

Dothiorella Rot

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The avocado has been passing through a very interesting period of transition. From the time of its early use by the natives of the tropics some hundreds of years ago, it has probably been accepted by them much in the spirit of simple gratitude. From them it passed into the hands of scientific plant collectors to be propagated more or less as a hobby throughout the warmer sections of the world. These people being accustomed to things of quality, were more critical than the natives. It would have been expecting a great deal of them, however, to see all the weaknesses and shortcomings of their pets. Many of their trees were grown from seeds and the owner's name was often pinned to the most promising offspring. It has only been since the avocado industry has emerged as a healthy growing commercial industry that the weaknesses of the various varieties have been brought to light by a critical buying public.

With increasing production of the avocado there has been a constant demand for fruit of a higher quality. This demand has not been alone from the buying public. The fact that we are constantly shipping to more and more distant markets necessitates that we grow fruit of the highest quality, in order that it may stand the additional handling and yet reach the market in the best possible condition. For this reason it has been necessary to recognize a number of rots as no longer being due to bruises of unknown origin, but diseases with specific causal organisms. The recognition of this fact, I believe, marks a very important step in commercial avocado growing.

The important problem of classifying these diseases and working out means of controlling them was fortunately placed in the hands of Prof. Wm. T. Home of the Citrus Experiment Station. Prof. Home has spent nearly a lifetime quietly working out similar problems of other tropical and subtropical plants. Under his careful research many of these problems which now appear so baffling to us will be unfolded with amazing simplicity.

Prof. Home chose the most troublesome of these rots on which to start his work, and has recognized the causal organism of this disease as *Dothiorella gregaria*, but now known as *Botryosphaeria ribis*. My only part in this investigation work has been through having been assigned by Mr. R. R. McLean, Agricultural Commissioner of San Diego County, to the problem of carrying out some of the details of experiments as laid out by Prof. Home and his associates. It is the results of this work on which I am reporting at this time.

While *Dothiorella* rot is to be found in practically every variety of avocado, it is more

destructive to the thin skinned varieties, as it penetrates the thick rinds more slowly. The injury to tree varieties, while probably no greater than to the dark fruits, shows up a great deal plainer, and for that reason, is much more offensive in appearance. The fact then that thin skinned green varieties are most damaged from the market standpoint means that the Fuerte is the chief commercial variety affected.

Prof. Home's work has shown that the causal organisms of this disease are harbored in the dead twigs and tip-burned leaves. The spores from the dead twigs are exploded into the air and the spores from the tip-burned leaves are carried by water dripping down over the infected leaves and on to the fruit. The nature of the organism causing this disease being understood, there are several points regarding its control which are quite evident.

The first and most important point is to prevent tip-burn, as these tip-burned leaves furnish the chief source of infection. While tip-burn must of itself have a harmful effect on the avocado, due to cutting down the active or functioning area of the leaf surface, it is of increased importance due to its relationship to Dothiorella rot. According to analysis by Dr. Haas and Prof. Thomas of the Citrus Experiment Station, one of the chief causes of avocado tip-burn is an excess of alkali in the form of common salt, which is measured chemically as sodium chloride, in the soil or the water used for irrigation. Where the drainage is poor a condition of this kind is greatly aggravated, as the alkali in the soil is brought up by capillary attraction, and it is impossible for the salts to be carried away by leaching. Prof. Thomas of the Citrus Experiment Station, in a preliminary survey of several of the districts in San Diego County, where tip-burn was a real problem, decided that conditions of poor drainage existed and immediately sent for Prof. Weir of the University of California. Surveys were made by Prof. Weir and two drainage systems were laid out. These surveys having been made. Carlsbad was in a position to secure federal funds for the installation of their system. A \$25,000.00 drainage system was installed in Carlsbad without cost to the district, using C. W. A. labor and materials. It is hoped that federal money will be available later on for the installation of a system at Encinitas.

