

Enhancement of Avocado Productivity

I. Plant Improvement - Selection and Evaluation of Improved Varieties and Rootstocks Continuing Project; Year 3 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 Matthews.
- 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. Since 1998 we have established the following 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 cooperator 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.

'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 Roostock; 'SirPrize' 'Lamb Hass', 'Harvest', 'GEM', 'Nobel', 'Marvel', 'Pinkerton', 'Fuerte', and 'Zutano'

Yield data from unreleased material. We have collected some yield data from Field 4 at the UC SCREC (UC South Coast Research and Extension Center) (Figure 1). The 2000 yield data is still being collected and may change slightly from what is presented. In 1998 - 1999 'Harvest' had the highest yield followed by 'Marvel' (BL516) and 'GEM'. 'Sir Prize' and 'OA184' had the poorest yield. In this current season preliminary data indicate that 'Harvest' has very little fruit (indicating alternate bearing) whereas 'GEM' appears to have good crop.

Dry Weight Tracking. Figure 2 presents the trends in dry weight for the 'GEM' at the 4 testing sites (UC SCREC, UCR, De Luz, San Luis Obispo). This data shows similar trends at all sites throughout the season. The comparison of dry weight changes for the 'GEM' as compared to the 'Hass' for the UCR and UC SCREC sites are presented in Figure 3. One can see that the two cultivars track very closely with each other. Figure 4 presents data similar to Figure 3 for the 'Marvel' (BL516) selection compared to 'Hass'. There appears to be some difference at the UCR site between the 'Marvel' and 'Hass'. Figures 5 and 6 presents data for the 'Nobel' (BL667) at 3 sites and as compared to 'Hass', respectively. We have also collected dry weight data for the 'Harvest' selection which is presented in Figure 7. Note that as compared to the other selections, that the 'Harvest' has lower overall dry weight even in the late season. Finally, Figure 8 shows a comparison of 6 varieties from the ACW Ranch in De Luz Canyon from March through September 2000.

New Material for the Breeding Program. We have planted approximately 220 seedlings from mixed maternal sources to provide material for the "next generation" of avocado selections. This was accomplished following consultation with Drs. Bob Bergh (UCR) and Uri Lavi (Volcani Institute, Israel). The trees were planted in Spring 2000. We are collecting additional seed material this year and hope to plant a similar number of seedlings in 2001. Additionally we have established a series of "isolation" blocks at UCR for generating additional seed material for the future (parents selected following consultation with Dr. Bob Bergh).

Sunblotch indexing. A section of Field 46 at UC SCREC tested positive for the sunblotch viroid. These trees were removed in March 2000. We have conducted a preliminary indexing of the 225 seedlings due to be planted at UC South Coast REC. One group of 15 trees tested as a weak possible positive and Dr. Dodd's group hopes to do further testing with this group of trees. The remainder of these seedlings will be planted out in Spring 2000 as outlined above.

Table 1. Listing of rootstock material acquisition from Israel.

VC#	<i>Obtained</i>	
	<i>May '99</i>	<i>March '00</i>
6		X
7		X
15		X
26		X
28		X
31		X
40	X	X
49	X	X
51		X
65	X	X
66	X	X
75		X
803		X
804		X
817	X	X
828		X

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

Introduction of new germplasm. In May 1999 D. Stottleyer, 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 as listed in Table 1. Budwood from the 5 selections obtained in May 1999 was also once again acquired. This material will be in quarantine for 2 years before it can be released for field testing. We have tested this material for the presence or absence of sunblotch. The VC49 selection (introduced in 3/00) has tested positive and we are currently waiting for indexing results from Israel.

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 will allow us to assess its performance on the following rootstocks: G755A, G755B, G755C, Toro Canyon, Borchard, Duke 7, D9, Thomas, Topa Topa. 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).

