

University of Massachusetts

TITLE: Determination of Volatile and Dislodgeable Residues on Treated Turfgrass

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EXECUTIVE SUMMARY

Methods for sample extractions and analytical detection of isazofos and mecoprop (MCP) from both XAD resin and cheesecloth collectors have been established. Recoveries of isazofos were 109% (+/-2.4) for resin extractions and 108% (+/-3.4) for cheesecloth. Recoveries of MCP ranged from 76% (+/-5.6) to 46% (+/-4.1) for resin extractions and efficiency of extraction depended largely on the initial spike concentration. Recoveries of MCP as dislodgeable residues were 96.2% (+/-8.7) efficient. Extraction efficiencies of spiked storage samples were not statistically different from spiked concurrent control samples from either collector (i.e., resin and cheesecloth) indicating that no significant loss of either isazofos or MCP occurred during storage period prior to analysis.

Average source flux for isazofos showed a diurnal pattern for volatile residues. Volatile residues were detected over the entire 12 day collection period with the highest flux associated with the 11:00-15:00 hr collection period of Day 1 (3453 ug/m²/hr). At the last collection period (Day 12) only 0.004% of the total applied amount of isazofos remained as volatile residues. Dislodgeable residues were maximal immediately after application (34,865 ug/m²) but were decreased some 400-fold by the watering process (96 ug/m² at 3 hrs post-application, Day 1). Dislodgeable residues were detected over the entire 12 day collection period but decreased to 0.0005% of the total applied amount of isazofos at Day 12.

The hydrolytic product of isazofos (CG-17193) was detected as both volatile and dislodgeable residues. Its maximal concentration was detected immediately after application as a dislodgeable residue (2804 ug/m², 0.44% of total) but was reduced to a non-detectable level after the watering-in process. As a volatile residue, CG-17193 appeared first during the 9:00-11:00 collection period of Day 1 after the watering-in process (131 ug/m², 0.02% of total). This hydrolytic product is apparently affected by evapotranspiration in that both volatile and dislodgeable residues disappear over time after application only to reappear after a precipitation event followed by a drying period. The amounts actually detected, however, were relatively small (56 ug/m²/hr, 0.009% of total and 91 ug/m², 0.01% of total, respectively).

MCP was detected principally as dislodgeable residues with a maximal residue (1330 ug/m²) collected immediately after application. The maximal volatile residue (271 ug/m²/hr) was collected also immediately after spray application. Neither type of residue was detectable at Day 5 of the collection following a precipitation event. This illustrates the water solubility of this compound.

I. METHODS AND MATERIALS

A. Extraction from Matrix.

All field samples, blank and spiked samples of isazofos were extracted with acetone, and those of mecoprop (MCP) were extracted with methanol (MeOH). The isazofos volatile field samples collected on XAD resin were split for analysis of its hydrolysis product (O-5-chloro-1-isopropyl-1H-1,2,4-triazol-3-yl-alcohol), CG-17193 (Ciba Giegy, technical method number AG-531). The CG-17193 samples were extracted with a 50% acetone/water solution.

1. Volatiles. The 120 ml of XAD-4 resin used to collect volatile residues from field samples and the 50 ml of resin for storage and concurrent spiked control samples were transferred to a 500 ml flask. The isazofos samples were shaken for 5 min and then split. The spiked control samples were amended with 1 ml of a standard solution (63 ug/ml for isazofos and 4 ug/ml for mecoprop). Solvent was added (150 ml for the field samples and 100 ml for the spiked controls) and the mixture agitated on a wrist-action shaker for one hour. The slurry of resin and acetone was filtered through Whatman # 1 filter paper and the eluant collected into a 500 ml amber glass jar. The resin was rinsed with 2 x 50 ml of solvent and the eluants pooled.

2. Dislodgeables. A 9" x 3" piece of cheesecloth, used for both field samples and spiked control samples, was placed into a 250 ml amber glass jar. Spiked control samples were amended with 1 ml of a standard solution. 50 ml of solvent was added to the jar, shaken for 15 min, and the extract decanted into a 500 ml jar. An additional 50 ml of solvent was added, shaken for 10 min, and the extract decanted. The cheesecloth was rinsed with 2 x 20 ml solvent and compressed to dryness. All solvent was pooled into a 500 ml jar.

