OCCURRENCE OF AQUATIC TOXICITY AND DORMANT-SPRAY PESTICIDE DETECTIONS IN THE SAN JOAQUIN RIVER WATERSHED, WINTER 1996-97

by

K.P. Bennett, C.E. Nordmark, J. Schuette, H. Feng, J. Hernandez, and P. Lee

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ENVIRONMENTAL HAZARDS ASSESSMENT PROGRAM

STATE OF CALIFORNIA
Environmental Protection Agency
Department of Pesticide Regulation
Environmental Monitoring and Pest Management Branch
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EXECUTIVE SUMMARY

"Occurrence of Aquatic Toxicity and Dormant Spray Pesticide Detections in the San Joaquin River Watershed, Winter 1996-97"

Environmental Monitoring and Pest Management Branch
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BACKGROUND

In the past, winter surveys conducted by the Department of Pesticide Regulation (DPR), the Regional Water Quality Control Board (RWQCB) and the U.S. Geological Survey frequently found dormant spray residues in the San Joaquin River watershed. Dormant sprays include organophosphate pesticides that are sprayed on dormant fruit and nut trees to control overwintering pests. Some dormant spray levels were high enough to cause aquatic toxicity. State and federal laws prohibit discharge of substances that make rivers toxic because the restoration and maintenance of the chemical, physical, and biological integrity of the nation's waters are a primary goal. The State Water Quality Control Board and the RWQCB's have established a narrative water quality objective designed to prevent aquatic toxicity. If the objective is exceeded, DPR may need to impose restrictions on the use of dormant sprays. Consequently, DPR established the Dormant Spray Water Quality Program.

Through its Dormant Spray Water Quality Program, DPR seeks to prevent aquatic toxicity from residues of organophosphate pesticides (primarily diazinon, chlorpyrifos [Lorsban] and methidathion [Supracide]) in the Sacramento and San Joaquin Rivers. Monitoring data gathered by DPR will verify compliance with water quality standards.

PURPOSE

DPR's dormant spray pesticide study was developed to identify the levels of dormant spray residues present in portions of the San Joaquin River (SJR) watershed, and their relationship to the water quality objective for toxicity.

STUDY METHODS

San Joaquin River watershed surface water samples were collected to determine the acute and chronic toxicity of the water to the water flea *Ceriodaphnia dubia (C. dubia)*. Acute toxicity monitoring was done at Orestimba Creek, a western tributary of the SJR which receives drainage from predominantly agricultural land uses; chronic toxicity monitoring was performed on the main stem of the SJR near Vernalis, where discharges are received from all of the major agricultural tributaries, including the Merced,

Tuolumne, and Stanislaus Rivers. Acute toxicity tests were performed twice per week; chronic testing was conducted weekly.

Background sampling for dormant spray residues was conducted during the week of December 2, 1996, before the start of the dormant spray season. Sampling continued through March 7, 1997, when no additional dormant spray applications were reported.

In addition to toxicity tests, surface water samples were analyzed for chlorpyrifos, diazinon, dimethoate (Cygon), fonofos, malathion, methidathion, methyl parathion, phosmet, carbaryl and carbofuran. These pesticides were chosen for analysis based upon historical records which indicate they had been used during the dormant spray season in the Central Valley study area, previous detections in the watershed, and the availability of analytical methods. Pesticide analysis of water samples was performed by the California Department of Food and Agriculture Center for Analytical Chemistry.

Acute toxicity testing was conducted by the Department of Fish and Game's (DFG's) Aquatic Toxicology Laboratory following current U.S. Environmental Protection Agency (U.S. EPA) procedures using *C. dubia*. Acute toxicity was determined using a 96-hour bioassay of undiluted sample water. Chronic toxicity was determined using a seven-day bioassay of undiluted sample water with *C. dubia* and followed current U.S. EPA guidelines.

