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CHAIRMAN CHADWICK: I am going to ask that you hold questions until we have had the practical slant on this matter of handling hardwood cuttings. Without further delay, I want to call on Louis Vanderbrook for his discussion of handling of hardwood cuttings.

MR. LOUIS VANDERBROOK (Manchester, Conn.) presented his paper, entitled "Hardwood Cuttings of Deciduous Shrubs." (Applause)

Hardwood Cuttings of Deciduous Shrubs

LOUIS C. VANDERBROOK

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In the propagation of deciduous shrubs from hardwood cuttings one of the first things we have to consider is that we are dealing with living organisms, and care must be taken in all our procedures to prevent death or losses. It therefore becomes necessary that we carefully select our cutting wood from healthy plants and only when it is in a ripened or good condition. In our nursery we have established stock blocks of most all the varieties which we propagate and in time will have every variety included in the stock blocks.

We usually cut our wood in the late fall after we have had sufficient frost to thoroughly ripen the wood. It is then brought into the warehouse and kept in a moist, cold part of the building until we are ready to start making the cuttings.

Cuttings which are going to be planted in the field outdoors in the spring are made up in eight inch lengths, starting about February 1st after we have finished our other winter work, tied in bundles of approximately 100 and then placed butts downward in boxes deep enough to accommodate the entire length of the cuttings. We use either moist peat moss or other packing material on the bottoms and around the bundles of cuttings.

The boxes of cuttings are then stored in the cold part of the ware-

house, placed one upon the top of the other with 2 x 4 inch blocks between the boxes to allow some air circulation and light. In the spring, when the land is ready for planting, we take the boxes of cuttings, just as they were packed during the winter, out to the field and plant directly from the boxes.

The varieties which we grow in this manner include *Forsythia*, *Spiraea*, *Cornus*, *Symphoricarpus*, *Lonicera*, *Ligustrum*, *Deutzia*, *Philadelphus*, *Weigelia* and the general run of varieties which root easily outdoors.

This procedure or method which I have outlined most nurserymen are conversant with, and use for reproducing deciduous shrubs.

About twenty-five years ago we decided to experiment with hardwood cuttings in the greenhouse during the winter months to see if the production of certain hardwood deciduous varieties, which did not root too well planted outdoors, could be increased or improved upon.

One of these varieties was Amur River Privet, which planted outdoors in the spring, did not always produce sufficient percentages of plants to satisfy us. When we grew these in the greenhouse, the results were very satisfactory, netting practically 100% after several angles of propagating had been solved.

The wood for this greenhouse growing is cut at the same time and in the same manner as our other hardwoods. But when it is in the warehouse, we store this wood tied in bundles, but set the bundles with their butts or bottoms on the moist dirt floor until ready to make them up.

The next step is to fit and prepare the greenhouses. For this type of growing we have used by the low propagating houses and the higher forcing or growing houses, and either type works equally well.

The benches are built so that they will hold at least eight inches of sharp, clean sand of the concrete grade. This is leveled off with a board so the bench is full to the top, and then the sand is lightly watered and pounded down firm, using a building brick. After pounding, the sand is again watered lightly and is ready for planting or dibbling.

We have started the winter propagating of these cuttings February 1st and even March 1st after completing our other winter work, and they have done equally well regardless of time started. If it were possible, we would even make and plant them in January, but we are usually not through with the other work of trimming, planting stock, etc.

These cuttings are made different than the field grown type, which is eight inches. The greenhouse cuttings we make only about 3½ inches long, as this is sufficient length, and we thereby get double the amount of new plants from the wood as we do by the other method.

Now we come to a critical step in the procedure. As these cuttings have been stored in a cold moist warehouse and with possibly some old dead foliage on the wood which frost did not entirely remove during the fall, or the wood may have been exposed to old moss spores or fungi which may be present in the warehouse, we take these 3½" cuttings after they have been made up, place them in a coarse screen and wash them with cold water under the strongest force of pressure which we can get with a hose to wash them clean of all possible fungi.

They are then laid in flats inside a wet piece of burlap and placed in the cold warehouse while waiting for the dibblers in the greenhouse to plant them in the sand. The dibblers take the flats of cuttings into the greenhouse, keeping them covered with the wet burlap until planting them.

The cuttings are planted in a trench, made with a trowel which has been flattened out with a hammer, and all but the top one-half inch of the cutting is shoved down in the sand.

As each row of cuttings are planted, they are pounded down tight with a piece of 2 x 2 inch hard lumber, the pounding being done with hammers. The next row is then marked off two inches from the last with the trowel and the process repeated until all benches are filled.

The fresh planted cuttings are flooded down with a coarse nozzle until all sand is washed level. From then on the cuttings are not watered for at least one week. The greenhouse vents are kept closed and a temperature of 55 degrees Fahrenheit or better is maintained. As soon as the cuttings leaf out, they are watered lightly and the vents are opened to air the house and plants during the daytime. During cold weather all vents are closed at night to prevent too sharp a temperature drop.

