produce oak leaf and ring patterns on old leaves. Leaf deformations occur as a change in shape, margins, and in the surface, which usually became rough and irregular due to raised veins and sunken interveinal tissue. Flower set and flower size also are reduced. Symptoms are severe, persistent, and completely systemic during the cooler months of the year; during the warmer months, symptoms tend to be mild and usually incompletely systemic, particularly following periods of rapid growth. Field infected plants also commonly suffer from mineral deficiency resulting in a marked chlorosis and yellowing of the areas between the veins.

Control. Since CMV is transmitted by aphids, and occurs commonly in numerous plants in the field, it is not likely that healthy plants will remain permanently healthy in outside plantings. These studies indicate, however, that disease-free shoots can be readily produced by growing diseased plants at high temperatures, thereby enabling growers to propagate from disease-free mother-stocks, and to produce and sell disease-free plants. Since the appearance, vigor, and growth rate of healthy plants is much greater than diseased plants, customer appeal and salability is greatly increased.

Mother stock plants should be grown in a greenhouse section free of aphids or under aphid-proof cages. If infection re-occurs virus-free plants may be obtained by growing mosaic-affected plants in the greenhouse at an average air temperature of 90°F. After 4 to 6 weeks, symptom-free tip-cuttings may be taken and the cuttings rooted under mist. Plants that are free of mosaic symptoms at 55-75°F may be retained as mother stock plants.

THURSDAY EVENING SESSION

October 26, 1961

This session - the Plant Propagation Question Box - convened at 7:30 p.m. with Mr. Percy Everett, Rancho Santa Ana Botanic Garden, Claremont, California, as the moderator.

MR. DON HARTMAN: Before we get started with the Question Box, I would like to introduce a visitor with us who is a distinguished individual. He has been introduced once already, but I'd like to re-introduce him and ask a few words from the gentleman - Mr. Louie Vanderbrook from Hartford, Connecticut, who is the representative from the Eastern group. Louie was born and raised in Hartford and operated a nursery that he took over from his father and enlarged it, if my memory doesn't fail me, from around 35 or 40 acres up to around 120 acres. Louie, would you like to say a few words, please.

MR. LOUIS VANDERBROOK: Ladies and gentlemen. I can't say that I'm not forewarned. Your President, Don Hartman, asked me yesterday if I would say a few words before this meeting. I have been very much impressed with the group here, the size of the group of people with your keen and intense interest in this subject. You are only a year and a half or two years old. I've seen ten years of this in the East because

I went in as a charter member. I know the intense interest we have there. I have watched your program develop under your able chairman, Herman Sandkuhle - he's done a wonderful job. He has arranged some very interesting subjects. Thinking back beyond the ten year history of our Plant Propagators Society - back 15 or 20 years ago - we common "green thumbers", as Herman calls them, didn't have the contacts with the academic men. We didn't know what they were doing. They didn't know what we wanted. Today we've gotten together and, boy, we are really going places. We have had real accomplishments in the last 10 years in the field of plant production.

I bring to you the felicitations, the good will, and a hope for a rosy future from the officers and members of the Eastern region. I had the very pleasing privilege of sitting in with your Board of Directors the first day that I came here and - gentlemen of the rank and file - you have an able group of men that are representing yourselves and, as long as the affairs of your Society are in their hands, you can rest assured that you are going to have the best. Your officers are very capable. Your president conducts his meetings with dispatch and is a brilliant man. I think his successor is going to be equally as good. With that I will ask your pardon and sit down.

MR. HERMAN SANDKUHLE: The gentlemen who is going to run the program and be the moderator this evening has been your Membership Chairman and he's had a real tough time; he's gone through a lot of papers and what have you, but I will say he's been doing a very capable job, and there is just no question about anyone not getting the right treatment when it comes up before our good friend, Percy Everett. Percy, would you please take over and moderate the Question Box.

MODERATOR EVERETT: Thank you, Herman, for those kind words. Ever since I have had anything to do with plants and their growth and have watched all the variety of places where we have attempted to grow plants and the variety of conditions under which plants are grown, I'm constantly amazed at the extreme diversification of all of the factors that a plant has in it. I was equally amazed about the light effects that Dr. Piringer told us about this afternoon, and to know that plants have a built-in "IBM computer", one that memorizes. I didn't know that plants had that ability, but I thought to myself then, here is another amazing fact about plants. The more you work with them, the more of these things are discovered. It's quite amazing what goes into the make-up and internal structure of plants, all of these chemical compounds that we find, all of the genes, etc.

