

PLANT PROPAGATION TEACHING TECHNIQUES

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The techniques in teaching of the Central and North Facility gardening classes are taught by separate instructors but in essence are the same.

At the Central Facility Ornamental Horticulture and Floral Work, along with landscape and general garden maintenance is taught. Seed sowing and cuttings for propagation are planted in a greenhouse under mist systems. In general, the inmate students work very much like any other plant growing establishment would operate. A number of aspects of propagation are taught, such as grafting and budding. The floral students learn various aspects one should know to enter the floral trade.

The North Facility student enrolled in Landscape Gardening is taught to properly use garden tools, along with techniques on how to grow plants, prune, bud, graft, plant bedding plants, trees and shrubs, and general garden maintenance, along with lawn care and planting.

The teaching techniques of the Department of Corrections in general is the same as in any other school teaching horticulture, with the exception of the social standing of our students.

MODERATOR VAN VEEN: Thank you, Ed. Lastly on the panel, we will hear from Jolly Batcheller, of the California State Polytechnic University, Pomona. Jolly:

TEACHING TECHNIQUES IN PLANT PROPAGATION

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The foundation projects, which Howard Brown spoke of, we have also. We have similar facilities, and we work with our students in a similar manner. I think the difference in geographical location has to do a little bit with the difference in programs.

In Southern California, as I think you realize, there are approximately a thousand nurseries within a fifty mile radius of us, so

there is an opportunity for many of our students to get practical work and to work in nurseries. The demand for plants, as I think all of you realize, is very large. As a result, we, I think, do a little bit more commercial growing and selling wholesale to nurseries than does Howard: but likewise we do not advertise off the campus. We do sell to our students and to the faculty on the campus and we average about \$1000 per month. Now this means a tremendous amount of production. We have about 13,000 square feet of glass; we have a five-acre growing ground; we have, I think, about 3,000 sq. ft. of lath or saran, much of which has been erected by students in class work. We have actually two courses in which propagation is presented. We have a basic horticultural course which is required of our ornamental horticulture majors; this is also an optional course for students in other majors.

We average about 50 students in the basic horticulture class, and it is given each fall, winter and spring quarters. Each class is divided into at least three laboratory periods. These labs involve considerable preparation, and planning months ahead of time in order to have plenty of proper plant material at the right stage of growth ready for each lab. I am very fortunate in having an outstanding graduate of our school as a technical assistant who handles this phase.

When one starts talking about propagating material, as has been brought out, one learns by doing. When we make cuttings, if we don't average at least 15 or 25 flats per lab, we are not doing what we should be doing.

When it comes to grafting, we do quite a lot of practice grafting because many of these students are not in the horticulture department and this may be their only opportunity to learn these techniques.

The second course in plant propagation is required of majors in ornamental horticulture and is primarily limited to such majors. Occasionally a bioscience junior or senior who has a nursery background is permitted in the class, but I discourage this because this course takes off where the basic course ends, and we don't go back to review details of the latter.

I have in prior years shown this organization the grafting models we use in class. I make these models of everything that I can, for example, for everything we do in the way of cuttings, grafts, buds, etc. I make a model at least 18 to 20 inches tall, so I can discuss this and illustrate it on the board. I have the actual plant and a large model so the students can understand. I find this is a tremendous help in teaching, because if a student can see, and if he can understand, then he can follow my conversation. But if a student can't see what I am doing and he doesn't understand, he loses interest: once he loses interest, I have lost the student. So I try very hard to use graphic means of presenting the material.

In this advanced propagation class, we go into tissue culture. Now, with a lab the size we have, we cannot do this with one station. So what we do is schedule the student's free time. It means about three or four times extra work for me because I only take three students at a time in the room where we are doing the transfers and the meristem tissue culture. It increases my load for it is a three to one type of operation, but it's very, very gratifying, due to the close individual attention. I think we are fortunate to have the type of student we seem to attract.

