ENVIRONMENTALLY SOUND DRIED PLUM FARMING PRACTICES

F. Niederholzer
Ken Giles, UC Davis
Jim Markle, CURES

PROBLEM AND SIGNIFICANCE

Balancing cost-effective pest management with minimal environmental impact is an ongoing challenge for California agriculture. This project continues previous work on alternatives to traditional timings, rates and application methods of organo-phosphate or pyrethroid pesticides for aphid control.

Previous research has demonstrated that effective prune aphid control can be achieved with fall sprays of pyrethroids, and that these sprays result in less pesticide runoff from sprayed orchards than following dormant sprays applied before rain events. However, direct drift from fall or dormant sprays can contaminate waterways and/or other sensitive sites.

Research to identify spray drift reduction practices that effectively control the target pest while reducing application cost over grower standard practices -- especially at times when limited tree canopy increases the risk of such drift – is needed.

OBJECTIVES

1. Test low drift spray practices for pest control efficacy, drift prevention, and application cost.

PROCEDURES

We are in the second year of a two year project and are reporting on activities conducted between November, 2010 and 2011.

Year 1: A demonstration spray drift/aphid control trial was established in a 30 acre commercial orchard in Sutter Co. The orchard layout is 15’ down the row and 18’ across the row. Two different sprayer set-ups were used.

Treatment 1: Standard UC recommendations for spray application in prunes:

- 2.5 MPH ground speed
- 100 gallons per acre spray volume, 150 psi sprayer system pressure
- 2100 RPM on tractor tac -- 540 PTO speed
- High gear setting on the sprayer fan

- Standard nozzle sizes (D4/25 & D6/25) with 2/3 of spray volume delivered through the top half of the open nozzles. Nozzles are targeted to the tree.

Treatment 2: Low drift set up:

- 4.0 MPH ground speed
- 100 gallons per acre spray volume/150 psi sprayer system pressure
- 20% reduction in tractor engine speed:1650 RPM tractor -- 420 PTO speed
- Low gear setting on the sprayer fan
- Larger nozzle sizes (D6/25 and D12/25) were used due to the higher ground speed at the same spray volume/acre (100 gpa). D12 nozzles replaced the D6 nozzles in Treatment 1 and D6 nozzles replaced the D4 nozzles at the same sites on the spray booms.

The entire orchard was sprayed with Warrior (3 oz/acre) November 12-18, 2010. A John Deere Model 5105ML tractor was rented and a Slimline Manufacturing TurboMist S30P600S sprayer with a 600 gallon tank and a diaphragm pump was leased. Drift was collected on two cellulose pads (8" x 11") placed at 25, 50, 100, and 200 feet from the southern edge of the orchard on November 12. Weather data were measured throughout the application by mobile weather station.

Rows in the study orchard are aligned E-W. The six rows on the south of the block, adjacent and perpendicular to the drift sampling were sprayed in this drift trial. The eastern half of each row was sprayed with Treatment 1 and the western half with Treatment 2. Two sets of drift samplers were positioned to the south of the portion of the orchard rows sprayed with each of the treatments. There were four sets of drift samplers used for the entire experiment – two for each treatment. Drift samples were stored in the freezer until submitted for pesticide analysis of the Warrior active ingredient, lambda-cyhalothrin by a commercial lab.

After the six orchard rows were sprayed for drift measurement, the remaining rows were sprayed from November 13-18. Diesel use per spray tank used was measured by refilling the tractor's diesel tank after each spray tank was emptied. Treatments were not replicated, but applied in two separate demonstration blocks of 12 (Treatment 1) and 18 (Treatment 2) acres. No trees were left unsprayed. Aphid control was evaluated in spring, 2011.

Year 2: Work from year 1 was repeated in a replicated trial to test aphid control using the same treatments and tractor/sprayer. A different commercial orchard, 40 acres in size with a history of high aphid pressure was the study site. The entire orchard was sprayed on November 16-17, 2011. Three replicates of each treatment, each 6 acres in size, were created. The orchard layout is 18' down the row and 20' across the row. The entire orchard was sprayed with equal amounts of lambda-cyhalothrin either as 3 oz of Warrior or 1.5 oz/acre of Warrior II. A small, unsprayed control section was left untreated. Diesel used/tank and spraying time/tank were recorded. Aphid control will be evaluated in spring, 2012. Spray drift measurements were not taken.