B. Sample Preparation.

1. Volatiles. The final extract volume for all isazofos volatile field samples was 250 ml. For spiked control samples (e.g. storage and concurrent), it was 213 ml. The final volume for MCPP was; 325 ml for field samples and 213 ml for spiked controls. Both the field samples and the spiked controls of CG-17193 had a final volume of 262 ml. For analysis of isazofos, 10 ml aliquots were taken from samples taken during spray application and all the spike control samples. 100 ml aliquots were taken from the remaining samples. For analysis of MCPP, a 20 ml aliquot was taken from samples taken during spray application, 50 ml aliquots were taken from the spiked controls, and 100 ml aliquots were taken from the remaining samples. 100 ml aliquots were taken for analysis of CG-17193 field samples and spiked control samples. The aliquots were concentrated under vacuum to near dryness, and then quantitatively transferred to a centrifuge tube. Isazofos field samples were condensed further under N_2 to 5 ml except for the spiked control samples which were brought to a final volume of 3 ml. The samples on day 1 from 9 AM through out the rest of the day and the sample from 11 AM to 3 PM on day 3 were brought to a final volume of 11 ml.

The MCPP samples were concentrated under N_2 to dryness, and 0.4 ml toluene and 0.5 ml 14% boron trifluoride in methanol ($BF_3/MeOH$, Sigma Chemical) were added. The samples were vortexed, capped loosely and placed in an oil bath at 100 °C for one half hour with vortexing every 10 min. 5 ml of distilled, deionized water (ddw) and 0.6 ml of toluene was added, followed by vortexing for 1 min. The total volume of toluene (1 ml) was taken for analysis.

All samples of the CG-17193 hydrolysis product were reduced to 2.0 ml under N_2 , 1.0 ml of 7.66% dinitrofluorobenzene in acetone and 1 ml of a buffer solution (100 ml 0.05 M Na_2HPO_4 and 8.2 ml 0.1 N NaOH) were added. The solution was vortexed and then submerged in an oil bath for one hour at 60°C. After cooling in an ice bath for 20 min, NaCl was added to saturate the water and the derivatized compound was extracted into hexane (3 x 3 ml). The final volume was adjusted to 10 ml hexane for analysis.

2. Dislodgeables. The final extract volume for all isazofos dislodgeable samples and spiked control samples (e.g. storage and concurrent) was 134 ml. The final volume for MCPP samples and spiked control was 122 ml. The final volume for CG-17193 samples and spiked controls was 156 ml. The dislodgeable extracts from isazofos samples collected prior to the watering-in needed to be diluted (i.e., 50 ul aliquots were taken and brought to 3 ml). The remainder of samples from day 1 and the samples from day 2 had 50 ml aliquots taken and were brought to a final volume of 5 ml. The

spiked controls required no further dilution or concentrating and all other isazofos samples had 100 ml aliquots taken that were brought to a final volume 5 ml. The MCPP samples taken immediately after application had a 1 ml aliquot taken that were diluted to 5 ml. The rest of day 1 samples and day 2 samples needed no further dilution or concentrating. 50 ml aliquots were taken from the spiked controls and 30 ml aliquots taken from the remaining field samples, all having a final volume of 1 ml. 100 ml aliquots were taken from all of the CG-17193 field samples and 10 ml aliquots taken from the spiked controls, all were brought to a final volume of 10 ml. The aliquots from all three compounds were concentrated under vacuum, to near dryness and quantitatively transferred to centrifuge tubes. The isazofos samples were adjusted to a final volume and analyzed. The MCPP and CG-17193 samples were concentrated under N₂, and derivatized as described above for volatile residues.

B. Preparation/Maintenance of the Turf Plots.

1. Establishing and Maintaining the Turf. In May of 1991, approximately 0.5 acres (0.202 ha) of turf was tilled, raked and prepared for seeding at the turf research facility in South Deerfield. On June 17, 1991, the plot was seeded with 'Penncross' creeping bentgrass. Throughout the summer, the turf was mowed at a height of 1/2 inch. Maintenance simulated that of a golf course fairway; mowing three times a week, and watering and pesticide application (i.e., pesticides of non-interest to this study) applied as needed.

2. Application of Pesticides of Interest. On the morning of July 22, 1992, the contact and systemic insecticide, isazofos (trade name, Triumph 4E), was applied in a 10 m radius plot. A fifteen foot, twelve nozzle spray boom applied the water formulation at a rate of 4.5 oz/3 gal/1000 ft². At this rate, concentration of the compound on the turf is 642.7 mg/m² (6427g/ha). It should be noted that this compound erroneously was applied at three times the recommended high rate. This is a restricted use pesticide with application allowed only on tees, greens, and aprons. Not all states have it registered. Approximately one month later, on September 24, 1992, the systemic hormone-type herbicide, MCPP (trade, Mecomec 4), was applied at a rate of 1.5 oz/1.65 gal/1000 ft², corresponding to 221.2 mg/m² (2211 g/ha).

C. Instrumentation.

All analyses were done with Hewlett-Packard 5890 Gas Chromatographs (GC).

