California Department of Food and Agriculture
Environmental Monitoring and Pest Management
1220 N Street, Room A-149
Sacramento, CA 95814

December 4, 1989

MONITORING SOIL DISTRIBUTION OF PESTICIDES IN AREAS WHERE IRRIGATION IS APPLIED FOR FROST PROTECTION TO ORCHARDS

I. INTRODUCTION

Leaching of pesticides in soil occurs when water moves pesticide residues downward through layers of soil. Ground water contamination results when deep percolating water eventually recharges a ground water aquifer. The amount of deep percolating water produced depends on the amount and frequency of irrigation or rain events.

For certain pesticides found in ground water, the Department has proposed a program to modify use to prevent pollution of ground water. Continued use of a pesticide under modified conditions requires the confinement of residues to the upper layers of soil where residues can be degraded, usually by microbial activity.

During the winter months, citrus in the lower San Joaquin Valley may be exposed to freezing temperatures. One method used for frost protection is to apply large amounts of irrigation water during the freeze. Herbicides are frequently applied in the fall prior to

freezing temperatures. In a study conducted at Fresno, the effect of winter rainfall on leaching of simazine was studied. Winter rainfall was approximately 10 inches which was close to the annual average. The distribution of simazine in the spring indicated a low leaching potential because most of the herbicide was retained in the upper one foot of soil with only very low concentrations detected to approximately 5 feet. The additional effect of irrigation application for frost protection on pesticide leaching is unknown. This study will be conducted in cooperation with Fresno County Farm Advisors and with growers to determine the soil distribution of a citrus herbicide before and after irrigation for frost protection.

II. OBJECTIVE

To determine the effect of frost protection irrigations on leaching of a citrus herbicide.

III. PERSONNEL

This study will be conducted by the Environmental Hazards Assessment Program under the overall supervision of John Troiano and Don Weaver and with the cooperation of Mark Freeman Farm Advisor, Fresno County. Key personnel include:

Project Leaders - John Troiano and Don Weaver

Senior Staff Scientist - Bruce Johnson

Study Design/Data Analysis - John Troiano

Cooperating Scientist - Mark Freeman, Farm Advisor, Fresno County

Field Sampling - Joe Marade

Lab Liaison/Quality Control - Cindy Garretson

Agency and Public Contact - Mark Pepple

ALL QUESTIONS REGARDING THIS STUDY SHOULD BE DIRECTED TO MARK PEPPLE AT ATSS 492-2395 OR (916) 322-2395.

IV. STUDY DESIGN

The soil distribution of simazine, a citrus herbicide, will be measured in fields that receive irrigation for frost protection. Soil cores will be taken: 1) after application but before frost conditions and then 2) after frost conditions where irrigation had been used for protection. Two fields will be monitored, one where furrow irrigation is used for irrigation and one where mini-sprinklers are used for irrigation.

Soil coring in the furrow-irrigated field will occur at the head of the furrow where potential infiltration is the highest and at the end of the furrows where potential infiltration is the lowest. The effect of winter rain on the distribution of simazine will be determined in areas located between the furrows that received only winter rainfall. Each core will be a composite of 3 cores taken 10 meters apart.

Soil coring in the mini-sprinkler irrigated field will occur at 4 randomly selected sprinkler sites. At each site, one composite core will be taken from the non-irrigated area between sprinklers and another composite will be taken from sprinkler. Each core will be the composite of 3 cores which at the sprinkler site will be located at the center, mid and end points of the wetting radius of the sprinkler head.

Soil cores will taken to the 7-foot depth in each field in 1-foot increments. Sampling will occur at two distinct times in each field;

1. Cores will be taken after pesticide application but before frost protection irrigation. Six cores will be taken from the head of the furrows, 6 cores from the end of the furrows and 6 cores from the mini-sprinkler-irrigated field. Three of the 6 cores taken at each location will be located in the furrows and 3 located in between the furrows. Two of the three cores will be analyzed to determine initial levels of pesticide residue. A total of 126 samples will be taken with 84 samples initially analyzed for residues of simazine and nitrate.
2. Cores will be taken after frost protection irrigations have ceased. Eight cores will be taken from each end of the furrow-irrigated field and from the mini-sprinkler-irrigated field. Four of the eight cores will be taken from sites that received no irrigation and 4 from irrigated sites. Nine of the 12 cores (3 from each site in each field) will be analyzed for chemical residues. The other 3 cores will be stored and analyzed as needed. A total of 161 samples will be taken with 126 samples analyzed for residues of simazine.

The effect of additional irrigation water on the total amount of pesticide recovered per core and on the depth to 50 and 90% leaching will be measured using a t-test. The test will be conducted for the head and end of the furrow-irrigated field and for the mini-sprinkler-irrigated field. A graphical comparison will be made between sampling times within a field and between fields to examine the extent of

leaching between the ends of the furrow and between furrow and mini-sprinkler-irrigated fields.

V. SAMPLING METHODS

Soil cores will be taken with a hand bucket auger down to 7 feet in 1-foot increments. Soil samples will be split into three sub-samples, one in a pint mason jar for pesticide analysis, one in a plastic bag for soil texture and organic carbon determinations, and one in 1/2-pint mason jar for nitrate analysis. Samples taken for chemical analysis will be stored in glass mason jars, frozen immediately on dry ice, and kept frozen until extraction.

VI. ANALYTICAL METHODS

Soil texture measurements will be made using the hydrometer method (Bouyoucos, 1962). Organic carbon analysis will be made using the Walkley-Black method (Rauschkolb, 1980).

It is anticipated that the herbicide analyzed in this will be simazine. Simazine has been frequently detected in ground water samples so standard analytical methods and quality control procedures will be followed.

Nitrate analyses will be preferentially conducted using a specific ion electrode. The soil extraction method recommended by the manufacturer of the electrode will be used. These analyses will be conducted by EHAP.

VII. TIMETABLE

December, 1989	Locate fields, take samples prior to frost protection irrigations
February/March 1990	Collect samples after danger of frost

IX. REFERENCES

Bouyoucos, G.J. 1962. Hydrometer method improved for making particle size analyses of soils. Agronomy J., 54:464-465.

Rauschkolb. R.S. 1980. Soil analysis method S:18.0. Organic matter dichromate reduction. In, California Fertilizer Association, California Soil Testing Procedures Manual.

Troiano, J. and C. Garretson. 1988. Soil distribution of simazine, diazinon and bromide in sandy soil after exposure to 1985-1986 winter rains in Fresno County. Environmental Hazards Assessment Program, California Dept. of Food and Agriculture, EH-88-2.

VIII. BUDGET

Personnel expenses	
Pesticide analyses (210 samples/field @ $150).	$31,500
Nitrate analyses (210 samples/field @ $50)....	10,500
QC (10%).....	6,000
Total.....	$4[illegible],000