Field Tests on Some Pests of Grapes

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EXPERIMENTAL DUST MIXTURES containing parathion were tested in Tulare County vineyards during 1947 in preliminary trials to determine their effects on certain grape pests. Only the results obtained in the parathion plots together with comparative plots treated with standard control insecticides will be reported upon here. For some species no standard control was available for comparison.

The little bear beetle, *Pocalta ursina* (Horn), is sometimes a minor pest of grapes in the southern San Joaquin Valley where the adults attack the tender shoots primarily of one- and two-year-old vines. On April 1, a 1% parathion dust was applied by hand duster to a small heavily infested vine. Three hours after dusting all beetles were on the ground under the vine. Most appeared dead but several were able to feebly move antennae and legs. The next observation was three days later at which time all were dead. Also on April 1, a 0.25% parathion dust was applied lightly by hand duster to eight vines and heavily to four more. After three days all beetles on the heavily dusted vines were dead. Under the lightly treated vines several beetles were still able to move legs and antennae, and two were able to crawl effectively.

The grapevine Hoplia, *Hoplia callipyge* Lec., is a minor pest of grapes sometimes causing considerable damage to an occasional vineyard. Several lightly infested rosebushes were dusted by hand with 1% parathion on April 19. The following day no Hoplia remained on the bushes but several were found dead on the ground beneath them showing that this insect is in some degree susceptible to the toxicity of parathion.

The grape mealybug, *Pseudococcus maritimus* (Ehrhorn) is a minor pest of grapes sometimes causing heavy damage in limited areas. On April 7, three vines were treated with 0.25% parathion dust by rotary hand duster. Five days later the kill was estimated to be near 40% with the best results on leaf areas which showed a visible deposit of dust.

Dusts containing concentrations of 0.25%, 1%, and 5% parathion were applied moderately to single vines by rotary hand duster on April 20. The live and dead mealybugs present on five leaves picked from each vine were counted on April 25. The 0.25% dust treatment resulted in a 58% mortality while the 1% and 5% dust treatments yielded a 100% mortality. The vines dusted with 1% and 5%, remained free of mealybugs for the remainder of the season. The vine dusted with 0.25% was lightly infested at harvest time.

On April 27, three plots comprising a total of 2½ acres of vines were treated with 1% parathion dust applied at the rate of 20 pounds per acre by a power duster in alternate middles. This treatment did not result in effective control, for although the population was considerably reduced in the treated areas for several weeks, it increased during the season so that by harvest there were few clean bunches.

The possibility of grape mealybug control with the proper use of parathion dust is indicated.

The grape leaf folder, *Desmia funeralis* (Hbn.) is a minor pest of grapes in California but is of primary importance in certain local areas. On April 18, a vine on which many eggs had been deposited was dusted by rotary hand duster with 1% parathion. First brood larvae had just started to hatch. On April 30 not a single live larva could be found on the vine. The dust had apparently remained completely effective. On May 19 a very few young larvae were present, and on June 12, near the end of the first brood, a small number of rolls had been made on leaves.

An isolated vine on a house arbor that was infested with first brood larvae was dusted on April 21 with 1% parathion dust by hand duster when most of the larvae were in leaf rolls. No larvae were found seven days after treatment.

On April 30 a test plot of 1% parathion—55% sulfur dust—was included in an experiment near Exeter (see table 1). Application was by means of a tractor-mounted duster, driving every middle, applying 20 pounds per acre, on plots slightly over one acre in size. First brood leaf folder larvae had just started to enter the third stage. Examinations of five vines in each plot were made on May 22. The rolls, and the larvae in them on each vine were counted. The data from parathion, cryolite—50% cryolite, 5% DDT, 40% sulfur and 5% inert formulated on request by Sunland Industries, Inc.—and untreated plots are presented in table 1. From the table it is evident that the degree of control in the treated plots was almost equal after approximately three weeks and were considered at this time to be very excellent.