I'm going to direct the first question from our Question Box to Dr. McClintock: Elizabeth, someone wants to know when and where your publication on the nomenclature of plants will be available.

DR. McCLINTOCK: I still don't know where it's going to be published. Mildred Mathias and I hope that it will be published sometime very soon. We have discussed the matter with the University of California, Agricultural Extension Service. We hope that it will be

published, if not by them, by some other agency. So I really can't say when, but we hope it will be soon and certainly, when it is published, it will be available to everyone.

MR. MARTIN USREY: I would like to ask Dr. McClintock how are you going to convert the public over from a name that has been in general use over 15 or 20 years and has been accepted as that, to a proper name when the proper, or correct, name is something no one has ever heard of?

DR. McCLINTOCK: Well, I don't know. That's pretty hard to answer. I hope that if you people find out that a plant should have a certain name, and that it's recommended that the plant should be known by that name, that you will do all that you can to accept that recommendation. All we can do is to suggest or to recommend.

MR. MARTIN USREY: But if we advertise it under the new name, no one will know what we are talking about.

DR. McCLINTOCK: Well, you can always say that the plant has been known by such and such a name or list a synonym following that name. It is unfortunate that there has been confusion in certain names that have been used. I think that the only way that we can resolve the thing is to try to use the names which are the correct names for the plants - just try to use them.

MODERATOR EVERETT: This business of naming plants is quite something. I know I've been disturbed many times by the fact that plant names I've gotten to know real well - plants which have become well known - then all of a sudden the name is changed - but there are basic reasons for this. It's unfortunate that these things do get mixed up, particularly in the trade, because I know it's quite a job to get them untangled, and those are just some of the things that we will probably have to work out among ourselves. I do know something of the work that has been entailed in the preparation of the list that Dr. McClintock has told you about, and it has taken a tremendous amount of time - in fact, well over two or three years. They have given unstintedly of their time and energy and I'm sure that the time spent is all going to be for the good.

Now, Dr. Hartmann, the question is directed to you. Will you give instructions for putting indolebutyric acid into solution?

DR. H. T. HARTMANN: It's really not too difficult to do. It depends upon whether you want to prepare a dilute solution for, let us say, a 24-hour soaking treatment, or a concentrated solution for a quick-dip treatment. Taking the first one, the 24-hour dilute soaking method, you should weigh out the proper amount and add just enough alcohol to the indolebutyric acid to dissolve it and then just add that to the volume of water that's required. If you're making a concentrated dip solution, 50 per cent alcohol ordinarily is used as the

solvent, so the proper proportions of 50% alcohol and the IBA are prepared and just mixed together. This concentrated material will keep almost indefinitely if it's sealed. It's a good idea to use a small part at a time, then discard that and then keep the main amount of the solution to use again. The diluted solution should just be used once and then discarded. It can't be expected to keep very long. The actual preparation of the correct proportions is something that would have to be figured out. The strength is usually expressed in parts per million. The University of California has a bulletin entitled "Propagation of Temperate Zone Fruit Plants". The proper measurements are given in teaspoons per gallon of water, so that the IBA would not have to be weighed out on an analytical balance.

MODERATOR EVERETT: You might explain the type of alcohol used and the difficulty of obtaining a small amount.

DR. HARTMANN: Ethyl alcohol is ordinarily used, but isopropyl alcohol will work quite well. You can ordinarily buy that in a drug store. It's a type of alcohol that's used for sterilizing needles, etc., and they will sell it in small quantities without a prescription. We have used this alcohol quite successfully.

DR. STOUTEMYER: I have used ordinary wood alcohol (methyl alcohol). You can get that without a prescription and it works just as well as ethyl alcohol.

