Adapting Commercial Production Techniques to Botanical Garden Propagation©

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Walking through the propagation range a few evenings ago, I had a brief but satisfying sense of accomplishment as I made my weekly "state of the prop" assessment. Usually these surveys only result in two page "To Do" lists and mild pangs of panic over how in the world to get it all done. But on that night as I looked in on the 30 growing spaces that make up our 33,000 ft^2 of glasshouses, the changes in approach to propagation and production, introduced through nearly 4 years of constant effort, were clearly evident. The standards of a well run, commercial production nursery: uniformity, consistency, predictability, and efficiency, had begun to take hold in this aging, inadequate, and overstuffed botanical garden facility. Finally!

The New York Botanical Garden, a National Historic Landmark and a museum of plants, was established in Bronx, New York over 100 years ago. Its 250 acres include display gardens, plant collections, 50 acres of original forest and the spectacular Enid A. Haupt Conservatory, the nation's most beautiful Victorian glasshouse. Across the Bronx River, sits the complex of Lord and Burnham glasshouses, pit houses, cold frames, polyhouses, bulb cellar, and outdoor growing areas referred to as the Propagation Range. These greenhouses hold more than 20,000 ft^2 of the most diverse plant collections used for research and display purposes, as well as, back-up stock for the Conservatory's biome collections. The balance of the growing areas are utilized for propagation and production of 60,000 to 80,000 finished plants per year that are planted in the display and container gardens throughout the grounds, and in the many thematic plant shows presented year around in the Conservatory.

I arrived at the Garden with a background in market gardening, estate greenhouse management, and commercial nursery production. In my previous 22 years of gardening, I had never seen anything like this plant production facility. The diversity of plant material was barely comprehensible to a sublime degree: aroids, tropical begonias, orchids, cycads, palms, bromeliads, tropical ferns, tropical ericads, cactus, aloes, agaves, succulents, aquatic plants, carnivorous plants, kiku mums, plus hundreds of bedding annuals, and herbaceous perennials. To top it all off, an entry corridor filled with rhipsalis on one side and epiphytic cactus on the other hung at just the right height to slap the unsuspecting "new guy" silly as he traveled back and forth from the work corridor to the office areas. Equally incomprehensible, but in a perplexing way, however, were the propagation procedures and production methods in practice throughout the range both in the collection, as well as, the display/show production houses. Everywhere I looked I saw capable gardeners, using antiquated, inefficient and, in many instances, ineffective techniques in a faltering facility, attempting to meet a seemingly unending need/demand for more plants, and top quality ones at that. And to make matters more entertaining, it was the middle of April; the 200+ Chinese peonies (5- to 7-year old plants) for the Chinese Peony Show in 2 weeks were not responding to being "forced" into bloom; and the computer control system, reacting to a power surge caused by millions of air conditioning units coming on line at once because of an unusually warm day, had just told all the mist systems in the various houses to activate.

Needless to say, adjustments were warranted. Now, botanical gardens are cultural institutions, not commercial entities, and while they are budget-minded, they are not profit-driven. Nevertheless, I determined that, at least, in the propagation range of this botanical garden, we would profit greatly from approaching our growing efforts with a more disciplined, rigorous perspective, adapting both principles and techniques from the world of commercial horticulture.

So we did, primarily, in the following ways.

THE STAFF: "COLLECTION MIND/ PRODUCTION MIND"

Early on we recognized that there were two major aspects of the propagation range mission: collection work, that is, building and maintaining discreet groups of documented plant material in containers over long periods of time; and production work, that is, propagating and growing on diverse groups of plants for shows and display gardens, primarily, in exact numbers, to specified sizes, and on a precise schedule. The rhythm, pace, and focus required in these two arenas are distinctly different. A few gardeners can prosper in both worlds but, in most cases, a gardener will have a propensity toward and greater ease with one or the other of these two spheres of activity. "Collection Mind" nurtures and develops plant material through long-term relationships: big pots, customized soils, and bamboo stakes. "Production Mind" pushes and prods plant material, in one door and out the other: plug trays, high-octane soils, and straight lines. So our first task was to get gardeners properly aligned with the plant material and approach that fitted them best. In our experience there's nothing more awkward than trying to make a collection gardener out of a production one except trying to do the reverse.

THE TEAM: "HAND WASHES HAND AND ALL HANDS ON DECK"

Even though every propagation range gardener had their area(s) of responsibility and expertise, as well as their particular "mind", we worked at getting the entire staff to widen out in their scope by an interchange of help and thereby information. Collection gardeners were encouraged to accomplish more tasks in pairs: orchid repots by the orchid grower and the fern grower; *Victoria* and *Euryale* sowing by the aquatic grower and the cycad grower; ericad cuttings by the high-montane grower and the succulent grower, for example: "Hand Washing Hand". Likewise, in production houses, larger projects were handled in tandem with one gardener leading and one assisting. As the content of the projects shifted from mum cuttings to coleus sowings to sweet pea trellising to stocks staking, each gardener's role would rotate according to primacy of skills and/or responsibility. However the real catalyst for staff cooperation and investment in the "Total Prop" has been the pre-emptive "All Hands On Deck" (AHOD). Each week a set of major, and usually, time-sensitive tasks were identified throughout the range as ones for the entire staff, collection and production gardeners, to work on and accomplish collectively in a specifically defined time frame of 90 min to 2 h maximum. The entire AHOD period was then carefully planned, staged, and intensively worked, so that a large task that would have taken one person alone days to complete, was wrapped up in a comparatively short time period. The work pace is brisk and focused but the sense of accomplishment and appreciation builds up quickly throughout the staff. So three times per week, for over 3 years now, we have "AHODed" through numerous, seemingly, insurmountable projects to the benefit of all.

