



Container Production of Palms¹

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Container-grown palms are raised for essentially three markets: liners for field production wholesale or mass market retail sales for residential landscapes, and interior specimens, both mass market houseplants and interiorscape use.

The largest market for container production is the interior. Palms are outstanding plants for the interior environment. Properly acclimated, a large number of subtropical and tropical palm species are capable of residing under low light conditions for a relatively long period of time. See Figure 1.



Figure 1.

Production Regimes for Container Palms

There are basically four production regimes for growing palms in containers. Three of these are largely oriented toward growers in the tropics, where cold protection is not as crucial a consideration and the production environment is thus much less controlled. It is, however, absolutely essential that a specimen-sized palm intended for indoor use be acclimatized for at least 1 year prior to exposure to low light conditions. A palm leaf produced in full sun will not survive under typical interior conditions (Broschat et al., 1989).

Containerized sun-grown—Container palms produced in full sun will either be used as liners for field production or landscape plants (retail or wholesale).

Containerized, full sun grown, shade acclimatized— This production strategy is also largely limited to tropical and subtropical areas due to climatic considerations. The palms remain containerized throughout production, but are grown first in full sun for several years. Though foliage may

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bleach in some species (e.g., Lady palm—*Rhapis excelsa*, Bamboo palm—*Chamaedorea seifrizii*), exposure to full sun stimulates increased "suckering" of many cluster palms, and larger caliper on solitary palms. The palms are moved to 70 to 80% shade for the final 3 to 12 months of production time. Palms treated in this manner are usually smaller than specimen size, but both mass market and intermediate size interiorscape products can be successfully produced.

Containerized, shade grown—This is the exclusive method for production for interior palms in more temperate areas (in greenhouses), though growers in tropical areas also grow a number of species in containers under open shade throughout the entire production cycle. Palms produced under shade usually have darker green leaves, but growth tends to be slower and less compact. Using a lower degree of shade (50 to 63%) during the first part of the production cycle and then shifting to heavier shade (70 to 80%) for the final year of production provides some degree of compromise, if the additional costs can be justified. Retractable shade systems may provide an even better solution in the future. The vast majority of the palms produced in this manner are for the mass market or small specimen interiorscape markets.

Containerized field grown specimens—Palms are grown to specimen size in the field nursery in full sun or (in the case of understory palms) as an interplant with an upper canopy species. When the palm achieves the desired size, it is dug, containerized and moved under 70 to 80% shade for at least 1 year before sale. This method is largely reserved for high market value large specimens (15 to 40 ft overall height) and is restricted to subtropical and tropical regions. Smaller, mass market palms can be produced similarly, however labor costs are high.

Handling Palm Seedlings

Growers of containerized palms can choose to grow their own liners from seed or purchase seedlings from another nursery. A grower wishing to produce material from seed is referred to *Palm Seed Germination* (Cooperative Extension Bulletin 274).

Transplanting the Seedlings

Palm seedlings should be transplanted after 1 or 2 leaves have formed. The objective is to minimize the degree of root disturbance to the seedlings; thus it is best to transplant before roots begin to circle the container or roots of adjacent seedlings become entangled. Transplant in the warmer months of the year, when root growth will be rapid. Seedlings will usually have one long root at the time of first transplanting. Seedlings should be first transferred from the germination container to a small liner pot that just accommodates the root system and allows some subsequent root growth. Deep liner pots with essentially open bottoms are being used by an increasing number of growers. Palm seedlings benefit from the deeper root run, and long roots emerging through the bottom opening are "air pruned" and cease growth, thus significantly eliminating the circling of roots around the inside walls of the pot. Two strategies are then possible for subsequent transplanting of the seedlings. They can be shifted successively to slightly larger containers as they grow (frequent small shifts), or they can be transplanted to larger containers than their size might seem to warrant (fewer and larger shifts). Frequent small shifts lessen the chance of loss due to over-watering, but increase labor costs. Transplanting into large containers lowers labor costs and provides for more unrestricted root growth, but may promote increased loss due to root rots when the seedlings are small. Thus, larger, less frequent shifts will require careful irrigation monitoring while the transplants establish in the new containers.

Palms are very intolerant of being planted too deep, regardless of age or size. For palm seedlings, planting as little as 1 inch too deep can result in severe production setbacks and, ultimately, death of the seedlings. Palm seedlings should be transplanted such that the soil line is about 1/2 inch above the base

of the stem. This point is sometimes marked by a noticeable swelling, particularly on older seedlings.

Planting palms too shallowly in containers is similarly detrimental to palm growth and quality. If the basal portion of the stem from which new roots arise is not in contact with the soil, newly emerging root initials will desiccate and not continue normal growth down into the soil. Thus the palm will be supported, both nutritionally and mechanically, only by those few original roots that were growing in the soil at the time of first planting. Such palms ultimately become stunted and are prone to breaking off at the soil line.

