

MR. GRAY: Indeed, I have, Charlie. I would not stand up here if I had not.

DR. HESS: Then have you made a cost analysis of the two? With the increased cost of the deflector reflector I wonder if you do not have a higher cost per cutting than you would have using a mist system alone?

MR. GRAY: No doubt you would. In this case I would not recommend the deflector reflector, but would suggest as I did in my formal presentation, that you go to the north side of the woods and set the cases up there. Here you would need no aluminum, and you would have plenty of light reaching the cuttings. I get 1000 fc on the north side in the summer period, ample and sufficient to do a good job in rooting, bearing in mind that our cuttings are strong with a high rooting potential.

MR. WALTER GRAMPP (Red Bank, New Jersey). Using that north light setup, how long does it take to root *Acer palmatum*?

MR. GRAY. We get very nice roots showing in six weeks time, and the root system comparable to the plants on exhibit in twelve weeks.

MR. GERALD VERKADE (New London, Conn): Is there any definite distance between the top of your plastic and the tops of your cuttings?

MR. GRAY: I don't think it makes a great deal of difference. We are checking this at the present time.

The important thing in case construction is that you do not build a circus tent and call it a vapor proof case. You have to keep the roof of your case flat. You fellows who have been in this business of propagating plants for a long time know what a grafting case looks like. A vapor proof case is exactly the same thing, except you vapor proof it with plastic.

MODERATOR NELSON. Thank you very much, Harvey.

The next person on our program is John Hill, better known to all of us as Jack. He is speaking on "A Practical Approach to Greenhouse and Liner Bed Sanitation" Mr. Jack Hill.

Mr. Hill discussed the subject of sanitation as it is related to the successful propagation of plants (Applause)

A PRACTICAL APPROACH TO GREENHOUSE AND LINER BED SANITATION

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Perhaps I should first define what I mean by greenhouse sanitation. Actually it is not a thing, but rather, condition. It is a condition which results from the application of cultural practices that are designed to initiate and maintain cleanliness throughout an entire plant producing facility. We feel that sanitation is a very important factor in this process of attempting to standardize. It is one of those factors which can be

controlled, but unfortunately, is not the type of cultural practice through which you go once, and it is all done. It is continuous.

The reason for practicing sanitation is simple. First, it will reduce cost, and, second it may permit the production of a plant which could not be economically undertaken otherwise. This condition of cleanliness is aimed at production without interference from diseases and harmful insects. Last but not least, it is aimed at producing an operation which is free from too many cull plants.

All experts on industrial relations stress the importance of neatness, orderliness and standardization, in any operation in order to achieve optimum results. It is not a type of problem that you meet only once, solve it, and never experience it again. It is a type of problem that you just have to work at every day. For example, we all know how rubbish and junk tend to accumulate in corners, which, is not noticed as much after one has walked through the pile three or four days.

I believe the primary point in the matter of greenhouse sanitation is a systematic cleanup. By that, I mean a specific period devoted to the collection of all plant refuse and rubbish, both inside and outside the greenhouse, under the benches, in the corners in the headhouse, and in the working area. After this has been done it is then time to give a little thought to the establishment of one, strategically located rubbish pile. One must then have the firm conviction that every bit of rubbish is to be taken to that one pile, for subsequent burning or removal to a public dumping ground.

There is, of course, an endless economy to be achieved from arranging work in such a way that debris falls directly into a container, so that it can be disposed of easily. We solve that problem by making cuttings, trimming grafts and the like, by arranging to have the worker perform his duties right over a receptacle, into which the pieces will fall.

I was brought up or associated with a greenhouse operation where it was standard operating procedure to carry literally thousands of pounds of live plant material into the greenhouse every week. From this quantity of plant material we made up cuttings or grafts which perhaps totaled about 20 per cent of the total mass brought into the greenhouse. The remaining 80 per cent was carefully swept into a pile and carried out in three or four days.

In our operation we have frequently seen jobs performed in such a way that it took one man, let us say, one hour to accomplish but it took two men, two hours apiece to clean up after him. We do not consider the job is finished until the working area is entirely clear and ready for the next job that comes along.

In our headhouses the work benches are mainly metal. We do have one or two old wooden ones with which we are extremely careful. We cover these with copper naphthanate, in an effort to keep whatever may be in the wood inside, where it will not do any harm. We use a great deal of used newspaper, ie newspaper that is no dirtier than it gets in reading. We try to stay away from old lunch papers and similar paper. We do all the work we can on these newspapers. This facilitates the cleanup operation because they can be bundled and transported to our one, centrally located rubbish pile.

You will notice that I have not referred to any specific disease, insect, or control measure, since actually there is no way of knowing whether any are present. Therefore, all the controls I am discussing are those not aimed at combating a specific, deadly disease but more at eliminating, so far as possible, the likelihood of any of the numerous agents becoming established. Any tool which is used to handle a large number of plants is much more suspect than a tool which is used to handle only a few plants. Therefore, things such as wooden boxes used in the greenhouse are certainly to be watched very carefully. In our operation we have almost entirely eliminated the use of wooden boxes. For example, we use metal trays for handling all our cuttings. We have also eliminated the use of the large, square wooden box for handling propagating material. Instead we handle it all in square galvanized washtubs. These tubs are nominal in cost, and of a handy size. They are easy to clean although we have good reason to believe that most fungi and bacteria would not find as happy a home on metal surfaces as they would on the wooden container. Wooden containers, if used, should be painted annually or dipped in a standard strength wood preservative in order to insure its longevity and to make sure that it is not going to carry any diseases that we will later have to eliminate from our operation. Of course, it is quite important to put these containers away in a clean condition. They should not be put away containing earth, old roots, or other debris.