MR. DENNISON MOREY: Another material in this connection which I don't think has been widely tried is making the ammonium salt of the indolebutyric acid. In Arizona last year we treated approximately two million cuttings with this particular solution and it seemed to work as well as the alcohol solution did, but you have to remember that in this case you are dealing with completely soluble hormones and something the ground water may leach away. In quick dip applications, all the hormone you put on the cutting stays there pretty much until it is taken up by the plant.

MR. GEORGE OKI: You can get IBA crystals in one gram bottles. It's more expensive this way than in the larger sizes, but using the rule of thumb that to get 1,000 parts per million, dissolve one gram per 500 cc of alcohol, and then adding 500 cc of water gives you 1,000 parts per million, so if you need any multiple of this, like 5,000 parts per million, then all you have to do is add 5 grams, which is already measured up for you, especially if you don't have the delicate balance that's needed.

MODERATOR EVERETT: Dr. Alley, a question for you: How is equitable distribution made of a limited supply of foundation stock?

DR. CURTIS ALLEY: Let me give you an example of what we have done in the past on distribution of registered Mahaleb cherry seed. We send out notices about the end of August to the nurseries that are participating in the registration and certification program, stating the approximate quantities of the registered Mahaleb seed that we have available. We state on the accompanying order blank that the deadline

is, say September 20th to order any quantities of registered seed they wish to obtain. That gives them about 3 weeks to a month to submit their order. After the 20th of September we take all the orders that we have received from these participating nurseries and divide up our quantities of seed which, up until this year, was always in smaller amounts than what the nurseries have ordered. If some of the nurseries have ordered only one or two pounds of seed, of course, we would fill such an order immediately. Then if we had say, about 20 pounds of seed left over, and there were three nurseries which each wanted about 15 pounds, we divide it as equally as possible.

The same goes for the distribution of registered Mahaleb liners. There might be two or three nurseries that want 200 liners each. We will have a total of somewhere between 7 and 9,000 liners. For those few nurseries that want small quantities, we will make up their orders immediately. Then for the large orders we divide those up as equally as possible depending upon what the nurseries want.

On distribution of grape materials it works very much the same way - not a matter of first come, first served. We generally set a deadline about January 20th or 25th in which orders for registered stock have to be in. After that time we make our distribution of the materials as equally as possible. The non-registered material is also worked the same way. We generally wait fairly late in the season and then divide it. For those growers and nurseries that want small quantities, the orders are made up rather quickly. On the large amounts it's generally allocated as equally as possible.

MR. HERMAN SANDKUHLE: Curtis, I'd like just to ask a question while you're here. It doesn't pertain to this particular subject, but you were talking about screen houses. Would you give us a quick run down on what a screen house is, and what is the usual size?

DR. ALLEY: We have two screenhouses at Davis. The first is approximately 25 feet wide, 35 feet long and 12 feet high. Dr. George Nyland designed the screenhouse with the idea that the trees would be placed in a container in the ground, and right now I'm very thankful that it is that high because those trees that are growing in the large wooden boxes buried in the ground just about reach the top of the screenhouse. The second unit that we built was 25 feet wide, about 35 feet long, and only 8 feet high. We have peach trees in this one, growing in three gallon cans. These are surrounded by a large box containing sawdust to keep the cans from getting hot in the summer time. This has worked very successfully. Otherwise one would have to bury the can. The screen used is a 32 X 32 mesh - 32 horizontal and 32 vertical threads to the inch. The actual screenhouse is a frame structure. About every four feet is a vertical upright. We have a series of posts placed in the center for support. There's a double entrance. The first door opens into a small hallway. Then you close the door. You open the second door which leads into the screenhouse proper.

MODERATOR EVERETT: The next several questions are directed to

Dr. Piringer. The first question is: (1) Would the use of red light be beneficial to ornamentals, specifically azaleas, and (2) will these light rays penetrate glass?

DR. PIRINGER: The light rays involved - red - will, indeed, penetrate glass. Photoperiod definitely controls growth of azaleas and the most recent work along this line is - I believe out of Oregon; a report that with continuous light, or very long day lengths, one gets very rapid growth. We are also doing work with cyclic lighting on azaleas and getting some response. I might call attention along the same line to work being done now by Dr. Neil Stuart at Beltsville. By using certain growth retardents, he can stop the vegetative growth of azaleas and induce flower-bud formation over a wide range of photoperiods. However, the plants still require cold temperatures for normal flower development.

