Contribution of Backwash Effect from an Axial-Fan Orchard Sprayer to Downwind Drift Potential

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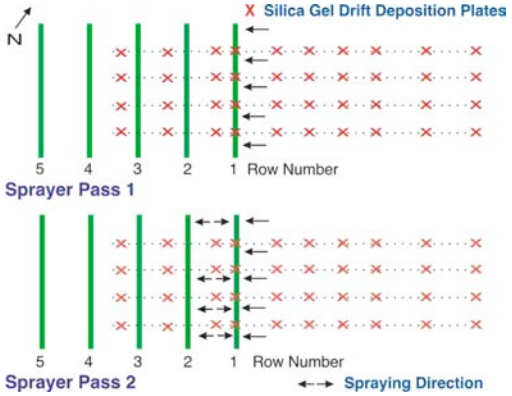
① Background & Hypothesis

- Spray drift from orchards is a serious concern because the insecticides used can be hazardous to nontarget organisms. To minimize drift, the EPA-approved product labels for insecticides applied from axial fan airblast sprayers dictate that the outward pointing nozzles should be turned off when spraying the outer two tree rows. However, air backwash from the axial fan rotation of the sprayer may contribute to out-of-field drift.
- This experiment measured and compared the amount of drift due to spraying the first row of an orchard with one set of nozzles to a second spray of the first two rows using the conventional method of spraying.

An axial fan airblast sprayer in conventional operation

Example of the sprayer backwash effect when the outer nozzles are off

② Experimental Design



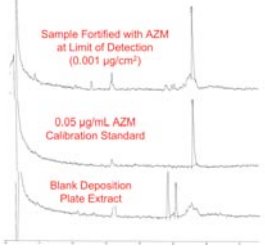
1. Guthion insecticide (azinphos-methyl, AZM) was sprayed in two passes to the first 50 trees in rows 1 & 2 of a commercial apple orchard.
2. The first pass sprayed row one from out to in with the leeward nozzles in the off position.
3. The second pass sprayed rows 1 & 2 with nozzles on each side of the sprayer in the on position.
4. For each sprayer pass, silica gel deposition plates were placed on the ground along four transects extending perpendicular from tree row one. Each transect was considered a replicate experimental unit.

③ Sampling

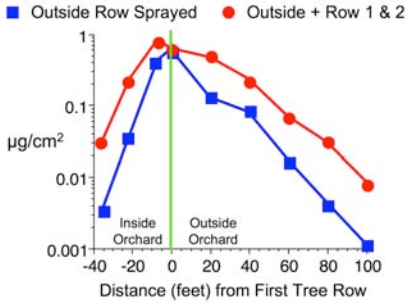
1. Silica gel drift deposition plates were placed at distance intervals of -35, -21, -7, 0, 20, 40, 60, 75, 100, and 150 ft along the transects. The plates were tethered on the ground with wires bent over two sides of the plate.
2. After the first pass treatment, the plates were collected, wrapped in aluminum foil and held in a cooler until returned to the FEQL lab.
3. After the second pass treatment, the plates were treated in the same manner as in the first pass.
4. After the deposition plates were returned to the lab they were frozen until analyzed.

④ Analytical Methods

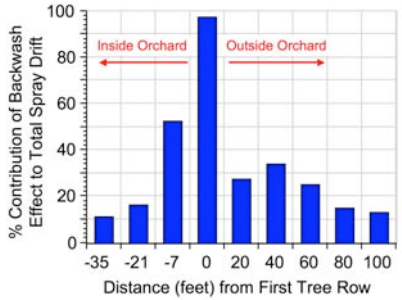
1. Plates were cut into small pieces and placed in jars with 30 mL of acetone:hexane (1:1). Jars were shaken for 20 minutes at high speed.
2. Extracts were filtered and then concentrated to dryness on a vacuum rotary evaporator.
3. The Guthion residues were re-dissolved in ethyl acetate.
4. Guthion residues were detected and quantitated using a gas chromatograph (GC) equipped with a PFPD (pulsed flame photometric detector).
5. Limit of detection was determined to be ~0.001 µg/cm².



⑤ Results



- Residues of Guthion were detected at a distance of 100 feet from the orchard following both 1 & 2 sprayer passes. However, residues were lower when only one pass was made.
- Residues were also detected in the alleys between unsprayed rows.



- The backwash effect contributed ~35% of the total drift outside of the orchard with a maximum contribution at 40 feet downwind.

⑥ Conclusions

The air backwash effect contributes significantly to drift. The current product label direction for outside row spraying will not minimize residues depositing outside of the orchard. A device is needed on the sprayer to reduce the effect of the air backwash.

⑦ Acknowledgments

The following organizations contributed financial resources to carry out this research: Am. Chem. Soc; MESA; WSU College of Sciences; FEQL; EPA Region 10,Wilbur Ellis. I especially appreciate the technical assistance of Kevin Montgomery, Jules Ruppert-Felsot, Bill Bagley & my mentor, Dr. Allan Felsot.