finisher provides a workable way to process carambola. The pasteurization temperature in citrus evaporator might be too high for processing a variety of delicate tropical fruits. A modification of heat pasteurization section in citrus evaporator might be needed. In order to further reduce transporation and storage costs, a contracted commercial processing service such as the spray-drying service can also be considered to produce the convenient and shelf stable spray-dried products from juice concentrates.

Processing of Tropical Fruit

No citrus processing plant in Florida is currently processing tropical fruit grown in south Florida. For a citrus processing plant to handle tropical fruit juice processing, a line of small capacity equipment needs to be assembled, and some specialized handling equipment needs to be developed. At the current levels of tropical fruit production volume in south Florida, there is little economic incentive to encourage citrus processors to become active in the processing of tropical fruit. However, in the past several years, blended juice products from orange juice and tropical fruit juices, such as strawberry-banana-orange and pineapple-passion-banana have been developed by some fruit juice processors. Meanwhile, the volume of tropical fruit production is increasing. The recent passage of the Tropical Fruit Policy Act (Chapter 90-277) by the Florida Legislature will undoubtedly accelerate further growth of the tropical fruit industry in Florida. Fruit juice processing experience and resources exist in the Florida citrus industry. There is a bright future for the integration of tropical fruit processing into citrus processing facilities.

Acknowledgements

The authors wish to express their gratitude to FMC Corp. for the donation of juice; Romicon, Inc. for the loan of a membrane system; and Freeborn Foods Co. for a gift for fruit juice processing research at Lake Alfred.

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VEGETATIVE PROPAGATION OF SPANISH LIME AND JABOTICABA[1]

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Additional index words. air layer, cutting, indole-3-butyric acid, marcot, *Melicoccus bijugatus, Myrciaria cauliflora.*

Abstract. **Propagation of Spanish lime (*Melicoccus bijugatus* Jacq.) and jaboticaba (*Myciaria cauliflora* (Mart.) Berg) was attempted from herbaceous and hardwood cuttings, and by marcottage. Shoots were either girdled one month prior to making cuttings, or left ungirdled. Basal ends of cuttings were treated with 0, 1.6%, or 4.5% indole-3-butyric acid (IBA), placed in perlite rooting media under mist (15 sec of mist every 10 min), and either exposed to bottom heating or not heated. Regardless of girdling, IBA or heat treatment, only a small percentage of hardwood cuttings of Spanish lime rooted; no rooting was observed for jaboticaba or for herbaceous cuttings of Spanish lime. In a second series of experiments, shoots of both species were either girdled (cinctured) about one month prior to marcottage or girdled at the time of marcottage. For both treatments, basal ends of marcots were treated with 0, 1.6%, or 4.5% IBA in lanolin at the time marcots were made. After 3 months, regardless of treatment, no rooting was observed for jaboticaba marcots. Rooting was observed in 60% to 88% of the Spanish lime marcots; there was no effect of IBA or time of girdling. However, for propagation of Spanish lime, marcottage of vigorously growing upright shoots was more successful then marcottage of less vigorous lateral shoots.**

The Spanish lime (*Melicoccus bijugatus* Jacq.) is a large evergreen tree native to the Caribbean basin that produces a fruit valued in many areas of the American tropics (Popenoe, 1920; Sturrock, 1959). The jaboticaba (*Myrciaria cauliflora* (Mart.) Berg) is a small evergreen tree native to Brazil, where its fruit is highly valued and has many uses (Argles, 1976; Popenoe, 1920; Sturrock, 1959). Both species are well adapted to South Florida, where they have been cultivated in home gardens for many years (Argles, 1976; Popenoe, 1920; Reasoner, 1887). Despite an increased demand for exotic fruits in the United States in

Florida Agricultural Experiment Station Journal Series No. N-00483. The authors thank Lynette Eccles and Mary Jackson for technical assistance with certain aspects of this study.

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recent years, commercial exploitation of these two species has been slow to develop. One of the major impediments to their commercial production is a lack of easy and reliable methods of vegetative propagation.

The Spanish lime is functionally dioecious, requiring both male and female trees to produce fruit (Campbell, 1976). Propagation from seed produces many more male trees than is required for pollination, and sex determination in the nursery is difficult. Furthermore, fruit quality and productivity are variable in female seedling trees. Currently, the recommended methods for vegetative propagation of Spanish lime in Florida are approach-grafting, or marcottage (air layering) of large limbs (Campbell, 1976), neither are feasible for propagation on a commercial scale.

The jaboticaba is polyembryonic, and thus generally true-to-type from seed (Argles, 1976; Ogden and Campbell, 1982), but seedling trees have a long juvenile period. Although there are reports of vegetative propagation of the jaboticaba (Argles, 1976; Ogden and Campbell, 1982; Fouque, 1972; Popenoe, 1926; Samson, 1986; Sturrock, 1959), vegetative propagation is considered difficult in Florida, and trees are grown almost exclusively from seed (Ogden and Campbell, 1982).

