it is blown into the hollow part of the tree. Grapefruit, picked in January from a tree treated in July, gave a difference of .47 in acidity, compared with fruit picked from an adjacent tree that was not treated. Fruit picked in January from a Valencia orange tree, which was treated in July, showed a difference of .44 in acidity when compared with the fruit from an adjacent untreated tree of the same variety.*

In using a poison for the control of termites, the object is for the poison to come in contact with some of these insects. Termites not only feed each other but they also groom each other and according to the literature, they dispose of the dead by eating them. In this way the colony is eventually wiped out, if some of them come in contact with even a small amount of the poison. In treating a tree, the speaker has found that the best place to apply the poison is by boring a hole in the tree just above the ground. The hole should extend into a gallery, for, as stated above, the largest galleries are in that section of the tree and also the largest number of termites were found there. The Paris green and the sodium fluoride were applied with a small plunger-type dust gum with a nozzle about one-half inch in diameter. Not more than one-half ounce of Paris green was applied to any one tree. After the poison had been blown into the tree, the opening was closed with some water-proof material. Since Paris green affects the fruit, other treatments will be tried whenever there is an opportunity to do so.

Although the termite situation is probably not an alarming one at present, growers should take the precaution of either destroying the infested trees or destroying the termite colonies, for they will no doubt spread to other trees in time. When a tree is taken out, all the roots and the infested parts should be burned. It would be well to paint all pruning wounds of any size, as termites enter a rough, uneven surface, rather than a smooth one, and small branches should be cut off rather than broken. It is hoped that in the near future more information may be had about these pests.

*Fruit tested by Chemistry Department, Florida Agricultural Experiment Station, Gainesville, Florida.

MELANOSE AND STEM-END ROTS OF CITRUS TREES

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This subject, considered alone in any detail, would require more time than is permitted to us. Therefore, we will at this time consider those parts of the problem to which we have been devoting some time and have been most interested.

If the problem of melanose and stem-end rots is viewed from the general viewpoint, we may say that we shall always be confronted by those diseases in Florida. And it seems logical that this problem will continue to be of increasing importance. Two factors, even when taken alone, will verify the truth of this statement. First, increased congestion and production of any fruit crop has tended to increase the diseased condition of that crop. And secondly, melanose and stem-end rots are fundamentally diseases of the older grove plantings of citrus, increasing in importance after the grove has reached about its tenth year.

From the standpoint of production, to develop and maintain a quality product of citrus on a given market, we cannot ignore this situation. For to ignore the increasing importance of these diseases is to admit defeat in those markets which we are striving to develop or to hold against other competitors. If we hope to hold a definite high standard for the products we are sending to market, we must strive against these troubles, and do all in our power to lessen these crop losses.

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MELANOSE

As previously stated, melanose is a disease of older citrus plantings. In the ridge section of this state it begins to make its appearance after the grove has been set about ten years. From that age forward its importance increases each year, but this importance may be modified by careful and systematic grove practices. Melanose appears on the fruits in the form of blemishes, lowering the grade and keeping qualities. At times, leaf infection may be so severe as to cause distortion, and partial losses of the foliage. This condition was rather common in some groves last May.

In gross appearances, melanose on the leaf, twig and fruit is familiar to most grove men. On all these parts, the earlier spots are small and depressed. Later, the tree attempts to cast out the fungous infection by the formation of a corky layer. Thus, in the final stages on leaf, twig and fruit, we find a small corky outgrowth of the tissues, which is rough and sandpaper-like to the touch. The color of these corky lesions varies in shades of brown to black. They are usually very sharply delimited from the remaining healthy tissues of the leaf, twig or fruit. This spring a rather confusing manifestation of melanose is present on some grapefruit foliage. Many instances have come to our attention in which the leaf shows a very decided outgrowth associated with a typical melanose spot. That is, the growth of the leaf has projected itself away from the blade so as to form a conical pimple of healthy tissue with the corky brown spot at the apex or inside this cone. This condition of melanose may be confused with citrus scab. The appearance of the fungus on dead wood of citrus is not simple to describe, and usually a miscroscopic examination is necessary to identify the spores which are found associated with the fruiting bodies of the fungus.

