Cutting Propagation

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There are as many ways to propagate as there are people that propagate. It is important to find out what works best for you and use it. One thing is certain, if you don't stick cuttings, they won't root. The more that you stick, the more that will be successful. It is a numbers game, and you have to figure out if changing your process is worth the potential increase in success. The key is to stick a lot of cuttings. I have never had a problem with getting rid of excess plants, and sharing plants is a great way to meet people and make new friends.

I have been asked to share my methods for propagating. I have tried a lot of things that have ended up working for me and some that have not worked so well. I have talked with many people to explore their methods and learned what works for them and incorporated some of their methods into mine. A great deal of information is available on the Internet. Some is helpful, but most is not. The key is to sort through the information to find what is useful. One of the things that I do is to examine the information to see if it makes sense and see why it works or would improve my process. I have been amazed at what I have heard or read from plant people over the years about plant propagation. It ranges from moon phases to strange practices passed down from great granddad. Examine your process to see if it makes sense. I do not present this information to say that this is the best way and that other methods are inferior. These are simply a few things that I have learned or observed. Take from it what you can use. I am very open to discussion about my methods and to learn from others' experiences. The more information the better. The following is a collection of things that I have learned that you may find helpful.

Vernon Bush Method

Vernon Bush is an expert propagator of deciduous azaleas at the Huntsville (AL) Botanical Garden. I use Vernon's method of cutting propagation. He uses plastic storage boxes with clear lids for his propagation boxes. (See Photo 1.) The 66-quart size from Walmart works best for me. I can stick 70 deciduous azaleas, 80 elipidote rhododendrons, 120 evergreen azaleas, or 100 lepidote rhododendrons in each box. I won't go into his process because he has done an excellent job of explaining his method, both in his presentation at one of Azalea Chapter ARS meetings and in his written instructions. His system has many advantages and provides an inexpensive method that is effective, portable, and scalable. I use his system for all my cutting propagation, not just for deciduous azaleas. My recommendation to anyone is to follow his method before you make modifications. If Vernon says to mist the cuttings 3 times a day, then mist 3 times a day not 3 times a week. Don't make changes and then complain that his system doesn't work. However, I have made a few modifications to suit my needs that I will cover a little later.

Photo Dale Berrong

▲ Photo 1— Cutting boxes containing rhododendrons, camellias, and evergreen azaleas ready to be potted up.

Hard to Root Considerations

Some plants are harder to root than others and require additional consideration for success. I have investigated existing research and have accumulated some thoughts from my personal observations and experiences.

New growth—Plant growth is not a uniform and continuous process in woody plants. Growth usually is produced in flushes where rapid growth occurs and is followed by a period when that growth matures and hardens before another flush will occur. Some plants can have several flushes during the growing season. This information is helpful to know so that roots can develop, or graft unions can heal before the next flush of growth. If a flush of growth occurs before roots develop or the graft union knits, the new plant is doomed. The new flush doesn't have the infrastructure available to support its needs. Timing of cuttings or grafting should coincide with the time between flushes. Roots or graft unions need 6 to 8 weeks to form. New growth on new cuttings or grafts is not a welcome sign. New growth requires moisture and nutrients that must come through the roots or the graft union.

Producing roots is easy—Producing roots is a necessary first step to successful cutting propagation. A cutting must also have enough strength to feed new growth. Many cuttings fail because they don't have enough stored carbohydrates to support the next flush of growth.

Failure to break bud—Some deciduous plants, such as deciduous azaleas, will root but fail to break bud and start new growth the next spring. I have discarded thousands of cuttings with roots and healthy buds that simply would not start new growth in the spring. Why does this happen? My belief is that the plant has used all of its strength reserves producing roots and surviving during the rooting process and doesn't have anything left for the push to generate new

food producing growth. The cutting has starved to death.

