DYNAMAC
CORPORATION

DISULFOTON

TASK 1: REVIEW AND EVALUATION OF INDIVIDUAL STUDIES

Contract No. 68-01-6679

Final Report

December 20, 1983

SUBMITTED TO:

Environmental Protection Agency
Arlington, Virginia 22202

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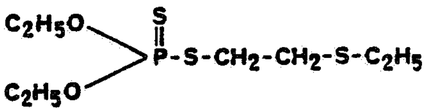
DISULFOTON

DISULFOTON, ETHYLTHIODEMETON, THIODEMETON, M-74,
DI-SYSTON, DITHIODEMETON, DITHIOSYSTOX



O,O-Diethyl S-[2-(ethylthio)ethyl] phosphorodithioate

Table of Contents

Study	
1	Flint, D.R., D.D. Church, H.R. Shaw, and J. Armour II. 1970. Soil runoff, leaching and adsorption, and water stability studies with Di-Syston.
2	Mitchell, T.H., J.H. Ruzicka, J. Thomson, and B.B. Wheals. 1968. The chromatographic determination of organophosphorus pesticides.
3	Shaw, H.R., II. 1975. The metabolism of Di-Syston in soil: Report No. 40234.
4	Helling, C.S., D.G. Dennison, and D.D. Kaufman. 1974. Fungicide movement in soils.
5	Mobay Chemical Corporation. 1972. Dasanit - Di-Syston: analytical and residue information on tobacco.
6	Kawamori, I., T. Saito, and K. Iyatomi. 1971. Fate of organophosphorus insecticides in soils. Part I.
	Kawamori, I., T. Saito, and K. Iyatomi. 1971. Fate of organophosphorus insecticides in soils. Part II.
7	Graham-Bryce, L.J. 1969. Diffusion of organophosphorus insecticides in soils.
8	McCarty, P.L. and P.H. King. 1966. The movement of pesticides in soils.
9	Thornton, J.S., J.B. Hurley, and J.J. Obrist. 1976. Soil thin-layer mobility of twenty four pesticide chemicals.
10	Kadoum, A.M., and D.E. Mock. 1978. Herbicide and insecticide residues in tailwater pits: water and pit bottom soil from irrigated corn and sorghum fields.

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CASE GS0107 DISULFOTON STUDY 1 PM 100 08/11/82

CHEM 032701 Disulfoton

BRANCH EFB DISC 30 TOPIC 0505

FORMULATION 12 - EMULSIFIABLE CONCENTRATE (EC OR E)

FICHE/MASTER ID 00095651 CONTENT CAT 01
Flint, D.R., D.D. Church, H.R. Shaw, and J. Armour II. 1970. Soil runoff, leaching and adsorption, and water stability studies with Di-Syston: Report no. 28939. Unpublished study received Apr. 2, 1971 under 3125-119; submitted by Mobay Chemical Corp., Kansas City, MO; CDL:119684-A.

SUBST. CLASS = S. OTHER SUBJECT DESCRIPTORS SEC: EFB -30-050515 EFB -30-050525
EFB -30-050530 EFB -30-05101505

DIRECT RVW TIME = 6 (MH) START-DATE END DATE

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CONCLUSIONS:

Degradation - Hydrolysis

This portion of the study could not be validated because raw data were not presented to support the reported half-lives and it was not specified that sterile conditions were maintained. This portion of the study would not fulfill EPA Data Requirements for Registering Pesticides (1983) because the nature and rate of formation and decline of degradates was not addressed, and the experiment was not conducted at 25 C.

Mobility - Leaching

This portion of the study is scientifically invalid because the experimental design was inadequate to accurately assess the mobility of disulfoton in soil. This portion of the study would not fulfill EPA Data Requirements for Registering Pesticides (1983) because the soils were leached with an insufficient quantity of water to assess disulfoton mobility in soil.

