MONITORING CONCENTRATIONS OF ALDICARB AND ITS BREAKDOWN PRODUCTS IN IRRIGATION WATER RUNOFF AND SOIL FROM AGRICULTURAL FIELDS IN KERN COUNTY, 1985

by

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In August, 1985, the Environmental Hazards Assessment Program (EHAP) was requested by the Assistant Director to collect irrigation water samples from selected fields in Kern County that had been treated with aldicarb. The purpose of the study was to determine if aldicarb residues were present in tail water or water standing on irrigated fields that had received aldicarb treatments at various times prior to sampling. Information from pesticide use reports in Kern County was used to locate fields that had received aldicarb applications in the previous nine weeks. Owners of the fields were contacted and permission to sample was received along with additional information on dates and rates of aldicarb applications and frequency of irrigation.

Collection of Water Samples from Fields Treated with Aldicarb

Eight of the most recently treated fields were selected for sampling. Seven of the fields were furrow irrigated and one received sprinkler irrigation. Water samples were collected from one or more of three sources at each field location. The sources included water standing in furrows between the crop rows, water flowing in a drain ditch that carried water off the field, and water from the sump pit where water from the drain ditch collected. Water from these sumps is frequently used to irrigate adjacent fields. Selection of the sampling sites was determined by the availability of water sources in the field. In fields where water was available at all three sources, only the drain ditch and sump were sampled.

At each sampling site, duplicate water samples were collected in one liter amber glass bottles. Where possible, samples were collected by submerging the bottle

below the water surface until it was filled. When submerging was not possible, water was collected in a wide mouth 1 pint mason jar and then poured into the 1 liter amber glass bottle. In very shallow standing water, samples were collected using a hand operated vacuum pump that drew water directly into the 1 liter amber glass bottle. All sampling materials that were to be reused were rinsed with distilled water and methanol between samples. Water temperature was measured at each site using an Electro-therm Model TM-99 electronic thermometer, and water pH was measured using a VWR Scientific Model 55 Digital mini pH meter. The pH meter was calibrated at pH 4.0 and 10.0 before each reading was taken.

Water samples were stored on wet ice immediately after collection and kept refrigerated until analysis. Each sample was accompanied by a chain of custody record that documented date, location, and type of sample. A folder was prepared for each field and contained information on the date and rate of aldicarb application, sample location, date sampled, and crop grown.

Water samples were analyzed for aldicarb, aldicarb sulfoxide and aldicarb sulfone by the CDFA Laboratory located in Sacramento. A second pH determination was also made by the chemists in the laboratory before analyses were performed.

Results

The results of the water sample analysis are presented in Table I. No aldicarb residues (MDL of 1.0 ppb) were found in any of the 11 water samples collected. The time that had elapsed between the aldicarb applications and the collection of samples ranged from 9 days to as long as 69 days. Four samples were collected from field sumps, three from drainage ditches, and four from water standing in furrows on the fields. The pH of water samples ranged from 7.2 to 9.5 and temperatures ranged from 24.2°C to 33.1°C.

Table 1. Concentration of aldicarb residues[a] in irrigation water collected from fields treated with aldicarb at various times prior to sampling.

Field Name	Crop	Aldicarb Application Date	Aldicarb Application Rate	Days Since Application	Sample Source	pH	Temp °C	Aldicarb Concen. (MDL=1.0 ppb)
Meyer Ranch	Cotton	6/9/85	11 lb/ac	66	Sump	9.1	26	0
Pig Ranch	Cotton	6/6/85	11 lb/ac	69	Sump	7.2	29.2	0
Cooper Ranch	Potatoes	8/6/85	20 lb/ac	9	Furrow	7.5	26.4	0
				20[b]	Furrow	7.5	25.0	0
				20[b]	Furrow	7.9	30.7	0
				21[b]	Furrow	7.2	20.7	0
				21[b]	Furrow	7.0	29.7	0
Block 22-3A	Deciduous Trees	7/9/85	30 lb/ac	35	Drain Ditch	8.0	31.7	0
Mom's	Cotton	6/24/85	12 lb/ac	51	Furrow	7.6	24.2	0
Warren Ranch	Deciduous Trees	7/1/85	30 lb/ac	30	Drain Ditch	9.5	33.1	0
					Sump	9.2	31.1	0
Franks	Blackeye Beans	7/2/85	15 lb/ac	43	Sump	7.7	31.1	0
				44	Furrow	7.9	26.3	0
Tenneco	Cotton	7/25/85	15 lb/ac	20	Drain Ditch	7.5	28.1	0
				21	Furrow	7.9	24.3	0

a/ Samples analyzed for aldicarb, aldicarb sulfoxide, and aldicarb sulfone.
b/ Water samples collected after second sprinkler irrigation; these samples were taken in conjunction with soil samples.

Collection of Soil Samples from a Field Treated with Aldicarb

One field (Cooper Ranch) used in the water sampling was selected for a study to determine the dissipation in soil of aldicarb and its breakdown products and to compare soil sampling methods for aldicarb residue.

