Walnut Aphid Studies in 1955

experimental systemic aphicide OMPA has outstanding promise but more studies needed before release for commercial use

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The 1955 infestations of the walnut aphid were exceedingly severe in certain areas, such as Linden. By early May, the average number of aphids found—on the next to the terminal leaflets—in some orchards exceeded 50.

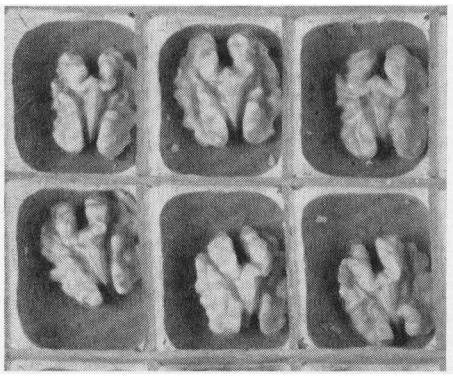
Studies with systemic aphicides—Systox and OMPA—as well as with nonsystemic aphicides were made at Linden, Modesto, Walnut Creek, and San Jose. Treatments were applied with air carrier sprayers, except at Linden where a conventional sprayer also was used. The aphicides were applied alone or incorporated with codling moth spray.

On April 16, 1955, the experimental orchard of Payne walnuts at Linden was surveyed. The average number of aphids in the plots that received nonsystemic aphicides in 1954 averaged 24 aphids per leaflet in contrast to the 0.22 average for the plots that received the OMPA treatments in 1954.

Because of the large aphid population outside of the OMPA plots, an additional plot of 4½ acres was treated with OMPA on April 27, when the aphids exceeded the April 16 average of 24 per leaflet. The leftover spray mix was applied to a portion of an orchard outside of the experimental plots and designated as grower OMPA treatment. By May 4, the aphid average in untreated plots ranged from 30 to 66 per leaflet except in the plots treated with OMPA in 1954. There the average was 0.68. Thus the OMPA treatments applied in May 1954 gave protection for an entire year. The carryover of the control into 1955 was not the result of the OMPA's still killing aphids but was due to the fact that the insecticide gave such complete control during the 1954 season that few or no overwintering eggs were laid.

In the heavily infested plots, aphids were controlled when—between May 11 and 17—aphicides were incorporated with the treatment against the codling moth. In the plots receiving nonsystemic aphicides, control was accomplished by a second treatment on July 1. In addition, unusually hot weather during early September all but eliminated the aphid from treatments where the population was beginning to increase. As a result, the only time the aphid could have greatly influenced the quality of the nuts was in early season.

The early aphid infestation at Linden apparently had little effect upon either soundness or lightness of meat color in the harvested crop. However, the aphid was responsible for a marked reduction in size and weight quality as shown by the marked contrast—throughout the season—between the grower trees sprayed with OMPA on April 27 and adjacent trees without the OMPA treatment which suffered severely from aphid attack. The



Influence of severe early season walnut aphid infestation upon the quality of the harvested crop. *Top:* Meats from part of orchard receiving ineffective control. *Bottom:* Meats from OMPA plot where excellent aphid control was obtained.

infested trees were well covered with the black sooty mold fungus growing on the quantities of honeydew excreted by the aphids. The difference in the size of the nuts was clearly visible and forecasted what occurred in the harvested crop. The heavy aphid population apparently exerted no influence on the set, because the nut crop on both groups of trees was exceedingly heavy.

In the experimental series, best meat size and weight were obtained in the plots that had OMPA treatments in 1954 and in 1955 and in the plot treated with OMPA on April 27, 1955. The former plots were almost completely free of aphids, while the latter one was infested until the April 27 treatment—illustrating that some degree of infestation can be tolerated.

The last aphid survey was on October 28, 1955, and few or no aphids were found in the plots treated with OMPA.

To determine the effect of early season aphids upon a variety later than Payne, a block of Franquettes was sprayed with OMPA on May 16, 1955, just when the developing nuts were in the feather stage. Following treatment, not a single aphid was found in this plot in 10 surveys conducted from May 24 through September 21. In an adjacent plot, a severe aphid population developed. On June 10, the average number of aphids per leaflet was 64. The number increased to 67 on June 16 but later was reduced by a large developing predator population.