Mobility - Adsorption/Desorption

This portion of the study is cannot be validated because no data were presented to demonstrate that equilibrium was achieved after 1 hour. Additionally, no desorption data were presented. If equilibrium was achieved after 1 hour, this portion of the study would partially fulfill EPA Data Requirements for Registering Pesticides (1983) by providing adsorption data for disulfoton in three soils.

Mobility - Runoff

1. This runoff portion of the study is scientifically valid.

2. Disulfoton concentrations in runoff measured <1.6% of applied amounts over a 28-day period in which 1.5-2.5 inches of irrigation was provided; disulfoton (6 lb/gal EC) had been applied at 4 lb ai/A.

3. This portion of the study does not fulfill EPA Data Requirements for Registering Pesticides (1983) because pesticide mobility was not assessed using one of the three EPA acceptable protocols and a technical grade or purer product was not used.

Field Dissipation - Aquatic and Aquatic Impact

This portion of the study cannot be validated because the increase in concentration of disulfoton in water during the first 24 hours of incubation was unexplained. This portion of the study would not fulfill EPA Data Requirements for Registering Pesticides (1983) because the experimental site was not representative of actual use conditions, soil samples were not collected for analysis, sampling depths for water were unspecified, the test water and sediment were uncharacterized, and patterns of formation and decline of degradates were not addressed.

MATERIALS AND METHODS:

Degradation - Hydrolysis

Disulfoton (Di-Syston, 6 lb ai/A EC, Mobay Chemical Corp.) was added to phosphate buffer solutions (pH 5, 7, and 9) to equal a final concentration of 10 ppm ai. The solutions were maintained in capped amber bottles at 30 or 50 C. Aliquots were taken at 0, 2, and 7 hours, and at 1, 2, 5, 9, 16, and 23 days posttreatment, and extracted three times with Skellysolve B. The extracts were analyzed by using GLC.

Mobility - Leaching

Forty-five centimeter lengths of nylon tubing (1.6-cm diameter), closed on one end with stopcocks, were packed with a plug of glass wool, and a 1-cm layer of reagent grade sea sand. Fifteen grams of sandy loam, silt loam, and high organic silt loam (Table 1) were each mixed with 6 g of Celite filter aid, and placed in separate columns. The columns were weighed, saturated with distilled water, and reweighed to determine the void volume of each column. Disulfoton (Di-Syston, 6 lb ai/A EC, Mobay Chemical Corp.) was applied in a small unspecified amount of water to the top of each column at a rate equivalent to 10 ppm of disulfoton relative to the soil in the column. Two void volumes of tap water were applied to induce leaching. After leaching, the columns were placed in a freezer for 1 hour and then segmented into 1-cm increments. The soil column segments were mixed with 2 ml of tap water, extracted with Skellysolve B, and quantified by GLC.

Mobility - Adsorption/Desorption

Aqueous solutions of disulfoton (Di-Syston, 6 lb ai/gal EC, Mobay Chemical Corp.) were applied to a sandy loam and two silt loam soils (Table 1) at 7.5, 6.0, 4.5, and 3.0 µg/ml. Five milliliters of each of the disulfoton solutions were equilibrated with 1 g of each soil for 1 hour. After centrifugation, the supernatant was decanted and analyzed by using GLC, as described above, to determine the amount of disulfoton remaining in solution. The experiment was repeated using technical grade disulfoton at 25, 20, 15, and 10 µg/ml.

Mobility - Runoff

Disulfoton (Di-Syston, 6 lb/gal EC, Mobay Chemical Corp.) was applied at 4 lb ai/40 gal/A to the upper 10 feet of sloping field plots (~1 inch per foot, Figure 1) of sandy loam, silt loam, and highly organic silt loam soils (Table 1). Each plot was prepared by separating three adjacent lanes (5 feet wide and 15, 20, or 30 feet long) with wooden barriers. Galvanized duct pipes were installed at the lower edge of each lane; the troughs were inclined to allow collected water to flow into buckets recessed in the soil. Simulated rainfall was applied weekly over the 5-week study using soaker hoses and oscillating lawn sprinklers; irrigation amounts were recorded by rain gauges placed at random locations within the plots. Each plot was covered with black plastic between irrigation periods to prevent the entry of natural rainfall. Runoff was measured for total volume, sampled in triplicate, and discarded at intervals of 2, 8, 14, 21, and 28 days posttreatment. Samples were frozen prior to analysis. Runoff samples were fortified with NaCl, extracted twice with chloroform, filtered, evaporated, treated with acetone:methanol (4:1) and analyzed by GLC.