Buildup of carbohydrates—Plants produce carbohydrates by photosynthesis and store it in plant tissues. This is the fuel that feeds new plant growth. The question is how do we get the new cutting to produce more carbohydrates before it goes dormant? The leaves that you left on the cutting will produce while they are still viable, but probably not enough to carry it through. New growth is required to produce new fuel-manufacturing leaves. Light in sufficient strength is required for the photosynthesis process. Lux of 1000 to 1300 is required for best production. A light color spectrum in the range of 6500K is best. Increasing photoperiod to 20 hours a day will also help. I have found that adding fertilizer and minerals to the water that I use to mist helps to encourage new growth.

Cultivar differences—Some cultivars root better than others. 'Aromi Sunrise' is easier to root than 'Aromi Radiant Red'. 'Admiral Semmes' is easier to root than 'Robert E. Lee'. That is why it is easier to find certain cultivars and other cultivars are always out of stock. When growers select new plants to introduce, they select not only the best flowers, foliage, growth habit, etc., but they must be easy to propagate. There is no need to introduce a new plant if you can't propagate it successfully. The old standard cultivars are easy to propagate, or they would not have become so common. A new selection or seedling may be a great plant but be difficult to propagate. My experience from taking cuttings in the wild is that there are great differences in success rates from cuttings from one plant to the next, even taken on the same day and stuck at the same time, prepared the same, and stuck in the same propagation box. Cuttings from one plant will root with almost 100% success, while cuttings from a plant just a few yards away will not root at all. Genetics definitely plays a part in determining which plants will generate new rooted plants and which ones will not.

Juvenility—Juvenility plays a role in rooting success rates. Cuttings taken from younger plants root better than those from older plants. Juvenility is not just an age: some parts of a plant are more juvenile than others. New growth closest to the root crown tends to be the most juvenile. You can see the differences if you look closely. American beech, *Fagus grandiflora*, will drop leaves from areas that are not juvenile in the fall, yet retain leaves through the winter on juvenile growth. Some growers will drastically cut back stock plants so that they will produce juvenile growth for cuttings. Juvenility certainly plays a part in the differences in success rates of cuttings taken from wild plants.

Many growers take cuttings from last year's plants to stick for this year to get the most juvenile cuttings. One of the reasons that tissue culture works so well is that plantlets are produced that are very juvenile and produce roots much more easily than older tissue. That is the same reason that stem cells are so valuable in bio research. One take-away is that very juvenile tissue roots very easily. In working around newly rooted cuttings, I occasionally knock off a new branch or shoot. Rather than waste the new growth, I will stick it, no matter how small or soft. I have had 100% success in rooting those cuttings no matter what time of year. I have thought about taking cuttings from newly rooted cuttings, but as of yet have not had the heart to do it.

Timing—Timing of taking cuttings can be critical for some hard-to-root plants. Usually we think of a particular date or range of dates, but the start of spring growth can vary greatly from year to year. Research that I found while I was trying to root *Magnolia* x 'Butterflies' had a better approach: The timing was expressed as weeks from bud break. Yellow flowered magnolias are difficult to root, and timing is critical for success. For 'Butterflies', the best time is between 5 and 7 weeks after bud break. Bud break can vary by weeks from year to year, and you could easily miss the window if you depended on a certain date. My success with 'Butterflies' increased significantly when I started sticking cuttings between 5 and 7 weeks after bud break.

I have taken *Kalmia* cuttings in June when the plants are flowering and had success, but it takes 6 months or more for roots to form. Last year I was given cuttings from a plant the first of December and found that the cuttings rooted in 4 to 6 weeks and new growth started in February. The new plants had three flushes of growth this summer, and now at just less than a year old are well branched and over a foot in height. All those cuttings were from the same wild plant. More research is needed to see if the same results can be achieved from different plants.

I believe that success with deciduous azaleas could be improved with more research on timing of taking cuttings. The research needs to examine the differences in species and extend to specific cultivars.

Basic Propagation Components

Rooting Medium—Rooting medium recipes are a balance between air space and moisture retention. It is important that the soil mixture drains well for most of the plants that we deal with. In general, harder-to-root cuttings require more air space to root successfully.

