-year period, however this variety also appears to exhibit severe alternate bearing. We have also collected the first year of yield data from the Santa Paula and Oxnard sites in Ventura County and the De Luz site in San Diego county (data not presented).

Fruit Characteristics. As an on-going process we are collecting fruit samples from all sites approximately every 3 to 4 weeks from fall through late summer. These fruit are evaluated using standard protocols for such characteristics as fruit shape, peel texture, peel color, flesh color, the percent seed, flesh and skin and skin thickness. Figure 2 shows the average percent seed for the various varieties. These are the averages for all fruit from all sites. Note that there is considerable variation between the different varieties in terms of the relative proportion of the fruit occupied by the seed ranging from a low of 7.1% for the 'OA184' to nearly 18% for 'Bacon'. Figure 3 presents a comparison of the 'GEM' and 'Hass' seed size from each sites averaged over all sampling dates. Note that the 'GEM' seed occupies a slightly higher percentage of the fruit as compared to the 'Hass' in all but one site.

Dry Weight Tracking. Figure 4 presents the trends in dry weight for the 'GEM' at the De Luz site. Similar trends were observed at the other 6 sampling sites (Irvine, Riverside, Santa Paula, Oxnard and San Luis Obispo). Figure 5 presents similar data comparing 'Hass' to 'Nobel'. Similar trends, with the 'Hass' having slightly higher dry weights than the 'Nobel' was observed at the other 4 sampling sites (Irvine, Riverside, Oxnard and San Luis Obispo). Figure 6 illustrates the comparison of 'Hass' to 'Marvel' from the De Luz sampling site. The 'Marvel' tends to lag behind the 'Hass' in dry weight accumulation throughout the season. This trend was also observed at the other 5 sampling sites (Irvine, Riverside, Santa Paula, Oxnard and San Luis Obispo). Figure 7 shows the same data for 'Hass' and 'Harvest'. The 'Harvest' tends to be substantially slower in dry weight accumulation as compared to the 'Hass'.

These large differences were also evident at the other 4 sampling sites (Irvine, Santa Paula, Oxnard and San Luis Obispo). The changes in % dry weight for 'GEM' for the 7 sampling sites are illustrated in Figure 8. The same general pattern for dry weight accumulation appears to occur at all sites. A comparison between dry weight accumulations between two maturity seasons for the 'GEM' variety is presented in Figure 9. This data is from the De Luz site in San Diego County. Both seasons show the same general trends.

New Material for the Breeding Program. In Spring 2000 we planted approximately 220 seedlings from mixed maternal sources to provide material for the "next generation" of avocado selections. An additional 270 open pollinated seedlings are currently being transplanted into sleeves at SCREC to be planted in the field in spring 2002. We are collecting additional seed material this year and hope to plant a similar number of seedlings in 2003. We have also established a series of "isolation" blocks at UCR and the Nakamura Ranch for generating seed material for the future (parents selected following consultation with Dr. Bob Bergh).

Sunblotch Viroid indexing. A group of 8 trees in Field 46 at UC SCREC tested positive for the sunblotch viroid. These trees were removed in Spring 2001. All the trees in field 4 at UC SCREC have been sampled for sunblotch. Results are still out on the last 7 trees but all other trees have tested negative for the sunblotch viroid.

B. To collaborate with other researchers worldwide in evaluating and exchanging promising plant material.

Introduction of new germplasm. In May 1999 D. Stottlemeyer, T. Chao and M. L. Arpaia visited Israel. One of our objectives was to visit with Dr. A. Ben-Ya'acov to review the status of the various rootstock selections, which he had made over the years. In May 1999 M. L. Arpaia brought material from 5 selections plus budwood of the 'Ardith' and the 'Gil'. M. L. Arpaia revisited Dr. Ben-Ya'acov in March 2000 and obtained additional material. Budwood from the 5 selections obtained in May 1999 was also once again acquired. We have tested this material for the presence or absence of sunblotch. The VC49 selection (introduced in 3/00) has tested positive and was destroyed. This remaining material is currently in quarantine at UC, Riverside and is scheduled to be released for propagation and subsequent testing during the next year.

We have continued to supply material to Dr. Richard Litz's program in Florida on an on-going basis during early fruit development. We are also supplying fruit and plant material to other researchers when requested.

C. To collaborate with Dr. Menge (Dept. of Plant Pathology, UCR), and Dr. Crowley on rootstock selection and evaluation for both root rot resistance and salinity tolerance.