TABLE 1

Average Number of Grape Leaf Folder Larvae per Vine in Rolls on 5 Vines in Plots Treated with Parathion and Cryolite Dusts at Exeter, California, on April 30, 1947

Treatment	Pounds per acre	Number of rolls on 5 vines	Larvae in rolls	
			Total	Average per vine
1% parathion, 55% sulfur..	20	9	10	2.0
50% cryolite...	20	11	12	2.4
Untreated control.........		173	179	35.8

A count of the total number of rolls on six vines in each of the treated plots was made on June 12, at the end of first brood larval feeding activity. The vines in the parathion plot averaged 142.3 rolls per vine, while those in the cryolite plot averaged 46.5. This indicates that the parathion application did not remain effective as long as did the cryolite, allowing more larvae to reach the leaf rolling stages.

These tests show that parathion is effective against grape leaf folder larvae.

The Willamette mite, *Tetranychus willamettei* McGregor, is a minor pest in San Joaquin Valley vineyards but is often responsible for considerable damage to vine and crops. Concentrations of 0.25%, 1%, and 5% parathion dusts were each applied by hand duster to 11 vines on April 4. Coverage of foliage was from very light to very heavy. Post-treatment counts were made under a binocular microscope of live and dead mites present on 20 leaves from each of the plots on the third and eighth day after treatment, and in the 5% dust plot also on the sixteenth day. The data from these examinations are summarized in table 2. From the table it is evident that the treatments were not highly effective. There is indication that the material remained toxic for at least eight days.

On June 6 one vine was dusted by rotary hand duster with 5% parathion dust. On June 10 a count of live and dead mites on five leaves under a binocular microscope revealed a total of 29 live newly hatched larvae, and 6,075 dead mites. This vine was again dusted on June 10 with 5% parathion. On 10 leaves examined June 17 only one live mite was found. No eggs were present. On the same date 1,743 live mites were counted on five leaves taken from adjoining vines.

On July 1, a 2% parathion dust was applied at the rate of 33 pounds per acre by a truck-mounted duster, driving alternate middles. Leaf samples were taken on July 6 and again on July 14 from the twice-treated area, the once-treated area and check plot. The number of live mites were counted on one third of each of 10 leaves per plot on July 6, while on July 14 the number of live mites and eggs on one half of each of 20 leaves per plot were counted. The results of the counts are given in table 3 as the computed number of mites per 10 leaves.

From table 3 it is evident that a single treatment of the 2% dust had effectively reduced the mite population on the sixth day following treatment as compared to the check plot, and seven days later the population had further decreased very slightly whereas an increase had occurred in the untreated plot. The effect of the treatment on the adult population is reflected by the very small number of eggs as compared to the check plot count on July 14. From the table it would appear that the second application did not increase the control over the first treatment. However, in the July 14 counts the mites and eggs were found scattered on 13 of the 20 leaves taken from the single-treated plot whereas all mites and 28 of the 30 eggs were found on a single leaf of the 20 taken from the double-treated plot. In both parathion plots the degree of control was satisfactory for the remainder of the season.

The results of these tests indicate that parathion may afford considerable promise for control of the Willamette mite.

The grape leafhopper, *Erythroneura elegantula* Osb., is the most important insect pest of grapes in the San Joaquin Valley. The first observations concerning the effect of parathion dust on the grape leafhopper were made during the tests against the little bear beetle previously discussed. It was noted that overwintering adults did not appear to be affected by the dusts as all vines remained heavily infested over a two-week period following treatment. No nymphs were present at that early date.

On May 1, the following dusts were applied at 20 pounds per acre by a tractor-mounted duster to plots of approximately one acre each in a vineyard near Woodlake; 0.25% and 1% parathion, and 5% DDT–50% sulfur dust. On this date nymphs of the first brood had just started to make their appearance. Maximum egg laying activity of the overwintered adults reaches a peak about this time and the adults begin to die off. A measure of the effectiveness of control was obtained by counting the first-brood nymphs before the earliest hatched nymphs had matured to adults. Counts were taken on May 18 of the number of nymphs present on a total of 20 grape leaves picked from each of the three dusted plots and an untreated check plot. The results indicate a high degree of control in the DDT dust plot in which no nymphs were found. Satisfactory control did not result in either of the parathion plots, although, compared to the check plot with 257 nymphs, both plots exhibited a definite degree of effectiveness that was more apparent in the 1% plot with 85 nymphs than in the 0.25% plot in which 154 were counted. Since very few nymphs were present on May 1, it is probable that these results reflect to some extent the effectiveness of a toxic residue.