Peat Moss—Peat moss is excellent for moisture retention, but very low in air space and drainage. It is very low in harmful pathogens. Peat moss when dry, is very hard to wet. If a soil mixture high in peat moss is ever allowed to dry out, it is next to impossible to get wet again. When wet, it will not drain and can cause problems for the roots of most of the plants that we work with. I try to use as little peat moss as possible in my soil mixes. I never use peat moss in any mix that I am going to use in pots larger than four inches and never in the landscape. The soils that most of the plants that I grow need to have good drainage to prevent root diseases, and peat moss doesn't allow proper drainage.

Soil Conditioner, Nature's Helper®—Soil Conditioner or Nature's Helper® are some of the names that are used to market decomposing wood chips and other organic material in bags at big box stores. The EPA has created an industry for the disposal of plant waste from construction sites. In days gone by, the material would have been burned on site, but now must be dealt with without burning. The material is chipped up into small pieces and composted in a process that involves mixing with older material and turning on a regular

basis to prevent spontaneous combustion. After a time, it is bagged and sold in big box stores as a soil amendment. Decomposition is encouraged as part of the manufacturing process to break down the organic matter, but this allows bacteria, mold, and fungus to accumulate in the mix which actually assists in decomposition of wood chips. Yet the same bacteria and fungi may be detrimental for propagation soil mix. This material should not be used around seedlings or cuttings unless you put it through a process to sterilize it first. The only time that I have had problems with mold and fungus was when I used this soil conditioner in my rooting mix. There are much better choices for propagation soil mix.

Compost—Compost certainly has its uses around the garden but should be avoided around propagation. As in the above paragraph, the process of composting encourages growth of organisms that decompose organic matter. These organisms don't know the difference between your newly stuck cutting and a discarded weed; they will go about their job of decomposing organic matter. Keep compost away from your propagation.

Pine Bark—Pine bark is very different from wood chips and hardwood bark. The decomposition is different, as is the result of decomposition. The pine bark in this area is sourced from pine timber, which are healthy trees. The bark is stripped prior to the lumber sawing process in the sawmills. Many of the mills sort the bark by size of pieces and sell it as a byproduct of the lumber process. The pine bark that I use for soil mix is classified as pine bark fines and is composed of pieces that are about one inch and smaller. I screen the fines using a quarter-inch soil screen to remove the larger pieces to make it more uniform for small roots when I root cuttings or sow seeds. I use the pine bark fines as is without screening for three-inch and larger pots without adding any other components, just 100% pine bark fines. The pine bark is relatively free of harmful bacteria and fungus, provides air space, and retains moisture fairly well.

Perlite—Perlite is a naturally occurring amorphous volcanic glass. After expanding during the firing process, it is light weight, does not absorb much moisture, and drains very well. The coarse grade used for agricultural purposes is excellent for providing air space in soil mix. The standard mix is 50% perlite. In general, the harder a cutting is to root, the greater the percentage of perlite the soil mix needs. My standard is 50% perlite, but I increase it to 70% when I am rooting yellow flowered magnolias and other very hard to root species. I have heard of increasing this to 100% for some very hard to root plants. One word of caution is that perlite doesn't retain moisture, so you must increase the frequency of watering and or misting in mixes with high percentages of perlite to compensate for the lack of moisture retention.

Vermiculite—Vermiculite is a hydrous phyllosilicate mineral that is expanded by firing. Sometimes it is used in soil mixes and retains more moisture than perlite. I don't use it. I have found that over time it decomposes into fine particles and no longer provides the drainage and air space that it was intended to provide. It should not be used in any soil mix that is going to be used for more than several months. Seed starting is its best use. Some vermiculite has also been found to contain asbestos; just another reason to avoid using it.