	Isazofos	MCPP
column:	DB-1 (30m X 0.541mm)	DB-5 (30m X 0.53mm)
detector:	Flame Photometric	Electrolytic Conductivity (Hall Detector)
injector volume:	3 ul	3 ul
injector temperature:	300° C	300° C
injector temperature:	250° C	200° C
temperature program:	150° C 10°/min 210° C (3 min)	120° C (1 min) 15°/min 250° C (3 min)
gases:	He @ 14.8 ml/min N ₂ @ 24.2 ml/min H ₂ @ 80 ml/min air @ 100 ml/min	He @ 30.0 ml/min H ₂ @ 100.0 ml/min

II. DATA REDUCTION

A. Quantification of Samples.

Standard curves were run at the beginning and the end of each working day, and an internal check standard was run every ten samples. The average of the two standard curves was used to generate calibration curves with an $r^2 > 0.998$. MCPP standards in the acid form and CG-17193 standards were derivatized and used for quantitation.

B. Concentrations on Resin and Cheesecloth Collectors.

Standard curves were used to determine the pesticide concentrations in the extract within a run. The appropriate concentration or dilution factors were then used to determine the sample concentration in its total extract volume. For example, the standard curve determined that the isazofos volatile extract from day 5 resulted in a concentration of 1.500 ug/ml, but the 100 ml aliquot from 250 ml was in a final volume of 5 ml, and the sample was split in half, therefore;

$$1.500 \text{ ug/ml} \times 250 \text{ ml}/100\text{ml} \times 5 \text{ ml} \times 2 = 37.500 \text{ ug of isazofos on the XAD resin.}$$

C. Correcting with Method Efficiency.

The percent recovery from the XAD resin and cheesecloth matrices have been determined for each compound. A known concentration of the analyte was administered (spiked) to XAD resin or cheesecloth, followed by extraction, concentrating and derivatization as described above. The concentration range of the laboratory spikes encompassed the concentration range of the field samples. The amount of the analyte determined in the sample was corrected for the average percent recovery of the spikes. The range of the laboratory spiked samples and the average percent recovery is presented in Table 1.

Table 1. Range and Recoveries of Laboratory Spiked Controls

<u>Isazofos</u>		<u>MCPP</u>	
<u>Volatile Residues</u>			
400 - 0.4 ug	109.0% (+/-2.4)* n = 7	100 ug	76.3% (+/- 5.59) n = 2
		30 - 5 ug	63.4% (+/-3.8) n = 5
		1 - 4 ug	45.7% (+/- 4.1) n = 5
<u>Dislodgeable Residues</u>			
1 mg - 0.2 ug	108.3% (+/- 3.4) n = 7	300 - 1 ug	96.2% (+/- 8.67) n = 10

* Mean value (+/- S.D.)

The corrected amount of isazofos on the resin for the fifth day would be calculated as follows:

$$37.500 \text{ ug} / 1.09 = 34.403 \text{ ug on resin}$$

The corrected amount on the cheesecloth is calculated in the same manner as above, yielding ug/ft². Converting square feet to square meters completes the calculations for the dislodgeables samples(ug/m²). Further calculations are needed to determine the rate of volatile loss from treated turf.

D. Airborne Concentrations.

Average air flow through the high-volume air samplers was determined by the attached flowmeters (ft³/min). A standardized calibration curve gave the correct amount in ft³/min. Converting to cubic meters of air per sampling period was done as follows:

$$39 \text{ ft}^3/\text{min} \times 0.0283 \text{ m}^3/\text{ft}^3 \times 240 \text{ min} = 264.96 \text{ m}^3 \text{ of air per sampling period.}$$

The amount of isazofos on the resin divided by the cubic meters of air gives the airborne concentration:

$$34.403 \text{ ug} / 264.96 \text{ m}^3 \text{ of air} = 0.130 \text{ ug} / \text{m}^3 \text{ of air.}$$

E. Source Strength.

Incorporation of the airborne concentration and the average wind speed at the instrument height into the Theoretical Profile Shape (TPS) model will yield the rate of volatile loss from the surface.

J.D. Wilson (1991), determined the normalized horizontal flux (NHF) for our 10 m radius plot, roughness height of 0.2 cm, and instrument height of 70 cm to be 2.9 . The average wind speed for each sampling period was collected by a Campbell CR10 Weather Station and stored in an IBM computer. Weather data was retrieved and summed as needed. Calculation of source strength was done as follows:

$$[\text{airborne concentration} \times \text{wind speed}] / \text{NHF} = \text{Source Strength}$$

$$[(\text{ug}/\text{m}^3) \times (\text{m}/\text{s})] / 2.9 = (\text{ug}/\text{m}^2 \text{ s})$$

$$[0.1300 \text{ ug}/\text{m}^3 \times 1.52 \text{ m}/\text{s}] / 2.9 = 0.0681 \text{ ug}/\text{m}^2 \text{ s}$$

$$0.0681 \text{ ug}/\text{m}^2 \text{ s} \times 3600 \text{ s}/\text{hr} = 245.0 \text{ ug}/\text{m}^2 \text{ hr}$$

III. RESULTS

The following Tables (2 - 14) report the source flux (ug/m² hr) and dislodgeable residues (ug/m²) for isazofos and MCPP and CG-17193. The physical characteristics of isazofos and MCPP are summarized in Table 15.