DR. ROY SACHS: Dr. Kohl of UCLA has recently found several variables in the day length response of azaleas - temperature is one and the other is the variety. Not all varieties will respond, and it will depend upon the temperature to which these plants are subjected.

MODERATOR EVERETT: The next question is: Has any work been done on light responses with bulbous plants in respect to increasing vegetative growth or flower promotion?

DR. PIRINGER: Flower initiation in bulbs is primarily due to thermoperiodicity; that is, primarily a temperature control.

MODERATOR EVERETT: Another question: Have you or your colleagues of the USDA worked with phytochrome reds - far reds - in regard to citrus? If so, has this been published? If not, has any such investigation been scheduled in the near future?

DR. PIRINGER: We have not looked for phytochrome specifically in citrus. Phytochrome itself is a regulating pigment and has been found in avocado fruits. It has been located in plant materials that are free of chlorophyll. Any time that we look for it in plant materials that has chlorophyll we have difficulty because of the masking influence of the chlorophyll. We know that phytochrome is operative in citrus because citrus is responding to photoperiod as far as growth is concerned, and citrus will recognize the difference between fluorescent and incandescent light, and again I say that photoperiod is involved but in this case it's guilt by association.

MODERATOR EVERETT: Mr. Dillon, does that answer your question?

MR. FLOYD DILLON: We would like to see more specific work done, sir.

DR. PIRINGER: I am interested in the photoperiodic responses of tropical plants. We have studied the responses of over three dozen kinds. We try to interest workers in the tropical or sub-tropical areas to study them in their natural environment.

We grow our material in the greenhouse in photoperiod chambers. As soon as our plants get to the order of four or five feet tall at most, they've grown beyond our facility, we can no longer get them into our chamber, and then we have to rely on natural day length or interrupted nights. The point is very simple, we just have no business studying tropical woody plants where we are located, and as soon as we can convince someone else to do it, fine.

VOICE: At what temperatures do you get photoperiodic response?

DR. PIRINGER: We use a 70° minimum. In mid-summer maximum temperature will go as high as 115° in the greenhouse, but about ten and one half months of the year we have no trouble getting a 70° night minimum.

MR. DON DILLON: Dr. Piringer, when you say that citrus will recognize the difference between fluorescent and incandescent lights, what are these differences?

DR. PIRINGER: The difference is in the stem internode length, and it's the same for Cacao and Rauwolfia. When we grow these plants in incandescent light, they get long internodes.

MR. DON DILLON: If the internodes are short, would you get more -

DR. PIRINGER: You would get the same number. In the case of -

MR. DON DILLON: I mean with supplemental light you would get more than you would with normal day -

DR. PIRINGER: Yes, and you would get them faster. In the tropical plants we've studied, there was essentially the same number of parts - under both light sources.

MR. DON HARTMAN: I was wondering if there are publications that have been printed from Beltsville on the subject you have discussed here today.

DR. PIRINGER: We have a wide variety of publications and these are generally available. There is one entitled from "Photoperiodism to Phytochrome", which will pretty much summarize and give in a little more detail some of the things to which I have alluded this afternoon. Also, there is a publication called "Light and Plants" (ARS 34-19) and this one again is a general summary. There are also technical papers on woody and tropical plants. The address to obtain these publications is: The Plant Physiology Laboratory, Agricultural Research Service, Crops Research Division, USDA Plant Industry Station, Beltsville, Maryland.

MODERATOR EVERETT: Do we have additional questions of Dr. Piringer? This is an excellent time to tap a wonderful source of information. As you know he works on the other side of the country. We don't have a man like this every day. Here we are, we've got him captured. Dennison, I knew you'd have a question.

MR. DENNISON MOREY: Dr. Piringer, do you get a photoperiodic effect with far red as well as with ordinary light?

DR. PIRINGER: If I understand you correctly, you are asking if far red substitutes for darkness? Yes, you'll remember that I said if you give a short day plant an interruption in the middle of the night with a minute of red, you prevent flowering and if you follow that with far red you do not get flowering. In other words, the plants see the far red as darkness. However, if you will give that far red for thirty minutes instead of a minute or two, you get a red effect.