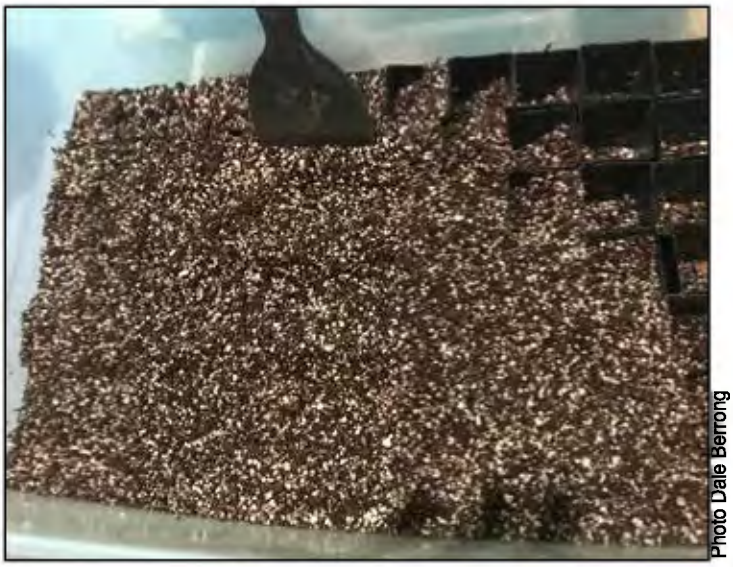

Photo Dale Berrong

▲ Photo 2—Preparation of cutting box for deciduous cuttings showing individual cells being filled with rooting medium.

Sand—There are many grades of sand that vary by grain size and shape. Very coarse sand or fine gravel, like aquarium gravel, can be used to provide air space. Other than for bonsai, I do not use it in soil mixes. In general, all sand does is add weight. I will pick a potted plant up to feel the weight to judge the moisture content of the soil to determine whether I need to water. Adding sand to the soil mix would make this determination more difficult. Plants in containers become heavy enough without adding unnecessary weight. Perlite provides the necessary air space without adding weight.

A standard mix of 50% peat moss and 50% perlite is suggested in many publications and is a good start for most propagation. My standard mix for deciduous azaleas and *Kalmia* is composed of 25% peat moss, 25% screened pine bark fines, and 50% perlite. I deviate from the standard mix of 50% peat moss and 50% perlite. Adding the screened pine bark fines increases the drainage and air space in the mixture and makes it much easier to add moisture if it dries out. I decrease the use of peat moss whenever I can.

For yellow flowered magnolias, I increase the ratio of perlite to 70% with good results. I should probably try this mix with the more difficult-to-root deciduous azaleas.

For easy-to-root evergreen azaleas and camellias, I have gone to 100% screened pine bark fines as my rooting mix and have had good results. (See Photo 2.)

Misting—Vernon Bush suggests misting about three t imes a day for the first six weeks after sticking. I follow his recommendation. I keep the tops on the boxes for the first six to eight weeks and continue to mist on this schedule for about four weeks after the tops are off. I will back off to once or twice a day from that point on. At first, I used a hand mister bottle that held 32 ounces. I have since moved to a one-gallon pump sprayer that has made the job much easier.

Fertilizing—A wise man once told me that fertilizer doesn't do you any good in the bag. That man was Earl

Sommerville, and I have heeded his words with very good results. I add a small amount of fertilizer and Epson salt (magnesium sulfate) to my mist water, and it has increased my success rates. I was never a fan of foliar feeding, but it is the only way that cuttings can intake nutrients and minerals until roots are formed. I started using it when I started rooting *Kalmia*, which can take six months or longer to grow roots. I don't know if the Epson salt does any good, but it does no harm. I use the same mix when I water seedlings as well. I think that having access to low levels of nutrients on a constant basis is better than being exposed to high levels on a periodic schedule. I experimented with increased amounts of fertilizer to see the plants' response. After all, I am an old hotrodder and our mantra was if a little is good, a lot has got to be better. I increased the amount of fertilizer until the new leaves started coming in yellow showing that I had gone too far. I watered the containers very heavily with plain water to flush the fertilizer out of the soil mix, and the problem went away with no permanent damage. It is essential that new growth is encouraged, especially with deciduous azalea cuttings, and higher rates of nutrients help with this.

Individual Cells–Variability in Growth Rates

One problem that I encountered with deciduous azalea was that some cuttings respond and grow better than others. Even though the cuttings are from the same plant, stuck in the same way, and in the same box, some will start growing sooner and will grow at a faster rate. This presents a problem when they are in the same box and some need to be removed and potted up and others need to be left undisturbed. To solve this problem, I have started creating individual cells within the cutting box. This allows me to remove individual cuttings to check roots, separate them based on growth, or pot them up, without disturbing adjacent cuttings.

