solution containing 1 5 to 2 pounds of 20-0-10 or a 20-0-20 water soluble fertilizer per 100 gallons of water and applying 1 pint per gallon container every 10 days throughout the growing season

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MODERATOR NORDINE: If we were to open the floor to questions it would be easy to devote the rest of the forenoon to questions. Dr. Kelley will be here on Friday night for the question box session. I feel sure that a great many of you will want to question him at a great length concerning this very, very interesting topic With your permission we'll hold the questions until Friday evening.

The Program Chairman has a great deal of latitude for the selection of his speaker and many times he selects something of a personal nature. Now I am quite sure that you all know the question that Martin brings up every single year at the question box, that is, the dropping of the needles on taxus. He has never been able to get an answer to this problem and I suspect that he brought in the next speaker for that particular purpose. However, I do know, too, that we will all benefit from this next particular topic.

Nearly 30 years ago Richard White, who is now Executive Vice President of the American Association of Nurserymen, made a statement to the former Plant Propagators Society that nurserymen will attribute the death of plants in propagating cases and in the beds to everything under the sun but to plant diseases. Many of us have become acquainted with this important statement in recent years So with this in mind we are very, very happy to introduce the next speaker He is Dr Spencer Davis of Rutgers University where he is Extension Specialist in plant diseases. In other words, he devotes full time to answering questions on plant disease problems With that, Dr. Davis!

DR. SPENCER H. DAVIS (Rutgers University, New Brunswick, New Jersey): Thank you, Sir and Gentlemen.

Apparently Dick White was a good reformer in New Jersey because he got all our nurserymen to think that nothing happens to a plant other than a disease. I wish many of our nurserymen had been here for the first two papers. I think it would have relieved our burden a lot. Incompatibility answers half of our problems and over-fertilization answers the other half.

DISEASES IN PROPAGATING BEDS

SPENCER H. DAVIS
Rutgers University
New Brunswick, New Jersey

I realize that each nursery has its own particular problems If you talk ten minutes about somebody's problems it is not of too much interest to the person who has a different type of problem confronting him.. We are going to talk therefore, a little bit about the general diseases found in propagating beds. We are also going to think about what happens to many of these cuttings after they become plants. You

people who grow these plants know enough about many of the problems It is after these plants are sold and get into the hands of the customer that either the county agricultural agent or I start to get questions; this is when we have a problem. I am going to try therefore to hit both of these sides

First of all, let's take the non-infectious diseases. They are usually easy to correct. You can get 100 per cent results with them, but you don't have any interest in these because you know the answers to them.

Cankering is common on taxus after it has been lined-out in the field. We find if we have a tall, spindly plant in dry soil we often get girdling or cankering around the base under very warm conditions. This is not a fungus disease but rather a result of injury to the tissue. To my way of thinking, taxus is probably one of the most tender plants we have and one of the ones most readily injured by too much or too little of something. This same plant will suffer from wet feet when you have lots of moisture. As a result browning of the foliage is often a good symptom of this trouble.

We often run into another thing when it is too cold at the wrong time of the year. This happens with many plants including *Ilex spp.* Incidentally, I am not going to give the varietal names of the holly because I had a sad experience in Connecticut. One gentleman said when they grafted on one variety they had failure but had excellent results with another rootstock. One of the men in the auditorium said they had the reverse situation in Oklahoma. We have this type of thing coming up when we talk about susceptibility to cold or heat. Apparently, in different parts of the country you obtain different results.

Another one of these so-called "non-infectious diseases" has been described by Dr. Kelley. You can imagine what happens to plants put in an area where you have opened your fertilizer drill and stood there and talked for a while. Later on in the season you have a "disease" that breaks out down in this area and the plants are completely killed. You call your plant pathologist and ask what fungus has started and spread out. Perhaps you buy a fungicide, apply it and that is the end of the trouble. It doesn't spread any more up and down the bed.