MR. DENNISON MOREY: Is your photoperiod an energy proposition rather than a color quality?

DR. PIRINGER: Yes, it's an energy proposition, but it's an energy proposition that's triggered by the red. Photoperiodism is just one of the responses that's triggered by this photomorphogenic system. Other responses controlled by this photo-reaction are seed germination, stem internode elongation, anthocyanin formation in certain plants, and skin coloration in tomato fruits.

MR. DENNISON MOREY: But your photoperiod also depends on the red - far red?

DR. PIRINGER: Yes indeed, but the point I'm making is that photoperiod is only one of the photomorphogenic effects that is controlled by the red-far reaction.

MR. DENNISON MOREY: One last question. Is it presently possible to generalize about this red-far red reaction to any extent, that is in terms of flowering, in terms of cell elongation, or length of internodes, in terms of anthocyanin development, etc.?

DR. PIRINGER: Yes. We know that the controlling substance is a pigment because light is involved. We know that the pigment has two interchangeable forms because of its characteristic reversible reaction with red and far-red light. Although we do not yet know the precise chemical nature of the pigment or its specific action in plants, the pigment is obviously involved in a basic reaction controlling the many features of plants' growth and development discussed here today.

VOICE: This is on the holly discussion. After potting the cuttings when you took them away from the light, wouldn't it affect the plant adversely?

DR. PIRINGER: That depends on what you mean by adversely. If we removed the plants from the light and put them on short natural days, their growth would be stopped. The plants would respond to whatever day length you provided, whether it were natural or artificial day length. If it were an 8 hour day, you would get no more plant growth. If it were a 16 hour day, the plants would grow very rapidly.

MR. MARTIN USREY: Normally where we are in Southern California we make our holly cuttings in November and they are potted up in January and so they would come under short days but they would be lengthening.

DR. PIRINGER: In Washington, D. C., I make my cuttings in November, because before this time the plants have gone into a rest and they presumably have not yet had enough cold to break the rest. In your area perhaps it is warm enough that they never go dormant.

MR. MARTIN USREY: Well, they're as dormant as they ever will be in November.

DR. PIRINGER: Well, if you would take them then, and if you would give them light, I'm sure they would respond accordingly. I would be very surprised if they did not.

MODERATOR EVERETT: Well, we've had quite a session here with theory. Let's get down to earth on some specific problems. Someone says he needs some help with propagating Clematis Armandi.

MR. BILL CURTIS: Well, I have found this. By taking cuttings from young plants you get a much better strike; they root more easily and they break better. We're potting our cuttings now (October) that we stuck last August. Next May they'll be 18 inches to three feet tall, depending upon the vigor and how soon the plant took off. We cut these back to two eyes and take cuttings from these plants. These will root very readily and they break right away. You don't have a bunch of plants sitting around for two years in pots that don't break. We don't put them under mist. They do not need it in our area of Oregon.

Quite frequently we will take our first rooted cuttings and will grade them out and put some of them in 2-1/2" pots, some in 3" and some in 4" pots, depending upon the size of the root system. The 2-1/2" are put into gallon containers. They will make twice the growth in a gallon than they do in a 3" or 4" pot. By August we have a plant that is 3 or 4 feet tall. These are then cut back giving us quite a few cuttings from a plant out of a gallon container. I might mention that just before I came down we started potting C. Armandi. Some of those that had been delayed in getting potted, had growth of 6 to 8" right in the cutting bench.

MR. LOUIS VANDERBROOK: May I ask, Mr. Curtis, do you take your cuttings in the dormant stage, or in the growth stage?

MR. BILL CURTIS: The plants are growing, but we try to get them just as the terminal stops.

VOICE: How many nodes do you take in your cuttings?

MR. BILL CURTIS: We cut them just above the node. We don't have any node on the part of the cutting that goes in the sand. We have one node out. We take one leaf off, and then cut about half of

the leaf off that we retain on the plant. We make them about 2 1/2 to 3 inches long and dip them in Hormodin 3.