Table 15. Physical Characteristics Isazofos and MCPP

	Isazofos	MCPP
<u>application</u>	642.7 mg/m ²	221.2 mg/m ²
<u>vapor pressure</u>	8.7 X 10 ⁻⁵ mm Hg	0.0
<u>water solubility</u>	69.0 mg/l	6.0 X 10 ⁵ mg/l

IV. DISCUSSION

The average corrected recoveries of storage spike samples were 96.2% (+/- 7.5), n=6, for isazofos residues on resin and 107.4% (+/- 14.6), n = 7, for the dislodgeable residues. The MCPP resin storage spike samples had an average recovery of 47.75% (+/- 5.8), n=2, and the dislodgeables had an average recovery of 94.3% (+/- 3.3), n=3. These recoveries were not statistically different from the efficiencies established in the laboratory spiked controls.

Isazofos was applied at three times the recommended rate. This error was not recognized until after sampling, and consequently the wrong amount of water was applied. The dislodgeable residues were reduced some four hundred-fold after watering. On the other hand, the volatile residues stayed constant through out the day light period of day 1. On day 2, there was 0.3" (0.9 cm) of rain and volatile residues were much less compared to day 1. Day 3 the weather was dry and sunny, and the volatile residues were comparable to what was found on day 2.

MCPP was applied as the potassium salt and therefore has undetectable vapor pressure and high water solubility. On day 3, it rained 0.6" (1.6 cm) and no volatile or dislodgeable residues were found after day 2.

CG-17193 was found as a volatile residue on day 1 and on day 4 at a concentration of 0.044% and 0.010% of the total applied material, respectively. As a dislodgeable residue, it was detected on day 1, before watering-in, and on days 2,3,and 5 at concentrations of 0.436%, 0.007%, 0.005%, and 0.014% of the total applied material, respectively.

V. PROPOSED STUDIES FOR THE FUTURE

Next summer the reapplication of izasofos at the correct recommended rate and trichlorfon followed by watering in will be done. Both of these compounds are insecticides, have metabolites, and appreciable vapor pressure, and therefore are of most toxicological concern.

The existing data is being organized for use in various computer models in order to assess possible hazards associated with dermal or inhalation exposures.

A comparison study will be done between the dislodgeable residue method used in this study and the dislodgeable residue method used by Gunther (1989). In addition, characterizing the interactions of these compounds with the inorganic content of the soil will be done as well.

Nigg (1981) instead of Gunther (1989)

