MODERATOR BLAUW: We next have Mr. Nordine who will discuss the budding of hawthorns.

PRESIDENT ROY M NORDINE: I happen to be one of those individuals who came to the convention with certain ideas and certain techniques and found out I wasn't quite one hundred per cent right.

I will read what I have written and then I will comment.

President Nordine read his paper on "Budding Hawthorns." (Applause)

BUDDING HAWTHORNS

ROY M. NORDINE
Morton Arboretum
Lisle, Illinois

The questionnaire inviting this topic asked for the "Propagation of Hawthorns." Because of the slow growth resulting from any method of grafting and the failures of cuttings we have selected the only profitable method.

Crataegus phaenopyrum, previously called *C. cordata* or Washington Hawthorn is used for the understock. This species provides a good root system, it transplants easily, and the bark peels well over a long period of time. Seedlings are easily raised from fresh, clean fall sown seeds that have not been allowed to dry too much. Dry seeds may become dormant and require stratification for a year

Seedlings can be lined out in the early spring and budded during August or the first half of September. Hawthorns vary a great deal in the size and shape of the buds making peeled buds difficult to fit and tie. Therefore, all buds are cut out with a sliver of wood attached to the bud, some refer to this as a wood bud. Buds are tied with a rubber band and waxed with paraffin and covered with soil. In the following early spring the understock is cut off about six inches above the bud. This stub is used to provide the growing bud with its only tie during its growth. This stub can be cut off during the fall or winter.

Several native and exotic species and numerous varieties have been budded and all produce excellent results I can't recall a case of incompatability.

During the first year whips of three to four feet or more are average growth. In the second year whips and branched plants of four to six feet are produced

I wish to quote from a letter from Wayne McGill of A. McGill and Son, Fairview, Oregon.

"We note your inquiry regarding the understock used for propagation of Paul's Scarlet Thorn and are glad to advise you that we have always used the *Crataegus oxycantha* and find it very satisfactory, as of course, Paul's Scarlet Thorn is a variety of *C oxycantha*. However, one year we were unable to secure all the *Crataegus oxycantha* that we desired and substituted *Crataegus cordata* and the trees are being dug this year as two year olds. We might say that our experience was quite

disastrous. The first year the Paul's Scarlet Thorn on *Crataegus cordata* grew very well and we could see no difference at all between the few we had on *Crataegus oxycantha*. However, during the second year, being this past summer, things were entirely different. Probably five to ten per cent of the trees began to die completely, even after they had made a fairly good growth. The balance of those that did not die had a peculiar burned condition to the edges of the leaf but still they made a good growth and developed into as good sized trees as those on *C. oxycantha*. But when we were ready to dig some this fall we found that the root system was very poor and extremely brittle and we felt that by the time our customer received the trees after packing, they would have few roots left on them and we were very much afraid of their ability to transplant so we are discarding the entire lot and buying what we need to take care of our orders Therefore, we would certainly recommend only *Crataegus oxycantha* for propagation of Paul's Scarlet Thorn.

However, we have found that *Crataegus cordata* is much better for an understock for the propagation of the *C. cordata* itself as we bud ours to a selected form."

* * * * *

MODERATOR BLAUW: The next speaker on our program will be Dr. Sidney Waxman who will speak on intermittent light as it affects growth of seedlings and cuttings. (Applause)

DR SIDNEY WAXMAN (Storrs, Conn): I have two parts to cover and I will try to cover them each in five minutes.

The first device I would like to discuss is a mist control that operates according to the intensity of sunlight. In misting cuttings we all know we need a greater frequency of mist when the sun is bright. As the days get cloudier, the need for mist decreases

This mist control has inside it a photocell that is activated by the intensity of the sunlight. The idea behind this unit was suggested by Dr. Hans Peterson of Denmark while he was a visiting professor at Cornell. I wanted a unit I could depend on in Connecticut and I had the Agricultural Engineering Department working on it They improved it. They made it more adaptable for the propagation of woody plant cuttings. The feature they added to this is that you can adjust its sensitivity to light. In other words, if you have cuttings that you don't want to get too wet, just turn the sensitivity light dial down and it will be less sensitive to light and there will be less misting. Conversely, if you have a plant that tends to dry out quickly, you can turn it up and get more frequent misting.