There is one very important characteristic of these corky blemishes of melanose as found on leaf, twig and fruit, which should be known to all. That is, the corky blemishes do not produce spores of the causal fungus; it seems that the fungus is pushed out of its host and does not secure enough food to develop spores. This fact means that an early spring infection of melanose on leaf, twig, and fruit has nothing to do with the amount of infection that may occur later in the season. Both early and late infection—in fact, all infection—in so far as we knew at the present time, originates from the spores which are produced in the dead wood

The perfect stage of the fungus which causes melanose is *Diaporthe citri* (Faw.) Wolf. Fawcett first described the incomplete or imperfect stage of this fungus, *Phomopsis citri,* as causing a stem-end rot of citrus. Stevens showed that this same organism was the cause of melanose. Wolf found, described, and connected to this imperfect stage, the perfect (ascus) stage. We have then, in this organism, two spore types. Both of these spores are developed in very definite bodies, which are produced beneath the bark of dead wood. These bodies are more or less spherical in general shape and are made up of closely interwoven tissues of the fungus. The spores are released from these bodies by one or more definite openings in the body-walls Although these two kinds of spores are a part of the same fungus, develop in dead wood, grow very similarly in pure culture in the laboratory, and produce very similar lesions when introduced on young citrus tissues, it does not necessarily follow that they are alike in the grove. In fact, the methods or means of dispersal of the two spores seem to be rather dissimilar. The spores of the imperfect stage (pycnidiospore) are developed most abundantly in the dead wood hanging in the citrus trees. When ripe, these spores are forced from the body producing them through an opening in the form of a long gelatinous string of spores, called a spore tendril. This is caused by the swelling of the contents of the fruiting body, which takes place normally under moist grove conditions. These spores are largely disseminated or carried from the gelatinous tendril to a place suitable to produce infection by the movements of water, such as heavy dews and the splashing of rain drops. The other kind of spores (ascospores) have not been observed or reported as developing in the dead wood, as it hangs in the tree, but are formed in the dead wood when it comes in contact with the soil. According to Wolf, these spores are forcefully discharged into the air and may be carried by the air currents from place to place. There are, then, two agents for spore dispersal in this fungus: (1) movements of water, and (2) movements of air. Perhaps the movement of

water, as the splashing of rain drops, is the more important when viewed from the standpoint of the amount of the infection produced in the grove.

Experimentally, we have studied a few of the phases of the melanose fungus in its development on dead citrus wood. If we take a pure culture of this organism and introduce the spores into other test tubes with various ages of sterilized wood, which was taken when alive from grapefruit trees, we find that this fungus will grow and produce its spores on all sizes and ages of this sterilized wood, ranging from the small citrus twig up to wood three inches in diameter. Spores of the imperfect stage are produced in these cultures in the laboratory in abundance, starting within a three to four weeks period after the inoculations. If the wood is removed from the test tubes, after a few days of incubation, the spores will develop in about this same length of time. Undoubtedly, the temperature is important. These experiments were made during the fall of the year. From this it seems probable that a fair estimate of time in the grove for spores to start being released from dead wood would be three to four weeks.

In a rough way, we are attempting to determine how long dead wood can produce spores. At the present time, it seems that we have not reached the limits in this experiment, perhaps because we have not had materials under observation a sufficient number of years. Two years ago, this past January, we constructed several wire frames above some young grapefruit trees. Into the frames we placed the ordinary prunings from a commercial grove of grapefruit trees afout fifteen years old. About fifty per cent. of these prunings consisted of dead wood. No special shelter was given to this wood above the trees. Observations and notes recorded the past two years show that this wood gave off abundant spores over that period of time, and we are still able to find evidence of spores being discharged to the young foliage this past spring. From a practical standpoint, we may estimate that dead wood in the tree is infectious for the first two seasons. The spores developed in this wood on the ground might extend this danger to a period of three to five years. At present, we do not know exactly how abundant or for how long this second spore may be developed.