Harvest quality—in size and weight—was slightly better in the OMPA plot but not outstanding as in the Payne variety. Apparently severe aphid infestations are less injurious to small developing nuts of the Franquette variety than to the Payne.

Although the systemic aphicides proved more effective than the nonsystemic aphicides, they have limitations.

Systox has the tendency to cause leaf injury and is not effective in controlling aphids on foliage that appears after treatment is applied.

OMPA must be applied thoroughly to insure control, and its effectiveness is reduced if it is applied after the foliage becomes too mature.

The outstanding feature concerning OMPA is its long residual action. At the lowest dosage—0.7 pound total actives—it controlled the aphid for the entire 1955 season. On October 28, 0.32 aphid was found per leaflet. Most of these were taken on the most recently produced foliage. The oldest foliage was apparently nearly free of the pest.

Even though the most outstanding control of the walnut aphid has been obtained with OMPA, it is restricted to experimental use. OMPA has not been nationally registered by the United States

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WALNUT APHID

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Department of Agriculture for use on walnuts, nor has a tolerance been established by the Food and Drug Administration as authorized by the so-called Miller Amendment. No off-flavor of the walnut meats is indicated, and it remains for future analyses to determine whether a residue hazard exists. Registration of OMPA for use on walnuts is largely dependent upon the findings of such analyses.

Systox—the second most promising chemical for the control of the walnut aphid—is registered for use on walnuts with an established tolerance of 0.75 part per million.

In the present investigations, 0.25 pound, 0.50 pound, and 0.75 pound dosages of Systox per acre applied with air carrier sprayers as single applications have resulted in satisfactory control of the walnut aphid. A 0.25 pound dosage can be used in the spring either alone or in combination with the codling moth spray. If a second treatment is needed later in the year, another 0.25 pound dosage can be applied in July or August. The second treatment should insure the control of the pest until harvest or a later date. However, no application should be made at the rate of more than 0.75 pound per acre per season or within three weeks of harvest. Where Systox applications are made with conventional sprayers, one fourth pint—of a product containing two pounds of actual per gallon—is used in 100 gallons of water and applied as a thorough coverage spray.

Aphicides that can be used safely include nonsystemic nicotine, parathion, malathion, TEPP, and BHC, but BHC should not be used more than once nor later than the end of May.

When these aphicides are used in air carrier sprayers, they can be incorporated in the codling moth spray, which is usually applied in 200 gallons of water per acre. When applied alone, the quantity of water will range from 50 to 150 gallons per acre, depending upon the capacity of the available equipment. The nonsystemic aphicides have been effective at the following amounts per acre:

Parathion ..... 1 to 1.25 lbs.
25% wettable powder
or
Malathion ..... 3 lbs.
25% wettable powder
or
TEPP ..... ¾ to 1 pint
40%
or
Nicotine ..... 5 lbs.
25% dry concentrate
or
BHC ..... 3.75 lbs.
12% gamma isomer

When these aphicides are incorporated with a codling moth spray and applied with a conventional sprayer, the effective amounts of aphicides per 100 gallons of mixture have been:

Parathion ..... 3 ozs.
25% wettable powder
or
Malathion ..... 8 ozs.
25% wettable powder
or
BHC ..... ½ lb.
12% gamma isomer
or
Nicotine ..... 0.6 lb.
25% dry concentrate

The finished mixture should be applied as a thorough coverage spray.

There are effective dusts that can be used for aphid control, but satisfactory

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Quality of Walnuts from Several Aphicide Treatments at Linden[a]

Aphicide and pounds per acre per application		Per cent sound	Per cent light colored meats	Size in per cent			Weight per 100 nuts in grams	
				Large	Medium	Baby	In shell	Meats
Payne variety								
Parathion, 25% W.P., 1[b]		88	71	9.3	46.6	44.0	846	412
Malathion, 25% W.P., 3[b]		84	66	13.0	46.5	40.5	885	402
Nicotine, 25% dry concentrate[b]		82	65	21.0	46.4	32.6	917	442
BHC, 12% gamma isomer first;	3.75							
Systox second	0.25	87	72	18.8	51.5	29.6	905	431
Systox (actual)[c]	0.25	86	67	38.5	44.0	17.3	928	461
	0.50	85	64	33.3	48.3	18.3	939	468
	0.75	88	66	...	...	...	992	477
OMPA (total active)[c]	0.7	90	73	28.8	49.8	21.3	942	454
	1.0	89	68	...	...	...	977	466
	1.5[d]	89	71	67.7	23.8	8.4	1083	510
	2.0[d]	92	74	59.8	32.4	7.7	1069	524
	2.0[e]	90	71	70.3	21.8	7.8	1109	515
	2.0[f]	96	92	59.3	29.0	11.6	960	441
Check (grower treatment)		94	85	0.7	13.6	85.6	686	305
Experimental material 3911		89	72	24.0	49.3	26.7	896	423
Experimental material 12008		89	75	...	...	...	...	...
Franquette variety								
OMPA (total active)	2.0[g]	93	82	27.7	45.0	27.3	985	463
Check		94	84	9.6	41.6	48.3	906	431

