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A Propagator's Notebook[®]

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INTRODUCTION

A number of months ago a former employer, James Gilbert of Gilbert's Nursery, suggested that I might consider giving a talk for this year's I.P.P.S. program. I decided he was right. Year after year I have come with notebook in hand to eagerly seek the knowledge and wisdom so generously offered by others. It's time I shared. I have been a member of I.P.P.S. for 20 years now and have tried my hand at propagating since 1981 when I first went to work as an intern for Ed Kinsey at Kinsey Gardens in Knoxville. Not long ago, in the process of moving, I came across my original propagation notebook. While rereading those notes I realized how many of my early observations were still valid today. While I certainly value my formal education in horticulture, it became very apparent to me early on as I tried to put my knowledge to work that it was going to take a lot more than "book learning" to be a successful propagator. Propagation is a field that depends heavily on empirical knowledge. Knowledge is gained daily through experience and doing. I grew up in Appalachia where empirical knowledge was considered to have great value. "Book learning" was fine, but "real" learning came by doing. I highly value both education and experience and use both in my work. However, I think that in this modern day of high technology, we sometimes neglect our ability to learn from our observations and keen senses. We neglect to observe, follow our intuitions, or "think outside the box." The I.P.P.S. was originally founded by a group of propagators who came together to share empirical knowledge. In that same tradition, I would like to share some of my observations and thoughts during my fascinating journey in the world of propagation.

I like to compare rooting a plant to getting a chemical reaction to take place. The reaction will not take place if any of the necessary parts of the equation are left out. The same is true when rooting plants. The secret is coming up with the right combination of events. Since I have spent many years working with difficult-to-root deciduous plants such as *Acer palmatum*, *Stewartia*, and *Styrax*, I would like to share some of what I have learned. The problem with most of these plants is not only do they have a short window when the wood is in a receptive state for root-

ing, but successful rooting does not guarantee that they will leaf out and grow the following spring. For many years, a common practice was to bring the plants into a heated greenhouse, take the cuttings early to ensure that they rooted, and allow the rooted liners a longer time to grow. The other concept was to place the liners under lights to extend the growing season. It finally occurred to me that maybe we were approaching the problem from the wrong direction. I'm dyslexic, so I tend to think upside down. I decided that since the root is the storage organ, it was far more important to develop a large root system. With a larger root system, the plant has enough stored carbohydrates for the shoot system to break-bud in the spring. I take large cuttings that are 13–15 cm (5–6 inches) long and leave a lot of foliage, which allows for better growth after rooting. The best time for cuttings is usually just after the first spring flush has finished and when the wood is just beginning to firm up. I use tree tubes for containers. The tree tube allows me to use a lot of mist to maintain the foliage without over-wetting the medium. I use a well-drained medium of 3 well-composted pine bark : 1 perlite (v/v). Liners seem to be very sensitive to cold the first winter. Once they have gone completely dormant, I maintain them just above freezing for the first winter. Contrary to common dogma, I fertilize unrooted cuttings using Osmocote 18-6-12 incorporated into the medium or with a short-acting fertilizer such as Sta-Green 12-6-6 (Spectrum Brands) just after removing rooted cuttings from the mist. I also liquid feed again just as the buds start to break in the spring. I have had very satisfactory results using these methods. Of course you need to adapt to your particular environment and cultural conditions. Much of what I have learned has come from closely observing recalcitrant plants.

STOCK PLANTS: TAKE ONLY THE BEST CUTTINGS

In 1982, I wrote this statement in my first propagation notebook. A pretty good observation for a neophyte. Too often growers want the propagator to take wood from plants that have performed poorly and will not be sold. What is frequently misunderstood is that the cutting and liner produced are only as good as the stock plant. I respond to their resistance in allowing me to take good wood by asking a question: "Would you pick out the worst horse in the stable to breed?" I believe that although we are supposedly propagating clones, there is also genetic variability within cuttings. After all, many of the cultivars used commercially come from shoots that were discovered as off-types and later propagated. We also frequently speak of selections or types. I believe it is possible to improve clonal selections by carefully choosing the wood. At Imperial Nurseries, where I presently manage the Propagation Department, my team leader and I scout the nursery looking for the best possible block of plants for our cuttings.

