# Tentiform Leaf Miner on Pears

## codling moth and spider mites affected by treatments in leaf miner control studies in Bartlett pear orchard near Penryn

Harold F. Madsen and James E. DeTar

**Approach to the problem** of tentiform leaf miner control was changed during the 1954 season—from that of previous seasons—in the continuing studies in the Auburn area.

Because parasites play an important role in reducing leaf miner populations, it was thought that the use of some substitute materials for codling moth control might be less destructive to the parasites than the DDT program in present use. DDT was used as the standard program, and the other materials were lead arsenate, Ryania, methoxychlor, and Diazinon.

In addition to the leaf miner studies, the plot arrangement permitted the study of the effect of these substitute materials on codling moth, spider mites, and other insects present in the orchard.

A 15-acre Bartlett pear orchard near Penryn was selected for the experiment. The plots were each an acre in size and were replicated three times. Materials were applied with a blower-sprayer at the following dosages and times of application: DDT and methoxychlor were applied on April 26, May 17, and June 29, at the rate of 10 pounds 50% wettable per acre; lead arsenate and Ryania were applied on April 19, April 26, May 17, and June 29, at the rate of 30 pounds per acre; and Diazinon was applied at the rate of 15 pounds 25% wettable per acre at the same timing used for the DDT and methoxychlor applications.

Spider mite counts were made at two-week intervals throughout the season. In addition, periodic checks were made on leaf miner populations and the larvae were examined in order to determine per-cent parasitism. The spider mite counts showed that all plots, with the exception of Diazinon, reached treatment level in June, and aramite was added to the June 29 spray. There were fewer mites present in the Ryania plot as compared to lead arsenate, DDT and methoxychlor, but even in this treatment a high enough population existed to warrant the inclusion of an acaricide. Mites were nonexistent on the Diazinon plot, and no added treatments were necessary.

The results of the leaf miner counts are summarized in the upper table on this page. Parasitism—in the case of the leaf miner—occurs in the late instar larvae. Another important fact in the complex is that parasitism does not become a factor until July and August, and this is correlated with the buildup of high leaf miner populations. Since the leaf miner adults emerge from pupae at the ends of the mine, and the old pupal cases remain attached to the old mines, it is therefore easy to determine how many larvae have reached the adult stage by the end of the season. This of course would give a count of the number of miners that completed development without being killed either by parasitism or by insecticides.

On July 23, there was indication that parasitism was higher in the lead arsenate plots than in the others, but by August there was no difference in parasitism between this plot and the DDT or methoxychlor plots. Upon examination, however, there were more dead unparasitized larvae in the lead arsenate plot than was true for the DDT and methoxychlor treatments, and the emergence counts at the end of the season showed fewer larvae reached maturity. Since parasitism did not account for the difference, it seems possible that lead arsenate is somewhat toxic to the larvae.

There was little difference in the DDT and methoxychlor plots as the counts for parasitism and leaf miner population were very close for each material. These plots showed the highest amount of adult emergence at the end of the season.

Ryania was extremely toxic to the leaf miner larvae. Even though the population counts showed a considerable number of mines to be present, not a single larva developed beyond the second instar during the entire season. This, of course, did not permit parasites to become established in the plot. Diazinon

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**Leaf Miner Counts—Penryn, 1954**

| Materials | Mines per 200 leaves June 7 | Mines per 200 leaves June 22 | Mines per 200 leaves July 23 | % Parasitism July 23 | Mines per 200 leaves Aug. 17 | % Parasitism Aug. 17 | Emerged adults per 200 leaves Sept. 13 |
|---|---|---|---|---|---|---|---|
| Lead Arsenate | 68 | 104 | 507 | 47.0 | 1113 | 23.0 | 176 |
| DDT | 92 | 110 | 455 | 21.0 | 1197 | 30.0 | 224 |
| Methoxychlor | 80 | 94 | 433 | 28.0 | 993 | 37.0 | 220 |
| Ryania | 5 | 21 | 106 | 0.0 | 256 | 0.0 | 0 |
| Diazinon | 15 | 46 | 200 | 3.0 | 457 | 12.0 | 36 |

**Harvest Fruit Counts—Bartlett Pears—Penryn, 1954**
(Harvest Counts Made July 14 and July 28)

| Material | Dosage per application | Application dates | Fruit examined | Codling moth % worms | Codling moth % stings | Mealybug % infested | % Stink bug damage |
|---|---|---|---|---|---|---|---|
| Lead Arsenate | 30 lbs. per acre | April 19, April 26, May 17, June 29 | 4000 | 2.1 | 1.6 | 9.0 | 9.5 |
| Ryanicide 100 | 30 lbs. per acre | April 19, April 26, May 17, June 29 | 4000 | 0.1 | 0.7 | 9.0 | 12.0 |
| 50% DDT | 10 lbs. per acre | April 26, May 17, June 29 | 4000 | 0.2 | 0.7 | 13.0 | 15.0 |
| 50% Methoxychlor | 10 lbs. per acre | April 26, May 17, June 29 | 4000 | 0.4 | 0.6 | 16.0 | 14.5 |
| 25% Diazinon | 15 lbs. per acre | April 26, May 17, June 29 | 4000 | 0.2 | 0.4 | 0.0 | 6.5 |

## ALFALFA

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The increase in yield from the 200-pound application was very similar to that obtained the previous year. The 400-pound application appeared to give some benefit over the 200-pound application—especially in the early part of the year. With each cutting, the yield difference between the fertilized and unfertilized alfalfa became progressively less. Perhaps a split application on this soil would further increase total yield.

