Water Spot on Navel Oranges

only slight injury observed in orchards treated with parathion for California red scale control

L. A. Riehl and G. E. Carman

Water spot injury to navel oranges was less on trees treated with 25% parathion wettable powder than on trees sprayed with oil, in four observed orchards in Los Angeles County.

Water spot is the term applied to a certain type of breakdown of the rind of the navel orange and is an economic factor in the production of navel oranges—principally in the citrus areas of the southeastern part of Los Angeles County and of the southwestern part of San Bernardino County.

The breakdown of the rind tissue is nonpathogenic but develops when the surface of the nearly mature or mature navel orange has been wet continuously with water for several days. In the field, rain may provide the necessary conditions as early as November and at any time thereafter until the fruit has been harvested.

Water is absorbed by the rind tissue in a local area which becomes swollen. Normally, water spot develops at the navel end which is generally the lowest point of the fruit. However, the injury is not limited to the navel end and frequently develops in other parts of the rind. The size of the affected area of the rind may depend on the length of the exposure to water. Cracks may develop in the surface of the water-soaked area and lead to decay from blue and green molds or the presence of the water in the tissue may cause death of the cells. If this leads to scar formation, the fruit will be put in the cull grade.

During the fall of 1951 parathion in wettable powder formulation was used in many navel orange orchards for California red scale control. In some of these orchards several tree rows, around the house, were usually sprayed with oil. Rain during January and March, 1952 provided conditions for the appearance of water spot. Counts of the incidence of water spot were made at the time of harvest in three such orchards in the southeastern part of Los Angeles County. In addition, water spot data were taken in a block of navel orange trees at Pomona in which experimental plots had been established primarily for studies of red scale control.

Most of the rind breakdown which occurred during that season was of the type known as shoulder spot which develops when freezing temperatures occur immediately following or within a day or two after rain.

The three orchards—in which the incidence of water spot was sampled among trees sprayed under commercial conditions—had only two plots, a small one treated with oil spray and the remainder of the orchard treated with parathion wettable powder at the rate of 1⅗ pounds per 100 gallons.

In two of the orchards—at La Verne and Upland—light medium grade emulsive spray oil was used in aqueous spray mixture at the rate of 1.75% and 1.80% respectively. In the third orchard—at Azusa—medium grade emulsive spray oil was used at a concentration of 1.80%. The application was made early in the season at Upland and relatively late in the season in the other two orchards.

Counts of the fruit affected with water spot were made at the time of harvest. Several pairs of trees were selected at random along the oil and parathion-sprayed border. As the fruit from a sample tree was picked it was placed in boxes beside the tree until all of the fruit picked from the tree had been collected. The fruits were then examined individually for rind breakdown due to water spot and a count made of the number affected and unaffected. After the picker finished picking the sample tree and moved on, the fruits on the ground underneath the tree were examined for water spot and counted.

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The per cent of Fruit Damaged by Water Spot Found at the Time of Harvest in Oil and in Parathion Treated Plots in Three Navel Orchards Sprayed Commercially in Southeastern Los Angeles County.

Location	Spray applied	Fruit harvested	Count trees per treatment	Total fruit counted	Mean per cent fruit with water spot					
					On tree		On ground		Total	
					Oil	Parathion	Oil	Parathion	Oil	Parathion
Azusa	18 Oct. 51	12 Mar. 52	8	21,543	11.2	4.5	48.4	33.2	11.9	5.1
La Verne	30 Oct. 51	27 Feb. 52	8	15,373	15.0	4.9	73.8	25.5	22.4	6.2
Upland	11 Aug. 51	27 Mar. 52	4	6,185	34.8	6.3	76.9	40.6	42.7	6.3

Comparison of the per cent of Navel Oranges with Water Spot Damage in Oil and in Parathion Sprayed Plots Established Experimentally in an Orchard at Pomona.

Treatment	Amt. per 100 gals.	On ground						Total		On tree	
		February 12		March 14		April 22				April 22	
		No. fruit	Water spot %	No. fruit	Water spot %	No. fruit	Water spot %	No. fruit	Water spot %	Water spot %	
Parathion 25% WP	2 lbs.	263	4.2	93	25.8	390	17.7	746	15.1	6.0*	
Parathion 25% WP	3 lbs.	347	1.2	96	12.5	337	13.6	780	10.6	4.7*	
Light Medium Oil	7 qts.[1]	265	4.9	108	13.9	375	25.6	748	17.5	18.7	
Triumph Oil[2]	6 qts.	203	2.9	89	19.1	217	24.4	509	15.3	6.0*	
Lime-Sulfur solution	6 qts.										
Casein spreader	1 lb.										

* Signifies that the mean value for the treatment differs significantly from the comparable mean value for Light Medium Oil, the standard treatment.

