

Codling Moth on Walnuts in '55

downward trend in infestations of 1955 in northern California not uniform and need of control treatments in 1956 indicated

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The codling moth was less destructive—generally—to northern California walnuts in 1955 than in 1954.

The downward trend was widespread—but not uniform—as indicated by the infestation in the experimental orchard at Linden where the injury was about the same as it was in 1954. In other localities the 1955 infestation in the harvested crop from experimental plots was considerably less than in 1954.

The reason for the low level of the 1955 infestation is not fully known. In some orchards there was a large codling moth population, but the larvae did not enter sound nuts to any great extent. In the experimental orchard at Modesto, codling moth larvae entered nuts infested with walnut blight in large numbers. Despite this sizable invasion, comparatively few larvae gained entry into sound nuts. This can be explained—in part—by the fact that the codling moth is able to infest injured nuts more easily than those with unblemished husks.

The heavy infestation in the blighted nuts in the Modesto orchard means that there is a large overwintering codling moth population and—in the 1956 season—the pest could be a more serious menace than it was in 1955.

In the experimental orchard at Linden—where the principal 1955 investigations were conducted—there was no falling off of the codling moth infestation during the season.

Tests in 1955

The investigations at Linden compared the effectiveness of sprays—of a lead arsenate-DDT mixture and of DDT alone—applied with a conventional sprayer, and treatment with DDT—only—applied with an air carrier sprayer.

The treatments and the results are given in the table on this page.

For the past several years, it has been observed in the experimental orchard at Linden that the border plots—those along the edge of the orchard—have had the highest degree of infested nuts in the harvested crops. The 1955 infestation in six border plots averaged 2.7% as compared to 0.71% for 16 interior plots. Because of the greater infestations of the border plots, three of them were

given a second DDT treatment in mid-June. In these plots 1.17% of the nuts in the harvested crop were infested. Although this was a marked reduction from 2.70% for a single treatment, the results were disappointing because the second application did not reduce the infestation to close to zero.

A single plot—at Linden treated with DDT in May—was sprayed again in mid-June with standard lead arsenate. Both applications were made with an air carrier sprayer. The degree of infestation with the double application was 2% as compared with a 3.2% infestation in the adjacent plot that received a single early application of DDT. This experiment—although limited—substantiates the findings of previous years, which indicated that when applications are made with air carrier sprayers, standard lead arsenate is not so effective as DDT.

In the experimental orchard at Modesto, a single DDT spray was applied on May 4. At harvest, the codling moth infestation in three plots averaged 0.75% as compared to 2.5% in the check.

In the experimental series at Walnut Creek and at San Jose, the 1955 codling moth infestation in the harvested crop amounted to practically nothing.

Control

Satisfactory control of the codling moth can be expected only when treat-

ments are correctly timed and proper sprays are applied thoroughly.

For most walnut varieties, the spray should be applied at the time the average cross-sectional diameter of developing Payne walnuts ranges from $\frac{3}{8}$ " to $\frac{1}{2}$ ". Treatment of late varieties—such as Franquettes—should be delayed until the latter part of June.

Under favorable weather conditions, a single treatment applied with effective equipment has given adequate control for the entire season. Under other conditions—or where past history shows a trend toward an increased infestation in the harvested crop—a second spray during the latter part of June has been necessary.

An effective aphicide incorporated with DDT sprays against the codling moth has been used to avoid a serious increase in the walnut aphid population. Where a systemic aphicide was added to the first spray, no other aphicide was needed in a second DDT spray applied to control the second brood of codling moth. The residual action of the systemic aphicide in the first treatment was sufficiently long to control the aphid following the second DDT treatment.

DDT has the tendency to increase the population of spider mites and the frosted scale. However, the danger of increasing the population of these pests is markedly reduced if DDT is not used

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Per Cent of Infested Walnuts in 1955 Harvested Crop in the Experimental Plots at Linden

Treatment (Amount of insecticide applied per acre)	Per cent infested nuts
Check ^a	7.30
No codling moth treatment.	
Conventional sprayer ^b (Applied May 16 and 17)	
Standard lead arsenate 20 pounds, plus 50% DDT wettable powder 5 pounds, in 1000 gallons of water	0.20
50% DDT wettable powder, 7½ pounds in 1000 gallons of water	0.27
Air carrier sprayer ^c (Applied May 11 to 14)	
50% DDT wettable powder 8 pounds in 200 gallons of water.	1.19 ^d
	Average for 21 plots
	Average for 6 plots located at edge of orchard
	Average for 16 interior plots
(Second application June 15)	
First treatment 50% DDT at 8 pounds, Second appli- cation 6 pounds; each in 200 gallons of water.	2.70
	Average for 3 plots at edge of orchard
	0.71
	1.17

^a Unreplicated plot of 9 trees.

^b Each plot approximately 2.25 acres in area, and replicated 3 times.

^c Each plot approximately 4.5 acres in area.

^d The variation for the 21 plots ranged from 0.0 to 3.2 %.

clover was very competitive in Field No. 5 where it amounted to 69% of the forage in the check and 71% in the fertilized treatments.

