CHAIRMAN STEAVENSON: Thank you for your observation. They are propagating a lot of ginkgos out there on the West Coast. Somebody ought to be able to tell us how they are propagating these.

PRESIDENT TEMPLETON: I suppose this is subject to correction by those people on the West Coast who are actually doing it. This is my impression of what they told me. They are grafting ginkgo seedlings in containers, usually in January. That isn't too critical, but they simply make an inverted cleft graft above the soil surface and put them back in the greenhouse. They can also be put out where they can be covered with polyethylene or under shade so the scion doesn't dry up too rapidly. It is easy to get a high percentage with no trouble at all.

MR VERMEULEN: Have you found there is any difference in the type of tree you get your cuttings from? We get different results from different plants. *I was wondering it anybody else did*

MR. RALPH ZIMMERMAN (Cincinnati, Ohio): We bought some Autumn Gold from the West Coast and also some ginkgo from the Princeton Nurseries. The Autumn Gold roots real well but the Princeton won't root at all. I don't know why, because we used the same kind of cuttings and everything.

CHAIRMAN STEAVENSON: Thank you, Mr. Zimmerman. Autumn Gold is a clone they are working with on the West Coast which has been developed by the Saratoga Horticultural Foundation. It is supposed to be a particularly nice male type, with good yellow autumn foliage and other desirable characteristics. It is available, by the way, in the West Coast nurseries.

Our next speaker I think is well known to all of you and to nurserymen and nursery groups over the country. I know he supplies a good deal of stock to other nurserymen for redistribution, and it is my particular pleasure to give you Richard Van Heiningen of Van Heiningen Nurseries, Deep River, Connecticut. He will speak on "Winter Propagation in Outside Frames with Electric Cables." Dick Van Heiningen!

Mr. Van Heiningen discussed the procedure he uses to root cuttings in outdoor frames equipped with electric cables.

PROPAGATION IN FRAMES USING ELECTRIC CABLES FOR BOTTOM HEAT

RICHARD VAN HEININGEN
Van Heiningen Nurseries
Deep River, Connecticut

I would like to give you a little history of our propagation method so that you can see how we sort of walked into the electric cable method of propagation

My father, who ran the Evergreen Nursery Company in Wilton, used frames exclusively for the propagation of evergreen cuttings. He was supplied in the wintertime with horse manure, until Bordens and Sheffield Farms turned from horses to trucks. When there was no man-

ure available, they continued to propagate in frames but with inadequate bottom heat It was their procedure to make cuttings in the summertime, starting about July

Now this encompassed all sorts of evergreen cuttings that are familiar to you, such as arborvitae, chamaecyparis, taxus, and the junipers. They had rather good success. I think it was to some extent similar to mist propagation, because when the cuttings were once in the frame they were kept nearly airtight by bags placed underneath the sash. The frames were not opened unless it was necessary to syringe them, which was done on a sunny day as many as three times. Cuttings usually did not root, however, until the following spring. They callused nicely before winter, stood still in the winter, and in the spring they would start off usually with roots first, and top growth later. This technique of summer propagation took men away from other work that was very important, and so we tried to do it during the winter with some form of bottom heat, which, as I mentioned before was with manure. When that wasn't available, we tried early spring cuttings in March. When this was done we got top growth and very little root growth until late in the season which usually was not good enough to carry the cuttings over winter.

When I went into business for myself up in Deep River, I started the same procedure of making cuttings in the summertime but it was also difficult for me It took us away from work such as weeding, that was necessary during July and August. We had to devise some method of furnishing bottom heat. I had been receiving a publication from the Connecticut Light and Power Company and one issue mentioned electric cables. I know some of you fellows had used it already, and it had been used on the floors of chicken houses to keep them warm It occurred to me this might be an excellent way to heat the sand in the frame, giving us exactly what we wanted.

We first tried one frame. This first experience with this cable heat in our frame was very successful and was very encouraging. We use it only on *Taxus* *Taxus* for the most part is not difficult to root, but we hadn't had too much success with our summer propagation techniques. We weren't able to hit it like my father had been able to do back in the twenties and thirties. When we did get what might be termed a 90 to 95 per cent stand, using electric cables, we were absolutely enthused because we felt it wasn't necessary to go to a great expense to install this equipment or to construct a greenhouse. We could just continue with the frames we already had by simply adding this electric cable to the bottom of the frame.