CUTTINGS: REMEMBER YOU ARE DEALING WITH A LIVING, BREATHING ORGANISM — NOT A STICK OF WOOD

Careful maintenance of cuttings during the collection process is vital. The cuttings may initially appear okay, even when held for long periods in the field. However, the damage often shows up later after the cuttings are stuck. We wonder what went wrong and frequently attribute the problem to erroneous causes. A mistake I have frequently seen made is packing cuttings too closely together. Living cuttings give off heat through metabolic processes, just as people do. When you fill a room full of people, it frequently gets overheated. That is exactly what happens to cuttings

when they are too tightly packed together. They overheat, suffer loss of vigor, and can die. Allowing cuttings to dry out either in the field or during processing is a frequent cause for loss in the propagation house. Obviously, some plants are more vulnerable to drying out than others. Plants with thin leaves that desiccate readily such as *A. palmatum* are much more susceptible to drying out during the collection process. I have made an astonishing discovery. No matter what part of the country I've been in, it rains somewhere between the last couple of weeks in May and the first couple of weeks in June. That particular time frame happens to coincide with the best time to take cuttings of many difficult-to-root deciduous plants. I have also had my best results with *A. palmatum*, *Stewartia*, *Styrax*, and *Betula nigra* when I take cuttings in the rain. However, my cutting crew does not necessarily appreciate the practice! The discovery of this rooting improvement under such extreme conditions has made me more fully aware of how important it is to protect cuttings during collection and harvesting. At Imperial Nurseries, we collect cuttings in the field, first thing in the morning. We put them in open baskets placed on top of each other. Burlap that is soaked with the disinfectant and algacide, Green-Shield (Whitmire Micro-Gen Research Lab) is placed on top of the baskets so the cuttings will remain cool and moist. We finish harvesting cuttings before noon. When the baskets are brought in from the field, the plants are misted before going into the cooler. As we bring the baskets out to process the cuttings, they are placed under mist until each cutter is ready to work on a basket. We also use a moist piece of burlap with each cutter's work area. We have one person apply rooting hormones. That person collects the cuttings from each workstation and, after dipping them into the hormone, arranges them in rows so the person who is sticking them for the day can easily pick them up. As the dipper works, the sticker periodically sprays the cutting again with water from a mist bottle. We put a lot of effort into protecting our cuttings from drying out while we work.

MIST — JUST USE THE RIGHT AMOUNT

We frequently cannot see when a cutting is under stress. By the time cuttings of woody plants wilt, it is too late! I sometimes try to imagine myself as the plant or as the Japanese might put it: "To root the plant, one must become the plant." How would it feel if I had just been snipped off the branch that was sustaining my life? With that concept in mind, I tend to use a lot of mist until the cutting has a chance to regain its equilibrium. Close observation will show when the cutting has regained turgidity. I frequently describe it to others as: "When the cuttings can stand up." Often propagators believe cutting loss is due to excess water, when in reality it was the lack of mist and water control when the cutting was first stuck, or drying out during the collection process. Cuttings die from the bottom-up as well as from the top-down. Rotting of the bottom of the stem is just as likely to be due to too little water as to too much.

One thing that is not well recognized is the beneficial cooling effect of mist. While we are all aware that mist minimizes moisture loss due to transpiration and evaporation, we tend to be unaware of the benefits of evaporative cooling. As a student nurse, I still remember standing in the operating room cracking sterile ice to put into the thoracic cavity while we performed some of the first cardiac surgeries. While they use more sophisticated methods now, the practice was based on sound theory. As you cool tissue, you reduce metabolism. The same is also true for plants.

Cooling helps lower a cutting's metabolism, making it easier to maintain in good condition until they root. Here in North Florida, where the summer temperatures are extremely high, that concept has been very valuable. Instead of removing plants from the mist house shortly after they start rooting out, as I was originally taught, I allow them to remain in the propagation house to enjoy the benefits of cooling until they are fully rooted and start to flush out. Plant growth tends to be shut down above 27 °C (80 °F).

When the ambient temperatures are consistently higher, I have found that cuttings actually benefit from the cooling effects of mist and continue to grow. If I place them outside during high temperatures they shut down and take much longer to form a good root system.

