Department of Pesticide Regulation
Environmental Monitoring Branch
1001 I Street
Sacramento, CA 95812

Study 244: Sediment ponds as a management practice to reduce pesticide runoff in almonds.

Sheryl Gill
July 22, 2009

I. INTRODUCTION

This study is part of a large research grant project titled *Implementing Integrated Pest Management Practices (IPM) and Best Management Practices (BMPs) to Reduce Organophosphate (OP) and Pyrethroid Runoff in Agricultural Land, San Joaquin Watershed*. The project is funded by a Proposition 50 Agricultural Water Quality Grant awarded to the Coalition for Urban/Rural Environmental Stewardship (CURES).

Sediment ponds or retention basins are promoted as a best management practice to help reduce sediment and pesticide runoff from orchards. This study will test the efficacy of sediment ponds in the removal of pyrethroid and organophosphate residues from agricultural runoff in orchards.

II. OBJECTIVE

The purpose of the study is to 1) quantify whole water runoff concentrations of an organophosphate and a pyrethroid hull split spray, and 2) determine the effectiveness of sediment ponds in reducing concentrations and total loading of pesticides in irrigation tailwater.

III. PERSONNEL

This is a cooperative study between several entities, including the Department of Pesticide Regulation (DPR), the Department of Fish and Game (DFG), and the University of California, Davis (UCD) under the direction of the Coalition for Urban /Rural Environmental Stewardship (CURES). DPR Environmental Monitoring Branch staff - under the general direction of Kean S. Goh, Environmental Program Manager - are responsible for collecting and transporting samples for chemical analysis. Key personnel are listed below:

Project Leader:	Sheryl Gill
Field Coordinator:	Jessica Mullane
Research Scientist:	Frank Spurlock

Chemists: California Department Fish and Game- Fish and Wildlife Water Pollution Control Laboratory

Questions regarding this study should be directed to Sheryl Gill, Senior Environmental Scientist at (916) 324-5144, sgill@cdpr.ca.gov.

IV. STUDY PLAN

The study site is a 140 acre orchard near Chowchilla in the San Joaquin Valley. The orchard is divided into numerous blocks, 80 acres of which are planted with Nonpareil almonds. A 40 acre block of the orchard will be used for this study (Fig 1). The entire block will be treated with a tank mix of chlorpyrifos (2 lb ai/A) and lambda cyhalothrin (0.04 lb ai/A) at the hull-split stage. The spray will be applied using the grower's air blast sprayer.

Flood irrigation will begin approximately 48 hours after application. The field is irrigated in five sets that last approximately 12 hours each (Fig 1). It takes three days to irrigate the entire field. All tail water leaving the block drains to a collection ditch (Fig 2) and then into a sediment retention basin (Fig 3). A recirculation pump returns the water from the basin for reuse in other parts of the orchard.

Samples of irrigation drainage will be taken at entrance and exit of the sediment basin and analyzed for residues of lambda-cyhalothrin, chlorpyrifos, total suspended solids (TSS), and total organic carbon (TOC). In addition, water volume will be measured at the inflow and outflow of the pond to allow determination of lambda-cyhalothrin and chlorpyrifos flux.

Sampling Regime

Chlorpyrifos runoff samples will be collected at the entrance to the sediment pond for each of the five irrigation sets. Samples will be collected every hour for the duration of the runoff event. Runoff will likely last for six to ten hours.

Lambda cyhalothrin runoff samples will be collected at the entrance to the sediment pond for irrigation sets 1, 3, and 5. CURES will collect samples for irrigation sets 2 and 4. Samples will be collected every hour for the duration of the runoff event. Runoff will likely last for six to ten hours.

The pond outflow will be monitored every hour for the duration of pumping. It is unknown how long the recirculation pump will run.

Total suspended sediment samples will be collected along with every runoff sample. Two total organic carbon samples will be collected from each irrigation event.

Discharge Measurements

Runoff volume will be estimated at both the entrance and exit of the sediment pond for the duration of the study. An ultrasonic Doppler flow meter and timer will be used on both the inlet and outlet. A UC Extension Specialist will be responsible for collecting this data.

Sampling Methods

Water Samples

Whole water (un-filtered) runoff samples will be collected from the inflow and outflow points into 1-Liter amber glass bottles following DPR SOP FSWA008.00 *Sampling for surface water runoff in agricultural fields* (Spurlock, 1999).

Suspended sediment measurements will be performed on companion samples collected at the same sampling location and time as the whole-water samples. Measurement will be conducted by DPR staff using vacuum filtration of the samples and subsequent oven drying of the filtrate collected on tared oven-dried filters following EPA method 160.2 *Residue, Non-Filterable (Gravimetric, Dried at 103-105°C)* (US EPA, 1971).

Transportation of samples will follow DPR SOP #QAQC004.01, *Transporting, packaging and shipping samples from the field to the warehouse or laboratory* (Jones, 1999a). A chain-of-custody record will be completed and accompany each sample. Number and type of samples to be collected is detailed in Table 1.

V. CHEMICAL ANALYSIS AND QUALITY CONTROL

The California Department of Fish and Game, Fish and Wildlife Water Pollution Control Laboratory will analyze water samples for pesticides. Quality control (QC) will be conducted in accordance with approved Quality Assurance Project Plan. Ten percent of the total number of samples will be submitted with field samples as blind spikes and ten percent as field blanks and duplicates.

Method detection and reporting limits for chlorpyrifos and lambda cyhalothrin are reported in Table 3.