Do not sever the connection of the seed to the seedling palm. If the seed is still attached to the plant by the cotyledonary petiole (remote germination), drape the seed over the edge of the pot or allow it to sit on the soil surface.

Some growers prune palm seedling roots when transplanting. This is not recommended, and usually results in growth setbacks or even death of some of the seedlings. If the seedling root is longer than the transplant container, it can be allowed to slightly curve upward or around the inside perimeter of the container. A better solution is use pots large enough to accommodate the full length of the root.

Ideally, newly transplanted seedlings should be placed under light shade (50%) for several weeks, or until new growth is apparent. If this is not possible, irrigation frequency must be carefully monitored so that the transplants are not water-stressed during establishment.

Division of Clustering Palms

Clustering palms, that is those that produce new erect shoots from a common base or system of rhizomes, can be divided carefully as a means of increasing stock. Species that produce new shoots at some distance from the parent stems (e.g., *Rhapis* species) are the most easily divided. In South Florida, containerized *Rhapis excelsa* (Lady palm) are typically propagated in this manner from clumps established in the ground. Divisions from the parent plant are made with a sharp spade and carefully lifted with as much of the root ball as can be managed.

Newly separated divisions are potted and kept shaded and well-watered until established (4 to 6 months). A drench with a broad spectrum fungicide is advisable after potting.

Production Parameters

Substrate

A container substrate for palms should be well-drained, well-aerated and slow to break down (some palms may remain in the same container for several years); percent air space of 10 to 15% is advisable with a water-holding capacity of 30 to 40% by volume. A 2:1:1 (v:v:v) mix of peat, pine bark and wood shavings works well for short term crops, as does a 2:2:1 peat:bark:sand mix. Indications are that either cocopeat or coir dust (coconut mesocarp short fibers) is an acceptable substitute for peat. Slower growing palms benefit from a mix with a higher sand fraction. Many other mixes are possible as long as they are slow to break down and meet these porosity and water-holding characteristics.

Irrigation

Good quality container palms have been produced with overhead irrigation, drip or trickle irrigation, and sub-irrigation. Overhead irrigation can detract from the saleability of the palms if water high in iron and calcium carbonate leaves deposits on the foliage. Overhead irrigation may lessen problems with two-spotted spider mites. Subirrigation is only suitable for palms if the pots will be periodically leached with fresh water from above to reduce the amount of salts that tend to accumulate in subirrigated pots. For small, mass-market containerized palms, drip irrigation is the most sensible system to consider and can be integrated with a fertigation program for maximum success. Irrigation frequency of containerized palms will vary considerably depending on the species grown, the prevailing temperatures, the type of growing substrate, and the size of the container. This makes it difficult to generalize. A reasonable rule-of-thumb is to program irrigation so that the substrate remains evenly moist but never saturated.

Temperature

Tropical palms grow most productively at temperatures between 75 to 95°F. Air temperatures up to 100°F will usually not have any deleterious effects. It is important to recognize that the root activity of many tropical palm species will decrease markedly if soil temperatures drop below 65°F. During the winter months, irrigation and fertilization frequency may need to be reduced accordingly in unheated growing environments.

Fertilization

Palms seedlings do not generally require fertilization during the first 2 to 3 months after germination. During this time, all nutrients are supplied by storage tissue in the seed. After this period several fertilization strategies are possible.

Fertigation

Injection of soluble fertilizers into irrigation water works best with drip irrigation. Injection of nutrients into overhead irrigation systems is wasteful and potentially polluting. Fertigation may result in excess soluble salt accumulation in the root zone. Constant feeds of 150 to 200 parts per million (ppm) nitrogen and potassium and 50 to 75 ppm phosphorus are recommended. The containers should be leached with plain water once per month if not exposed to rainfall. The program should be reduced if temperatures drop below 65°F.

Controlled-release fertilizers

Controlled release fertilizers are a highly efficient method of applying nutrients to container-grown palms. Release rates for controlled release fertilizers vary widely among products, thus manufacturer's recommended rates should be followed. In general, the rate of nutrient release for controlled release fertilizers is directly proportional to soil temperature. Thus, optimal rates will be higher for summer months than during the winter. Optimal fertilization rate is also related to production light intensity, with palms growing in full sun requiring considerably higher rates than those growing under shade. A 3N-1P-2K ratio is ideal for container production of palms. Although controlled release

fertilizers are relatively expensive, the reduced labor requirements for infrequent application often more than compensates for the higher cost of these materials. They also result in the most rapid growth and least pollution of the environment of any fertilization method (Broschat, 1995).