I'm going to digress from the matter of teaching students but I am going to talk to you about a subject that is dear to my heart, and that is teaching people. I think it's wonderful that we have 200 people here today for this, but the trouble is with us horticulturists, we talk too much to each other and not to other people. Now, we are very fortunate to be in the field we are, because we are working with living, growing things. "In nature, there are no rewards or penalties, there are only consequences." Now human beings butter each other up and say you're the greatest guy in the world and for five minutes the guy believes it, but you can't do this with plants. If you don't water them, if you don't fertilize them, if you don't take care of them, they won't respond. And this is what Howard was talking about in these projects, where the students learn this. I've had similar experiences with my students where two students take the same kind of seed in starting a project and one comes out with a tremendous crop, the other comes out with a complete failure. They have learned from the experience.

I think many people, including California's governor, are sort of mad at educational institutions: I think people point at education or at institutions and say, "you're not doing a good job." And I ask each of you at this time, to point your finger at something, will you? Just each of you take a look at your hand as you point at something. Just hold up your hand and look at it. Will you look and see that three fingers are pointing back at you.

This is a story I tell when I work with scouts. I also tell it to students and to parents. It's the story of the scoutmaster walking along a mountain trail with his troop. They pause for a rest under the shade of a shrub. As the scoutmaster is sitting there, he notices a small chrysalis on one of the branches. He calls it to the attention of the scouts. "Look, scouts, here is a chrysalis; this is a butterfly in the making." He said, "You know, I've never seen one of these things break out of the chrysalis and I'm going to take this home with me." So he very carefully cut the twig and, as all scoutmasters are prepared, he had a little box with some cotton wool to put it in. He wrapped it up and he took it home. He placed it on the kitchen table where he could watch it very closely. One Saturday, and he was very glad it was Saturday, he noticed that the thing was

beginning to move, so he quickly got on the phone and he called the scouts. He said, "Look, fellows, this thing is beginning to come out and I want you to come over and see it." So the scouts came over and they gathered around and pretty soon, sure enough, there was a twisting action of this chrysalis and suddenly it cracked. You could see the wings beginning to emerge. Well, it's a slow process. So he called his wife and said, "Dear, I want your tweezers and a pair of nail scissors." Very carefully he cut part of the chrysalis that was exposed, not touching the butterfly. Soon he had the butterfly out of the chrysalis — and apparently undamaged. So the boys had seen the butterfly come out of the chrysalis and they went home. But the scoutmaster watched that butterfly during the day and that night the butterfly had not changed. It was still hanging from the chrysalis with its wings helpless beside its body. Two days later, it died, and dropped on the floor. So the scoutmaster got in touch with an entomologist and he said, "What happened? Why did this chrysalis die? He said, "I'm positive I didn't touch it — I know I didn't touch it. What happened?" The entomologist said, "You killed it." He said, "How could I have killed it? Was it the temperature of the house? Was it diseased?" "No," the entomologist said, "you killed it, because you see, a butterfly is first a caterpillar and then it goes into this chrysalis, where 90% of the body fluids are in the thorax or the body. It is the struggling, the twisting, the turning, the effort, that forces these fluids from the thorax into those helpless wings to fill them out to make it possible for the butterfly to fly." And so to you parents, to you horticulturists, to you teachers, don't make it too easy, because that is one of the problems of education today. There are too many people, I believe personally, who shouldn't be in college. They don't want to be there but the parents want them to be. I think it would be better if some of them were working to learn the value of effort. Don't make it too easy. Make it tough. Thank you very much.

TED VAN VEEN: Thank you very much, Jolly. Do we have any questions that you'd like to ask of these four people at this time? If not, we'll go on, but I do want to hand out these certificates of appreciation.

Next we will have Bill Curtis and his perennial Question Box. Are you ready, Bill?

WILLIAM CURTIS: Sometimes you have quality and sometimes you have quantity. Tonight we have quality but we don't have very much quantity.