The cost of one frame's operation for this period of about four months ran somewhere around fifty dollars and we felt it as well worth it because the actual cost per cutting was around .8 of a cent. We felt that was certainly well worth doing. So the following year we went into three frames with electricity Now we had about eight frames, but we put three frames into electricity to check it once more. We had an overflow of cuttings, so we rented a small greenhouse for a year with no heat in it other than these electric cables. Again the frame proposition

was successful but the experience in the greenhouse, although successful, cost us a tremendous amount of money. Without heat in the greenhouse to aid the electric cables, the electric cables continued to run even though we had a thermostat controlling the bed temperature. The temperature never got high enough to shut off the juice It was the constant running of this very high electricity consuming piece of equipment that we had that cost the money. As a result we discontinued that, although the results from the propagation were fairly good.

The following year we went into eight frames, all equipped with electric cables This time we had almost complete failure because we got an infestation of *Rhizoctonia* that was devastating. We also changed our medium in our frames, but we never did any fumigation. We either brought it in with the cuttings or it had begun to form in the frames during the first two years of use with electric cables We lost out of 120,000 cuttings all but 5,000, and when we planted those 5,000 we lost more still. We hadn't paid any attention to this fungus problem that we might suddenly get and that was a blow when we lost all our cuttings that particular year. From that time on, we have thoroughly fumigated all our frames with formaldehyde We have also tried pouring on Dithane and that has worked satisfactorily We feel, too, that we have gotten some hormone action from this chemical. No hormone has been isolated from Dithane, yet when it breaks down it aids in the rooting. We use Dithane as a thorough cleanup and follow it by spraying on Dithane about a week before we stick the cuttings We have used Vapam as a drench on the walls and sand surface and that also seems to work.

Now I might mention that we have rooted about everything in these frames that we can grow. We have rooted all varieties of *Taxus* up to 90 per cent. With junipers we have great variation in rooting, anywhere from zero to say 90 per cent, depending on the variety. *Juniperus chinensis sargenti* we just can't get to root. Myers columnar we can't root very well. However, we have had good luck with such types as the variety that is sometimes sold as the Blue Sargent, and good luck with *Juniperus scopulorum viridifolia,* which looks like *J. excelsa stricta* but it is a columnar type and is not subject to the difficulties you have with *J. e. stricta.* The Sargent hemlocks have been rooting since we listened to Harvey Gray. We do that following his directions for use of a plastic covered case within the frame. The plastic completely encircles the medium underneath and over the top We have had good luck rooting anywhere from 50 to 75 per cent of the Sargent weeping with the cuttings in sand, peat and Styrofoam and with the aid of two per cent indolebutyric acid. We have rooted some dwarf hemlock, and some *Tsuga canadensis microphylla* but not as successfully as arborvitae. Some of the spruces have been rooting rather well, such as *Picea abies n. nidiformis* and *compacta*

We root azaleas too, but not with bottom heat. We put our azalea cuttings in August and enclose them in a plastic case, much like we do with the Sargent hemlocks. We get very good rooting on such vari-

eties as *Azalea yedoensis, poukhanensis,* one called John Cairns and *Azalea y poukhanensis compacta.*

We also root rhododendron in an enclosed case within the frame. This time we do it in October with bottom heat, using the cables We have had some variation in our results The easier varieties, such as America, seem to do well, but the more difficult ones, like *R. atrosanguineum,* and Mrs. C. S. Sargent, we haven't been able to do too much with them. We can root them probably as well as you can root them anywhere but we can't keep them growing. So in frames of this type I think we are probably limited to doing just about as well as we can, which is not up to that which you can do in a greenhouse. With *Ilex* we have no trouble. *Ilex opaca* and *crenata* can be rooted fairly easily.

