ALTERNATIVES TO DORMANT TREATMENTS AND APHID MONITORING IN PRUNE ORCHARDS

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BACKGROUND

Alternatives to the traditional oil plus organo-phosphate dormant applications are needed to meet the growing environmental concerns. Dormant treatments with organo-phosphates such as diazinon and supracide have become suspected of drifting to nearby crops in the fog, killing raptors like the red-tail hawk wintering in orchards, and getting into regional waterways killing small invertebrates that are fish food. One alternative is a bacteria *Bacillus thuringiensis (BT)* which works on a select group of worm pests. BT is a stomach poison that, when ingested by the worms, makes them sick and later die. The BT program has proven to be an effective control for peach twig borer on prunes. However, we began to observe aphid infestations in prune orchards after several years of using BT on prunes. New approaches to aphid monitoring and control are needed if alternatives to dormant treatments are to succeed.

We have seen 3 species of aphids in prune orchards. The predominate aphid is the mealy plum aphid. This aphid is easy to recognize as the light green waxy aphid which does not curl the leaves. The leaf curl plum aphid, also present in several orchards, can be recognized by its light green color, and it severely curls the leaves. The third aphid is reddish brown and is the waterlily aphid. This aphid has only been found in small numbers and occurs occasionally on almonds after using BT.

Both the mealy plum aphid and the leaf curl plum aphid have similar life cycles. They both over winter as eggs. The eggs of the mealy plum aphid are black and covered with wax to match the waxy nature of the aphid. The egg of the leaf curl plum aphid is smooth and black. A green egg is a newly laid egg, and that is what you might see in November. A collapsed egg is one that has not been fertilized and will not develop into an aphid. After egg hatch the first instar nymphs are the same color as sepals so they are not easily visible. It is critical to know when the eggs hatch since oil treatments should be able to control aphids once they have hatched. Oil treatments applied before egg hatch only provides minimal aphid control (40%). The mealy plum aphid generally starts to hatch at bud swell and most are hatched by 5% bloom around March 10th. The timing of egg hatch will vary depending on climatic conditions. The more egg hatch, the better the oil spray is likely to provide control.

For the last several years, we have been developing a monitoring program for aphids so growers using the BT program can predict whether or not they will have an aphid problem. We have been trying to correlate over wintering eggs in a spur sample from prunes to aphid damage seen in the spring. This sampling system was not successful even after sampling 400 spurs per orchard.

Besides evaluating a new sampling system, rates of oils, timing, coverage, and oil phytotoxicity were the focus of our 1996 research

OBJECTIVES

1. Evaluate a fall sampling technique for the presence of aphids to determine treatment recommendations.

2. At several sites and at three timings (5% bloom and 10 days later, 5% bloom only, and at post bloom) compare the efficacy of oil treatments at different rates against aphids.

3. Observe any oil phytotoxicity as a result of the treatment.

4. Test liquid - lime sulfur and M-Pede (soap) as treatments for aphid control.

PLANS AND PROCEDURES

1. Fall Aphid Sampling Technique

In early November prune trees were sampled in orchards for the presence of aphids. Recordings were made where aphids were and were not found. In part of the orchard where aphids were not found dormant insecticides are not to be applied during the 96-97 winter. We will sample the trees in the spring of 1997 to see if aphids are present or not.

2. In Season Aphid Control

A. A replicated experiment originally conducted in 1995 in a mature prune orchard in Glenn County (Prune Research Reports 1995) was repeated in 1996. The treatments were: an untreated control, and 2 and 4 gallons per acre of Omni oil applied on March 18th at approximately 80 % bloom. A fourth treatment was added in 1996 and was 2 gallons of Omni oil applied on March 18th and again on March 26th at petal fall for a total of 4 gallons. The treatments were replicated three times and applied with a standard air blast sprayer at 100 gallons of water per acre and with recommended rates of Rovral and BT. On May 2nd, 1996 five trees within each treatment replicate were evaluated for aphid infestation and oil toxicity. The number of Mealy Plum Aphid (MPA) colonies and Leaf Curl Plum Aphid (LCPA) colonies were recorded. The number of shoot tips per tree infested by LCPA was also recorded. Any phytotoxicity as a result of the oil treatments was observed and recorded.

In an attempt to assess the potential for phytotoxicity as a result of interaction with the oil and subsequent fungicide applications label rates of Captan and Bravo were applied to three individual trees in each of the above treatments using a mist blower sprayer at 100 gallons of water per acre. These applications were made on March 25th, seven days after the first air blast applications were applied and one day before the second air blast application was applied to the fourth treatment listed above. The treated trees were evaluated for phytotoxicity two weeks after the materials were applied.