In light of this evidence, we would stress for your consideration systematic and regular pruning of the citrus tree as the first principle of melanose control. It should also be kept in mind that the prunings left under the trees are still able to produce spores of the causal fungus.

The second phase of melanose control is spraying. Spraying of citrus in Florida for fungus diseases is not a single operation; it must be a program. Unfortunately, as yet, we have not been able to find a "differential" fungicide; that is, one which will kill or retard the spores of the melanose fungus and at the same time will leave the entomogenous fungi unharmed. To find such a fungicide would be ideal. Therefore, in speaking of spraying for melanose, we must at the same time consider the question of insect control.

The past season we have tested a number of the new and old spray materials. These materials include sulfur compounds, mercury compounds and Bordeaux mixture. This spring we are again testing in the groves sulfur compounds, mercury compounds and copper compounds. And from this fact you may correctly conclude that the results of one year of spraying do not lead to definite conclusions in the spraying for melanose control.

At present, there is no question but that Bordeaux mixture and Bordeaux-oil are the outstanding spray materials for melanose control. Bordeaux mixture, as was applied last spring, during early May, resulted in a marked improvement of fruit quality. One application produced the following percentages of fruits free of melanose blemish, over and above that of the unsprayed checks: On twenty-four year old seedling grapefruit, thirty-three per cent.; on ten year old Silver Cluster, Krome Davis and Foster and Thompson Pink grapefruit, fifty per cent., sixty-two per cent., and sixty per cent., respectively. The data on Valencias are incomplete at this time.

This application of Bordeaux in which we were using a calcium caseinate spreader) was followed in June with a one per cent. oil emulsion. Table 1 shows scale insect responses as checked on these trees this past fall. To these same trees (excepting the seedling grapefruit) a second application of one per cent. oil was made in December. At no time did any of these trees show a detrimental result from scale following this program.

RESPONSES OF SCALE INSECTS WHEN SPRAYED WITH BORDEAUX FOLLOWED BY ONE APPLICATION OF OIL EMULSION

Variety	Treatment	Date	Percentage of Leaves with Scale	Average No. of Living Scale per Leaf	Percentage of Dead Scale		Percentage of Living Scale
					With Fungus	Total Dead	
Silver Cluster	Sprayed	11/30/32	54.0	1.4	8.7	77.0	23.0
Krome Davis	Sprayed	11/30/32	56.7	2.0	3.5	79.9	20.1
Foster & Thompson Pink-o	Sprayed	11/30/32	24.5	0.95	0.3	68.1	31.9
Above Varieties	Unsprayed	12/1/32	50.9	0.44	23.1	90.5	9.5
Seedling Grapefruit*	Sprayed	11/1/32	80.0	6.1	0.3	49.7	50.3
	Unsprayed	11/1/32	78.0	2.9	22.7	78.1	21.9
Pineapple Oranges	Sprayed	11/21/32	35.6	0.31	11.4	69.8	30.1
	Unsprayed	11/23/32	78.0	0.79	31.7	86.1	13.9

*Many of the older leaves shed.
†W. L. Thompson assisted in making this scale count.

The time of application for any spray material is an important factor. This question is involved; it is just about as complicated as our seasonal rainfall and the part weather conditions may play in producing different responses to the citrus varieties. Last year, in many instances, drought and other factors so varied the setting of citrus fruits that many varieties had fruits from three sets of bloom.

To cover these fruits and protect them from infection was a physical impossibility with one spraying of the trees. This year, we are having very different conditions. All that can be done under these circumstances is to keep accurate notes on the contributing factors, so that an analysis of results may be made after years of spraying experiences.