Another change that I have made to the cutting boxes is that I no longer make holes in the side of the boxes. I found that the cuttings in the center of the boxes did just as well as the ones around the edges where the additional holes were. Now I only put holes in the bottom of the boxes.

Lighting

I had trouble finding a place to put my cutting boxes that got enough light yet was never in direct sunlight. Direct sunlight on the boxes, when they have the lids on during the first six to eight weeks, can increase the temperature inside the box enough to cook the cuttings. My solution was to move the boxes into my basement under lights. This had additional benefits of providing temperature control that allowed me to extend the growing season and increase the growth the first season. (See Photo 3.)

Background—My first experience trying to provide outdoor lighting indoors was in the mid-1960s. One of my first hobbies was saltwater tropical fish. This led to the desire to keep corals and other invertebrates in the aquariums. To keep corals and some other invertebrates alive, you need to duplicate the sunlight that hits a coral reef in the tropics. This is still difficult today, but in the 1960s it was close to impossible. I did learn a lot about sunlight though. For us, our advantage is that we are trying to duplicate partial shade in the subtropics which is much easier than full sun in the tropics.


Photo Dale Berrong

▲ Photo 3—Rooting deciduous cuttings spending first winter under lights.

Also, with the passage of time and the industry of recreational drugs, the technology has greatly improved, and the costs have reduced drastically.

Produce Carbohydrates ASAP—Our goal is to enable the cuttings to produce enough carbohydrates to replenish what was used when they were producing roots and to provide enough strength to make it through a dormancy period and push out new growth and leaves the first spring. This is best done by encouraging the new cuttings to push out new growth as soon as they have enough roots to support it. If new growth is not produced along with new food producing leaves, the cuttings will not have enough strength to break bud and push out new growth in the spring.

One of the keys is to provide enough light to the new cuttings without providing too much heat. Using natural light is best but be careful especially when there is a clear cover over them. Direct natural light will produce enough heat inside the box to cook the cuttings in a very short length of time. Shade cloth must be used if you are using natural light.

Deciduous azaleas need more light than most people think for vigorous growth. They will survive in heavy shade for years, but growth is very slow, and flowering may stop completely. Observing plants that are planted in different sites with different light levels will show you all that you need to know about the light levels that you need to provide your plants. In nature, compare the plants that are growing in deep shade with the ones that are growing on balds, on the edge of fields, or along roads where they can get several hours of direct sun. The ones in deep shade are waiting and hoping for the large trees that are shading them to die or get blown over to open a hole in the canopy so that light can come in to them. Most of them started life in a clearing or hole in the canopy that was later filled in as trees around them outgrew them and blocked their light.

Lumens/Lux—1000 to 1300 lux—The amount of light

that your plants receive is also a consideration. We are fortunate that most of the plants that we propagate grow well in part shade or dappled sun. I have found that 1000 to 1300 lux works well for most of the plants that I propagate. If you are growing plants that need full sun in the tropics, you will need to increase the lux that you provide. Lux is the measure of the strength of light and can be measured with a light meter. These were used in the olden days when cameras used film. You will need to adjust how close your light source is to your plants and the number of lights that you use to achieve your targeted amount of light. One note is that 20 hours at 500 lux does not equal 10 hours at 1000 lux. Plants need a certain minimum level of light to function properly. I have seen people try to root deciduous azaleas with light levels of 500 lux or less. At these low light levels, the cuttings may survive, but they do not prosper. The higher light levels are critical to produce new growth that will produce carbohydrates.

Photo Period—Photo period is another factor that should be considered. It is best to increase to length of light that the cuttings will receive to about 20 hours a day. Some people leave the lights on 24/7. I prefer to give them 4 hours of darkness. I have read that some plants need a period of darkness. I don't know if this is true. More work should be done to determine the optimum photo period. If you are using natural light, providing artificial light to increase the day length will improve the growth. One thing to consider is that lengthening the day length will not make up for light levels that are too low. Twenty hours of 500 lux light does not equal ten hours of 1000 lux light. The plants need certain light levels to produce proper growth.

