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REDUCING DORMANT SPRAYS AND THEIR IMPACT ON THE ENVIRONMEN

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ABSTRACT

Organophosphates (OPs) such as diazinon and chlorpyrifos have been applied as a dormant spray to orchard crops, such as almonds, prunes, peaches and other stone fruits, in California for a number of years. The sprays have been effective in controlling pests such as Peach Twig Borer (PTB) and San Jose Scale. But, these OPs have been shown to expose wildlife (specifically treaty protected Red-tailed Hawks), drift onto unregistered sites (such as specialty vegetables), and appear in the Sacramento and San Joaquin river drainages at levels lethal to Ceriodaphnia, an invertebrate species used as a sentinel by the EPA. Field tests continue on reducing the rate of diazinon application and risk to sentinel birds without loss of insect control and experiments began to model runoff from orchards and to study toxicity to Ceriodaphnia and native invertebrate aquatic species.

OBJECTIVE

The overall goal of the project is to maintain efficacy of OP dormant sprays while reducing their risks to people and the environment. This year's field studies examined use of lower rates of diazinon, deposition of agent on the trees and maintenance of control against PTB. A microchamber model of an orchard floor was constructed and work was initiated on runoff and toxicity of dormant sprays to invertebrates. The approach is based on the Integrated Pest Management strategy that the use of less OPs will cut down drift onto non-target crops, reduce exposure to wildlife, decrease levels of OPs in surface water run-off, and reduce the cost to growers. The objectives outlined in the proposal were to:

1. Evaluate reduced AI/acre.
2. Determine OP residues in the orchards.
3. Measure off-target movement of OPs via drift and surface runoff.
4. Assess the effectiveness of the test conditions on control of insect populations.

PROCEDURE

Two demonstration field studies took place in the winter of 1995; one was in an almond orchard in Clovis, CA with 30-40 foot trees on January 19-20, 1995; the others was in an almond orchard in Easton, Ca with 12-15 foot trees on February 1, 1995. Early in March, corrugated cardboard bands were placed around tree limbs to trap PTB larvae; they were collected in mid-April to assess the number of PTB pupae surviving the sprays. Twigs from the same trees were collected and diazinon residues determined by gas liquid chromatography.

RESULTS AND CONCLUSIONS

Table 1. Control of Peach Twig Borer with Diazinon (1995 Season)

Orchard	Rate	Peach Twig Borer	Deposition
Easton	0	5.07 ± 2.20 a	0.82 ± 0.13 b
	2	5.50 ± 3.44 a	5.59 ± 1.15 c
	4	6.80 ± 3.12 a	10.12 ± 2.73 d
Clovis	1.5	3.00 ± 3.43 x	4.49 ± 0.94 y
	3	3.43 ± 1.99 x	8.42 ± 3.28 y

Rate = pounds of active ingredient per acre.
Peach Twig Borer = # of pupae counted per tree.
Deposition = ug of diazinon per square cm.
Values with the same letter are not significantly different ($p < 0.01$).

Table 2. Control of Peach Twig Borer with Diazinon 50W (1994 Season)

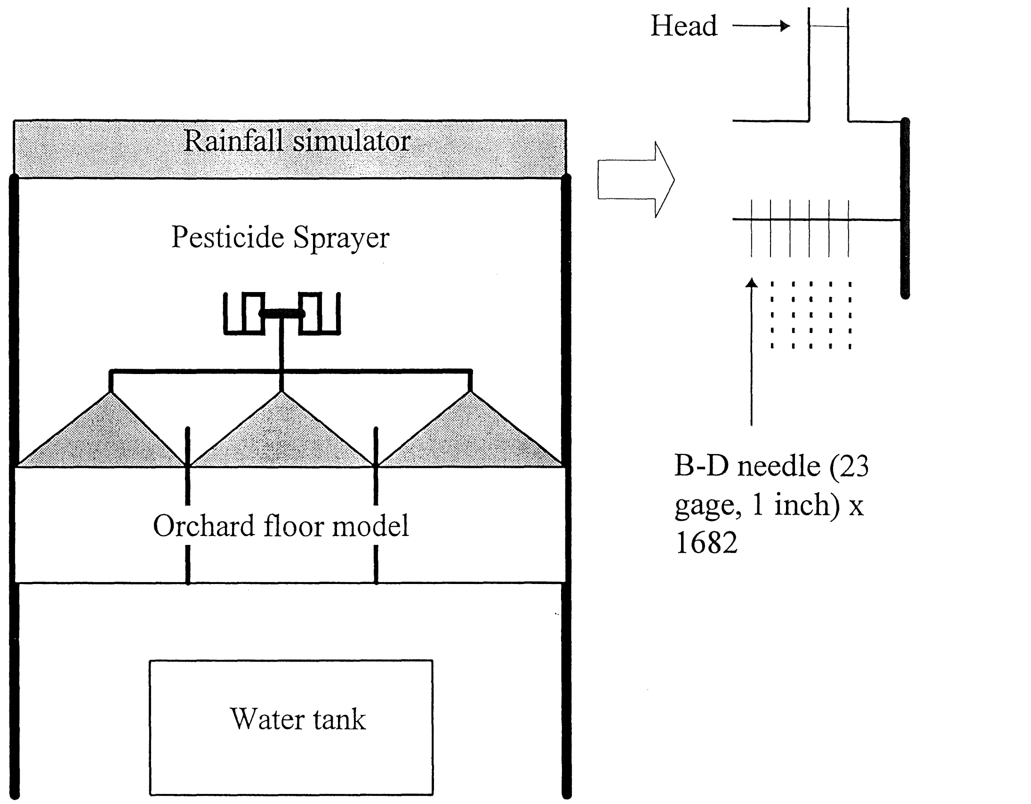
Test	Rate	GPA	Deposition	Upper Deposition	Strikes/Tree
A	0	100	0.09 a	0.09 e	1.92
B	0.125	100	0.37 ab	0.4 e	0.78
C	0.25	100	0.38 ab	0.38 e	0.78
D	0.5	100	0.75 bc	0.74 ef	1.05
E	1	100	1.25 cd	1.29 fg	0.28
F	2	100	2.68 e	2.81 h	0.6
G	1	50	1.58 d	1.60 g	0.5
H	1	300	1.76 d	1.70 g	0.4