Now the construction of our frame is from cinder block The high side has four tiers of block, the low side three. About two rows of the blocks are underground. The surface of the sand when it is placed in the frame comes to about half way up on the second row. In other words, it is about 12 inches from the bottom of the frame which is about eight inches from the surface outside. The surface of our sand is about eight inches down from the outside of the surface. That, we feel, gives us good insulation from the cold on the outside. When the frame is completed we first put in a good drainage bed consisting of three inches of stone, followed by an inch of fine sand upon which the cable is laid. Then a four-inch cover of sand is placed over the cable. Our cables are all hitched to a main line which in turn has a thermostat which controls the temperature. We try to keep our heat at about 70 degrees F, although it varies from 68 to 72° F. It is very close to being accurate and I think that is probably as close as you can keep heat under most conditions with most types of equipment

We use glass sashes over the frames. Last winter for the first time we put plastic over the top of the sashes to help insulate the beds. We have been afraid to seal all the frames very tightly since we had fungus trouble that one time and we felt a little aeration might be good. Because of this we have not sealed the sashes to the frame itself but rather have draped the plastic over the sashes. It did keep a good bit of wind out.

Coming back once more to the cost of operation, you might ask if this isn't a very expensive means of propagation? Well, I don't know. I don't have an accurate figure on what it costs to propagate in the greenhouse. Each of our frames is 180 square feet inside. In *Taxus* cuttings we can stick about 15,000 in that area, and with good results it costs eight-tenths of a cent per cutting. With poor results, of course, the price immediately goes up. It costs $12 per month per frame for that number of cuttings. In other words, 15,000 cuttings costs $12 a month for a four-month period. That is $48 to root 15,000 cuttings That can vary, but say the average is $12. Two winters ago we had very cold weather in January and the thermostat called for heat even during the day when the sun was out. Because of the extreme cold, the cost of electricity ran up to $15.00 or a total of $60.00 for a four-month period. But let's remember this, that the cost of construction

is very low. To build a 30 by 6 foot frame of this type, it takes 190 blocks at 75 cents a block, which includes the block, the mortar and the labor of construction which means $150 per frame. Then, of course, you must have the usual sash, which are about $12 apiece, or maybe more now. The wiring in the frames themselves, the cable, and the thermostats will cost $70 per frame. The switchboard, and incidentally, the size of the switchboard will depend on the number of frames you have, can be rather expensive. W have 10 frames, each one draws 10 amps, so we needed more than 100 amp service. The next service was 200 amp service, which costs a little better than $200 to install.

Now compare this to the cost of installing heat of another form, such as steam heat or hot water heat underground in frames It would be necessary to construct a building for the burner and it would be necessary to put in the pipes which probably would have to be done by a professional It might add considerably to the cost. Over the years, however, there is a possibility it might be cheaper.

I would like to give you some of the advantages that I feel we have in the use of this type of heat I have mentioned one, that is the initial low cost of construction and the need for little professional help. You can do all this yourself with the exception of possibly the switchboard. The maintenance cost is low. In fact, there is no maintenance whatsoever in this equipment. There is no painting, of course, to do except on the sashes. The excellent results that can be obtained by the use of cable heat is another advantage. The frames themselves are very convenient for the purposes of changing your medium and for general access. You can back a truck up to the frames and empty the frames or you can bring the sand in, in the same manner. The convenience of irrigation, too, is an advantage. We have installed irrigation in these frames by the use of tobacco nozzles on a pipe which runs lengthwise over the frame. We cannot only water the frames without opening the sashes but we can also fumigate these frames initially by pouring the formaldehyde or whatever material we are using through the pipes, cleaning them very thoroughly and keeping in all the gases. You can also harden-off your cuttings very well in frames, once the cuttings are rooted. When the weather is right the sashes can come off and screens can go on Your cuttings go out in the open and before you have a chance to move them they acclimate themselves to the conditions under which they have to grow.

Here are some of the disadvantages. Snowfall of any great amount is a nuisance because you have to shovel it off before it can get into your frames The inspection of frames during cold weather is difficult. It is not easy to raise or open the frames. It raises the amount of heat necessary to keep them warm and gives the cuttings a cold blast of air which we feel is not advantageous. The growing of rhododendrons is difficult because once you have them rooted you can't keep them growing, since the air above the sand is always very cool and possibly is the cause of the high cost of heating. I think we are in a very cold area because we get cold air draining into our frame area. We don't get sun probably as long as if we were on the crest of a hill. Our day is a little shorter in the winter time and it makes for a long night and a higher

heat requirement. If you were on top of a hill in a very sunny location I think you would find the cost dropping considerably, especially when you have bright, sunny days.