TOOLS OF THE TRADE: "PLUG A DRIP OR DRIP A PLUG?"

Shortly after starting my position in the prop range, an article celebrating the 30th anniversary of plug propagation and growing appeared in one of my trade magazines. (I had, 10 years earlier, revolutionized my production efforts with plug trays.) At that moment, not only were there no plug trays in use at the New York Botanical Garden but also there was a strongly entrenched bias against their applicability. The article's celebratory message impressed nobody. Regardless, today over 90% of our propagation, seeds and cuttings, is accomplished in plugs. Whether it's wild collected *Hoodia* and *Aloe* seed from South Africa, *Cycas* seed from Vietnam and *Zamia* seed from Bermuda, or just the hottest new *Salvia coccinea* and our favorite Spring Show perennial *Rehmannia elata* (syn. *R. angulata*), they all get sown either singly or in clusters in the appropriate plug trays. Thousands of cuttings each spring and fall from coleus to conifers, mums to figs are stuck in plug trays deep and shallow. Another trade magazine, not long after that, featured a range of articles on the efficiency, uniformity, and reliability of drip and micro-sprinkler irrigation in production systems. At that time, the bulk of a gardener's day and energy at the prop range was spent pulling hoses and watching water flow out of nozzles into pots of soil. Currently, there's well over a mile of pressure compensating driplines in our production areas with plans to introduce another half mile of lines in larger groups of our collections material. All of our perennials, mums, tender perennials, and woody plants in pots from 1- to 60-gal sizes, are on drip or micro-misters. Drip irrigation revolutionizes even small-scale production because it requires large block/zonal thinking and organization: straight lines, soil mix uniformity, and standardized pot size ratios and fertilizer formulas. And the results for us have been undeniable: watering time reductions of 60% to 70% in many areas, near elimination of watering-related plant losses, and increase in plant vigor and quality.

THE MEDIUM: "GETTING THE DIRT ON SOIL MIXES"

Hardly 2 weeks had passed in my tenure at the prop range when I made the most outrageous demand of all — an All Points Bulletin for each gardener to surrender the soil mix recipes for each area and or/plant group. The outcry and gnashing of teeth was remarkable. Nearly 2 weeks later, I finally had all the top-secret formulas in one stack — many in print for the first time ("oral tradition" recipes), and many with shifting approximations of ingredient amounts ('touchy-feely or mood-dependent' recipes). We carefully read through all the legible submittals, whether on cardboard scraps, strips of paper, or backs of envelopes, trying to discern the guiding principles upon which they were based, as well as, the appropriateness of the mix for the plant roots it was meant to embrace. In the end, all but two were relegated to the "Discontinued Practices" file. We, then, spent a number of days in committee with various groups of gardeners reviewing containerized soil mix practices and procedures, in order to come to common understandings of how to determine soil mix needs of various plant groups and how to get there with a standardized approach using available materials and aggregates. The results: four basic soil mixes based on particle size, drainage, moisture holding capacity, and fertility which can then be nudged one way or the other to handle over 90% of the soil needs for the 30,000+ taxa that we grow. (All "nudgings" for any particular plant must be pre-approved, justified and, most important, documented in the gardener's house journal.) We use our own, carefully monitored and pasteurized, compost in almost

all mixes. And because most of our potting operations require small batches (10 to 12 ft^3) of mix at any given time, we mix most of our soils by hand using an exacting "landslide" technique. In short, we get our hands dirty making soil.

THE FACILITY: "FUTURE GLASS"

Our present greenhouse facility, "7-ft gutters and overhead clutters" along with regular, complimentary glass showers from vents stuttering shut, has served us over 40 years. Few tears will be shed, however, when the place is "deconstructed" next year. This final major adjustment has been a full $3^1/_2$ years in coming. Happily, 1 month ago, we broke ground on our new 43,000-ft^2 propagation facility, the Nolen Glasshouses for Living Collections. Designed in-house, by a team of architects, engineers, and myself, it will feature all glass, open-roof construction with gutter heights of 22 ft, radiant floor heating, rolling production benches, retractable shade and thermal curtains, evaporative and high pressure fog cooling systems, and "wide-body" plant transportation corridors. In addition, there will be a separate glasshouse zone, open to the public, dedicated to educational displays of propagation and production techniques along with glasshouse management practices. Needless to say, the entire staff eagerly waits the commissioning of our "Future Glass". Let me know if you'd like to drop in for a tour in Spring 2005, after we've moved in and got the bugs out.

If Walt Disney Was A Propagator, How Would He Have Reached His Customers?©

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INTRODUCTION

Propagation is one of the oldest skills, it has been practised since man stopped roaming the earth and started settling in one spot. Seeds or cuttings were germinated or rooted, plants sold or grown on, and eventually a finished plant became a valuable commodity in the economy.

It has always been the way of doing things, should it be the way of the future?

The world is changing rapidly. One hundred years ago the entrepreneur was the farmer or grower, during the last century it became the manufacturer, and in the new century it is the idea maker who is changing the world.

Entrepreneurs, such as Walt Disney, Richard Branson (Virgin), Howard Schultz (Starbucks), and Anita Roddick (Body Shop) have challenged the way things are done in their respective industries; none of them saw the opportunities in horticulture. If they had, would they have done things differently?

Alas, these personalities are not with us for this presentation, all we can offer is conjecture on how they would have developed the propagation industry.

These are my thoughts and I hope they stimulate some ideas.

START WITH THE END IN MIND

The most important person in this process is the end user, the consumer. Disney, Branson, Schultz, or Roddick would have analysed the end user's needs and wants