New Materials for Codling Moth

new compounds evaluated for control of codling moth should resistance to DDT be developed by the pest in California

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An increasing number of reports of codling moth resistance to DDT—although none of the cases occurred in California—prompted the testing of several new materials for codling moth control during the 1956 season.

The materials tested were Trithion, Diazinon, a combination of DDT and Diazinon and, as a comparison, a combination of DDT and parathion.

One series of experimental plots was established in a Bartlett pear orchard near Courtland. The orchard had a history of severe codling moth in a section about three acres in extent even though the spray schedule was followed. During the 1955 season the late appearance of the first brood caused difficulty in controlling the moths because they were depositing eggs when the DDT spray program was least effective.

In the area of the severe codling moth damage half acre plots replicated twice were established. The materials were applied with air carrier equipment, and the amount of spray per acre averaged 700 gallons.

Because of the late appearance of the first brood of moths, the sprays were timed by the use of bait pans rather than following the standard DDT spray schedule. The materials were applied shortly after the peak of the codling moth flights. Again, in 1956 as in 1955, the peak flight occurred late in the season. This is illustrated in the accompanying graph. Observations of larvae under the bark indicated that most of this late flight was made up of first brood moths.

Fruit Examined

To evaluate the spray materials tested, fruit was examined for the presence of worms or stings at two different pickings, July 24 and August 7. At the first picking, the fruit which had dropped to the ground was collected from the center of the plots, and was included in the final results.

The materials used, dosages, dates of application and fruit counts are shown in the table on this page.

The two phosphates—Diazinon and Trithion—as well as the DDT-Diazinon combination did not give adequate commercial control. Over 7% infested fruit was found in these three plots. The parathion-DDT combination gave better results, showing a little more than 2% worms. The DDT-Diazinon combination was included because it had been reported to give adequate control in other areas. As a comparison to this, the DDT-parathion plot was established. Since the latter combination gave so much better control than the DDT-Diazinon combination, it is apparent that parathion adds more to the effectiveness of the spray than was expected.

On examination of the fruit late in the season, it was found that Trithion has a phytotoxic effect on pears, causing irregular russet spots on the sides of the fruit. Although the damage was shallow, it would be a factor with fresh shipped fruit.

A fairly high population of European red mites in the test orchard made it possible to evaluate the new materials on their abilities to control the mite. One hundred leaf samples were taken from each plot at intervals during the spring and summer. The results are shown in the upper table on page 14 as the average number of mites per leaf at each date of sampling. Trithion—as a codling moth spray—gave excellent control of the European red mite for the season. The other

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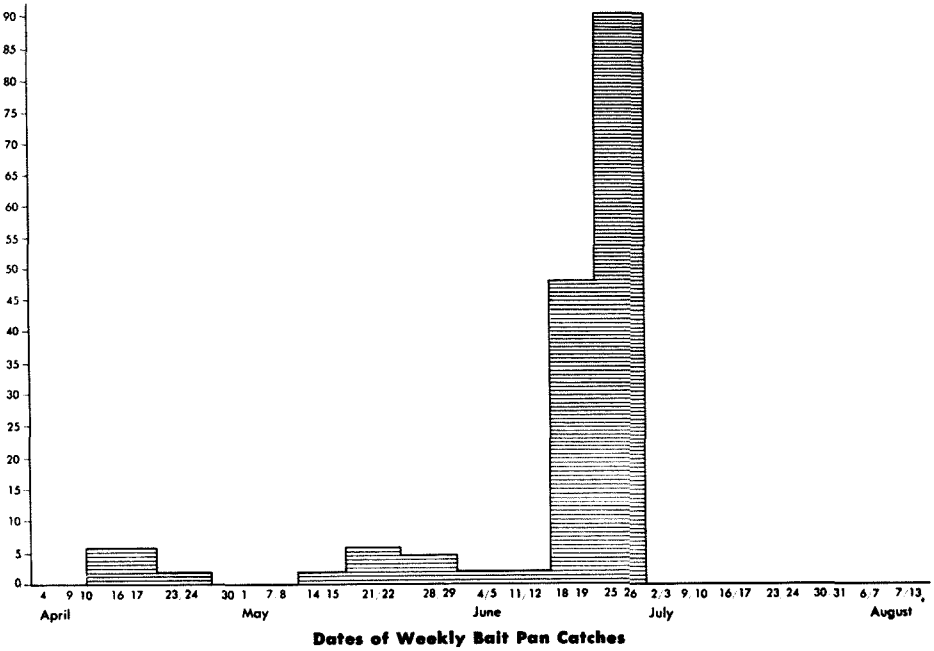
Summary of 1956 Codling Moth Plots—Bartlett Pears Courtland

Materials	Dosage per acre	Application dates	Fruit examined*	Worms	Stings	Per cent infested fruit
Diazinon	14.2 lbs. 25% wettable	May 1 ..... June 1, 29	2215	140	20	7.2
Diazinon and DDT	7.1 lbs. 25% wettable 7.1 lbs. 50% wettable	May 1 June 1, 29.....	2326	149	28	7.6
Parathion and DDT	7.1 lbs. 25% wettable 7.1 lbs. 50% wettable	May 1 June 1, 29.....	2140	47	6	2.4
Trithion	14.2 lbs. 25% wettable	May 1 June 1, 29	2304	144	20	7.1

*Total of two pickings, first on July 24, second on August 7, 1956.

Codling moth bait pan records at Courtland, 1956



Dates of Weekly Bait Pan Catches

NEW MATERIALS

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three materials required treatment with an acaricide on June 15.

