

tree, growing 30' tall in 12 years. Its flowers are a vibrant red and it has the attributes of flowering later than most *Dombeya* and its flowers do not hang on the tree as do those of *D. × cayeuxii* or *D. wallichii*.

Our Palm Garden is 4 acres. The *Jubaea chilensis*, Chilean wine palm was apparently being cut down rapidly in Chile. Within these massive trunks is a sap yielding up to 90 gallons of commercial palm honey which can be fermented to make a wine. Fortunately this practice has stopped.

The Desert Garden at the Huntington brings thousands of people annually to visit. This Garden and the Japanese Garden are undoubtedly the public's two favorites. This is the largest collection in the world of mature cacti and succulent specimens grown outdoors. During the winter months the Garden is a mass of red from the flowering South African aloes. The Mammillaria Bed was established in 1930 and is made up of Arizona volcanic rock, it is approximately 1/5 mile long. The Golden Barrel Cactus, *Echinocactus grusonii*, is well represented with large and mature specimens in the Garden.

Along the main road are sun and winter hardy succulents tested for their use as groundcovers. New future projects in this Garden include a Baja California bed and a glasshouse for plants unable to be grown out of doors.

I'd like to welcome all of you to visit the Huntington Botanical Gardens in San Marino, California. We are closed the entire month of October, but are open 1:00 to 4:30 Tuesday through Sunday the rest of the year.

AVOCADO NURSERY PRODUCTION

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The propagation of avocado trees has been discussed before this group a number of times. I presented the details of avocado production, as practiced at La Verne Nursery, at the Western Region Meeting in San Diego in 1974 (2), and a very detailed account on the same subject was given by W.H. Brokaw in 1977 (1).

I should point out that the avocado trees which have been planted in California during the last 20 or 30 years were produced by specialized growers who produced several hundred thousand trees annually, while only a relatively small amount of

avocado trees were used for the home garden. At La Verne Nursery, we have been propagating avocado trees since 1972, primarily for the retail trade.

During the last few years avocado tree producers in California had to reduce their volume due to a decline in demand for avocado trees. The reason for this is that most of the available agricultural areas in the relatively frost free coastal zones of Southern California have been planted to subtropical fruit orchards of many kinds including avocados. In addition, more and more prime grove land was converted into residential housing tracts.

Yet, there are still areas where avocado groves are being planted but their long term future is in jeopardy because of fast rising land and water prices, restrictions on the use of water, and the ever-present threat of infection of a grove with the root rot fungus, *Phytophthora cinnamomi*. *Phytophthora cinnamomi* will affect many species of plants, however, it is most devastating to the avocado industry in that it destroys year after year from 10% to 15% of all avocado groves in California.

Deep fumigation of the soil with heavy doses of methyl bromide or Vapam have, at best, provided marginal results. Surface applications of Terrazole only result in slowing the spread of the fungus. A new fungicide, Ridomil, produced by Ciba-Geigy looks very promising and good results are being achieved with its application in foreign countries, where it is registered for use in bearing avocado orchards. According to a recent report by a San Diego County farm advisor, Ridomil is being applied to *Phytophthora*-infested groves in South Africa at the rate of 2½ grams per square meter with a 5% material three times per year. The results there are fascinating in that trees which were at a point of 75% decline, were brought back to normal health and productivity with the use of this chemical. Fortunately, in the United States, Ridomil is being tested and registration for use on non-bearing trees will be available in the near future.

A chemical named Aliette is currently under laboratory testing at the University of California at Riverside. It is hoped that this material, when applied to the foliage, will render the trees resistant to pathogens.

In the area of research for root rot resistant understock cultivars much work has been done which resulted in the development of at least two, which have been named 'Duke #47' and 'G-6'. Their level of resistance to root rot is classified upward of 80% when planted into root rot infested soil. Orchard trees grafted on these resistant understocks are becoming more readily available as propagation techniques for these vegetatively grown understock cultivars have now been developed. Trees grown on

the root rot resistant clonal understock are growing well, and they are expected to be as vigorous and productive in the orchard as trees grafted on seedlings

Most avocado trees planted in the United States and other suitable locations throughout the world are grafted or budded on seedling-grown understock. In California, the most popular cultivars are 'Topa-Topa' and 'Lula'. Both produce a fairly large seed which generally stays in good condition during the early life of the plant in the nursery, providing it with nutrients in addition to chemical fertilizers provided by the grower. Another important factor is their compatibility with scions of all commercial orchard cultivars.