On cloudy days the light will be down so low you may not get any mist at all This is good for some plants. However, for other plants that have a thin epidermis or cuticle you may want to keep the mist on. Therefore, we turn another dial and this changes the slope of the curve so you get a little mist, ie, just enough to keep them wet.

There is another feature. It needs no 24-hour clock to control it. As night comes the frequency of misting will get longer and longer and will eventually turn off once it gets completely dark. You may perhaps want to mist during the night. In that case, there is another switch and it will operate on a timer and you will get a slow misting all night long. You must remember this is adaptable for use within the greenhouse. It is possible that it can be arranged to work outdoors, but I won't go into that now.

I will go on to the next paper. On the table you may have noticed a box with a clicking light. The light goes on for one second and will remain off for five seconds. To review briefly, you will remember that in a paper presented several years ago, we showed that you can make a plant grow continually by giving it long days. That is giving it light during the night or stop it from growing by giving it short days.

If you take a flowering dogwood and give it 10 hours of light each day, it will just stop.. If you give it 14, 16 or more hours of light, it will tend to keep on growing. More recently, York has shown that this response occurs only when the temperatures are above 65° F. If you live in an area where the night temperatures get below 60° F., your response is very small, and it wouldn't really pay.

What, then, is the value of giving these plants light during the night? Well, we have learned that photoperiodic treatment can keep a plant from growing, and it can also break dormancy. The plant however, must have leaves. Whenever I refer to this effect on plants I am referring to plants that respond to daylength. There are many plants that do not respond to this phenomenon.

In earlier experiments we have found that we can obtain more roots per cutting when they are given long photoperiods instead of short photoperiods.

(*Editor's note*: Dr Waxman continued his discussion from colored slides. Some of the comments are herewith recorded.)

You really don't need to have a long photoperiod to get increased or better rooting. You can let the normal day stay a little longer by lighting at the end of the day. It really doesn't pay to light up cuttings just for the sake of getting more rootings. However, for those plants that tend to drop their leaves and even those which root first and then drop their leaves the effect of light may come in handy. A plant like this uses up its food in the manufacture of roots which cannot be replaced because it loses its leaves. It will be weak. By putting on additional leaves the plant will be invigorated and will rebuild itself which will allow it to withstand the winter better.

There is one other feature When you take a leaf bud cutting, the bud is very slow to grow. We gave this particular batch long days and when we have the long days the bud breaks out very soon ie, within three months after the start of lighting.

Now in lighting plants during the night there is quite a bit of cost involved, if you were to do this on a large scale What we tried to do was see if we could eliminate or reduce the cost. It wasn't the amount

of light that was giving us our response but rather it was the amount of continuous darkness during the night. What we did was to break up the night into very narrow parts. We gave the plants light for one second out of each minute during the entire night. With *Cornus florida* on an eight hour day the plants stopped growth in 20 days. In the next treatment they were given 16 minutes of light during the night beginning at 12.00 midnight, or in other words the night was broken up into two parts. They grew taller, but even that stopped. Where they were given 16 hours they received continuous light and at night received continuous artificial light Under this treatment the growth is at a fairly rapid pace. Where the plants received only one second of light out of every one minute and in treatments where the plants received 16 hours of light, the growth curves are nearly identical. Actually, we have run it one second every two, three and four minutes, and it works almost as well up to three minutes. When it gets to four growth slows down. Thank you.

MODERATOR BLAUW: We will now have Hugh Steavenson who will talk on, "Tree and Shrub Seedlings Produced under the Mulch System." (Applause)

MR. HUGH STEAVENSON. Just a few notes on our seedlings produced at Forrest Keeling Nursery at Elsberry, Missouri.

(*Editor's note*: Mr. Steavenson used a series of colored slides to describe the system he uses at the Forrest Keeling Nursery to produce tree and shrub seedlings. His comments follow.)