A clonal rootstock trial was planted in Spring 1998 in the San Joaquin Valley. This trial used the 'Sir Prize' as the scion variety. Three sites were planted: UC Lindcove Research and Extension Center in Exeter, Cutler-Orosi and Porterville. Unfortunately these research sites were greatly affected by the December 1998 freeze. Although the trees are still in the ground, we anticipate that we will terminate the Cutler-Orosi site and possibly the Lindcove REC site. The trees in Porterville appear to have survived and we hope to collect reasonable information from this site.

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. 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 some re-working of the trial trees. We hope to begin collecting data from this trial 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 not initiated any activities with this objective. Mr. Stottlemeyer has coordinated some activities with Dr. Hoddle, namely providing plant material for Dr. Hoddle's laboratory testing.

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 data base maintained by David Stottlemeyer. The volunteers have been instrumental in maintaining this block. Several new and/or historical varieties are being grafted on an on-going basis by the volunteers. We are also in the process of establishing 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 avocado website at www.ucavo.ucr.edu has been on-line since June 1998. The site continues to be updated with new information and photographs of different varieties. Questions sent via e-mail are answered on an ongoing basis.

Figure 1. Field 4 Variety Trial at UC SCREC in Irvine, CA. Average number of fruit per tree for 1999 and 2000.

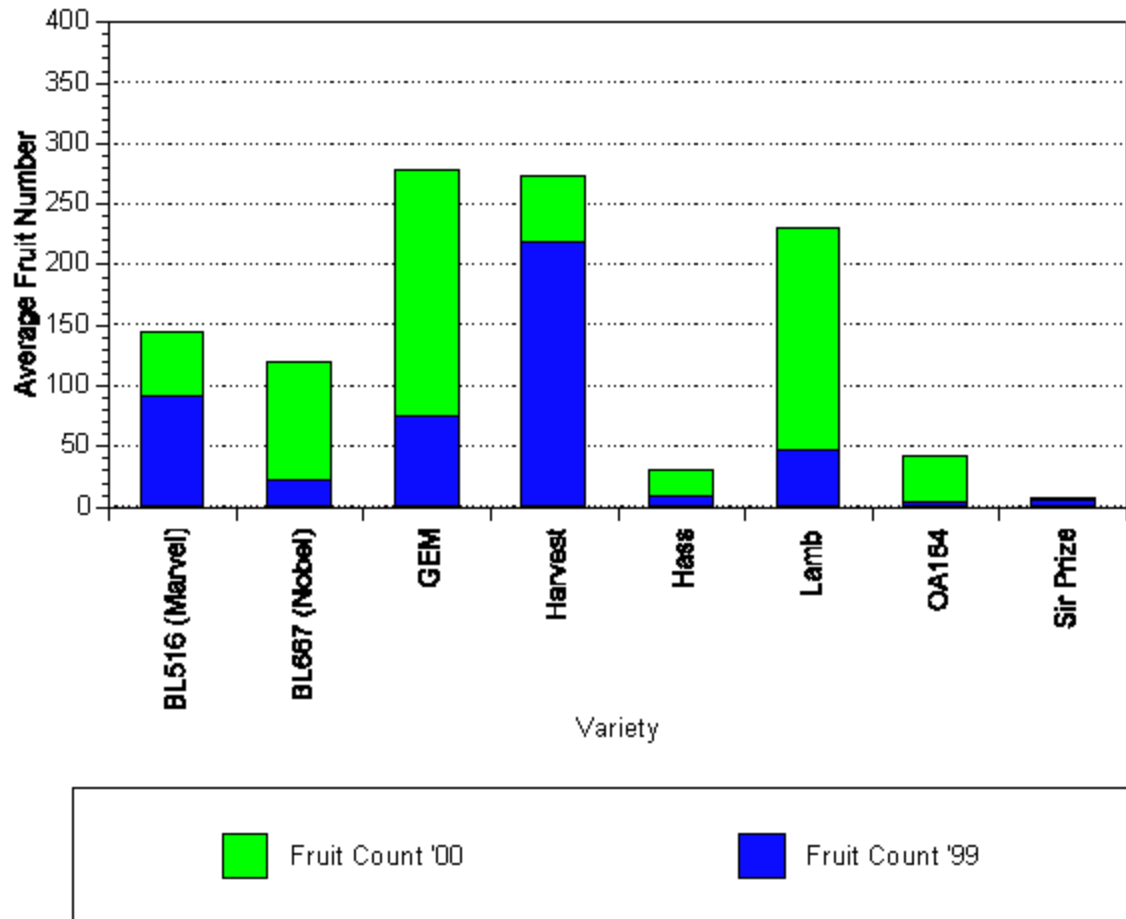


Figure 2. The average percent dry matter for 'GEM' for four sites from 12/99 to 9/00.

