



**Department of Pesticide Regulation
Environmental Monitoring
1001 I Street
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Study 215: Protocol for determining the runoff potential of esfenvalerate in a prune orchard with managed floors. A sampling plan for a cooperative project by DPR and the Glenn County Surface Water Stewardship Program.

I. Introduction

The Glenn County Surface Water Stewardship Program, which is comprised of local growers, pest control advisors, academic institutions and government agencies, was formed in 1997 to reduce the offsite movement of pesticides, fertilizers, and soil. The Stewardship Program provides outreach to industry, develops demonstration sites, and cooperates with other agencies to test management practices (GCSWSP, 2001). This project will be a cooperative effort with DPR and the Stewardship Program at an orchard floor cover crop demonstration site established by the program five years ago.

Esfenvalerate is increasingly used in the dormant season in stone fruit and nut orchards as a replacement for diazinon. Statewide there were 8,952 lbs of esfenvalerate used in fruit and nut orchards during the 2000-2001 dormant season. Nearly 1,800 lbs were used in the six counties (including Glenn) in the upper Sacramento and Feather River Watersheds (DPR, 2001). Reliable monitoring data for evaluating potential off-site movement of dormant season pyrethroids from orchards, including esfenvalerate, are sparse. This study will test the rainfall runoff potential of esfenvalerate in a prune orchard with managed floors during one runoff event.

II. Objective

The objective of this study is to evaluate the potential for runoff of esfenvalerate from dormant-season applications in orchards. This evaluation will be based on three types of samples:

1. Whole-water orchard rainfall runoff samples,
2. Edge-of-field whole-water samples taken from a drainage ditch receiving runoff from the treated orchard, and
3. Post-runoff sediment samples from the drainage ditch.

III. Personnel

This study will be conducted by staff from the Environmental Monitoring Branch under the general direction of Kean Goh, Ag. Program Supervisor IV. Key personnel are listed below:

Project Leader: Sheryl Gill

Field Coordinator: Roger Sava

Senior Scientist: Frank Spurlock

Laboratory Liaison: Carissa Ganapathy

Chemists: Jane White and Hsiao Feng

Collaborators:

Craig Vereschagin, Three V Ranch

Fred Degiorgio, Du Pont

Ed Romano, GCSWSP

Rey Lopez, GCSWSP

Bill Duckworth, GCSWSP

Fred Thomas, Cerus Consulting

Frank Zalom, UC Davis, Dept. of Entomology

Mike Oliver, Retired UC-IPM, consultant

Steve Gruenwald, PCA

IV. Study Design

The study site is a 300 acre Glenn County prune orchard located near the town of Artois. Forty-eight rows of the orchard were planted with cover crops in 1998 as part of a research and demonstration project. The current study is comprised of 2 parts.

A. Study components

1. Esfenvalerate in-field runoff concentrations and cover crop effects

This portion of the study is a designed experiment, and the purpose is to quantify within-orchard whole water esfenvalerate runoff concentrations, and to determine if either these concentrations or total water runoff volume are significantly different for two different floor management treatments. These treatments are a perennial sod cover crop planted in row middles, and bare ground in the middles. Each treatment will be replicated six times for a total of twelve study plots. Runoff water samples will be collected from the orchard floor row middles of the plots in the first significant rainfall event after esfenvalerate application. These samples will be taken at fixed intervals after runoff begins. Auto-samplers designed by UC Cooperative Extension (Zalom, 2001) will be placed in the treatment rows to determine runoff volume in the rows.

2. Esfenvalerate movement off-site to edge-of-field drainage ditch.

The second portion of this study consists of collecting observational data of off-site concentrations of esfenvalerate in both whole-water and sediment in the adjacent drainage ditch that receives runoff from the orchard.

B. Esfenvalerate Application

Esfenvalerate will be applied to the entire orchard at normal label rates, with the timing determined by the grower's PCA. A spray tank sample will be taken to determine esfenvalerate concentration in the application mix, and the volume applied will be recorded. These data will be used to estimate the actual application rate.