Forage Quality

The feed composition of the 1953 samples was analyzed. In every field, crude protein was increased. The phosphorus-fertilized areas averaged 13.1% protein compared to 9.0% for the check treatment. Total protein per acre was increased from two times in Field No. 3 to nine times in Field No. 4.

The quality of the feed prior to the introduction of the clovers and use of fertilizer—at the stage of maturity when sampled—was at a nutritional level that would require feeding a protein supplement.

The values for crude fiber, fat, ash, and calcium were not consistently affected by fertilization.

The phosphorus level of feed grown on this range soil—when unfertilized—is inadequate for livestock well-being. The range improvement operations of seeding legumes and phosphorus fertilization increased the phosphorus in the feed significantly. This was in large part the result of the response of the clovers, since their phosphorus content was increased more than the resident annuals.

Effect of Livestock Use

The relative difficulty of establishing seeded forage species encountered in areas with an herbaceous cover is primarily due to that cover. Resident annuals are present in most seedings, and these annuals develop faster than most seeded species. A heavy concentration of stock in early spring not only reduces this competition by weedy annuals but converts them into meat or wool when palatable and nutritious.

Field No. 1 was very weedy in the seeding year, so two enclosures—12' square—were placed in the field. The clovers in the enclosures suffered from the severe competition of the resident annual grasses, but in the open field a good stand of seeded clovers developed the first year.

The grazing load of better than three animal-unit-months per acre in early spring favored the legumes. The continuation of this practice for three seasons resulted in the dominance of sub-clover over rose and crimson clover. In the phosphated strips in Fields Nos. 2, 3, and 4, which were relatively clean, deferring the grazing had no unfavorable effect on the clovers.

In the unfertilized strips in Fields Nos. 2 and 4, and in both the fertilized and unfertilized strips in Field No. 5,

an early grazing during the seeding year would have been helpful to the clovers.

Since it is almost impossible to have range land in a Mediterranean-type climate completely free of weeds before seeding, a concentrated grazing by livestock or a mowing is usually imperative the first spring.

The use of a mixture of annual clovers of varying growth habit allows much greater latitude of adjustment of livestock use than is otherwise possible.

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WALNUTS

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at a rate to exceed four pounds of actual material per acre. This dosage is sufficiently high to give adequate control of the codling moth.

Where air carrier sprayers are employed—at a maximum ground speed of 1½ miles an hour—the following mixture in combination with a suitable aphicide and applied at the rate of 200 gallons per acre has been effective:

DDT, 50% wettable powder.....	20 lbs.
DDT depositor	2 lbs.
Light summer oil emulsion containing 80% oil	3 gals.
Water	500 gals.

Experiments conducted with a dry depositor substituted for the light summer oil emulsion gave inconclusive results.

Where treatments are applied with a conventional sprayer, the following spray mixtures in combination with a suitable aphicide are effective:

1. Standard lead arsenate.....	2 lbs.
DDT, 50% wettable powder.....	½ lb.
Safener-commercial basic zinc sulfate product containing 50% zinc expressed as metallic	½ lb.
Light summer oil emulsion containing 80% oil	¼ to ⅓ gal.
Water	100 gals.
2. DDT, 50% wettable powder.....	¾ lb.
Light summer oil emulsion, containing 80% oil	¼ to ⅓ gal.
Water	100 gals.

Regardless of the formula used, it was necessary to slurry the dry ingredients and add them to the spray tank with agitator going and the tank one-third to one-half filled with water. The oil was added when the tank was three-fourth or more full.

The finished spray mixture must be applied as a thorough coverage spray. For large trees, upward to 1,000 gallons or more of spray are needed per acre.

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RUSSET

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tonite, five showed less russet on the bentonite-dusted fruit, but the differences were not significant.

Further tests using more and varied applications will be needed to determine more accurately the effect bentonite may have on russetting.

Insecticides have come under suspicion as possible russet-causing agents. Therefore, in 1955 a number of commonly used insecticides were tested in the Sacramento Valley orchard. A block of about 100 mature trees was given the standard lime sulfur, wettable sulfur cluster-bud spray and the 10-90 copper-lime dusts for blight control. Single applications and various combinations of nine insecticides were applied at the recommended time and concentration for each. Each treatment was applied to a set of four trees.

As seen in the table in column 1 on page 9, none of the four miticides applied either alone or in combination with parathion had any effect on russetting. DDT, lime sulfur, wettable sulfur, and TEPP also were shown to have no influence on the amount of russetting.

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The studies concerning streptomycin treatments and fruit russetting in the Sacramento Valley orchard were made in Professor Peter Ark's plots.

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ALFALFA

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of the available control measures. Best results can be obtained if all alfalfa growers in an area cooperate in combating the pest so that heavy infestations are not left untreated to serve as a reservoir for reinfestation. Poor timing, inadequate applications, and negligence in watching the development of the pest will reduce the effectiveness of the control measures and in some instances may even aggravate the problem by disturbing natural control factors.

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The spread of the aphid reported above has been followed by co-operative surveys conducted by the University of California, the State Department of Agriculture, and the County Farm Advisors and Agricultural Commissioners.