[a] Based upon cracking an average of at least three 100-nut samples per plot or at least six 100-nut samples per treatment.
[b] Two applications; first May 14; second July 1, 1955.
[c] One application, May 11 to 13 inclusive, 1955.
[d] Plots received an OMPA treatment in 1954.
[e] Treated April 27, 1955.
[f] Grower treatment April 27, 1955.
[g] Treated once May 16, 1955.

Relative Effectiveness of Several Aphicides in Controlling the Walnut Aphid at Linden

Aphicide and pounds per acre		Average number of aphids per leaflet on: May 4	May 16	May 24	June 16	July 1	July 5	Aug. 5	Aug. 24	Sept. 21	Oct. 28
Air carrier sprayer											
Systox[a]	0.25	43.0	0.00	0.00	0.00	0.35	...	1.54	2.60	2.11	5.07
	0.50	40.5	0.00	0.00	0.00	0.08	...	0.59	1.70	1.58	4.29
	0.75	30.4	0.00	0.00	0.06	0.06	...	0.21	1.76	1.90	5.76
OMPA[b]	0.7	31.5	0.73	0.00	0.00	0.00	...	0.00	0.00	0.16	0.32
(total actives)	1.0	35.2	0.34	0.00	0.00	0.05	...	0.01	0.00	0.00	0.04
	1.5	0.6	0.00	0.00	0.00	0.00	...	0.00	0.00	0.00	0.00
	2.0	0.3	0.00	0.00	0.00	0.00	...	0.00	0.00	0.00	0.02
	2.0[c]	...	0.00	0.00	0.00	0.00	...	0.00	0.00	0.00	0.00
Parathion, 25% W.P.[d]	1.0	52.0	0.00	0.00	2.27	10.90	0.00	0.40	1.03	1.01	6.46
Malathion, 25% W.P.[d]	3.0	65.9	0.01	0.00	1.28	7.23	0.00	0.30	0.78	1.50	7.00
Nicotine, 25% dry concentrate[d]	5.0	45.7	0.01	0.01	2.30	13.96	0.27	0.85	0.58	2.60	9.02
BHC, 12% gamma isomer[e]	3.75	43.9	0.28	0.06	2.44	17.92	0.00	0.01	0.08	0.21	3.13
Experimental material 3911[b]		...	0.00	0.00	0.76	13.86	...	1.10	0.76	1.60	...
Experimental material 12008[b]		...	0.00	0.06	0.96	12.48	...	0.48	0.56	1.44	...
Conventional sprayer											
Parathion, 25% W.P.[f]	1.5	...	...	0.00	9.84	27.54	0.00	0.12	1.03	0.80	...

[a] Applied May 11, 1955.
[b] Except as noted applied May 12 and 13, 1955.
[c] Applied April 27, 1955.
[d] Two applications; first May 14 and second July 1.
[e] Applied May 14, followed 0.25 pound dosage of Systox July 1.
[f] Applied May 16, second treatment applied with air carrier sprayer July 1.

SODIUM–CALCIUM

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solutions and decreasing those of calcium was to greatly reduce the fresh and dry weights of the root systems.

In drained soil cultures of three-gallon capacity the effect of adding increasing concentrations of sodium nitrate to Hoagland's nutrient solution was studied to determine whether any changes occurred in the calcium content of the dry matter of the roots when calcium was always abundantly supplied. At the two highest sodium concentrations, the calcium content of the roots of rough lemon seedlings showed a decrease. An increase in sodium nitrate in the nutrient solution was accompanied by an increased calcium content in Cleopatra mandarin roots.