During August, a series of tests were conducted against both adults and nymphs with 1%, 3%, and 5% parathion dusts compared to plots dusted with 5% DDT. On August 6, in vineyard block A, plots which varied in size from .59 to .75 acres were dusted with dosages varying from 5.5 to 7.3 pounds per acre, while on August 8, a second series of plots .50 acre each in size in block B were treated with the same dust mixtures at from 16 to 21 pounds per acre. Applications were made with a tractor-mounted duster. Pretreatment population counts were made either one or two days prior to application and post-treatment counts were made three days following application. In addition, a second set of post-treatment counts were taken on the 14th day after treatment in the block A plots and on the tenth day in those in block B. Adults and nymphs present on 15 leaves picked from each plot in block A and on 20 leaves per plot in block B were counted. The data are presented in tables 4 and 5.

Table 4 shows the average number of adults and nymphs per leaf per plot for each sample. Treatments were applied near the end of the second brood activity and close to the peak of hatching of the third brood nymphs as evidenced by counts during the second post-treatment counts as compared to those of pretreatment counts.

In table 5, data contained in table 4 is arranged in two ways: First, as the per cent decrease or increase of populations from the pretreatment to first post-treatment counts. This shows the immediate effects of treatments. All stages of leafhoppers were susceptible to parathion, but nymphs appeared to be more susceptible than adults. This is especially indicated in column seven which shows a decrease of from 79.33% to 99.91% of the nymph populations present in the parathion plots at the time of treatment. The figures in column five, which include nymphs in the first instar which presumably hatched after treatment, show a more moderate decrease for nymph populations. The heavier dosages in block B which were approximately three times those in block A, resulted in increased effectiveness, more marked against adults than nymphs. The effectiveness of the 1%, 3%, and 5% parathion dusts increased with the increase in concentration at both dosage levels. The results in neither DDT plot were as good as anticipated from previous experience.

TABLE 2

Numbers of Willamette Mites Counted on 20 Grape Leaves from Plots Treated with Parathion Dusts at Poplar, California, on April 4, 1947

Treatment	Numbers of mites on 20 leaves on days after treatment								
	3 days			8 days			16 days		
	Alive	Dead	Per cent dead	Alive	Dead	Per cent dead	Alive	Dead	Per cent dead
0.25% parathion	174	13	7.0	60	20	25.0	...	...	....
1% parathion	272	38	12.0	169	68	28.7	...	...	....
5% parathion	63	102	61.7	55	112	67.1	143	174	54.9
Untreated check	134	3	2.2	51	4	7.3	...	...	....

TABLE 3

Computed Number of Willamette Mites per 10 Leaves in Plots of Aleatico Vines at Delano, California, after Treatments with Parathion Dust

Treatment	Date of Treatment, 1947	Computed number of mites and eggs per 10 leaves		
		July 6	July 14	
		Mites	Mites	Eggs
2% parathion dust	July 1	51	34	21
2% parathion dust	July 1 and July 7	....	55	30
Untreated	....	1,110	1,281	438

Second, the data is arranged as a ratio of the second post-treatment counts to the corresponding pretreatment counts as a measure of the effectiveness of treatments over a longer time. In all treated plots the adult population remained lower than before treatment with the lowest levels indicated for the 5% parathion treatments. The nymph populations increased greatly in all plots except in the one treated with 5% parathion at 18 pounds per acre, and only in this one plot was the total population lower at the time of second post-treatment count than when the dusts were applied. Populations in all treated plots showed less increase than either untreated plot, and, therefore, all treatments did kill some leafhoppers. The tests indicate that parathion dust may perhaps be a useful material for grape leafhopper control.

The green sharpshooter, *Draeculacephala minerva* Ball is the most important vector in the San Joaquin Valley of the virus causing Pierce's disease of grapes and dwarf disease of alfalfa.