Here you see our seed-cleaning operation Virtually everything that we collect or harvest themselves, is put through an old hammermill which we have been using for many years This is usually a high capacity operation for cleaning seeds in some quantity although it can also be used very well for small batches of seeds. The seed does not go through the screen at the base of the unit since it should be slightly smaller than the seed. The pulp is mashed and a heavy stream of water carries away the effluent leaving the clean seed which is then dropped into a wire-bound basket.

After cleaning, the seed may be ready for sowing. If we want to put the seed through a seed drill, of course, we have to dry it and put it through a fanning mill to clean it up. If it is going to be broadcast by hand or stratified right away, it doesn't need to be cleaned any further.

In the event that a seed has a hard seed coat and a dormant embryo, it must be scarified at this time. All our scarification is done in a sulphuric acid bath.

I might say in connection with seed that it is much better where you can harvest your own seed. However, this isn't always possible with all the various items that you may want to grow from seed. We grow or try to grow around a couple hundred different species of tree and shrub species, and of course many have to come from more distant places. We secure seed from a number of collectors throughout the various states and, of course, also foreign countries such as Italy, Ger-

many, Austria, Japan, and elsewhere. Usually when you have a good domestic collector lined up, this works quite well. You get your seed about the time you should get it It is usually fresh seed and ready for the handling you want to give it. Of course, the difficulty with foreign importations is that so many times you will get the seed after the time when it is necessary to start the after-ripening process and as a consequence you may have to carry it over as a two-year item. We have many seedbeds that do carry over, which normally if we could harvest the seed ourselves would germinate the first year

We do treat our seed with a fungicide when we are going to stratify it, or in some cases where we seed it immediately.

Our seed beds are all made with a Lachmount seedbed former which is made in Massachusetts. They are all six foot on center or four foot beds. Regardless of what we do in the field, whether transplanting or field lining, everything, as I mentioned the other day, goes into beds of this dimension so that they fit all our various pieces of equipment that we use.

We treat our bed areas with allyl alcohol which is relatively inexpensive and easy to apply through the irrigation system. It is a pretty good herbicide. It is used in a fairly heavy dosage and at the same time it isn't too expensive It is considerably less expensive than the various proprietary items, such as Vapam, Mylone and methyl bromide, and is also much easier to apply. It is not as effective as methyl bromide. I wish we had something as effective as methyl bromide and still relatively easy and economical to apply. We need something that will take the place of allyl alcohol since it is hazardous to use and should be used with a great deal of caution.

I might say that we never have to touch up our beds by hand once they have been formed. When we finish with the Lachmount spreader and the Brillion Culti-packer, they are ready to go

Our soil preparation is the usual preparation going through a sod crop, if possible, and the development of the optimum degree of soil fertility Once we do get into seedling production we add so much organic matter in the form of sawdust that we think we maintain a fairly good humus content and so we are not reluctant to go back and seed after one crop of seedlings. I might say further in regard to soil, this happens to be in the Mississippi River bottom which has glacial aeolian deposits, called loess, where the hill soil is eroded and runs down to the bottom. It is a light, friable soil.

I don't think it makes any difference in production what kind of soil you have so long as it has characteristics of good internal and external drainage. It can be a loam or sandy loam or a silt loam; as long as it has the right physical characteristics you can certainly get along with it.

Somebody asked about sawdust in the beds. We use it in very large quantities, ie, a few hundred truckloads a year. We have used it for many, many years on the same ground We think we get a constant improvement in the physical properties of our soil Of course, it takes

a good deal of nitrogen, about two pounds of actual nitrogen per hundred pounds of dry sawdust. We haven't observed any pathogenic situation arising from the use of sawdust. As Shadow Hoskins mentioned the other day, it is necessary to have a friable condition for the seed to emerge through. This could be had through the use of sawdust, or ground corncobs, although it doesn't make too much difference what you use as long as it is readily available and not too expensive.

We use a portable irrigation system which pumps out of our ponds We would prefer to have a permanent type Skinner overhead system. There are times when we would like to get water on faster than we can by moving our pipes around. With this mulch system we can get by pretty well without the need of applying water daily or anything like that, because the mulch does hold the moisture during germination and during the after-ripening period so that the constant application of water to keep the seed in a moist condition and prevent the germinating seedlings from drying is not essential.