RESULTS

The results of this monitoring program include environmental measurements, pesticide use information, pesticide detections in surface water, pesticide transport information, and aquatic toxicity. Interpretation of the results presented in this study should take into account that conditions during this monitoring period were not necessarily characteristic of a typical winter season. The data collection period coincided with an unusually wet season with extensive flooding during the first half of winter, followed by a dry second half.

During the 1996-1997 dormant spray season, 7,299 pounds of chlorpyrifos, 20,573 pounds of diazinon, and 13,434 pounds of methidathion were applied to the study area. This represents a 63 percent decrease in the use of chlorpyrifos, a 58 percent decrease in the use of diazinon, and a 55 percent decrease in the use of methidathion compared to the 1995-96 spray season. Because dormant sprays are generally applied by ground rigs in clear weather, this decrease was attributable to ground saturation and inclement weather which prohibited growers from entering their orchards to manage overwintering pests.

Orestimba Creek--Acute Toxicity Monitoring Site

Water samples from Orestimba Creek were found to have residues of diazinon, carbofuran, and dimethoate in 20, 13, and 7 percent of

the samples collected, respectively. No other pesticides were detected throughout the monitoring period. The maximum detections for diazinon, carbofuran, and dimethoate were 0.092, 0.238, and 0.082 micrograms per liter (ug/L), respectively.

Acute toxicity tests on water collected from Orestimba Creek revealed a survival rate which ranged from 40 to 100 percent. Split samples collected on January 29 were significantly different from the control, indicating that these samples were acutely toxic to *C. dubia*. However, there were no pesticides detected in the January 29 samples, and all water quality parameters were within acceptable limits. Based on the data collected, no determination can be made regarding the cause of mortality.

San Joaquin River--Chronic Toxicity Monitoring Site

Three of the 24 samples collected from the SJR near Vernalis contained diazinon residues. The maximum concentration was 0.070 ug/L. No other pesticides were detected at this site for the remainder of the monitoring period.

Chronic toxicity tests performed on water samples taken from the SJR site near Vernalis revealed a 90 to 100 percent survival rate for *C. dubia* in the seven-day chronic toxicity tests. Statistical analysis showed no significant differences between the samples and controls, indicating no chronic toxicity. Diazinon was present in two bioassays; both bioassays displayed 90 to 100 percent survival.

General Results

The estimated mass of diazinon, carbofuran, and dimethoate transported to the SJR from Orestimba Creek was 7.87, 6.68, and 2.93 pounds, respectively. The estimated mass of diazinon transported in the SJR past Vernalis was 85.8 pounds.

There was a single occurrence of acute toxicity at Orestimba Creek and no chronic toxicity at SJR near Vernalis.

CONCLUSIONS

During the winter of 1996-97, there was no toxicity in the samples collected attributable to the pesticides detected. Diazinon, carbofuran, and dimethoate residues were found in surface water samples at Orestimba Creek. Diazinon was detected most frequently. At the SJR near Vernalis, diazinon was the only pesticide detected. The maximum concentrations at both sites were less than those found in previous studies; this is believed to be due to flooding and reduced dormant spray pesticide use in Merced, San Joaquin, and Stanislaus counties.

DPR's approach to addressing dormant spray water quality has been to establish a Dormant Spray Water Quality Program. Through this

program, DPR seeks to prevent aquatic toxicity by relying on growers to adopt voluntary practices which reduce the movement of dormant spray pesticides to surface water. Adjustments to mixing and loading practices, application techniques, orchard floor management, and other integrated pest management practices can reduce the impact of dormant sprays.

DPR will evaluate the success of the voluntary efforts toward achieving water quality compliance by using standard toxicity tests. DPR may impose regulatory measures at any time, depending upon the assessment of the monitoring results. As long as progress continues toward compliance with the water quality standard, regulations will be unnecessary.

A thorough evaluation of the Dormant Spray Water Quality Program will occur in within the next five years. If the evaluation concludes that aquatic toxicity from dormant sprays is an ongoing problem, DPR will impose regulatory controls to reduce dormant spray residues to acceptable levels.

Branch Chief

Feb 27, 1998
Date