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Production Research Accomplishments A Five-Year Record: 1986-1991

H. Leonard Francis

Production Research Coordinator, California Avocado Society.

The California Avocado Society is under contract to the California Avocado Commission to administer the industry's production research program funded by growers through assessment. The Industry Affairs Committee, of the Commission is charged by the Commission's board of directors to oversee the administration of the program. The following is based upon my report to the Industry Affairs Committee submitted by me as Coordinator for the Production Research Committee of the California Avocado Society.

Root Rot *Phytophthora cinnamomi*

The major objective of this research is to find a resistant or tolerant enough rootstock to grow in "root rot soil." G755 rootstock was declared to be resistant to *P. cinnamomi* in 1984, yet performance on this stock has been only moderate to good. (G755 is now called 'Martin Grande'.) Dr. M. D. Coffey found that use of Ridomil or Aliette for the first two years increased performance by 30-50%.

Much of Dr. Coffey's successes were in integrating practices that by themselves were only moderately successful: use of Ridomil, or even Terrazole, as well as Aliette; mounding replants; incorporating organic matter with the soil; close control of irrigation. These techniques allowed continued use of Duke 7 rootstock. We now have other very tolerant or resistant clonal rootstocks: Thomas, Barr-Duke, and Toro Canyon.

Because of data supplied by Dr. Coffey and full support of the California Avocado Society and the California Avocado Commission, Aliette received a special use registration that was renewed again this year. Rhone Poulenc, the maker, is working on obtaining full registration. Trunk injections are the most effective use of Aliette. This technique came from Australia and South Africa. Dr. Coffey confirmed its efficacy here. We need a more successful program for injection, and this is being worked on. Phosphorous acid is the main ingredient in Aliette. Dr. Carol Lovatt, at the University of California at Riverside, on our request and with industry funding, determined that phosphorous acid is also used by the avocado tree as a fertilizer. This would have future significance.

Biological control of root rot: After only 18 months, Dr. William Casale, at UC/R, has isolated several organisms, taken from root rot infected soils, that show excellent control of root rot in the laboratory and greenhouse. He is moving this project to the field after

successfully increasing the population of two of the most promising organisms.

The rootstock and breeding program is on the verge of being a total success with the potential of *many* future successes. With our funding, Dr. B. O. Bergh (UC/R) established an isolated block for cross-breeding only those selections of already known tolerant rootstocks: Thomas, Duke 7, G755A, Barr-Duke, G6, G9, Toro Canyon, and the latest selections of the screening program: G875, G810, G874, Borchard, Steyermarkii, G1033, UC2001, and CRI-71.

The 1317 seedlings from the initial breeding block were screened, and 59 selections with high resistance were retained for increasing so we can get enough out to the field for practical testing. Parentages were determined, and crosses of Barr-Duke and Thomas and several with Toro Canyon as a parent gave exceptional resistance.

Our greatest bottleneck for this program is not enough greenhouse space to increase these promising selections. Dr. John Menge actually reduced his grant request—from \$90,000 down to \$70,000—because, at my urging, he is backing down on creating new selections and working on the ones that already have all the potential we probably need. This is still an expensive project—yet so cheap. These are all selections cloned by the etiolation propagation technique developed with our funds twenty years ago. With so many highly resistant stocks, we are going to have enough selections to try them under various field conditions for their tolerance of salinity, suitability to sandy or clay or high-lime soils, etc. Many of the selections are already out in field trials.

Crown Rot *Phytophthora citricola*

We have not spent much money to research *P. citricola*, but because researchers were asked always to consider citricola when researching *P. cinnamomi*, a great deal has been learned about citricola. A partial host list was established: apple, citrus, hops, maple, eucalyptus, tomato, hibiscus, rhododendron, rose, syringa, and walnut. We have not spent the money to find a cure for citricola; we will, this next year. In 1990-91, Dr. Peter Tsao (UC/R) did report some unsettling news that has far-reaching consequences: our stocks most tolerant to root rot are sensitive to citricola, especially Thomas. Barr-Duke and G755 are also sensitive. Duke 7 is quite tolerant. Because of its combination tolerance to *P. cinnamomi* and *P. citricola*, Duke 7 is probably our best rootstock when used with proper cultural techniques established by Coffey.