MR. LOUIS VANDERBROOK: This particular question has intrigued me because we had a similar question in the Eastern group. We had this question rear its head in the East because evidently the James I. George Company of Freeport, New York, was having some problem in raising Clematis, not necessarily this variety. That intrigued me then, so I went home and did some experiments for two years. If you will look back in some of your Plant Propagator Proceedings, you will find out the reason why I was unfortunate enough to become an official of this organization, made Vice President, and President of it. I submitted a paper at the instigation of Jim Elginfritz on our method of rooting shrubs from hardwood cuttings in the greenhouse in the winter time. I took double node cuttings in the month of February and put them in the greenhouse, with no node on the bottom - in a greenhouse which was filled with evergreens - we applied Chloromone to the base of the cuttings, and I was amazed at the results. Everyone of them rooted and by July we had 3 to 4 foot plants. Now these men have been growing Clematis all the time and producing them even with the stock plants in the greenhouse. So I said to Mr. George, why don't you take cuttings from finished vines, or your young plants outdoors and try this hardwood method?

MR. BILL CURTIS: I have dabbled with Clematis for quite a few years. I found this with armandi - if you let the buds get hard and well matured, they don't break well. If the buds have got a tough, hard scale on them, they'll just set and set and set. When spring comes, a year after you've rooted them, you've got 25 or 30% left that still haven't broken, and you keep them around until fall and you'll get 5% of them that will break and grow.

Now on the deciduous Clematis, I like to use a cutting from a plant that is just starting to bloom. I don't keep them in the greenhouse because that space is too valuable. I have a plastic house and I keep my plants there. We take the small plants that we don't sell and shove them into 4 inch pots. They then go into a cool house or into a plastic house - and from these we take two crops of cuttings. Then we sell the 4 inch potted plant as a by-product of our cuttings.

MODERATOR EVERETT: Now here's one. I'm not sure who to pitch this to. How to make plants set seed and for the seed to mature?

DR. DALE KESTER: This question is very general; you'd almost have to take each plant separately. One point is that if you have a plant that remains vegetative, you may make it flower and produce seed by girdling. But I think your question was if they have flowers on them why do they drop off? Well, first of all, there are plants that set fruit without actual seeds in them but the fruits may grow for a while; the question is whether or not these plants actually have any seeds. Your problem may be lack of pollination or some of the genetic abnormalities that prevent fertilization.

Then there are cases where an embryo may be viable for a period of time, and before the fruit gets ripe the embryo is dead. It is possible to extract these embryos while they are immature and grow them in artificial culture. But this isn't a way to grow plants and make a very big profit. Some growth regulators - such as gibberellic acid - have been placed on the plant at the time they bloom and cause the fruit to remain but the seed may not be there; that is, you could set the fruit, but you can't set the seed. I think this actually boils down to the fact that there isn't a real basic way that you can make these fruits set seed. I think that the basic thing is why the fruit is falling off; it's probably lack of pollination.

MODERATOR EVERETT: Now we come to another more mechanical question. What are the advantages of fine high pressure mist over low pressure mist?

DR. H. T. HARTMANN: I don't think there's any particular advantage in the different types of mist. I think it's just a matter of getting the leaves wet, keeping a film of water on the leaves. Whether it comes on by high pressure or low pressure doesn't make much difference.

MR. MARTIN USREY: Well, I think it's two different types of operation. One of them is under high pressure. It's not actually a mist, it's more like a fog.

MODERATOR EVERETT: We have just installed at Rancho Santa Ana Botanic Garden both a mist and a fogging system - and we're beginning to look very favorably toward the fogging. We get away from certain deposition of salts on the leaves and defoliation of our cuttings that way. We haven't carried it far enough yet to know yet with the growing of our California native plants whether this is going to be satisfactory, but it looks very favorable at the present time.

MR. GEORGE OKI: We put in a high pressure mist for temperature control, thinking that by putting in high pressure mist or high pressure fog that we could lower the temperature. When you first turn it on it cools off the house from 110 down to about 90. When the humidity builds up, then the temperature rises quickly.

MODERATOR EVERETT: One disadvantage we found in the mid-summer was just the same sort of a thing. We have also an evaporative cooler and when the fan came on for the cooler it blew all the fog out. Paul Moore, we have a couple of questions for you. How do you treat large acreages with methyl bromide?

