4. Plants used for terrariums, bottle gardens and special effects: *Ficus sarmentosa* — dwarf creeping fig; *Sinningia* x 'Freckles'; and *Tillandsia* species.

Each plant has its own cultural restrictions, soil requirements and, of course, various methods of propagation are involved. However, in general, they will all take "normal" house conditions, such as low humidity (down to as little as five percent), filtered light (as behind a curtain), sufficient water, fertilizing enough to maintain their vigor, and other needed maintenance.

MODERATOR WEIDNER: Our final speaker in this session is a young man who came here from Germany some years ago. He has worked for Monrovia Nursery as a propagator and, more recently, has had his own nursery business. Dieter Lodder is a very well-trained horticulturalist. I always appreciate the training the boys get in Germany. Dieter Lodder:

GRAFTING AS A BUSINESS

DIETER W. LODDER
La Verne Nursery
La Verne, California 91570

La Verne nursery is a business that produces grafted and budded plant material in containers. We grow primarily woody ornamentals, plus some citrus and avocado plants. For many years we had the intention to start a nursery business but we had to decide on a line of plant material that has a place in the local market, and also could be produced economically. After studying this problem we found that, especially here in Southern California, there are many propagation nurseries set up to supply lining out material to firms that either do not propagate their own plants or are in need of additional plants to supplement their own production. These plants are usually produced from seeds or cuttings. Although there are nurseries in this area that produce grafted plants for their own needs, we decided to specialize in this form of propagation and try to supply the industry with most grafted plants which are currently in demand.

During the first years of our business a comparatively high volume of only a few kinds of plants such as *Pyrus kawakami, Liquidambar,* and avocado were produced until understock material of more plants could be produced or purchased in larger quantities. Occasionally, a customer supplies his own understock

which is budded or grafted for him at our facility. Usually the plants are sold in the smallest possible container size; that is, one gallon or smaller, and are then grown on by our customers until they reach a size suitable for landscape or orchard planting.

Some of the methods I will describe have been discussed before this group at previous meetings; however, there might be some useful ideas worth trying in your operation.

One very challenging subject for grafting here in Southern California is *Acer palmatum* cultivars. High mortality is often caused, soon after grafting in January, by a few days with warm temperatures of 75°F to 80°F accompanied by relatively low humidity. The scion buds grow out before the scion is connected sufficiently with the understock. Since these warm spells are fairly common in this area during January and February, a low volume mist system could be used to protect these *Acer palmatum* grafts.

Most broadleaved evergreen ornamentals and conifers are grafted in December and January. The understock is brought into the greenhouse about ten days before grafting. This will cause some new root development and bud swelling. The plants are side-grafted, cut surfaces sealed with Tree Seal and then placed under plastic or glass within the greenhouse. The humidity in this enclosure or closed bench is kept high by means of moist peat moss under the plants. The temperature should be kept no lower than 65°F at night and no higher than 85°F during the day. Shading may be necessary to prevent overheating. An antitranspirant, such as "Wilt Pruf" should be used on most evergreen grafts to help prevent dehydration of the scion wood.

The maintenance of the grafts consists of airing the enclosure at regular intervals to remove excess moisture. Dry plants should be watered, and spraying against fungus should be done on a regular schedule — every two weeks, or more frequently, if needed. A fungicide drench may be necessary, especially on *Cedrus*, *Camellia*, and other plants susceptible to root rot. When the scion buds begin to develop, the plants should be hardened off by allowing them to remain uncovered for longer periods of time, until the cover is no longer needed. The understock part of evergreen plants should be removed in two or three stages to allow for continuous leaf area for photosynthesis.

Because of the high expenses involved in the use of greenhouses, we are making use of understock material in smaller containers. We are also changing, when possible, from greenhouse grafting to out-of-door budding methods. Selections of *Magnolia grandiflora* have been grafted in the greenhouse, but budding out-of-doors in early spring or summer also produces good results. *Eriobotrya* cultivars used to be grafted on *Eriobotrya japonica* in one gallon containers but now they are being grafted using 2½"

pots and later shifted to one gallon cans. This makes it possible to place 25 plants per square foot of bench space, as opposed to only 4 plants in one gallon containers.