I might say in regard to herbicides, I think we have tried everything in the book for possible pre-emergence weed control in seedlings. Aside from the Stoddard Solvent for conifers, we don't know of anything that is applicable with seedlings. In other words, the newer chemicals, such as Simazin and Chloro-IPC are not applicable to seedling production, although we certainly use them extensively for our transplant areas We do use them, too, in our paths. However, the necessary thing with seedling production is to get the bed areas free of weeds before the seed is sown.

In our harvesting operation we have used various types of diggers over the years. Last year we secured a Plumfield digger, developed by the Plumfield Nursery, Fremont, Nebraska, which is mounted on my high clearance 560 International tractor. This tractor is of the type that is used in the rice and sugar cane fields in the South and it has a pan, that gives us almost my clearance It is inter-changeable with a U-shaped blade for digging. One thing we need is a shaker on this thing for a more rapid pull. These diggers can go any depth we want although usually we don't want to go more than 10 to 12 inches for seedlings.

After pulling the seedlings are taken to the packing shed We have a nice cave that some of you people have seen, an old quarry, where we grade and store these seedlings. Many items are spring dug except those for fall shipment We try to store as close to the freezing point as possible, keeping the roots in a moist medium. In recent years we have been trying storing seedlings in polyethylene bags. This seems to work just fine. We are going into this more and more.

We cannot grow cedar a second year because of blight. We have tried all the usual fungicides and I believe, because the fungus attacks the growing tip, it is virtually impossible to keep a protective coat on the plant. We have tried sanitation, ie, growing them completely away from where any cedars have been grown before. We can get by very nicely the first year. The second year they get woody and I don't

think the understock is worth a darn It is a case of getting them up there the first year. If we don't do that, we might as well forget about them Thank you very much.

MODERATOR BLAUW. We will not have a talk on the "Propagation of Woody Ornamentals Under Mist in Peatmoss Pots," by J. Peter Vermeulen. (Applause)

MR. PETER VERMEULEN (Neshanic Station, N.J.): As commercial propagators we are continually thinking, of course, in addition to quality about costs. One of the primary costs in the nursery business is the overwintering of stock

This idea of rooting plants directly in the growing medium, contained in the selling container is not new, I am sure. Perhaps this particular phase of it is new, and we thought it would be both interesting to you and perhaps profitable.

We have thought about rooting directly in the soil in the selling container for sometime, but there have always been disadvantages imposed on us. Because of recent developments that have taken place in the field of propagation in the last several years we think now that this type of culture can be applied on a commercial and wholesale basis.

One of the problems, of course, has been the rooting or the growteing medium. Heretofore we didn't have the aerators such as vermiculite, perlite, or styrofoam. The plain soil that we could use in New Jersey, being our red New Jersey clay, is not conducive to rooting, but rather to rotting.

We also had the time factor in propagation, which with the hormones and chemicals we have now, have cut the rooting process down considerably in the length of time it takes.

We know that we can stick a given number of cuttings in every square foot of a propagating bench If we are going to use this same space for pots and insert cuttings into these pots we are going to cut down very markedly the number of cuttings we can get in a given area of our propagating house.

As I mentioned before, these three most serious disadvantages now have more or less disappeared. We can make a growing medium using soil which is fitted to this type of culture We use a medium composed of one part soil and one part peat to which is added 20 per cent by bulk of finely shredded styrofoam We chose styrofoam in preference to some of the other aerators because it is completely inert and very light. It does not hold moisture, therefore, does not give us an added moisture headache. Also, by not absorbing moisture, it gives better soil aeration as well as a very light, growing medium which we can use very effectively.

In 1958 we thought that we would go ahead and try to propagate directly in the medium in selling containers. We did this on a very small scale, perhaps 200 or 300 cuttings. Most of these were inserted into clay pots, only a few were put in peat pots. We were still feeling our way with the peat moss pot at that time. The results were very encouraging.

