DDT Resistant Leafhoppers

malathon outstanding for grape leafhopper control in tests in areas where DDT resistance was present

E. M. Stafford and Fred L. Jensen

Field tests and experiences of many Tulare County grape growers in 1952 showed that a 4% malathon dust gave excellent kill of leafhopper adults and nymphs—in both spring and summer treatments.

When measured one week after application, the results from 4% malathon were better—in general—than those from DDT dust when it was first used in vineyards in 1945 and 1946.

Reports of DDT control failures have been more numerous year after year and it is to be expected that more and more vineyards will show DDT resistant leafhoppers. But poor application of DDT dusts must be considered as a factor as well as DDT resistance in any instance of control failure.

From the beginning of the commercial use of DDT for grape leafhopper control during the growing season, occasional cases of failure were reported. Later, some of the failures—attributed to DDT resistance—could be definitely traced to poor coverage.

In Tulare County in 1951, 10% DDT dusts gave poor control in some vineyards where 5% DDT dusts formerly were highly effective. In the spring of 1952 dusts of 10% DDT and vapor-sprays of 4.5% DDT gave little control in a number of vineyards.

Investigations in resistance of grape leafhoppers to DDT were started in the spring of 1952. In early May, two DDT-50% sulphur dusts were used in a Thompson Seedless vineyard at Orosi. A 5% DDT dust at 20 pounds per acre—with the duster traversing every middle between vine rows—gave a 70% reduction of adults 12 days after treatment. A 10% DDT dust at about 20 pounds per acre—with the duster traversing alternate middles—gave a 95% reduction of adults after 12 days.

A few days after the Orosi applications, the same two DDT dusts were used in a similar manner on Emperor grapes at Exeter. Eight days after dusting the 5% DDT dust showed a 75% reduction and the 10% DDT dust a 61% reduction of adult leafhoppers. DDT vapor-sprays applied at the same time as the dusts gave good control in both vineyards.

On July 16, 1952, a 10% DDT-25% sulphur dust was applied to Palomino grapes at Farmersville at the rate of 16 pounds per acre. The dust coverage was poor. On the same day the same dust formulation was applied to Emperor grapes at Woodlake at the rate of 20 pounds per acre. In both vineyards the duster traversed alternate middles. The reduction in leafhoppers—adults and nymphs—one week after treatment was 27% on the Palomino and 55% on the Emperors.

In all four vineyards—Orosi, Exeter, Farmersville and Woodlake—direct comparisons were made with DDT and compound Q-137. Compound Q-137 is an experimental insecticide similar to DDT but having a much lower toxicity to warm-blooded animals. Control by Q-137 vapor-sprays was equal to control by DDT vapor-sprays. In tests made in early May and in July, Q-137 dusts gave better control than comparable DDT dusts as measured by reduction of leafhoppers seven to 12 days after treatment. On the other hand, 15 to 29 days after treatment, more leafhoppers were found in the Q-137 plots in six to seven instances where Q-137 and DDT were compared. Neither DDT nor Q-137 dusts gave adequate control in the Tulare County vineyards when the field tests were made in July.

The DDT and Q-137 treatments were compared also to a 2% malathon-sulphur dust and a 4% malathon-sulphur dust.

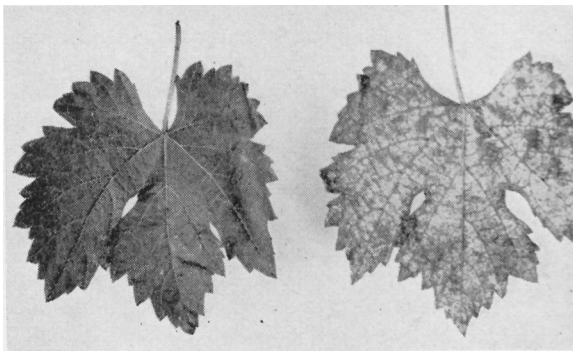
In early May both malathon dusts gave excellent results—equal to those obtained by using DDT or Q-137 vapor-sprays.

In two vineyards dusted in July, the 4% malathon dust showed 100% reduction of leafhoppers—nymphs and adults—one week after treatment. The 2% malathon dust showed 97% to 98% reduction of leafhoppers. After 10 days to two weeks, young nymphs began to appear on malathon-treated vines.