How do you get a new plant accepted? I think every one of us has been through that. We see something good, we pick it up in some

other part of the country, we bring it home with us, and we have a hard time getting the public to accept it. Who wants to answer the question as to how we go to work and get a particular plant into the hands of the public, into the hands of the architect, into the hands of the landscapers so that we can produce it and make some money. Who wants to answer this question? There ought to be a dozen answers. Dr. Clark, you've introduced a number of new rhododendrons. How do you go about getting rhododendrons accepted?

HAROLD CLARKE: I haven't introduced any new rhododendrons, but I'd say the first thing is to be sure you have a plant that's better than anything else.

WILLIAM CURTIS: Well, that's one answer. Go ahead, Joe.

JOE KLUPENGER: I always felt, Bill, that if a new plant is to get propagated in quantity, first send out sample plants all over the country where you know this plant will survive, for tests. Get it out before the public, get good color pictures, get its characteristics, get all the information you can on it and get it out into many areas and to as many people as you can and, by doing that, I think those who have developed this plant will have very successful stories to tell.

We can look at the rose growers; you will find that many of the patent roses have been handled in that way. But I think that anything, whether a tree or shrub or any plant material that you know surpasses those in the same field, the same area, the same type of plant should be handled this way. Take for example, we have a new Pfitzer-Tam-juniper that was developed right here in our area quite a few years back but as far as I could see, there's never been any promotion of it. The man who owns that plant, if he would propagate it and get it scattered out into all the zone areas where it will grow, he would find that he can get it accepted by the general public.

ED JELENFY: Just plain advertising; for example, a number of years ago there was the black rose of Germany. If some of you old timers remember, they sold thousands of them even though it wasn't any good, just by heavy advertising.

WILLIAM CURTIS: Right now, there is on the market a new *Pieris* the North Willamette Valley Experiment Station has developed and we're all wondering, when it gets the acid test, what's going to be the final results. I would put it out now into the hands of a number of nurserymen; these nurserymen will evaluate it and the time will come when we will know whether it's a plant that is going to go over big and everybody will be able to accept it and sell it. So there are a number of ways that you can get a plant introduced. *Sunset* magazine is very helpful if you have something unusual. I know in this area the editor from Seattle will come down to your place and take pictures and write an article about it. It is possible for an unusual plant to get introduced to the trade through *Sunset*

and lots of people read *Sunset* magazine.

EUGENE BACUI: Bill, there's one method I didn't hear mentioned; that's with the architects. Contact architects, especially with ornamentals. It just takes a few to like it and put it into a good landscape job or on a big important work and your plant is sold.

WILLIAM CURTIS: The next question is: What is the proper way to make a cutting for the best rooting? Who wants to answer that? There are several ways to make cuttings — different woods, and different materials that have to be cut differently. Who wants to answer this? Dr. Brown? You supervised the making of a good many thousand cuttings among your students; would you answer this question? The way you would want to make a cutting so it would root the best.

HOWARD BROWN: I think, Bill, you just have to narrow this down a little bit to the kind of plant. Because certainly some things are going to root very well from hardwood cuttings. Others are going to take softwood cuttings; and, of course, the location of the basal cut can have quite an influence on rooting in some kinds of plants, too. I think you'd have to know which kind of a plant you're talking about.

WILLIAM CURTIS: Who wrote this question? Have you a particular plant in mind?

JOE KLUPENGER: I'm talking about hardwood cuttings. As we look around over the past years, we find so many ways the cuttings are taken off, at a 20° or 45° angle; some cut 90° across the end of the cutting. Some wound halfway up one side or for $\frac{3}{4}$ inch or $\frac{1}{2}$ inch. Some wound both sides. This seems to be pretty general among all woody cuttings. I wonder if there has been any work done on hardwood cuttings as to which is the best method to make the wound on a cutting to get the best rooting. Has there been any work done experimentally to find exactly what is the best way to make the cuttings.