Another type of injury to nursery stock can be caused from the use of certain toxic chemicals. Here you see a wooden fence that was treated with pentachlorophenol, which is sold under the trade name of Wood Life It was put on in June and when we got a hot day when the wind was blowing some of these volatile chemicals that are used in preserving the wood gave off a toxic residue. You may have a screened bed or lath house in which you would like to save those posts or that lath for as many years as possible. You treat it and during a hot day you may get some of this fumigation from it on the plants.

We sometimes find a batch of cuttings that are completely rotten at the base. This usually results from having poor aeration in the medium, overwatering or overfertilizing.

All right, now let's look at some of the infectious diseases. How are we going to combat them? Well, we have soil sterilization and a good sanitation program We can select the propagating stock carefully. If we do all this we will probably end up with 100 per cent results.

Some time ago we collected a batch of holly seedlings from a flat where the plants were dying. Mr. Batchelor isolated a fusarium from it. Having seen these in the flats it was my feeling that in some of the cases it was too wet and the fusarium came in as a secondary organism.

Another organism that can give you trouble is verticillium Those of you from agricultural areas should be cautioned not to pick up top soil from an area which had been planted with tomatoes or peppers or egg plants. If you do you may be bringing in a load of verticillium also. This will effect rooted cuttings, and in fact I don't care whether it is maple, peach, crabapples or any one of 87 plants that we can name for you, they will get the verticillium disease.

In another case we have an example of a disease which occurred when azaleas were brought in from the field in the fall and put in benches too tightly. A fungus got in with these plants that were put so close together that there was no air through them. The same propagator planted some benches with a little more space between them, and these benches had no fungus.

This is one we run into when the soil is heavily manured and then is kept on the wet side. This is slime mold. It is not a disease but rather a type of fungus that runs all through the place even up a telephone pole. If you stood there long enough, it would run up your leg.

This next one is getting into the true diseases, which by proper sanitation or sterilization you can do a lot about. This is crown gall on rhododendron. This particular lot was almost 100 per cent infected because the bacterium was brought in with the soil. Here is a photo of a willow tree infected with crown gall, which is typical of so many Here again, I think proper selection of stock from which the cuttings are taken will help a lot to clear this trouble up.

All right, let's look at another complex, which is a combination of a virus and/or what we might call graft transmissable troubles. Here again, if you select your propagating material correctly and if you control insects, (this applies more to herbaceous plants than to your type of plants), you can have 100 per cent results.

Just this year one of the men picked up a plant of *Ligustrum lucida,* which had what we believed to be a virus. Just within the last six or seven months the Plant Disease Reporter carried a very nice description of this. Taking any cuttings from plants with this virus even though there are no visible symptoms in the leaves will result in propagation of the virus as well as the privet.

There is a disorder on holly which to my knowledge is not a virus. We call it purple blotch Perhaps some day it may be proven to be a virus. To my way of thinking it is just a clonal characteristic. When we get soil too wet, all cuttings from that clone will come down with purple blotch In Clarence Wolf's Nursery in southern New Jersey, where he has 10 or 11 acres of holly, we find that all the same selection will have purple blotch and the row next to it won't have it Here again, proper selection is the way to avoid troubles.

Last night we talked to Bill Flemer about anthracnose. He said that we are not too much interested in anthracnose on the London plane tree in the nursery. Somehow nurserymen get the London plane

and the Sycamore mixed up and we are running into some areas in Jersey where there is an awful lot of anthracnose on street trees. These trees were sold to street tree commissions as the London plane. When you start looking for white bark and the small balls, you know they did not buy a London plane tree.

The next disease, phytophthora shows considerable variation with varieties of rhododendron. Some varieties are almost completely knocked out with this fungus while others are untouched. Dick White is probably the one that has done the most work on phytophthora. This was done 25 or 30 years ago Since then, a lot of new varieties have come in. Next summer Professor Nichols of Penn. State University is going through the northern states, trying to run a survey on resistant varieties. I think he will be visiting some of you nurserymen on this trip.

