

sodium hydroxid, the writers' conclude that the sodium ion is not a repellent to house-fly oviposition and its presence in some salt combinations may be moderately attractive.

Of the remaining substances in the list receiving more than 60 percent of eggs, all are fatty acids and therefore chemically kin to carbonic acid. Of these acetic acid leads by a wide margin and it is worthy of note that this is the acid most likely to occur in the ordinary decomposition processes of vegetable matter where carbon dioxid is also liberated.

Gravid house flies appear to be indifferent to the presence of the organic bases, grain alcohol and glycerin, as might also be stated of the mixed compound lactic acid. The mineral acids, hydrochloric and sulphuric, appear to be moderate repellents.

In the light of present results the writers' suggest that the female house fly is attracted for egg laying by decaying organic matter in proportion to the amount of carbonic and acetic acids liberated in the fermentation processes, and that the preference for decaying vegetable rather than animal matter may have its explanation in this fact. Also it is possible that its predisposition for these two acids may explain the fondness of the house fly for human environments generally, particularly dwelling houses and livery stables.

DUSTING vs. SPRAYING FOR THE CONTROL OF INSECT PESTS ON THE AVOCADO¹

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The Avocado which is now being propagated quite extensively on a commercial scale in Florida has like all other fruits a number of injurious insect enemies. It is during the dry winter months particularly, while the trees are dormant that the grower of this fruit often experiences serious trouble with a number of enemies which attack his trees. Among these enemies may be mentioned the Avocado Red Spider, *Tetranychus yothersi* McGregor; the leaf thrips commonly called in the North the greenhouse thrips, *Heliothrips hemorrhoidalis* Bouche' and the leaf hopper, *Empoasca minuenda* Ball. The red spider and the leaf thrips confine their attacks to the upper surface of the foliage, while the leaf hopper does its work on the lower surface.

During the seasons 1918 and 1919 a number of tests were made with a view to ascertaining the relative merits of several contact insecticides in the dust or powdered form alone and in combination, with similar contact

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insecticides in the liquid form in the control of the above mentioned pests which attack the avocado. A portion of a large grove consisting mainly of the Trapp and Pollock avocados of West Indian strains, which were considerably infested with all the mentioned insect pests was selected for a comparison of the two methods.

In conducting the dusting operations the equipment used was the regular orchard power duster. At the time the applications were made the weather was clear and the foliage was dry. The temperature averaged between 75 and 80 degrees Fahrenheit. The dust was so directed on the windward side of the trees so as to cover the trees well, and the machine was never allowed to stop except at a large tree to be certain it was well covered.

The spraying work was performed the same day a power outfit being employed, using one of the spray guns at a pressure ranging from 225 to 250 pounds.

In the dusting experiments several kinds of material were used among which was an impalpable sulphur dust. This sulphur dust is nearly pure sulphur very finely pulverized and capable of going through a 200 mesh screen. The other material used was a combination consisting of the above dusting sulphur impregnated with a quantity of nicotine sulphate, 40% solution, in the form of Black Leaf-40. Both of these dusting materials are manufactured and on the market as contact dusting insecticides. In the spraying work several sprays were tried out in comparison with the above dusts as lime sulphur solution one gallon to fifty gallons of water, and lime sulphur solution at the rate of one gallon to fifty gallons of water in combination with Black Leaf-40 at the rate of one gallon to nine-hundred gallons in the diluted lime sulphur solution. A portion of a block was left as a check experiment.

Subsequent examinations at various intervals of the dusted and sprayed portions of the grove showed that the dusting method, where the dry dusting sulphur in an exceedingly pulverized form was used, to be equally as effective as spraying with lime sulphur solution against the avocado red spider, *Tetranychus yothersi* McGregor. The mites were not killed immediately, however, on the dusted trees, but after thirty minutes practically all the mites were killed. On examination of the foliage with a hand lens the sulphur was very evenly applied, no portion of the upper surface of the foliage being free from the fine sulphur. In the dusted portion of the grove with the dusting sulphur, the red spiders again made their appearance after a period of five weeks, which was also true approximately in the block where the lime sulphur

solution, one gallon to fifty gallons of water was applied. The weather following application of the dusts was rather dry although for several days following very heavy dews occurred which wet the foliage thoroughly, and a week later a heavy shower occurred in the grove. These heavy dews and shower had very little effect on the sulphur dusted trees in removing any of the dust. Where the lime sulphur solution was applied it killed the red spiders by contact almost immediately, and proved satisfactory in controlling the red spiders over as long a period as did the sulphur dust.

Where a large acreage of avocados exists, and the red spider is the only pest with which the grower has to contend, the dusting method would make it possible for the grower to protect his orchard at critical times from the attacks of the red spider. The dusting method is by far the quicker method.