ED SCHULTZ: There is lots of information on early work done with cuttings in making the basal cut in relation to the nodes. The cutting that has prominent nodes is most likely to root at a node, because here is the place that natural storage of foods is concentrated. In making cuttings that you don't know anything about, the most likely place for it to set roots is at the nodes, so a basal cut just below the node is considered ideal. The angle of cut depends a little on your conditions. With mist I don't think it would make any difference whether you cut square across or at any angle. If your conditions are similar to those under which the old time nurseryman propagated, in which he watered the cuttings himself, chances are the longer the angle of the cut the more likely there will be a surface that is exposed to water — the greater surface exposed to water in the medium. So an angle cut would be very important — if you don't

have an automatic watering system. But, as far as angle of cut, some work at Texas A. & M. University was done with pruning shears versus sharp knife versus dull knife, along with different positions on the cutting end. The conclusions were that the sharp knife at an angle in which you increase the base at twice the length of a straight cut was about ideal. You shouldn't have too long a sharp point that could be bent over and make an opening where decay could get started. And yet, you should have an angle cut that makes it easy to stick the cutting and to give a cut surface exposed to moisture in the medium. This also allows more hormone — in that study they were using powdered hormones — to coat the cut surface.

WILLIAM CURTIS: Many years ago, when I worked for Franz Krusky—and I don't think he ever read about this work — that is the way he explained it to us. I think that stands pretty true today. Dr. Clarke, though, has a different method for making rhododendron cuttings. He uses the pruning shears and he whacks them off at the base with the shears and he cuts the extra leaves off with the same pruning shears — real simple. I asked him how they rooted and he said, "good." So since then, when Dr. Clarke gave a talk and was asked that question, at our meeting at West Lynn, Oregon (1963), we've always made our cuttings with pruning shears, and I couldn't see any difference in rooting. Just a straight cut. Anybody else wish to comment on this question?

JOE KLUPENGER: Cuttings with no visible nodes; now with plant material as camellias it is very easy, but when you get into wood that has no visible nodes or bud eyes showing on the stem, what do you do?

WILLIAM CURTIS: Does anybody have the answer to that? Well the first article that I read about wounding was when I first went to work for Franz Krusky; it mentioned that if you wounded and then dipped your cutting in hormones, you could use a longer cutting. We made very short rhododendron cuttings. We had the darndest time to hold the cutting in the medium because we didn't have stem enough. That's the way Pop Krusky rooted them. But when we started using a hormone and wounded the cuttings with the wound on the side, we made longer cuttings and we had less problems rooting. So now we make a cutting about 2½ to 3 inches long and we wound it heavily with a pair of pruning shears. But rhododendron doesn't have visible nodes like you find on a deciduous magnolia or some other plant. Mr. Bosley, here, he is an expert on rhododendrons. How do you make your rhododendron cuttings?

RICHARD BOSLEY: With the shears, just slice it down the sides.

WILLIAM CURTIS: We have a man, Ted Van Veen, who wrote a book about rhododendrons; he must have all the answers. Ted.

TED VAN VEEN: Well, its just what you said about

rhododendron cuttings. I think it's a matter of experience. Cuttings should be 2½" to 4" long, and with the hormone powder that we use, they root beautifully. I remember a couple of years ago when one of our fellows who normally doesn't make cuttings came in one afternoon, and there was some odd things to make, he made some six inches long. I stuck them in, just out of curiosity, to see what would happen and they did not root very well; in other words, we have just too long distance from the top to the bottom of the cutting. I think they just did not root because they were too long. Where the happy medium is on rhododendron cuttings, I don't think anyone really knows.

BRUCE BRIGGS: Well, I would have to go along with Howard Brown to a certain extent, although, I believe, you have to consider also the effects of your mix, your media, how you handle the cuttings, etc. Let's look back to 10 or 12 years ago in the Plant Propagators' Proceedings to an article on grape cuttings. It amounted to extensive work on hardwood cuttings cut with sharp shears, scissors, clippers, and a saw. Results were that the saw was the best because there was a certain amount of wounding. You had a ragged cut. So here, again, it may be the way the cuttings are handled. So I don't think you could say any one way is the best; it is only when the method is best under your conditions.