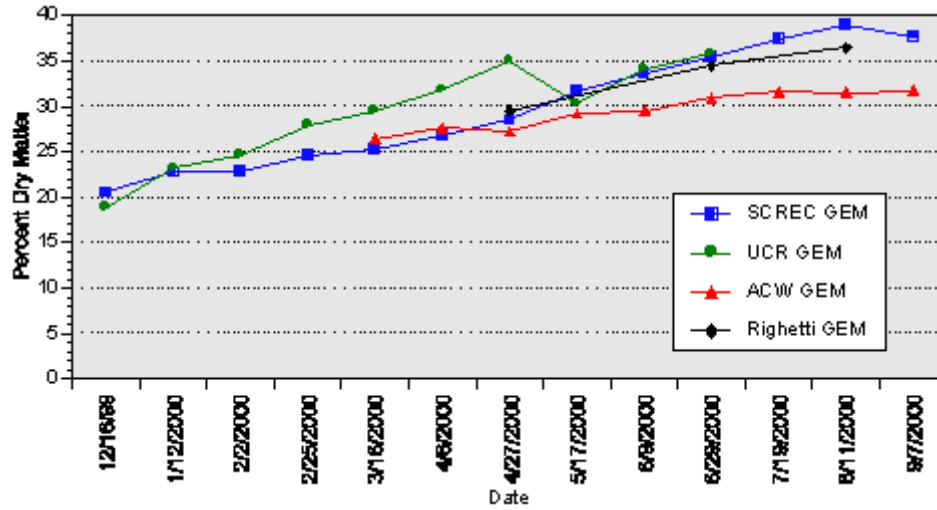


Figure 3. The changes in dry weight for 'Hass' and 'Gem' from UC SCREC and UCR.

