

## Spraying for Avocado Diseases

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Last year, in a paper read before this Society, I mentioned some spraying experiments for the control of Avocado diseases which the Experiment Station then had in progress. At that time it was too early to anticipate what the results would be. Today I wish to again refer to those experiments and give you the results that were obtained since this work was done in the Redland section of Dade County. I believe this information will be of interest to the Avocado growers of this section of the State or other sections where diseases of the Avocado fruit are troublesome.

If you will pardon a little digression, I would like to touch on the future possibilities of the Avocado in Florida, for a few moments. I believe that a substantial and profitable industry can be developed in this line, not only with the Avocado but with the Mango and other sub-tropical fruits that seem to be well adapted to culture in South Florida. This view is becoming more prevalent among our home folks and even the newcomer expecting to make Florida his home. This industry is yet new and few have gone into it in a strictly commercial way, but at the present time I find many people who are interested in developing plantings of this nature and I believe that the Horticultural Society can aid materially in fostering such a spirit and at the same time help to establish such an industry on a sound basis. There is a demand for information concerning these crops which can hardly be supplied from our present general store of knowledge. In any new horticultural enterprise the development usually moves slowly, but the time has now arrived when greater impetus should be given to finding out just what can be done with the Avocado and Mango in a commercial way, how these crops can best be handled and what prospects do they offer for the future. Is it a safe and sane policy to invest one's money in commercial plantings of this nature for the future? These are some of the questions that come to the beginner.

Personally, I am optimistic in regard to the future of the Avocado and Mango, and believe that the time is not far distant when these fruits will be as much in evidence on our leading markets of the country as the grapefruit is today. We do not have to go very far back into history to find the grapefruit regarded as a novelty, yet today there are thousands of acres in grapefruit groves and more acres are being planted each year. Why should this not apply to the Avocado and Mango, within the next few years, especially in those localities where it has been demonstrated that they can be grown. We can not hope to grow Avocados on a commercial scale and sell them for fifty cents to one dollar apiece, and any one going into the industry with this in view, is apt to be disappointed. I do not think I am wrong in the supposition, however, that Avocados can be grown and put on the leading markets at a price that would tempt the average consumer and at a price that would give a fair return to the producer.

There are a number of things we must yet learn concerning the production of the Avocado and Mango before many persons will attempt plantings on a large scale. The soils and locations best suited for their culture; the best varieties to plant; methods of caring for the trees; kinds and amounts of fertilizers suitable for best results; disease and insect pest; available market and methods of marketing the output; are some of the questions that come to those interested in developing Avocado or Mango plantings for the future. We have a scattering knowledge in all of these subjects, but in some cases it does not extend beyond certain local limits. The beginner needs some more or less definite plan or set of instructions that he may follow with some degree of certainty.

The lower east coast has been the first to recognize the commercial possibilities of the Avocado here in Florida. Dade County has the largest commercial plantings in the State and probably the oldest bearing trees. There are two men in this locality who have done pioneer work with the Avocado and Mango and they are largely responsible for what we know today in regard to the culture and varieties of these fruits best suited to Florida conditions. Mr. W. J. Krome and Mr. Geo. B. Cellon have contributed much to our knowledge of what can be done with these fruits in a practical way. It is here that the industry as such has started and other sections of the State naturally turn to Dade County for information. While this section is first in the production of Avocados and has demonstrated the feasibility of commercial plantings, there are other sections in South Florida where the Avocado and Mango can be grown equally as well. I believe there is just as great a future for these fruits along the lower west coast as there is here on the east coast. On the higher lands and the soils that can be well drained, I can see no reason why the Avocado and Mango can not be as generally grown in Lee County as they are in Dade. Lee County has a climate just as favorable, and a soil in many localities which I believe is better adapted to their growth, if the trees that I have seen thus far can be taken as a criterion.

At present our commercial plantings are few and of small acreages. The door yard plantings are limited to a few seedling trees and but little thought has been given to the Avocado and Mango as a commercial proposition in the past.

Now, however, the people are beginning to consider planting Avocados for the future and they are seeking all the available information on this subject.

We will have our problems to work out as we go along and in many cases can profit by the experiences of the Avocado growers in this section. If the industry develops in Lee County as I anticipate it will, this section should contribute something of interest to the Avocado industry in the future. I believe that by close cooperation and through a free exchange of ideas on the subject, much can be done to rapidly build up a permanent and healthy industry in the growing of subtropical fruits. We have a section of country peculiarly suited for such development, so why not take advantage of the opportunity.

But to return to the subject I am to discuss, "Spraying for Avocado Diseases."