In both—the May and July—field tests the 2% malathon dust treated plots showed more nymphs 16 to 22 days after treatment than did the 4% dust.

On September 12 and 13, 1952 dusts of 10% DDT, 10% Q-137, and 4% malathon were compared in a White Malaga vineyard at Fresno. The application was very poor. The reduction of leafhoppers from all treatments was inadequate—ranging from only 65% to 69%.

In several cases in the Woodlake area nymph counts were made in vineyards where growers were comparing 10% DDT with 4% malathon dust or where the malathon dust had been applied after DDT had failed to control leafhoppers. Counts made June 2–4, 1952, showed that the malathon dust gave far better control than the DDT dust.



Normal and severely injured Palomino grape leaves. The leaf on the right has lost its green color due to feeding of grape leafhoppers.

For further tests adult leafhoppers were collected from four vineyards. Taken to the laboratory they were put into cages containing grape leaves which had been dipped in a suspension of pure DDT or pure Q-137 and then dried.

Two of the source vineyards were in different parts of Fresno County where reports of failure of DDT to control leafhoppers were not general. In fact, good control had been obtained in one of these vineyards from use of Q-137 dust. DDT had been used in these vineyards only once or twice in the past six years. The Farmersville and the Woodlake vineyards—in which field tests were made in July—also served as sources of adult leafhoppers for the cage tests.

In one test a 43-hour exposure to DDT-treated leaves was sufficient to kill from 95% to 99% of the leafhoppers from the vineyards in Fresno County. The same exposure killed 73% of the leafhoppers from the Farmersville vineyard but only 20% of the leafhoppers from the Woodlake vineyard—which had received yearly DDT treatments and was located in an area where difficulty in controlling leafhoppers with DDT was general.

The results with Q-137 treated leaves paralleled those of DDT.

In another test where leafhoppers were confined on treated grape leaves, 54% and 66% of the insects from two vine-

Continued on page 12

SPRINKLER

Continued from page 3

a healthy vigorous condition with the branches of adjoining trees coming together in many cases. The orchard is in a permanent cover crop, principally grass which is mowed several times a year. The sprinklers are supplied from an underground pipe system and are moved in a regular rotation that provides each tree with a watering every 12 days. The sprinklers are run about 12 hours and apply a little over 3″ of water at each setting. The soil holds about 1.25″ of available water per foot of depth.

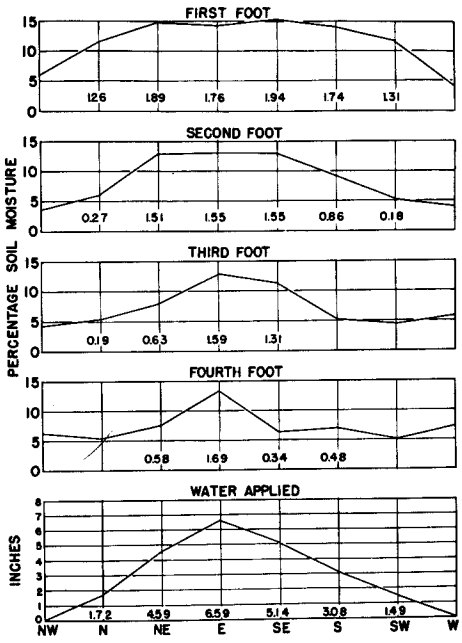
The bar graph shows the percentages of soil moisture around a recently irrigated tree, and one just before the water was applied. The open bar of each pair shows the average soil moisture content a few hours after sprinkling, and the solid bar, the moisture content a few hours before the end of the 12-day interval. The dry tree—solid bar—was brought up to about the same moisture content as the sprinkled one within the next 24 hours.

The length of the solid bar indicates that, in the early part of the season, while there was some moisture left from the winter rains and the previous irrigations, the soil moisture could be maintained above the permanent wilting percentage easily. Later in the season, however, the amounts of water applied were barely adequate to maintain readily available moisture during the 12-day interval. The last irrigation—October 15—wet down only about 2′.