I would just like to run over the equipment we have been using. For a thermostat we use a G.E. Model HSC 5 with a 30-inch capillary tube which is a very simple thing, costing about $10 It has a cover on it which keep water out. We run our equipment on 220 volts. We use cables that are 120 feet long. You can use shorter 60 foot cable, but you need more outlets over a given area. These thermostats are rated for 20 amps We are using lead cable instead of plastic I would say this, the plastic cable would last longer in the soil in the sand, but it is a hard thing to put down. It just doesn't seem to want to stay put. The lead cable once it is bent and laid down, stays in place. If it is not removed too often for frame cleaning it will last indefinitely. The lead covering on the lead cable does crack and that will cause a short circuit. We like the Rockbesto heating cable and it costs us seven cents a foot, which is a special price It usually runs about 13 cents a foot.

Now there is one other thing I might mention before I close and that is that there may be another means of heating with electric heat, although I have nothing but a very small amount of information on it. This is an electric ground warming with the help of wire netting. In the pictures that are shown in this booklet it appears to be a two-inch mesh chicken wire, but evidently it is not exactly the same because they claim you must buy this particular wire because the other type won't work It is being used in various Dutch nurseries and has the advantage of distributing the heat very evenly throughout the bed without drying the medium. It operates on 42 volts and therefore is harmless, even though the wires are not insulated. We are now looking into this possibility for supplying bottom heat to our cuttings

If there are any questions I will try to answer them.

* * * * * *

MR. RADDER: Would you tell us a little about your establishment?

(*Editor's note*: Mr. Van Heiningen then reviewed the major points of his talk by means of colored slides.)

DR. CHARLES HESS: Dick, did you ever try to put hardware cloth over your cables to get a better distribution of heat or don't you think it is practical enough or beneficial enough to warrant the extra work?

MR. VAN HEININGEN: We have tried it and we didn't think it helped too much. We had some drying out although that was our own fault. We didn't have quite enough sand over the top of that wire and the cuttings got rather close to the cable. We had drying throughout the entire frame, and so we decided to discontinue it because it adds quite a bit to the cost. It would save us, however, from having to remove the cable every time we changed the medium We have done

that because we are afraid of hitting the cable with the shovel when they are digging the sand out.

DR. HESS. We are just about ready to install a heating setup at Purdue. We got ours from a person by the name of Peterson who was at Cornell from Denmark. He brought this idea with him. We used the Allis-Chalmers transformer to drop the voltage down from 110 to around 30 volts Now the saving comes from the fact that you don't have the lead-covered cable expense. You can use just plain 10-gauge fencing wire. The total outlay of funds are the same but you eliminated the replacement cost of the cables which, as you pointed out, do crack if they are moved around a lot

MR. VAN HEININGEN: It is necessary to handle the lead-covered cable when it is warm. Usually we plug it in and bend it to whatever shape it has to be.

PRESIDENT TEMPLETON: On this subject of bare wire electric heating cable, I might say that it has been used in England for many, many years. It is usually bare, galvanized wire operated at six, eight or ten volts. It isn't as attractive as it sounds, because the transformer is quite expensive There is no danger of shock with the low voltage wire

As pointed out, it is a heated, single wire. If you are interested, it is no trouble to get all sorts of information on it from England. Write to NIAE in England and they will send you cost figures on the installation, diagrams of installations, as well as electrical consumption as it varies with the temperature during the year. They have all the data.

MR. LOWENFELS: I am using electric cable in a greenhouse and the instruction sheet said to put wire over the lead cable. I took old window screening and put it on over the cable. Have you tried that, and is there any advantage or disadvantage to its use?

MR. VAN HEININGEN: I just mentioned that I had tried it and it would appear to me that there should be an advantage to its use. However, we had some trouble with drying out simply because we did not have enough sand cover over the wire screening. I think we should try it again and be sure we have enough sand cover.

DR. STUART NELSON: Seemingly Charlie has found a source for a transformer, which has always been the problem. I would like to ask Charlie if he knows what it would cost.

