

DEGRADATION OF PROPARGITE RESIDUES ON
ORANGE FOLIAGE IN TULARE COUNTY, CALIFORNIA
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By

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SUMMARY

Foliage was sampled from Tulare County orange groves to determine typical concentrations of dislodgeable propargite residue. The average (first-order) half-life for propargite residue was ten days (Range = 7 - 14 days). Initial propargite deposited on foliage ranged from 3.3 to 10.5 ug/cm². Dislodgeable propargite residue decreased 32 percent after rinsing with water. Upon expiration of the temporary 35-day reentry period propargite residue concentrations ranged between 0.1 ug/cm² to 1.2 ug/cm². Most orchards had less than 1 ug/cm² 21 days post-application. A reentry interval of 42 days was set for the controlled-release formulation of propargite (Omite-CR) based upon review of data in this report and the reports of injuries of workers exposed to residues of propargite (Omite-CR) in citrus groves in May 1986.

INTRODUCTION

A dermatitis outbreak occurred in May 1986 among 114 of 198 orange pickers employed by a Tulare County, California packing house. These workers harvested oranges from groves treated with Omite-CR^R --a wetttable powder acaracide containing 30% propargite in a controlled release formulation. The Tulare County Agricultural Commissioner's (CAC) staff initially determined that Omite-CR was the agent responsible for the dermatitis outbreak:

- 1) A different propargite formulation, Omite-30W, was previously identified as a cause of similar dermatitis outbreaks in California;
- 2) Omite was reformulated for citrus applications several years earlier and in 1986 it was sprayed in 20% to 30% of the 90,000 acres of orange groves in Tulare County;
- 3) Based on spraying records, Omite-CR was the only pesticide common to the dermatitis cases of this outbreak.

The Tulare CAC staff notified the California Department of Food and Agriculture (CDFA) of the outbreak. CDFA is responsible for evaluating and setting reentry intervals for fields treated with pesticides.

After the outbreak occurred, CDFA's Worker Health and Safety Branch investigated the incident in cooperation with the California Department of Health Services and the Tulare CAC staff. Serial samples were collected in eight groves that had been treated on to 23 days previously with Omite-CR. One grove was washed with 5000 gallons per acre to evaluate the effectiveness of washing lower available residues.

When Omite-CR was submitted to the Department for registration, the amount of active ingredient remained unchanged at 30 percent. Therefore, the Department considered the reformulation a non-substantive change, and the pesticide was registered without requiring new data or further testing.

Consequently, Omite-CR became available for use on citrus with little concern about its safety to field workers. At the time of the exposure incident, a one-day reentry interval for citrus orchards treated with propargite was in effect. When it became clear that a longer reentry interval was necessary to protect workers, the Department instituted an emergency extended reentry interval of 14 days; this interval was later extended to 35 days by emergency regulation. The Department recently proposed a 42-day reentry period for controlled-release propargite applied to citrus.

The granules of Omite-CR are coated with a series of inert materials to prevent leaf burn. This inert coating may have slowed the foliar degradation of propargite and contributed to skin irritations by field workers. Worker Health and Safety investigators used the dislodgeable residue method to estimate propargite concentration on the citrus foliage. The objective of our investigation was to determine the rate of degradation of Omite-CR residues on foliage so that an appropriate reentry interval could be established.

In a detailed epidemiological investigation of this incident, the Department of Health Services determined the cause of the reported burns to be exposure to propargite residues (Saunders, et al.). A strong statistical association was found correlating symptoms to residue-hours of propargite exposure.

METHODS

We sampled foliage from fields where harvesters developed dermatitis using methods described by Iwata et al. (1977): Four one-inch diameter leaf discs per tree were sampled from ten trees at a diagonal across the field. Samples were stored and shipped on wet ice. CDFA chemists analyzed the samples for dislodgeable propargite residue within 24 hours.