B. In a Sutter County, replicated, hand-gun trial, five treatments were applied to eight single tree replicates that had aphids the previous fall at the rate of 40 gallons water per acre and were evaluated for aphid control. The treatments were: 3 % liquid-lime sulfur, 3 % liquid-lime sulfur + 2 % Gavicide oil, 2% Gavicide oil, 4 % Gavicide oil and an untreated control. These treatments were applied on March 19, 1996 at 10 % bloom and were evaluated for aphid infestations and phytotoxicity on April 29, 1996.

C. In a Sutter County non-replicated air blast sprayer trial applied at 100 gallons per acre to every other row four treatments were applied on April 29, 1996 to blocks containing high levels of MPA. The treatments were 1.5 % Saftiside oil, 3 % Gavicide at 4 % Gavicide oil, and an untreated plot. On May 16, 1996 this trial was evaluated for aphid infestation and leaf phytotoxicity.

D. In a Sutter County, replicated hand gun trial applied to 10 single tree replicates with aphids six treatments were applied at approximately 400 gallons per acre. The treatments were: 1% Omni oil, 2 % M-Pede (soap) + 4 % Omni oil, 2 % M-Pede (soap), 2 % Omni oil, 4 % Omni oil and an untreated control. On May 28, 1996 this trial was evaluated for aphid infestations and phytotoxicity. Fruit phytotoxicity was measured on August 14, 1996.

E. In a Butte County replicated air blast sprayer trial applied at 100 gallons per acre the following treatments were applied:

		TREATMENT TIMING		
#	TREATMENT	5% BLOOM	FULL BLOOM	POST BLOOM
1.	2 gal. Omni oil/a	**X**		
2.	2 gal. Omni oil/a	**X**	**X**	
3.	4 gal. Omni oil/a	**X**		
4.	4 gal. Omni oil/a			**X**
5.	UNTREATED			

Treatments 1, 2, 3 & 4 also contained recommended rates of Rovral and BT.
Each treatment was replicated three times with replicates every three tree rows wide. Treatments were evaluated for aphid infestations on April 29, 1996.

RESULTS

1. Fall Aphid Sampling Technique

Twelve orchards in 4 counties were sampled for aphids in early November 1996. Trees with and without aphids were marked to be re-evaluated next spring. Aphids were almost always found on edge trees and near wind breaks.

If only trees with aphids in the fall have aphids next spring this will confirm our preliminary finding and indicate fall aphid sampling could result in a viable technique for determining treatment needs. If trees without aphids in the fall have aphids in the spring then this technique is of little value. This will be evaluated in the spring of 1997.

2. In Season Aphid Control

A. In this bloom time air-blast sprayer trial oil treatments reduced MPA populations compared to the control (Table A). However , unlike results obtained in 1995, the bloom oil treatments did not completely control MPA. LCPA counts were reduced compared to the control, but not significantly (Table A). The additional treatment of two gallons of oil applied eight days after the initial two gallon treatment did not improve control of either aphid species. In contrast to our 1995 results, the aphid control achieved by these treatments was not considered to be adequate and it was our judgement that an additional treatment would be advisable. Reasons for the different results between the two years are not clear. It may be that a warm fall in 1995 led to higher aphid populations which were not as easily controlled in 1996. We are planning to repeat this trial in 1997 to see if better results will be obtained. Phytotoxicity as a result of the oil treatments was not an issue in this trial.

No phytotoxicity was observed with either the Captan or Bravo treatments when they were applied one week after the oil treatments. However, when two gallons per acre of oil were applied one day after the fungicides, slight phytotoxicity was observed for both of the fungicides. The trees recovered and the damage did not appear to be significant. From these results it would appear that phytotoxicity is less of a concern if the fungicides are applied after the oil treatments than if they are applied before.

B. This hand-gun, high gallonage trial failed to control Mealy Plum Aphid possibly because treatments were applied before aphid egg hatch. No phytotoxicity was observed. Results from this trial can be found in Table B.

C. This non-replicated trial applied at 100 gpa by airblast sprayer failed to control aphids. This failure may have been due to poor coverage as a result of the low gallonage and the every other row application. No phytotoxicity was observed. Results from this trial are presented in Table C.

D. Treatments with 2 and 4 % oil completely controlled aphids in this replicated high gallonage hand-gun trial. One % oil was not adequate for aphid control. No leaf phytotoxicity occurred. Treatments with M-Pede (soap) caused a percentage of the fruit to lose their bloom and take on a reddish appearance. This color change was not detectable in the dried fruit. Results from this trial are presented in Table D.