Field Dissipation - Aquatic and Aquatic Impact

A simulated aquatic environment was prepared by filling a large plastic pool (42-inch diameter) with ~2 inches of uncharacterized silt and 10 inches of uncharacterized natural pond water. Disulfoton (Di-Syston, 6 lb/gal EC, Mobay Chemical Corp.) was added to the water of the pool at 10 ppm. The pool was incubated outdoors. The daytime water temperature was 10-23 C. Water samples were taken at 0, 2, 4, and 6 hours, and at 1, 3, 6, and 13 days posttreatment. The samples were mixed with acetone, extracted twice with chloroform, concentrated, and analyzed by GLC for disulfoton (parent compound). Total disulfoton residues were determined by oxidizing the water samples with 20% $MgSO_4$ and 0.1 N $KMnO_4$ for 30 minutes at room temperature. The samples were extracted three times with chloroform, the solvent evaporated, and the residue dissolved in acetone for quantification by GC.

REPORTED RESULTS:

Degradation - Hydrolysis

Disulfoton degraded at 30 C, with half-lives of 186, 60, and 30 days in buffered solutions at pH 5, 7, and 9, respectively. At 50 C, half-lives were 8.25, 6.75, and 3.50 days in these solutions.

Mobility - Leaching

The results of the leaching experiments were expressed in terms of R values, which correspond to the number of inches of rainfall required to leach disulfoton residues 12 inches into a soil. Disulfoton leached most rapidly in the sandy loam (R = 68.7 inches; K_d = 2.3 ml/g) followed by the silt loam (R = 77.7 inches; K_d = 3.3 ml/g) and the high organic silt loam (R = 173.2 inches; K_d = 8.8 ml/g).

Mobility - Adsorption/Desorption

Adsorption K_d values for technical grade disulfoton were 1.3, 2.1, and 8.5 ml/g for the sandy loam, silt loam, and highly organic silt loam soils, respectively. Adsorption was increased with an increase in soil organic matter content. However, adsorption K_d values for disulfoton EC were essentially the same for all three soils ranging from 1.9 to 2.2

Mobility - Runoff

At the end of 5 weeks, runoff water collected 5 feet from treated sandy loam, silt loam, and highly organic silt loam soils contained 0.42, 1.58, and 1.01% of the disulfoton originally applied following irrigations totalling ~2.5, ~2.0, and ~1.6 inches, respectively (Table 2).

Field Dissipation - Aquatic and Aquatic Impact

The half-life of disulfoton (parent compound) in the water of a simulated aquatic environment was 2.87 days at pH 7. Total disulfoton residues (uncharacterized) remained at ~6-8 ppm over the 13 day study period; however, the amount of parent compound detected declined from a peak of ~9 ppm on day 1 to ~0.5 ppm on day 13.

DISCUSSION:

General (All Studies)

1. Recovery and limit of detection values were not reported.

2. Two of the test soils were altered prior to use; brick sand and Iowa peat were incorporated into the sandy loam and highly organic silt loam soils, respectively.

Degradation - Hydrolysis

This portion of the study could not be validated because insufficient information was provided regarding the experimental design and results; raw data were not presented to support the reported half-lives, and it was not specified that sterile conditions were maintained.

Mobility - Leaching

1. This portion of the study was considered to be scientifically invalid because the procedures and protocols were inadequate for the assessment of disulfoton mobility in soil. Test soils were prepared with a nonadsorptive Celite filter-aid which may have affected the mobility of disulfoton, and the columns were eluted with an inadequate amount of water (two void volumes).