DR. HESS: There are several sizes, depending on how large a bed you want to heat. We got the medium-sized one, which runs about $95 for the transformer.

MR A. D. SLAVIN (Elbridge, New York): Actually, we are up in pretty cold country and what we actually do, without going into details, is use one of Hugh Steavenson's polyethylene houses inside of which we have electrically heated trays We use plastic covered cable, which as has been mentioned is tough to tie down. What we do is simply take a 2" x 4", soaked in copper napthanate and stick it at the end of each frame in this house The cable is tacked down with staples. We put about an inch of good gritty sand on top of this and then we

stretch hardware over this. If a clumsy person digs down in the frame he wouldn't ruin the plastic cable. That cable has now been in over five years. It is still giving us the same response in temperature.

The plastic wire has become brittle. I could take it out but you couldn't handle it easily. I chose plastic cable because the wire itself does not reach the temperature that lead cable does, although there is a lot more per unit. Ours is laid in the same fashion as the lead cable, but because there are so many more feet per unit, it is laid two inches apart in order to get a better distribution of heat. I don't think that is necessary, but it is working all right and it is cheaper than the lead cable After five years it has been pretty well amortized Each unit is 25 feet long and four feet wide. We use two sections of this plastic cable Each one draws 800 watts for each 100 square feet when we have the current on. This is usually all winter in our country The thermostat used is essentially the one that has been described.

I may say something about our results in polyethylene covered frames. Under our conditions when winter really sets in, the highest we can get the soil temperature in these frames in the polyethylene house, is 54 degrees. As a result, we don't try to heat the unit any longer than we have to That is one reason, and the other reason why we don't make *Taxus* cuttings in August, is that we have one of the longest growing seasons in the country and our *Taxus* aren't hardened up by this time. We wait until they are hardened up and start taking cuttings Now that we have good dormant wood, we pay no attention to a heel because we can see no difference in the rooting between those that have a heel and those without one We are getting 82 per cent take on yews We get 90 to 93 per cent on arborvitae On *Ilex crenata,* which we propagate later in the winter because it doesn't take so long to root. we get about 100 per cent. On the desirable species of juniper we average about 30 per cent For that reason we have actually gone down and rented space in a greenhouse and done our juniper propagation under the electric heating technique that I mentioned

We have kept very careful tract of costs because it was one of the first plastic houses around our part of the country. The building costs are amortized over a five-year period. These costs include cleaning up the place, putting the new polyethylene on, the cost of electricity, and also for the last two years this figure includes the cost of cleaning, making and placing the cuttings. It costs four and six-tenths cents a cutting. Don't ask me how that corresponds with somebody else's cost. We are quite happy Incidentally, we have as much as 18 inches of snow for a two-week period in the winter, and in the frames we limit the frames to yew. We put them in and we never look at them again in the winter time. As winter comes on, and we are through with our open mist season, we move the lines into the greenhouse along with the timer. All during the winter we just merely use the mist nozzles instead of manually watering the cuttings. As spring comes on we will put on the timer when we feel it is desirable.

Another thing I like particularly with yews is that with this type of propagation, my experience is that we get no top growth until there are roots on the cuttings.

MR VAN HEININGEN· That is very true. The frames are very cold except for the sand, consequently, there is not much top growth until root formation has taken place This is a very good point.

MR. ROLAND DE WILDE: We use hardware cloth over cables because I find when we don't use it the boys cut the cables. I used plastic one year and the first thing that happened was that the temperature was 102 degrees, which nicely cooked everything in the frame. Since that I have stayed with the lead cables which I think are a little more satisfactory

MR. VAN HEININGEN: One advantage with the plastic cable is that it is longer I think the 220 volt system has 160 feet instead of 120 for the lead cable and for this reason you can cover a little more area and distribute your heat more evenly If you use hardware cloth with lead cables you can probably get the same distribution. The wattage is the same. I think it is 800 watts per cable and that is true for the plastic as well

MODERATOR STEAVENSON. Thank you very much, Dick. I would like to ask if you know what your kilowatt hour cost is for your electricity?

MR. VAN HEININGEN· Yes, it runs about three and a half cents. We are on demand meter and the more we use the more we pay I don't know exactly how they figure it out.