Applications by rotary hand duster were made on July 26 of dusts containing 0.25% and 1% parathion–55% sulfur, 2% parathion (without sulfur) and 5% DDT–50% sulfur to single plots approximately 24 feet square containing summer grasses six to 20 inches tall growing along a vineyard margin near Woodlake. Five similar plots remained untreated as controls. Results were measured by taking 20 full sweeps with an insect net in each plot and counting the nymphs and adults. Counts were made on July 24, 30, and August 9, that is two days before, four

TABLE 4

Average Number of Grape Leafhoppers per Leaf Counted in Three Population Samples in Plots of Emperor Grapes Near Woodlake Treated with Parathion and DDT Dust in August, 1947

Plots	Treatments	Average number of leafhoppers per leaf counted on 15 leaves in block A plots and 20 leaves in block B plots on sampling dates									
		Pretreatment count			First post-treatment count				Second post-treatment count		
		Adults	Nymphs	Total	Adults	Nymphs Instars 1 to 5	Total	Nymphs Instars 2 to 5	Adults	Nymphs	Total
Block A	August 6	August 4			August 9				August 20		
1	1% parathion	16.6	53.5	70.1	12.1	18.7	30.7	11.1	16.0	232.3	248.3
2	3% parathion	12.7	56.5	73.2	11.6	9.7	21.3	6.5	6.5	183.0	189.5
3	5% parathion	26.5	68.1	94.5	7.2	0.6	7.8	0.1	8.4	222.4	230.9
4	5% DDT	33.9	105.2	139.1	13.8	40.7	54.5	....	23.9	271.1	295.0
5	Untreated	24.7	72.1	96.8	28.7	87.9	116.7	....	32.1	365.4	397.5
Block B	August 8	August 7			August 11				August 18		
6	1% parathion	12.8	25.0	37.8	4.0	9.5	13.5	4.0	3.5	99.9	103.4
7	3% parathion	6.2	16.5	22.7	2.4	2.4	4.9	0.6	1.2	54.7	55.9
8	5% parathion	16.6	37.8	54.5	2.2	2.7	4.9	0.2	0.7	43.0	44.6
9	5% DDT	9.7	26.3	36.0	3.4	17.9	21.3	....	3.1	90.3	93.4
10	Untreated	8.1	21.8	29.9	7.8	30.5	38.4	....	6.8	134.0	140.8

TABLE 5

Effects of Parathion and DDT Dust Treatments on Grape Leafhopper Populations in Plots of Emperor Grapes Near Woodlake, 1947

Plot	Treatment	Pounds per acre	Per cent decrease or increase of populations from pretreatment to first post-treatment count				Ratio of populations: Second post-treatment count / Pretreatment count		
			Adults	Nymphs instars 1 to 5	Total	Nymphs instars 2 to 5	Adults	Nymphs	Total
	Block A treated August 6; sampled August 4, 9, and 20								
1	1% parathion	7.3	−27.3	−65.2	−56.1	−79.33	0.96	4.34	3.54
2	3% parathion	5.5	−30.7	−82.8	−70.9	−88.33	0.39	3.24	2.59
3	5% parathion	5.9	−72.8	−99.1	−91.8	−99.91	0.32	3.26	2.44
4	5% DDT	7.0	−59.3	−61.3	−60.8	.....	0.70	2.58	2.12
5	Untreated	....	+13.9	+18.1	+17.1	.....	1.29	5.07	4.10
	Block B treated August 8; sampled August 7, 11, and 18								
6	1% parathion	21.0	−69.1	−61.8	−64.3	−84.00	0.27	3.99	2.73
7	3% parathion	16.0	−60.8	−85.2	−78.2	−96.36	0.19	3.32	2.46
8	5% parathion	18.0	−86.5	−92.7	−90.2	−99.47	0.04	1.16	0.82
9	5% DDT	20.0	−65.1	−31.7	−40.8	.....	0.32	3.43	2.59
10	Untreated	....	−2.5	+28.5	+22.1	.....	0.84	6.15	4.70

and 14 days after treatment. The results are presented in table 6.

Nymphs were just starting to hatch on July 24, so that all nymphs counted were in the first or rarely the second instar. It is clearly evident from the table that all treatments were very effective against the numbers of nymphs had increased very slightly or, in the DDT plot, not at all. On August 9, the adult population exhibited a further decrease in the control plots. No change of adult population occurred in the DDT plot which indicates an effective persistant toxicity, but occasions during the season and results studied.

