Hartmann and Dale E. Kester. Also, *Plant Propagation Practices* by James S. Wells. As stated before, I seem to get no direct instructions from any of these authors or from other books I have read. However, they are a big help because they helped create practices we do use.

Locally, over the early years I got some most valuable suggestions and help from successful propagators such as Chase Nursery Company, Byers Nursery Company, Huntsville Wholesale Nursery, and Rodenhauser Florist.

REFERENCES

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GROWING TREES FOR INTERIOR USE

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Interior trees can be defined as tropical or semitropical plants with evergreen foliage, woody, predominantly upright stems which are approximately three feet or more in length. Most interior trees have prominent branching structure including plants with single stems, branched trunks or multiple stems from the base and are well adapted to the light level, humidity and temperature regimes inside buildings maintained for human comfort. Several unique aspects of producing interior trees are discussed in this paper. Cultural practices are those commonly used by Florida nurserymen in southern and central regions of the state. Nurseries located in Dade, Palm Beach, and Broward counties, the southeastern region Florida, account for most of the interior tree production, with limited production in southwest and central Florida.

Interior tree production on a massive commercial scale is a relatively new industry when contrasted to the landscape tree business. Most interior tree nurseries in Florida have developed within the last twelve years, making it one of the fastest growing segments of commercial horticulture. Present rate of expansion is much less than recorded during the early 1970's.

Just as landscape plants must be evaluated for adaptability to

regional factors such as temperature, soil type, rainfall, pathogens, insects, nematodes, other pests, and maintenance requirements, interior trees must also be evaluated for their ability to adapt to indoor locations which have light levels of 50 to 150 foot candles, relative humidities of 10 to 30 percent, and temperatures betwen 55 and 80°F.

Interior trees are produced in a wide range of sizes depending upon where the plants will be used. Trees used in residential and office interiors usually are available in 8- to 12-inch diameter containers while large scale commercial or institutional buildings may require plants in containers up to 200-gallon capacity. Specifications for interior trees were initially developed and published by the Florida Foliage Association (4) and later expanded by Associated Landscape Contractors of America (1). Table 1 lists 24 of the major interior tree species and cultivars with container diameter range produced.

Table 1. Major interior tree species available in Florida [z]

Plant[y]	Container size[x]
Araucaria heterophylla	6 - 17-inch
Beaucarnea recurvata	6- inch - 30-gallon
Brassaia actinophylla	5-inch - 30-gallon
Chamaedorea erumpens	6 - 17-inch
Chamaedorea seifrizii	6-inch - 20-gallon
Chrysalidocarpus lutescens	6-inch - 40-gallon
Clusia rosea	6 - 14-inch
Dizygotheca elegantissima	6 - 17-inch
Dracaena deremensis 'Janet Craig' and 'Warneckii'	6 - 17-inch
Dracaena fragrans 'Massangeana'	6-inch - 20-gallon
Dracaena marginata	6-inch - 20-gallon
Dracaena reflexa	6 - 17-inch
Ficus benjamina (F nitida[1]*)*	6-inch - 95-gallon
Ficus benjamina var benjamina (F benjamina)	6-inch - 200-gallon
Ficus elastica 'Decora' and 'Decora' types	6-inch - 20-gallon
Ficus lyrata	6 - 14-inch
Ficus triangularis	6-inch - 10-gallon
Podocarpus macrophyllus	6-inch - 40-gallon
Polyscias balfouriana 'Marginata'	6 - 14-inch
Polyscias fruticosa	6-inch - 35-gallon
Rhapis excelsa	10 - 21-inch
Schefflera arboricola	6 - 14-inch
Yucca elephantipes	6 - 17-inch

[z] Adapted from *Florida Foliage Buyers Guide* (2).
[y] Plant names listed according to *Hortus Third* (3)
[x] Several plants listed are available in container sizes smaller than 6-inch diameter

[1] Bot Ed note *Ficus nitida* in U S trade is often *F microcarpa*

Propagation of interior trees is done by a variety of techniques depending upon species or cultivar, amount of stock available, economic factors relating to cost of propagule, size of propagule desired, production schedule, and size of finished plant. Table 2 indicates some of the techniques which are used for commercial propagation of interior trees. Trends in propagation observed in recent years include: (1) use of tissue culture for a few interior trees, (2) use of larger air layers (up to 5 feet in length with some species), (3) a shift of stock production from southern Florida to Central America, South America, and the Caribbean Islands where the climate is nearly ideal and labor costs are low, and (4) improved nutrition of stock plant cuttings and layers