Table 2. Determination of ug of Isazofos on Resin

Table 3. Micrograms (ug) of Isazofos per m³ of Air

Table 4. Average Source Flux of Isazofos per Hour

time	concentration of extract (ug/ml)	corrected ug on resin*	sampling period (min.)	m ³ of air per min. (m ³ /min.)	m ³ of air per samp. pd. (m ³ /samp. pd.)	ug per m ³ of air (ug/m ³)	avg. temp. surface (C)	solar radiation (kj/m ²)	wind speed (m/s)	cumulative precipitation (cm)	source flux (ug/m ² .hr)	% of applied
Day 1												
pre-spray	0.0	0.0	240	1.217	292.08	0.000	23.11	604.23	1.28	0.00	0.0	0.000
7:00-7:40**	0.349	88.815	44	1.217	53.55	1.659	13.86	342.40	1.65	0.00	3397.3	0.529
9:00-11:00	2.630	141.815	120	1.160	139.20	1.019	17.69	1922.50	2.42	1.27	3060.6	0.476
11:00-15:00	1.278	410.316	240	1.217	292.08	1.405	21.71	3016.50	1.98		3452.9	0.537
15:00-19:00	2.000	273.176	240	1.075	258.00	1.059	22.90	2260.75	1.08		1419.6	0.221
19:00-7:00	3.000	159.131	720	1.132	815.04	0.195	15.72	31.01	0.50		121.2	0.019
Day 2												
8:00-11:00	2.678	61.423	180	1.217	219.06	0.280	14.73	198.30	1.11	2.17	560.2	0.087
11:00-13:00	2.060	47.253	126	1.132	142.63	0.331	16.14	581.65	1.60		954.1	0.148
16:00-19:00	1.136	26.256	180	1.274	229.32	0.114	15.49	136.47	0.77		158.7	0.025
Day 3												
7:00-11:00	2.287	52.452	240	1.217	292.08	0.180	14.70	702.30	1.94		432.5	0.067
11:00-15:00	2.670	142.840	220	1.217	267.74	0.534	22.81	3052.75	1.70		1125.9	0.175
15:00-19:00	1.516	34.770	240	1.075	258.00	0.135	24.30	2011.00	1.88		314.5	0.049
Day 4												
9:00-13:00	3.338	76.556	240	1.132	271.68	0.282	19.20	2144.75	1.26		440.8	0.069
13:00-17:00	2.010	46.092	240	1.075	258.00	0.179	25.45	3068.00	1.79		397.0	0.062
Day 5												
9:00-13:00	1.500	34.403	240	1.104	264.96	0.130	20.24	1429.03	1.52	2.27	245.0	0.038
13:00-17:00	0.960	22.011	240	1.104	264.96	0.083	23.33	1231.25	2.15		221.7	0.034
Day 7												
9:00-13:00	0.354	8.124	234	1.217	284.778	0.029	22.39	2273.75	3.24	2.37	114.7	0.018
13:00-17:00	0.464	10.650	240	1.019	244.56	0.044	24.10	2783.25	3.07		166.0	0.026
Day 12												
9:00-13:00	0.334	4.600	240	1.075	258.00	0.018	23.35	2199.50	1.20	2.69	26.6	0.004
13:00-17:00	0.174	2.392	240	1.075	258.00	0.009	27.64	2885.75	2.44		28.1	0.004

* corrected for average percent recovery which is 109.0% (+/- 2.4), n = 7.

** followed by 1.27 cm of water

0185

Table 5. Determination of ug of MCP P on Resin

Table 6. Micrograms (ug) of MCP P per m³ of Air

Table 7. Average Source Flux of MCP P per Hour

time	concentration of extract (ug/ml)	corrected ug on resin*	sampling period (min.)	m ³ of air per min. (m ³ /min.)	m ³ of air per samp. pd. (m ³ /smp. pd.)	ug per m ³ of air (ug/m ³)	avg. temp. surface (C)	solar radiation (kj/m ²)	wind speed (m/s)	cumulative precipitation (cm)	source flux (ug/m ² hr)	% of applied
Day 1												
pre-spray	0.000	0.000	58	1.218	70.63	0.0	6.69	992.00	2.08	0.00	0.0	0.000
9:00-13:00	1.023	26.219	220	1.274	280.37	0.094	12.41	2201.50	2.33		270.5	0.122
13:00-17:00	1.586	8.128	243	1.218	295.92	0.027	15.92	1946.25	1.88		64.1	0.029
Day 2												
9:00-13:00	1.654	8.480	240	1.246	299.06	0.028	12.65	1533.80	1.60	0.00	56.3	0.025
13:00-17:00	2.752	14.107	239	1.218	291.04	0.048	17.68	1428.75	1.01		60.8	0.027
Day 5												
9:00-13:00	0.000	0.000	240	1.246	299.06	0.000	20.42	1984.33	1.00	0.16	0.0	0.000
13:00-17:00	0.000	0.000	240	1.076	258.28	0.000	22.04	1411.93	1.09		0.0	0.000
Day 7												
9:00-13:00	0.000	0.000	239	1.062	253.82	0.000	8.97	1161.83	1.92		0.0	0.000
13:00-17:00	0.000	0.000	231	1.090	251.86	0.000	10.05	1005.93	3.10		0.0	0.000

* corrected for average percent recovery which is 63.4% (+/- 3.8), n = 5.