Controlled release fertilizers can be applied to the surface of the container substrates, but are also amenable to incorporation into the substrate at the time of mixing. Dolomitic limestone and a micronutrient blend should always be incorporated into potting substrates at rates of 8 to 12 lbs and 1.5 lbs. per cubic yard, respectively. These will provide adequate Mg and micronutrients for good palm growth for 12 to 18 months or longer.

"Palm Special" and other granular fertilizers

Most "palm special fertilizers" in the United States are formulated for landscape or field nursery use and are not recommended for container palm production. There are a number of other granular fertilizers available for use as container top-dresses for nursery stock, but they are generally not recommended for container production since their higher solubility often results in soluble salt injury to the roots. These products are also rapidly leached through most container substrates with the result that most of the applied nutrients end up polluting the environment rather than supporting good palm growth (Broschat, 1995).

Foliar fertilization

Many indoor palm growers carry on a regular program of foliar fertilization, even though research has not supported this method as the most effective way to fertilize. This is an extremely inefficient way to provide macronutrients such as K or Mg as palm leaves can only absorb marginal quantities of these elements through the leaves. While micronutrients can be applied as a foliar spray, chelated forms are best reserved for soil applications due to their phytotoxicity. Foliar fertilization should be viewed as a possible supplement for soil fertilization, but never as a substitute for it. Foliar applications of micronutrients should not be performed more than once per month.

Foliar analyses are valuable diagnostic tools for container grown palms if sub-optimal nutrition levels are suspected in the crop. In table 1, suggested foliar nutrient levels are listed for several ornamental palms. Further information and color pictures of common palm nutrient deficiency symptoms are available in University of Florida Publication SS-ORH-02, Palm Nutrition Guide.

Weed Control

Preemergent herbicides should be applied to weed-free container medium surfaces before weed seeds germinate. Some herbicides require incorporation into the soil either manually or by 1/2 to 2 inches of precipitation or overhead irrigation. Although metolachlor (Pennant) and dichlobenil (Dyclomec) appear to be phytotoxic on most palm species, most other preemergent herbicides can be safely used on container-grown palms if applied according to their labels. If a palm species is not listed on a label, the product should be tested on a small number of plants for possible phytotoxicity prior to more widespread use. Keep in mind that preemergent herbicide phytotoxicities may not show visible symptoms for 6 to 8 months. In general, foliar-applied preemergent herbicides have an effective life of about 2 months, whereas granules, particularly those containing oxyfluorfen, control weeds for 6 months or longer (Broschat, 2000).

Postemergent herbicides are applied to actively growing weeds. They are most effective when the weeds are small. These herbicides should be applied one or more hours before any rainfall or overhead irrigation. Weeds should not be cultivated for several days after application or effectiveness may be reduced. The only postemergent herbicides registered for use in palm nurseries are Fluazifop-P-butyl (Ornamec and Fusilade II) and sethoxydim (Vantage). These two herbicides will only kill annual and perennial grasses; they are ineffective on broadleaf weeds and sedges. Glyphosate, applied as a directed spray around the base of a palm, will kill grasses, broadleaf weeds, and sedges. Should glyphosate drift onto leaves or green stem tissue of palms (and possibly exposed white roots as well), plants may be stunted and new leaves deformed. However, palms should grow out of this injury within a few weeks (Donselman and Broschat, 1986).

Cold protection

Palms in heated greenhouses are generally safe from freeze damage unless heaters fail. In open shadehouses or in the full sun container nursery, special protection is necessary. Anti-transpirant chemicals applied to the foliage may help prevent cold damage, but there is insufficient research proving that these chemicals provide significant cold protection.

Specialized fabrics for covering container-grown plants during a freeze are available, but they can be difficult to keep in place during windy weather.

Icing the plants with overhead irrigation works well if performed properly. The irrigation must be turned on before temperatures reach freezing and should continue until the ice visibly melts from the plant surfaces. The weight of the ice can, however, cause breakage of palm leaves.

Pests

Container palms, like other tropical foliage plants, are subject to a number of generalized plant pests such as mealybugs, thrips and scales. False oleander, black thread and brown scales are the most common scale insects on Florida container palms. Supracide (a highly toxic, restricted use insecticide) and Cygon 2E (dimethoate) have proven effective on both scales and mealybugs. Lannate has successfully controlled number of thrips, but has now lost its ornamental label. Several pests are particular problems on container palms, however. Good management practices, combined with judicious use of pesticides, is necessary to keep palm pests under control. See Weissling and Broschat (1999) for a detailed discussion of this subject.

Two-spotted (red) spider mite

Spider mites are a particular problem on many greenhouse-grown indoor palms. The predatory mite species, *Phytoseiulus persimilis* has been very successfully used to control two-spotted mites on palms in the greenhouse environment and in shadehouses as well.