Within the past eight years cultural recommendations for interior tree production have changed considerably as the result of University of Florida research on factors required for foliage acclimatization. The term acclimatization is synonymous with conditioning and acclimation used by other authors. Trees in foliage nurseries are grown under light levels and fertilizer regimes many times that which they will be subjected to when

Table 2. Means of propagating selected interior tree species and cultivars commercially

Plant[z]	Propagation techniques[y]						
	Seeds	Single or Terminal cuttings	Multi node cuttings	Cane cuttings	Air layers	Divisions	Tissue Culture
Araucaria heterophylla	A	C	—	—	C	—	—
Beaucarnea recurvata	A	C	—	C	C	—	—
Brassaia actinophylla	A	C	C	—	C	—	B
Clusia rosea	A	A	—	—	C	—	—
Chamaedorea erumpens	A	—	—	—	—	C	—
Chamaedorea seifrizii	A	—	—	—	—	C	—
Chrysalidocarpus lutescens	A	—	—	—	—	—	—
Cizygotheca elegantissima	A	B	C	—	C	—	—
Cracaena deremensis 'Janet Craig' and 'Warneckii'	—	A	C	A	C	—	—
Dracaena fragrans 'Massangeana'	—	A	C	A	C	—	—
Cracaena marginata	—	A	C	B	A	—	—
Dracaena reflexa	—	A	C	C	B	—	—
Ficus benjamina (F nitida)	—	A	B	—	A	—	—
Ficus benjamina var benjamina (F benjamina)	—	A	C	—	A	—	B
Ficus elastica 'Decora' and other 'Decora' types	—	B	C	—	A	—	B
Ficus lyrata	—	C	B	—	A	—	—
Ficus triangularis	—	A	C	—	B	—	—
Podocarpus macrophyllus	A	B	C	—	C	—	—
Polyscias balfouriana 'Massangeana'	—	A	A	B	C	—	—
Polyscias fruticosa	—	A	A	B	C	—	—
Rhapis excelsa	—	—	—	—	—	A	—
Schefflera arboricola	A	A	A	—	A	—	—
Yucca elephantipes	C	A	C	A	C	—	B

[z] Plants listed according to *Hortus Third* (3)

[y] A = a major commercial technique, B = a minor commercial technique, C = a technique not significant commercially

installed indoors. The objective of producers is to make the transition of plants from the nursery to the interiorscape as stress-free as possible. Table 3 lists the suggested light intensities and fertilizer rates for production of acclimatized, container-grown, interior trees.

Another factor influencing acclimatization of interior trees is establishment of roots in the soil mixture of the finished plant. Fully established trees will have a root system extending to the bottom and lower portion of the container side wall at which point they twine. Without this degree of root development, plants should not be regarded as fully acclimatized because they lack the desired balance of roots and shoots.

In some instances large specimen trees are grown in the ground under full sun conditions until close to the desired size, leaving the remaining time to be containerized in a high quality

Table 3. Suggested light intensity ranges and fertilizer application rates for production of some interior trees

Plant[z]	Light intensity[y] (foot-candles)	Nitrogen rate[x] (lbs/1000 sq ft/yr)[y]
Araucaria heterophylla	4000-8000	28
Beaucarnea recurvata	4000-8000	28
Brassaia actinophylla	400-6000	41
Clusia rosea	3000-6000	34
Chamaedorea erumpens	3000-6000	28
Chamaedorea seifrizii	3000-6000	28
Chrysalidocarpus lutescens	4000-6000	34
Dizygotheca elegantissima	4000-6000	28
Dracaena deremensis 'Janet Craig'	2000-3500	28
Dracaena fragrans 'Massangeana'	2000-3500	28
Dracaena marginata	4000-6000	41
Ficus benjamina (F nitida)	3000-6000	41
Ficus benjamina var benjamina (F benjamina)	3000-6000	41
Ficus elastica 'Decora' and 'Decora' types	6000-8000	41
Ficus lyrata	4000-5000	41
Ficus triangularis	3000-6000	41
Podocarpus macrophyllis	3500-4500	28
Polyscias species and cultivars	1500-4500	41
Rhapis excelsa	3000-6000	28
Schefflera arboricola	4000-6000	41
Yucca elephantipes	3500-4500	28

