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SUBJECT: RESULTS OF PESTICIDE ANALYSIS OF RAIN RUNOFF MONITORING FOR THE RED IMPORTED FIRE ANT PROJECT IN ORANGE COUNTY, OCTOBER 2000 (STUDY 183)

SUMMARY

During October 2000, twelve rain runoff samples collected from San Juan Creek and Arroyo Trabuco in Orange County, California, showed no detectable residues of fenoxycarb, hydramethylnon, pyriproxyfen, and methidathion. There were two detections of bifenthrin at 0.096 and 0.163 parts per billion (ppb). There were seven detections of chlorpyrifos (0.052- 0.34 ppb), twelve detections of diazinon (0.241-0.647 ppb), two detections of dimethoate (0.076 and 0.085 ppb) and eleven detections of malathion (0.051- 0.361 ppb). Of the twelve samples taken, ten have detections of insecticides above LC_{50} values for *C. dubia*.

SCOPE OF THIS MEMORANDUM

This memorandum reports results of surface water sampling conducted by the Department of Pesticide Regulation (DPR), under interagency agreement with the Department of Food and Agriculture (CDFA), for the Red Imported Fire Ant (RIFA) control project. Data included here are from the October 27, 2000, rain runoff monitoring and encompassed results from chemical analyses. This memorandum summarizes results for bifenthrin, fenoxycarb, hydramethylnon, pyriproxyfen, and five organophosphorus insecticides: chlorpyrifos, diazinon, dimethoate, malathion, and methidathion. Only bifenthrin, fenoxycarb, hydramethylnon, pyriproxyfen, and chlorpyrifos are used in the RIFA control program. The other four organophosphates are in our multiresidue analytical method. An in-depth interpretation of data is not included here, but will be provided in the final report when the 2000 pesticide use report becomes available. Stream discharge measurements will also be included in the final report.

The rain runoff sampling event was conducted during the first rainfall of the rainy season following months of dry weather and RIFA insecticide applications. DPR also conducts monthly surface water monitoring. Previous sampling result memos may be requested by calling the number above or you may download or review them from DPR's website at <www.cdpr.ca.gov/docs/rifa>.

MATERIALS and METHODS

Sample and Data Collection

On October 27, 2000, surface water samples were collected at two creeks within the Orange County treatment area (Table 1 and Figure 2). Sites I and J from our monthly monitoring sites were sampled six times at roughly two hour intervals, these sites were chosen due to the high use of the RIFA insecticides in the area. Sampling began in the morning of October 27 and continued until late afternoon. This sampling event coincided with measurable rainfall. From 10AM October 26 until 10AM October 27, 0.41 inches of rain was measured in San Juan Canyon; from 10AM October 27 until 10AM October 28, 0.19 inches of rain was measured in the same area. Weather data are from Touchstone station #47, San Juan Capistrano (UCD, 2000).

Table 1. Sampling site descriptions in Orange County, California

Site #	Description	Coordinates
I	San Juan Creek at Stonehill Drive	N 33°28'31", W 117°40'43"
J	Arroyo Trabuco at Oso Parkway	N 33°35'06", W 117°38'09"

All water samples were collected at center channel using a 10-liter stainless steel bucket and divided into one-liter amber sample bottles using a Geotech® 10-port splitter. Samples designated for organophosphate chemical analysis were preserved by acidification with 3N hydrochloric acid to a pH between 3.0 and 3.5. Because diazinon rapidly degrades under acidic conditions, it was analyzed from a separate, unacidified sample. All samples were stored on wet ice or in a 4^{o} C refrigerator until transported to the appropriate laboratory for analysis.

Environmental Measurements

Water quality parameters measured included temperature, pH, electrical conductivity (EC), and dissolved oxygen (DO). Water pH was measured using an IQ Scientific Instruments® (model IQ 150) pH meter. EC, water temperature, and DO were measured using an YSI® multi parameter meter (model 85).

Insecticide Analyses

All water samples were analyzed for bifenthrin, fenoxycarb, hydramethylnon, pyriproxyfen, chlorpyrifos, diazinon, dimethoate, malathion, and methidathion. The CDFA Center for Analytical Chemistry performed all analyses using gas chromatography and a flame photometric detector for the five organophosphorus insecticides; a high performance liquid chromatography and a ultra violet detector for fenoxycarb, hydramethylnon, and pyriproxyfen; and gas chromatography with an electron capture detector confirmed with a mass selective detector for bifenthrin. The reporting limit (reliable detection levels) for chlorpyrifos and diazinon is 0.04 ppb, 0.1 ppb for fenoxycarb and pyriproxyfen, 0.2 ppb for hydramethylnon, and 0.05 ppb for the other insecticides.