When I said that some of you weren't interested in some of these methods for controlling these troubles, I meant it. However, if we have a high-priced chemical and it is difficult to use and requires special equipment, and if instead of 100 per cent results you can get 25 or 50 per cent results, and maybe it will injure some varieties such as weed killers might do, you might have a lot of interest because they are new chemicals or you heard about it or read about it some place.

In New Jersey they were having a lot of trouble with phomopsis on gardenia. This is a random selection of cuttings which had about 30 per cent rooted beautifully and 70 per cent dead because of the fungus. We tried incorporating a fungicide in the soil. The next slide shows what one and two per cent Ferbam or Fermate actually incorporated in the sand will do the growing results. We controlled the disease 100 per cent with about two pounds of Ferbam in 100 pounds of sand but we had short roots. With 100 pounds we had longer roots. We then dropped down to one-half and one-quarter per cent We now have as our state recommendation for gardenia the use of one pound of *Ferbam* in 400 pounds of sand Occasionally there are problems that come up that just can be answered without further experimentation We had one in a rose greenhouse where the plants just did not grow. A fungus we call Lepiota was responsible for this condition It is a fungus that permeates the soil and may run for four or five feet. We did quite a bit of work on this, using some of the newer materials.

We ran into a flower blight problem on holly this past spring which was very wet. I realize that you are not so much interested in the flowers on these plants but the thing here is that these diseased parts fall down on the leaves or worse yet, on the soil which will give you a soil canker on some of these plants. This is the sort of thing we may have to try to control with chemicals.

Too, on rhododrendron, we have a leaf spot which is caused by a simple type of fungus, but it attacks early in the spring. We have chemicals to control this, but we must get it in at the right time.

There is a potential problem for all azalea growers in this section of the country. This disease is known as petal blight. This slide shows a plant just starting down with the disease in New Jersey. It was on a plant that was brought up from the south apparently with the fungus

on it. For those who think they have it, whether you have the southern form or not, we suggest that you put the petals in a polyethylene or glass container and keep them for one week. At the end, of this time if you have these little black structures then you will know that you have this petal blight disease or azaleas. Here again, the disease can be controlled with proper sprays.

Very quickly let's look at soil sterilization. Two chemicals have come out in the last couple of years that looks very promising. Methyl bromide, perhaps sold as MC-2, and Vapam are the two to which I refer. Just within the last two months a paper has come out that states that you can control crown gall by using these materials at the recommended rates. I know a lot of nurserymen use these chemicals for weed control but here is a suggestion for their use to control organisms in your soil also.

One of the worst problems in seedbeds of cabbage and broccoli is damp off and wire stem. These can be controlled by mixing terrachlor with the soil. I must caution you not to use chemicals such as terrachlor and captan on crops until you have first tested them to be sure you will not get any injury or stunted growth.

Now let me conclude by mentioning some of the new chemicals that are showing a lot of promise in vegetables and fruits. As some of you people heard me say, you people are on the sucker list. Every station in the country has somebody working on apples and peaches and when we get to ornamentals, a lot of you people have to pick up the chemical samples and do the research yourself Dyrene, Maneb, Cyprex, and Phaltan are some of the newer ones Incidentally, Phaltan appears to me to be an excellent thing for you folks who are dealing with roses. It is the only thing I know that controls both black spot and powdery mildew. To my knowledge, we have no other chemical that will do this. Dithane A-40 is out for the first time this year. It is a dry material taking the place of the old Dithane D-14, the liquid material. Karathane is still an excellent material, out three or four years, for powdery mildew, and the liquid mercuries are ideal for a lot of sanitation work.

Of course we always have the situation where you sell a well grown tree to some customer who stakes it after planting. Then at the end of the season the tree is dead and the post has six inches of growth on it. In one town, 500 trees were planted like this, and at the end of the summer we had 200 live posts and 200 dead trees. They used swamp maple for stakes. The soil was so soggy wet that it swoshed when you walked on it.