00186

Table 8. Determination of ug of CGA-17193 on Resin

Table 9. Micrograms (ug) of CGA-17193 per m³ of Air

Table 10. Average Source Flux of CGA-17193 per Hour

time	concentration of extract (ug/ml)	corrected ug on resin*	sampling period (min.)	m ³ of air per min. (m ³ /min.)	m ³ of air per samp. pd. (m ³ /smp. pd.)	ug per m ³ of air (ug/m ³)	avg. temp. surface (C)	solar radiation (kj/m ²)	wind speed (m/s)	cumulative precipitation (cm)	source flux (ug/m ² hr)	% of applied
Day 1												
pre-spray	0.0	0.0	240	1.217	292.08	0.0	23.11	604.23	1.28	0.00	0.0	0.0000
7:00-7:40**	0.000	0.000	44	1.217	53.55	0.000	13.86	342.40	1.65	0.00	0.0	0.0000
9:00-11:00	0.083	6.054	120	1.160	139.20	0.043	17.69	1922.50	2.42	1.27	130.7	0.0203
11:00-15:00	0.191	6.599	240	1.217	292.08	0.023	21.71	3016.50	1.98		55.5	0.0086
15:00-19:00	0.245	17.829	240	1.075	258.00	0.069	22.90	2260.75	1.08		92.6	0.0144
19:00-7:00	0.090	6.5264	720	1.132	815.04	0.008	15.72	31.01	0.50		5.0	0.0008
Day 2												
8:00-11:00	0.000	0.000	180	1.217	219.06	0.000	14.73	198.30	1.11	2.17	0.0	0.0000
11:00-13:00	0.000	0.000	126	1.132	142.63	0.000	16.14	581.65	1.60		0.0	0.0000
16:00-19:00	0.000	0.000	180	1.274	229.32	0.000	15.49	136.47	0.77		0.0	0.0000
Day 3												
7:00-11:00	0.000	0.000	240	1.217	292.08	0.000	14.70	702.30	1.94		0.0	0.0000
11:00-15:00	0.000	0.000	220	1.217	267.74	0.000	22.81	3052.75	1.70		0.0	0.0000
15:00-19:00	0.003	0.235	240	1.075	258.00	0.001	24.30	2011.00	1.88		2.1	0.0003
Day 4												
9:00-13:00	0.019	1.364	240	1.132	271.68	0.005	19.20	2144.75	1.26		7.9	0.0012
13:00-17:00	0.089	6.455	240	1.075	258.00	0.025	25.45	3068.00	1.79		55.6	0.0087
Day 5												
9:00-13:00	0.000	0.000	240	1.104	264.96	0.000	20.24	1429.03	1.52	2.27	0.0	0.0000
13:00-17:00	0.000	0.000	240	1.104	264.96	0.000	23.33	1231.25	2.15		0.0	0.0000
Day 7												
9:00-13:00	0.000	0.000	234	1.217	284.778	0.000	22.39	2273.75	3.24	2.37	0.0	0.0000
13:00-17:00	0.000	0.000	240	1.019	244.56	0.000	24.10	2783.25	3.07		0.0	0.0000
Day 12												
9:00-13:00	0.000	0.000	240	1.075	258.00	0.000	23.35	2199.50	1.20	2.69	0.0	0.0000
13:00-17:00	0.000	0.000	240	1.075	258.00	0.000	27.64	2885.75	2.44		0.0	0.0000

* corrected for average percent recovery which is 72.2% (+/- 10.0), n = 6.

** followed by 1.27 cm of water

00187

Table 11. Isazofos Dislodgeable Residues

time	extract concentration replicate #1 (ug/ml)	extract concentration replicate #2 (ug/ml)	extract concentration replicate #3 (ug/ml)	corrected ug* per square meter replicate #1 (ug/m^2)	corrected ug* per square meter replicate #2 (ug/m^2)	corrected ug* per square meter replicate #3 (ug/m^2)	average ug per square meter (ug/m^2)	standard deviation	cumulative precipitation (cm)	% of applied
Day 1										
pre-spray	0.000	0.000	0.000	0.00	0.000	0.000	0.000	0.000	0.00	0.000
15 min post appl.*	0.198	0.512	0.508	17028.27	43973.581	43591.773	34864.542	15447.842	0.00	5.4249
3 hr post appl.	-	1.510	0.538		120.626	71.611	96.118	34.659	1.27	0.0150
8 hr post appl.	0.385	0.384	0.446	51.22	51.101	59.444	53.920	4.784		0.0084
Day 2										
12 noon	0.957	1.347	0.921	127.46	179.374	122.596	143.144	31.470	2.17	0.0223
Day 3										
12 noon	0.230	0.273	0.275	15.30	18.192	18.308	17.265	1.707		0.0027
Day 4										
12 noon	0.433	1.090	0.556	28.85	72.538	36.964	46.118	23.237		0.0072
Day 5										
12 noon	0.246	0.475	0.244	16.45	31.634	16.222	21.437	8.832	2.27	0.0033
Day 7										
12 noon	0.056	0.091	0.550	3.71	6.025	3.708	4.480	1.338	2.37	0.0007
Day 12										
12 noon	0.073	0.083	0.064	2.90	3.360	2.549	2.935	0.407	2.69	0.0005

* Adjusting for dilutions and average percent recovery of 108.3% (+/- 3.4), n = 7, gives the corrected amount of isazofos per square foot.

Converting square feet to square meter yields ug/m^2.