Tools, in which I include such things as hand trowels, short-handled shovels, spades, and implements that are generally used in the greenhouse and propagation area, should be dipped frequently in some kind of decontamination solution. For example, a shovel might be dipped three or four times a day into a solution containing one part Chlorox to four parts of water.

As for the greenhouse itself, it is very important that it is cleaned completely. By complete cleaning I mean that everything from the benches, to the gutters of the house should be scrubbed. If possible, the bars should be washed and certainly fastidious operation would require repainting the bars inside the house, if for nothing more than to eliminate the mold that often forms on them. Use of a 1.50 formaldehyde solution for washing has proven to be excellent for this type of cleaning operation.

We follow a somewhat different procedure in the handling of our sand propagation benches than is generally accepted in that we do not change the sand. We have some sand which has been in use now for five years. We steam it at least annually, and between every crop possible. It is possible, of course, to have two benches steamed in the greenhouse while you have a crop in, say, two others. This is one of the main advantages in using steam as an overall antiseptic agent as compared to many chemical sterilants which cannot be used in a house containing growing plants. It is admitted that the medium will eventually build up with plant refuse so that the moisture capacity is higher than we like for a propagating material. However, we feel that it is safer and that there is less likelihood of diseases developing from the plant refuse which invariably comes off the cuttings and falls on the sand, than

there would be in going to new sand about which we know very little. New sand is never used unless it is first steamed.

Pots, are a frequent source of contamination in the greenhouse. It is standard procedure with us to boil pots prior to use in a couple of old stock tanks that are 10 or 15 feet long, 20 inches deep and 30 inches wide. We put flats, pots and everything into the tank, hook the steam manifold in the bottom of it and attach the portable steam generator. After they have boiled, we let them soak for at least an hour in order to get as much of the salt out as possible. The boiling kills off whatever fungi and bacteria may have accumulated on that pot, and they are then put away.

In the outdoor beds used to produce banded liners we like to treat the soil either chemically or with steam. Use of chemicals such as Vapam and possibly Mylone seems to be more convenient than steaming. After the soil has been cleaned up we like to apply at least two inches of gravel so the plant bands in the trays rest on the pea gravel rather than on soil. In the past, liners which rooted out of the band and tray into the pea gravel were believed to be damaged by the lack of moisture. After a little study we had good reason to believe that much of the damage to the root tips could be traced to the lack of cleanliness or the lack of facility for maintaining it.

For several years now we have followed a procedure that we now regard as standard procedure in our operation. It is that of dipping every cutting, scion and understock which is brought into our propagating facilities into a combination dip, that we call the Triple Dip, for lack of a better name. It is comprised of Captan, Agrimycin and Terrachlor which are dissolved in ordinary water. It is a relatively inexpensive dip, and every piece of material is run through it. We are sure that this dip slows down rooting. However, since we are generally dealing with plants that are easy to propagate from cuttings, this slight reduction in speed of rooting is not serious. On the other hand, if a propagator was handling a group of plants considered difficult to root, then it might be a factor and would keep him from using this dip. We have used Ovatran in the dip, in an attempt to get rid of all mites before we ever put cuttings in the bench. We found that it often inhibited rooting more than we liked. In the process of running cuttings through this dipping solution it naturally accumulates plant debris. When this becomes excessive we do not throw the dip out but rather use it to wash down our work benches and the greenhouse floor.

In what appears to be a somewhat elaborate procedure and pre-occupation with something that you often can't see, we figure that it is cheaper to take steps to prevent a disease infestation than perhaps having to fight it after it has started. You will remember in my introductory remarks that my original analysis of this sanitation procedure was to reduce production costs. Although these things I have described, sound elaborate, they are quite simple and require very little time, once they are established as routine.

A good question for me to ask in conclusion is, "How mature is your thinking in reference to things like sanitation?" We don't have to look very far back in history to find where the human race thought

it was pretty well advanced, but was doing what appears now to be some pretty foolish things. For example, there was a time when surgery was just almost a warrant of death. Then it was discovered that through asepsis, surgery could be performed on the human being with pretty well, predictable results. That was quite a big step. Often, this was accomplished before it was known what caused the disease or for that matter before the germs were actually seen. Thanks to Zacharias Zanser, a Dutchman and Anton Leeuwenhoek we began to see things that could not be seen with the naked eye. I believe this same thing applies in the matter of greenhouse sanitation. The presence of these disease organisms cannot be seen with the naked eye until it is too late. To my way of thinking it is far easier to control them by sanitation and by preventative control measures than to attempt to fight them after they have become established. Thank you very much.

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(*Editor's Note:* Mr. Hill illustrated several of the points brought out in his paper by means of colored slides.)

MODERATOR NELSON: Thank you very much, Jack. Are there any questions you would like to ask Mr Hill?

MR. HANS NIENSTAEDT (Rhineland, Wisconsin): Do you treat your benches in the greenhouse with Mylone?

MR. HILL: No, we have not used it in the greenhouse. We have it on hand, and it is our plan to use it for the sterilization of outdoor beds next spring.

DR. CHARLES HESS: Jack, can you tell us what is in your dip that is reducing your rooting?

MR. HILL: I believe it is the Terrachlor that is giving us the inhibiting action. We have used the Agrimycin and Captan alone on several occasions and have not experienced as much inhibition.

DR. CHARLES HESS. The reason I asked is that the chrysanthemum people have found poorer rooting from cuttings which are dipped in streptomycin.

MODERATOR NELSON Thank you very much, Jack

To continue with our program I take pleasure in introducing Professor L. J. Enright, of the University of Maryland, College Park, who will speak on "Response of *Magnolia grandiflora* and Several Species of *Berberis* to Root Promoting Treatments."

Dr. Enright then presented his paper on the use of concentrated, quick dip chemical treatments for rooting cuttings of magnolia and barberry. (Applause)