Provided factors such as possible harmful residue or deleterious effects on beneficial insects do not develop, parathion appears to offer good promise of affording satisfactory control not only of most

TABLE 6

Effect of Parathion and DDT Dusts on Draeculacephala Minerva in Summer Grass Vineyard Cover Applied by Hand Duster Near Woodlake, July, 1947

Treatments	Numbers of sharpshooters per 20 sweeps per plot on sampling dates											
	July 24			July 30			Per cent differences of populations			August 9		
	Adults	Nymphs	Total	Adults	Nymphs	Total	Adults	Nymphs	Total	Adults	Nymphs	Total
July 26												
0.25% parathion, 55% sulfur	36	14	50	6	1	7	−83.4	−92.9	−86.0	29	4	33
1% parathion, 55% sulfur	62	12	74	1	0	1	−98.4	−100.	−98.6	16	2	17
2% parathion	104	0	104	1	0	1	−99.0	−0.	−99.0	32	1	34
5% DDT, 50% sulfur	46	4	50	3	0	3	−93.5	−100.	−94.0	3	0	3
Av. 5 untreated plots	33.6	3.6	37.2	24	5.4	29.4	−28.6	+33.3	−21.0	18.4	30.8	49.2

nymphs up to four days after treatment. At the same time the parathion and DDT dust applications resulted in from 83.4% to 99% reduction of adult populations. During the same interval from July 24 to 30, adult populations in five untreated plots had decreased by 28.6%, due possibly, to some drift of dusts into the small plots and also perhaps to flight activity which causes an increase in adult population in favorable areas, and a decrease in less favorable spots. Continued hatching increased the nymph populations in untreated plots by 33.3%. By August 9, populations of nymphs in untreated plots had again increased by nearly six-fold from July 30, whereas in all treated plots marked increases took place in all parathion plots, which indicates no effective residual toxicity.

Parathion appears to be safe to use on grapevines. Only very slight foliage injury developed as a result of extremely heavy applications of 5% dust by hand duster during April to tender young shoots. Areas of immature leaves over which the dust had caked or covered solidly often appeared glassy due possibly to injury to epidermal cells. Leaf margins would sometimes appear abnormally ruffled. No injury was observed at any time with dusts of lower concentration nor as a result of heavy applications of 5% dust when it was used on several later San Joaquin Valley grape pests but of combinations of such pests where they are present together. It is probable that more than one application of parathion dusts would be required for control.

Preliminary field tests with dust mixtures containing 0.25%, 1%, 2%, 3%, or 5% concentrations of parathion with or without sulfur applied by hand or power dusters have shown parathion to be effective against the following pests of grapes in the San Joaquin Valley: *Pocalta ursina, Hoplia callipyge, Pseudococcus maritimus, Desmia funeralis, Tetranychus willamettei, Erythroneura elegantula,* and *Draeculacephala minerva.* No significant injury to vines was observed.

California Cotton Insects

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THE CONTROL OF THE COTTON OR MELON aphid, *Aphis gossypii* Glover, on cotton with HETP in liquid preparations only was considered practical since this insecticide in dusts had given such poor control in most trials, and proprietary dust mixtures were not being readily supplied. HETP was tried in "vapo-oil" applications by airplane but resulted in much foliage injury. One to two quarts of 50% HETP per five gallons of water applied per acre by airplane were effective in some applications, but in more than half of the applications these failed to give good control. When good control was obtained on young cotton plants, it was difficult to find a live aphid within the treated area. When control was poor, it was so nearly ineffective that no exact measurements were necessary. The applications tried were all made in the morning and temperature differences were not found to account for the variations in control. Two proprietary compounds—Vapotone and Blade—only were used, and these were apparently quite comparable.

The method for making counts consisted of fastening a merchandising tag on the petiole of a leaf and marking the tag with the number of aphids present on the leaf. When aphids were very numerous late in the season, the closest estimates of the number were used.

HETP was used in one application with an emulsifiable DDT concentrate and gave good control of the cotton aphid in the upper part of large cotton plants, without injury to the foliage. This airplane application applied 10 gallons per acre of a mixture containing one half gallon of 25% DDT plus 1½ quarts of 50% HETP.

BHC was unreliable in control of cotton aphids during 1947. Several proprietary dusts applied by row crop duster and airplane and sprays by airplane failed in the control of the cotton aphid. Few applications of BHC gave as good control of any cotton insect pest as were obtained with other insecticides.

In May, parathion was found very ef-