I might say it was all done under mist in a greenhouse rather than in an open bed This method, I am sure, can be applied to open mist bed propagation also. I might say here that our mist system is not one of the commercial types that can be purchased or whose integral parts can be purchased and put together yourself. It is one of our own making We have always thought that the mist systems as presented to us by commercial concerns gave us more water than we wanted. This idea did not originate with us, but we are using the oil burner nozzles under extremely high pressure with a pressure regulator at the end of the line. The oil burner nozzle is one and a half gallons per minute and the pressure we use is 125 pounds This pressure we get with an inexpensive bronze gear pump that can be purchased for approximately $18 or $20. It has a lasting life of approximately one year, at which time it can be traded in for another pump, we get $6 for the old one. The pressure costs us practically nothing The oil burner nozzles are spaced on a three-quarter inch overhead line We place our pipe over the tap, because there is drip from an overhead nozzle We also placed the pipe over the path and directed the nozzles so they will disperse the fog over the growing bench. We chose the oil burner nozzles at one and a half gallons per minute because this gave us the best fog. We would rather call it fog than mist, because of the pressure that we have. For instance, in one house 130 feet long we have 40 nozzles Our mist interval is one minute on, two minutes off. For one minute application of mist with 40 nozzles we can get a very fine fog in that house with one-half gallon of water, which is highly desirable. That gives you a little background of the physical house that we are doing this work in.

As I mentioned, in 1958 we started on a small scale. We chose to start with *Franklinia alatamaha,* the Japanese maple variety *Acer palmatum oshio-beni, Cornus kousa chinensis, Viburnum fragrans, Viburnum tomentosum,* and *Prunus beni-higan*

I might add that the reason we chose these was because of the sometimes difficult nature of transplanting these plants once they were rooted. This was another thought behind this method, so that we could reduce losses in the initial transplanting from the cutting bench.

Our results were, as I said before, very encouraging. We got in the neighborhood of 60 to 100 rootings within 16 days on some items and three to four weeks on the rest depending on the variety. *Franklinia alatamaha* was practically 100 per cent. *Cornus kousa chinensis* gave 100 per cent. *Acer palmatum oshio-beni* about 100 per cent, the two viburnums, *V. fagrans* and *V. tomentosum* 100 per cent, and *Prunus beni-higan* gave about 80 per cent rooting. At the same time we also did just a few plants in 2¼ inch, Jiffy peat moss pots and the results were about the same

With this background, this past summer we expanded our experiments to approximately 4,500 plants. This time we chose mostly the three-inch pot because it afforded us more growing medium. We also planted some in two and a quarter inch pots, thinking maybe that we

would watch this growth to see whether we would get better growth in the three-inch as opposed to the two and a quarter inch pot

Our results this year were approximately the same. We added some genera, species and varieties. I will name them just briefly: *Viburnum tomentosum* and *fragrans* were tried again. We also added *Viburnum sieboldi, Viburnum carlesi, burkwoodi* and *juddi*. We chose also to try the magnolias and in this group we chose *Magnolia stellata* Royal Star, and also *Magnolia soulangeana* and *M. stellata* We also tried *Wistaria rosea* and an unknown crabapple. This latter happened to be a plant growing in the greenhouse. *Cornus florida rubra, Cornus kousa chinensis, Cornus florida plena, Cornus florida xanthocarpa. Cornus florida pendula, Viburnum tomentosum plicatum, Viburnum rhytidophylum,* and *Franklinia alatamaha* were also tried.

The plants were inserted between July 15 and August first. The medium was placed directly into the peat pot, firmed fairly well, and the pots were placed in a veneer tray. This is another cost-cutting method that we are using. We ship directly in these veneer trays in which our stock is grown. You can see how much we can save if we can place the pot in the tray, insert the cutting, root it, store it over winter or grow it in the greenhouse over winter, and ship in the spring. We will pick up a unit of 25 or 36 plants as opposed to picking up individually 25 or 36 plants and preparing them for packaging.