MODERATOR STEAVENSON: We are up against the same thing. I had a house about 100 feet long with electric cables and our electricity cost is about the same. It was simpler for me to put in hot water, which I did because of the cost. However, I can see for your frames where it would be much more convenient to use cables than it would be to use hot water. What is your rate on your formaldehyde fumigation?

MR VAN HEININGEN: The formaldehyde is a two per cent solution. It is used at the rate of three gallons in 150 gallons, or 147 gallons of water, and three gallons of formaldehyde. That is a two per cent solution if my figures are correct, and we use 150 gallons per frame. That is an awful lot of liquid but with the irrigation system it works fine. We put it through the pump from a barrel and it is a simple matter to do all the frames at one time

MR. RADDER: How long, Dick, do you wait before you stick cuttings?

MR. VAN HEININGEN: We have to wait two weeks and if we smell formaldehyde we wait longer. If we haven't got time to wait we will use Dithane, because you only have to wait seven days for that. Vapam is even quicker, but if you us formaldehyde you have to wait at least two weeks and you can smell it if it is there

MODERATOR STEAVENSON: Do you cover your frame with sash after you put formaldehyde on?

MR VAN HEININGEN· Our irrigation is inside the frame The sashes are put on the frames after application. After two weeks we open it up and air it out.

DR. CHARLES HESS: Just one comment, on why we are personally intersted in low voltage heating. We do on occasion like to run heating cables in our mist beds even in the summertime and particularly if you are in a cold area, or have a cool summer, as we did have this year If you have ever had lead heating cables with a few cracks, under mist, you can really get set on your ear. That is why we want to try out this low voltage idea to see if we can't overcome this hazard.

MR. VAN HEININGEN: We had trouble with one of our cables last winter and you couldn't even take a plant out to check it without getting a shock.

MR. RALPH SHUGERT (Neosho, Missouri): There is a question relative to what temperature you keep your frames?

MR. VAN HEININGEN: About 70 degrees We keep it at 70 degrees for everything.

MR. A D. SLAVIN: We can't maintain the temperature at 70, but it hasn't been any great disadvantage in our experience You are only going to get one crop over the winter and you can save some money in two ways. One is to take your *Taxus* cuttings and get them callused Under our temperature condition, they will callus up pretty well in six or seven weeks. After that for the rest of the winter you might as well turn off the heat. In our case we would turn it on about the 20th of March. In other words, we could have six full weeks with the current off on *Taxus,* and I think we are going to for arborvitae also. It is a waste of time to put them in before Washington's Birthday. You get no better results with December, January and early February placement under these conditions In the frames that we are going to use for arborvitae, the current doesn't have to be turned on until that time Of course, it won't work for juniper.

MR. VAN HEININGEN: May I follow that through for a moment? We had a faulty thermostat on one occasion and when I opened this frame up the temperature was actually 90 degrees You can get it up there if you keep the heat on

We don't stick all our cuttings at the same time. We do that for two reasons, ie, it isn't necessary, and it is a saving if you don't run your frames all the time. We stick juniper cuttings in November We stick our hemlock cuttings earlier if we can do it, in October These are already rooted by the first of the year, and we can actually take those out and store them. We did this last winter and put in another crop, because we can't keep the temperature up there *Taxus* cuttings we do not bother with until after the first of the year unless we have bad weather before and we have nothing else to do Arborvitae are the very last thing we take and they will root in a matter of a month. *Taxus* will take anywhere from four to six weeks to start making roots Our men can work all winter long because the heat can be kept up to 70 degrees.

MR. SLAVIN: Another thing I would like to mention, except for the matter of safety and cost of installation I don't think it makes a darn bit of difference what type of heating you use I am not an electrical engineer, but are going to get so many thermal units out of every

watt There is probably nothing that can be measured more accurately in transferring one type of energy to another than electricity. The two most imoprtant points is the safety factor and the cost of installation. If you put the watts in, you will get the watts out, providing you have a well-designed electrical unit or some other type of system

Incidentally, when we go to frames we can keep a higher temperature than in the greenhouse because we have less air to heat.

MR. HARVEY GRAY: Have you time for two questions? One, what depth do you place your thermal tube to give you most efficient control of your heat?