At this stage the propagator has to use extreme care not to water too much, or mold or fungi will start damping off the foliage and the crop will be ruined.

Also, if the weather is clear and there is bright sunshine, the glass must be shaded by using either lime, kemtone or some other method of shading. We use a Paragon pressure sprayer and spray our glass with hot lime as needed for shade. True, snow storms will accumulate on the glass and as the snow melts and slides off the greenhouse, some lime will come off the glass also, but with the spray method of application it does not take long to shade the glass as desired.

About three weeks from the time the cuttings were planted they will begin to form callus and start to root. At this time the ventilation should be increased to about 50% of total, and the watering can be stepped up slightly, however it is still very necessary to watch for damping off.

The most difficult time to control the cuttings and prevent mold or damping off is during the month of March, when practically the entire month may be cloudy weather with very high humidity and not much breeze to give air circulation.

While propagating this type of crop, the greenhouses and cuttings should be checked twice daily to prevent anything getting out of control.

By the middle of April most all varieties will be well rooted and maximum ventilation should be put on and watering cut down or watched very carefully. Temperatures are kept at 55 degrees Fahrenheit at least at all times during the growing of the crop, until planted.

In New England we never plant these soft topped cuttings until after Decoration Day and all danger of freezing temperatures has passed. When ready to plant, the cuttings are lifted from the greenhouse benches and placed upright in boxes with the roots in moist sand. The boxes

transported out to the fields and the cuttings are planted immediately. The ground is well firmed.

This year we sprayed all cuttings in the greenhouse before lifting from the benches with Wiltpruf to prevent any wilting or sun scald, when planted out. This spray paid off in less loss after planting from sun scald or hot weather, and we shall continue this practice in the future.

Now a few words about hormones or root inducing powders on the hardwood cuttings in the greenhouse. We have experimented with many types and strengths and have found that the use of such powders will severely burn and rot the bottoms of the cuttings and very seriously reduce the number of plants callusing and rooting.

This does not mean that we have stopped experimenting, as we run experiments of all kinds all the time. Some of them cost us money, others save us money, but we continually learn something new every year.

Some varieties of shrubs which will not root by this method are: *Forsythia suspensa*, *Rhodotypus kerroides*, *Weigelia*, *Spiraea van houttei*, Hybrid Lilac, *Spiraea prunifolia*, and *Kolkwitzia amabilis*. We have tried all these many times but they do not root enough to pay commercially, so these varieties we root in the summer from soft wood cuttings, pot them up in September and carry them over the winter in cold frames under sash covered with reed mats to prevent alternate freezing and thawing, which would cause heaving out of the pots.

Some of the varieties which we do root successfully from hardwoods in the greenhouse include Almond Pink, Almond White, *Philadelphus virginialis*, *Kerria japonica*, *Spiraea Anthony Waterer*, *Ligustrum amurense*, *Ligustrum obtusifolium regelianum*, *Syringa persica*, and *Symphoricarpos racemosus*.

Whenever our production on other varieties drops, due to losses from drought or other causes, we also put these short supply items in the greenhouse because, as mentioned before, with a cutting only 3½ inches long we get twice the yield from the same amount of cutting wood as would be obtained by rooting from eight inch cuttings in the field planting in the spring.

We have tried other rooting mediums than sand, including vermiculite and several others, but have rejected them all in favor of clean sand, as we find we have less trouble with rot or damping off with sand than any other medium. Vermiculite and many other mediums hold too much water too long and cause too much rot. Also, they cannot be firmed as tightly as sand. One thing I have tried on these cuttings and found to be beneficial at times is sulphur dust. I tried sulphur dust on some of the cuttings and found that it made a difference of 50 per cent in the stand.

Someone may ask why do we require benches deep enough to hold eight inches of sand when we use only a 3-½ inch cutting. The answer is we like plenty of medium below our cuttings to induce good rooting. Also, in the summer we use the same greenhouses and the same sand for the second crop to root our soft wood cuttings, which are made longer than the hardwood type. Our softwood cuttings are made six inches or

longer, depending upon the varieties and the type of wood, whether it is long or close jointed between leaves.

We clean out the sand in all our greenhouses once each year—in the fall after removing all softwood propagation—and refill with new clean sand. Thus we get two crops per year from each greenhouse and still have some time for repairs, painting and general upkeep.

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CHAIRMAN CHADWICK: Thank you, Louie, for that very fine and concise report.

MR. JOHN B. ROLLER (Verhalen Nursery Co., Scottsville, Texas): I would like to ask Mr. Vanderbrook if he has ever tried using hormones on the base of the cuttings and then storing the cuttings with the butts up, packed in some material like moist sawdust?

MR. VANDERBROOK: No, we have never done that. I have put the hormones on them, stored them horizontally, and in such materials as sphagnum, peat moss, sawdust, and shavings. None of the methods in which we have ever used hormones gave us anything but negative results. I have never tried storing them upside down.

MR. ROLLER: With *Wisteria*, which is one of the main hardwood cuttings we make, we incorporate the hormones in the regular clay mud, as we do all our cuttings, put it on the base of the cuttings, and store them with the butts up and covered with wet sawdust. If we don't get them in the ground in about six weeks, part of them are already rooted.

MR. VANDERBROOK: One other observation I would like to make is that years ago the thought used to be that all hardwood cuttings had to be stored so they would be callused and rooted when they went out in the field. We don't want our hardwood cuttings rooted before we plant them in the field.

MR. ROBERT J. FRANTZ (Niles, Michigan): I didn't quite understand the application of sulphur.

MR. VANDERBROOK: The sulphur dust is used exactly the same as any hormone powder. Take moist cuttings, shake off the surplus moisture, and plunge the base of the cutting into the sulphur in the same manner as treating with a hormone.

DR. L. BAUMGARTNER (Baumlanda Horticultural Research Laboratory, Croton Falls, N.Y.): I would like to comment on the sulphur treatment from the point of view of safety. I am always concerned when I think of people using some of these things that are rather dangerous, such as sulphuric acid. Sulphuric acid for the control of the pH of the rooting medium can be extremely serious material if an accident happens, and it is possible to use this same procedure that was mentioned for treating cuttings for the control of the pH of the rooting medium because sulphur in the presence of water will form sulphuric acid, but it does so at a slow rate. It is safe to handle and is not too difficult on the

plants. I believe it would be a lot better from the stand point of safety of the workmen if you dispensed with the use of concentrated or even dilute sulphuric acid and used sulphur instead.

MR. CARL KERN (Wyoming Nurseries, Cincinnati, Ohio): I just heard a remark made about the storing of hardwood cuttings in an upside down position. I want to report this practice was first advocated in the early 1800's by Steven Albrecht, of Zurich, Switzerland. I have also seen this practice used in France and Germany. We prefer to store our cuttings out of doors in trenches. We store our cuttings upside down. The cut ends are near the surface. That again relates itself to matters of temperature and air. We find we get a much better callusing action. At the same time it will retard the bud growth because the buds are down where it is cooler. It has always been my practice to retard the bud growth as much as possible and encourage callusing as quickly as possible.

In regard to the early bud-breaking varieties, such as *Lonicera fragrantissima*, we make the cuttings and plant them in open field rows as soon as possible. In storing cuttings in boxes filled with peat moss or sawdust, often a large number of cuttings are lost, especially those with thin bark. You get rot in the boxes where there is an exclusion of air. I may remind you of the tremendous number of cuttings we have made. We have made millions of cuttings of Paradise apple and of multiflora rose. The success in rooting these cuttings by handling them in an upside down position is a very, very advantageous procedure.

CHAIRMAN CHADWICK: Carl has proposed a question and answered it himself. I am familiar, of course, with the old practice of storing cuttings upside down and outside. Personally, our thinking in this matter is exactly the same. We are after the same end and we are after good management and the proper regulation of temperature, oxygen, and moisture. I still feel that we can do a better job under controlled conditions inside than can be done outside.

MR. VANDERBROOK: I would like to mention that, with the possible exception of California privet, the way we store cuttings in boxes we don't have any rot or fungus.

MR. KERN: Do you have trouble with *Weigelia*?

MR. VANDERBROOK: No we do not.

MR. JACK SIEBENTHALER (The Siebenthaler Co., Dayton 5, Ohio): My question concerns the planting of hardwood cuttings in the fall. If they are stuck in the ground, what is the best method of preventing heaving?

CHAIRMAN CHADWICK: We follow the practice of making the cuttings from eight to ten inches long. They are set in a well drained sandy soil, planted deep so that only an inch or so of the cutting is above the surface. Under these conditions we do not have any trouble of heaving. I think there might be some trouble in heavier soils, however. Has any-

one had any experience of putting the cuttings out in the fall and mulching to prevent heaving?

MR. RICHARD FILLMORE (Shenandoah Nurseries, Shenandoah, Iowa): It is a common practice in the Shenandoah Nurseries to leave the top exposed for an inch or so and to ridge the rows of cuttings. In the spring, the ridge is pulled away with rakes. Whether it is a real good cultural practice or not, I don't know, but they have been doing it for a long time.

MR. KERN: I might say that is a similar procedure to what we follow. Sometimes we use a ridge of sawdust. Ordinarily we just cover them with soil. We have very little trouble with heaving.

CHAIRMAN CHADWICK. I think that there are a lot of other questions which might be asked, however it is essential that we close this panel so that the business meeting may be held. Thank you very much for your interest and participation.