[1] Equivalent to 1.75 per cent.

[2] Triumph Oil is a trade name for a miscible spray oil made for use with lime-sulfur and calcium caseinate. With respect to conventional citrus spray oils, the petroleum fraction used is extra light, distilling between 513° and 663° F., and the unsulfonated residue, 72% U. R., is relatively low.

Lemon Cuttings with Fruit Rooted

means of prolonging useful life of lemon fruits developed at Riverside valuable aid in research

Louis C. Erickson and Paul DeBach

Light green Eureka lemon fruits—with 1″ to 2″ stems—were rooted successfully in an experiment designed to develop a means of prolonging the useful life of lemon fruits for studies of a physiological, biochemical, and entomological nature.

Detached lemon fruits are utilized in many general and specialized research problems but a major drawback to their use has been the relatively short period during which they would remain turgid and more or less normal.

A simple solution to the problem seemed to be the production of roots on stems attached to the fruits. Such a technique should not only result in maintaining healthy turgid fruits for long periods under the usual conditions of high humidity but also should permit studies involving low relative humidity.

An experiment was initiated to determine the rooting response of lemon cuttings with fruits attached.

On February 7, 249 medium-sized lemons—ranging in color from yellow to light-green—were clipped from several Eureka lemon trees. Stems on the fruits varied from 1″ to 2″ in length, and approximately half of them had one or two leaves attached.

The fruits were segregated into three color groups of yellow, silver, and light-green. The silver category is a packing-house designation for yellow fruit which still retains a slight amount of green color, usually at the ends. Each color group was subdivided into cuttings with and without leaves. These groups were further divided into groups to be treated with a rooting preparation—0.2% naphthalenacetic acid on talc, ANA—or left untreated. The cuttings were placed in a rooting bed, with sand as a rooting medium, and were usually sprinkled two or three times daily during the rooting period.

A count of rooted cuttings and roots was made on March 6, four weeks after the start of the experiment. Cuttings with light-green lemons attached rooted most readily, whereas those with yellow lemons rooted least readily. The presence of leaf tissue appeared to be unnecessary in the cuttings with light-green and silver lemons but necessary for root formation in the cuttings with yellow lemons. Naphthalenacetic acid increased the percentage of rooted cuttings in all comparisons.

Leafy lemon cuttings have been reported to root better than leafless ones, even when treated with a growth regulator such as indolacetic acid.

In the present study it was found that leaves were not essential for the rooting of cuttings when light-green or silver-colored lemons were attached.

It appears that immature lemon fruits can supply the same factors as are ordinarily supplied by the leaves. Sugars and nitrogen are present in both green and yellow lemons. Whether these factors become less available for mobilization to the base of the cutting as the fruit matures, or whether other factors for rooting are concerned requires further investigation.

Rooting Response of Lemon Cuttings

	Light-green				Silver				Yellow			
	Leaves		No leaves		Leaves		No leaves		Leaves		No leaves	
	No ANA	ANA	No ANA	ANA	No ANA	ANA	No ANA	ANA	No ANA	ANA	No ANA	ANA
No. cuttings	38	37	31	26	21	22	13	12	13	15	10	11
Percentage rooted	31	59	52	81	10	68	15	67	8	67	10	18
Roots per rooted cutting	1.8	3.8	3.3	3.0	1.5	4.4	1.5	2.4	1.0	3.9	5.0	7.5

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WATER SPOT

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In the experimental block at Pomona application of the treatments was made late in the season. A design of one pair of trees per plot replicated three times was laid out in a block with over-all dimensions of two by 33 rows.

The date of harvest in this block was delayed and the fruit was held on the trees. The fruit that dropped from the trees was examined for rind breakdown due to water spot and a count made of the number affected and unaffected for each tree on three occasions during the harvest season, February 12, March 14, and April 22.

Water spot injury during the 1951–52 season occurred for the most part as a result of two periods of rain. The first of these consisted of heavy rains during the latter part of January accompanied, on several occasions, by freezing temperatures while the fruits were still wet or partially so. These conditions were largely responsible for the shoulder spot type of injury—so prevalent among the fruit observed at the Azusa and La Verne orchards.

The second rainy period which contributed to water spot damage occurred in mid-March when the rains were not followed by freezing temperatures. Water spot developed through the penetration of water into the rind tissues. The fruit at Upland was subject to both of these sets of water spot conditions. This would account for the much higher incidence of water spot in the oil sprayed plot of this orchard than was found in the similar plots of the orchards at Azusa and La Verne.

The data obtained in these studies support the general observations, made by packing-house managers and by field men concerned with the crop, and show that the incidence of water spot was less in plots treated with parathion wettable powder than it was in those sprayed with oil.

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