The table on page 13 shows the consistently high calcium content of the roots of the sour orange—Spanish—seedlings in the various sodium nitrate cultures.

Results of the tests confirm previous preliminary findings on the calcium content of the roots of various citrus rootstocks collected from trees in the rootstock variety plots. In the plots of these orchard trees, there were no appreciable sodium concentrations and the results in the table indicate the tendency to maintain a more or less stable calcium and magnesium content in the roots of citrus seedlings when sodium is increased and the supply of calcium is maintained by the nutrient solution and initially increased by base exchange.

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APPLE APHID

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There were three heavy peaks of movement—in late July, late August, and early September. The sudden drop in September was due to the action of parasites which killed a high percentage of aphids during this time. In the treated plots, the downward movements can be used as a measure of the control obtained following the foliage applications. As shown by the almost negligible number of aphids trapped on the bands, 12008, 3911, and Diazinon were very effective. Good control—though less outstanding—was also obtained with 1303. In contrast to its effect on upward movements, the weakest of the phosphate compounds was 17147, the reason for which is not clear. Ryania—as compared with the check—again showed a reduction in aphid movement but was far less effective than the systemic and nonsystemic phosphate compounds.

As a check on the method of analyzing results by the use of sticky bands, colony counts and core aphid counts were made on each plot at harvest. The colony counts were made by recording the number of active colonies on four limbs in each tree and were expressed as the average number of aphid colonies per limb. The core aphid count was made by selecting 100 apples at random from each plot, cutting them in half from calyx to stem, and recording the number of infested cores. The materials used, dosages, times of application, and harvest counts are summarized in the table below.

Summary of 1955 Woolly Apple Aphid Plots, Watsonville, California

Material	Dosage per 100 gals.	Dates of application	Harvest counts	
			Av. no. aphid colonies per limb	% core aphid
Ryania	6 lbs. 100% wettable	Apr. 19 May 26 June 23 July 27	2.7	7.0
Am. Cy. 12008	1 qt. 48% emulsion	Apr. 19 May 26 June 23 July 27	0.1	0.0
Stauffer 1303	1 pt. 50% emulsion	Apr. 19 May 26 June 23 July 27	0.5	1.0
Bayer 17147	1 lb. 50% wettable	Apr. 19 May 26 June 23 July 27	1.2	2.0
Diazinon	1 qt. 25% emulsion	Apr. 19 May 26 June 23 July 27	0.3	0.0
Check	No spray	.....	9.6	16.0

The harvest counts correlated closely with the band counts. Excellent control was obtained with 12008, 3911, and Diazinon. Less effective—but still providing commercial control—were 17147 and 1303. Ryania was the least effective of the materials used.

At harvest—because the number of colonies present in the check trees indicated that a higher percentage of core aphid should have been present—a check was made and 50% of the apples were found to have an open calyx, which was less than had been recorded in previous seasons. Although many apples in the unsprayed plot had active aphid colonies on the stem and calyx end, the aphids were nevertheless unable to penetrate to the core. The variation in core aphid infestations from season to season is no doubt connected not only with the severity of aphid infestations in the tree but also with the factors which cause open and closed calyx ends in the fruit.

Most of the chemicals used in the Watsonville plots are still in the experimental stage. In the case of the systemic compounds—which were so effective in reducing the aphid movements—it may be possible, in further tests, to lengthen the intervals between treatments.

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PINE

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roots within the first month, October and November seedlings produced an average of less than three new roots over ½" long per seedling, whereas the April transplants averaged more than eight new roots over ½" long per seedling—a highly significant difference statistically.

Close examination of the seedlings that produced roots and of those that did not failed to reveal any external morphological differences. Apparently, therefore, some physiological condition exists which is associated with the ability of seedlings to produce new roots.

If these findings are substantiated by later and more comprehensive observations, a basic change taking place during the winter which increases the ability of the seedling to produce roots will be indicated.

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WALNUT APHID

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results can be obtained only where they are thoroughly applied with adequate equipment under favorable weather conditions.

In areas where the resistant walnut aphid is known to occur, an aphicide other than parathion, malathion, or TEPP must be used.

Insecticides used in the walnut aphid control program are poisonous and care must be exercised in handling and applying them, especially with parathion, TEPP, and Systox. Precautions—as given on the insecticide manufacturer's container—should be followed carefully.

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