E. This replicated air-blast sprayer trial at 100 gpa also failed to control aphids presumably due to poor coverage and low gallonage and/or because aphid egg hatch had not occurred prior to treatment application. Results from the trial are shown in Table E.

CONCLUSION

It will not be until the spring of 1997 before we can see if fall aphid sampling can be useful as a monitoring system. Edge trees and trees near wind breaks appear to be the best place to monitor for aphids.

Our results on in season oil treatments is confusing. Two or more % oil applied at high gallonage, in full coverage hand-gun treatments completely controlled aphids after aphids were present. Low gallonage air blast applications gave mixed results presumably because they were applied: 1) before aphids were present, and/or 2) coverage was not complete. Additional work in this area will take place in 1997.

Table A: Aphid Control with Bloom Oil Sprays					
#	TREATMENT	MPA COLONIES/ TREE	LCPA COLONIES/ TREE	LCPA INFESTED SHOOT TIPS/TREE	PHYTO.
1.	Untreated	3.0 A	1.0 A	8.7 A	0
2.	2 gal. Omni oil/A.	0.00 B	.13 B	2.6 A	0
3.	2 gal. Omni oil + 2 gal. Omni oil/A.	.33 B	.13 B	2.5 A	0
4.	4 gal. Omni oil/A.	.85 B	.14 B	6.7 A	0

Treatments 1,2,3,&4 were applied 3/18/96 (80 % bloom) with an airblast sprayer with 100 gallons of water per acre and Treatment 3 was also applied on 3/26/96 (petal fall) with airblast sprayer at 100 gallon water per acre.
Numbers followed by different letters are significantly different from each other at the 5% level using Duncan's Multiple Range Test.

Table B: Aphid Control with Bloom Spray		
	Aphid Colonies/Tree*	
TREATMENT	MPA	PHYTO.
3 % Liquid-lime sulfur	3.6 A	0
3 % Liquid-lime sulfur + 2 % Gavicide oil	3.3 A	0
2 % Gavicide oil	2.9 A	0
4 % Gavicide oil	2.3 A	0
UNTREATED	4.0 A	0

Treatments were applied on 3/19/96 (8 % bloom) by hand-gun at approximately 400 gpa.

* **Aphid Colonies/Tree can be equated to the following rating:**
1=NONE; 2=SLIGHT; 3=MODERATE; 4=HEAVY

Table C: Post Bloom Aphid Control

Aphid Colonies/Tree*

TREATMENTS	MPA	PHYTO.
1.5 % Saftiside Oil	3.5	0
3 % Gavicide Oil	2.7	0
4 % Gavicide Oil	2.2	0
UNTREATED	3.6	0

Treatments were applied by air blast sprayer at 100 GPA and applied to every other row.

* **Aphid Colonies/Tree can be equated to the following rating:**
1=NONE; 2=SLIGHT; 3=MODERATE; 4=HEAVY

Table D: Post Bloom Aphid Control

Aphid Colonies/Tree*

TREATMENTS	MPA	LEAF PHYTO.	% FRUIT BLOOM LOST
1 % Omni Oil	1.5 AB	0	0
2 % M-Pede (soap) + 4 % Omni Oil	1 B	0	.60
2 % M-Pede (soap)	1 B	0	.20
2 % Omni Oil	1 B	0	0
4 % Omni Oil	1 B	0	0
UNTREATED	2 A	0	0

Treatments were applied on May 24, 1996 by hand-gun in 400 gallons water per acre.
Treatments means followed by different letters are significantly different from each other at the 5% level by LSD.

* **Aphid Colonies/Tree can be equated to the following rating:**
1=NONE; 2=SLIGHT; 3=MODERATE; 4=HEAVY

Table E: Aphid Control with Bloom Sprays

#	TREATMENTS	% TREES WITH APHIDS (MPA)	PHYTO.
1.	2 gal Omni oil/A. at 5% bloom	50% AB	0
2.	2 gal. Omni oil/A. at 5% bloom + 2 gal. Omni oil/A. 10 days later	70% A	0
3.	4 gal. Omni oil/A. at 5% bloom	30% AB	0
4.	4 gal. Omni oil/A. at post bloom	50% AB	0
5.	UNTREATED	80% A	0

Treatments means followed by different letters are significantly different from each other at the 5% level by LSD.
Treatments applied by air blast sprayer at 100 gpa according to treatment schedule.

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