California Avocado Association 1931 Yearbook 16: 90-94

DOTHIORELLA ROT

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Talk given August 15, 1931, at Vista.

A rot of ripe fruit has appeared in the coastal sections which was quite severe this year. This was called to the attention of the authorities in January when it was noted that ripening Fuertes were developing a very marked rot at the calyx end and that this rot was not noticeable until the fruit was ripe and ready to eat, that is soft and just on the down-grade. Then the rot appeared and quickly finished the fruit.

This rot became so bad in the late winter and early spring that coast Fuertes were discounted in the open market from two to four cents a pound because of the prevalence of this rot on the Fuertes.

Investigations were immediately begun to determine the cause of the rot. These investigations were undertaken primarily by the calavo association working with Prof. Home at the Citrus Experiment Station in Riverside. Their final conclusion which was supported by that of other authorities was that this rot was the "Dothiorella rot." This is a saprophytic fungus that lives on dead material. While it will exist on live material, it does no damage except to some part of the plant that may be dead—like the fruit. Of course, damage to a dead leaf or a dead twig means nothing but when it comes to damage to the fruit, that is a different matter.

A rather long series of experiments was undertaken by Prof. Home to determine just the character of this fungus on avocados and how it got into the fruit. This is not completely determined yet but we do know that presumably it enters the fruit either at blossoming time or somewhat later. As soon as the fruit was picked and before the disease developed, ripe Fuertes were treated with every conceivable substance that would kill a fungus on the surface but the rot developed just the same. This indicated beyond any doubt that the rot was under the skin. It was then finally determined that these fungous threads permeating the surface of the fruit penetrated the skin or perhaps entered the blossom end, lodging underneath the skin. Prof. Home has, I am sure, taken bits of the skin from an apparently healthy Fuerte and developed the Dothiorella rot from that bit of skin, after sterilizing the outside of the fruit in every conceivable way. I am going into this in detail so that it can be understood that no exterior treatment of the fruit will kill the spores of this fungus.

There is no doubt that Dothiorella rot has caused a great deal of damage to the coast growers. Up to the present time the disease has not been found inland.

I do not know yet how far inland it has been taken. We have found the fungus as far

inland as La Mesa though only on dead twigs and leaves. It is possible in dry sections that it will not under ordinary circumstances develop in the fruit.

The fungus evidently lives on dead twigs on the trees. As you know, dead twigs are frequently found in avocado trees and on this dead wood you will notice the black spots of Dothiorella, if the rot should be present. The spores wash onto the blossoms and fruit by the rain, fog, overhead irrigation and may even be carried by insects. The spores rest on the leaves under the trees also.

After identifying this rot and determining exactly what it is, the next problem and the one in which we are most interested is Control. At the present time we do not know how to control it but we are trying to find out. In cooperation with the Extension Service, Mr. France, County Farm Advisor, we are running some experiments now at Carlsbad and Encinitas. We thought it might indicate how Dothiorella could be controlled if we entered into a series of spraying and dusting experiments, using copper in some form which is perhaps the best fungicide known. These experiments began the latter part of April which is a little too late this year but we did not want to waste any time and thought we might at least get far enough with the problem this year so that we could undertake a more comprehensive experimental plot next year.

Here is a progress report sent in by Dean Palmer, August 11: "Both experiments are identical as to treatment. Each includes three spray programs and three dust programs with check plots.

"The first program calls for an application of Bordeaux mixture 4-5-50: *First,* before the first bloom opens; *Second,* applications thereafter at two weeks intervals or following each rain or sprinkle until the bloom is over; *Third,* applications monthly and after each rain or sprinkle until the fruit is picked.

"Our experiment was not started early enough to make an application before the first bloom opened and not until the trees had been in bloom for several months. The first application was made on April 30, 1931, and thereafter as follows: May 14, May 29, June 13, July 13, and August 13. These trees have been constantly covered with Bordeaux and this program represents a maximum program. This program may not have been started early enough to give us much information of value this season, but it will be carried on next year and should show results if it is at all possible to control this fungus with copper.

"The second program calls for an application of Bordeaux mixture 4-5-50: *First,* before the first bloom opens; *Second,* applications thereafter at two week intervals or following each rain or sprinkle until the bloom is over. This program like the first was not started until late, the first application being made April 30, 1931, and applications thereafter on May 14, May 29, and June 13. These plots will not receive another application until just before the bloom opens. It may not receive another application until after the fruit is picked.

"The third program calls for one application only. This is to be made immediately following the bloom. This application was made on April 30, 1931, which was after considerable fruit had set but while the tree was still in bloom.

"Each spray plot is duplicated by a dust plot which is treated with mono-hydrated

copper-sulphate corresponding to a 4-5-50 mixture in the liquid spray. The purpose of this is to determine whether a dust is as effective as the liquid spray.

"Each program comprises a plot consisting of three trees. The dead wood and twigs are kept pruned out of one tree in each plot.

"Check plots are kept under both the overhead and basin systems of irrigation.

"At picking time fruits from all plots will be kept separate and observations and records kept on them in storage.

"Only the best materials and equipment have been used in this experiment and the work has been done thoroughly and carefully. If favorable results are not obtained after carrying it on over this season and next, it would seem that it will be necessary to turn to other methods of procedure."

The avocado grower has this in his favor. We have had a long experience with this kind of problem in handling citrus. There has been no citrus problem of this character that has not yet been worked out. I have no doubt in the world that sooner or later the menace of this Dothiorella rot will be overcome. At the present time, however, it is a menace along the coast and we are endeavoring to control it as soon as possible.