There are other pests, however, with which the avocado grower has to contend with such as the leaf thrips, *Heliothrips hemorrhoidalis* Bouche' and the leaf hopper, *Empoasca minuenda* Ball. Neither the dry sulphur dust or the liquid lime sulphur had any effect in ridding the trees of the leaf thrips or the leaf hoppers. These two insects are usually present and causing damage to the trees at the same time generally that the red spider is carrying on its depredations, and which are not destroyed by applications of sulphur in the dust or liquid form. To possibly control these by the dusting method the writer procured a dusting material consisting of the finely pulverized sulphur dust charged with nicotine sulphate, 40% solution, in the form of Black Leaf-40. This material was dusted in the same manner as was the dry dusting sulphur. This combined material killed readily the adult and immature red spiders, leaf thrips and a good majority of the leaf hoppers. The material, however, did not adhere to the foliage for any length of time, even the heavy dews removing the majority of the dust. This apparently was due to the incorporation of the liquid nicotine sulphate to the dry pulverized sulphur causing the sulphur particles to aggregate and forming a wettable sulphur. In the case of the dry dusting sulphur, it is due to its fineness and dry condition when applied that it adheres so well to the foliage. The continued heavy dews and subsequent shower removed the majority of the combined dust from the foliage, and it was but a short time after application that the red spiders were again present on the trees in goodly numbers. This is readily explained as nothing effective remained on the foliage to destroy the young which later hatched from the eggs not destroyed by the dust. Hence it is essential, that

the dust remains on the foliage for a sufficient length of time after application in order to destroy the young mites as they hatch from the eggs.

In combining the lime sulphur solution at the rate of one gallon of the stock solution to fifty gallons of water with the nicotine sulphate 40% solution at the rate of one gallon to nine hundred gallons in the diluted lime sulphur solution, this combination proved an excellent spray in killing the red spiders, thrips, and leaf hoppers. The lime sulphur solution in this combination proved effective over as long a time as did the lime sulphur alone against the red spiders on the trees. Examination of the check plot showed the red spiders, thrips and leaf hoppers alive.

COMPARATIVE COST OF SPRAYING AND DUSTING

During the time the comparative experiments were made a few figures were taken on the cost of the different dusting and spraying materials employed, and the time required to dust and spray 100 average avocado trees nine years of age.

COMPARATIVE COST OF SPRAYING AND DUSTING

Materials	Average amt. used per tree	Price per pound or gallon	Price per tree	Time required to apply to 100 trees	Cost labor 2 men at \$6.00 per day	Cost materials and labor per tree
1 Sulphur Dust	1.33 lbs.	\$.0375	\$.05	50 minutes	\$.63	\$.0563
2 Sulphur Dust + Nicotine Sulphate	1.33 lbs.	.15	.18	55 minutes	.69	.1869
3 Lime Sulphur Sol. (1-50)	4.16 gals.	.005	.02	2 hrs. 40 mins.	2.00	.04
4 Lime Sulphur Sol. (1-50) + Nicotine Sulphate (1-900)	4.16 gals.	.02	.08	2 hrs. 50 mins.	2.13	.1013

CONCLUSIONS

1. The dusting method with dry sulphur was found to be equally as effective in controlling red spiders on avocado trees over as long a period of time as the spraying method with liquid lime sulphur solution.
2. The experiments proved that it is not necessary that the foliage of the avocado be wet with dew in order that the dry dusting sulphur be effective.
3. Sulphur in any of the combinations used did not control leaf thrips or leaf hoppers, and nicotine sulphate 40% solution when used alone or combined with either lime sulphur solution or dry dusting sulphur will destroy them.

4. Dry dusting sulphur when charged with nicotine sulphate 40% in the form of Black Leaf 40 and applied to avocado foliage was readily removed by succeeding heavy dews and light rains after application. The incorporation of liquid nicotine sulphate 40% caused an aggregation of the sulphur particles and a wettable sulphur.
5. Liquid lime sulphur solution when combined with nicotine sulphate 40% solution proved to be the most satisfactory combination used in combatting the red spiders, leaf thrips and leaf hoppers and remained effective against the red spiders over as long a period as did the lime sulphur solution applied alone.
6. Where a grower has a medium sized grove of avocados, which is usually the case up to the present time, and where a number of insects occur, spraying would be the more effective and cheaper method considering the price of sulphur and nicotine sulphate in the dust form as compared with the same in the liquid form.

CONTROL OF TWO SCALE INSECTS OF THE MANGO¹

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There are a number of scale insects which attack the mango in Florida, but two found to be the most injurious up to the present time and more generally distributed are the Tessellated Scale, *Eucalymnatus tessellatus* Sign. and the Mango Shield Scale, *Coccus acuminatus* Sign. These two scale insects are readily recognized in the field by the difference in shape and color. The Tessellated Scale is oval in shape, but broadly rounded posteriorly. It is of a dark brown in color, with a decidedly mosaic appearance on the upper surface. The Mango Shield Scale is yellowish green, and in shape it is deltoid, bluntly pointed in front and broadly rounded posteriorly. It is very thin and flat and irregularly marked with black.

Both of these scale insects infest the lower surface of the foliage, usually clustered along both sides of the midribs. When very numerous they may also be found along the lateral veins and the interstices. The scales reproduce continuously throughout the year, the generations overlapping considerably so that at any time one may find the scales in almost any stage of development. During the spring months the scales move from the older leaves onto the new growth of foliage. Usually these are the crawlers, but even the older scales often leave their feeding grounds and wander to the new growth.

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