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Greenhouse Culture

PHIL BERGMAN

3233 Brant St., San Diego, CA 92103 USA

Greenhouse culture is a means of providing a plant with an improved growing environment to enhance its growth and survival. There are heated greenhouses that maintain a minimum temperature. There are cold frames that use only passive solar heat. There are even greenhouses that cool the air. All greenhouses are an attempt to give the plant optimal growing conditions and to control and stabilize the environment.

Greenhouses are used for seed germination, vegetative propagation, maximizing growth, creating “tropical” environments, commercial production of plants, and just for fun. For propagation, one wants to maintain good humidity, adequate warmth, and less than full sun. For maximum growth on a palm from a hot, dry climate (e.g., *Bismarckia*), one would want a dry greenhouse with good light, very high temperatures and very little humidity. For high elevation forest palms, such as *Geonoma*, one would want a cooler greenhouse with a narrow temperature spread and high humidity. Thus, there is no simple formula or set of rules will apply to all greenhouses.

Temperature

A well constructed and efficiently operated greenhouse controls and stabilizes the temperature. A must is mounting several “high-low thermometers” to monitor temperature. The most important goal is to maintain a minimum temperature during cold weather. I find that a minimum of 10°C (50°F) allows me to grow most palms.

Regarding maximum temperatures, there are very few species that need temperatures in excess of 33°C (90°F). Certain genera, such as *Brahea*, *Bismarckia*, *Nanorrhops*, and *Washingtonia*, like temperatures even higher, but these are the exception. *Chamaedorea*, *Howea*, *Lepidorrhachis*, *Hedyscepe*, *Geonoma*, *Rhopalostylis*, *Asterogyne*, and many mountain species will succumb when faced with such extreme high temperatures. To avoid exceeding such maxi-

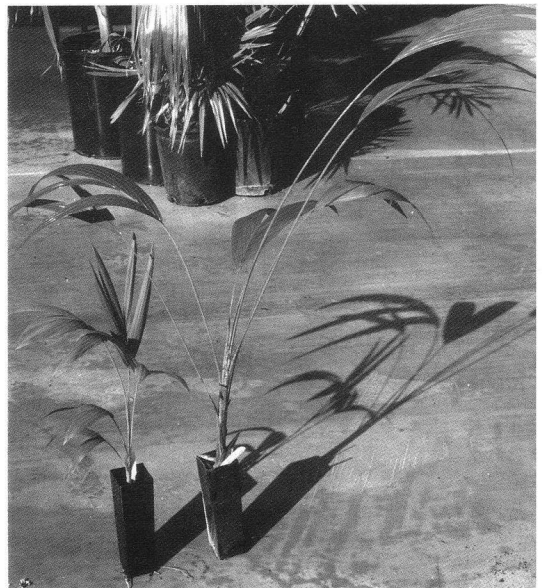
imum temperatures, one can use cooling apparatus, intake and exhaust fans, interior air circulation with water mist, and overhead sun protection in the form of shade cloth or white paints.

Light

Sunlight can be quite intense in the greenhouse. Too much light will produce faded, yellow and sometimes burnt leaves on the palm. Too little light produces green but stretched out and unstable plants that lack vigor (Fig. 1). Use shade cloth or paint the roof with water-based white paint to reduce the light intensity.

Humidity

Humidity should be maintained at about 50–60% for most species. Too little humidity leads to leaf desiccation, frequent watering requirements, red spider and other pest infesta-



1. The seedling palm on the left is grown with adequate light. The seedling on the right is stretched and weak, a casualty of insufficient light.



2. A well-grown palm in a greenhouse (*Colpotherinax cookii*). The plant is growing in a soil-less mix, in a standard black plastic pot, with adequate drain holes. Note, however, some salt build-up is visible along the soil surface and around the drain holes. The pot is elevated on a metal bench, perforated to allow water drainage and air circulation. The greenhouse floor is easy-to-clean concrete. (Photo K. Maidman)

tions, and overall poor performance. Too much humidity makes the greenhouse slippery with algae and slimy and sooty molds and may encourage rot on arid palm species. Humidity can be raised by spraying the greenhouse walkways with water on a regular basis or by using electronically controlled misting devices. Adequate air circulation can help overcome some of the algae/mold problems associated with too much humidity.

