Approximate location of the fields used in tests for integrated control of omnivorous leaf roller.

Integrated control of grape pests:

EFFECTIVENESS OF CRYOLITE AND STANDARD LEAD ARSENATE AGAINST THE

Omnivorous Leaf Roller

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The use of cryolite and lead arsenate for the control of early season infestations of omnivorous leaf roller on grapes has many advantages and a great potential. It is estimated that during a year of light to moderate population, one or two early season applications of cryolite or lead arsenate may provide effective and economical control of OLR throughout the season.

THE OMNIVOROUS LEAF ROLLER *Platynota stultana* (Walsingham) Tortricidae: Lepidoptera, was first described from Sonora, Mexico, in 1884, and since has been frequently reported in California on different field and greenhouse crops. Occasionally, this pest attained high population levels and caused economic damage to different commercial crops, such as cotton, citrus, carnation and roses.

In Fresno County, the omnivorous leaf roller (OLR) was first recorded on grapes in 1963 in a vineyard near Sanger. Since then it has established itself in practically every vineyard in the area. It caused considerable damage in 1968, 1969 and 1970 at many locations in the San Joaquin Valley. Grapes are an ideal host for OLR. The larva can feed on any green part, such as leaves, succulent shoots, clusters and fruit—including raisins. Economic loss occurs when the pest feeds in the ripening bunches. This feeding breaks the skin of the berries and allows yeast and fungi to initiate rot.

The primary source of infestation in grapes is the vineyard itself since the pest overwinters in the old mummified clusters that hang on the vines or remain on undisturbed soil under the vines. However, since many agricultural crops, ornamentals and weeds are host plants, there is almost always a nearby source to begin infestation. Once established in the vineyard, the pest may build up to damaging population levels within two to three years.

Feeding habits

It is difficult to control OLR on grapes because of their protective feeding habits; they usually feed within the webbed and folded leaves and tight bunches. Such sanitation practices as French plowing, and the removal of old mummies from vines help to reduce the overwintering populations. Besides sanitation, it has been observed that the early application of stomach poison can help to reduce the insect population. However, sufficient experimental evidence on this possibility has been lacking. Therefore, during the spring of 1970, detailed experimental work, primarily aimed at determining the effectiveness of lead arsenate and cryolite against OLR was initiated.

Eight fields

Eight fields, six in Fresno County and two in Kern County, were used for this study (see map). Each trial was divided into eight plots of 250 vines each (each plot approximately ½ acre). Four plots were treated with cryolite and four with lead arsenate. Another plot of 300 vines was left completely untreated as a check. The experimental plots were treated from May 13 to 17, 1970. In one vineyard, a second application of insecticide was given at the end of May. Standard lead arsenate was used at a rate of 7.2 lbs active ingredient per acre in 200 gallons of water. Cryolite (sodium fluoaluminate) was used at a rate of 5.7 lbs active per acre. The chemicals were applied with an over-the-vine type boom sprayer.

Effectiveness

The effectiveness of insecticides is judged by the number of nests obtained in a one-hour search. To arrive at such figures, a random search for OLR nests was made during every generation. The

TABLE 1. EFFECTS OF LEAD ARSENATE AND CRYOLITE ON THE POPULATION OF OMNIVOROUS LEAF ROLLER IN DIFFERENT VINEYARDS

Field no.*	Grape variety	Date treated	Treat-ment	Number of omnivorous leaf roller nests counted per hour														
				Pre-treatment			Post-treatment											
							1 week			4 weeks			7 weeks			10 weeks		
				Foliage	Fruit	Total	Foliage	Fruit	Total	Foliage	Fruit	Total	Foliage	Fruit	Total	Foliage	Fruit	Total
			chem.†															
1	Thompson Seedless	5/14	A	8	0	8	2	0	2	0	0	0	0	0	0	4	4	8
			B	8	0	8	2	0	2	0	0	0	0	0	0	4	8	12
			C	8	0	8	10	0	10	8	0	8	8	6	14	8	32	40
2	Carignane	5/15	A	6	0	6	0	0	0	0	0	0	2	4	6	4	6	10
			B	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
			C	6	0	6	4	0	4	4	0	4	16	12	28	4	18	22
3	Thompson Seedless	5/16	A	16	0	16	12	0	12	0	0	0	0	0	0	8	12	20
			B	16	0	16	10	0	10	0	0	0	6	2	8	4	6	10
			C	16	0	16	20	0	20	12	0	12	40	12	52	16	24	40
4	Thompson Seedless	5/17	A	14	0	14	10	0	10	2	0	2	4	0	4	0	2	2
			B	14	0	14	12	0	12	2	0	2	4	4	8	0	2	2
			C	14	0	14	16	0	16	6	0	6	10	14	24	0	10	10
5	Thompson Seedless	5/13	A	20	0	20	12	0	12	0	0	0	14	0	14	14	4	18
			B	20	0	20	12	0	12	0	0	0	12	0	12	10	6	16
			C	20	0	20	22	0	22	6	0	6	30	10	40	12	14	26
6	Thompson Seedless	5/13	A	22	0	22	10	0	10	0	0	0	8	0	8	4	6	10
		5/28	C	22	0	22	26	0	26	4	0	4	32	0	32	16	16	32
7	Thompson Seedless	5/13	A	26	0	26	10	0	10	0	0	0	12	0	12	8	8	16
			B	26	0	26	14	0	14	4	0	4	12	0	12	16	8	24
			C	26	0	26	24	0	24	8	0	8	32	0	32	16	16	32
8	Thompson Seedless	5/15	A	12	0	12	–	–	–	2	0	2	6	0	6	4	8	12
			B	12	0	12	–	–	–	2	0	2	6	0	6	4	8	12
			C	12	0	12	–	–	–	8	0	8	20	4	24	16	12	28