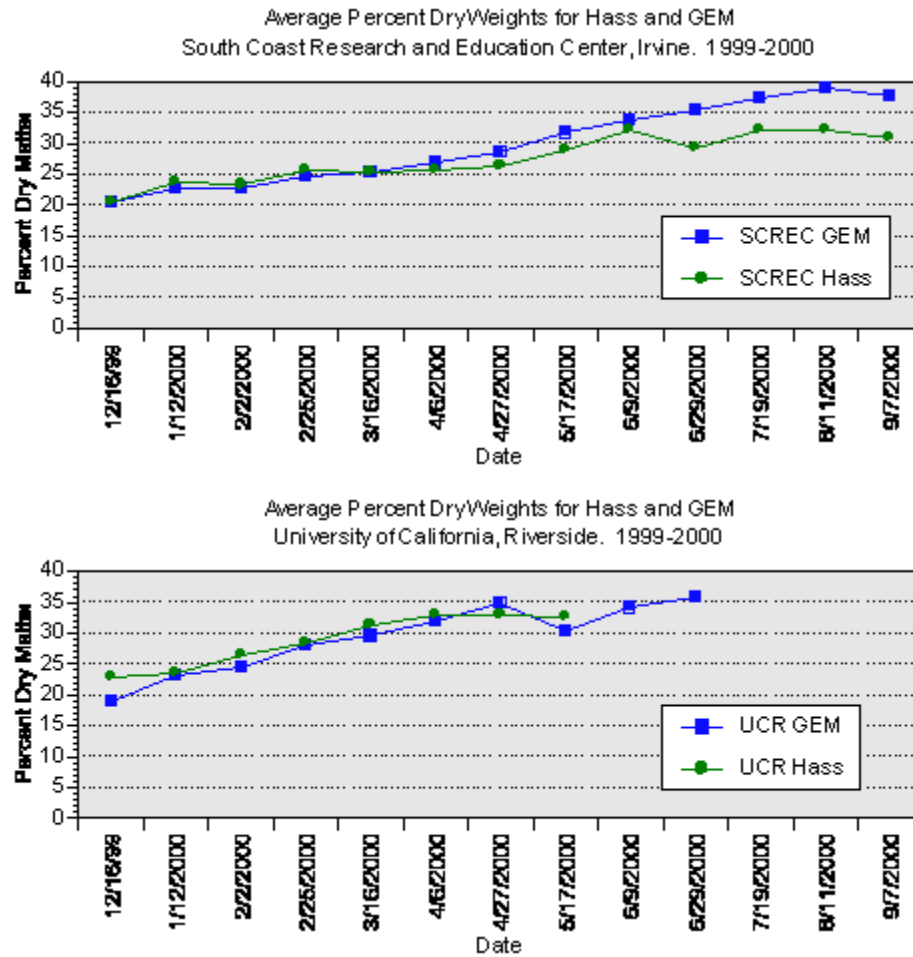


Figure 4. The changes in dry weight for 'Hass' and 'Marvel' from UC SCREC and UCR.

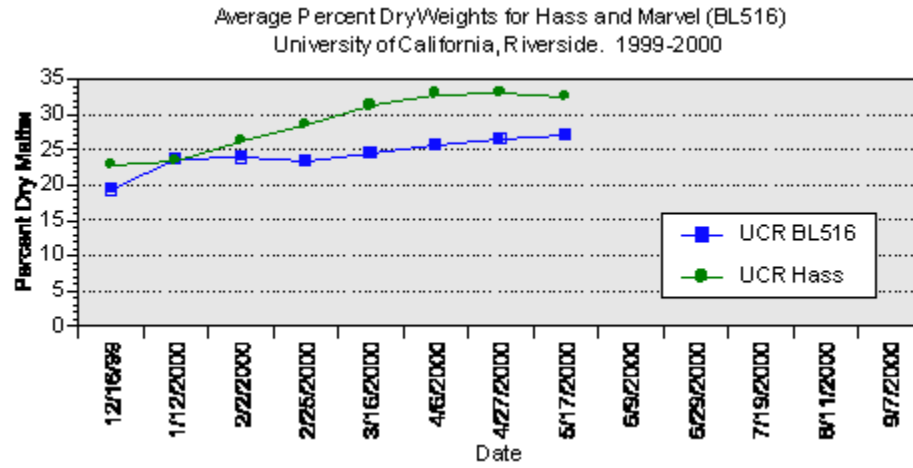
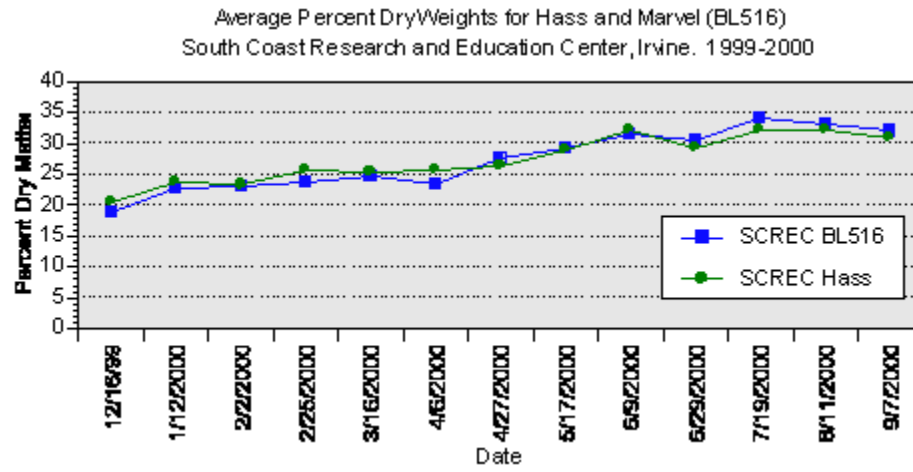


Figure 5. The average percent dry matter for 'Nobel' for three sites from 12/99 to 9/00.