Some districts, after overcoming their drainage problem will still have the problem of securing a better source of irrigation water, and these districts are laying plans, which, if they materialize, should greatly reduce the problem of tip-burn and Dothiorella rot. However, until these conditions are overcome, there are several points which we will have to consider in the control of this disease. As I have stated before, the most important point is to prevent tip-burn as far as possible. A certain amount of chlorine in the soil and irrigation water can be tolerated, providing one has good drainage and pays attention to such details as wind protection, frequent irrigations, periodic leaching of the soil, adequate fertilization and building up of the soil by addition of organic matter. Dead twigs and branches should be kept out of the trees and destroyed or covered with a mulch. The ascospores which are found in the twigs are heavy sticky spores and are only thrown a distance of about one-half inch. While their importance in the dissemination of this disease has not been clearly determined it is thought that their dissemination should be prevented as far as possible. If the trees become tip-burned the fruit should be picked as soon as it attains a satisfactory oil content. Overhead irrigation should not be used where tip-burn exists. Off-bloom fruits show a greater

percentage of infection than the normal bloom and should be picked separately when possible. Insect injury should be reduced as far as possible.

Using the information which Prof. Home had previously worked out regarding the type of organism and its method of dissemination, as a basis upon which to work, we set out to find a satisfactory method of controlling this disease with a spray material. Laboratory tests showed that Bordeaux sprays prevented the germination of *Dothiorella* spores. Three and one-half years ago we started our first experiments using Bordeaux as a fungicide. That year we brought out two important facts: first, that we could control *Dothiorella* rot in the orchard with the use of Bordeaux; second, that Bordeaux applied as a spray was much more effective than the same material applied as a dust. We were not entirely pleased with the thought, however, of having to use Bordeaux as a fungicide, as it contains copper, which is not compatible with cyanide, and about this time it was becoming evident that we were going to have to use cyanide as a fumigant against some of our scale insects.

The next year we carried on experiments using zinc sulphate as a substitute for the copper sulphate. We also continued our experiments with the copper Bordeaux. By this time it was apparent that we were going to be compelled to use sulphur for the control of the avocado brown mite, so in some of our formulae we included sulphur for this purpose. The results of our second year's experiment indicated three important points: first, that the addition of the sulphur apparently made the Bordeaux more effective; second, that three applications were necessary to give satisfactory control, and third, that the zinc sulphate in comparable amounts was not as effective as the copper sulphate.

Last year we continued our experiments with both of these materials. The results of this year duplicated those of the year before. In other words, we were apparently able to secure 100% control of *Dothiorella* rot with three applications of a spray material made up as follows:

- 16 lbs. commercial Bordeaux
- 6 lbs. flotation sulphur
- 1 lb. casein spreader
- 100 gallons of water

The three applications of this spray material were made at proper intervals to insure that the fruit and foliage be covered at all times.

This material has given us satisfactory control for two seasons. However, we do not regard these results as final, for the reason that due to extremely light crops of fruit during the past two years, the fruit with which we have dealt has been very limited in quantity. As this material is not compatible with cyanide and since fumigation is apparently quite necessary under some conditions, it is not always practical to use this material as a spray. While the zinc sulphate did not give us as satisfactory results as the copper, it gave a certain degree of control, and we are continuing experimental work with this material hoping that by modifying our formulae we may increase its efficiency.

Dr. Fawcett has been able to secure very satisfactory results with the zinc sprays

against *Phytophthora* fungi, but he is of the opinion that the *Dothiorella* will be more resistant than the *Phytophthora*.

Now in regard to the method in which this fruit was handled: The fruit was picked as soon as it had attained a satisfactory oil content. It was then shipped to the Calavo Growers packing house where it was handled exactly like a commercial shipment. After the fruit had softened at room temperature it was examined for the presence of *Dothiorella* rot and the results of the data from fruits in each spray plot were compared with data from plots in which the trees were not sprayed.

The cost of spraying for *Dothiorella* rot is about twenty cents per tree per application for a normal six-year-old tree, and considering that all insects, with the exception of scale insects, can also be controlled, this is not excessive. However, it means an additional cost in producing one's fruit. Taking everything into consideration, the most satisfactory solution to this problem might be in the development of new varieties which would not be so damaged by *Dothiorella* if it were allowed to go uncontrolled. The development of such varieties is one of the problems which has been undertaken by Prof. Hodgson. While we are expecting great things to come from his work, we must not become impatient, for this type of work usually progresses slowly.

Dothiorella is to be found in all avocado growing sections, yet its injury is pretty well confined to sections within the moister districts where tip-burn is severe. We hope by modifying our zinc lime formula to have a spray material which will give us a satisfactory method of controlling the disease within these districts.

Many of the defects of senile off-bloom fruit should not be confused with *Dothiorella* rot, but are problems which can best be dealt with by harvesting our fruit at the proper time.