The total sulfur content of each of the five cuttings is shown in the lower graph on page 9.

The seasonal pattern of variation in composition was very similar to the results obtained the previous year on this soil. If sulfur in a soil is inadequate, the total sulfur content of hay is at a minimum in midsummer. This is attributed to a more rapid rise of growth during this period, which increases the demand for materials used in growth. Root uptake presumably is not able to meet this demand. After a heavy application of gypsum, on the other hand, the sulfur content of alfalfa grown in the same soil reaches a minimum at the end of the season.

Nearly 50% of the 200-pound gypsum application was removed in the five cuttings of hay. This value was calculated as the difference between the computed sulfur in hay from the fertilized plots and that in hay from the unfertilized checks. The total sulfur removed per acre in the hay from the 200-pound-per-acre plots was about 32 pounds compared with about 10 pounds in that from the unfertilized plots. Converted to calcium sulfate—gypsum—these values become 136 pounds and 42 pounds. The alfalfa receiving the heavier application of gypsum removed sulfur equivalent in terms of calcium sulfate to nearly 200 pounds per acre more than the unfertilized.

Most of the difference in the total sulfur content between the fertilized and unfertilized hay could be accounted for as sulfate sulfur. The lower supply of sulfur in the unfertilized soil, however, also depressed the percentage of protein sulfur in the plant. This effect was of greatest magnitude in the hay cut in midsummer, when the stress imposed by the lack of sulfur was at a maximum. The protein sulfur content was about 0.11% in hay from the unfertilized plots compared with about 0.17% in hay from the fertilized plots.

The average percentage of protein was slightly higher in the five cuttings of fertilized alfalfa than in the unfertilized. The first cutting accounted for practically all of the difference. Fertilized hay of this cutting contained about 24% total crude protein compared with about 17% in the unfertilized. Were this a depression of protein synthesis imposed by a lack of sulfur, the effect logically should be accentuated in midseason, when total sulfur content is at a minimum. This, however, was not the case. The unfertilized alfalfa varied little in protein content from cutting to cutting. The higher value for the fertilized hay would seem more likely to be the result of accumulation. During the slower growth rate of early spring, the fertilized alfalfa presumably was taking up—or fixing—more nitrogen than needed for growth. Chemical analysis revealed that the fertilized hay from the first cutting contained a higher proportion of nonprotein nitrogen than did the unfertilized.

Certain other analyses were made to determine whether the percentage of other elements might differ in the fertilized and the unfertilized alfalfa. No appreciable differences were found in the levels of manganese, iron, and nitrate in the samples from the third cutting.

While the composition of forages as revealed by chemical analysis are helpful in assessing their nutritive value, the final answer can only be obtained by actual feeding tests. Lamb feeding trials are being conducted to learn whether the animal benefits from the higher percentage of sulfur in the fertilized alfalfa and whether there are other differences in the fertilized and unfertilized alfalfa that affect its feeding value.

*V. V. Rendig is Assistant Soil Chemist, University of California, Davis.*

*W. C. Weir is Associate Professor of Animal Husbandry, University of California, Davis.*

*T. S. Inouye is Senior Laboratory Technician, University of California, Davis.*

*M. J. Wolfe, formerly University of California Farm Advisor, Merced County, assisted in the studies reported here.*

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## WEEVIL

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for control of the adults are not suggested as this pest is not consistently damaging over a wide enough area to warrant preventative control measures. If it does become necessary to control the larvae, the field in question should be examined in order to determine whether the pea aphid or the yellow clover aphid—or both—are abundant enough to cause damage.

Usually, spray applications are preferred to dusts.

Preliminary data indicate that chemical control applications should be made when the weevil population first reaches 20 to 25 larvae per 180° sweep of the standard insect net. Population samples should be taken at several places throughout the field and the counts averaged. Usually, the most heavy populations are encountered on the edges of a field and if other areas are not sampled a mistaken impression of potential damage may be obtained.

Although many insecticides will give effective control, those listed in the accompanying table at the dosages indicated have given the most promising results.

*H. T. Reynolds is Assistant Entomologist, University of California, Riverside.*

*L. D. Anderson is Entomologist, University of California, Riverside.*

*A. S. Deal is Farm Advisor, Imperial County, University of California.*

## PEARS

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was also toxic to the leaf miners, and only a few larvae reached maturity. It does not, however, possess enough residual value to prevent some buildup between applications. Since so few miners developed in the plot, parasitism was not a factor.

Evaluation of the effect of the materials on codling moth was made by taking fruit counts at harvest. Two pickings were made in the orchard, and at each picking 2,000 fruits per treatment were selected at random and examined for codling moth entries and stings. Mealybug and stink bug were also present in the orchard, and fruit damage resulting from these two pests was recorded.

The lower table on page 10 shows the harvest fruit counts. To summarize the results, all materials with the exception of lead arsenate showed less than 0.5% worms at harvest.

Diazinon was the only material that completely controlled the mealybug, and not a single infested fruit was noted.

There was less stink bug damage in the Diazinon plot, but since this insect can fly so readily from plot to plot, it is difficult to determine if the material was actually killing the bugs. The material may have killed stink bug by contact during the June 29 application, but one would not expect any marked residual effect from that period until harvest.

Work will be continued on codling moth control the coming season, especially with Diazinon and Ryania. Both of these materials may eventually find a place in the codling moth control program, and they will be especially valuable if the codling moth should develop resistance to DDT.

*Harold F. Madsen is Assistant Entomologist, University of California, Berkeley.*

*James E. DeTar is Farm Advisor, Placer County, University of California.*