The difference between the amount of moisture found at the end of each 12-day period and the amount applied at the beginning, indicates that the average daily use of a mature plum orchard in permanent cover crop in the foothills of central California is closer to 0.3″ per day than to 0.2″—the amount sometimes used.

A study of the distribution of water by sprinkling was made in a pear orchard where many branches hung down and touched the ground. The orchard was left unirrigated for several weeks until the soil moisture was reduced to the permanent wilting percentage—5%—to a depth of 4′. The orchard was then irrigated.

Soil samples were taken to a depth of 4′ at eight compass points about 8′ from the trunk of a tree with low-hanging branches. The sprinkler position was on the east side of the tree. No water reached the northwest and the west sides of the tree in the top foot of soil. Water penetrated the second foot in four of the sampling places, the third foot in three, and the fourth foot in only one sample. The total amount of water at the eight sampling points is shown in the bottom unit of the diagram on this page.



Distribution of soil moisture from sprinklers in a pear orchard where low branches interfered with uniform delivery.

Observation throughout the orchard showed dry areas behind each tree when the position of the low-hanging branches interfered with the distribution of water. Moving the pipeline to change the relative position of the sprinklers with regard to the trees would change the position of the unsprinkled area, so that the same area would not remain dry all season.

These studies showed that whether irrigation of deciduous orchards is by sprinklers or by surface methods, the growth of the fruit is the same—provided the supply of readily available soil moisture is maintained.

A. H. Hendrickson is Lecturer in Pomology, University of California, Davis.

F. J. Veihmeyer is Professor of Irrigation, University of California, Davis.

The above progress report is based on Research Project No. 633A.

LEAFHOPPERS

Continued from page 5

yards were killed after 43-hour exposure to DDT-treated leaves. On leaves treated with malathon—dipped in a suspension one fifth as concentrated as the DDT-treated leaves—the leafhoppers from both vineyards were all dead in 24 hours. In this test the cages were cloth covered on opposite sides. This lessened the possibility that malathon killed leafhoppers by fumigant action.

Malathon is a new organic phosphate insecticide of much lower toxicity to humans and animals than most of the other organic phosphates. It is less persistent than DDT—especially in warm weather—and part of its effectiveness appears to result from its fumigant action. Probably the fumigant effect is less during the cooler weather of spring, so in the pre-bloom dust applications good coverage is most important.

As compounded during the 1952 season, malathon dusts possessed an unpleasant odor which, however, could not be detected in the vineyard the day after treatment. Taste tests conducted with grapes either sprayed or dusted with normal dosages have shown no off-flavors. As presently licensed for use on grapes, malathon may be applied not later than two weeks before harvest.

Although field tests and grower experience during the 1952 season showed malathon to be outstanding for leafhopper control where DDT resistance is present, some questions as to dosage and timing still await solution. Further tests with malathon are planned for 1953.

E. M. Stafford is Associate Professor of Entomology, University of California, Davis.

Frederick L. Jensen is Farm Advisor, Tulare County, University of California.

The above progress report is based on Research Project No. 962.

STRAWBERRY

Continued from page 7

be high enough to prevent serious infestations of cyclamen mite. In most fields, however, TEPP applications against red spider destroy the predators and early-season or mid-season infestations of cyclamen mite are the natural result. Populations of these predators recover fairly soon from a single early spring treatment but applications of TEPP—where no real red-spider threat exists—are likely to do more harm than good. Three or more repeated applications over an interval of time may so reduce the predator population that it will not reappear in sufficient numbers to regain control of the cyclamen mite until serious loss has resulted.

Pesticide applications to adjoining crops may drift into fields under natural predator control and destroy the predators throughout a wide margin of a field and disrupt an achieved control. This has been observed where dust applications of adjacent crops by airplane were made.

Research is in progress to develop methods of mass-rearing this predator or of harvesting it from clipped strawberry tops, cold-storing them, and distributing them in developing infestations of early-season 2nd-year, or late-season 1st-year fields.

C. B. Huffaker is Associate Entomologist in Biological Control, University of California, Berkeley.

C. E. Kennett is Principal Laboratory Technician in Biological Control, University of California, Berkeley.

The above progress report is based on Research Project No. 1490.