2. No data were presented on the distribution of disulfoton in the soil columns.

Mobility - Adsorption/Desorption

1. Desorption experiments were not performed.

2. Data were not presented to support the reported K_d values.

Mobility - Runoff

The procedures and protocols used were adequate only for the study of the mobility of disulfoton in runoff.

Field Dissipation - Aquatic and Aquatic Impact

1. The increasing concentrations of disulfoton during the first 24 hours of incubation were unexplained.

2. The pattern of formation and decline of degradates was not addressed.

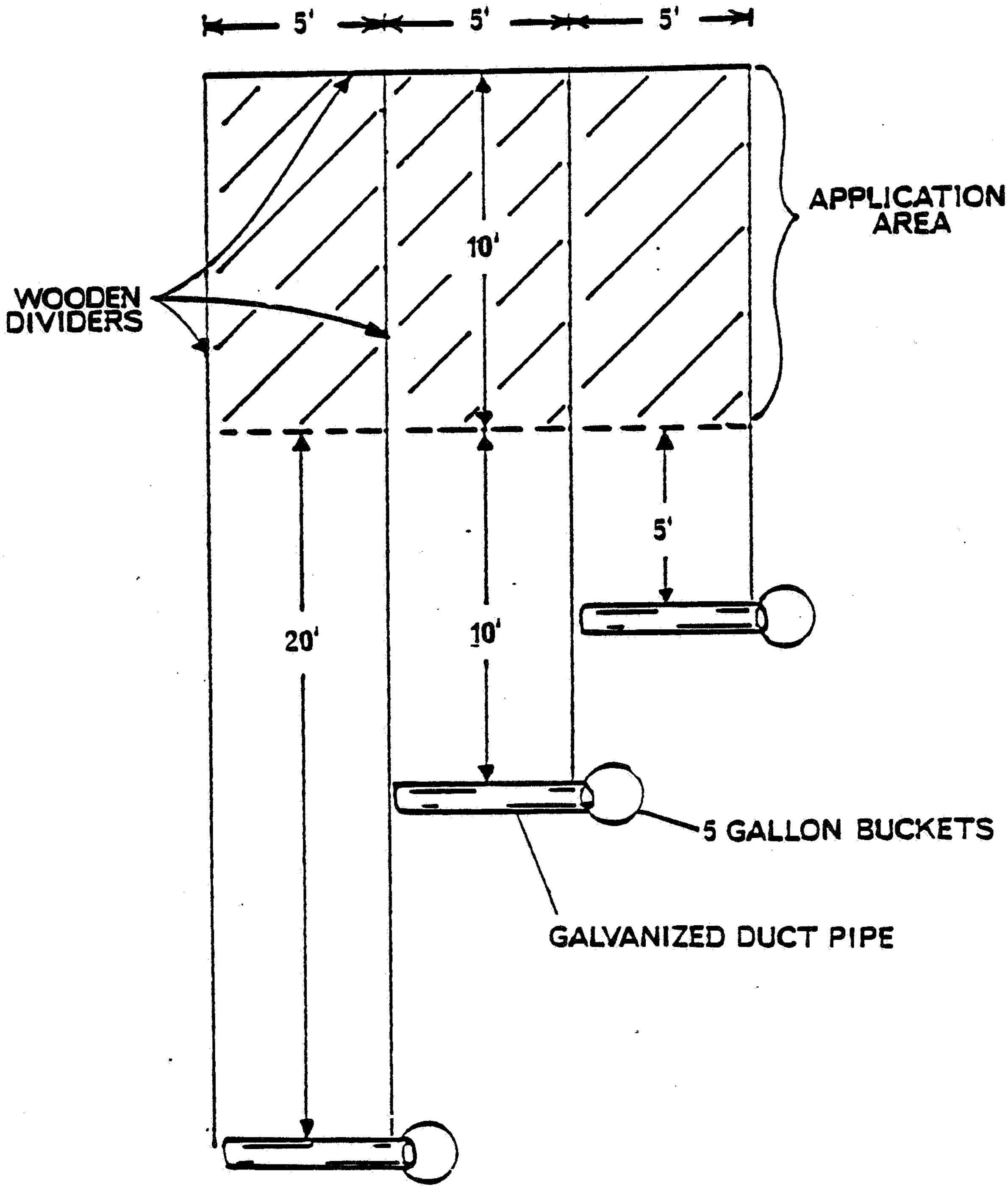

Figure 1. Soil runoff plot design.