RESULTS and DISCUSSIONS

Insecticide Concentrations

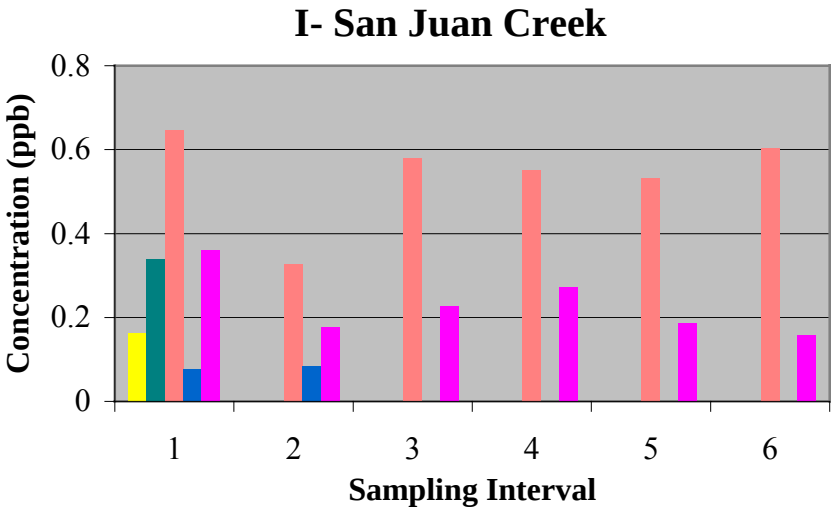
A total of twelve samples were analyzed for the five organophosphorus insecticides, bifenthrin and the three RIFA insecticide baits (Table 2, Figure 1). Storm runoff samples had no detectable residues of fenoxycarb, hydramethylnon, pyriproxyfen, and methidathion. Bifenthrin was detected in two samples, one from each site, at 0.096 and 0.163 ppb. Chlorpyrifos was detected in seven samples ranging from 0.052 to 0.34 ppb. Diazinon was detected in all samples and ranged from 0.241 to 0.647 ppb. Dimethoate was detected in two samples, both at site I, at 0.076 and 0.085 ppb. Malathion was detected in eleven samples ranging from 0.051 to 0.361 ppb.

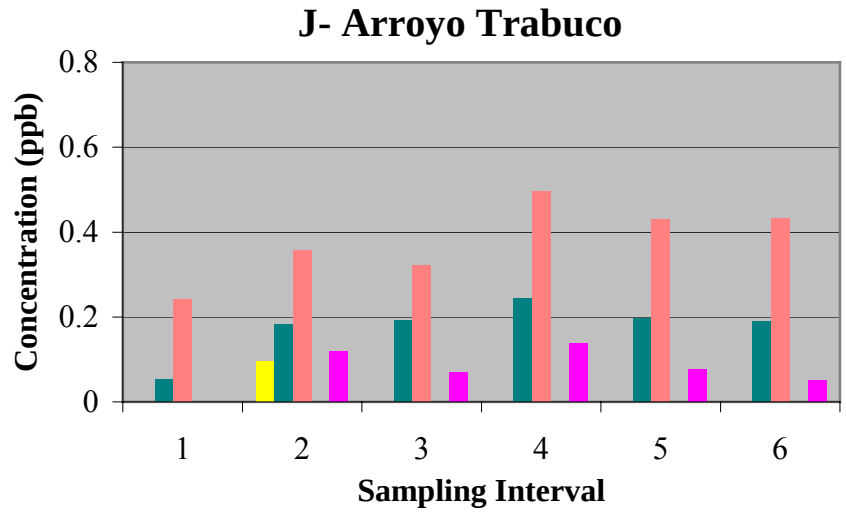
Bifenthrin, chlorpyrifos, diazinon, and malathion were detected at both sites; chlorpyrifos was detected at site I once with the other six detections at site J. Sites I and J drain mostly residential and commercial areas with some commercial nurseries above site J; site J drains into site I. Of the nine insecticides tested, only chlorpyrifos, bifenthrin, fenoxycarb, hydramethylnon, and pyriproxyfen were allowed use in nurseries for treatment of fire ants to comply with U.S. Department of Agriculture's quarantine requirements. All of the organophosphorus insecticides listed are registered for uses in commercial agriculture, nurseries, golf courses or parks for the control of other insect pests. Malathion, diazinon, and chlorpyrifos are widely available for homeowner use.