Use of "Grow-lights"—Florescent lights are used to help replicate normal daylight. They are available in several sizes and efficiencies.

T12 florescent tubes. These 1-1/4-inch tubes that have been around since the 1950s and maybe before. They are not as efficient as the newer types and do not produce the lumens that are needed to produce the proper lux (lumens or light) levels, but they are still used.

T8 florescent tubes. These 1-inch tubes are newer in design than the T12 tubes. They are more efficient and produce more lumens than the T12 tubes.

T5 tubes. These are the newest florescent design, in 5/8-inch tubes. They are more efficient and produce more lumens, especially in T5HO form, than the previous designs.

Florescent tubes produce light in a 360-degree pattern and require reflectors to focus the light in the desired direction. Florescent tubes produce heat, with the newer designs producing less than the previous design.

LED Lighting—LED lighting is now available and has become much more cost effective. LED has an advantage that it is much more energy efficient than older forms of lighting. The cost per lumen is much lower than even florescent lighting. Another advantage is that LED produces very little

▼ Photo 4—Ten-week-old deciduous azalea cutting.

Photo Dale Berrong

▼ Photo 5—Ten-month-old deciduous cutting.

Photo Dale Berrong

heat and emits light in one direction in a 120-degree pattern, so no reflectors are necessary.

Color Temperature/Spectrum—We are trying to replicate natural light. Plants use certain wave lengths of light for photosynthesis. Trying to replicate these wave lengths with artificial light is a science in itself. Color temperature is a way to describe the appearance of light. It is measured in degrees of Kelvin from 1000 to 10,000. For our purposes, using light around 6500K is best for vegetative growth and florescent tubes and LED lights are available in this color spectrum. For reference, incandescent bulbs produce light around 2700K, cool white florescent around 3300K, daylight florescent around 5000K, and sunlight or bright white around 6500K. The color spectrum of the light does matter, and cool white florescent tubes at 3300K do not produce wavelength light necessary for healthy plant growth.

Light spectrum is important to consider when choosing artificial lighting. Lights that produce light of 6500K are about the best for plant growth. The spectrum of natural light changes throughout the day and time of year due to the amount of atmosphere that the light must pass through. Noon on the summer solstice produces light of 10,000K or more, while light near the winter solstice will be reduced to 3000K due to the angle of the sun and the increased atmosphere that the light must travel through. The same changes occur during the day as the angle of the sun changes. Light of 6500K is the best compromise to simulate natural light during the growing season. Cool white bulbs produce light of about 3300K, which simulates light in the fall of the year. These lights are readily available now due to the recreational drug industry. The pot growers use bulbs of 6500K during the growth phase of their crops and change the bulbs to 3300K to simulate the fall of the year to stimulate bud and flower development that enhances the crop. The lights are available in many different forms and the choices are increasing all the time. Although there are others that can be considered, the easiest and most common are florescent and LED. (See Photos 4 & 5.)

Leaf Lifespan

Deciduous plants have leaves with a short lifespan. The useful lifespan of a leaf is only about 6 months. The leaves are productive when young, producing food for the plant, but as the leaves age their productivity diminishes due to wear and tear. By the end of summer and early fall, those early leaves are barely producing any food for the plant at all. I mention this to emphasize the importance of encouraging new growth with new leaves as soon as possible to produce food for your new plant. The plant will store food in its tissues to be used to fuel the dormancy period and the required new growth that follows. By moving the new plants into a protected heated environment with artificial light, the growing period can be extended through the first winter. This will allow the plant to increase strength, and it will be well on its way the following spring. I have had deciduous azalea cuttings taken and stuck in June attain a height of 30 inches and a caliper of 3/8 inch by March, by having them indoors under lights during that first winter.

Dormancy Period—I have had people tell me that the plant must have a dormancy period the first winter. I have found that this is not true. The plants continue to grow during the winter and continue the following summer with no ill effects. Many are 36 inches tall, well branched, and ready to be put into the landscape at 18 months of age. Most are full of flower buds and will bloom by 24 months of age. Some even have a few flowers on growth from the first year at 12 months.