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Table 1. Characteristics of soils used in mobility experiments.

Soil	Sand	Silt	Clay	Organic matter	pH	Bulk density (g/cc)
	%					
Sandy loam[a]	56.4	33.1	10.5	1.4	6.4	1.50
Silt loam	16.7	62.8	20.5	1.8	5.5	1.34
High organic silt loam[b]	24.2	56.8	19.0	4.6	5.4	1.28

[a] Prepared by incorporating brick sand into the silt loam soil.

[b] Prepared by incorporating Iowa peat into the silt loam soil.

Table 2. Percentage of applied disulfoton detected in runoff from three soils treated at 4 lb ai/A.

Soil	Days posttreatment	Irrigation water (inches)	Disulfoton recovered at various distances (in feet) from the application area (% of applied)		
			5 foot point	10 foot point	20 foot point
Sandy loam	2	0.75	0.18	0.15	0.04
	8	0.60	0.09	0.07	0.09
	14	0.60	0.04	0.02	0.04
	21	0.25	0.07	0.06	0.03
	28	0.28	0.04	0.04	0.04
Silt loam	2	0.80	0.60	0.01	0
	8	0.50	0.58	0.33	0
	14	0.20	0.15	0.07	0
	21	0.25	0.15	0.10	0
	28	0.20	0.10	0.09	0.04
High organic silt loam	2	0.80	0.17	0.06	0.06
	8	0.35	0.22	0.10	0.04
	14	0.20	0.25	0.13	0.04
	21	0.12	0.21	0.25	0.12
	28	0.12	0.26	0.15	0.06

(TDR03B) DATA EVALUATION RECORD PAGE 1 OF 2

CASE GS0102 DISULFOTON STUDY 2 PM 100 10/04/82

CHEM 032501 Disulfoton

BRANCH EFB DISC 30 TOPIC 05101505 GUIDELINE 40 CFR 163.62-7b/c

FORMULATION 00 - ACTIVE INGREDIENT

FICHE/MASTER ID 00092972 CONTENT CAT 01
Mitchell, T.H., J.H. Ruzicka, J. Thomson, and B.B. Wheals. 1968. The chromatographic determination of organophosphorus pesticides. Part III. The effect of irradiation on the parent compounds. J. Chromatogr. 32:17-23. Also In unpublished submission received Sep. 8, 1970 under unknown admin. no.; submitted by American Cyanamid Co., Princeton, NJ; CDL:120350-X.

SUBST. CLASS = S.

DIRECT RVW TIME = 4 (MH) START-DATE END DATE

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CONCLUSION:

Degradation - Photodegradation in Water

This study is scientifically invalid because dark controls were not used. This study would not fulfill EPA Data Requirements for Registering Pesticides (1983) because the experiments were conducted in acetone and not in water, a materials balance was not conducted, and degradate identification and quantification were inadequate.

MATERIALS AND METHODS:

A stock solution containing 100 μg of disulfoton (source unspecified, test substance uncharacterized) per ml of acetone was prepared, and a 10 ml aliquot placed in a glass beaker. Beakers (uncovered) were irradiated with UV light (maximum wavelength 254 nm), with the lamp (Camag Universal UV lamp, Type T.L. 900) 2 cm from the surface of the disulfoton solution. Solvent was added at the end of each day to compensate for any evaporation. Samples of exposed solutions were taken at unspecified intervals, and stored under refrigeration until analysis by using GLC and TLC.