Tsao also found more than one strain of citricola; one is very virulent. This is not a success, but it is very important. All new selections for root rot resistance must be fully screened for citricola resistance, as well.

Weed Control

With the advent of the loss of simazine (Princep), Dr. Lowell Jordan (UC/R) was contracted to study alternative herbicides. He found Goal to be very effective, and it is

now registered for avocados. Devronal is registered and is quite effective, also. Losing simazine is not so disastrous now.

Molecular Genetics

After only two years, Dr. Michael Clegg (UC/R) has already established definite genetic determinations of our main avocado varieties. He can now analyze seedlings of unknown origin and determine their parentage if the parents are any of our major varieties. This has significance in cross pollination and the potential for breeding or genetically engineering root rot resistance or other desirable traits.

Variety Breeding

The Gwen is the success of the breeding program, even though it was patented in 1981. Production and fruit quality continue to be the advantages of Gwen. Industry growers have had major disappointments with production and fruit drop that Dr. Bob Bergh does not have at his test plots in Irvine and Riverside. Dr. Bergh has just retired. There still is need to find what factors make his test plots so much more successful than industry plantings. Gwen still out-produces Hass by as much as fourfold at the test plots where even Hass has decent production.

There are 70,000 seedlings being evaluated as a result of the breeding program. The philosophy of Dr. Bergh and his associate, Gray Martin, is: if it is not better than Hass, move on. There are definitely some promising selections that will be increased for more in-depth field study.

The Bob Lamb 122 is among those listed for success; it is a late market, heavy producer of excellent quality. It looks like a Hass, but it is from a Gwen mother. The Regal is another selection of interest that has pegged the specialty market. It is purplish-black, with the shape of a Bacon but with a smooth-thick peel. It is late season, like Gwen, and produces well.

Biological Control of Insect Pests

Greenhouse Thrips. Five years ago, the No. 1 concern of the avocado industry was greenhouse thrips. Major funding went to Dr. James McMurtry, at UC/R, to investigate an insect from Australia, *Thripobius*, that showed desire for thrips. He requested the importation of this parasitic wasp in 1986.

Dr. McMurtry established a technique for rearing the parasite, and performed controlled releases in late 1988. Although continued observation is necessary, and Dr. McMurtry has requested funds for that purpose, *Thripobius* appears to be a great success. It does reduce thrips populations and has been observed to over-winter, although not always. There is already commercial availability of *Thripobius*. It is my opinion that there is no

reason to have to use chemical control for greenhouse thrips if releases are made soon enough.

Amorbia and Omnivorous Looper. *Amorbia cuneana* and the Omnivorous looper are our major worm pests. Through earlier research funding, we found a parasite, *Trichogramma platneri*, specific for Amorbia and Omnivorous looper. Dr. Blair Bailey's recent research was to perfect a trapping technique to help growers determine when releases of *Trichogramma platneri* should be made. This has been perfected. The fact that *T. platneri* parasitizes both worms and traps are available now for both pests allows concurrent monitoring and control. Again, no chemical control is necessary if proper monitoring is done. We are one of the very few commercial crops that does not have to spray for insects or mites.

Long Time Storage of Hass

During 1987, the industry fully realized the importance of exporting our avocados. The most efficient method of shipment is by boat to the Orient and Europe, but boats are slow. Dr. Mary Lu Arpaia (UC/R) proposed to find a controlled atmosphere that would allow for longer shipping time. She was so successful that she was not funded for 1991-92. She has found what the Production Research Committee feels is so effective that continued research to work out peculiarities is not necessary at this time. A controlled atmosphere of 2.5 % CO₂ maintained firmness of Hass for *nine* weeks.

Other Research Institutions

During the past five years, we actively solicited research proposals from institutions other than U.C. Riverside. Two grants were awarded to Twyford Laboratories—one for two years, one for three years. Twyford tackled tissue culture; they were sure they could do it—that is their business: tissue culture, or vegetative propagation. They failed, as UC/R failed ten years ago.

Dr. Arpaia worked with researchers at UC/Davis. A UCLA researcher submitted a proposal this July.

There are other research results that look to be successes for the avocado industry. However, not enough years of duplicated results have occurred for us to give the green light for industry acceptance. We look forward to changes in irrigation and fertilization programs that either produce more fruit or save growers money.