Evolution in the Propagation of Tropical Foliage Plants

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Foliage propagation over the past 10 years has become more refined and specialized and it has improved dramatically. I will share the evolution in my lifetime, and what changes Southern California growers have experienced.

In my father's facility we held our own stock on many varieties, or took cuttings from production plants in rotation. Frequently we stuck cuttings in flats and later re-potted them. Misting and the use of labor-intensive sweat tents were common practices.

Cuttings purchased from Central America often had long thin roots that had to be trimmed off. Loss rates of these purchased cuttings were high, which made direct sticking difficult. Tissue-cultured plants presented their own problems; much was promised, but little was delivered. Often the parent plants selected to tissue culture were of poor quality, sizing of tissue culture products was inconsistent, and filling grower orders was sporadic. One month you would get your order, and the next you wouldn't. This has all improved, however, because the market has demanded it.

Foliage propagation requires four key cultural elements: (1) clean stock that has been grown in such a way as to increase the odds of success; (2) heat, preferably bottom heat; (3) humidity; and (4) an open, aerated soil medium.

At Kallisto Greenhouses we use a special propagation house to meet the heat and humidity requirements of propagation. In this propagation house we have rolling benches for space utilization and bottom heating is provided by EPDM tubing with forced air heaters as back-up. The system is designed to maintain soil temperatures of 74F.

To achieve an open aerated mix we use a combination of 25% peat moss, 25% coconut fiber (coco peat), 40% perlite, and 10% cinder rock. I have observed the newer element in this mix, coco peat, to hold the water better than straight peat moss, while also adding to the overall aeration of the mix.

Relative humidity in this house is provided by a fog system regulated by an environmental control computer. Although the fog system can provide a wide range of relative humidity, there have been design problems with the system. My concept in a propagation house was to get away from labor-intensive sweat tents. Originally I maintained 90% humidity in the entire 30,000 ft^2 propagation house. While unrooted cuttings needed and liked the 90% humidity, many rooted cuttings, such as *Dracaena*, did not. Some cuttings would rot or spot and it was difficult to maintain a balance between unrooted cuttings requiring 90% plus relative humidity, and the rooted plants needing to be hardened off. In the last stages of propagation all the plants became too soft and had to be moved out very quickly. Depending on the season, I now run the house at 60% relative humidity. Plants which require additional relative humidity, are misted.

If I were to redesign the propagation house, I would compartmentalize smaller areas to accommodate the special needs of each type of crop. While this would facilitate better growing, it would add to the labor costs. Another improvement would be to minimize drafts. Also, because of the very low outside relative humidity here in the summer, when I tried to raise the relative humidity to 80% to 90% inside, the air temperature dropped too much, cooling the propagation house down to a Fahrenheit temperature in the 70s. Although rolling benches optimize space utilization, there are added labor costs bringing plants in and out. In the future this problem will be addressed with the use of a monorail system. As we specialize in select crops, the propagation house will become even more efficient and productive.

Other changes in propagation we have made over the years have been due to the market driven need for a fatter fuller plant grown in a faster turn around production cycle. We direct stick as many cuttings as possible in the container in which they will finish. This makes a fuller plant that finishes faster, with less chance of transplant shock.

The last major change we have made is no longer relying on in-house seed production for our *Spathiphyllum*. We now buy tissue culture *Spathiphyllum* from four different vendors. The improved genetics of these tissue culture plants and the delivery of uniform plants, in sufficient numbers, have made it possible to meet the market demand.

In preparing this presentation I talked to several key San Diego growers about the changes they have seen. Although each grower handles propagation material differently in order to adapt to his greenhouse structures and production goals, they uniformly agreed a major change has been the improved quality of the Central American cutting material. The Central American growers have specialized their growing grounds or farms, by putting each crop into its own best climatic zone. Fertilization and cooling techniques have hardened cutting material for better shipping durability and air rooting has also cut loss rates for growers here. Plant material is more consistent, aiding in crop cycle timing and there is a wide range of sizes from which to choose. Some growers will buy a larger cutting closer to its finish size for a quicker turn, while others buy a smaller size, then put on more leaves here for a more polished fuller look. Overall, each element in the chain is getting better and more specialized.