We fitted residue data to a first-order decay model using least squares regression analysis. The equation for this model is $Y=Y_0\exp[-BX]$, where Y = Amount of pesticide in micrograms per centimeter squared remaining at any time (X) after application, and B = specific rate constant.

RESULTS

Table 1 presents dislodgeable residue results from orange groves intensively monitored for 30 days or more.

Figure 1 graphically presents data from plots A through G with the corresponding regression line.

Table 2 lists the first-order regression parameters for data of Table 1.

Plot H was monitored after an initial rinsing with 50 gallons of water per tree by workers using hand-held hose sprayers. Residues decreased 32 percent after rinsing; a similar decrease in foliar residue can be achieved by waiting approximately six days.

Using combined data from fields A through G we calculated a regression equation to estimate average dislodgeable foliar propargite residues. The regression equation is $Y = 4.57 \exp[-0.0718 X]$. The average initial deposition of propargite in plots A through G was 4.57 ug/cm². These groves were treated with propargite at a concentration of 2.7 to 3.3 lbs active ingredient per acre. After deposition the amount of residue decreases exponentially with time. Most orchards monitored had less than 1 ug/cm² of propargite after 21 days post-application. These calculations are based primarily on data collected nine to 42 days after application. Estimation of deposition involves very significant extrapolation and, therefore, should be considered only a rough approximation.

Six different harvesting crews were involved in the dermatitis incident. Using the above degradation equation, we estimated foliar residue for the day workers harvested a grove. Table 3 lists the estimated residue concentration at the time of harvest and the resulting percentage of harvesters reporting dermatitis.

Propargite residue concentration in the fields monitored generally decreased

with time. Because the initial deposit for each field was variable, we estimated the amount of residue present on a given day after application by using the average initial deposit (4.6 ug/cm^2) and half-life (9.7 days). Our calculated degradation rate for Omite-CR is similar to the rate calculated for wettable powder propargite in Kern County, California (Table 5); however, higher residues were initially deposited with Omite-CR compared to wettable powder propargite because applicators sprayed the foliage with more pounds of active ingredient per acre when using Omite-CR.

Consequently, this investigation revealed that the foliar degradation of Omite-CR is similar to that of wettable powder propargite (Omite 30W) in Kern and Tulare Counties. The average half-life is approximately 10 days, and the average initial deposit is approximately 5 ug/cm^2 . Most harvesters developed dermatitis when the foliar residue was greater than 1.6 ug/cm^2 . Typical Omite-CR applications in the study area resulted in foliar residues of 1.2 ug/cm^2 or less after 21 days.

REFERENCES

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TABLE 1

Results of Dislodgeable Propargite Residue From
Orange Groves Sampled in Tulare County, California, May - June 1986

PLOT					
<u>Application Date</u>	<u>Sampling Date</u>	<u>Days</u> <u>Post-Application</u>	<u>ug/cm²</u>	<u>ug/cm²</u>	
A					
5/9/86	5/10	1	3.44	3.04	
	5/13	4	5.37	5.71	
	5/14	5	2.50	3.10	
	5/15	6	3.50	2.30	
	5/21	12	0.77	0.82	
	5/29	20	0.61	0.69	
	6/10	32	0.32	0.17	
B					
4/17/86	5/10	23	1.27	1.71	
	5/15	28	1.20	0.92	
	5/21	34	0.35	0.39	
	5/29	42	0.37	0.35	
	6/10	54	0.33	0.31	
C					
4/25/86	5/10	15	2.21	2.03	
	5/15	20	1.20	0.96	
	5/21	26	0.62	0.45	
	5/29	34	0.65	0.27	
	6/11	47	0.08	0.06	
D					
5/1/86	5/10	9	5.49	3.29	
	5/15	14	3.70	4.20	
	5/21	20	6.10	5.10	
	5/29	28	0.97	3.3	
	6/10	40	0.46	1.0	
E					
4/25/86	5/10	15	2.16	2.03	
	5/15	20	1.20	1.20	
	5/21	26	0.70	0.38	
	5/29	34	0.37	0.23	
	6/10	46	0.26	0.19	
F					
4/29/86	5/10	11	1.91	1.96	
	5/15	16	1.20	0.97	
	5/21	22	0.47	0.44	
	5/29	30	0.57	0.40	
	6/10	42	0.12	0.13	