It may be important to consider two places in the life cycle of the melanose fungus which may be attacked with spray materials. These necessitate different times. One period of attack is during the dormant season in an effort to prevent spore formation in the trees so that practical control may be obtained to leaves as well as fruits. The other period is after petal fall and the fruits have set to cover these young fruits and prevent their becoming infected. We are at present working on both programs to determine which time of attack will prove most effective in controlling the disease. At present, the indications are that for a spore-preventing program, the sanitary conditions of the grove must be maintained each year, and the spraying must be very thorough. Some very bright fruit is being produced in Florida at the present time by a systematic and regular pruning, followed by a dormant application of Bordeaux mixture, with two oil sprays, one in the spring, one in the fall.

Perhaps your minds revolve more to what could be used other than the Bordeaux and oil program. From the results of last season, and these are far from conclusive, the mercury compounds have shown a definite stimulation to citrus with apparently most effective scale control. Practically all of the sulfur compounds which we used last season may be clearly demonstrated in the laboratory to be toxic to the spores of the melanose fungus,

but in the field they all show little or no control. With these sulfurs we may be like two of the experiment stations were years ago. The one reported excellent control of a certain disease by dusting with sulfur; the other, inquiringly, informed the first that they were not securing such results. It is reported that the reply came back, "Perhaps you don't know how to dust with sulfur." So here, the sulfurs seem toxic, only we do not know how to use them at present. This season, we are trying more sulfurs in more combinations and with more applications of these mixtures than heretofore.

STEM-END ROTS

The stem-end rots of citrus are caused by two fungi, *Diplodia natelensis* Evans, and *Diaporthe citri* (Faw.) Wolf. This latter is the same fungus that causes melanose. Our interests have been primarily centered on it. Both of these fungi are very common in older citrus groves. They may be considered as sporulating most abundantly on dead wood; the Diplodia on large limbs and branches, the Diaporthe on the smaller citrus twigs. As considered in the fruits, these two rots are undistinguishable except by laboratory methods. The characters of stem-end rot are a soft, very pliable rot originating at the stem-end of the fruits.

There are increasing numbers of rules and suggestions for the control of these rots. The past publications of Stevens, Winston, Fulton and Wolf, as reported in the Proceedings of that Society, may be consulted for these more complete recommendations. At this time, we wish only to point out the fact that a certain amount of infection with the melanose fungus, resulting in stem-end rot, takes place in the groves as the fruits are developing. This early or grove infection seems to be present largely in a quiescent stage in the citrus buttons. Any practice for melanose control, as pruning and spraying, has materially lowered the percentage of stem-end rots of fruits in storage and transit. Spraying with Bordeaux this past season for melanose, showed a stem-end rot control varying between 0.0 and 60 per cent over the unsprayed checks. These grove practices are to be commended as auxiliary measures to be used for the control of this type of rot.

HIGH PRESSURE SPRAYING IN THE CITRUS GROVE

Chas. D. Kime, Orlando

Spraying is again becoming a popular grove procedure, for which fact we can thank the Automotive industry. Yet with all of our progress the really difficult grove locations, where spraying is being done, are still in the test stage. The cost of the work as compared with the price of the resulting fruit crop will decide if our present equipment is good enough or too expensive to operate, and if it needs further development.

A good many of us remember the wheezy, vibrating noisy outfits of 1912 which we called spray outfits. Surprising to say, due to the effectiveness of the spray materials available even then, the old bamboo rod did effective work but it was slow, terribly slow, and impossible to use because spraying only five acres was quite a lengthy chore.

Since 1912 we have seen intensely interesting mechanical developments. And while there is still much to be desired, machinery adaptable to grove work is vastly better suited to our needs today than even so short a time as three years ago. Although its use seems to be well within the range of allowable grove cost, we will have to admit that cost figures are not very plentiful. With increased production and only the better grades of fruit bringing a good profit spraying is no longer a luxury but a necessity. As one grower very emphatically told me, "It makes no difference