DAVE ADAMS: Some of the work done at the University in the last few years indicates that there are probably many more things that are a darn sight more important than how the cutting is made, although I grant we did not look at this particular problem. But when we start getting into leaves, the number of leaves, and flowers versus no flowers and all the other factors, then they become much more important than how long the stem is.

WILLIAM CURTIS: Another question. Is the superiority of the German pine seed a matter of elevation, or a matter of uniform stand, or different strain?

EDSAL WOOD: That was *Pinus sylvestris*. There is no question that the seed of the German strain germinated more quickly; they put on more growth than the French strain. Don't ask me why, I never grew them before in my life until last year so I don't really know. They just performed a lot better.

WILLIAM CURTIS: Ed, did you bring a package of those cartridges that you plant the seedling in? I understand there's a larger size being developed and I wonder if you'd cover that a little bit with the group here. They were quite interested in them as a means of maybe using it for greenhouse crops.

EDSAL WOOD: Here is the one we came up with. This was the original without the hole in the bottom. Believe me, don't do it. Put the hole in the bottom. You won't get the root curling. This is the larger one that we're going into. This is 2½ inches by 10 inches. We

will transplant the plugs from that into the larger one. They come out as individuals. Shaped the same way with the hole in the bottom. You can space them wherever you want to, about 140 per square foot. You can space them every other one, every third one, or whatever space you need for whatever plant you're growing.

WILLIAM CURTIS: Anything about costs?

EDSAL WOOD: Not yet. These are the first ones off the die. They haven't come up with production costs. I'm assuming they will be about 6 cents apiece. We figure on using them for about five years. So that cuts the cost This we developed primarily for Noble fir Christmas trees because we want to shoe-plant them out of a tractor and this will fit a three inch shoe. That's the reason we came up with 2½ inches by 10 inches. We need to put the root ball far down because this land is non-irrigatable. We don't have enough water up there to plant the Christmas trees so we've got enough depth to get down to normal soil mixture and hold them until the plant has a chance to regenerate its root system and carry itself. They are all tapered so they should slip out just like the plugs do. You are welcome to come up and take a look at them.

I'm glad to see we are catching up with California. It's just a matter of transposition. They have a thousand nurseries in fifty miles; we have fifty nurseries in a thousand miles.

WILLIAM CURTIS: Do you use any nutrients in the sawdust you root rhododendrons in? This is for Bill Smith.

BILL SMITH: Last year, no; this year, yes. We are now using about 10 pounds dolomite and 3 pounds superphosphate per cubic yard.

WILLIAM CURTIS: Do you prefer cedar sawdust?

BILL SMITH: I don't know really, Bill. We haven't decided yet.

WILLIAM CURTIS: I'd like to ask one of these experts here what is the difference in the chemical composition of cedar and redwood sawdust? Are they similar? Is there much difference between them? I know they use redwood a lot in California for rooting or they use it in their rooting mixture. Has any work been done on this subject? Have you tried anything, Dr. Brown?

HOWARD BROWN: We haven't done any analysis but we know that for years people tried to avoid redwood sawdust or redwood chips because of tannic acid, and then in recent years it has been used very extensively. Is Don Dillon here this evening? Or Fred Real? Don? You've had some real fine experience on this.

DON DILLON: You know, it's terrible; we got so many roots we couldn't get them separated from the mix, so we stopped using it.