MR. PAUL MOORE: We use injection. Our tractor mounted injection equipment has ten shanks spaced twelve inches apart on a regular tool bar. Two trips across the field fumigates a strip which can be covered with a twenty foot tarp. The fumigant comes in steel pressure cylinders. A tank of nitrogen gas is used to pressurize the tanks of fumigant.

After determining the required dosage, which for us is 175 lbs. of actual methyl bromide per acre, we calculate the proper tractor speed, tank pressure, and discharge orifice size to use at the shanks. The fumigant is injected eight inches deep. The shank openings in the soil are closed by a drag. Immediately following the injection, the treated area is covered for 24 hours with a plastic tarp sealed at the edges by covering with dirt. On the following day we inject another strip and flip the tarp over the newly treated ground. This is repeated, moving across the field until it is completed. We use four tarps 20 feet wide and 800 feet long in fumigating our nursery ground.

VOICE: Do you use straight methyl bromide or methyl bromide - chloropicrin mixture?

MR. PAUL MOORE: We have been using straight methyl bromide, in the form sold under the trade name "Weedfume". The material is 69% methyl bromide - the rest a petroleum solvent. This year we have a condition that we think may be benefited by using a methyl bromide - c chloropicrin mixture. The method of application will be the same.

MODERATOR EVERETT: We have one more for you on the subject of fumigation. What is your impression of Vapam for pre-plant fumigation of citrus sites for the control of Phytophthora and weed seeds?

MR. PAUL MOORE: For replants in old citrus orchards there has been some unfavorable experiences with Vapam. These cases have occurred where small areas - 6' x 6' - have been treated. Under these conditions it is easy to recontaminate the sterilized area. Phytophthora really goes to town once it comes back into fumigated soil. This is less likely to happen where large areas are treated. I have not had any immediate experience with the use of Vapam in treating large acreages except through observation. It is my personal opinion that it is a little more difficult to apply than methyl bromide. It must be applied in water, either in flooded basins or through sprinklers to be effective. I would favor methyl bromide because of the ease of application. I really don't know what the comparative cost is, but considering only the general operations, I prefer the ease with which we can inject and tarp.

MODERATOR EVERETT: We have liked the use of Vapam, not in large areas, but in treating specific spots. We have had a great deal of trouble with plants rotting, a root rot, (Phytophthora), and by applying Vapam to the area after the plants have been cleaned out, we have been able to go back and replant and the plants grow very vigorously and do much better.

Ted Frolich, we have a number of questions for you. First one, does the etiolation technique cause rooting in any other species considered difficult or impossible to root, for instance, eucalyptus or strawberry guava?

MR. TED FROLICH: I've not been able to etiolate eucalyptus. We've tried it. We couldn't get it to grow in the dark - and the strawberry

guava, I haven't worked with, but I'd guess it's pretty close to the eucalyptus. Etiolation has been listed as working in apples, pears, I think mulberry, persimmon, camphor, plums - a good many things. I don't know anyone who has rooted eucalyptus very successfully by any method.

MODERATOR EVERETT: You should have read the last Newsletter; I believe it was edited by Mr. Challenger of New Zealand, in which they talk about rooting eucalyptus with abandon.

MR. GEORGE SPAULDING: I believe that Frances Cheng of the Arboretum staff has been able to get callusing but never root formations.

MR. STAN SPAULDING: I recall when I was a student at UCLA under Dr. George Ryan we discussed the subject of juvenility and its effect on the wood that we used for the rooting of stem cuttings, that on some plants the juvenile wood was much superior than wood that was taken from older plants or which possessed an adult leaf form. Now I was a very good friend for many years, and hope I still am, of Walter J. Husband and in my enthusiasm when I discovered this phenomenon of juvenility in plants, right away I discussed this with Mr. Husband and attempted to stimulate him in trying this on eucalyptus. So we proceeded to take stock plants and cut them off close to the ground and induce heavy suckering from the base and in most cases the new foliage was the seedling leaf. Now in the case of Eucalyptus ficifolia he had some success although I wouldn't call his percentages commercially profitable. These little tests that were conducted with Mr. Husband back a number of years ago occurred in small propagation glass houses. The benches were covered with sash, possessed bottom heat, and growth regulators were used. The wood was tips, terminal shoots which were rising in the base of older trees that had been cut back sharply close to the ground.