What is the nature of this rot? The fruit turns black and decays at the calyx end but it doesn't decay until after the fruit is at the optimum condition to be eaten. If you picked your own fruit, softened it yourself, kept it in your own coolers, you would eat it and never know you had the rot in your orchard. But when we put it on the stands and keep it even just a day or two beyond that optimum point for eating, it goes down very rapidly. At first the rot is only superficial, the skin is slightly black and sunken though later it turns black through the fruit. But avocados sell like everything else on looks and nobody would buy a fruit that looks decayed.

Questions and Answers: What varieties have you found affected the most?

McLean: Fuertes, Anaheims, and Dorotheas.

Question: Does this affect the fruit on the side or only at the apex?

McLean: Slightly at the side although I have found it did not spread very far from the apex.

Comment: I have seen the fruit pretty well covered.

Question: Does the rot affect Guatemalan varieties?

McLean: I have seen it principally on Fuertes and Dorotheas.

Question: What about the danger of heavy mulching?

McLean: That is an open question. Undoubtedly the spores will live on the ground with the mulch in the leaves but whether or not they will be taken back up by insects or other carriers, I cannot say. It is possible that it might be carried by the little leaf-eating beetles, snails, Fullers rose beetles, or insects of that character.

Question: Is there anything that could be put over the mulch that would have a

tendency to kill it?

McLean: I presume some form of copper, copper sulphate or bordeaux.

If you can help us in any way by reporting fruits apparently affected by Dothiorella it will greatly aid us. We have the cooperation of the University of California, the Calavo Growers and the County Farm Advisors, but we need your help. (Someone presented a fruit affected with a rot.)

McLean: That is not Dothiorella. In my experience Dothiorella never develops in a green fruit—only in a ripe soft one. It is a saprophytic fungus, which means it only lives on dead wood and other dead material. You know fruit is dead when it ripens and begins to soften.

Question: Is it best to burn dead rubbish—leaves and twigs?

McLean: Most surely. (Someone showed a blackened leaf.)

McLean: That looks like a burning from the absorption of salts. Avocado leaves will burn through the absorption of a certain amount of chlorine from the soil. Also sometimes due to excessively hot weather where there is not enough water drawn into the leaf and fruit for evaporation purposes. (Someone exhibited a fruit.)

McLean: These are greenhouse Thrips. You control them with Nicotine, 8% dust.

Please understand just before I stop that this is not an exact science as yet. There are lots of things we do not know and that we are trying to find out. As I said before, you can help us. Even the most expert pathologist cannot tell you any more about the origin of this disease than we now know but we hope to find out.

You will be interested in a letter received from Prof. Home under date of August 5.

"When I visited your place with the class in Subtropical Horticulture a week ago last Saturday, you will recall that you gave me two off-bloom Fuerte avocados. These fruits were of excellent size, sound, and in every way good fruits and I promised to investigate them with regard to Dothiorella. These fruits were earned, as you know, in paper bags and were brought home to the laboratory. I kept them for a short time in the Frigidaire until I was able to use them in an experiment which I had in mind.

"I was interested to know first whether any Dothiorella spores were present on these fruits. I washed off the fruits as carefully as I knew how, and examined the washings for the presence of Dothiorella spores. I found three objects in the course of considerable search which might possibly have been spores of Dothiorella, but if so, were very old and not recognizable any more with certainty. The amount of dust on a reasonably clean avocado in the orchard is such that, of course, there might be a good many spores of a certain kind present and yet one might not see them, except by a microscopic examination. I think it probable, however, that at least not many spores of Dothiorella are present on the fruits, at least not a considerable number of spores which have been recently deposited.

"The fruits were brought out and allowed to soften under conditions favorable to the development of Dothiorella and the spots of surface rot developed rather abundantly on the fruit, at about the time the softening commenced. By the time the fruits were ready

to eat, spots were rather conspicuous from a little more than one-sixteenth of an inch in diameter to a little more than one-fourth of an inch. The Dothiorella spot can hardly be recognized completely until it is a little more than one-sixteenth of an inch in diameter as it does not start as a sharp pronounced spot but as a very vague and rather broad darkened area. Before the spots developed or the fruit had softened, certain areas of the surface were marked off and these were first wet with alcohol and flamed off vigorously. Pieces of the skin cut off from this treated area developed Dothiorella fungus in the culture freely. Also the surface which was treated in this way developed the spots just as the untreated surface did so that I am confident the spots came from fungus which had gotten a little start in the skin and not from spores lying on the surface.

"This entirely confirms the experiment which I had made previously and makes me believe that the Dothiorella is not being deposited during the dry summer weather but that its distribution will have to wait until there is rainy, or rather copious dripping fog. I think this aspect of the matter makes the possibility of protecting the fruit by spraying with Bordeaux while it is small rather hopeful. I should say also that the fruits were used, I think, with very little waste after my experiments were carried out.

"Below some of the spots which had started a little earlier than the others which spots had gotten to be nearly, or quite three-eighths of an inch in diameter, a little decay was visible, penetrating at most probably not more than one-eighth of an inch. Of course, such fruit is not adapted to sitting on the fruit-stands waiting for customers to appear.

"Another point which should be clear is that now that I have gotten used to looking for Dothiorella, I find it quite commonly. I may say practically everywhere that I look in the coastal areas and as far inland as Whittier I have not yet found it in the trees at the Citrus Experiment Station. My present impression is that we are going to find this fungus more or less abundant in those areas where the climate is more favorable to the growth of the avocado.

"I am sure that those of us who came with the classes in Subtropical Horticulture all appreciated very much your courtesy and I heard numerous favorable comments upon your orchard."

Although Dothiorella fungus has been found on dead leaves and twigs inland it has not been found to injure the inland fruit.