

## Control of Avocado Scale

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**President Thille:** The meeting will please come to order. We are just a little bit late getting started on our scheduled program. There are probably no questions before the avocado growers of as much concern as the problem of pest control. The very nature of the avocado tree makes pest control difficult. Professor Quayle of the University of California has made some interesting studies on this problem of pest control.

**Professor H. J. Quayle:** I think most of you know that we really have just started on investigations connected with avocados. We have begun this work more or less incidentally by sacrificing some other work. We have, however, carried on some investigations during the past year and I want to speak about those, together with contributions made by other men working on the same problem. You remember that Mr. D. B. Mackie of the State Department of Agriculture reported to this organization last year on the survey made by that Department and on this chart is shown the summary of Mr. Mackie's survey which was published in monthly bulletin form, July, last year. This has to do with scale infestation on the avocado.

An inspection was made of all avocado districts. The number of properties inspected was 1,148, comprising 1,586½ acres, planted with 27,000 trees. Twelve thousand trees were infested with one scale or another, or 43% of the total number of trees inspected.

Latania scale was found on 10,521 trees, or 85% of the trees infested with scale.

Ivy scale was found on 2,000 trees, or 17%, and the Spanish red scale or *Dictyospermum* scale on 1,136 trees, or 9%.

The greedy scale found on 755 trees, or 6.17%; and the red scale on 626 trees, or 5.11%.

In addition to this, four or five unarmored scales—those without waxy covering, were found on the avocado. You will see from the chart that the latania scale is the most widely distributed in most of the counties. Of the trees infested in San Diego County with one scale or another, about 60% were infested with latania; of the trees infested in Orange County, about 66% were infested with latania.

In Los Angeles County, of the trees infested with scale, 92%, according to this report, were infested with latania. In Ventura County, infested 24% latania. One or two infestations in Santa Barbara County and the same in Riverside County. None in San Bernardino County.

The ivy scale and the greedy scale are two of our common scales, widely distributed, attacking a wide range of host plants. We have never considered them of very great importance. They occur fairly generally on the avocado tree but as a rule they are not so abundant as the latania scale, for instance, and the injury they do is not so marked considering the same number of scales. Spanish red scale, that is *Dictyospermum* scale, is the scale that attacks citrus in Mediterranean countries and the Western Mediterranean Basin. It is the most important of all of the scales there. It is most important of all scales attacking avocado in Florida.

The California red scale, of course, is widely distributed on citrus throughout the avocado area but only occasionally found in avocados but when it is found on avocados it sometimes occurs in considerable numbers.

Of all of these armored scales then, the latania is the most important and most widely distributed.

Injury from these pests is caused by the thread-like mouth parts which are inserted into the tissues and by means of which the juice is extracted, causing the dying of twigs, when there is heavy infestation.

The life cycles of these scales still remain to be worked out and that is something we are proposing to undertake during the coming year. We of course know the life history of red scale pretty well and we made some comparisons with this red scale and latania scale. The red scale on citrus trees, in warm weather, has three, four and even five generations in a season, and about 100 to 150 young are produced. Some preliminary studies on latania scale indicate that they go through the life cycle a little more slowly than the red scale but there is possibly three generations a year of the latania scale and that is sufficient to account for the rapid build-up of the scale in a short time and the rapid increase of this scale on the avocado trees during the past year or two.

What we are discussing particularly this morning is the control of these scales; and of the methods of control there are two available—either spraying or fumigating. There is still a third biological method which may be followed up a little later.

## **LATANIA SCALE**

Latania scale was first described from a palm by the name "Latania Barbonica" in a French conservatory; from whence it came into this conservatory is not known, but it is apparently of foreign origin. In order to get some facts regarding the susceptibility of the latania scale to fumigation, we made some comparisons with the well known red scale of citrus. We know about what is required to kill red scale on citrus, and red scale is rather hard to kill as compared to some other scales. This chart represents some tests made in a fumatorium, 100 cubic feet capacity, where we had lemons infested with red and avocados infested with latania, put in chamber together, and gave them 2 cc. of hydrocyanic acid. Number of scales as result: 14.7% red scale alive and 2½% latania alive with that dosage. When we raised that another cc., or 3 cc., under same conditions, there were still 8.4% red scale survived as against .35% of latania scale. 4 cc. gave 4.3% red scale alive as against .3% of latania. With 5 cc. we got a complete kill. So we are safe in assuming for a time at least that the latania scale is much more

readily controlled by fumigation than is the red scale.

We have paid more attention thus far to fumigation. Tests were started at Riverside in June, 1931. In September we began some tests in San Diego. In the meantime, considerable work was done by A. F. Kirkpatrick of the Owl Fumigating Company, and Dean Palmer, agricultural inspector at Carlsbad during August in fumigating with Cyanogas—a cyanide.

Before going further on fumigation, I wish to mention briefly that we have tried some sprays and made some observations on the results of some of the sprays, commercially, and we hope that we will get a spray that will handle this scale satisfactorily. There are a number of avocado trees, where it is not practical to cover them with a tent, because of their size or closeness of planting. This is one of the lines we hope to work on during the coming year.

The fumigation of the avocado is rather a different problem than the fumigation of citrus. In the first place, the avocado tree is brittle and branches are liable to be broken off and consequently more or less destruction to the tree. The ordinary fumigation tents used in citrus are not practical excepting the small robust trees that can be covered without too much pressure on the tree itself. A lighter tent is desirable and the tents used with satisfaction so far are of much lighter material than those used heretofore on citrus—so called sheeting—"350 sheeting" is the trade name for it. It doesn't tend to break the tree as other tents do, but still holds a sufficient amount of gas. Then the fumigators who are in the habit of fumigating citrus trees, are not in the habit of taking so much care, since the citrus tree will withstand a lot of grief so far as the pulling of tents over them is concerned.