Growers also agreed foliage production is becoming more like bedding plant production. It is no longer a time of one greenhouse propagating everything in-house. Besides better cutting material coming in from Central America, there are many more top quality tissue culture plants and seedling plugs available from Florida. These sources have allowed Southern California growers to shorten the growing window and the ability to concentrate on finishing the product.

Chuck Ades, of Ades & Gish Nursery, pointed out the proliferation of new varieties. At one time I was growing more than 35 varieties of *Spathiphyllum*. Today there is a flood of new *Hedera* (ivy), *Ficus benjamina*, *Dieffenbachia*, *Aglaonema*, fern, and *Calathea* all done by tissue culture. There are also new types of *Dracaena*, *Algaonema*, and *Croton* coming in from Central America. While there are so many more new plant varieties to propagate, I have found this abundance of choices has not been appreciated by customers and often has only caused confusion in the market.

In the future, new communication technology will push the need to continue to specialize and improve the quality of cutting material even further. As an example, I plan on using a digital camera to take pictures of cuttings, then transfer these photos onto my computer as e-mail attachments. I will be able to show the growers in Central America exactly what I am looking for and the problems I encounter using this Internet-based technology. Both parties will be able to communicate more easily and more precisely. Because there are so many good products available, I doubt this will result in price increases. But, those suppliers who can respond to these clearly defined propagation needs, will get the most business.

Because of this diversification of sources for propagation material and dependency on suppliers worldwide, all growers are much more subject to fluctuations in the world economy. Because our local market will not absorb price increases, the availability of cutting material from Central America shifts when Europe or Asia will pay more relative to the value of the dollar. In closing, economic pressures have dictated that every producer of foliage crops must do a better job for the same or a lower price.

Propagation of Aquatic Plants

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I want to thank you for inviting me to speak at this International Plant Propagators' Society meeting. Van Ness Water Gardens is a third-generation company and, in my opinion, our propagating methods have change significantly since my father and Mr. Van Ness ran the business.

Originally, we used 4-inch-terra-cotta pots to grow our plants. These eventually became too expensive so we started using tin cans that we purchased from a local school cafeteria and dipped them in large vats of hot tar to rustproof them. Plants growing in the 1-gal tin cans had to be spaced further apart than the ones growing in the 4-inch-terra-cotta pots, but the plants grew larger. The larger plants and the increased volume of the 1-gal cans increased the volume of soil and the amount of fertilizer needed to grow the plants and it increased the labor required to plant and move them around the nursery. Smaller flats were also tried, but resulted in overgrowth of algae and/or the growth of some other dominant plant that killed the plants we were trying to grow.

We've tried several novel techniques to improve the propagation of our plants. In the late 1970s we tried plant hormones that improved the growth of our plants, but their use did not compensate for their cost and added labor requirements. In the early 1980s I worked with Martin Creehan at his meristem culture laboratory in San Dimas to develop a micropropagation protocol. We found it very difficult to surface-sterilize the aquatic plants and we could never completely remove fungi that grew on them.

We propagate hardy lilies and hardy tubers today the same way they were propagated thousands of years ago by cutting their "eyes" and planting them in our special soil mix. Most of the other plants we produce are propagated by cuttings. The tropical lilies are propagated by bulbs that we bring out from storage each spring. Some tropicals have the added advantage of producing viviparous off-shoots from their leaves. We use a special "tamale" planting method for our off-shoots. This means that we use a special soil mix with the plant wrapped in newspaper. One thing we have found is that the roots of aquatic plants do not like to be isolated; it is important for them to exchange gases and nutrients in the water surrounding them.