[z] Plant names listed according to *Hortus Third* (3)

[y] *Araucaria, Ficus benjamina benjamina, Ficus retusa, Podocarpus* and *Rhapis* are frequently grown under full sun light levels (8000-15000 foot-candles) and then placed under suggested light intensity for final 3-month period

[x] P_2O_5 and K_2O rates should be computed on basis of a 3-1-2 fertilizer ratio for long term fertilization programs P_2O_5 and K_2O rates may be increased up to but should not exceeding a 1 1 1 ratio for starting crops or crops not exceeding 8 weeks in production

soil mixture, established and fully acclimatized under the light and fertilizer programs shown in Table 3.

Soils are an important consideration in both production and utilization of interior trees. Presently most soil mixtures formulated for container-grown interior trees consist of 60 percent or more organic particles (high quality fibrous peat, pine bark, etc.) and the remaining portion being inorganic materials (coarse sand, calcined clay, perlite, vermiculite, styrofoam shreds or beads, etc.). Particles such as pine bark, calcined clay, and perlite tend to open the soil mix and provide good drainage and aeration. The primary function of sand is to increase the weight of the mix so the trees will be less likely to be blown over by wind. Durability of the large particles placed in soil mixes used for tree production is important. Interior trees should be grown in the most durable combination of components possible because they are the longest lived and most expensive of all foliage plants. Ideally the soils for interior trees should have certain ranges of chemical and physical characteristics (Table 4).

Table 4. Suggested chemical and physical characteristics for container-grown interior trees

Characteristic	*Suggested range*
pH	5 5 - 6 8
Salinity (Soluble salts)	200 - 800 ppm (indoors)
Bulk density	40 - 60 g/cm^3
Free pore space	8 - 20 percent (by volume)
Water holding capacity	20 - 40 percent (by volume)
Cation exchange capacity	5 - 25 meq/100 cm^3

Interior trees should have nearly perfect leaves with regard to mechanical damage, pest damage, or foliage residues. To achieve this degree of perfection nurserymen must avoid wind damage by shielding plants from wind or properly staking, bracing or guying tall plants exposed to wind. Plants which are blown over are usually damaged mechanically and very vulnerable to sunscald. Plants should also be handled carefully as they are moved within the nursery and especially during packaging or wrapping and transportation stages. Rigid pest control and monitoring programs are needed throughout the crop cycle. Avoid extensive use of wettable powder pesticide formulations which leave unsightly residues and use overhead water sources low in dissolved carbonates and iron.

Shipping is an important and usually expensive portion of the total plant cost to consumers. Unlike many plant products foliage plants have rather narrow tolerances with regard to physical, chemical and biological stress factors during shipment. Plants should be packaged and supported in a manner which protects them from being crushed or torn during shipment. The

normal shipping temperatures for tropical foliage plants are 60° to 70°F, achieved by specially designed trailers or trucks with the capability of heating, cooling, and circulating air around the cartons or plants. Special consideration should be given to protect plants from temperature extremes as they are moved to and from the trailers or trucks. Care should also be taken to avoid exposing plants to ethylene gas levels exceeding 1 ppm. Ethylene injury is dependent upon ethylene concentration around the plant, exposure duration, and temperature.

A very thorough discussion of commercial culture of foliage plants, including interior trees, is provided in *Foliage Plant Production* (5)

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3 Bailey, L H Hortorium, Staff of the 1976 *Hortus Third* Macmillan Publishing Company, Inc New York, New York pp 1290

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QUESTION BOX

The Southern Region Question Box was moderated by Richard Ammon and Ted Richardson

LES CLAY: We are working with tissue culture of rhododendron and kalmia using IAA (3-indoleacetic acid). Has anyone tried using 2,4-D or 2,4,5-T in tissue culture preparations? We have a problem getting a complete plant when tissue culturing kalmia.

FRANK BLAZICH: The usual auxin is NAA (1-naphthaleneacetic acid).

HENRY VAN DER STAAY: You can use IAA or NAA, depending on what results you want and what species you are using; 2,4-D induces callus formation, and you may then have trouble getting a complete plant.

LES CLAY: We are using IAA in agar with kalmia and rhododendron and are then taking the explants from agar to the medium. We use sand, soil, peat and perlite for the rhododendron. However, this mix is not satisfactory for the kalmia, but instead we have found that a mix of peat and sand is better. We