In Spring 1998 we topworked trees in the old 'Gwen' rootstock trial to the 'Lamb Hass' variety. This allows us to assess its performance on the following rootstocks: G755A, G755B, G755C, Toro Canyon, Orchard, Duke 7, D9, Thomas, Topa Topa. The first yield data from this trial has been collected in 2001. The "take" in this trial has been mixed but we have successfully established sufficient trees for evaluation. We planted a new clonal rootstock trial at UC SCREC with Dr. Menge in spring 1999. The 'Hass' and the 'Lamb Hass' are included in this trial on selected clonal rootstocks ('Hass' on Day, Duke7, Dusa, Evstro, G755A, Parida, PP4, Spencer, Thomas, Toro Canyon; 20 replicates 'Lamb Hass' on Day, Duke 7, Evstro, Thomas, Toro Canyon; 20 replicates). The trees have set fruit for the 2001/2002 season and will be harvested sometime in Spring 2002.

We continue to collaborate with Dr. Crowley in his salinity research.

D. Evaluate the potential of new and established cultivars (B flower types) for use as pollinizers in collaboration with Drs. Ben Faber and Betty Fetscher; assist Dr. Mike Clegg on coordination of pollinizer research plots as requested.

Pollinizer Trials. In conjunction with Ben Faber we established a pollinizer site in Ventura County (Oxnard) in spring 1999. The varieties included in this trial are 'Ettinger', 'Fuerte', 'Bacon', 'Zutano', 'Harvest', 'SirPrize', 'Nobel' and 'Marvel'. There are 60 trees of each variety divided into 6 replicates of 10 trees each. The trees in this trial have been incorporated into the Avocado Pollination and Bee Biology project headed by Drs. N. Waser and B. Fetscher. The first year of differential yield data is presented in Dr. Waser's report. Ben Faber and M. L. Arpaia also established a site in Ventura County (Somis) looking at the distance from the pollinizer row vs. yield and now

have 3 years of yield data (no significant trends observed). Finally we established a pollinizer trial in San Luis Obispo County using 'Bacon', 'Nobel' (BL667), and 'Marvel' (BL516) with 7 replicates of each in spring 1998. This trial was affected by the 12/98 freeze and required re-topworking of the trial trees. We had our first harvest from this plot in 2001.

We continue to discuss with Dr. Clegg ways to incorporate the B flower type selections into an organized research program to evaluate the value of outcrossing and which pollinizers to utilize and to discuss future directions for the breeding program.

E. To assist Drs. Morse and Hoddle on identifying plant material tolerant to *Persea* mite and the avocado thrips.

We have initiated a cooperative project with Dr. Hoddle looking at growth flushes and relative susceptibility to *persea* mite. Dr. Hoddle will report on preliminary results of this effort.

F. To maintain and improve the CAS variety block and the *Persea* germplasm block located at the UC South Coast Research and Extension Center.

An accurate plot map has been generated for the CAS Variety Block. Any changes to the planting are being recorded in the master database maintained by David Stottlemeyer. The volunteers have been instrumental in maintaining this block. The volunteers graft several new and/or historical varieties on an on-going basis. We have also established the capability of growing clonal trees on a small-scale for the breeding program. This is being done using the greenhouse facilities at UC SCREC.

G. To insure the timely and effective dissemination of information developed from this research program.

The current avocado web site at: www.ucavo.ucr.edu has been on-line since June 1998. The site is being revised and updated with new information and photographs of different varieties and should be online by this fall. Questions sent via e-mail are answered on an ongoing basis.

Figure 1. Yield data (average fruit count per tree) from Field 4 variety trial at the UC South Coast Research and Extension Center in Irvine, CA from 1999 - 2001.

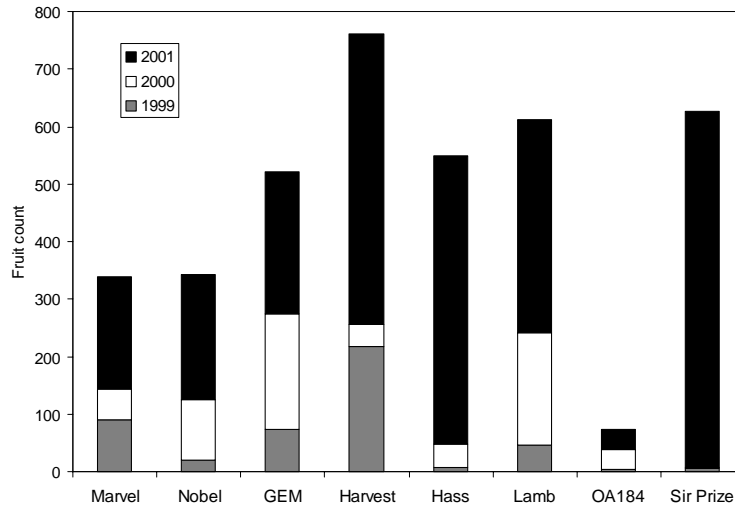


Figure 2. Average seed size (% of total fruit weight) for all sampling sites. Fruit sampled from November 2000 through August 2001.