PLOT		Days		
<u>Application Date</u>	<u>Sampling Date</u>	<u>Post-Application</u>	<u>ug/cm²</u>	<u>ug/cm²</u>
G				
4/25/86	5/10	15	0.81	0.69
	5/15	20	0.77	0.96
	5/21	26	0.27	0.17
	6/11	47	0.05	<0.05
<u>Days After Wash*</u>				
H				
4/23/86	5/13	4 hrs.	1.3	0.67
	5/14	1	1.5	1.00
	5/15	2	0.91	0.94
	5/21	8	0.51	0.52
	5/29	16	0.39	0.31
	6/10	28	0.15	0.12

* Trees washed with 5000 gallons of water per acre.

TABLE 2

Estimated Residue Degradation Parameters for Orange Groves
Treated With Controlled-Release Propargite (2.7 - 3.3 lbs. a.i./acre) in
Tulare County, California, May - June 1986

<u>Plot</u>	<u>Initial Deposit (ug/cm²)</u>	<u>Degradation Rate Constant</u>	<u>Half-life (days)</u>	<u>Correlation Coefficient</u>	<u>Residue Below 1 ug/cm² at... (days)</u>
A	4.54	-0.0970	7.1	-0.938	16
B	3.48	-0.0495	14.0	-0.844	25
C	8.86	-0.1005	6.9	-0.966	22
D	10.46	-0.0631	11.0	-0.819	37
E	4.81	-0.0732	9.5	-0.924	21
F	4.09	-0.0820	8.5	-0.962	17
G	3.32	-0.0906	7.7	-0.956	13
Combined					
A-G	4.57	-.0718	9.7	-0.815	21
H ^a	1.07	-.0742	9.3	-0.963	1 ^b

^a Samples taken after trees were rinsed

^b Days after rinsing

TABLE 3

Estimated Propargite Residues on Orange Foliage
and the Resulting Harvester Dermatitis Incidence

<u>Estimated Foliar Residue (ug/cm²)</u>	<u>Dermatitis Incidence (% harvesters in the harvesting crew)</u>
0.34	2
1.67	2
1.67	10
1.80	1
1.80	1
1.80	13
2.07	1
2.08	1
2.23	1
2.23	2
2.23	2
2.23	2
2.23	3
2.32	1
2.39	1
2.39	7
2.57	11

TABLE 4

Range of Propargite-CR Residue
on Orange Foliage at Times After Application

<u>Time After Application (Days)</u>	<u>Average Foliar Residue (ug/cm²)</u>	<u>95% Confidence Range of Residue (ug/cm²)</u>
16	1.5	1.33 to 1.67
21	1.0	0.84 to 1.16
26	0.7	0.54 to 0.86
31	0.5	0.33 to 0.67
42	0.2	0.01 to 0.39

TABLE 5

Estimated Residue Degradation Parameters For Grape Foliage Treated With
30 Percent Wettable Powder Propargite

<u>Location</u>	<u>Pounds of Active Ingredient Per/Acre</u>	<u>Initial Deposit (ug/cm²)</u>	<u>Degradation Rate Constant</u>	<u>Half-Life (days)</u>	<u>Correlation Coefficient</u>
Kern Co., CA (Source: Maddy et al. 1986)	2.0	0.14	-0.0813	8.5	-0.40
Santa Barbara Co., CA (Source: 1986 CDFA data)	2.5	2.05	-0.236	2.9	-0.92

FIGURE 1. DEGRADATION OF DISLODGEABLE PROPARGITE RESIDUE.
TULARE COUNTY, CALIFORNIA, MAY-JUNE 1986. PLOTS A-H.