** followed by 1.27 cm of water

00188

Table 12. MCPD Dislodgeable Residues

time	extract concentration replicate #1 (ug/ml)	extract concentration replicate #2 (ug/ml)	extract concentration replicate #3 (ug/ml)	corrected ug* per square meter replicate #1 (ug/m^2)	corrected ug* per square meter replicate #2 (ug/m^2)	corrected ug* per square meter replicate #3 (ug/m^2)	average ug per square meter (ug/m^2)	standard deviation	cumulative precipitation (cm)	% of applied
Day 1										
pre-spray	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000		0.000
15 min post appl.	2.195	2.262	1.834	1392.240	1434.440	1163.250	1329.977	145.923		0.6013
3 hr post appl.	2.137	1.440	1.375	271.020	182.620	174.350	313.995	53.585		0.1420
8 hr post appl.	3.043	-	1.872	386.020	-	237.480	311.750	105.034		0.1409
Day 2										
12 noon	1.183	1.517	1.309	150.000	192.480	166.050	169.510	21.450		0.0766
Day 4										
12 noon	0.625	0.651	0.656	2.640	2.750	2.770	2.720	0.070	0.16	0.0012
Day 5										
12 noon	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000		0.0000
Day 7										
12 noon	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000		0.0000

* Adjusting for dilutions and average percent recovery of 96.2% (+/- 8.7), n = 10, gives the corrected amount of MCPD per square foot. Converting square feet to square meter yields ug/m^2.

68100

Table 13. CGA-17193 Dislodgeable Residues

time	extract concentration replicate #1 (ug/ml)	extract concentration replicate #2 (ug/ml)	extract concentration replicate #3 (ug/ml)	corrected ug* per square meter replicate #1 (ug/m^2)	corrected ug* per square meter replicate #2 (ug/m^2)	corrected ug* per square mete replicate #3 (ug/m^2)	average ug per square meter (ug/m^2)	standard deviation	cumulative precipitation	% of applied
Day 1										
pre-spray	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.00	0.0000
15 min post appl.*	0.920	0.809	0.583	4476.477	3935.342	2835.689	2803.940	836.087	0.00	0.4363
3 hr post appl.	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	1.27	0.0000
8 hr post appl.	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000		0.0000
Day 2										
12 noon	0.021	0.034	0.024	51.680	82.039	57.242	44.573	16.163	2.17	0.0069
Day 3										
12 noon	0.016	0.024	0.016	38.934	58.864	39.745	32.599	11.280		0.0051
Day 4										
12 noon	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000		0.0000
Day 5										
12 noon	0.053	0.059	0.053	129.200	143.105	129.316	90.769	7.995	2.27	0.0141
Day 7										
12 noon	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	2.37	0.0000
Day 12										
12 noon	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	2.69	0.0000

* Adjusting for dilutions and average percent recovery of 74.3% (+/- 10.3), n = 7, gives the corrected amount of metabolite per square foot.

Converting square feet to square meter yields ug/m^2.

** followed by 1.27 cm of water

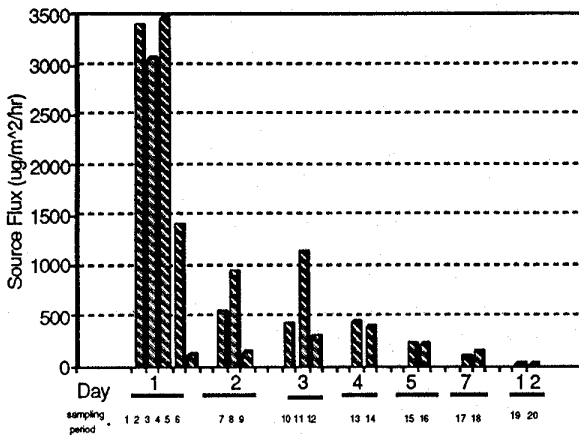
06100

Table 14. Project Summary to Date - Volatile and Dislodgeable Loss of Pesticides Applied to Turfgrass