Another difference with avocado fumigation is that there are a good many small plantings where the owner is prepared to do the work himself, and with a tent or two and fumigating over a period of time, he can fumigate his planting himself or with very little help. That means there is more individual fumigation than is the case with citrus which is developed on a highly commercial scale. The material used mostly in avocado fumigation so far is Cyanogas, which comes in powder form, and when sprinkled on the ground the moisture in the air generates the hydrocyanic acid gas. Calcium cyanide comes in tins or drums and keeps indefinitely so long as you have it in air-tight containers; and it can be used by the individual grower with safety. Of course poisonous fumes come from this, but there is little danger compared with the use of the liquid, so it lends itself to use by the individual grower in a small way. This dust material is simply put in a tin can with holes punched in the bottom, with a handle of bamboo five or six feet long, and sprinkled on the ground, and is the most feasible method for the small grower who wishes to do the work himself. There is necessary, in the way of equipment, a few tents (as few as one or two in some cases) or as many as the grower feels he wants to purchase, depending, of course, upon the acreage. In addition to that, a couple of poles (and for these light tents bamboo poles are most popular and easily handled), with a rope attached to the end of them, three feet longer than the poles.

For the commercial and larger plantings, the use of liquid hydrocyanic acid is most feasible because the material is cheaper. It is necessary to have the liquid trucked from the plant to the premises and generally the liquid is handled by people who are more or

less in the business of fumigating, or managers hired by Associations or Cooperatives in carrying on this fumigation, as it is in citrus.

As to results of fumigation and spraying we made an examination of a good many of the trees treated shortly after being fumigated a couple weeks, and three or four weeks after spraying last Fall and that examination showed quite a satisfactory kill of scale where the trees were fumigated, but not a very satisfactory scale kill where trees were sprayed.

This brings us to the time of treatment or fumigating, and you, of course, understand we are now at the beginning of this work and haven't the last word on any of these questions. You can't expect to get these things definite with a few months' experience, but so far as results go, at present, the time for fumigation appears to be in September, October and November or up to the time of blooming. In San Diego coastal section trees begin to have bloom then, but much later in other sections where fumigation could be carried on at any time up through the winter season providing you haven't too much growth with cover crop. The bloom is the most susceptible part of the avocado to cyanide fumigation. We found we got injury more or less on all varieties but the Fuerte was one of the ones particularly susceptible. So, excepting in the early part of the season, possibly, when the first bloom appears, when some growers don't mind if that first bloom is destroyed (the first fruits are not so desirable), fumigation should be avoided when trees are in bloom.

Now as to the size of the fruit—that we haven't enough evidence on as yet, but as a general proposition I would say the fruit should be half grown. We have injured small fruits in June and July, and the smaller the fruit, the more likely they will be burned by hydrocyanic acid gas, the same as with citrus.

That covers the treatment of the scales at the present time and I am speaking only of the control of scale insects. There are other insects attacking the avocado, but we are not discussing those this morning. We hope to continue this work more energetically during the coming season for treatment both with sprays and fumigation. We recommend fumigation for the treatment of these scale insects, but where you can't cover the trees with a tent, then spraying will have to be resorted to, and just what kind of spray and how applied to these plantings that are close together and on terraces, are some of the problems we hope to give attention to during the coming year.

**Question:** What percentage of kill resulted on the trees treated?

**Prof. Quayle:** Many trees showed heavy infestations, the percentages I haven't given you. We had count records but the percentage doesn't mean anything so far as the commercial aspect was concerned. If you have 100 scale and kill 99% of them, you have a pretty good clean-up. But, if you have a million scale and you get 99% kill, you haven't got a clean-up at all. Percentage of scale doesn't mean anything. What the grower wants to know is the population per tree at the time and that is what we have tried to give,—the number of live scale found on the tree, and I think that is a better criterion to go on.

**Question:** Are the thrips susceptible to the cyanide fumigation?

**Prof. Quayle:** No, fumigation does not handle the thrips situation. It may kill adults at the time, but more come on. That is one of the problems needing investigation. For control of thrips, at the present time we are using lime sulphur with nicotine and many as high as three applications. It is very expensive. Another and better kind of spray needs to be worked out for thrips.

**Question:** What varieties were you treating for scale?

**Prof. Quayle:** All varieties as we came to them in the grove, but the majority were Fuertes.

**Question:** The reason I asked my first question is to know whether you would make any distinction as to the date of treating this tree or that tree, according to variety.

**Prof. Quayle:** No, we did not, but were careful not to treat any variety during or just previous to bloom.

**Question:** Is it possible to treat them afterwards, when the fruit is partly formed?

**Prof. Quayle:** No, not until the fruit is half grown, because up to that time it would be dangerous.

**Question:** Does fumigation kill red scale as well as latania?

**Prof. Quayle:** The red scale didn't occur in most of the places where these investigations were carried on. The kill on the red would not be as good as on latania, which is more susceptible to fumigation, as I showed you on one of those charts.

**Question:** Is it any less susceptible on avocado?

**Prof. Quayle:** We have very little experience with fumigation for citrus red scale on avocado. Red scale has been seen occasionally on the avocado but as yet has not caused sufficient damage to warrant concern on the part of the growers.