Our cuttings were all treated with either Hormodin No. 2 or in some cases Hormodin No 3. In some cases we have used Cutstart No. 7 Our results on the *Viburnum tomentosa* were excellent since 295 rooted out of 300 That is in the three-inch pot. In the two and a quarter inch pot 36 out of 36 rooted. Of the *Viburnum sieboldi,* 275 out of 300 in the three-inch and 35 out of 36 in the two and a quarter inch pots rooted For the *Viburnum fragrans,* 200 out of 225 in three-inch pots rooted. *Viburnum carlesi* rooted only 10 out of 36 in the two and a quarter inch container. The *Viburnum burkwoodi* was not much better with only nine out of 36 in the two and a quarter rooting We had a similar results in *Viburnum juddi* which rooted only 10 out of 36. All of these later died, which we think could be attributed to too much water.

Magnolia stellata Royal Star rooted 20 out of 25 and I might add here that we had much better roots in the manufactured growing medium than we had in the sand. For the *Magnolia soulangeana,* 20 out of 25 in the three-inch pots and 15 out of 25 using Hormodin No 2 rooted. *Magnolia stellata* gave 15 out of 25, with an inferior root size Cuttings of *Wistaria rosea rooted* 10 out of 15 while none of the crapapple struck. Only 25 out of 75 of the *Cornus florida rubra* rooted *Cornus kousa chinensis* only rooted 50 out of 324, as compared to 100 per cent in 1958. Keep in mind that in 1958 we inserted the *Cornus* cuttings in clay pots rather than in peat moss pots We believe that they got too much water. For example *Cornus florida plena* gave only 6 out of 36, *Cornus florida xanthocarpa,* none out of 36, and *Cornus florida pendula* also none out of 36.

Viburnum tomentosum plicatum rooted 400 out of 500, while *Viburnum rhytidophylum* gave 25 out of 25, which was more or less a surprise *Franklinia alatamaha* rooted 750 out of 775. We were so much encouraged with that, that a week later we stuck 1625 and got approximately 1590 cuttings of this same plant

Just as a matter of comparison, at the same time we stuck in sand, as we ordinarily do, 400 *Cornus kousa chinensis,* and rooted 350. Of the *Cornus florida xanthocarpa* cuttings we stuck 200 and rooted 200 *Cornus florida pendula* gave us 47 out of 50 stuck. *Cornus florida plena* rooted 178 out of 200

If we can compare what we stuck in sand with what we stuck in peat moss, you can see that our results on the dogwood were much higher in the sand We definitely have a water condition here that we think is causing poor rooting as far as this genus is concerned

In conclusion, we definitely think that this method has distinct possibilities. We would be very willing to compare notes with anyone else who has done any work in this line or who might attempt to do so in the future.

The requirements for success are as we have seen, a very light, well-drained and well aerated rooting medium or growing medium, a very fine mist, that is, one that gives you maximum moisture without too much moisture, and root-inducing chemicals to hasten the process so that the plants are not in the very moist environment too long Thank you.

MODERATOR BLAUW: The last speaker on our list is Tom Kyle, Jr. who will speak on the "Propagation of Miniature Roses." Mr. Kyle. (Applause)

MR. TOM KYLE, JR. (Tipp City, Ohio): Ladies and gentlemen of the Plant Propagators Society: Since I am the last speaker on the program, I will try to keep this talk within the allotted time.

While miniatures have been known for over a century, they have not become really popular until the last ten years. Until this time there were only one or two varieties Approximately 25 varieties are now either patented or have patent rights reserved.

We are growing in the neighborhood of 250,000 plants of over 50 varieties. Several of these varietiess are recent European introductions and are being grown in rather limited quantities

Miniature roses have tiny buds and blooms and dainty foliage and are just like larger garden roses except that they only grow 10 to 15 inches tall and the flowers are seldom larger than a quarter when fully open.

They are completely hardy and very easy to grow outdoors when not overcrowded in borders, beds, and rock gardens. They should be spaced a foot apart in good, well-drained soil and should be fertilized, watered and sprayed the same as large roses. Soil should be mounded over the crown for winter protection.