Table 2. Insecticide concentration in storm runoff samples at San Juan Creek (I) and Arroyo Trabuco (J), October 27, 2000, Orange County, California.

		Concentration in ppb								
Site	Time	Bifenthrin	Fenoxycarb	Hydramethylnon	Pyriproxyfen	Chlorpyrifos	Diazinon	Dimethoate	Malathion	Methidathion
I	645	0.163	ND	ND	ND	0.34	0.647	0.076	0.361	ND
I	820	ND	ND	ND	ND	ND	0.328	0.085	0.177	ND
I	1030	ND	ND	ND	ND	ND	0.579	ND	0.227	ND
I	1150	ND	ND	ND	ND	ND	0.552	ND	0.272	ND
I	1350	ND	ND	ND	ND	ND	0.532	ND	0.186	ND
I	1510	ND	ND	ND	ND	ND	0.604	ND	0.158	ND
J	550	ND	ND	ND	ND	0.052	0.241	ND	ND	ND
J	740	0.096	ND	ND	ND	0.182	0.358	ND	0.12	ND
J	1000	ND	ND	ND	ND	0.192	0.321	ND	0.07	ND
J	1050	ND	ND	ND	ND	0.243	0.496	ND	0.139	ND
J	1300	ND	ND	ND	ND	0.196	0.429	ND	0.077	ND
J	1425	ND	ND	ND	ND	0.191	0.433	ND	0.051	ND

ND= none detected at the reporting limit for that chemical.





Bifenthrin Chlorpyrifos Diazinon Dimethoate Malathion

Figure 1. Concentration of insecticides in surface rain-runoff water at two sites in Orange County, October 27, 2000. Samples taken at one- to three-hour intervals.

Toxicity Data

No toxicity samples were taken during this sampling event. Both bifenthrin detections were above the LC_{50} for *C. dubia*, with the detection at site I also above the LC_{50} for rainbow trout. Six of the chlorpyrifos detections were above the LC_{50}'s for *C. dubia* and *D. magma*. Five of the diazinon detections were above the LC_{50} for *C. dubia*. Of the twelve samples taken, two did not have detections above LC_{50} values for *C. dubia*. Table 3 lists LC_{50} values for rainbow trout, *D. magna,* and *C. dubia* as comparisons to the concentrations detected.

Table. 3 LC_{50}'s of insecticides (ppb) for three aquatic species. [1]

Pesticide	Rainbow trout	*D. magna*	*C. dubia*
Bifenthrin	0.15	1.6	0.078[2]
Chlorpyrifos	10	0.1	0.13[3]
Diazinon	3200	0.96	0.51[4]
Dimethoate	8500	2500	ND
Fenoxycarb	1600	400	ND
Hydramethylnon	160	1140	ND
Malathion	68	1.0	1.14[5]-2.12[6]
Methidathion	10.5	7.2	2.2
Pyriproxyfen	>325	400	ND

[1] Data from CDPR, 2000
[2] Data from CDFG, 2000
[3] Data from Menconi and Paul, 1994
[4] Data from Menconi and Cox, 1994
[5] Data from Nelson and Roline, 1998
[6] Data from Ankley et al., 1991

Environmental Measurements

Table 4 presents the data for temperature, pH, DO, and EC. DO was not taken for site I due to equipment constraints. Water temperature ranged from 14.8 to 18.0° C; pH ranged from 7.5 to 8.1; DO ranged from 7.8 to 8.88 mg/L; and EC ranged from 260 to 787 µS/cm. The California Regional Water Quality Control Board, Water Quality Control Plan, Santa Ana River Basin (1995), and the Water Quality Control Plan, San Diego Basin, (1994), list the following water quality guidelines as acceptable: DO above 5.0 mg/L, pH between 6.5 and 8.5, and water temperature no higher than 78°F (25.5°C). The plans do not provide an acceptable range for EC. All water quality measurements were within the acceptable guidelines.

Table 4. Water quality measurements at sampling sites, October 27, 2000, Orange County, California.