RESULTS AND DISCUSSION

Year 1:

1. Weather data for November 12 showed mild temperatures (52-63^{o}F), high relative humidity (63-86%) and calm winds (< 1.5 MPH from the Northeast) during the time the time the spray treatments were applied. Winds were well below the recommended 10 MPH threshold for spraying cut off. See Table 1 for 15 minute weather data.
2. Pesticide drift was less for the low drift (Treatment 2) compared to the grower standard (Treatment 1). See Table 2.
3. Diesel use per 600 gallon tank was roughly half for treatment 2 compared to treatment 1 (Table 3). Spray time per tank (6 acres) was a third less in treatment 2 vs treatment 1.
4. No aphids were observed in any of the treated area (30 acres). The grower did not apply any in-season aphid treatments.

Year 2:

1. Similar time and cost savings results were obtained in Year 2 compared to Year 1 (Table 4). Diesel use per 600 gallon tank was roughly half for treatment 2 compared to treatment 1. Spray time per tank (6 acres) was a third less in treatment 2 vs treatment 1.

To date, our results suggest that it may be possible to maintain good pest control while reducing labor and fuel costs and pesticide drift when spraying with standard equipment (PTO sprayer, disc & core nozzles, etc.) in the late fall and, presumably, dormant season in prunes. If spring, 2012 evaluation shows no treatable aphid damage in the test orchard using the low drift treatment, then on-farm tests by grower during dormant spraying may be warranted.

Table 1. On-site weather data (15 minute averages) for 12 November, 2010 field spray tests in Sutter County, CA.

Time	Wind Speed (MPH)	Direction (from)	Temperature (^{o}F)	% Relative Humidity
Treatment 1				
0930	0.00	NE	53.1	85.6
9045	0.00	NE	53.1	87.0
1000	0.02	NE	53.1	87.3
1015	0.02	NE	53.6	85.5
1030	0.10	NE	54.9	81.5
1045	0.00	NE	56.1	77.7
1100	0.05	NE	56.5	76.3
Treatment 2				
1200	0.00	NE	59.2	71.8
1215	0.13	NE	59.3	71.9
1230	0.09	NE	60.1	69.6
1245	0.00	NE	60.7	68.2
0100	1.18	NE	61.1	67.1
0125	0.10	NE	61.8	64.2
0139	0.00	NE	62.5	62.6

Table 2. Lamba-cyhalothrin ground deposition onto two 8" x 11" cellulose cards (μg/2 cards) at each of five different locations at different distances directly south of the first prune tree row in the study orchard on November 12, 2010. Two card transects were established for each spray treatment. Detection limit = 0.05 μg. Where sample recovery was below the detection limit, "ND" is reported.

		---------μg lambda-cyhalothrin--------				
Sample	Treatment	25'	50'	75'	100'	200'
A	2	1.99	0.28	ND	ND	ND
B	2	2.42	0.28	0.11	ND	ND
A	1	9.42	1.56	1.06	0.45	ND
B	1	9.76	1.95	1.11	0.36	ND

Table 3. Diesel use and spray time per 600 gallon tank applied November 12-18, 2010. Spray volume was 100 gallons/acre. Tree planting was 15' down the row and 18' across the row.

Tank No	Treatment	Gallons of Diesel used	Spray time (min) per 600 gallon tank
1	1	2.75	66
2	1	2.44	66
3	2	1.06	40
4	2	1.19	50*
5	2	1.19	44

*unscheduled stop during application

Table 4. Diesel use and spray time per 600 gallon tank applied November 15-16, 2011. Spray volume was 100 gallons/acre. Tree planting was 18' down the row and 20' across the row.

Tank No	Treatment	Gallons of Diesel used	Spray time (min) per 600 gallon tank
1	1	4.13	76
2	2	2.19	40
3	1	4.08	73
4	2	1.50	46
5	1	4.47	72
6	2	1.55	48