* The fields were numbered 1 through 8, starting from south to north.
† A = Cryolite, B = Lead Arsenate, C = Control.

search was conducted for one-half hour in each plot at all eight locations (see map). The half-hour readings were then doubled to obtain an hour-search count. This method proved to be effective in determining existing OLR populations in any given field. All the fields tested had high populations of omnivorous leaf roller. Most of them had a history of serious damage in previous years.

Significant control

The results (tables 1 and 2 and the graph) indicate that both cryolite and lead arsenate gave a very significant degree of control as compared with the untreated checks. Although the population densities varied from field to field (table 1), the effectiveness of treatments was quite clear after the first week's counts, which on an average showed a 60.5 per cent and 49 per cent control for cryolite and lead arsenate, respectively. One field (No. 1) showed 80 per cent control with both cryolite and lead arsenate at one week's count (table 1). The data obtained at two weeks indicated a 75 to 100 per cent control with cryolite and 50 to 100 per cent control with lead arsenate, with averages of 96.5 per cent and 87.5 per cent, respectively (table 1 and graph).

AVERAGE PERCENTAGE OF CONTROL OF OMNIVOROUS LEAF ROLLER AS COMPARED WITH UNTREATED CHECKS, OBTAINED BY THE USE OF CRYOLITE AND LEAD ARSENATE

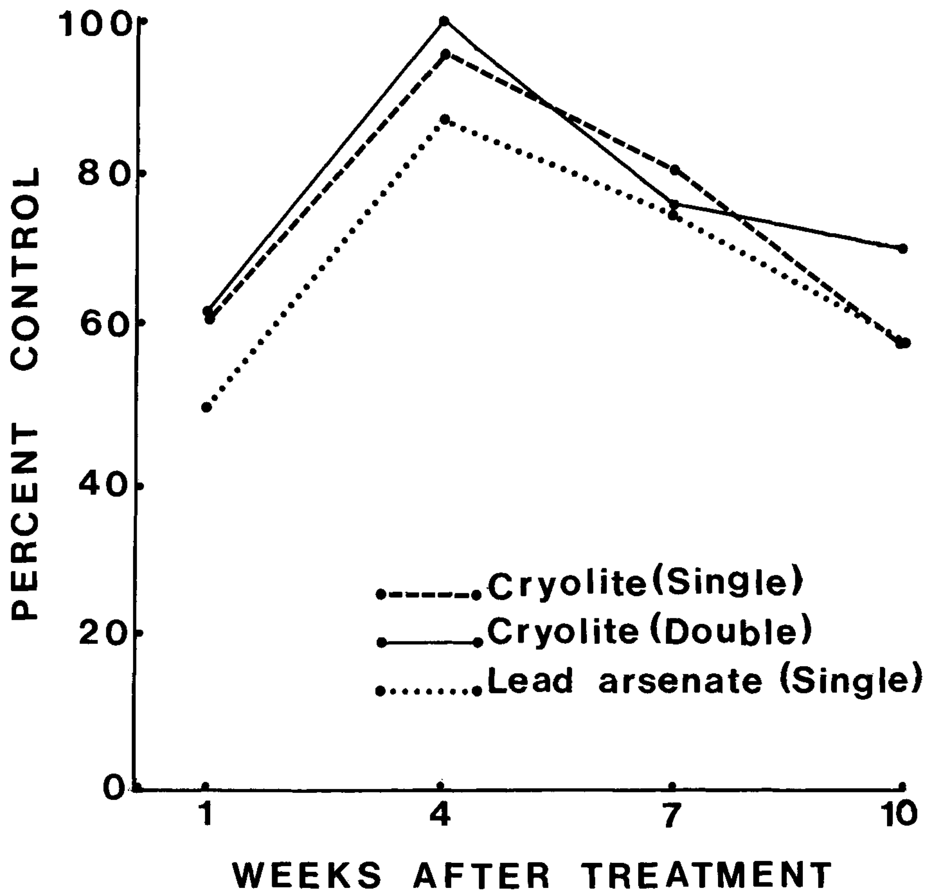

TABLE 2. PRE-HARVEST COUNT TABLE, SHOWING THE EFFECTS OF STANDARD LEAD ARSENATE AND CRYOLITE ON THE INFESTATION OF OMNIVIROUS LEAF ROLLER INTO GRAPE BUNCHES.

