Grape Leaf Folder

field tests compared effectiveness of insecticides in control of vineyard pest

E. M. Stafford and F. L. Jensen

Sprays of standard lead arsenate for first brood grape leaf folder control and parathion dusts for second and third brood controls have generally given the best results in trials carried out during the last three years.

The grape leaf folder has been a serious pest in parts of Tulare and Fresno counties, especially in recent years. Previous to 1952, serious late infestations occurred only occasionally. Since then, however, large areas are heavily infested every year. It is also becoming a problem in areas not previously troubled and where no controls have ever been applied. At times, this insect has been suppressed by its natural enemies to such an extent that control with insecticides was unnecessary. While parasites have not disappeared entirely, little activity was seen in 1956. If leaf folders are not controlled, vines may be partly defoliated by midsummer, and become completely barren by fall. Not only may the current season's crop be reduced in value or lost—in the case of table grape vineyards—but the defoliation may so deplete the food reserves in the vine that the next crop is also reduced. By 1944, the approximate dates during which the three broods develop were established by another research worker, and this made possible better timing of insecticide applications. He made two pertinent observations. First, each larva makes more than one roll, so that if it is not killed in the first roll, it may be killed later by insecticides applied before the next rolls are made. This observation is important for the best use of stomach poisons such as lead arsenate or cryolite, that must be applied before the last rolls are formed. Second, the eggs for the second and third broods are almost exclusively laid on leaf rolls made by the previous brood. He also suggested that treatment of the first brood produced better control than did treatment of the two succeeding broods.

The current leaf folder project was begun in the spring of 1954. Dusts of 1% endrin and a 1.5% dieldrin were tested against first brood larvae. Of these, endrin looked promising and in subsequent tests against second and third brood larvae a 1.25% endrin dust produced controls comparable to a 2% parathion dust. The use of parathion dust came about as a result of a search for an effective insecticide that was already licensed for grapes and therefore could be used immediately. In July, 1954, several growers experienced failures with cryolite, the standard material used for control of second brood leaf folders. This failure started the search for other effective insecticides. Several candidate materials were applied in one of the vineyards where cryolite had been ineffective. At this time the second brood larvae were well into their leaf rolls. Of the materials used, 2% parathion dust had 71% fewer larvae as compared to the cryolite treatment. Considerably less benefit was secured from 4% or 10% malathion dust, or a 2% Chlorthion dust. No reduction in larval population was obtained from the use of a pyrethrum-rotenone dust, a treatment sometimes used on third brood populations.

Two more field tests were made in 1954. Dusts were applied in mid-August, the normal time for control of the third brood with cryolite. The reductions in numbers of larvae as compared to the check 13 days later was 73% for parathion and 34% for cryolite. Analyses of cryolite residues indicated that heavy deposits remained on the leaves for at least two weeks. Thus the poor performance of cryolite was not due to lack of sufficient residue. In another test dusts were applied on September 8 and counts of larvae were made five days later. Again parathion dust was much more effective than cryolite dust and also more effective than 4% malathion or pyrethrum-rotenone dusts.

In 1955, counts of leaf rolls were made after both the first and second broods in three vineyards in Tulare County. In two of these vineyards cryolite, parathion, and endrin dusts were applied for control of first brood larvae. In the first vineyard, after the first brood, there were fewer leaf rolls in the parathion and endrin treated plots than in the cryolite treated plots. All three materials showed considerable improvement over the check. After the second brood had developed, however, the cryolite treated vines had fewer leaf rolls than did vines treated with either endrin or parathion. The latter material was the poorest of the three. In the second vineyard no first brood leaf rolls developed, presumably because of a lack of infestation. After the second brood there was little difference in numbers of leaf rolls on vines treated with any one of the three materials. In one vineyard, therefore, it appeared that there was some carryover effect of cryolite into the second brood. In the second vineyard no such effect could be noted.

No first brood leaf rolls were found in the third vineyard, where insecticides had not been applied. Counts of leaf rolls were again made at the time that leaf folders were nearing the end of their second brood in infested vineyards. Leaf rolls were found. A third brood population serious enough to warrant control developed in this vineyard where no first brood larvae were found. Moths lay most of their eggs on leaves rolled by larvae of previous broods. However, the two cases cited above indicate that moths may fly into an uninfested vineyard as late in the season as July and start what may become a serious leaf folder problem.