Site	Time	Temperature (^{o}C)	pH	Dissolved Oxygen (mg/L)	Electroconductivity (µS/cm)
I	645	14.8	7.7	NT	260
I	820	14.9	8.0	NT	309
I	1030	15.8	7.9	NT	583
I	1150	15.7	7.9	NT	639
I	1350	17.9	7.9	NT	750
I	1510	18.0	7.9	NT	774
J	550	16.1	7.9	7.8	787
J	740	15.8	8.1	8.88	400
J	1000	16.0	7.8	8.56	356
J	1050	15.7	7.5	8.76	411
J	1300	16.6	7.9	7.92	513
J	1425	17.7	7.6	8.6	664

NT= measurement not taken

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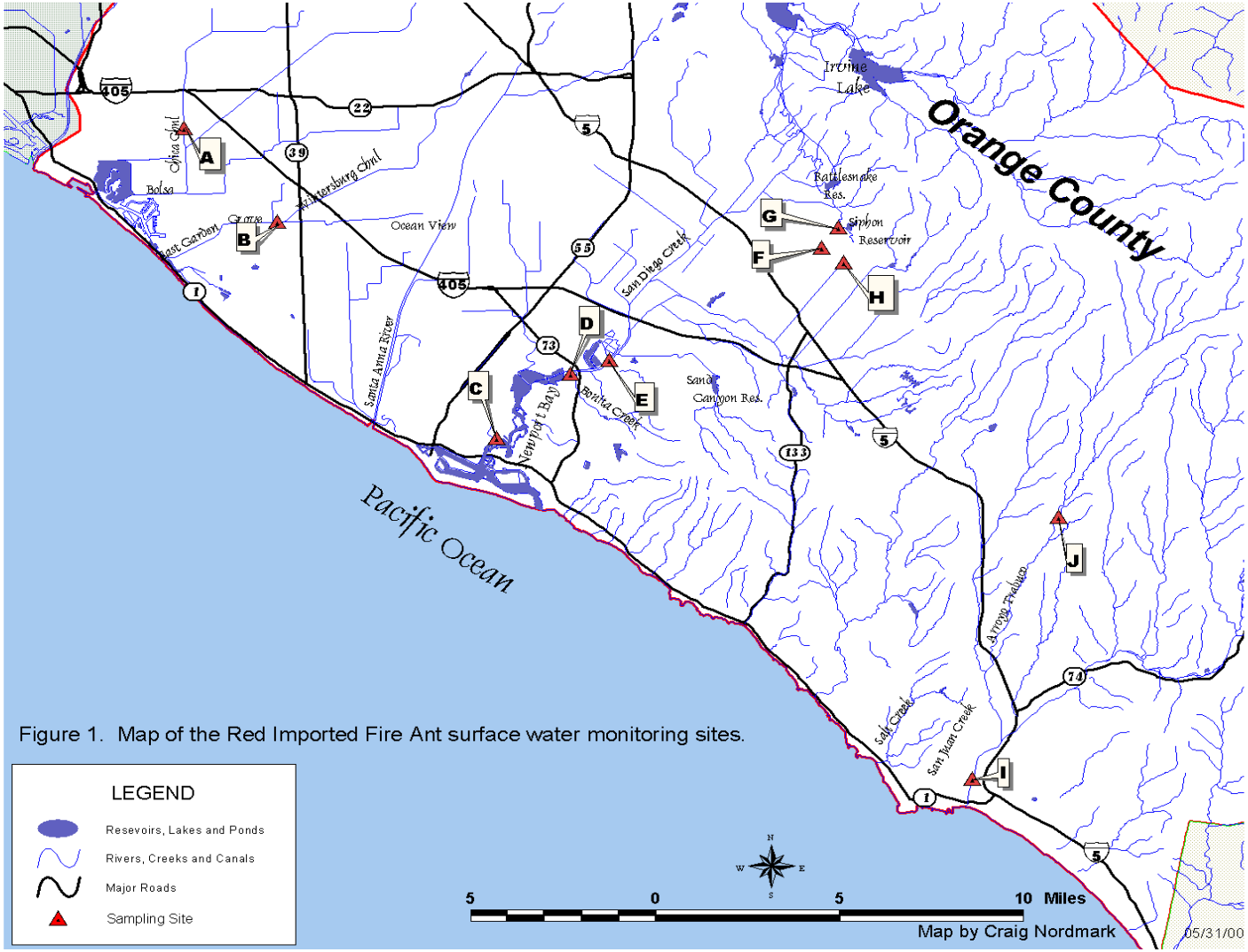

Figure 1. Map of the Red Imported Fire Ant surface water monitoring sites.