Aldicarb had been applied to the field on August 6, 1985 at a rate of 20 lbs per acre of the 15G formulation, placed 8 inches deep in a narrow band in the center of 8-12 inch wide planting beds. Potato seed pieces were planted in the band with the aldicarb granules and the field was irrigated by sprinkler irrigation for the first time on August 15 at which time the water samples were collected (Table 1).

Soil samples were collected from three locations in the field on August 26, 21 days after the aldicarb was applied, and 11 days after the first irrigation had occurred. Sample sites in different areas of the field were selected from planting beds that had visible potato sprouts to better ensure the location of the aldicarb band.

Two different sampling methods were used to collect soil from each of the three locations (Figure 1). The first method utilized a flat bladed shovel to collect a composite soil sample across the planting bed. After being washed with water and then rinsed with methanol before a sample was collected, the shovel was used to dig soil from a band six inches wide and eight inches deep across the width of the seed bed. The soil was placed in a large polyethylene bag, mixed thoroughly in the bag and then a steel trowel was used to remove enough soil to fill a 1 quart mason jar. The jar was sealed with aluminum foil and a screw cap lid and placed on dry ice. Separate soil samples were collected from the 0 to 8 inch depth and from the 8 to 16 inch depth at each location.

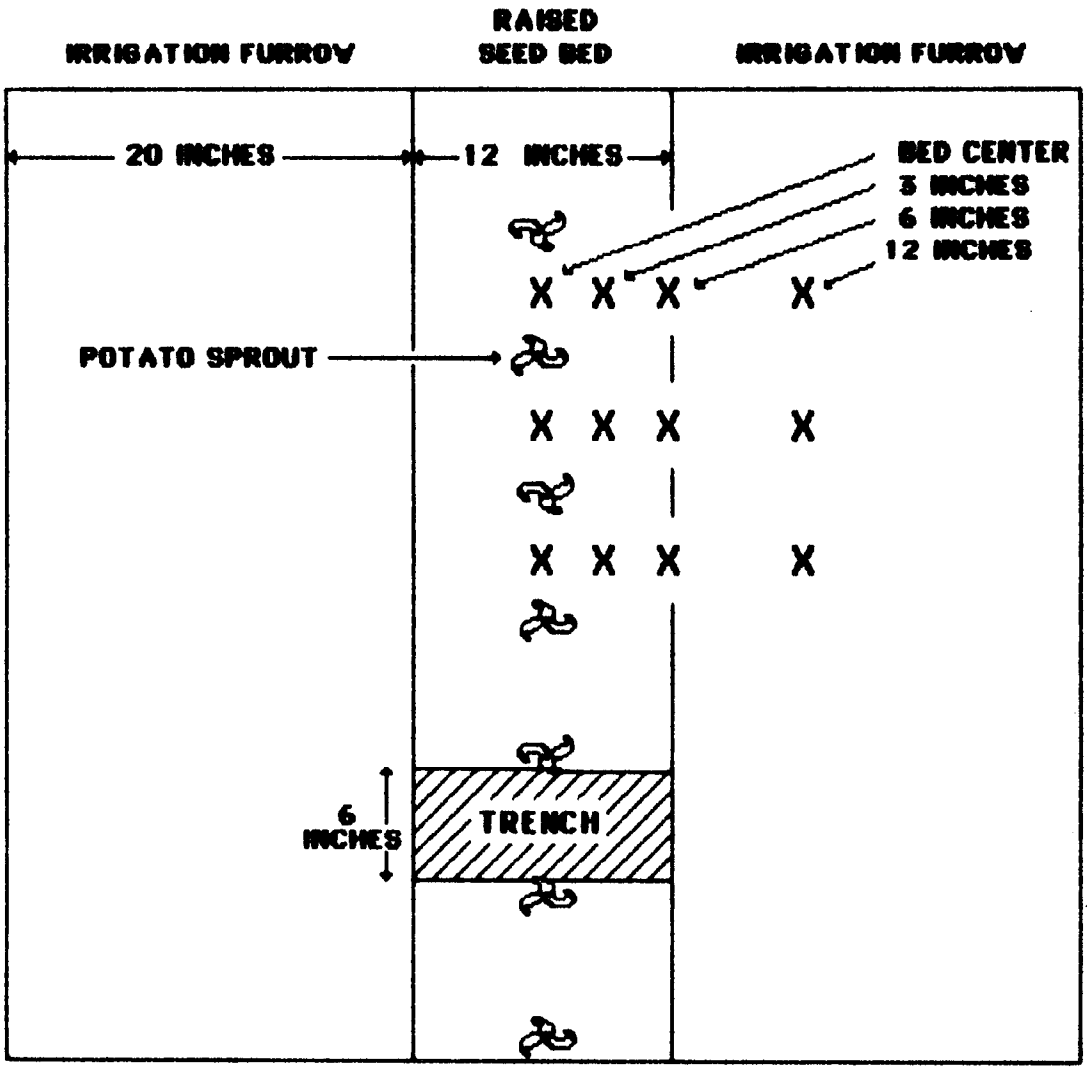

FIGURE 1. SAMPLING SITES FOR ALDICARB IN A POTATO PLANTING BED.