Field tests for comparison of insecti-

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Results of Treatments for Control of Grape Leaf Folder

Summary of effect of treatment in the first brood in reducing numbers of leaf rolls caused by larvae of first and second broods, 1956. Per cent reduction in leaf rolls, is the average per cent reduction in numbers of leaf rolls from the averages of adjoining untreated plots.

Vineyard location and variety	Average number rolls per vine on untreated plots in first brood	Per cent reduction in leaf rolls—first brood[a]			Average number rolls per vine on untreated plots in second brood	Per cent reduction in leaf rolls—second brood		
		Lead arsenate	Cryolite	Parathion		Lead arsenate	Cryolite	Parathion
Fresno County								
Sanger—Ribier	0.6	69[b]	96	..	1.6	50	51	..
Orange Cove—Mission	0.9	..	76	80	19.4	..	67	71
Tulare County								
Exeter—Emperor	1.9	90	94	79	13.2[c]	73	78	47
Woodlake—Emperor	2.3	92	93	89	31.3[c]	46	9	−32[d]

[a] Lead arsenate spray at 4 lbs./100 + sulfur 3 lbs./100 using 250 gallons of spray per acre except where otherwise noted. Cryolite 45–50%, sulfur 47–50% dust at 33–35 lbs. per acre except at Exeter and Orange Cove (44–45 lbs. per acre). Parathion 2% dust at 31–35 lbs. per acre.

[b] Dosage per acre about ½ of that normally used.

[c] Check plots only, treated with parathion 2% dust, 20–25 lbs. per acre, on July 26, 1956.

[d] Average infestation greater than average of adjoining check plots. (Dusted on July 26—see [c].)

Frost Protection by Sprinklers

use of overhead sprinklers for frost protection on low growing plants tested on blueberries in Santa Cruz County

H. B. Schultz and R. R. Parks

Heat released by ice forming from water sprinkled on plants—that can carry the ice load—appears to be an efficient means of frost protection.

In comparison with heaters the sprinkling method often is preferred for protecting low plants—strawberries, tomatoes, potatoes, cranberries, flowers—which usually bend to the ground when coated by the heavy ice film, but do not break.

However, despite the success of the sprinkler method for frost protection—which does not even depend on favorable weather conditions such as inversions—there is some hesitation in putting the practice into more extensive use, because thorough information is lacking. There is a fear that the ice crust around the leaves, blossoms or flowers might cause physiological damage. The required supply of water—about $\frac{1}{10}''$ per hour—makes all field operations impossible during the following days, and also root damage could result.

In orchards, the amount of breakage because of the ice load from sprinkler applied water has been disastrous in some cases. When overhead sprinkling of orchards is used—in certain countries—the reason might be shortage or high cost of fuel which prevents the use of heaters or wind machines. Economic feasibility also is doubtful in many places, as overhead sprinkling for frost protection requires complete coverage which is usually permanent installation.

In the spring of 1954, temperature measuring equipment was installed on a blueberry farm in Scott's Valley—in the Santa Cruz mountains—to investigate temperature conditions and verify the success of the sprinkler system. By comparison with surrounding stations, Scott's Valley with an elevation of 600′ proved to be a frost hole, because the surrounding hills—500′ higher—do not allow good cold air drainage. The opening of the valley is to the northwest, but the possible air drainage in this direction is strongly opposed by the overhead circulation pattern of prevailing northwest winds.

An additional cooling of sections of the blueberry plot was caused by a woodchip ground cover that acted as an insulator and mulch. The cover was beneficial primarily in reducing weed growth and conserving moisture in the root zone but it did not allow much solar heat absorption by the ground. At night, the woodchip mulch deprived the air above the surface of the ground heat supply and permitted about 5°F more cooling at 10″ height—shielded thermometer—than in the shelter at 5′ height.

To protect the blueberry bushes—3′-4′ high and planted in 8′ wide rows—pipes were installed every twelfth row at a distance of 96′. Elevated nozzles at 80′ intervals along the pipes provided overhead sprinkling with a little less than six sprinklers per acre. The sprinklers were of the slow revolving type operated under about 55 pounds pressure per square inch. By plugging the spreader nozzles of the conventional sprinkler-heads the watering was done by the $\frac{11}{64}''$ diameter range nozzles only, thus cutting down the water supply to 6.3 gpm—gallons per minute—equal to an average rainfall of between 0.08″ and 0.09″ per hour.