VI. DATA ANALYSIS

Discharge water volume and dissolved lambda cyhalothrin and chlorpyrifos concentrations measured at the inflow and outflow sites will be used to determine fluxes in load. Paired t-tests will be used to compare changes in pesticide concentrations between the inflow site and outflow point of the pond.

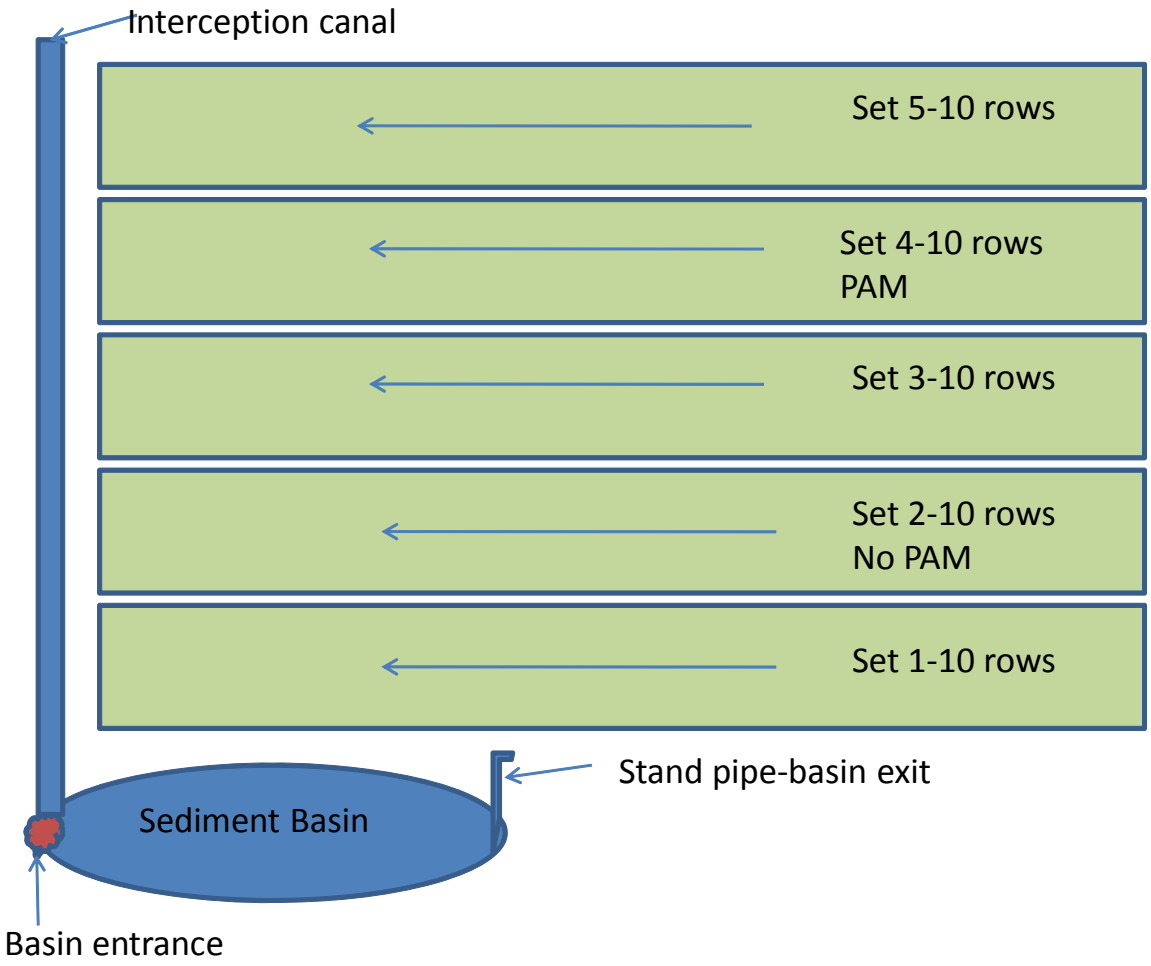

Figure 1. Study site schematic.

Figure 2. Drainage ditch.

Figure 3. Sediment retention basin

VII. LAB BUDGET

Table 1. Lab budget and sampling breakdown.

Lab Budget	# Samples	Cost	
OP Runoff	50	294	14700
Pyrethroid Runoff	30	294	8820
Pond outlet- OP	30	294	8820
Pond outlet-PY	10	294	2940
Method Verification	12	294	3528
Field Blanks	2	294	588
Duplicates	8	294	2352
Blind Spikes	10	294	2940
		Sub total	44688
DFG Overhead		21.90%	9786.672
		Total	54474.67

Table 2. Method detection and reporting limits for selected OPs and pyrethroids in water and sediment.

OPs in Water					
Chlorpyrifos	0.02	0.05	Esfenvalerate	0.002	0.005
Diazinon	0.005	0.020	Lambda Cyhalothrin	0.002	0.005

VIII. LITERATURE CITED

Jones, D. (1999a). Transporting, packaging and shipping samples from the field to the warehouse or laboratory. DPR SOP QAQC004.01. Retrieved online July 31, 2007 http://www.cdpr.ca.gov/docs/empm/pubs/sops/qaqc0401.pdf.

Spurlock, F. (1999). Sampling for surface water runoff in agricultural fields. DPR SOP FSWA008.00. Retrieved online July 31, 2007 from http://www.cdpr.ca.gov/docs/empm/pubs/sops/fswa008.pdf.

US EPA (1971). U.S.EPA National Exposure Research Laboratory (NERL) Method 160.2. Residue, Non-Filterable (Gravimetric, Dried at 103-105). Retrieved online July 31, 2007 from http://web1.er.usgs.gov/nemi/method_summary.jsp?param_method_id=5213.