Reducing Impact of Dormant Sprays

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Support from the Almond Board supplements a large multidisciplinary project (Zalom, PI) funded by the California Department of Pesticide Regulation (DPR). Its objective is to monitor the surface runoff of pesticides from orchards. The research focuses on the insecticide diazinon (an organophosphate) applied to the orchards during dormant season, and the movement of the insecticide out of the orchards after rainstorms. A potential mitigation measure for organophosphates applied to orchards in the dormant season is earlier treatment timing. It is presumed that drier soil conditions and lower probability of storm occurrence which are typical earlier in the dormant season of most years would facilitate water infiltration and allow time for pesticides to break down before storms, thereby reducing pesticide runoff. However, the timing at which dormant sprays are applied may also impact their efficacy against target pest species. This study describes research intended to test the hypotheses that acceptable pest control efficacy and reduced pesticide runoff would result from earlier dormant season applications. Our role on the project is the chemical analyses.

Procedure

The timing experiment was carried out in a Sutter Co. prune orchard. There were four treatments: Control (unsprayed); Early Season Dormant Spray (1/17/03); Mid Season Dormant Spray (2/4/03); Late Season Dormant Spray (2/24/03). Treatments were carried out in each of 3 randomized complete blocks in a mature dormant prune orchard where trees are planted on berms approximately 20 feet apart. Each treatment was carried out in a 50-meter long section of orchard floor between two berms using a gas-powered backpack sprayer to apply the diazinon directly to the ground in each plot. Diazinon was applied at a rate of 1 pound of active ingredient per acre. Diazinon was applied to the ground to: (1) reduce the variance of volume and total active ingredient applied in the plots; (2) eliminate the potential for drift from one plot to the next; (3) ensure that equal areas of ground are treated in all plots. In contrast, conventional spraying with an air-blast sprayer is much more difficult to control and the amount of material that adheres to the trees and/or drifts off-site are uncontrollable variables. It is fully recognized that applying all of the material to the ground will result in a higher than normal ground residual, but it can be viewed as representing a worse case scenario.

A second experiment investigated the concentrations of diazinon in rainfall on the boundaries of a sprayed dormant peach orchard. The southern half of the orchard was

sprayed on 1/31/03 and the northern half on 2/3/03. Rainfall was collected around and in a peach orchard that had been sprayed with 1 pound of active ingredient per acre. Collections were made on the upwind side (5 and 20 meters outside orchard, measured from the canopy) and to either side of the sprayed block (5 meters outside orchard), as well as on the downwind side (10 meters inside orchard and 5, 10, 20 & 40 meters outside orchard). Collections were made in duplicate in 2.8 L Pyrex glass pans raised a foot above the ground in the open (no branches overhead), 10 meters apart. Rainwater samples were transported to the laboratory on ice and then frozen at –20^{o}C for later chemical analysis.

Water sampling stations consist of an autosampler placed between berms. At the low end of sample areas, earthen dams were built diagonally across the area between the berms. Each dam isolates runoff to the defined area and directs the runoff water to one side where a 19 liter plastic bucket was buried in the soil. The runoff water was then pumped out of the bucket through a flow meter to a T-fitting that diverts 99% of the water back into the row downslope of the dam, and 1% to a Nalgene® tub to supply a composited sample for chemical analysis. The water samples were transported to the laboratory on ice and then frozen at –20^{o}C for later chemical analysis.