Temperature Minima on Eleven Clear and Calm Nights at Scott's Valley, and Surrounding Stations for Comparison During the Spring Frost Season

	Davis	San Jose	Santa Cruz	Scott's Valley: Shelter 5′	Scott's Valley: at 10″	Scott's Valley: 5′ unshielded
May						
1	46	42	37	(31)	(26)	(25)
2	43	43	37	33	28	27
16	49	50	43	38	35	33
23	51	52	44	38	33	31
26	46	47	40	36	31	30
27	51	46	43	32	27	26
June						
5	44	50	43	36	31	30
6	49	45	39	33	28	27
7	48	49	42	37	31	30
10	45	48	39	36	32	31
11	49	48	45	38	32	32
Ave.	47.4	47.4	41.1	35.3	30.4	29.3
Diff. vs. Sc. V. shelter	+12.1	+12.1	+5.8	0	−4.9	−6.0

The recording instruments were installed at the edge of the plot about 40′ from the last sprinkler and—because there was no overlap from other sprinklers at the instrument location—the equivalent of only 0.05″ of rainfall per hour was recorded during a four hour operation on May 1. The temperature records were plotted to show the comparison of two long distance thermographs with the two bulbs unshielded. The bulb located at the water measuring

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cides in 1955 showed parathion and endrin dusts to be much more effective than cryolite in control of second brood larvae. Various dusts applied in early September showed the following decreases in numbers of larvae as compared to the check: 4% Diazinon dust—94%; 4% methyl parathion dust—85%; 2% parathion dust— 78%; 5% Niagara Bio 1137 dust—71%; and 5% Trithion dust—42%.

In 1956 cryolite and parathion dusts and standard lead arsenate sprays were applied in both Fresno and Tulare counties for control of larvae in the first brood. Numerous untreated check plots were established to obtain some estimate of how the population of leaf folders varied in different parts of the treated vineyards. Counts of leaf rolls were made at the end of the first brood and again at the end of the second brood. In Tulare County the plots which were untreated in the first brood were dusted with 2% parathion dust at 20–25 pounds per acre in the second brood. This treatment was applied too late in the second brood to obtain the best results. Plots treated in the first brood were not retreated. Counts at the end of the second brood were made to observe the carryover effect. The results are briefly summarized in the table on page 4. The average number of rolls per vine in untreated plots estimates the over-all leaf folder infestation in the vineyards. Per cent reduction in leaf rolls is a measure of the initial control and degree of carryover effect of the treatments. The table is a simplification of the results since it does not show the variation in infestation in the check plots or variations in degree of control between plots receiving the same treatment within the vineyards.

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Russet on Bartlett Pears

neither sprays nor dusts applied during the cluster-bud and bloom period increased russeting in tests during 1956 season

Richard W. Harris and William H. Griggs

Russet of Bartlett pears was not increased by the cluster-bud spray or bloom period dusts applied in test orchards during the spring of 1956.

Even though the cause of russeting has not been determined, earlier experiments have shown that protecting branches with large cloth bags during the bloom greatly reduced the amount of fruit russet. During this period Bartletts normally receive a cluster-bud spray for the control of mite eggs and scab as well as sprays or dusts during bloom for fire-blight control.

During the 1956 season the materials recommended for the cluster-bud spray were tested to determine their effect on pear russeting. The standard copper dust blight-control program and the experimental streptomycin-pyrophyllite dust were compared with no blight-control treatment.

The standard cluster-bud spray consists of a mixture of lime-sulfur, wettable sulfur, and a miticide such as Genite 923. These materials were applied singly and in all possible combinations to two-acre blocks of a Sacramento County Bartlett orchard.

Just before harvest, samples of pears were collected from the trees receiving the cluster-bud sprays and evaluated as to the extent of fruit russet. None of these materials used singly or in combination caused a significant increase in the amount of russet.

To compare the effects of copper and streptomycin dusts on russeting, fruit samples were collected from plots in seven orchards in five counties. As in the tests of the previous three years, neither the copper nor the streptomycin dusts caused significantly more russet than was obtained under no blight-control treatment. A difference of 10% of the lenticels russeted would be difficult to observe between different lots of fruit. The sample pears from Sacramento, Yuba, and Mendocino counties were only lightly russeted; those from the Lake and San Joaquin county orchards were more severely russeted.