REPORTED RESULTS:

Disulfoton was degraded with a half-life of ~15 hours. Two possible degradates were identified (but not quantified): disulfoton sulfone and disulfoton sulfoxide. A third possible degradate could not be characterized, but was reported to have been either disulfoton oxygen analog sulfone or disulfoton oxygen analog sulfoxide.

DISCUSSION:

1. Dark controls were not run.

2. No attempt was made to conduct a materials balance. Beakers containing the test substance were left uncovered during irradiation, and there was no attempt to determine the extent to which disulfoton was lost through evaporation.

3. Patterns of degradate formation and decline were expressed as "% of maximum," without any quantitative indication as to the actual maximum levels reached.

4. The intensity of the light source was not specified.

(TDR03B) DATA EVALUATION RECORD PAGE 1 OF 11

CASE GS0102 DISULFOTON STUDY 3 PM 100 10/04/82

CHEM 032501 Disulfoton

BRANCH EFB DISC 30 TOPIC 050520

FORMULATION 00 - ACTIVE INGREDIENT

FICHE/MASTER ID 00095664 CONTENT CAT 01
Shaw, H.R., II. 1975. The metabolism of Di-Syston in soil: Report No. 40234. Rev. Unpublished study received May 23, 1978 under 3125-183; submitted by Mobay Chemical Corp., Kansas City, MO; CDL:234065-A.

SUBST. CLASS = S. OTHER SUBJECT DESCRIPTORS SEC: EFB -30-05052005 EFB -30-05052010

DIRECT RVW TIME = 22 (MH) START-DATE END DATE

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CONCLUSIONS:

Degradation - Hydrolysis

This portion of the study could not be validated because the sampling intervals were inadequate to provide data for an accurate assessment of disulfoton hydrolysis. This portion of the study would not fulfill EPA Data Requirements for Registering Pesticides (1983) because the test substance used was not technical grade or purer, the analytical method was inadequately described, the experiment was not conducted in buffered solutions, and the incubation temperature was unspecified.

Degradation - Photodegradation in Water

This portion of the study could not be validated because the sampling intervals were inadequate to accurately assess the photodegradation of disulfoton in water. This portion of the study would not fulfill EPA Data Requirements for Registering Pesticides (1983) because the test substance used was not technical grade or purer, the analytical method was inadequately described, and the experiment was not conducted in buffered solution.

Degradation - Photodegradation on Soil

This portion of the study could not be validated because the sampling intervals were inadequate to accurately assess the photodegradation of disulfoton on soil. This portion of the study would not fulfill EPA Data Requirements for Registering Pesticides (1983) because the test substance used was not technical grade or purer.

Metabolism - Aerobic Soil

This portion of the study could not be validated because the sampling intervals were inadequate to provide data for an accurate assessment of disulfoton metabolism in soil. This portion of the study would not fulfill EPA Data Requirements for Registering Pesticides (1983) because the test substance used was not technical grade or purer, and for all but one experiment the incubation temperature was either unspecified or not maintained at a constant temperature between 18 and 30 C.

Metabolism - Anaerobic Soil

This portion of the study could not be validated because the sampling intervals were inadequate to provide data for an accurate assessment of disulfoton metabolism in soil. This portion of the study would not fulfill EPA Data Requirements for Registering Pesticides (1983) because the test substance used was not technical grade or purer, and the incubation temperature was unspecified.

MATERIALS AND METHODS:

Degradation - Hydrolysis

[^{14}C]Disulfoton (Di-Syston, specific activity 2.92 mCi/mM, chemical purity 98.8%, radiochemical purity 99%, Mobay Chemical Corp.) was formulated as a 6 lb/gal EC and applied at 2 ppm to beakers of deionized water. Water samples were maintained in the dark under ambient temperature conditions (unspecified), and were sampled at 7, 64, and 126 days posttreatment.