Banana moth (*Opogona sacchari*)

The larva of this moth has been a destructive pest primarily on *Chamaedorea* species and areca palms, but other palm species, especially slender stemmed species, are also susceptible. This pest is confined to South Florida. The caterpillar tunnels through the stems of the palms. Lindane and Sevin have had some success in control, and Dipel (*Bacillus thuringiensis*) may be effective as well. Parasitic nematodes have also been fairly effective in controlling infestations of this insect.

Diseases

The most complete and current review of palm diseases can be found in Chase and Broschat (1991). Several disease problems are particularly prevalent in container palm production in the United States.

Gliocladium blight (Pink rot)

This fungal disease is a serious problem on *Chamaedorea* species and areca palms. The causal agent is not active at temperatures above 85°F, thus it is primarily a winter disease. Oozing lesions occur on the stems, and leaves turn brown and droop. The fungus produces salmon-pink, powdery fruiting bodies. The disease is easily spread if affected leaves are pulled off the plant prematurely, thus leaving an entrance for new disease inoculum.

Leaf spots

Leaf spots diseases caused by various *Bipolaris*, *Exserohilum* and *Phaeotrichoconis* fungi (often called the Helminthosporium-complex) affect a broad range of indoor palms. The disease is easily spread by overhead irrigation and poor greenhouse sanitation. *Cercospora* leaf spot is frequently a problem on *Rhapis* palms, cylindrocladium on kentia (*Howea forsteriana*), and anthracnose (*Colletotrichum*) on various species.

Phytophthora bud rots

Often this disease is not observed until the spear leaf wilts, turns brown and then black. If pulled, a foul smell is often noticed. Unfortunately, at this point, it is too late for control measures. This soil borne, warm-season disease is aggravated by wet conditions.

Soil drenches with metalaxyl (Subdue), or foliar spray with fosetyl aluminum (Alliette) are the best controls in the early stages of infection. Bacterial bud rots are less common, but frequently the cause of bud loss after freeze damage (Meerow, 1992).

European and California Certification

Palms grown for export into the European market must be produced in a media that contains no conifer bark.

Palms grown for the California market must be produced on raised benches at least 18" above the ground and treated with approved insecticides for fire ant control.

Growers interested in certification for either market should contact the Florida Department of Agriculture, Division of Plant Industry for the latest regulations.

Production Times

Production times vary widely depending on the species and the finished size. For fast-growing areca palms (*Dypsis lutescens*), a 8 to 10" container crop can be produced in 1.5 years from seed, while a slow-growing species such as kentia (*Howea forsteriana*) may take 3 to 5 years from seed to a finished 10" container.

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Table 1. Critical concentrations of 12 elements in: Group I—*Chamaedorea elegans*, *C. erumpens* and *Dypsis lutescens* (Areca); Group II—*Howea forsteriana* (Kentia) and *Rhapis excelsa* (Lady palm). Concentrations above the maximum range are considered excessive. All data from Chase and Broschat (1991).

Element	Group	Deficient	Low	Normal	High
N (%)	I	1.90	2.0-2.4	2.50-3.50	3.60-4.50
	II	0.84	0.85-1.19	1.20-2.75	2.76-4.00
S (%)	I	0.14	0.15-0.20	0.21-0.40	0.41-0.75
	II	0.10	0.11-0.14	0.15-0.75	0.76-1.25
P (%)	I	0.10	0.11-0.14	0.15-0.30	0.31-0.75
	II	0.10	0.11-0.14	0.15-0.75	0.76-1.25
K (%)	I	1.20	1.25-1.55	1.60-2.75	2.80-4.00
	II	0.59	0.60-0.84	0.85-2.25	2.26-4.00
Mg (%)	I	0.20	0.21-0.24	0.25-0.75	0.76-1.00
	II	0.19	0.20-0.24	0.25-1.00	1.01-1.25
Ca (%)	I	0.39	0.40-0.99	1.00-2.50	2.51-3.25
	II	0.25	0.26-0.39	0.40-1.50	1.51-2.50
Na (%)	I	---	---	0.0-0.20	0.21-0.50
	II	---	---	0.0-0.20	0.21-0.50
Fe (ppm)	I	39	40-49	50-300	301-1000
	II	39	40-49	50-250	251-1000

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Mn (ppm)	I	39	40-49	50-250	251-1000
	II	39	40-49	50-250	251-1000
B (ppm)	I	17	18-24	25-60	61-100
	II	15	16-20	21-75	76-100
Cu (ppm)	I	3	4-5	6-50	51-200
	II	4	5-7	8-200	201-500
Zn (ppm)	I	17	18-24	25-200	201-500
	II	17	18-24	25-200	210-1000