Miniatures are the only roses which can be grown successfully indoors Like azaleas, however, miniatures should be allowed to go dor-

mant or have a rest period outdoors during the fall and early winter in order to force well If a few rather simple cultural practices are followed these little roses will bloom for several weeks indoors during the winter. The biggest problem is to maintain a reasonable humidity in the relatively dry, modern home The roses should also have a sunny location with a constant 65 degree temperature, careful watering and occasional spraying. Miniatures grow better outdoors and should be moved outside in the spring for best results

Miniatures are very easy to grow from either hardwood or softwood stem cuttings and can be rooted in the greenhouse or outdoors in frames. We perfer softwood cuttings and propagate year-round indoors, using an 18 x 100 foot house for rooting cuttings and two, 36 x 100 foot houses for growing houses.

A constant 65 degree temperature is maintained in these houses and the cuttings are rooted in coarse sand and one-half sand and one-hall perlite mediums. During the summer an intermittent mist system is used to control temperature and humidity. During the winter months roses are rooted without misting, although a high relative humidity is maintained in the house.

A stem cutting is taken from one of the mature established plants in our growing houses and all of the top leaves are removed from the cutting with the aid of small shears. Cuttings which average from two to two and a half inches long are stuck directly in the medium, using a board guide and a knife. The cuttings root in 21 to 30 days, dependent upon the season of the year and the variety involved.

The cuttings are then removed and potted off in two and a half inch clay pots, using a medium consisting of two parts good topsoil and one part German peat The medium is treated with methyl bromide to control weeds and disease organisms The roses are then moved into one of our growing houses and placed in concrete benches

After the plants have matured and have developed several sturdy upright canes, they are hardened off and are moved outdoors in beds in our lathhouse. During the winter these beds are covered with sacks and the plants are held in a dormant condition in these cold frames until spring.

During the maturing period indoors the plants are watered daily, fertilized and sprayed weekly. The buds and blooms are removed in order to get more vegetative growth Watering is done by hand, using a breaker and being selective with certain varieties which do not require excessive moisture.

During the summer months a dilute soluble fertilizer is injected into our greenhouse water lines at a 200 to 1 ratio, through a FertoJect unit. We mix our own concentrated solution, using dry constituents. Winter fertility is maintained by spraying every two weeks with Rapid Gro at recommended rates.

Disease control is the biggest problem in growing miniatures Until recently we were unable to obtain satisfactory control of mildew and Botrytis blight without constantly spraying and shifting the roses in the

bench. We were often able to root a high percentage of cuttings only to lose half of them after potting because of mildew or blight.

We seem to be getting satisfactory control now with a weekly spray schedule, using Malathion for two succeeding weeks and Systox the third week. We also use electric sulphur vaporizers in the greenhouse and ventilate during winter to change the air and cut down on the moisture in the vicinity of the foliage.

Some varieties are very susceptible to red spider; however, this is very easily controlled by our spray program, provided the underside of the leaves are well covered with the material.

SUMMARY

1. Miniatures are easy to grow and require a minimum amount of care.

2. They may be propagated using either hardwood or softwood cuttings and may be rooted in frames or in the greenhouse.

3. Rather rigid watering and fertility cycles must be adhered to in order to obtain optimum growth.

4. Disease control is the biggest problem but can be controlled by adopting a timely spraying schedule and an adequate sanitation program, both in the rooting and growing areas.

MODERATOR BLAUW: Are there any questions?

MR. F. L. S. O'ROURKE (East Lansing, Mich.): I would like to have one minute, if you please

Mr. Chairman, fellow members: I am prepared to present a paper by a graduate student at Michigan State University, one James R. Feucht, who has done a good job of air-layering of pine and spruce. However, since time is limited I will merely pass this paper around and will plan to publish it in the Proceedings. I also have a tool in my pocket which was devised by Mr. Feucht that I would like to show anyone interested in making a girdle.

(*Editor's note*: The paper by James R. Feucht and Professor F. L. S. O'Rourke follows.)

AIR-LAYERING OF PINE AND SPRUCE

JAMES R. FEUCHT AND F. L. S. O'ROURKE
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The widespread use of many superior selections of conifers is limited by the difficulty of propagation. While established clones of pine and spruce are commonly grafted on seedling rootstocks, the method is seasonal, costly requires special facilities. Several propagators and scientific investigators have reported on trials with both cuttings and air-layers but without any marked degree of success.