Rate: pounds active ingredient per acre; GPA: gallons water per acre.
All treatments included dormant oil at 4 gpa, except test G with oil at 3 gpa.
Deposition: on entire tree, values normalized against average deposition of all treatments.
Upper deposition is on the upper part of the tree.
Values with the same letter are not significantly different ($p<0.05$).

Table 1 summarizes data on deposition of diazinon and PTB strikes. The amount of diazinon deposited was correlated with its rate of application. The more diazinon applied, the more was deposited on the trees. Low levels of PTB were present in these and other orchards in the winter of 1995 (Zalom, private communication and Almond Board Project 95-C1), and the dormant spray had little effect. Work during the preceding winter (Table 2) demonstrated that application rates lower than the standard 2 lbs AI/acre of diazinon controlled PTB, leading co-investigator Zalom to recommend reducing the OP portion of dormant sprays under conditions of low infestation.

Mark Grismer and graduate student Pochi Watanabe designed and constructed a micro-ecosystem model of an orchard floor (Figures 1 and 2) to simulate dormant spray environments and remediations such as the use of vegetative filter strips. It is equipped with sprayer heads for rain and pesticides, and sampling ports. Calibration of the device is underway. Results obtained from it will lead to models that can be used to compare its results with those obtained from field studies on this project and the work of others.

Aquatic toxicologist David Hinton and irrigation specialist Terry Prichard have joined the project. Next steps on the project are to carry out more field studies on full and half application rates in areas anticipating high infestations of PTB and to compare the toxicity of dormant sprays to Ceriodaphnia and to local invertebrate aquatic species. Two kinds of field studies will be done: one will emphasize runoff using fan spray applications; another will emphasize efficacy of insect control using backpack sprayers and study of individual trees. Deposition measurements will provide the common denominator between the two kinds of studies enabling us to compare risks (runoff and aquatic toxicity) to benefits (efficacy of insect control). The spraying took place during the winter of 1996. Field samples have been taken. Residue analysis and insect assessments will be done in the coming months.



Cross sectional view of Microecosystem set up.