HORMONES: I HAVE NEVER PUT A LOT OF STOCK IN FINDING A MAGIC HORMONE TO PRODUCE ROOTS

I have used all kinds of rooting hormones over the years: Hormodin (#1, 2, 3), Dip 'N Grow, and K-IBA. I am presently using Chlormone K+, which I purchase from Ozzie Coor (Coor Farm Supply, Smithfield, North Carolina). I dilute it with sterile water to whatever strength I need: 1%, 0.5%, or 0.25%. I then dilute it 50% (1 : 1) with Celluwet (water thickening additive from Griffin Laboratories). I have a chart we use for mixing the hormone, and we color-code the different strengths with food coloring so that we do not confuse the solutions in our haste. I have been very pleased with the results. Like any other rooting hormone, it takes some experimentation to find what works best for each species. I have never heard or seen any experiments that discuss the interaction between temperature and hormones. However, it makes sense to me that an increase in temperature will increase the reaction of hormones. I have observed this to be true. I usually reduce hormone concentration when we reach higher temperatures. I also reduce hormones when using bottom heat, particularly with plants I have found to be hormone-sensitive, such as *Ilex*. If you decide to push cuttings too hard with too high a hormone level, cuttings can rapidly abscise their leaves. In short, too much hormone is just as detrimental as too little.

TIMING IS EVERYTHING — WELL, ALMOST EVERYTHING!

From working with difficult-to-root plants, I have come to believe that every plant has an ideal time when it has a physiological state that is most opportune for rooting. We talk about finding “windows.” Most species have a window or seasonal time frame when they will optimally root. Some plants have long windows, while particularly hard-to-root plants have short windows. The windows are highly complex. They involve temperature, daylength, dormancy, condition of the wood, and probably a lot of other things we do not fully understand. When I first went to work for the late John B. Kinsey, he looked at me and said “Charlotte, ivy roots in August.” I was a little surprised by that comment, since I was still in school and had learned that you could root ivy just about any time. I soon found out that he was right. If you stick ivy in August it will root almost instantly. Of course it will root at other times, but much more slowly. I put a lot of emphasis on finding the very best time to stick a particular plant. Why fight nature? Instead, I try to work with it. I am frequently asked if I can stick a cutting during an unfavorable time. My answer is always, “Yes, but when it roots is another story.” It has been my experience that

when a cutting is stuck at an unfavorable time, the cutting may eventually root, but it never makes a very good liner. When working with unfamiliar plants or in a new location, I have found that when the plant actually roots is a very good indication of when it will optimally root. If I subsequently propagate it during that time, I will have far better results. At Imperial Nurseries, we work hard to develop a cycle that both works for propagation and has the rooted liners ready to pot so that they will meet the sales needs.

THE PROPAGATOR IS ONLY AS GOOD AS HIS OR HER EQUIPMENT

Several times I have had the opportunity and pleasure to design my own greenhouses. I was one of the first people to insist on a self-starting generator. Many nurseries now seem to feel it is worth the cost. I also like to have as much redundancy in my watering system as possible. Last year when we needed a new pressure tank, we decided to put in two tanks for water storage, along with two pumps to fill them and two pumps to pump water to the greenhouses. If either system fails, we have a back up.

IMPORTANCE OF PEOPLE!

Shortly after I went to work for Gilbert's Nursery, Susie Strong made a statement that has stuck with me because it held an important truth. She said, "I can never decide what is most important — the plants, the customers, or the employees." As plant people, we tend to be very fascinated with plants. One fellow propagator confessed that his wife got very angry with him, because he only took pictures of plants and never of people. As a manager, I try to treat my employees with the same care and concern that I apply to my plants. Selecting good employees is like carefully selecting cuttings. Find the best ones. Everyone has a different management style, but I like to think of myself as a teacher rather than a manager. With few exceptions, most people want to do well at their job and be recognized. As a manager I feel it is up to me to help them succeed and that means teaching them how to do their jobs well. It is also up to me to create a team atmosphere of cooperation. Every person on the team has an important role. I'm constantly surprised and delighted by what we can achieve when we work well as a team. I pay piece rate at the nursery. A bonus is given for production over the expected rate, which is divided among all the team members.

While we work hard, I think it important to also play together on occasion. We recently had a Labor Day Picnic at Imperial Nurseries. Our Vice-President of Farm Operations, Ed Sossaman, volunteered to sit in the dunking booth, as did several other managers. Ed was the most popular of course. It was great fun for the employees to have someone of authority join in the spirit of fun. We charged for the balls and donated the proceeds to the Katrina Hurricane effort. We also had a horseshoe competition, a flower arranging contest, and a watermelon-eating contest. Such activities build team spirit.

Every day the propagator is faced with the wonderful and still only slightly understood world of living things. It was my curiosity about the living plant world that attracted me in the first place, and it is that same curiosity that keeps me coming back day after day in the heat, cold, rain, and wind. I love the uncertainty. I love the continuing quest to understand and the reality that I will never totally unravel the mysteries that living plants present to me daily. I think we are very fortunate to have work that keeps us in tune the world around us. Virtual reality may be fine for some people, but personally I like the "Real World."