HOWARD BROWN: I think rate of decomposition is one of the

main reasons many of our growers stay away from sawdust. We avoid the fir sawdust because it does decompose rather rapidly; it involves a nitrate tie-up. Redwood, on the other hand, breaks down much more slowly. I know when the cut flower growers, particularly San Lorenzo Nursery in the Los Angeles area, started using redwood sawdust in their soil mix for chrysanthemums and carnations, just because it was being used successfully in Northern California, they found they had to go into a very severe leaching program in order to remove the tannic acid, or some other harmful substances, from the redwood sawdust before it could be used. After that, it was quite satisfactory. About 1/3 of their soil mix was this particular material.

AL ROBERTS: Some work at Oregon State with cedar and redwood showed that the volatile water soluble oils in cedar could be leached out in piles fairly rapidly through an Oregon winter, or putting them under sprinklers. But these oils are very toxic to plants, even in packing materials, for several months until they are leached out. I don't think the tannins, Howard, are as much a problem as some of these other materials that we are certain have toxic properties.

VOICE: The best way to eliminate the essential oils is to steam sterilize for half an hour. When I use cedar, I steam sterilize. It drives the oil out and that solves the problem.

HOWARD BROWN: I'd like to add here that several of our students and staff members have been working closely with the Sequoia Forest Products Company in Visalia, California. The objective is to get a lightweight medium for growing plants in four inch pots. This would be for plants as miniature carnations, salvia, marigolds, petunias, etc. In order to increase the water holding capacity, the fertilizer holding capacity, and cut the weight, they used a number of different mixtures of various organic materials. One of the most satisfactory mixes we're using right now is a composted redwood sawdust, 50%; 30% perlite; and 20% Canadian peat. And then, of course, we adjust the pH through the addition of dolomite lime and fortify it with nitrogen, phosphorus, and potassium. This does make a very lightweight mixture that holds moisture and fertility for a long period of time and it induces a very good root system. When we raised it up to 75% sawdust, then we got into trouble. So about 50% seems to be the maximum we can use. A number of the growers in our area are using this mix now even for various other potted plants.

AL ROBERTS: Further with the toxicity of cedar material is the fact that in some of the piles where they were leaching them through the winter, they weren't careful about the run-off and they actually could kill trout in the streams this material was running into. So there are some real toxic properties in it, but apparently they are water soluble and easy to leach out.

WILLIAM CURTIS: I remember a number of years ago, there was injury with some bare root trees that were shipped. You know in this country they used to, I suppose they still do, use a shingle tow around the roots of bare-root trees and there were some quite severe injuries. Now I don't remember why for that particular reason but there was some injury from shingle tow in bare-root trees that were shipped East.

We have one final question unless someone else has another question.

VOICE: I don't know what shingle tow is.

WILLIAM CURTIS: Well, shingle tow is the sawdust that really isn't sawdust, but is something like excelsior. You know what excelsior is? Shingle tow has the same formation of excelsior but it comes from cedar when they saw shingles. The type of a blade they use runs out shavings that is similar to excelsior; and they call it shingle tow. It's a rip-saw and it goes the length of the grain. They use it in cars for shipping nursery stock — in boxes, and so on.

We have one final question: "I am having trouble in rooting *Juniperus scopulorum* 'Pathfinder'. What are the practices being used?" Is anybody rooting this juniper? That's one of the upright ones. I always grafted when I was growing them.

IVAN STRIBLING: I'm having all kinds of trouble with it. I still haven't solved the problem. We get a fair percentage, but that's it.

WILLIAM CURTIS: Anybody else have a comment on this item? I know Rudy Wagner always grafts them and he does a real good job of grafting.

BRUCE USREY: We are rooting them in January or February in an outside mist bed with bottom heat at 65° F for six weeks, then resetting them with 3,000 ppm into indolebutyric acid after sticking them in this way in 1,000 ppm IBA and along about June or July we get 80 or 90% rooting. It's all done in the open air outside in the full sunlight (in Southern California).

WILLIAM CURTIS: Did all you people who want to grow 'Pathfinder' juniper follow that? I think I'm going to graft mine. I think it would be cheaper.