There are three diseases of the Avocado fruit that might prove to be troublesome factors in the production of Avocados for commercial purposes. These are Black Spot, Avocado Blotch and Avocado Scab. They are all fungus diseases and they were described and treated in the Annual Report of this Society for last year.

Black Spot and Blotch affect the fruit as it approaches maturity, making a worthless fruit for shipping purposes, and both of these diseases may be forerunners of rapid decay. These two diseases are more common on the seedling varieties at the present time, however, Black Spot has been observed to occur on some of the budded varieties to some extent. Avocado Scab occurs on both seedling and budded varieties and this disease attacks the fruit during the early stages of its development. Scab does not affect the interior of the fruit but it mars the outward appearance of mature fruits and severe attacks may cause a heavy shedding of young fruits or a stunted and misshapen growth.

As plant pathologist of the Florida Agricultural Experiment Station, I had made some investigation of these diseases for two or three seasons past to determine their causes and find some means of control. The preliminary experiments that we previously tried had shown little effect in controlling Black Spot or Blotch. In the spring of 1920 a definite plan of spraying was outlined and carried through the season, which took into consideration the control of each of these diseases. Our plan was to begin about the middle of the bloom period and to spray at monthly intervals over a period in which the fruits appeared to be more susceptible to these diseases. Bordeaux mixture 3-3-50 or its equivalent was used in the first applications and the 4-4-50 formula in the last applications. The spraying was done with a power sprayer and spray guns. The object of this experiment was to determine the number of applications of Bordeaux Mixture necessary to control these diseases and the time they should be applied to be effective. The results obtained were very encouraging and I think demonstrate that each of these diseases can be controlled by proper spraying.

In the sprayings for Black Spot and Blotch thirty-six seedling Avocado trees were selected in a grove where the fruit had spotted badly during the past few seasons from these two diseases. The trees were large and from fifteen to eighteen years old. The trees were divided into groups of four trees each and each group was treated as a separate unit.

Group 1 was sprayed four times during the season. The first application was made on March 23, spraying directly into the bloom. A second spraying was made April 21. The 3-3-50 Bordeaux mixture was used in the first two sprayings. A third spraying was made on May 21, and a fourth on June 22, using the 4-4-50 Bordeaux formula, in the last two applications. The first part of August the fruits on these trees were examined and checked over for Black Spot and Blotch. Only 1.6% of the fruit from trees in this group showed slight attacks of these diseases. The infected fruits were found mainly in the tops of the trees and probably were not thoroughly covered with the spray material. A striking illustration of the effectiveness of Bordeaux mixture in controlling these diseases was brought out by a single tree in this group. This tree had been observed for two or three seasons past and the fruit at maturity was always badly affected by Blotch and Black Spot. This season at the end of the experiment the tree was carefully examined and the fruits checked over, but not a single fruit was found that showed any indications of Black Spot or Blotch. The previous year fully 90% of the fruits on this tree were more or less spotted.

Group 2 received three applications of Bordeaux mixture during the season. The first two applications were made with 3-3-50 Bordeaux, and in the third the 4-4-50 formula

was used. These trees were sprayed first in the bloom,

March 23, again on April 21 and the last application was made on May 21. On the first of August when the fruits were examined 5% were found to be slightly affected with Black Spot and Blotch. The slight increase in the percentage of infected fruits in this case over those in groups 1 and 3 is probably due to failure to thoroughly cover the fruits with the spray solution.

Group 3 was sprayed only twice during the season with the 3-3-50 Bordeaux mixture. The first application was made March 23 into the bloom, and the second on April 21; 1.2% of infected fruits were found on the trees in this group when the fruits were checked over the first of August.

In the following three groups the bloom spray was omitted and the first application was made after the fruit had set and the bloom had all disappeared.

Group 4 was sprayed three times during the season. The first application was made April 21, using 3-3-50 Bordeaux mixture. A second application was made May 21 and a third on June 22. The 4-4-50 Bordeaux mixture was used in the last two applications; 2.6% of the fruit on these trees showed slight infections of Black Spot and Blotch on August 1st.

Group 5 was sprayed twice during the season. First on April 21 with 3-3-50 Bordeaux and again on May 21 with 4-4-50 Bordeaux mixture; 2.6% of the fruit of these trees showed slight infections of Black Spot and Blotch.

Group 6 was sprayed only once during the season. An application of 3-3-50 Bordeaux mixture was made on April 21; 18.8% of the fruit on these trees were found to be affected with Black Spot and Blotch on August 1st.

Group 7 was sprayed twice during the season with 4-4-50 Bordeaux mixture. The first application was made May 21 and the second on June 22. Sixty per cent of the fruit on these trees were found to be badly affected with Black Spot and Blotch on August 1st.