MR. TED FROLICH: Actually there was a report from the Boyce Thompson Institute in Arizona of eucalyptus rooting. We had not too long ago reports from both New Zealand and Australia that they could root eucalyptus. When anyone asks me about eucalyptus I immediately think of ficifolia because this is the one that everyone is trying to root in our area.

MODERATOR EVERETT: Is there a list of plants on which propagation by etiolation has been successful?

MR. TED FROLICH: It will work on a great many plants if you can get them in to grow in the dark. This is not possible with all. Well, for instance, to grow a plant in the dark we sometimes have to have a very large root system under it and then we can get it to grow in the dark when we couldn't when we had a small root system under it. However, if we get too large a root system, it pushes so fast again that we don't get rooting. You're working in a very narrow range. It's pretty ticklish, Iwouldn't want to make any predictions.

MODERATOR EVERETT: On what kinds of plants has etiolation been used - hardwood, softwood? Does time of year or temperature exert much effect?

MR. TED FROLICH: They have to develop in the dark, so they're plenty soft when they are being processed. Temperature - I wouldn't know. It doesn't seem to be a factor, except that you can get very heavy fungus infections in the dark at certain temperatures that you wouldn't get at the same temperatures in the light. A real epidermal layer does not form on these etiolated shoots. Any fungus that comes along will just work them over good.

MODERATOR EVERETT: Dr. Alley would like to know in your etiolation of avocado shoots with a tar paper collar, would the application of indolebutyric acid at the base of the young succulent shoot assist in rooting?

MR. TED FROLICH: We haven't tried this. We don't know whether an etiolated shoot would respond to hormones or not. We do know that the green shoot in an avocado will not.

MODERATOR EVERETT: Will long-day treatment or light treatment help break dormancy in woody plants?

DR. PIRINGER: We cannot make a generalization. We can base our answer only on specific plant materials that we have. This simply says that it depends on the plant material. In the case of Catalpa, as I mentioned, long days will help break dormancy if we catch it before the plant becomes - I don't like that word "dormancy" - I'll use the word "quiescense" because that covers up a lot of evils. Short days will make the plant quiescent and, in the case of Catalpa, if it becomes quiescent, we see this by the necrosis or the death of the terminal. If we put the plant on long days, within two weeks after we see this, we will get bud break from axillary buds. If we wait more than two days the plant really goes into a deep quiescence and then it requires a cold treatment. In the case of the birchs a short day will make the birch dormant or quiescent. Now if we put it on long days we can break the dormancy or the quiescence of the axillary buds but not of the terminal buds. To break the terminal buds we have to get a cold treatment. Again with the maples, if they are made dormant with short days, we can, in some cases, break that dormancy with long days if we get it early enough. If we wait too long, again it takes cold to break the rest. So it depends upon the plant material with which we are dealing. Again our experience is based only on plants that have been made dormant with short days. We do not have much information on this with plants that would have been made dormant say, for example, with low temperatures. I would say this -- we have had experience with Poncirus trifoliata, a hardy orange, which is used as a barrier plant in the Washington, D. C. area and farther north where it does become dormant over the winter. It is deciduous. It does lose its foliage, and yet we have had plants for about 3 to 3 1/2 years now at 70°, 8 hour days that have not become dormant. They have grown more slowly. They have retained their leaves. They flush very slowly but they still keep going, so in the case of P. trifoliata, it is not day length that makes

them dormant but low temperatures. After the low temperatures, if we put them on long days, then we have no trouble. They start growth right away.

VOICE: You're not saying that this photoperiodic response can be accepted by parts of the plants without leaves, are you? In other words, you wouldn't wait until the leaves dropped off; you can't affect the plant then, can you?

DR. PIRINGER: That's right, these are plants that have always had their leaves.

VOICE: It has no effect on the woody plant without leaves?

DR. PIRINGER: No.

MODERATOR EVERETT: Ladies and gentlemen, I think we shall bring this session to a close. It has been very fruitful. I know the clapping is for all the experts who gave of their time this evening. We certainly are most grateful to you people and to you gentlemen who shared so freely with your experiences and your knowledge. That's the very wonderful thing about this society, this give and take, the sharing of our experiences and our knowledge for the betterment of the profession.