In one of the Sacramento County orchards, copper-lime dust treatments were varied in concentration, rate and number of applications. The amount of metallic copper applied per acre during the season was 3.15 pounds in the block receiving the least amount of copper which was dusted six times with 10–90 copper-lime at the rate of 15 pounds per acre. The block receiving the most copper was dusted 12 times at the rate of 30 pounds per acre of 20–80 copper-lime. The trees were dusted with 25.2 pounds of metallic copper per acre during the season.

Fruit russet was essentially the same whether the fruit came from trees not dusted with copper or those dusted with up to 25.2 pounds of metallic copper per acre during the blight-control season.

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The studies concerning the comparison of streptomycin, copper, and no blight-control treatment were made in plots in which Peter Ark, Professor of Plant Pathology, University of California, Berkeley, conducted blight-control experiments with streptomycin-pyrophyllite.

Effect of the Materials Used in the Cluster Bud Spray Applied Alone and in Combination on the Russeting of Bartlett Pears, Sacramento County, 1956

Treatment*	Lenticels russeted
	%
Check	29
Lime sulfur	32
Wettable sulfur	35
Genite 923	32
Lime sulfur—wettable sulfur	28
Lime sulfur—Genite 923	28
Wettable sulfur—Genite 923	36
Lime sulfur—wettable sulfur—Genite 923	32

	Amount per 100 gallons
* Lime sulfur	2 gal.
Wettable sulfur	4 lbs.
Genite 923	1½ pints of 50% emulsion

The effect of Copper and Streptomycin Blight-Control Dusts on the Russeting of Bartlett Pears, 1956

County	Lenticels Russeted		
	Check	Copper*	Streptomycin**
Sacramento	%	%	%
Orchard No. 1	23	32	24
Orchard No. 2	22	28	28
Orchard No. 3	26	32	26
Yuba	21	21	30
Mendocino	30	32	30
Lake	..	56	49
San Joaquin	..	46	52

* Copper dust was applied from 6 to 12 times, as 10–90 or 20–80 copper-lime or a fixed copper at 15–35 lbs. per acre each time.

** Streptomycin-pyrophyllite dust, 1,000 parts per million, was applied from 6 to 9 times, using various amounts from 15 to 50 lbs. per acre at each application.

The Effect of Different Concentrations, Rates, and Number of Applications of Copper-Lime Dusts on the Russeting of Bartlett Pears, Sacramento County, 1956

Treatment	No. of applications	Total lbs. metallic copper /acre during season	% of lenticels russeted
Check		0	23
Copper-lime 10–90			
15 lbs./acre	6	3.15	28
15 lbs./acre	12	6.30	32
Copper-lime 20–80			
15 lbs./acre	12	12.60	21
30 lbs./acre	12	25.20	28

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In general, the results indicate that vines treated during the first brood showed fewer leaf rolls at the end of the second brood than did nearby untreated vines. This carryover effect was more evident where the infestations were not heavy. The carryover effect on moderately infested vines was as great for parathion dust as for cryolite dust. In the vineyard showing the second highest infestation—at Exeter—the more persistent insecticides—standard lead arsenate and cryolite—gave better carryover effect. In the vineyard showing the highest infestation—at Woodlake—the differences between treatments were greater. In this case standard lead arsenate spray gave the greatest carryover effect while cryolite dust showed little such effect. Plots treated with parathion dust showed greater infestation than vines not dusted with parathion until the second brood, that is, the check plots.

A number of dusts were tested in a second brood plot. The timing was a little late, so that the counts did not show differences as great as desired. The greatest reductions were obtained with 2% parathion, 2% methyl parathion, 4% Diazinon and 2% Phosdrin. Poorer controls were secured with 5% Guthion, 2% Niagara 1240, 3% Hercules 528, 1%

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Soil fumigant chemicals are poisonous—and dangerous—unless reasonable care is exercised. If the manufacturer's directions are followed carefully—and accurately—handling fumigants should not cause trouble.

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BARLEY

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from the federal government at a per unit value cost identical with the per bushel value issued to the producers. Periodical deposition of certificates with the government by processors—according to the amount of malt beverages produced—would provide an effective control.