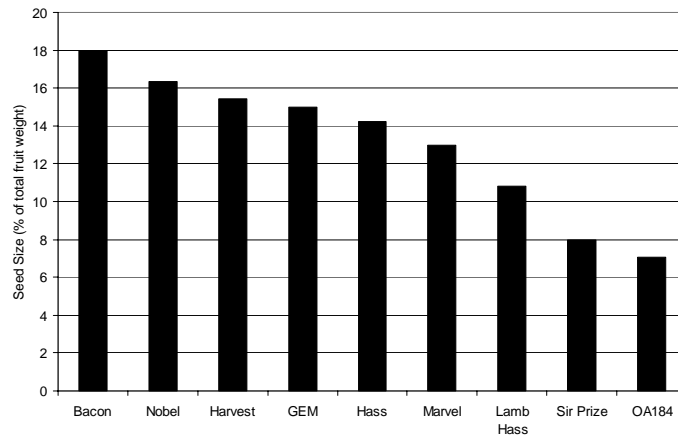


Figure 3. Average seed size (% of total fruit weight) for 'GEM' and 'Hass' from the various sampling sites. Values averaged over all sampling dates.

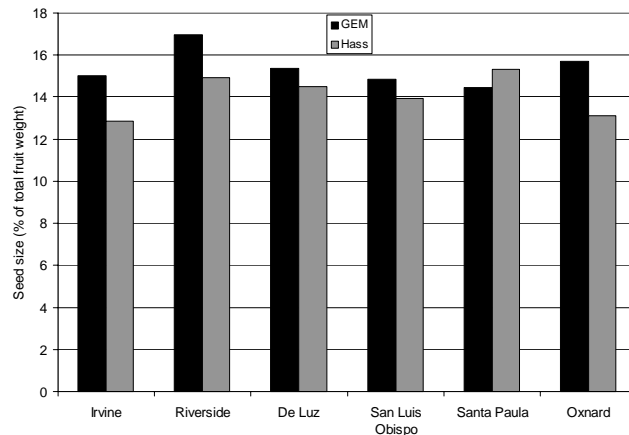


Figure 4. Comparison of changes in % dry weight for 'Hass' and 'Gem' harvested from November 2000 through August 2001 from the De Luz site in San Diego County.

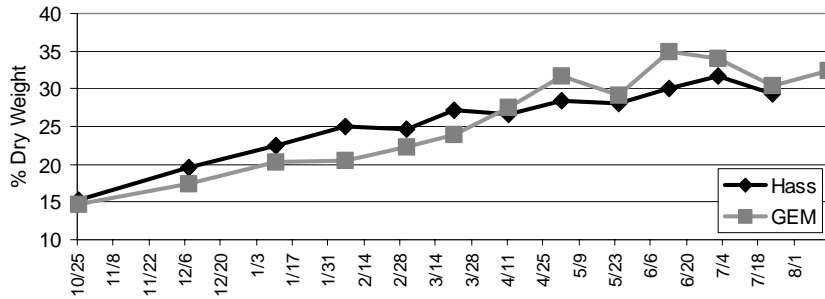


Figure 5. Comparison of changes in % dry weight for 'Hass' and 'Nobel' harvested from November 2000 through August 2001 from the De Luz site in San Diego County.

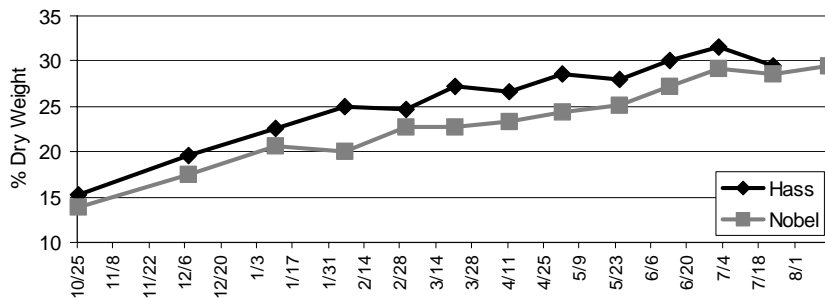


Figure 6. Comparison of changes in % dry weight for 'Hass' and 'Marvel' harvested from November 2000 through August 2001 from the De Luz site in San Diego County.