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MODERATOR NORDINE: All right, let's have some questions.

MR. JIM WELLS (Red Bank, New Jersey): I'd like to ask Dr. Davis if there is any general treatment that he would recommend of new or old chemicals for treating the soil before planting to reduce infection in the field?

DR. DAVIS: One would be Ferbam, which is one of the nicest you can get in that there is generally less injury with it than with others. Try it at the rate of one pound for 400 pounds of propagating sand. When you get into soil, you are getting into a different matter. The chemist refer to the soil as being well buffered. When we get a lot of these chemicals in the soil, it ties them up rather quickly Quite a few of our florists, are starting to experiment with Terrachlor and Captan now for use on a number of flowering plants. Here again, use it carefully and try it on a few plants before you hit all of them.

MR. WELLS: We had a discussion either last year or a couple of years ago on this question of sterility. Dr. Waxman made the statement at that time that in the best nursery run in an orthodox manner if you adopt sterile methods and conditions you will increase your efficiency by 20 per cent. Now that is substantial. My point in asking this was, Do you think it is worthwhile for any nurseryman growing any crop to consider using this Terrachlor and Captan as a general preventative measure, and if so, what percentage improvement would he get?

DR. DAVIS: I would *not,* and I underline not, suggest that all nurserymen go out and start using this mixture. Any time you are satisfied with the results you are getting don't try to get another 20 per cent by putting these chemicals in your medium. You will probably get more trouble than benefit. The only place we recommend the use of chemicals are the places where you have had previous experience with disease problems If I were trying something and getting 80 per cent results year after year I would not worry about trying to put a chemical in and getting an extra 20 per cent. Farmers don't do this; they just plant another 20 per cent to feed the bugs

MR. ALBERT LOWENFELS (White Plains, New York): You mentioned purple blotch on holly, *Ilex opaca* You recommend not propagating from these plants. What should one do then, spray for it?

DR. DAVIS. I ran some experiments about 10 or 11 years ago at the Wolf Nursery using about 15 chemicals. We tried to isolate the thing and found that it is not a fungus, or a bacteria. We call it a physiological disturbance and not something tied up with any organism.

MR. TED E. FOULKE (Cleveland, Ohio): Dr. Davis, this past summer I spent some time with Dr. Roberts and they have a purple blotch problem in English holly which apparently is traced to the presence of boron deficiency. In the places where they fed boron at the rate of 25 parts per million they didn't find the blotch. Is there any relationship between this and our American holly?

DR. DAVIS: There is probably a pretty fair relationship. Dan Fenton, who works at Wolf's Nursery ran quite a lot of experimental work on different fractions of potassium and lime on *Ilex opaca,* with added boron Again you have the choice of propagating from a clone or strain that does not have purple blotch in it, or one that has this tendency. I will take the clone that is free from this trouble.

DR. CHARLES HESS (Lafayette, Indiana): You mentioned that purple blotch was somewhat related to soil moisture conditions. In

other words, would you say that with wet feet you would have more blotch?

DR. DAVIS: In the years when purple blotch is prevalent we find it is worse on plants that are growing with wet feet. Here again, you can have two seedlings side by side, one can be blotched up and one completely free from the trouble.

PRESIDENT TEMPLETON: I want to ask a question about this purple blotch. Is it possible that iron deficiency is involved?

DR. DAVIS: Iron has been used but it has not given consistently good results.

MR. RALPH SHUGERT (Neosho, Missouri): Have you done any work on phomopsis blight of cedar?

DR. DAVIS: Charley Hess probably has done more work along that line with Pat Pirone, than I have. I think he is using the old copper spray as the best material.

About a week ago I thought Captan, of the new materials was a good answer to juniper blight. In reading the fine print however, they were not referring to phomopsis.

MODERATOR NORDINE We stand recessed until 1:30 this afternoon.

The session recessed at 12:15 o'clock.

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