A Veihmeyer tube was used to collect the next series of samples from each location. The Veihmeyer samples were collected adjacent to where the samples were taken with the shovel.

The Veihmeyer tube was rinsed with distilled water and methanol. Then, three soil cores from 0-8 inches deep were taken in a line where the aldicarb was applied and between the potato sprouts. The three cores were combined in a 1 quart wide mouth mason jar, sealed with a piece of aluminum foil and a screw cap lid and put on dry ice. Cores from 8-16 inches deep were then removed from the same three holes, combined in a mason jar and placed on dry ice. The same sampling procedures were used to collect sets of three cores from 0-8 inches and 8-16 inches deep at points 3, 6, and 12 inches away in a line perpendicular to the center of the seed bed where the first core samples were taken.

Water samples were collected from a portion of the field on August 26 and 27 immediately after the second sprinkler irrigation had occurred. Methods previously described were used to collect samples from water standing in furrow at four locations in the field.

Results

The results of the soil analyses presented in Table 2 show that both sampling methods yielded detectable levels of aldicarb residues (MDL of 0.05 ppm). All three of the trench samples collected from the 8-16 inch depth contained detectable aldicarb residues, while residues were detected in only one trench sample taken from the upper 8 inches of soil. Aldicarb sulfoxide was detected in the one 0-8 inch trench sample. For the 8-16 inch depth, aldicarb sulfoxide was

Table 2. Concentrations (ppm) of aldicarb residues in soil samples collected 20 days after treatment from a field in Kern County using two different sampling methods.

	Trench samples		Vehmeyer tube samples							
			Distance (inches) from center of seed bed							
			0		3		6		12	
Location	A[a/]	B[b/]	A	B	A	B	A	B	A	B
Site I										
Aldicarb	ND[c/]	ND	ND	ND	ND	ND	ND	ND	ND	ND
Sulfoxide	ND	0.96	0.13	ND	2.40	2.80	ND	ND	ND	ND
Sulfone	ND	0.10	0.09	ND	0.23	0.23	ND	ND	ND	ND
Site II										
Aldicarb	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Sulfoxide	ND	0.64	ND	2.80	0.29	2.10	ND	ND	ND	ND
Sulfone	ND	ND	ND	0.10	ND	0.09	ND	ND	ND	ND
Site III										
Aldicarb	ND	0.12	0.36	ND	ND	ND	ND	ND	ND	ND
Sulfoxide	0.17	2.60	5.90	1.90	0.05	ND	0.06	ND	ND	ND
Sulfone	ND	0.10	0.34	0.16	ND	NDd	ND	ND	ND	ND

a/ Soil collected 0-8 inches deep.
b/ Soil collected 8-16 inches deep.
c/ N.D. indicates not detected. Minimum detectable levels: aldicarb=0.05 ppm; sulfoxide=0.05 ppm; sulfone=0.05 ppm.

detected in all three samples, aldicarb sulfone in two, and the parent compound in only one; one sample contained all three compounds.

The Veihmeyer tube samples were taken to provide information on the extent of lateral and vertical movement of the aldicarb residues from the area of application in the planting bed. Our results show that very little lateral movement occurred during the period between application and sampling. At all sites, detectable aldicarb residues were present in soil plugs taken at the seed bed center (where chemical was applied) and 3 inches out from the center. Only one site had detectable aldicarb 6 inches away and no residues were detected in soil collected 12 inches from the center. Aldicarb residues were detected in two of three samples collected at both depths in the centers of planting beds. For samples collected 3 inches from the centers of planting beds, residues were detected at all three sites for the 0-8 inch depth and at two sites for the 8-16 inch depth. One sample collected 6 inches from the center (0-8 inch depth) contained detectable aldicarb residues. No positive samples were found 12 inches from the center. Aldicarb sulfoxide (0.06-5.90 ppm) was detected in 10 of the 24 Veihmeyer tube samples and was the most prevalent compound detected. The sulfone (0.09-0.34 ppm) was detected in 7 of the 10 positive samples; one sample collected from the upper depth at the center of the pland bed contained the parent compound at a concentration of 0.36 ppm.

No aldicarb residues were detected in any of the water samples collected from this field (Table 1).

CONCLUSIONS

The results of this small scale study indicate that under the conditions encountered, residues of aldicarb and its breakdown products are not likely to

occur at measurable levels in irrigation water collected more than 8 days after pesticide application. In soil, there was little lateral movement of aldicarb 3 weeks after application and by this time less than 15% of the aldicarb detected was present as the parent compound. A comparison of two soil sampling methods showed that the trenching method used probably gave a good indication of aldicarb residues that were present.