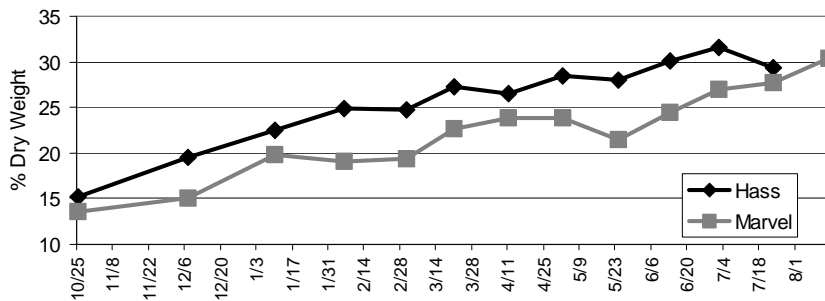


Figure 7. Comparison of changes in % dry weight for 'Hass' and 'Harvest' harvested from November 2000 through August 2001 from De Luz site in San Diego County.

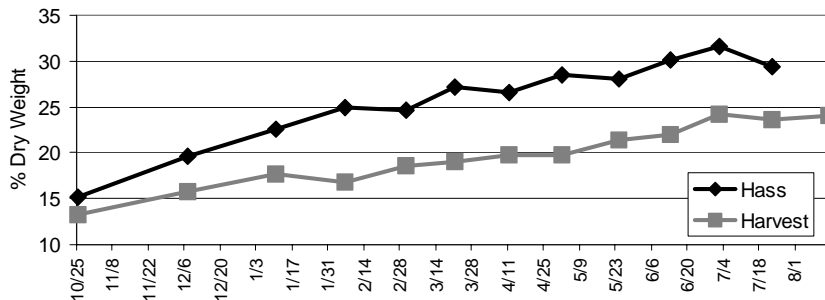


Figure 8. Changes in dry weight percentage for 'GEM' from November 2000 through August 2001 from sampling sites (De Luz, Rainbow, Riverside, Irvine, Santa Paula, Oxnard, San Luis Obispo).

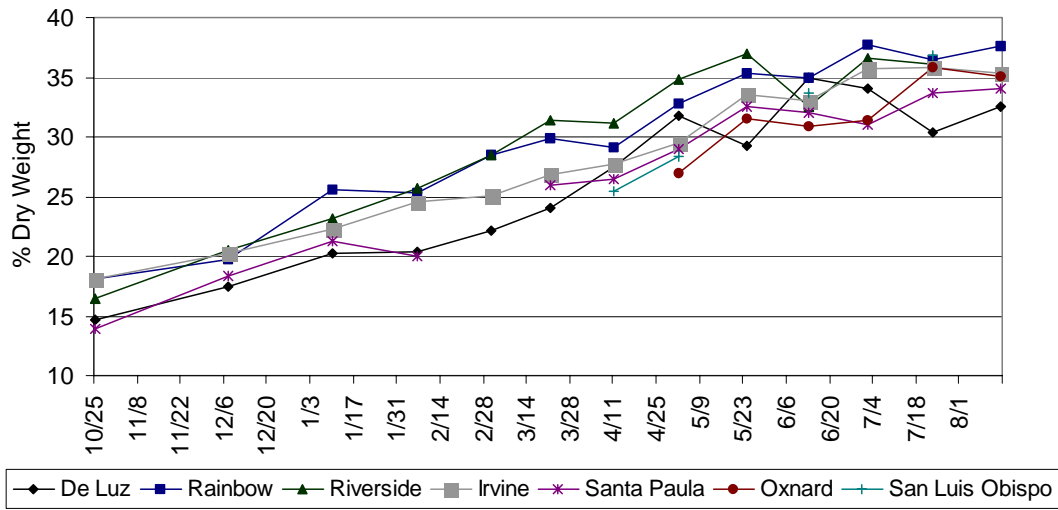


Figure 9. A comparison of dry weight changes for 'GEM' between the 1999/2000 and 2000/2001 maturity seasons. Data collected from the De Luz site in San Diego County.