To the authors' knowledge, there have been few reports of systematic studies of vegetative propagation of either Spanish lime or jaboticaba. This article describes several methods that we tested in attempts to develop rapid and reliable methods of vegetative propagation for these two species.

Materials and Methods

All experiments were conducted using plant material from the fruit tree collection of the University of Florida/IFAS Tropical Research and Education Center, Homestead. For Spanish lime, plant material was obtained only from female trees.

Propagation from cuttings. Herbaceous cuttings of Spanish lime, and hardwood cuttings of both species, were obtained in May, 1988. For Spanish lime, herbaceous and hardwood cuttings were about 0.8 cm and 2.5 cm in diameter, respectively. For jaboticaba, hardwood cuttings were either about 0.50 or 1.0 cm in diameter. Cuttings were obtained from healthy branches in lower, but well-illuminated, parts of trees. Immediately upon cutting, the basal ends were placed in water to avoid dessication. The cuttings were transported to a lathhouse (50% shade), where approximately 50% of the lateral branches and leaves from each cutting were removed. The basal 2.5 cm of the cuttings were subjected to one of the following treatments: no hormone (control), or dipped in rooting powder that contained either 1.6% or 4.5% IBA (indole-3-butyric acid, Brooker Chemical Corp., N. Hollywood, CA). Just prior to hormone treatment, 3-4 vertical cuts were made in the basal 2.5 cms of each cutting to improve IBA uptake and adventitious root emergence (Garner, 1976). Cuttings were placed in horticultural grade perlite in 10-cm deep flats or in 3.8-liter containers (Spanish lime hardwood cuttings) and transferred to a mist bench. Mist was provided for 15 sec at 10 min intervals, which was sufficient to maintain a constant film of moisture on the leaf surface. On the mist bench, cuttings were left either unheated, or were exposed to bottom heat provided by a thermostatically-regulated heating cable (Gro-Quick Soil Heating Cable, A.H. Hummert Seed Co., St. Louis, MO) buried in sand directly beneath the flats. Diurnal rooting media temperatures fluctuated between about 18° and 26.5° C (65° and 80° F), and 21.5° and 30° C (71° and 86° F), for the unheated and heated flats, respectively. Thus, for both species, there was a 2 × 2 × 3 factorial arrangement of treatments (two temperature treatments, two ages (or sizes) of plant material, and three hormone treatments). For both species, there were 20 cuttings for each size of plant material for each hormone/temperature treatment; however, due to space limitations in the mist bed, there were only 10 cuttings per treatment for the hardwood Spanish lime cuttings. Root development was evaluated monthly for three months.

To determine if girdling (cincturing) the shoots several weeks prior to making cuttings would stimulate rooting, hardwood shoots of both species were either girdled or left ungirdled in August, 1989, about one month prior to making cuttings. Selected shoots were in the lower, but well-illuminated, parts of the tree, and were about 1.0 cm and 2.5 cm in diameter for jaboticaba and Spanish lime, respectively. Similarly, for jaboticaba and Spanish lime, girdling wounds were about 1.0 cm and 2.5 cm wide, respectively. After one month, shoots from both treatments were harvested, placed in water and transported to a lathhouse. Pre-girdled shoots were harvested by cutting immediately below the girdling wound. Cuttings were subjected to periodic misting, either bottom heating or no heating, and one of three hormone treatments, as described previously. There were 10 cuttings for each girdling/hormone/heat treatment combination for each species. Root development was evaluated monthly for all cuttings.

Propagation from marcottage. To determine the potential for vegetative propagation by means of marcottage (air layering), marcots of both species were made in November, 1989. Shoots were selected from lower, but well-illuminated, parts of trees and were about 1.0 cm in diameter for jaboticaba and 2.5 - 3.0 cm in diameter for Spanish lime. In making marcots, two encircling cuts about 2.5 cm apart were made on each shoot. All tissue external to the xylem was removed in the area between the two cuts. The basal end of each marcotted shoot, i.e., the acropetal side of the girdling wound, was subjected to one of three IBA treatments: no IBA (control), 1.6% IBA in lanolin, or 4.5% IBA in lanolin. The IBA/lanolin paste was made by blending 2.8 g of the specified percentage IBA powder in 7.2 g of heated lanolin (Garner, 1976). This paste was stored in the dark at room temperature, and applied to the marcots by means of a syringe. The lanolin/IBA paste was applied so as to evenly coat the basal portion of the marcot. About 0.5 g of IBA/lanolin paste was applied per shoot, although the amount varied with shoot diameter. There were 5 marcots for each treatment for each species. The wounded area of each marcot was covered with moist sphagnum moss, wrapped in foil, and then wrapped in black polyethylene. Root development was visually evaluated after 3 months, using a subjective scale of 0 to 5 (0 = no rooting, 5 = profuse rooting). For Spanish lime, the experiment was repeated in February, 1990 using six marcots per treatment. However, due to a lack of readily accessible plant material, half of the marcots in each treatment were obtained from vigorous, upright shoots in the upper part of the tree, while the other half were obtained from less vigorous lateral shoots in the lower part of the tree.