Number 2, in your use of a two per cent formaldehyde solution, do you make this application prior to the placement of your fresh medium or after the medium has been put in place?

MR. VAN HEININGEN: To answer your first question, the capillary tube is placed about one inch above the wire and we place it crosswire over the wire so that it is directly above the cable. We have found by experience you get a closer temperature by having part of the tube over part of the cable.

To answer your second question, we clean the frame completely, add the new medium, and then we put on the formaldehyde so that we treat the fresh sand as well as the walls and the base of the frame.

MR. SLAVIN: We put our tube about two and a half inches below the surface, which means the tubes are three to three and a half inches above the wire. My idea is to put the tube about where the base of the average cutting would be located, or within an inch.

MODERATOR STEAVENSON: Thank you, gentlemen. We have time for two more questions.

MR. AART VUYK (Indiana, Penn.): Dick, do you have an trouble with the cables when you change the sand?

MR VAN HEININGEN: That is one of the good reasons for having it covered with a wire of some sort to protect it. We always pull the wire out after we are through.

MR. WELLS: Hugh, I just wanted to make a couple of comments regarding the use of these plastic cables and about arborvitae cuttings. We have used two kinds of plastic cable. One is a stiffer, single wire made by a company in Chicago, which comes in long lengths and which has been quite satisfactory The other is a much more flexible type of plastic-covered cable made by Cox and Company in New York. That comes in 120 foot lengths only and also works well

The cost of using these cables to heat a frame made up of 10 standard sash, using the current from a power source which cuts off from 4:00 o'clock in the afternoon until 11:00 o'clock at night was $25 a month.

Now in regard to the arborvitae, we have rooted a number of these varieties successfully in this following manner. Make the cuttings about the middle of February, treat them with hormones, pack them in deep flats in moist sphagnum moss and put them in the cellar where the temperature is 55 or 60 degrees. Place a couple of electric lights in there so they have a little light during the day and leave them there for six

weeks They will callus in the moss and even begin to initiate roots Six weeks from the middle of February brings you to the end of March. At that time, take them out in the ordinary frame and set them upright in sandy soil, shut the frame down tight and water them often. Give them a little shade and they will root practically 100 per cent without any heat.

MODERATOR STEAVENSON: Thank you, Jim, for your comments.

About the nicest thing that happened to me when I got Martin's program was to pick it up and notice that my old sidekick was going to be on this panel here this afternoon. Our next speaker, two other men in the audience and I started out together. I hate to say the date, but it was exactly 25 years ago in the Conservation Service. I would like to introduce the third man who is here, who started with Thor and I, Al Dodge, please stand up The fourth culprit, who I am mighty happy and proud to see here is Art Slavin. To me, and to all of us it is like old home week after these 25 years to get back together again.

Our next speaker, as I mentioned has the fancy title of "Woodland Conservationist." He tells me that is a fancy title for forestry. Thor Bergh has operated a large seedling nursery for many years. He has been in commercial nursery work and he has been engaged in various types of forestry and woodland practice, principally in the colder lake states area. He is exceedingly well qualified for the topic that he is going to discuss, namely, will seed from Northern plants produce harder plants than those produced from seed collected in Southern regions? Thor Bergh!

MR. THOR K BERGH. As you said, this is very much like old home week with the four of us back, and not only that but I have met several other fellows here that have made my stay so far a lot of fun. I expect to have a lot more pleasant experiences before I leave here.

Mr. Bergh presented his paper on the affect of seed source on hardiness of plant material

WILL SEED FROM NORTHERN PLANTS PRODUCE PLANTS HARDIER THAN THOSE FROM SOUTHERN REGIONS

THOR K. BERGH
Woodland Conservationist
U. S. Soil Conservation Service
Saint Cloud, Minnesota

Mr. President, Mr Chairman, members of the Society and guests. It is a real challenge to present a talk on a subject that, I am quite certain, is very familiar to some of you, probably most of you Not only is this a challenge but also a distinct honor for me and for the Soil Conservation Service, the agency that I represent, to have the privilege of talking to you today.

The title that was assigned to me is "Will Seed From Northern Plants Produce Plants Hardier Than Those From Southern Regions?".