C. Samples:

Samples will be taken during the first significant rain event following esfenvalerate application. Background and post event samples will also be taken. Whole-water samples will be collected directly into 1 liter amber glass bottles and will be extracted in their entirety, including the bottle. The whole-water samples will not be filtered prior to extraction.

1. Background samples

A total of four composite background soil samples will be taken from the row middles of the treatment blocks prior to esfenvalerate application. Each sample will be a composite of samples taken from the three treatment rows within the block. Four soil samples will also be taken at a pre-determined interval along the drainage ditch at the end of the field. Two whole-water grab samples will be taken from the holding pond at the bottom of the orchard. One tank mix sample will be taken just prior to application.

2. Within-row whole-water runoff samples

Forty-eight whole-water grab samples will be taken in the middles of treated rows during the runoff event. This will consist of four samples per treatment row taken at a pre-determined time interval.

3. Drainage ditch whole-water samples

Four whole-water runoff samples will be taken from the drainage ditch and holding pond during the runoff event.

4. Post-application middles samples

Twenty-four post runoff soil samples will be taken from the middles of treated rows within ten days of the rain event. These samples will consist of two samples per treated row.

5. Drainage ditch sediment samples

Four post runoff soil samples will be taken from the drainage ditch within ten days of the rain event.

Table 1. Estimated number samples†

	Sediment	Water
Background	8	2
Tank Mix		1
Runoff Event		52
Post Runoff	28	
Total	36	55

† excluding QA/QC samples

V. Chemical Analysis

All samples will be submitted to California Department of Food and Agriculture Center for Analytical Chemistry (CDFA) for esfenvalerate analysis. Analysis of esfenvalerate in water, soil and sediment will be accomplished using gas chromatography with electron capture detection (GC/ECD). Gas chromatography with a mass selective detection (GC/MSD) will be used to confirm the soil and sediment samples. Ongoing quality control samples will be ten percent of the total number of analyses, submitted with field samples as field blanks and blind spikes.

Table 2. Method reporting limits

Pyrethroid Pesticides in Surface Water Method: GC/ECD		Pyrethroid Pesticides in Sediment Method: GC/ECD, confirmed with GC/MSD	
<u>Compound</u>	<u>Reporting Limit</u> ($\mu\text{g/L}$)		<u>Reporting Limit</u> ($\mu\text{g/g}$)
Esfenvalerate	0.05	Esfenvalerate	0.01

VI. Data Analysis

Esfenvalerate concentrations in water and sediment will be reported in micrograms per liter ($\mu\text{g/L}$). Runoff volume from the sampled rows will be reported. Population means or medians of the two treatments will be compared to determine differences in esfenvalerate concentration and runoff volume using standard statistical procedures. Mass balance will be estimated based on runoff volume, runoff concentrations, and post-application middles soil samples.

VII. Time Table

Site Preparation: November- December 2002

Sampling: December, 2002- February, 2003

Data Analysis: June- August 2003

Final report: September 2003

VIII. References

DPR, 2001. Draft pesticide use report data summary, 2001.

GCSWSP, 2001. Glenn County Surface Water Stewardship Pommittee. Field day and tour handout. May 25th, 2001.

Zalom, F.G., M.N. Oliver, W.W. Wallender, I. Werner, B.W. Wilson, W.H. Krueger, B.T. Angermann, L.A. Deanovic, T.S. Kimball, J.D. Henderson, G.H. Oliveira, and P. Osterli, 2001. Monitoring and mitigating offsite movement of dormant spray pesticides from California orchards, in review.

IX. Budget

Table 3. Proposed budget

Staff			Cost
	Env. Scientist (\$25/hr)	500 hours	\$12,500
	Senior & Supervision (\$32/hr)	100 hours	\$3,200
	Staff Benefits (31%)		\$4,867
	Student (\$11/hr)	50 hours	\$550
	Admin. on Personnel Services (31.15%)		\$6,578
		Total Personnel	\$27,695
Samples	Sediment and water	100 samples @ \$300	\$30,000
Service orders	Study site maintenance		\$700
	Dormant spray		\$1,000
Equipment	Auto-samplers	5 samplers @ \$500	\$2,500
			\$34,200
		Grand Total	\$61,895