Since the development of a rather efficient method of propagating avocado trees in the greenhouse, most growers have abandoned more conventional methods. Following is a brief description of this method which is being used at La Verne Nursery:

Here in southern California, seeds of the avocado cultivar, 'Topa-Topa' are available in October and November while 'Lula' seeds are brought in from Florida at about the same time. The seeds are cleaned and placed into a coarse-meshed container which allows water to flow freely among the seeds (onion sacks are quite useful) Seeds are submerged in water at a temperature of 49°C (120°F) for 30 minutes, followed by cooling off in cold water. From the cold water the seeds are transferred to a fungicidal dip or to a mild solution of sodium hypochloride. The hot water treatment is to remove *Phytophthora cinnamomi* spores which may adhere to the seeds, and the fungicidal dip is necessary as a safeguard against hardier fungus diseases, such as *Rhizoctonia*, which require 145°F or higher temperatures for elimination, a temperature not tolerated by avocado seeds. Seed coats which adhere firmly to the seeds are removed at this time by cutting a slice about 1/8" thick from the seed at the bottom and the top. This allows for unobstructed root and top growth. The seeds are then planted into prefilled seedling bags, 5.3×5.3×23 cm (2½"×2½"×9") in size, solidly placed on sterilized greenhouse benches. The growing medium is a blend of peat moss and perlite which is also used as top dressing for the seeds.

Less than two months after the seeds are planted the young seedlings are ready for grafting. A short cleft graft is used. The grafts are covered with a single sheet of newspaper until leaf petioles begin to fall off and buds on the scion begin to swell. As soon as new growth and foliage develops the grafts are moved out of doors into full sunlight and are planted about three weeks later into 5 gallon containers filled with sterilized soil. The ground below the containers is disinfected between crops with Mylone, and immediately before planting a thin layer of Copper

Bordeaux (12½% copper) is applied to the surface. In addition, roadways into avocado growing areas are treated heavily with Bordeaux and the use of step-thru containers containing Bordeaux for use by foot traffic is strictly enforced.

As mentioned earlier, most of our trees are grown for the retail trade and eventually homeowner's use. In contrast to the flexible poly sleeves used as containers by growers who produced trees for orchards, our trees are in metal containers in which they can be easily maintained by the retail nursery. Our containers are designed especially for avocado and citrus trees. They are 35.5 cm (14 in) high and 20.3 cm (2 in) in diameter with a number of holes in the bottom plate, which allows for water exchange with the soil below.

Under proper growing conditions a 5 gallon avocado tree should be saleable 10 months after the seed is planted. While an avocado tree grown for orchard use is acceptable for planting at a size of two feet above the graft, the retail trade desires a tree about 3 to 4 feet in height, well branched, healthy and mature in appearance, with a stake that will support it until the tree is established in its permanent site.

LITERATURE CITED

- 1 Brokaw, W H 1977 Subtropical fruit tree production avocado as a case study *Proc Inter Plant Prop Soc* 27 113-121
- 2 Lodder, D W 1974 Grafting as a business. *Proc Inter Plant Prop Soc.* 24:36-39

MODERATOR KATHY VAN VEEN: Do we have some questions now for our speakers?

VOICE: Dieter, you mentioned that you put newspaper over avocado grafts just after you are finished grafting; that is a new thing to me. You just lay it right on top of the graft, physically in contact?

DIETER LODDER: This is true. The idea is to take the paper off just as soon as the leave and petioles fall off the scionwood and then, as I said, the new growth grows right into full sunlight, requiring little or no hardening off under shade once the plant is moved outdoors

VOICE: It is in a greenhouse that you are doing this?

DIETER LODDER: Yes

VOICE: What is the sunlight in the greenhouse? What is the intensity?

DIETER LODDER: I haven't measured it. I should be able to tell you what it is. The grafting is done during the winter months. Often we have overcast weather — we have rain. Then we have

bright sunlight Usually with the initial cover up of newspaper, which is removed, the plants go right into practically full sunlight in the greenhouse It requires a lot of cooling sometimes but we open up the greenhouse doors and that helps.

AUDREY TEASDALE: I would like to address a question to William Brokaw. What are the kiwi cultivars that you grow in southern California and which are easier to propagate by cuttings?

WILLIAM BROKAW: I don't know which are easier to root; they are all hard for us to root. I think that 'Hayward' may be easier than 'Chico Hayward'. I might make two suggestions with cultivars in southern California. One of them is if you are choosing between 'Chico Hayward' and 'Hayward', that you choose 'Hayward'. The second is that if you don't have enough chilling for 'Hayward', there are a couple of other cultivars which you might use. One is 'Bruno', which is from Australia. The fruit has an unfortunate shape, however, and some people do not like the flavor as much. It looks like a fat sausage; it is long and narrow. Another cultivar is one that was discovered as a seedling by Fred Vincent from Yorba Linda, California. This is a warm winter region and an area which had gone out with avocado root rot. This cultivar is called 'Vincent'; it fruits very well for him although the fruit is somewhat smaller than 'Hayward'. In our nursery at Saticoy, California, as well, it has fruited very well whereas all of our 'Haywards' or 'Chico Haywards' that have fruited have been from chilled budwood from the California Central Valley which has relatively cold winters.

SOLAR EFFICIENT GREENHOUSES

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With the current interest in energy conservation, the efficiency of greenhouses has come under close scrutiny. The use of double walls, ground insulation, tight doors and vents is now common practice. Several new ideas are being put to use and it seems certain that energy costs can be reduced even more. I'd like to review four areas that show great promise:

Placement and Design. A complete turnabout in thinking has occurred in the orientation and construction of greenhouses. It has been found that for maximum solar energy entry, the single-