Rooting Hormone—I use rooting hormone when I stick cuttings. My hormone of choice is Hormodin. I use 1, 2, or 3 depending on what I am sticking. It is true that many plants will root without hormone, but the quality and quantity of roots produced is superior with hormone. IBA (indole-3-butyric acid) is the active ingredient in most rooting hormone that is a powder. The powder is talc and contains various amounts of IBA. Hormodin 1 and most basic rooting hormones contain 0.1% IBA. Hormodin 2 contains 0.3% IBA, and Hormodin 3 contains 0.8% IBA. Some of my research has indicated that levels of IBA as high as 1.6% or more could be helpful in rooting some of the very hard to root plants. I have added making batches of 1.2% and 1.6% concentrations to my to do list. Research has shown that liquid preparations such as Dip'N Grow can be more effective than hormones in talc. Research has also found that some plants are very susceptible to damage by alcohol which is the solvent used in most liquid hormone formulas. I have used both and have found that hormone in talc is much easier to use and seems to be quite effective for azaleas and rhododendrons.

Some people do not like to use hormones because some research has shown that hormones can migrate throughout the plant and sometimes may have an effect of inhibiting budbreak in the spring after dormancy. That is one reason to have deciduous azaleas avoid dormancy and continue to put on new growth during the first winter. This gives the plant more than 18 months for any residual hormone to dissipate before budbreak and after dormancy.

Rooting hormone has a shelf life of 2 to 3 years and should be replaced even though few of them are labeled with an expiration date. Both IBA and NAA (Napthaleneacetic acid), the active ingredients, are effective for only about 2 years according to the available research.

Basic Propagation Techniques/Considerations

Wounding—I double wound pretty much everything that I stick. I have tried with and without wounding and have found that rooting and subsequent growth is better with wounding. I tried doing half a rooting box of the same cultivar without wounding and the other half with wounding. The results were noticeable. The wounded cuttings were about 25% larger than the ones without wounding.

Sticking—I use a nail or dibble to make a hole in the rooting medium before I insert the cutting. I do this to avoid rubbing off the rooting hormone. I leave the terminal bud on the cutting unless it is very soft, and I use small scissors to remove the lower leaves rather than stripping them off. Stripping the leaves can damage buds under the leaf petioles.

I prefer to keep the petioles to help protect the new buds. The less damage to the new cutting the better.

I use a very sharp knife to cut the base of the cutting at a sharp angle and double-wound the cutting. I use an 8000 grit water stone to sharpen my knife. I want to cut rather than tear the plant tissue. The cuts are to expose the cambium layer inside the bark to the rooting hormone; the less damage to that tissue the better. Roots will form at the exposed cambium.

Mold and Fungus—I have read a great deal about problems with fungus that people have in their rooting beds. It seems to be a big problem for many people. I have never had a problem with fungus in my propagation containers with the one exception when I used bagged soil conditioner in my medium. It may just be dumb luck or the fact that I use higher light levels than most people. The higher light levels may discourage mold and fungus, I don't know for sure. Having less peat moss in my rooting medium may also help with the drainage around the roots.

Rooting Other Plants

Most of the above information relates to rooting deciduous azaleas. I thought that it might be helpful to cover other plants that I root. I hope that you find this information helpful.

Evergreen Azaleas—I stick evergreen azaleas during the summer when the new growth has firmed. I usually stick 120 to 150 per cutting box, depending on the size of the leaves. I take cuttings with 4 to 6 inches of terminal growth. I remove lower leaves with small scissors, cut the base at a sharp angle and double-wound. I use Hormodin 1. I mist several times a day and keep the lid on the box for about 6 weeks. I have gone to 100% screened pine bark fines as a rooting medium, but adding perlite works well. The cuttings are ready to be potted up in about 12 weeks but can be left in the box for longer. The cuttings need protection for the first winter. Sometimes I just leave them in the box over the winter and pot them up in the spring.