I want to make one comment about growing or rooting *Magnolia grandiflora*. You know we spoke about taking cuttings at the eye or the nodes, so on, like that. Through the years, I've made quite a few cuttings of *Magnolia grandiflora* and I've always found that I had best luck by taking cuttings with a "heel". Now I know they say that's old-fashioned and it's all baloney. But I think if there is something there that will help you so you will get better rooting percentage, why not use the "heel"? So we've always taken "heel" cuttings. I always tried to have sufficient stock in the field so I could

go into my two-year-old plants, because such plants in the field have a tendency to send out side branch right down close to the ground. If they aren't too vigorous, you can get a cutting with the heel from an inch to six or eight inches long. Then we wound them, use Hormodin 3 and put them in sand, or sand and perlite; we use high bottom heat, up to 85° F. But we don't take the cuttings until the tip, the bud tip, has fully developed. I have found that in many cases if we take the cutting before this tip has developed and is firm, sometimes we lose it. Then we get a "dog-leg", and get a tree that's awkward-shaped. But if we take the cutting when the tip has matured, we won't lose it and get a nice straight tree. We go in the field with a sharp knife and sever this cutting right close to the trunk and get, of course, a little bit of the old wood. Now magnolias, as you know, are pithy. They have a hollow stem with pith in it. My understanding has been that anything with a pith was difficult to root. So if you take magnolias with the heel you get away from that pith.

Any other questions?

VOICE: What time do you do it, Bill?

WILLIAM CURTIS: We generally take them along in November — maybe about the middle. But you can take them whenever the tip has firmed up so it's not growing anymore. I think if you look at the plant along in November, you see what I mean. If you take them now (September), they are soft and are growing and something could happen. It's real soft tissue — fungus could get in, and you could lose it. The tip will die or, quite frequently, if we get a frost this time of year (September), on magnolias you'll invariably lose the tip, at least on many of them. If you grow a plant from a cutting like that, you get a "dog-leg". But generally those cuttings from down below, underneath, do not get frosted. We always take the material after the tip has developed and we get very good results.

BRUCE BRIGGS: I have one question that I put in the Question Box to Dick Bosley. I'd like to ask in regard to the foot candles on the white poly. The question would be this: Why did you get higher light intensity through the white poly than you did through the clear? What time of day did you measure the light intensity?

RICHARD BOSLEY: I measured it about 10 a.m. I measured it at right angles to the film, about three feet away. The interesting thing was not the specific levels but the relationships.

BRUCE BRIGGS: Then you had more light with the white poly than you did the clear. You had 400 against 100 f.c.

RICHARD BOSLEY: Where the white was on the outside, and the clear on the inside there was an intermediate level; when the clear was on the outside and the white on the inside, there was the highest level.

BRUCE BRIGGS: What was the reason?

RICHARD BOSLEY: I don't know. Somebody suggested that certain wavelengths come through the clear and can be converted to different wave-lengths which would go on through the white. But where the white was on the outside, the initial wave-length was reflected. I don't know.

BRUCE BRIGGS: Now the other thing, was there any moisture on the film, because of the relationship of film. Water can decrease the light and water will form on the film under certain conditions; but this didn't bother?

RICHARD BOSLEY: Somebody else asked me about the moisture, I don't know.

ANDY LEISER: You mentioned the heat was higher with the clear on the outside and the white on the inside than it was with the reverse situation. This is your greenhouse effect . . . it would be somewhat the same with the visible wave-lengths.

PAUL ADAMS: What is the best way to stratify Mazzard cherry seeds for spring planting?

IVAN STRIBLING: We store the seeds when they come in fresh. We maintain them in plastic bags through the winter at about 34° F. Then we start our moist stratification around January and carry it for about three months, then plant in the spring and we get good results. We also put the seed through a warm stratification period before the cold. At 70° F; this seems to increase the germination of Mazzard seed. That is a fairly short period; if I recall, it's about three weeks at 70° F and then we follow that with moist, cold stratification between 34° and 40° F for the remainder of the three months.