A second series of plots was established in an abandoned Hardy pear orchard near San Jose. A high population of codling moths was present, and as the fruit would not be harvested, the plots afforded an excellent chance to test new materials which had little data available with respect to residues.

The plots consisted of four trees each replicated three times, the replicates being randomized throughout the orchard. The materials were applied with conventional ground equipment and orchard guns. The amount of spray per acre averaged 750 gallons.

The sprays were again timed by means of bait pans in the check plots.

The fruit was harvested on August 14 and examined for the presence of worms and stings. Fruit that had dropped to the ground was included with the fruit on the tree for each treatment. An attempt was made to examine 200 pears per treatment, but because of a light crop, this was not possible for all treatments.

The materials used, dosages, time of applications and harvest counts are summarized in the lower table on this page.

Several materials, including Diazinon, Trithion, Thimet, Dipterex and the spore preparation of *Bacillus thuringiensis* did not give adequate control of the codling moth. These plots all showed more than 4% damaged fruit at harvest. The one pound dosage of DDT alone was as effective as a combination of one pound of DDT with one pound of Diazinon, indicating that the Diazinon adds little to the spray. Neither of these two materials gave satisfactory control. Hercules 528 showed some promise, but was not as effective as the two-pound dosage of DDT and the Ryania, both of which gave good control considering the high populations of moths present. The most outstanding control was obtained by two new chemicals, Guthion, and Carbon and Carbide 7744, each of which had less than 1% worms at harvest.

The more promising materials from the 1956 plots will be evaluated on a larger scale during the 1957 season.

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Summary of European Red Mite Control on 1956 Codling Moth Plots—Bartlett Pears Courtland

(Mite Counts Expressed as Average Number Mites per Leaf)

Materials	Dosage per acre	Mite Count Data					
		May 1 Pre-spray	May 9 Post-spray	June 1 Pre-spray	June 6 Post-spray	June 15 Post-spray	July 23 Harvest
Diazinon	14.2 lbs. 25% wettable.	5.2	0.1	3.1	1.1	7.3*	....
Diazinon and DDT	7.1 lbs. 25% wettable. 7.1 lbs. 50% wettable.	4.8	0.1	2.5	2.1	10.4*	....
Parathion and DDT	7.1 lbs. 25% wettable. 7.1 lbs. 50% wettable.	5.4	0.08	1.5	0.2	4.6*	....
Trithion	14.2 lbs. 25% wettable.	4.3	0.1	0.02	0.05	0.0	0.0

* Resprayed with chlorobenzilate at this point. *Application Dates:* May 1, June 1, June 29.

Summary of 1956 Codling Moth Plots—Hardy Pears San Jose

***Application Dates:* May 1, May 28, July 9**

Materials	Dosage per 100 gallons	Fruit counted	worms	Stings	% Infested Fruit
DDT	2 lbs. 50% wettable	600	2	4	1.0
DDT	1 lb. 50% wettable	600	15	8	3.6
Diazinon—DDT	1 lb. 25% wettable 1 lb. 50% wettable	564	14	7	3.7
Diazinon	2 lbs. 25% wettable	600	26	8	5.6
Thimet	1 qt. 48% emulsion	600	28	33	10.1
Hercules 528	2 lbs. 25% wettable	600	8	6	2.3
Carbon and Carbide 7744	1½ lbs. 50% wettable	553	2	1	0.6
Trithion	2 lbs. 25% wettable	600	20	6	4.3
Dipterex	4 lbs. 50% soluble powder	516	32	19	9.8
Ryania	6 lbs. 100%	586	7	4	1.8
Guthion	2 lbs. 25% wettable	600	2	1	0.5
Bacillus thuringensis	100 grams of spore preparation	600	80	18	16.3
Check No. 1		600	92	32	20.5
Check No. 2		600	115	21	22.6

SOFT SCALES

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against the frosted scale than against the European fruit lecanium or the calico scale. Five pounds of parathion, 25% wettable powder per acre, applied in 100 to 200 gallons of water, with an air carrier sprayer has resulted in good control of the frosted scale.

In the full dormant season all three species of soft scales can be satisfactorily controlled by spraying with a 3% dormant oil emulsion. Control has been obtained where 15 gallons of dormant oil was applied in 100 to 200 gallons per acre by an air carrier sprayer. A dormant oil spray should never be used on dry trees or in orchards that have suffered for water during the year.

Time of Treatment

The best time to control soft scales is during the summer. The effectiveness of parathion for summer use is shown by the suppressive action it exerts when applied at a dosage of one pound of 25% wettable powder per acre for the control of the walnut aphid.

For highly satisfactory scale control, parathion should be used at the rate of two to three pounds per acre and applied with an air carrier sprayer. The amount of water needed—75 to 150 gallons—depends upon the air capacity of the equipment.

Treatment should not be applied later than three weeks before harvest nor delayed until after harvest. By the time harvest is completed, winter strength of parathion may be needed to give control.

Where winter treatment is applied, the addition of an oil emulsion—four gallons per acre—has improved the control obtained.

In the full dormant season a dormant oil emulsion has been used, but for other periods a summer oil emulsion is better.

Parathion treatments for soft scales —applied in mid-February—also result in the destruction of the overwintering walnut aphid eggs.

Malathion 25% wettable powder has given both summer and winter control of soft scales, but the dosage required was three times that of parathion.

Natural enemies of soft scales—when given an opportunity—provide effective control. This apparently happens in the case of the calico scale, regardless of chemical treatments, because effective control results from the action of an insect parasite and the feeding of the Audubon's warbler upon the scales during the winter and early spring.

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