The radioactivity was characterized on silica-gel TLC plates using the following solvent systems: ethyl acetate:benzene (2:1); ethyl acetate:hexane:acetone (8:2:1); and acetonitrile:water (7:3). Radioactivity was detected by using a radiochromatogram scanner and comparison with known standards. The method of extraction and quantification of [^{14}C]disulfoton residues was not specified.

Degradation - Photodegradation in Water

[^{14}C]Disulfoton (Di-Syston, specific activity 2.92 mCi/mM, chemical purity 98.8%, radiochemical purity 99%, Mobay Chemical Corp.) was formulated as a 6 lb/gal EC and applied at 2 ppm to beakers of deionized water. One sample was continuously exposed to artificial sunlight at an intensity of 75 footcandles using Vita-lite fluorescent lamps. The UV intensity between 300-400 nm was 400 ergs/sec/cm. Water samples were maintained at ambient temperature (unspecified). Water samples were collected for analysis at 4, 7, and 28 days posttreatment. Another treated deionized water sample was maintained under room lighting and ambient temperature conditions, and analyzed at 7, 64, and 126 days posttreatment. The samples were analyzed as described previously under hydrolysis.

Degradation - Photodegradation on Soil

[^{14}C]Disulfoton (Di-Syston, specific activity 2.92 mCi/mM, chemical purity 98.8%, radiochemical purity 99%, Mobay Chemical Corp.) was formulated as a 6 lb/gal EC and applied at 2 ppm to 50-, 20-, or 100-g portions of sandy clay loam, muck, and silty clay soils, respectively (Table 1). Soil samples were placed in 250 ml beakers and continuously exposed to artificial sunlight at an intensity of 75 footcandles using Vita-lite fluorescent lamps. The UV intensity between 300-400 nm was 400 ergs/sec/cm. Samples were collected for analysis at 1, 3, 7, 14, 28, and 126 days posttreatment. Control samples kept in the dark were sampled at 7 and 56 days posttreatment (muck and sandy clay loam soil) and at 3, 7, 28, 56, and 126 days posttreatment (silty clay soil). Soil moisture content was maintained at 100% of field capacity.

Soil samples were extracted with acetone and water, filtered under vacuum, and the filtrate was reextracted three times with chloroform to yield aqueous organic acid, and solid fractions.

The organic fraction was characterized by using silica-gel TLC plates with the following three solvent systems: ethyl acetate:benzene (2:1); ethyl acetate:hexane:acetone (8:2:1); and acetonitrile:water (7:3). Radioactivity was determined by using a radiochromatogram scanner. Infrared analysis was performed to confirm TLC results.

The solids fraction was further extracted with hot solvents (94 C) or by Soxhlet extraction with chloroform:methanol (9:1), the aqueous fractions were combined, concentrated and eluted from a Sephadex G-10 column and isolated degradates were ethylated according to the procedure of Stanley (1966. J. Agric. Food Chem. 14:321). The degradates were quantified by using TLC and GC and were compared to similarly detected standards. Soil solids were combusted and the $^{14}CO_2$ evolved was trapped and quantified by using LSC.

Humic acids were isolated from sandy clay loam samples by the method of Kazane et al. (1972. J. Agric. Food Chem. 20:975). Sand and silt fractions were separated, and the silt portion was extracted with hot solvents, shaken with 20% NaOH, filtered, and acidified. The humic acid, the aqueous phase, and the solid residue were then radioassayed.

A portion of the sandy clay loam soil was autoclaved and acid hydrolyzed. The hydrolysate was extracted with acetone:chloroform, and the aqueous phase was concentrated and quantified by using column chromatography.

Metabolism - Aerobic Soil

Experiment 1

[^{14}C]Disulfoton (Di-Syston, specific activity 2.92 mCi/mM, chemical purity 98.8%, radiochemical purity 99%, Mobay Chemical Corp.) was formulated as a 6 lb/gal EC and applied at 2 ppm to sterile (autoclaved) and nonsterile sandy clay loam, muck, and silty clay soils (Table 1). Soil samples were maintained at 100% of field capacity under room lighting and ambient temperature conditions. Nonsterile soil samples were taken at 3, 7, 14, 28, 126, and 365 days posttreatment. Sterile soil samples were taken at 7, 56, and 126 days posttreatment. Soil samples were quantified as described previously for photodegradation on soil.