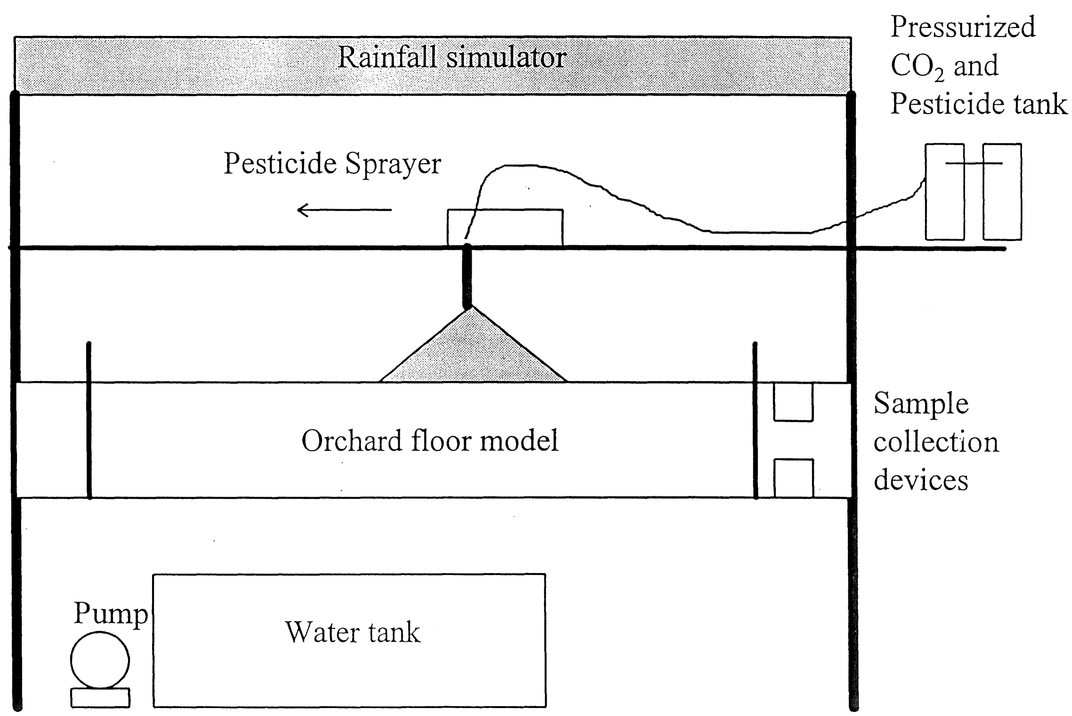


Figure 1. Microecosystem model.

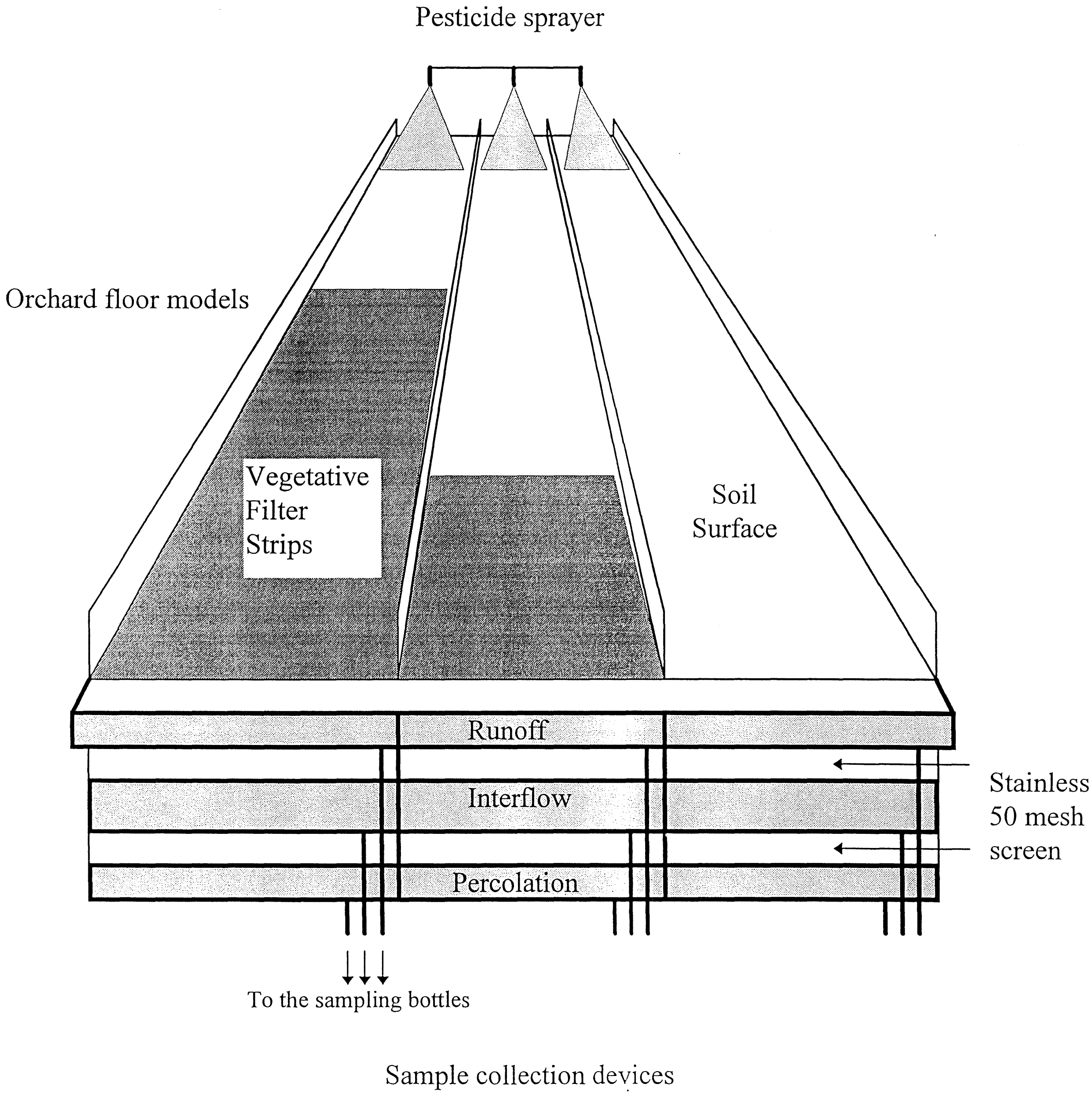


Figure 2. Orchard floor models and sample collection devices.