Field number*	Treatment	Grape bunches infested with OLR		Bunches clean
		With rot	Without rot	
	chem.†	%	%	%
1	A	8	0	92
	B	7	0	93
	C	16	4	80
2	A	4	2	94
	C	7	6	87
3	A	3	1	96
	B	3	2	95
	C	10	6	84
4	A	2	2	96
	B	2	1	97
	C	6	4	90
5	A	4	4	92
	B	6	2	92
	C	14	8	78
6	A‡	3	1	94
	C	12	2	86
7	A	4	2	94
	B	6	2	92
	C	16	6	78
8	A	1	3	96
	B	4	2	94
	C	6	6	88

* The fields were numbered 1 through 8, starting from south to north (see map).
† A = Cryolite, B = Lead Arsenate, C = Control.
‡ Double treatment of cryolite.

Average levels

The average levels of control by cryolite and lead arsenate dropped slightly after seven weeks, at which time they ranged from 62 to 100 per cent, averaging 80.5 per cent for cryolite and 75 per cent for lead arsenate (see table 1 and graph). The readings after ten weeks indicated that control with cryolite and lead arsenate both dropped to 57 per cent, although two fields were showing as high as 80 per cent control (table 1 and graph). The results also indicated that the double treatment of cryolite performed as well as the single treatment of either cryolite or lead arsenate. Although at 7- and 10-week readings a few single-application fields showed better control than the double-application fields; the average per cent control of single treatment of both lead arsenate and cryolite at 10 weeks was lower than the double treatment (table 1 and graph).

Relative percentages

Table 2 describes relative percentages of clean and OLR infested bunches of all the eight locations (just before harvest) in the last week of August or first week of September. One hundred bunches from each replicate (or 400 bunches from each treatment) were examined to obtain such a count. The data indicate that OLR infestations in the untreated checks varied between 10 and 22 per cent with an average of 16.2 per cent. The single treatment of cryolite showed a 4 to 8 per cent bunch infestation with an average of 6.8 per cent, whereas the single treatment of standard lead arsenate ranged between 3 and 8 per cent infestation with an average of 7.2 per cent (see table 2). This reflects the fact that early single treatments of lead arsenate and cryolite each resulted in a 55 to 60 per cent reduction in the infestation of omnivorous leaf roller into grape bunches.

Double treatment

The double treatment of cryolite was as effective as the single treatment and resulted in 68 per cent control (table 2). Here again, there were individual fields treated with a single application that performed slightly better than fields treated with double applications. Both lead arsenate and cryolite can effectively reduce the OLR population, although they may take up to two weeks; their effects last as long as 2½ months.

Integrated control

In integrated pest control, the effort is to use all available methods of insect control so they will complement each other and cause little or no biological disturbance or upsurge of secondary pests. Many of the broader-spectrum contact pesticides do not fit well into this kind of approach. For instance, in most cases, the use of wide-range contact insecticides for the control of OLR on grapes may result in the higher population densities of Pacific mites, *Tetranychus pacificus*, and other insect and mite pests. The stomach poisons, such as lead arsenate and cryolite, (systemic) insecticides and other selective compounds are considered basic to a successful program of integrated pest control. Such chemicals limit their action to the target species, thus sparing the natural enemies of both the target and non-target insects; in most cases, they cause relatively little disturbance in the existing biological balance and discourage the quick onset of insecticide resistance.

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THIS DISCUSSION OF FLOWER QUALITY is limited to the three major factors in grading: flower size (weight), stem size (weight per unit stem length) and stem length. In general, the larger the flower and stem, the higher the quality.

Many things influence quality-determining characteristics in carnations. Stem length varies with variety. In a recent greenhouse trial at Davis stem length of the shortest variety, Wogan, was 20 inches while that of the longest variety, Orchid Beauty, was 37 inches. A better known variety, Scania, averaged 28 inches. Greenhouse cultured flowers are longer stemmed than equivalent outdoor cultured flowers. What differences in environment are responsible for this is not known in detail. Also a warmer temperature (60°F greenhouse) during the life history of the shoot resulted in a 20 per cent longer flower stem than that achieved in a cooler greenhouse (50°F).

Less is known about weight per unit stem length since this has rarely been measured. The weight of the upper 50 cm (ca 20 inches) of stem of White Sim was found to average 16 grams for plants grown in a 50° case and only 12 grams for those grown in a 60° greenhouse. In a recent trial at Davis the weight of the upper 50 cm of stem was found to be 10 grams for the lightest variety (Light Pink Littlefield) and 21 grams for the heaviest variety (Peace River). Scania averaged 16 grams.

Flower weight

The weight of the flower also depends on which variety it is. Again referring to a recent trial at U. C. Davis, commercial varieties were found to vary from a low of 7 grams for the variety Pajee to a high of 12 grams for the variety Salmonaise. Scania averaged 11 grams per flower. A good commercial flower of the Sim variety can weigh 10 grams or more. Temperature is another important