Group 8 was sprayed only once during the season with 4-4-50 Bordeaux. This application was made on May 21. . On August 1st when the fruits were examined, 97% were found to be affected with Black Spot and Blotch.

Group 9 was not sprayed during the season and served as a check. The fruits were examined on August 1st and 84% were found to be affected with Black Spot and Blotch. Why the unsprayed trees should show less spotting than the trees in group 8, which was sprayed once, can probably be explained by the fact that two trees in this group showed a marked degree of resistance to these diseases.

In summarizing the results it will be noted that sprayings made in April and May were more effective in reducing the amount of Black Spot and Blotch. Where the April spraying was omitted the disease showed an increase following two applications of, Bordeaux mixture.

For the control of Black Spot and Blotch the bloom spray hardly seems necessary. It appears to me that these diseases can be controlled by two timely applications of Bordeaux mixture or three at most. The first spraying need not be made until the fruit is well set, probably two or three weeks after the bloom has disappeared. A second

spraying should follow three weeks to one month later and possibly a third spraying three weeks to one month after the second. I would advise the use of 4-4-50 Bordeaux mixture which should be made of fresh stone lime rather than hydrated lime.

The above experiment will bear repeating and should be carried through a few more seasons before final conclusions might be drawn, but from the results obtained it seems to me that spotting of the Avocado fruit can be easily taken care of by timely and efficient sprayings. The lime sulphur solutions might work equally as well as the Bordeaux mixture and they should be tried out along the same lines. I can see no serious objection at the present time, however, to the use of Bordeaux on the Avocado tree.

A similar spraying experiment for the control of Avocado Scab was carried along with the sprayings for Black Spot and Blotch. In each case the sprayings were made on the same dates and the same solutions were used. The scab spraying experiment, however, was conducted in a different grove. The trees were of the Trapp variety and were in their second or third year of bearing. Eight blocks of trees were set apart for this experiment.

Block 1 of ten trees was sprayed once during the season. An application of 3-3-50 Bordeaux was sprayed directly into the bloom on March 23. The fruits were examined on August 1st and 25% of the fruit on these trees showed slight scab infections.

Block 2 of ten trees was sprayed twice during the season with 3-3-50 Bordeaux. The first application was made on March 23 into the bloom and the second application on April 21. Six per cent of scab infected fruits were found on the trees in this block when the fruits were examined in August.

Block 3 of ten trees was sprayed three times. The first application was made on March 23 into the bloom and a second application on April 21. 3-3-50 Bordeaux was used in these two applications. A third application of 4-4-50 Bordeaux was made on May 21. The fruits on this block showed 9% of scab infection.

Block 4 of 15 trees received four sprayings during the season. The first two applications were made with 3-3-50 Bordeaux mixture and the 4-4-50 formula was applied in the last two applications. The trees were sprayed first into the bloom March 23. A second spraying was made April 21, a third on May 21 and the fourth on June 22. Four per cent of scab infected fruits were noted on the trees in this block.

Block 5 of five trees was sprayed three times. The first application was made on April 21, after the bloom had disappeared and the fruit had set. The second application was made May 21 and the third on June 22. 3-3-50 Bordeaux was applied in the first spraying and the 4-4-50 formula in the last two. Nine per cent of scab infected fruits were found on this block. Through a mistake four of the five trees in this block were sprayed into the bloom during the March spraying and this probably accounts for the low percentage of scab noted.

Block 6 of five trees was sprayed twice. An application of 3-3-50 Bordeaux was made on April 21, after the fruit had set. A second spraying was made on May 21 with 4-4-50 Bordeaux. Twenty per cent of the fruit on the trees in this block showed scab infections.

Block 7 of five trees was sprayed once. An application of 3-3-50 Bordeaux was made on

April 21. Sixty-three per cent of the fruit on the trees in this block showed scab infections.

Block 8 of 12 trees was reserved as a check and received no spraying during the season. Ninety-two per cent of the fruit on these trees were affected with scab and in a majority of cases the fruit was badly affected.

With the exception of block 7 all of the sprayings made in this experiment materially reduced the percentage of scab. I believe, however, that a convenient and effective spray schedule can be made up for the control of Avocado scab which need not include more than three applications of Bordeaux. The bloom spray seems to be essential and should not be omitted. In making such a schedule I would suggest that the first application be made into the bloom during the latter part of the bloom period. A second application should follow in three weeks to one month later and a third application in three weeks after the second. The 3-3-50 Bordeaux will be of sufficient strength to control attacks of scab on the fruit.