Department of Pesticide Regulation
Environmental Monitoring Branch
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Protocol for Study #242: Vegetated Ditches as a Management Practice for Reducing Offsite Movement of Lambda Cyhalothrin in Irrigated Alfalfa.

I. INTRODUCTION

This study is part of a larger Pesticide Research and Investigation of Source and Mitigation (PRISM) Grant Program project designed to demonstrate the use of several best management practices (BMPs) to reduce pesticide loading in return water from irrigated crops in the Orestimba Creek watershed. Previous research indicates that irrigation ditch vegetation may play an important role in reduction of pesticides in runoff from agricultural fields (Cooper *et al.*, 2004; Gill 2006). This study demonstrates a constructed vegetated ditch as a potential BMP for reducing offsite movement of lambda cyhalothrin to surface water in irrigated alfalfa.

II. OBJECTIVE

This study is designed to evaluate the effects of two management practices on lambda cyhalothrin concentrations in irrigation runoff from alfalfa. The management practices will include (1) a standard irrigation return ditch dredged to remove vegetation just prior to irrigation event and (2) a specially constructed ditch planted with grasses to provide a dense cover of vegetation for the irrigation event (Figs. 1 and 2).

The evaluation will be based on whole-water (unfiltered) irrigation runoff samples collected at the inflow and outflow points of both the standard and vegetated ditches. The effect of the management practices will be determined as the difference between lambda cyhalothrin concentrations in runoff entering and exiting the ditches.

III. PERSONNEL

This is a cooperative study between several entities, including the Department of Pesticide Regulation (DPR), the Department of Fish and Game, and the Coalition for Urban and Rural Environmental Stewardship (CURES) under the direction of the San Luis and Delta-Mendota Water Authority. Funds for this project are provided by the California State Proposition 13 (2000 Water Bond) PRISM Grant Program. The vegetated ditch system was designed by staff from Ducks Unlimited. DPR Environmental Monitoring Branch staff - under the general direction of Kean S. Goh, Agricultural Program Supervisor IV - is responsible for collecting and transporting samples for chemical analysis. Key personnel are listed below:

Project Leader: Sheryl Gill
Field Coordinator: Jerah Frye
Senior Scientist: Frank Spurlock
Chemists: California Department Fish and Game

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

IV. STUDY PLAN

The study site is a 75 acre commercial alfalfa field near the cities of Crow's Landing and Patterson in the San Joaquin Valley of California. The soil type at the site is a Vernalis-Zacharias Complex clay loam (USDA, 1997). Lambda cyhalothrin is commonly applied at the site during the irrigation season to control several species of weevils and worms (Fig 3).

The study field is flood irrigated using two sets of gated pipe, one set at the top of the field and one set midway through the field. The field, which is divided into ten irrigation sets that are rotated every twelve hours, takes a total of five days to irrigate (Fig 2). Each irrigation set waters approximately 7 acres and results in a discrete runoff episode that lasts four to six hours. It takes approximately eight hours for water to travel down the field and reach the drainage ditches at the low end of the field (Fig 1). Tail water leaving the site drains into a small creek, which flows through a pipe to Orestimba Creek and eventually to the San Joaquin River. Water is applied at rate of 10 cm to 15 cm.

Samples will be collected from one irrigation event following a lambda cyhalothrin application. The application will occur between July and September 2007. Application timing and rate will be determined by the grower's pest control advisor (PCA).

Irrigation Runoff Samples

Samples of the irrigation return water will be taken every half hour for three hours during each runoff episode at each of three sampling sites (Table 1).

Table 1.

Sample Type	Number Samples
Runoff Water Samples	120
Lab QA Spikes	12
Method Validation	15
Blind Spikes	6
Field Blanks	2
Duplicates	4

Sample Site 1 (Figs. 1 & 2) represents the inflow location for both the conventional and vegetated ditches. Samples will be collected just upstream of the water control structures that split the water into the two test ditches.

Sample Site 2 (Figs. 1 & 2) represents the outflow location of the 200 m long vegetated ditch. Samples will be collected from the vegetated ditch just upstream of the stand pipe that carries return water off-site to the creek.

Sample Site 3 (Figs. 1 & 2) represents the outflow location for the 200 m long conventional ditch. Samples will be collected from the conventional ditch just upstream of the stand pipe that carries return water off-site to the creek.

Unfiltered, whole water runoff samples will be collected by hand directly into 1 L amber glass bottles and sealed with Teflon ® lined lids. Samples will be stored on wet ice then refrigerated at 4º C until extraction for chemical analysis. Samples will be collected following DPR SOP #FSWA008.00 Sampling for Surface Water Runoff in Agricultural Fields (Spurlock, 1999). Transporting of samples will follow DPR SOP #QAQC004.01, Transporting, Packaging and Shipping Samples from the Field to the Warehouse or Laboratory (Jones, 1999). A chain-of-custody record will be completed and accompany each sample.

Suspended sediment measurements will be performed on companion samples collected at the same sampling locations and times as the runoff samples. Measurement will be conducted by vacuum filtration of the samples and subsequent oven drying of the filtrate collected on tared, rinsed, and oven-dried filters following EPA Method 160.2 Non-Filterable Residue (Gravimetric, Dried at 103-105°C)(EPA, 1971).

Discharge Measurements

Runoff volume will be measured using weirs equipped with transducers. Transducers will be connected to dataloggers that will record height every 10 minutes from both the inflow and outflow sampling points. More frequent discharge measurements may be conducted if it is determined that water levels fluctuate greatly in short periods.

V. CHEMICAL ANALYSIS AND QUALITY CONTROL

The California Department of Fish and Game, Fish and Wildlife Water Pollution Control Laboratory will conduct chemical analysis of all water samples. Quality control (QC) will be conducted in accordance with SOP QAQC001.00 (Segawa, 1995) and will include general continuing QC. Twenty percent of the total number of samples will be submitted with samples as matrix spikes, blind spikes, field blanks, and duplicates as shown in Table 1.

VI. DATA ANALYSIS

Discharge water volume and dissolved lambda cyhalothrin 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 lambda cyhalothrin concentrations between the inflow site and outflow point of each ditch.

VII. LAB BUDGET

	Number Samples	Lambda Cyhalothrin		
Runoff Samples	120	294		$35,280
Lab QA Spikes	12	294		$3,528
Method Validation	15	294		$4,410
Blind Spikes	5	294		$1,470
Field Spikes	2	294		$588
Duplicates	4	294		$1,176
DFG Overhead (18%)				$8,361
			total	$54,813

VIII. LITERATURE CITED

Cooper, CM, MT Moore, ER Bennet, S Smith, JL Farris, CD Milam, and FD Sheilds Jr. (2004). Innovative uses of vegetated drainage ditches for reducing agricultural runoff. Water Science and Technology. Vol 49 (3) pp 117-123.

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