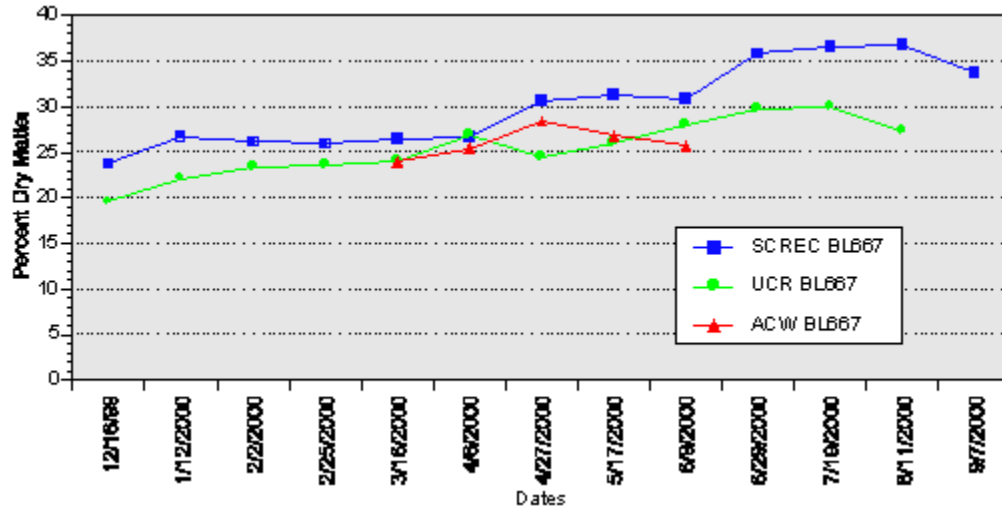


Figure 6. The changes in dry weight for 'Hass' and 'Nobel' from UC SCREC and UCR.