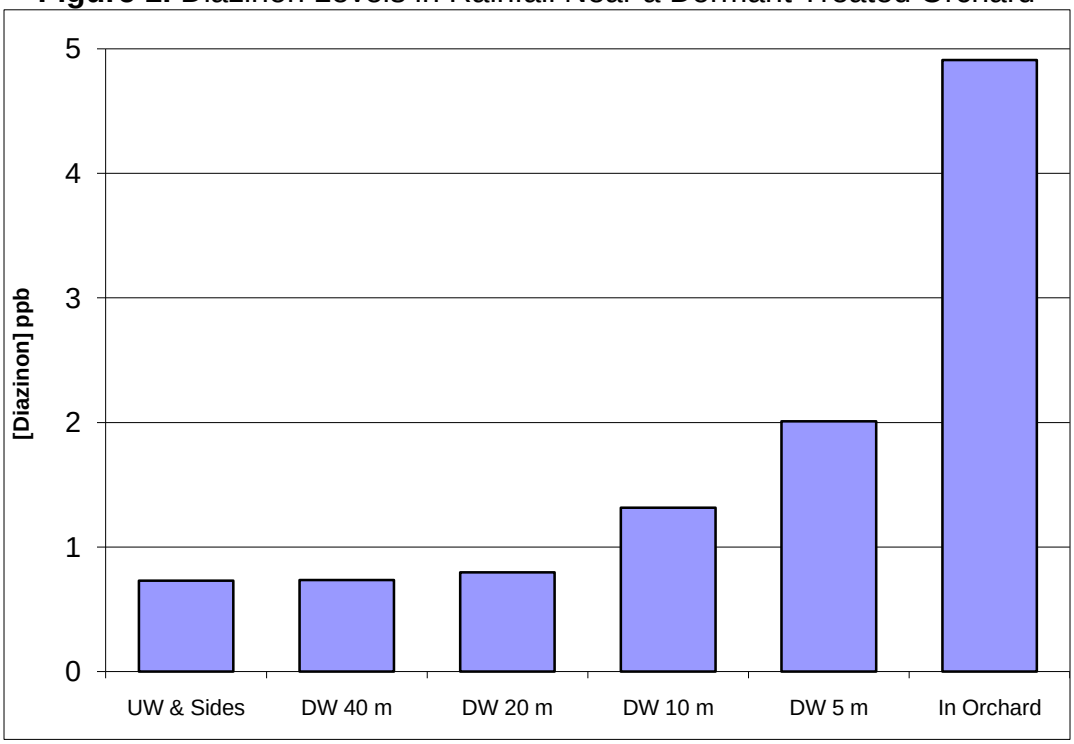
Diazinon was extracted from the water samples into ethyl acetate by one of two methods: solid phase extraction (for clean samples, e.g. rain water) or liquid-liquid extraction (for samples with sediment). The solvent extracts were analyzed by gas chromatography and compared to analytical standards to determine the concentration of diazinon present in the original sample.

Results and Conclusion

Water samples were collected from 3 different storm events: 1/22/03-1/23/03 (between Early and Mid spraying); 2/16/03-2/17/03 (between Mid and Late spraying); 3/15/03. At the time this report was being prepared analytical methods were being tested to meet recovery levels acceptable to DPR. Following that, levels of pesticide in runoff will be determined and results presented to the Almond Board.

The rainfall was collected over 2/12/03 to 2/16/03, 9 to 16 days after spraying. There was ½" on 2/12-2/13, and $1^{1}/_{8}$" on 2/15-2/16. The wind was weak to moderate, as reported by the two closest CIMIS stations: out of the SE at 3 (on 2/13) to 7 MPH (on 2/16) at Colusa; out of the SW at 1 MPH (on 2/212 & 2/16) at Oroville. Rainfall collected inside the orchard (10 meters from the downwind edge) contained 4.9 ppb diazinon. Figure 1 shows that diazinon concentrations in the rain downwind (north) of the orchard are about 40% at 5 meters and 25% at 10 meters compared to inside the orchard. Beyond that, at 20 and 40 meters downwind, levels are similar to upwind (south) and to either side (east and west). This higher level of pesticides in the rainfall near the orchard boundary should be kept in mind when considering movement into nearby waterways or when conducting environmental monitoring.

Figure 1. Diazinon Levels in Rainfall Near a Dormant Treated Orchard



UW = Upwind, DW = Downwind; m = meters
Diazinon concentrations are the average of 2 samples.