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Description of Spraying Experiments

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The study of any disease, whether plant or animal, is often very slow and discouraging. The causal organisms of plant diseases are particularly difficult to control, not only because of their minuteness and the rapidity with which they multiply, but also because of certain economic limitations; by this I mean that a control for a plant disease, in order to be successful, must not only be effective in controlling that disease but must also be cheap enough to be economically used on a large field scale. We have very few fungicidal materials that answer this description.

In giving you a report of progress on the study of Dothiorella it may be well to give a brief review of the results of our previous experiments. Last year we conducted two experiments for the control of Dothiorella. One of these was carried out at Encinitas and the other at Carlsbad. Both of these experiments involved the use of three different spray programs. The fungicidal material used was bordeaux at a strength of 4-5-50. We also left some untreated check plots. The fruit was picked and shipped to the Calavo house, where it was handled the same as any commercial shipment. Disease determinations were made after the fruit was allowed to soften, and the results recorded. The results were as follows:

Check 1, which was an untreated plot, under overhead irrigation showed 80% infected fruit.

Check 2, which was also an untreated plot, under the basin system of irrigation showed 50% infected fruit.

Spray program 1 showed 0% of infected fruit.

Spray program 2 showed 8% infected fruit.

Spray program 3 showed 28% infected fruit.

All of the spray plots were irrigated by the basin system.

We also carried on programs using dusts in place of the liquid fungicide but we found them very much less effective. From the result of these experiments, we brought out three important points: First, that overhead irrigation had tendency toward spreading Dothiorella. Second, that we could control Dothiorella by spraying with bordeaux spray. Third, that liquid sprays are much more effective than dusts.

While spray program 1 gave us perfect control of Dothiorella, yet this program was not

commercially possible, due to the fact that it required ten different applications. It had another drawback in that copper sulphate in bordeaux is not compatible with cyanide and since it is necessary at times to fumigate with hydrocyanic acid gas, for scale insects, we would much prefer to find some other fungicidal material.

Now, basing this year's experiments on the results of last year, we laid out fourteen different programs. We believe that three sprays would be commercially possible and practical, particularly if we could add insecticides for the control of insect pests. We laid out these fourteen different programs so that none of them have over three applications, these applications to be made at various times, trying to find out the most effective times for applying fungicides. While the results of these experiments will not be known for some time, or until the fruit is harvested and disease determinations are made, we have one program that looks particularly promising. This program, as Professor Horne pointed out, uses zinc sulphate instead of copper sulphate. This seems to be compatible with hydrocyanic-acid gas. This spray material also includes sulphur for the control of brown mite and arsenate of lead for the control of leaf-eating insects. In the control of these it has been perfectly satisfactory.

Oftentimes an investigation which has been started for a certain purpose brings out other points which are of greater importance than the question which we have started out to investigate. This has been the case to a certain extent with our investigation work with Dothiorella.

Last spring, Professor Horne and myself made a tour of many of the chief avocado growing districts of the state for the purpose of determining in which districts Dothiorella existed and to what extent present. We found it present in practically every district which we inspected. Its abundance was found to depend largely upon the amount of tip-burn present in leaves and the amount of dead twigs found in the orchard. Since dead twigs can quite easily be eliminated by pulling them out and burning, tip-burn leaves are the chief source of infection with which we are concerned. We then started out to determine the cause of tip-burn. Analyses of tip-burn leaves show them to be very high in chlorine. In the normal mature avocado leaf the total chlorine varied from .09 to .33 of one per cent total chlorine. In the tip-burned leaves it varied from .54 to 1.21 of one per cent, or on an average of 1% in the tip-burned leaves.

We next collected a number of samples of drainage water and analyzed them and found all high in chlorine. We found a correlation between the amount of tip-burned leaves and the amount of chlorine in soil and drainage water. We then investigated methods of removing chlorine, and experts at the University told us the only way to remove chlorine from the soil is by leeching it out. We now have some experiments going in this connection, but as soil salts and the study of soils is entirely out of my line, I am going to turn that part over to Professor Thomas, who is here.

Question: Do you think Dothiorella is spread by the scale?

Dean F. Palmer: We have made a number of tests trying to find out different ways in which this organism is carried. Practically all insects which move about are capable of spreading the disease, although the chief source of infection, as I believe Professor

Horne told us, is from the dead twigs and from the tip-burned leaves. The method by which it is spread from tip-burned leaves no doubt is by irrigation water, rain, heavy fog, washing down over these tip-burned areas in which spores are located and carrying them on to the fruit in that way. Another way the disease spreads is from the dead twigs—spores from dead twigs are exploded into the air, picked up by wind and carried probably quite a distance.

Question: What variety is most affected?

Dean F. Palmer: We have found this rot on practically all varieties but the Fuerte is most susceptible. I wouldn't attempt to make out a variety list in accordance with susceptibility. We have found it on practically all varieties where it has had a chance.

Question: This most promising spray program—is that just one application a year?

Dean F. Palmer: We are trying it out with from one to three applications. We have used three as a maximum number because we consider that to be the maximum number commercially profitable and we don't care to experiment further with anything that is commercially impossible.

Question: Do you have any figures as to what it would cost to spray?

Dean F. Palmer: We do not; not any that I would like to give out at this time. However, it would be a cheap spray, particularly if we incorporate the insecticides. We usually have to make three applications a year and if we can combine these materials we should be able to control our Dothiorella at very little extra cost.

Question: How about size of fruit and time of spraying?

Dean F. Palmer: We have started from the blooming season and we are trying different programs to find out what is the most practical time to make these applications.

Question: Does spray have any effect on maturity?

Dean F. Palmer: I don't know.

Dean F. Palmer: The best way to observe these experiments is to start below the house and walk down; all the experiments are plainly labeled. On the spray program it shows the materials used, the different times of spraying. There are some other interesting points that you may notice. There is one interesting thing which I have labeled. This shows two different types of fruit—pollinated and unpollinated. In every case we found that the good, pollinated fruit set during periods of warm weather; the unpollinated fruit set during periods of cold, dark weather.