Air Circulation

Greenhouses have two types of fans: 1) thermostatically controlled exhaust fans that cool the greenhouse by blowing out hot air and passively pulling in cooler outside air, and 2) fans

that circulate air within the greenhouse. In small greenhouses, temperature sensitive hydraulic devices can open vent windows at the top of the house. Interior circulating fans, however, are important regardless of greenhouse size. Typically they are set to operate 30 minutes on and 60 minutes off in any given part of the greenhouse.

Benches

Placing plants on benches gets them above the colder ground temperatures and helps them get more air circulation (Fig. 2). Benches also make plant inspection easier and lessen weed problems.

Potting Soil for the Greenhouse

Comments on potting soil are similar to those discussed under Container Plants, but in the greenhouse one has to make sure soil drainage is good because of the higher humidity. Drainage is increased by adding perlite, pumice, peat moss or chunky bark material. In time, however, the bark and peat moss that you added to increase drainage will decay and slow the drainage. When soils break down, repotting into fresh soil is needed.

Watering

All the rules regarding watering described in the article on Container Culture still apply in the greenhouse. However, because of higher ambient temperatures, pots may dry out more quickly in the greenhouse, especially during a hot dry summer. During the winter, especially if the greenhouse is "closed up," pots stay wet much longer. Watering will also be affected by inside humidity levels, air circulation, and the soil formulation.

Fertilizer

The greenhouse is the perfect place to use a fertilizer injector system that injects soluble fertilizer of any N-P-K ratio directly into the irrigation system. Unfortunately, there is potential for unsightly salt buildup on the foliage if the fertilizer is sprayed.

There are also very good alternatives to injector systems. Granular or soluble, organic or chemical fertilizers can also be used in the greenhouse. Bloodmeal is good for greening up leaves and carries little risk of burn. It does, however, have an unpleasant odor.

Pests

Palms are surprisingly pest free; however, any insect that can attack a palm will do so more voraciously inside the greenhouse. Infestations typically spread more rapidly in a greenhouse. The most common insect pathogens include aphids, scale, mealy bugs, and spider mites. When introducing new material into the greenhouse, make sure it is free of pests. Preventative practices which can reduce problems include: spraying down the foliage, adequately spacing the plants, ensuring good air circulation and humidity, avoid overheating the greenhouse, removing dead leaves and debris, and treating problems as soon as they occur. For any given pest problem, it is best to consult your local nursery or garden center for the appropriate pesticide available in your locality. Always follow manufacturer's instructions and use appropriate protective gear. Prophylactic use of fungicides as a soil drench on new seedlings is advocated by some growers.

Pruning

As palms grow faster in the greenhouse, more attention must be placed on pruning dead leaves. Always use clean equipment. Leaves are removed when they are unsightly and detract from the palm's beauty. Do not remove healthy green leaves as these leaves are providing photosynthesis and nutrition for the plant.

Weed Control

It is imperative to control weeds on the ground and in the containers so that they do not overwhelm your greenhouse. Most growers hand weed before the weeds have a chance to flower and seed. Plastic ground covers can be used to

prevent weed growth on the pathways and under benches.

Moving Plants Out of the Greenhouse

Whether you are a grower or a customer purchasing plants from a greenhouse, acclimatization outdoors is of critical importance. There are three things to consider when moving a plant out of the greenhouse: sunlight, temperature, and humidity. Of greatest risk is the outdoor sunlight. Your palm has typically had less than full sunlight in the greenhouse. Higher humidity levels have also protected its foliage. The most common mistake is to take a sun-loving species from the greenhouse and plant it directly into full sun. This invariably gives some degree of leaf burn which can be avoided by gradually moving the plant into sun over a two to three month period. On first removing the palm, put it in shade. Every two to three weeks, progressively move it into a little more sun. Some species are more tolerant of this move, but caution is definitely in order. If a greenhouse plant is destined for filtered light, the acclimatization process can be shorter.

Cold damage can be avoided by not moving a plant out during cold weather. Unaccustomed cold can be just as devastating as sun. Make sure any threat of frost has passed. You can tell cold burn from sun burn in that the former is a more universal brown or faded look and will invariably hit the new leaf spear or newest tender foliage. The foliage will also look somewhat wilted and weak with time. Horizontally oriented leaves are more susceptible to cold damage than vertically oriented, mature leaves. Sun burn is on sun exposed areas only. Antidesiccant sprays may prevent some cold damage.