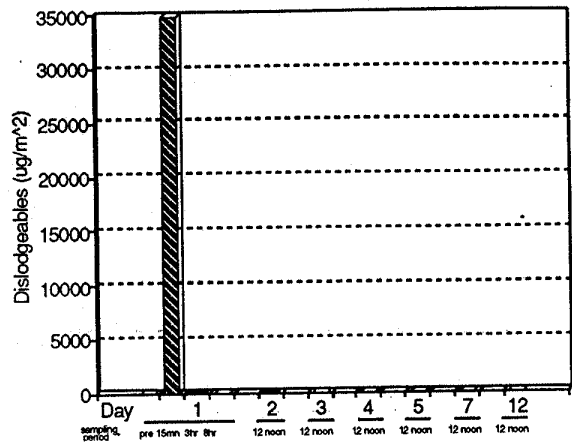
Species	Experimental conditions	Soil texture	Sampling period (day)	Source	Application rate (kg/ha)	Cumulative precipitation/irrigation (cm)	Average daily temp. (C)	Source flux (mg/m ² day)	Percent loss of applied	Dislodgeables (mg/m ²)	Percent loss of applied
Agrostis palustris Huds.	Field	Hadley silt loam	1	Triadimefon	1.52	-	29	4.719	3.105	3.677	2.410
			2	(Bayleton)			31	4.009	2.638	0.921	0.603
			3				29	2.281	1.501	0.943	0.618
			5		(equivalent to		32	0.930	0.612	0.068	0.045
			7		152 mg/m ²)		29	0.510	0.336	0.020	0.013
			11			0.3	19	0.044	0.029	0.005	0.003
			15			2.0	23	0.032	0.021	0.003	0.002
			1	Trichlorfon	9.15	-	12	44.610	4.875	52.103	5.691
			2	(Proxol 80 SP)			12	37.430	4.091	10.181	1.110
			3				12	30.450	3.328	6.719	0.734
			5		(equivalent to		23	22.870	2.499	2.708	0.296
			7		915 mg/m ²)		24	0.480	0.052	1.212	0.133
			10			6.1	11	0.120	0.013	0.028	0.003
			15			8.3	11	0.066	0.007	0.010	0.001
			1	Isazofos	6.43	1.27	19	29.308	4.558	34.865	5.448
			2	(Triumph 4E)		2.17	15	4.065	0.632	0.143	0.022
			3				21	7.492	1.165	0.017	0.003
			4				22	3.351	0.521	0.046	0.007
			5		(equivalent to	2.27	22	1.867	0.290	0.021	0.003
			7		643 mg/m ²)	2.37	23	1.123	0.175	0.004	0.001
			12			2.69	25	0.219	0.034	0.003	0.001
1	Mecoprop	2.21	-	14	1.338	0.605	1.330	0.884			
2	(Mecomec 4)			15	0.468	0.212	0.169	0.077			
5		(equivalent to	0.160	21	0.000	0.000	0.000	0.000			
7		221 mg/m ²)		10	0.000	0.000	0.000	0.000			

00191

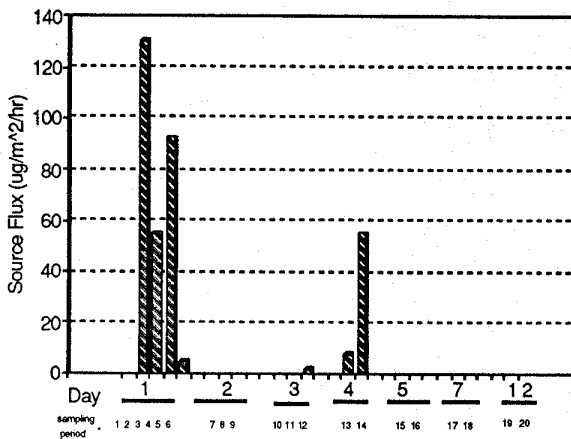
Isazofos Volatiles



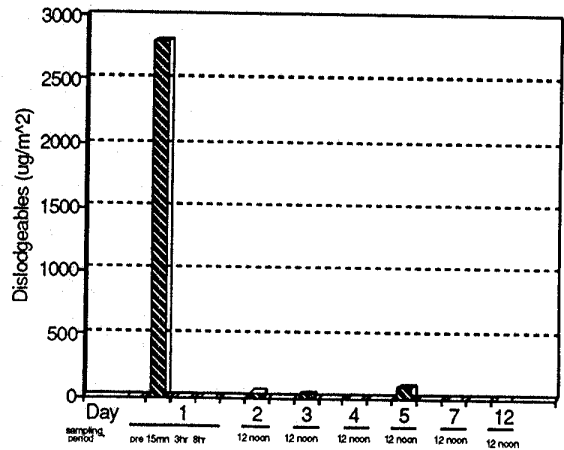
Isazofos Dislodgeables



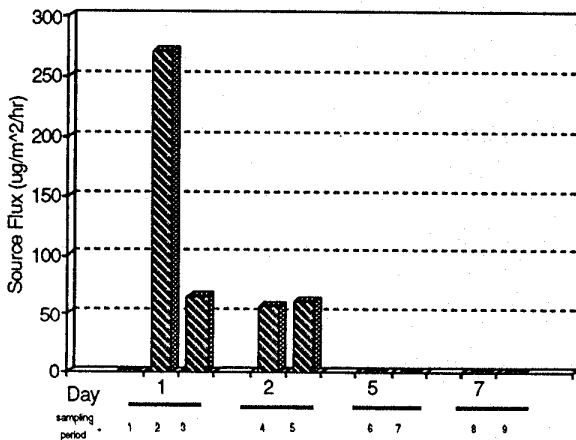
GC-17193 Volatiles



CG-17193 Dislodgeables



MCPPP Volatiles



MCPPP Dislodgeables