Statistical estimation for the period of study implies that such a plan under like conditions—a price target of 110% of parity on the malt market and with no intervention in other channels—would increase returns to the industry by about 10% with fixed supplies and perhaps by a larger percentage with variable supplies. Benefits could be distributed equitably with no production control necessary. A producer could grow barley in any amount, but that in excess of his allotment would be worth the feed price only, because support would be limited to the allotted portion of the crop.

Free market prices for barley would not be materially affected by increased barley supplies, so the differential between target price and free market prices —the value of the certificate—in any given year would not be significantly changed. Thus, the direct cost involved to finance the program would remain fairly stable and largely independent of barley supplies. In contrast, year to year changes in the value of the certificates would be largely attributed to changes in the price of corn.

During the period under study, the interest of producers of competing commodities—such as corn—would not have been seriously affected. Increased barley supplies at the end of the period would not have significantly changed the relative proportion of barley and corn in the total feed grain concentrates. Sales of malt beverages, as a result of increased costs, would have dropped less than 0.5%. With respect to administrative feasibility, there would have been no major problems encountered.

Some inequity—as a result of probable production expansion—undoubtedly would have resulted under dual pricing. Statistical supply-response analyses indicate that output response to higher price expectations would have been different in the various areas depending largely upon alternative crop availabilities. Supplies of barley in the North Central States appear to have been more responsive to higher prices than in the Pacific region.

Long run benefits from the malt outlet during 1948–1954 would have been identical for all barley producers because the value of the certificate would have been the same for all growers. If this benefit were distributed over the whole crop, the resulting weighted average value of the crop—the price per bushel—would have been relatively smaller in areas where production expanded more than in areas where output under the impact of dual pricing expanded only little. This also implies that the certificate plan under consideration would have had some constraining influence upon output expansion.

A two-price system with an assumed 110% of parity in the period under study would have affected between 25%–30% of the California barley crop and would have increased the gross value to the producer over 10% in most years without significantly affecting prices on the feed market.

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Phosdrin and a pyrethrin-rotenone mixture. Also tested were pyrethrin additions to a 2% parathion dust. The pyrethrin supplements did not appear to improve the performance of parathion.

In a third brood plot applied on August 30, the following reductions of larval populations were obtained as compared to a check: 2% methyl parathion, 92%–98%; 4% Diazinon, 89%; 2% parathion, 85%; 4% Trithion, 47%. In another vineyard, 2% parathion and 2% Phosdrin dusts were compared. Parathion gave the greater reduction. Neither Diazinon, Trithion, Phosdrin nor endrin are currently licensed for use on grapes.

The work on this project has not clarified all of the problems involved. One can not suggest that all grape growers apply chemical treatments for the control of first brood larvae since, in some vineyards, there is generally little or no first brood infestation. Moreover, the application of chemical control measures in the first brood offers no certainty that control measures will not again be necessary in subsequent broods. Good control of the first brood will reduce the size of the second brood. It is believed by many in Tulare County that second and third brood applications are to be preferred over first. In this locality, 2% parathion dust has provided 70%–90% reduction in leaf folder infestations in second and third broods. In comparison, cryolite dust has been inferior.

None of the presently available materials has given complete control of any brood of larvae. Obviously, larvae that are not killed will cause some further damage. Moreover, leaf rolls and other parts of the leaves upon which the larvae have fed will continue to turn brown and dry up even though the application of an insecticide kills the larvae and prevents further feeding. Thus, unless the vines are growing vigorously, they will continue to show increased leaf folder injury for some time after any chemical treatment is applied.

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D. F. Barnes, Marketing Research Division, Biological Sciences Branch, USDA, Fresno, established the dates of the grape leaf folder broods.

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SCALY BARK

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6.8% to Stage 4, and 23.5% had been pulled.

Of the 413 trees previously designated Stage 3, 57.6% showed no change, 9.2% had declined to Stage 4, and 33.2% had been pulled.

Thus, by the end of the nine-year period, 14.45% of 6,056 trees examined were affected with symptoms of psorosis. The disease accounted for the complete loss of 3.32%, while an additional 6.49% were reduced to a state of unprofitable production. The new cases—174—which developed during the study period amounted to 2.87% of the total number of trees examined. If these trees continue to decline at the same rate as the earlier cases, 40% of them will have become firewood in another ten years.

Notwithstanding its slow advance—which, however, may be more rapid than is generally believed—psorosis should be recognized as a major cause of declining production in many of the older orchards.

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