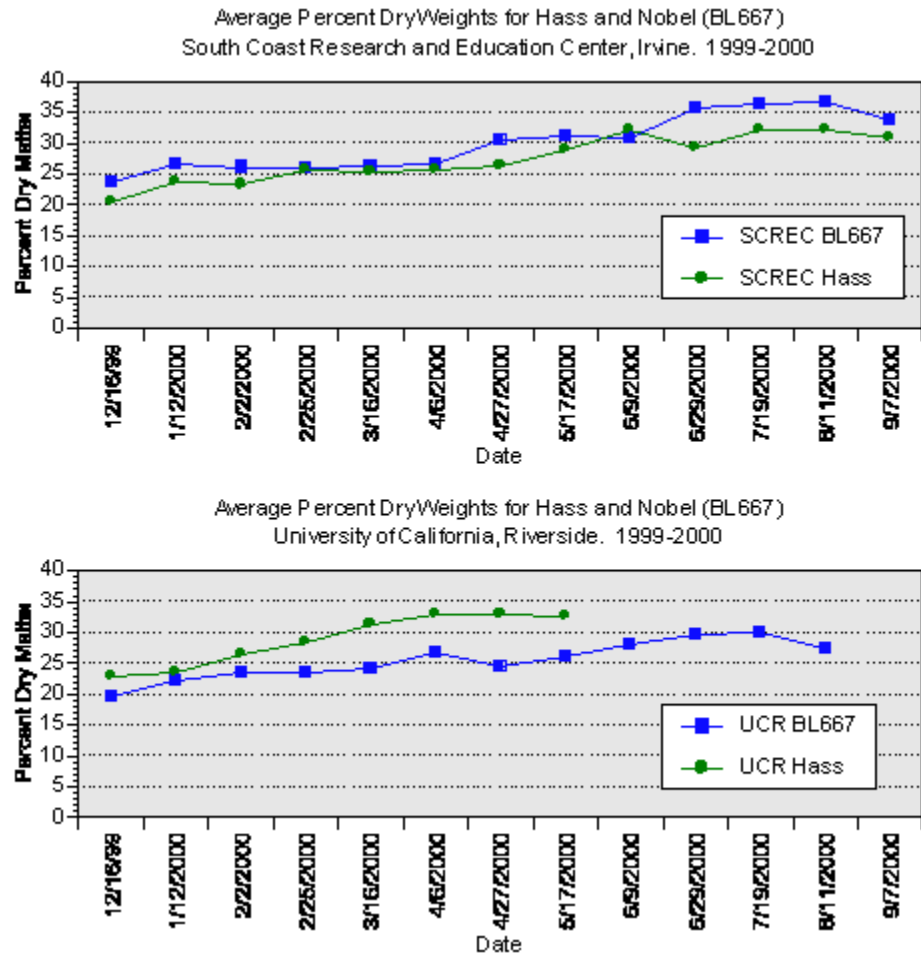


Figure 7. The average percent dry matter for 'Harvest' for three sites from 12/99 to 9/00.

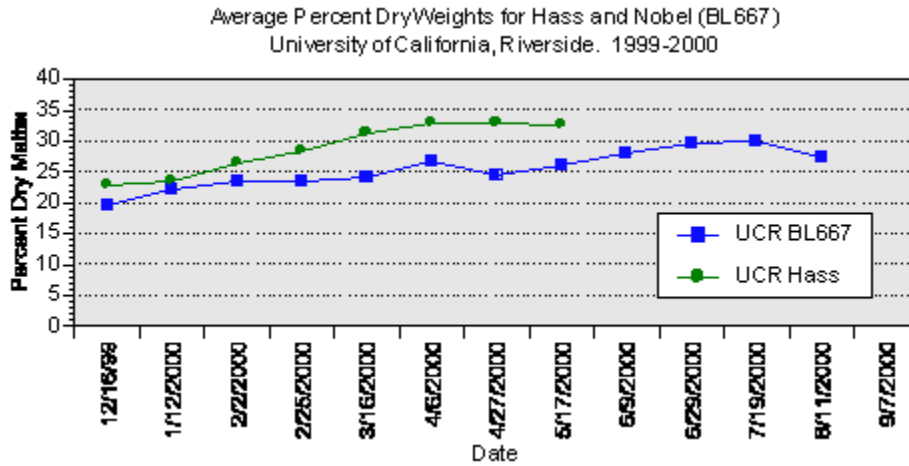
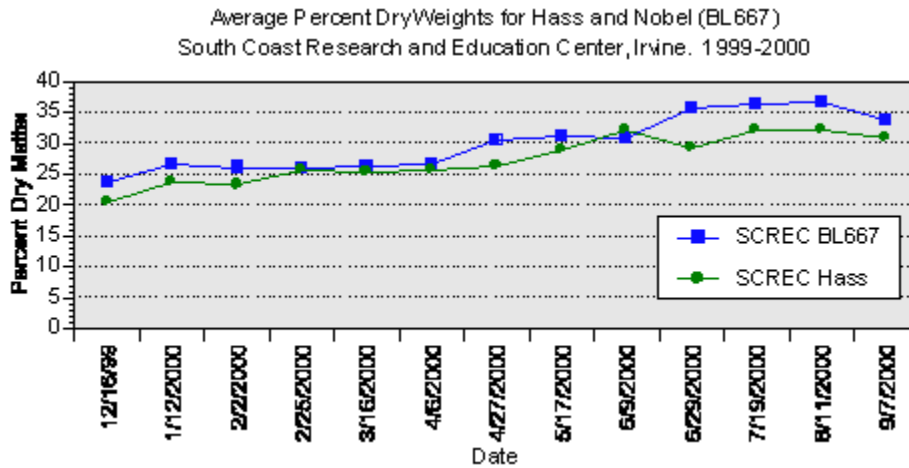


Figure 8. The average percent dry weight for various selections at the ACW Ranch in De Luz, CA from 3/00 through 9/00.