Elepidote Rhododendron—I stick big leaved rhododendrons in November and December. The reason that I wait so late is that if I take the cuttings in September or October, they grow so fast under the lights that they grow above the lights and outgrow the boxes before it is warm enough outside to pot them up and avoid frost. I take cuttings that are about 4 to 6 inches and only the ones with no flower buds. These cuttings have thinner stems and root better than ones with thicker stems. I remove lower leaves with scissors and cut the top leaves in half, due to their large size. I cut the base at a sharp angle and double-wound. I use Hormodin 3. I can put about 70 in a box. Sticking common named cultivars results in success in the 90%+ range. I stuck a box of 73 wild collected *R. catawbiense* last year and I only got 5 to take. The others were still green, just no roots. My conclusion is that named cultivars are not only selected for their appearance, but their ease of propagation. Rooting hormone containing higher concentrations of IBA may be helpful for the harder to root selections. I hope to try 1.2% and 1.6% concentrations.

Photo Dale Berrong

▲ Photo 6—Rhododendron at about 16 weeks after sticking, March 10. Still a month away from being able to pot up and move outside.

Lepidote Rhododendron—I stick lepidote rhododendrons mid-summer much like evergreen azaleas. Many of them bloom in the fall and have so many flower buds that occur even several nodes down from the tip that I leave them on when I stick them to avoid damaging vegetative buds. The cutting box is covered with blooms in the fall. I usually wait until spring to pot the cuttings up, and they bloom again that spring. (See Photo 6.)

Camellia—I stick camellias in late June when the new growth is beginning to firm up, just as it starts to turn from green to brown. I remove the lower leaves with scissors, and if the top leaves are large, I reduce them by as much as half. They will root using IBA at 0.1%, but the root quality will be better with Hormodin 2 or 3. I usually leave the cutting boxes outside under high shade during the summer being careful to see that they don't get direct sun until after the top is removed at about 6 to 8 weeks. I bring the boxes inside under lights in September. They must be protected during their first winter. I lost all of my first crop by potting them up in early fall and leaving them outside during the winter. I now overwinter them inside the first winter and pot them up in the spring.

Photo Dale Berrong

▲ Photo 7—Eighteen-month-old deciduous cutting ready to be planted into the landscape.

Kalmia—My first experience with rooting Kalmia was with cuttings that I took in late June while the wild plants were in full bloom. I was told that you can't root Kalmia and I was wasting my time. The cuttings were firm, but still young. I stuck the cuttings in the same manner as deciduous azalea cuttings. The cuttings did not start to root until December, started to put out new growth during the winter, and were ready to pot up in June. I took cuttings of named cultivars in late June of that year and had the same results on the second try. I had a friend send me cuttings of a wild selection on December first, so I tried that one, thinking that it was probably a waste of time. To my surprise, the December cuttings rooted within 6 weeks, started new growth in 8 weeks, and were ready to be potted up in April. The cuttings put on three flushes of growth during the first season and were almost a foot tall at 12 months. I am now trying more December cuttings from other selections to see if I can duplicate the results.

There are several take-aways from that story. One is that it appears that you can root Kalmia most any time of the year. The second is that you should take cuttings when you can get them. The third is that you can't always believe what people tell you, and that you need to try for yourself.

Conclusion

I am sure that this information is nothing new to the commercial growers and some of my methods may not be cost effective for people that make a living propagating plants. Heated and well-lighted greenhouses are expensive, and the growers that need to produce thousands of marketable plants probably can't cost-justify the added expense and labor to implement some of these methods. I am a hobbyist and don't need to cost-justify my basement or my time. People already think I'm crazy, so I don't need to worry about the PR impact of my actions.

These are a few things that I have learned over the years from working with my plants, learning from others, reading on the subject, and searching the Internet. I have never had formal training on these subjects. I may have misinterpreted some of the information and have some of it just plain wrong. I am interested in learning more and am sure that there are many among the readers that have more information and might be willing to share and have open discussions on some of these topics. I would like to suggest that we have round table discussions on some of these topics or better yet, meet over drinks and share our war stories and experiences. (See Photo 7.)

Dale Berrong has been a member of the ASA since 2016 in the Central Carolinas Chapter. He was elected as a national ASA Board of Directors member in 2019. He is a past president of The Maple Society, North American Branch, and is vice-president of the Azalea Chapter/ARS. He gardens in USDA Zone 8a.