One of the items produced in large quantities is *Pyrus kawakamii*, the evergreen pear. It is a popular landscape tree, especially here in Southern California. Propagation is relatively easy by either softwood cuttings, grafting, or budding. A typical method followed by container nurseries is to plant *Pyrus calleryana* understock in 1 gallon containers in January or February. Grafting can begin the following summer with some protection and with high humidity but it is usually done during the winter out-of-doors under temporary shade, which is removed when the grafts begin to grow.

Departing somewhat from this typical method, our *Pyrus* understock is grafted bare-root in January and February with the grafts planted into plastic bags measuring 2"x2"x9½". The bags are closed at the bottom and have holes along the side and bottom for drainage. The bags with the grafts are set on open benches in the greenhouse, about 25 plants per square foot. The grafts are moved to the shade house as soon as new growth develops. The salable product is well-rooted and has 18 inches of new growth about four months after grafting. These plants are then large enough to be transplanted to 5 gallon containers. I should stress again the economy factors used in this production method which results in lower costs to us and to our customers. Since the total production period is only four to six months after grafting, an added benefit would be flexibility in production planning, according to increasing or decreasing demands for the product.

The production of avocado plants for retail and commercial use can fit into almost any Southern California nursery operation. However, the large volume of trees required for orchard plantings is currently being produced by nurseries specializing in the growing of avocado plants, citrus, and other subtropical fruit trees.

The conventional method for growing avocado plants was to plant seeds in field rows for budding and grafting and eventual digging for sale with soil balls. As the demand for trees increased a new, perhaps more economical way, was developed over the past 10 to 15 years. By this new method, seeds of suitable understock species are planted in the greenhouse usually from September through November, although stored seeds can be planted at any time of the year. I might add that the storage procedures of avocado seeds have yet to be perfected and for the time being the incidence of germination failure increases with the increase in storage time.

Since seeds may be infested with *Phytophthora cinnamomi*, the most dangerous avocado root rot disease, they should be treated, prior to planting, for 30 minutes in hot water at 120°F and allowed to cool gradually. A stratification period of 10 to 14 days in

a sterilized medium at about 60°F after the heat treatment is helpful in the promotion of even germination. The seeds are then planted into plastic sleeves or bags (2''x2''x9½'' or larger) which are filled with a sterilized planting medium. Under the provisions of the California State Certification regulation for the production of certified avocado plants, the requirement for the sterilization of planting media with methyl bromide is three pounds per 100 cubic feet of material.

Sixty to 90 days after seed planting the seedlings are ready for cleft grafting, using dormant tip growth as the scion. Buds will grow out under adequate care in the greenhouse within 60 days. The grafts are then removed from the greenhouse to a shade house for a three to four week hardening-off period and then are transplanted to a larger container, in which they are sold to the orchard or retail trade. The growing period in this larger container is from 7 to 11 months depending on whether the purchaser is in a climatic area where he will take delivery of the material before or after the cold season. Although we are growing a limited quantity of avocado trees for the retail trade, most of them are sold as small grafted plants to wholesale nurseries who will produce the marketable tree for retail or commercial use.

MODERATOR WEIDNER: Any questions for our panel?

BOB WARNER: I would like to ask Dieter Lodder what the material was he put in his potting mix.

DIETER LODDER: I guess there have been as many different soil mixes used as there are people using them. We use a U. C. type mix, which is 2/3 peat moss and 1/3 fairly course sand. This seems to work quite well for us.

BOB WARNER: How much methyl bromide do you use for soil pasteurization?

DIETER LODDER: 3 pounds per 100 cubic feet.

STAN SPAULDING: I am wondering about smog injury in the areas where these avocados and evergreen pears are being grown.

DIETER LODDER: We have smog out there at La Verne but we don't keep our plants long enough to recognize any damage.

A. CANHAM: I've noticed no real smog damage to avocados grown in the greenhouse or outside. We have young trees and old trees growing right along the San Marino Freeway and we have exceptionally good crops along there. Anyway, I think there is smog damage but I haven't recognized it as anything being a problem.

MODERATOR CLAY: We will now go into our next panel which I will moderate. The first speaker on the second panel this morning is Dr. Phillip Parvin. Dr. Parvin is the Superintendent of the Maui Agricultural Research Center, Maui, Hawaii, and is working on the development of *Protea*. Dr. Phillip Parvin: