

MR. METZLER: I would like to know a little more about the storage. You put the cuttings in the box upside down. How are you going to keep the temperature at 28 or 32?

MR. BLYTHE: We have automatic fans and thermostatic control and when the temperature comes down at night the fans let cold air in. When it warms up in the daytime, the fans shut off. That helps keep the storage temperatures. The fans cool it down again at night. It is insulated. It is just controlling the temperature with an automatic thermostat.

MR. VAN HOF: We store our hardwood cuttings in a homemade cold storage. We are kind of sloppy propagators. When we do put our bundles upside down - the bundles upside down means when you get a layer of peat, or whatever you use - it touches all the bottom and that, of course, will give you a callus formation. I think the main thing is to get your cuttings out in time. Stick them as deep as possible and see that the ground is pressed down firmly so there are no air pockets.

MR. BLYTHE: In planting we rotohoe the ground and push in the cuttings to a depth of about six inches.

MR. DOUGLAS BUTLER (Rosehall Nurseries, Brantford, Ontario): What kind of sawdust do you use?

MR. BLYTHE: It is a mixed sawdust from a small sawmill. It is a new elm hardwood. There is a sample in the other room.

MODERATOR COGGESHALL: I am sorry, but I must interrupt now, if you have additional questions you can see Mr. Blythe later.

I have saved our last speaker for a very definite reason. He is Mr. A. M. Shammarello, of Shammarello & Sons, South Euclid, Ohio. In corresponding with him, he indicated a hesitancy to come before you this evening to speak, due to the fact that results he has obtained from year to year have not been consistent. However, certainly the subject he is to speak on has been worked on by a great many of you in the audience and he may possibly get a solution here to some of his problems. Mr. Shammarello will speak on the "Propagation of Rhododendrons by Stem Cuttings".

PROPAGATION OF RHODODENDRONS BY STEM CUTTINGS

A. M. SHAMMARELLO

Shammarello & Sons, South Euclid, Ohio

Ladies and gentlemen: The questionnaire we received this summer asked us to check plants we would be most interested in hearing someone talk about. I checked rhododendrons. Little did I realize at the time that I would be asked to tell you how to propagate rhododendrons by stem cuttings. I had hoped that some successful propagator would enlighten us on the subject. I am seeking information and I am sorry to say I do not have much to contribute.

However, I will tell you of my experiences and hope to stimulate some interest and thereby obtain more information from the audience.

I have propagated rhododendrons by leaf-bud cuttings and by stem cuttings for the past 15 years. My results have been inconsistent from year to year. Some years I have rooted them easily and on hard varieties had 90 per cent. Some years I only got 10 per cent to root. Therefore, it is quite evident that the conditions and the methods used were not the same. Something was wrong.

We know that some varieties root easier than others, but I have discovered that timing, condition of cutting, hormones, media, and after care, each play an important part.

Timing is important, depending whether the cuttings are to be rooted in a cold frame, or a greenhouse. I suggest the latter part of July for cold frames and the early part of September to late December for the greenhouse. I have used both.

Condition of cutting is of utmost importance. That is, cuttings should be in a healthy, turgid condition. The size of a pencil thickness is just about right. A large cutting or very weak thin cutting are not good.

Hormones without a doubt aid in rooting. Hormodin No. 3 or one per cent indolebutyric acid both tend to be of some value.

The way I am situated, I use a sashhouse with no heat for summer propagating. I remove the sashes and cover with a No. 8 burlap. On the bottom of the frame I place a 3/8 inch screen and on this screen one inch of gravel and two inches of media, composed of one part of No. 7 silica sand, one part of a coarser sand and one part of moss culled or otherwise, all mixed together. Over this mixture I lay an electric cable about 3 to 4 inches apart, and finish filling the frame by adding 3 or more inches of the same mixture of sand, coarse sand and peat moss. I then cover the frames with sash. Now, for the propagations of the cuttings, I usually take my cuttings in the early morning, place them in a bushel basket covered with wet newspapers, and put them in a damp cool cellar until I am ready to make the cuttings. In making the cuttings, I leave three medium-sized leaves. If they are large, I cut those leaves back, and make the cuttings two and a quarter to two and a half inches long, with the wound on the side say an inch to inch and a quarter long. I then dip them in indolebutyric acid.

I use a pencil to make my holes in the media so that I don't rub off my powder. Then, I press them down slightly and thereafter I water them thoroughly until the water runs from underneath the benches. We do not water them that heavily again.

Thereafter, I sweat the sashes each morning and syringe with a fine spray. Again, I syringe about 10:00 o'clock and cover the sash with a cloth. About 1:00 o'clock they are once more syringed with the cloth being removed about 6:00 o'clock in the evening. My burlap is coarse enough so that I'd get light during cloudy days. Therefore, on sunny days I must cover those cuttings, or otherwise they will just burn up.

Cuttings are sprayed about every two weeks with Fermate and the electric cable is turned on the first part of November. Now this is my general procedure until the first part of December, and at this time the cuttings

that have rooted are potted and the cuttings that are not rooted are placed in a frame in my greenhouse and many more will root.

The potted plants are kept in a cool greenhouse until June first, and thereafter planted in beds under an irrigation system.

I hope this brief outline has been of some interest. (Applause)

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MODERATOR COGGESHALL: What is the temperature of the media?

MR. SHAMMARELLO: I would say around 65 to 70.

MODERATOR COGGESHALL: You only water the cuttings in; you don't pound them down?

MR. SHAMMARELLO: No, sir, I wouldn't pound them down.

MR. VAN HOF: What do you mean by thin cutting?

MR. SHAMMARELLO: A cutting about a pencil thickness, I think that has enough sap in it and is hard and healthy. I have never had any luck with a cutting half the size of a pencil with deformed leaves or a cutting as large as my thumb.

MR. VAN HOF: Which are the easiest ones to root?

MR. SHAMMARELLO: *R. roseum elegans* I believe is the easiest, also *Boule De Neige* and *R. Catawbiense album*.

MR. WELLS: I hesitate to say anything on this. I take issue with Mr. Shammarello on one or two points. I think I can best point these out, if I can take a few moments and run through the sequence of events, as I understand them.

I don't agree with his remarks about small cuttings. Jack Blauw will collaborate that we set out to produce small cuttings by pinching the stock plants after the first growth had been made following flowering. In other words, the stock plants grew the first growth in May and June. We pinched out the terminal bud. We got three or four shoots coming from the apex of the first growth. They were relatively small, certainly much less than pencil thickness, one half or one-third pencil thickness and we found such cuttings rooted much more readily. The timing was thrown back further into the winter, because the shoots had to develop from dormant buds, thus they had to go through their period of growth and be sufficiently ripe to take.

We found that the optimum time was from the end of September through October and November and with the easier rooted varieties even in December, and January. I also think we rooted some in February. Small cuttings reduced to 3 or 4 leaves. The mixture we found to be best was 90 or 95 per cent peat with very little sand, a heavy wound on most varieties and a quite strong hormone. The easy rhododendrons were treated with Hormodin No. 3. The less easy varieties were treated with 2 per cent indolebutyric acid, and the more difficult, such as Dr. Dresselhuys with 2, 4, 5-trichlorophenoxypropionic acid. Considerable time was necessary to root the more difficult varieties, such as Dr. Dresselhuys. We have put cuttings of those in during October and did not get good rooting until the following March.

One other factor that I think enters into production of a good plant with which I disagree with Mr. Shammarello, is the time of planting the rooted cuttings. We followed out his procedure of potting them as soon as rooted. We found it advantageous to pinch the terminal bud from the cutting at time of potting. That induced side buds to develop throughout the winter. The plants were apparently dormant in the cold frames where they spent the remainder of the winter.

At the time the ground was fit to use in the spring, these terminal buds had developed. If we delayed pinching until we planted them out, we lost three weeks or maybe longer while the buds were developing and getting ready to grow. We like to plant those potted cuttings with a little fat bud at the top, as early as possible in the spring. If we delayed planting for two or three weeks because of the weather, we could see a difference in the growth of those plants for the following two years. The earlier they were planted the better they grew.

One final point: we found that humidication, or the use of a mist system in the greenhouses, was the greatest single help that we had in successful rooting. We rooted quite a lot of varieties, and as Mr. Shammarello said, our percentages varied from year to year, but on some of the more difficult ones I think that new Jack Blauw has obtained 75 or 80 per cent.

MR. SHAMMARELLO: We make just one cutting out of each branch, just below the node. I don't think it makes so much difference. I always believed you had to have good drainage and oxygen in your sweat box in order for those rhododendron to make roots. A friend of mine in Brookville, Pennsylvania, is using a frame called an "airing frame." There they built a box. It is all wood in the bottom as tight as can be, and in this wood he put in 3 or 4 inches of plain peat moss and then a mixture of half peat moss and half sand, on top another inch or half inch of sand. You flood those frames until the water rises a half inch above the sand. A couple of days later you insert those cuttings. Again you flood the frame until the water again rises a quarter to a half inch over the bottom of the sand but not over the leaves. You do that once every week.

MR. STROOMBEEK: I wanted to ask Mr. Wells a question about *Dresselbuys*. Do you put it in in October and leave it in the same peat until March? I have had the experience that in about three months the peat seems to be decomposed and loses its strength. What do you think?

MR. WELLS: Yes, it does.

MR. JACK BLAUW: I would like to answer his question too. I believe in high humidity, but I disagree with Jim Wells in that you can have high humidity without using the fogline on top of the rhododendron cuttings. I set up an experiment this summer with cuttings. This is the way we did it. About two inches of coarse gravel is placed on the screen. On top of that we had a mixture of 75 per cent peat moss and 25 per cent sharp silica sand. We had one bench filled with rhododendron cuttings. The bench next to us was completely empty. Over this empty bench we had a fogline and after we watered the cuttings in very heavily we didn't water the cuttings at all. We just used the mistline on top of the empty bench to keep the humidity

high. The humidity was maintained close to 100 per cent by turning the water on the empty bench. We kept the humidity high by covering the whole greenhouse with Polyethylene. In that way, we were able to keep the rhododendrons wet all the time without watering them with the fogline on top of the rhododendrons.

I believe it is very important not to pour water on the cuttings because rhododendrons especially don't like a high pH. As we all know, the pH of peat moss is around 4 or 4-1/2. In South Jersey where I am working, the pH of the water is about 6 or 6-1/2. By pouring all the water on top of the peat moss you are bound to raise the pH and I have found that by using other means of keeping the humidity high we have better results.

MR. SHAMMARELLO: I don't understand, where do you have the polyethylene?

MR. BLAUW: We have a rather low greenhouse, about 10 feet high and we cover the whole house from one end to the other.

MR. SHAMMARELLO: On the inside?

MR. BLAUW: On the outside, over the entire houses.

MR. BLAUW: We made our cuttings in September and the cuttings rooted close to 100 per cent.

MODERATOR COGGESHALL: There is one other thing. In talking with you previously Jack, you mentioned the advantage of polyethylene as a fuel saver.

MR. BLAUW: After we put the plastic on there, the temperature rose about 10 degrees, so we had to cut the thermostat down. I think by using polyethylene, which is not too expensive, you save on your fuel.

MR. CHARLES HESS, Jr.: There is a man near Jack's place in North Jersey by the name of Nippenburg, who has been causing the nurserymen in the area quite a bit of concern. He has a hobby of growing red rhododendrons of the more difficult varieties and he has worked out a system which is incorporating several of these ideas.

First, he constructs his beds of concrete and he puts copper tubing in the base of them and uses a type of radiant heat. On top of the bed in which the tubing is placed, he puts a layer of about two feet of cinders and on top of that he puts his layer of sand and on top of that he puts a layer of sand and peat in which the cuttings are inserted.

Before he inserts the cuttings, the medium is really saturated. Then the cuttings are inserted. It is a small and tight house. The radiant heat under the cinders causes the water to evaporate and it condenses to a certain extent on the upper part of the greenhouse and falls down on the medium again. That is the only water those cuttings are given.

He also sticks the cuttings in November and takes them out in March. By using this method, he has had very consistent results.

MR. HARVEY GRAY: Three years ago, on Long Island, Mr. O'Hagan started with a few rooted cuttings. At the present time, he has in a

greenhouse of his own construction something like 10,000 rhododendron cuttings. He has over 10,000 one- and two-year old plants in the field.

As I sat and listened to this discussion having to do with the media, I hear: wet the media, don't wet the media, dry it out, or don't dry it out. When Dr. Chadwick wrote his book he emphasized very nicely the one element that most of us are apt to play down a little bit, and that is the subject of oxygen.

Now, oxygen, I think, is one of the most important things in getting plant growth, particularly in the callusing and rooting of cuttings. Whether we soak that media, or we don't soak it, let's not forget it is oxygen we are looking for and to root anything successfully that is what we need - oxygen.

MR. CHARLES HESS, Jr.: For one thing, I do appreciate the importance of oxygen but I do not think it is that critical. Even under constant mist, as we had it in the greenhouses this year and last year, we had no trouble at all from lack of oxygen. We think that the main trouble was the temperature was too low.

To back this up a little bit, the year before last, Sidney Waxman, a graduate student at Cornell had a series of studies trying to find out just what amounts of oxygen were needed. I believe about 10 per cent was the critical point. There is 20 per cent oxygen in the air. In other words, if you have half of what is potentially available, you still will have enough.

Now whether this constant mist passing through the air is picking up oxygen, not dissolving it, and pulling it through, I can say. In our experience we have had no trouble with constant mist as far as causing trouble along oxygen lines. We will have more to say on why you should use mist tomorrow.

MODERATOR COGGESHALL: Sorry, gentlemen. I must cut this short, or we will go on all night. You have a whole morning devoted to mist.

I would like at this time to terminate this symposium, to thank each participant, and to turn the meeting back to Dr. Chadwick. (Applause)

PRESIDENT CHADWICK: Thanks, Roger, for conducting a very fine session this afternoon and also this evening. I would also like to thank all the others who have been on the program during the day.

The session recessed at 10:30 o'clock.

Panel on *Taxus* Propagation

FRIDAY MORNING SESSION

December 3, 1954

The session convened at 9:30 o'clock, President Chadwick opening the session.

PRESIDENT CHADWICK: As the result of the survey that was sent out regarding the program this year, one of the topics most frequently specified was *Taxus*. The decision was reached that perhaps we would go a little bit further than simple propagation in one sense of the word, at least, on this group of plants, and carry on through to at least the first stages of field production. Consequently, the program has been set up in that way and it is going to start from the beginning and go on through field production, covering seeds and cuttings and other methods of plant propagation.

The moderator in charge of the session this morning is Professor Ray Keen, Department of Horticulture at Kansas State College.

If you want to know anything about identification of *Taxus*, see Ray. Don't talk to me. I am just the guy who tells him what to do, but Ray is going to head up this session, and I am sure you are going to be interested in it. We hope we will have as good a discussion following the papers as we did yesterday. So I will introduce Ray Keen at this time.

Mr. Ray A. Keen took the chair.

MODERATOR KEEN: Thank you, Dr. Chadwick.

Mr. President, and fellow propagators: It is really a pleasure for me to come before you this morning and present this review of the propagation of *Taxus*. Chad, I am very glad that I can run back and forth between Kansas State and Ohio State, because, had I been at Ohio State, I am sure I would have closer to 1,000 papers to review than 100. Even though we live far beyond the range where *taxus* grows, commercially at least, we had a goodly number of papers to choose from in presenting this paper.

Mr. Keen presented his paper, entitled "The Propagation of *Taxus* — A Review." (Applause)

THE PROPAGATION OF *TAXUS* — A REVIEW

RAY A. KEEN

Department of Horticulture, Kansas State College

Taxus are commonly propagated by seeds and cuttings, a few varieties by grafting, and occasionally an amateur will propagate a plant by layering.

Seeds are used to propagate the species of yew and are preferred by many growers, according to Wells (34) and others (12, 21, 28), for producing the excurrent "capitata" form of the Japanese Yew, *T. cuspidata*. Hatfield (12) and Wells (34) have pointed out that the source of seed is impor-