Experiment 2

Samples of sandy clay loam, muck, and silty clay soils (Table 1) were adjusted to pH 5 and 8, and treated with [^{14}C]disulfoton as described in Experiment 1. Soil samples were maintained at 100% of field capacity under room lighting and ambient temperature conditions. Samples were taken at 7, 14, and 126 days posttreatment. Soil samples were quantified as described previously for photodegradation on soil.

Experiment 3

Sandy clay loam, muck, and silty clay soils (Table 1) were treated with [^{14}C]disulfoton as described in Experiment 1. Soil samples were maintained at 100% of field capacity in the dark at 20 or 40 C (±0.5 C). Samples were taken at 7, 28, and 56 days posttreatment for soils maintained at 20 C, and at 7, 14, and 56 days posttreatment for soils maintained at 40 C. Soil samples were quantified as described previously for photodegradation on soil.

Metabolism - Anaerobic Soil

[^{14}C]Disulfoton (Di-Syston, specific activity 2.92 mCi/mM, chemical purity 98.8%, radiochemical purity 99%, Mobay Chemical Corp.) was formulated as a 6 lb/gal EC and applied at 10 ppm to a silty clay soil (Table 1). The treated soil was divided into four portions, which were maintained aerobically under unspecified conditions for 30 days. Two of the four soil samples were then converted to anaerobic conditions by purging with CO_2 and hydrogen. At 60 and 90 days posttreatment, one aerobic and one anaerobic sample were taken for analysis, and quantified as described previously for photodegradation on soil.

REPORTED RESULTS:

Degradation - Hydrolysis

[^{14}C]Disulfoton was degraded with a half-life of ~7 days; 48.2% and 14% of the radioactivity was recovered as parent compound at 7 and 56 days posttreatment, respectively. The majority of the radioactivity (51.8-81.5%) was associated with disulfoton sulfoxide throughout the 126-day test period. Concentrations of disulfoton sulfone, disulfoton thiol sulfoxide, and disulfoton thiol sulfone were <5.4%.

Degradation - Photodegradation in Water

[^{14}C]Disulfoton was degraded rapidly in irradiated water samples, with 1% of the radioactivity recovered as parent compound after 3 days of exposure. No disulfoton was detected (detection limit not reported) at days 7 and 28 of exposure. Maximum concentrations (% of applied) of photoproducts detected were: disulfoton sulfoxide, 79.8% on day 7; disulfoton sulfone, 19.1% on day 28; disulfoton thiol sulfoxide, 27.5% on day 28; and disulfoton thiol sulfone, 15.1% on day 3.

In water samples maintained under room lighting, [^{14}C]disulfoton was degraded with a half-life of <7 days (21.3% of applied remaining at day 7) and was not detected (detection limit not reported) at days 56 and 126 posttreatment. The majority of the radioactivity was associated with disulfoton sulfoxide (78.7-88.3% of applied), while disulfoton sulfone and disulfoton thiol sulfoxide accounted for <11.7%. No disulfoton thiol sulfone was detected at any sampling interval.

Degradation - Photodegradation on Soil

[^{14}C]Disulfoton was degraded with a half-life of <7 days in irradiated and dark control sandy clay loam, silty clay, and muck soils. The distribution of radioactivity in silty clay soil is shown in Table 2.

Metabolism - Aerobic Soil

Experiment 1

[^{14}C]Disulfoton was degraded with half-lives of <3 and <7 days in nonsterile and sterile soils, respectively (Table 3). Disulfoton sulfoxide and disulfoton sulfone accounted for up to 76.7% of the applied radioactivity during the 126-day test period, while disulfoton thiol sulfoxide and disulfoton thiol sulfone were found at <2.9%.

Experiment 2

After 7 days of incubation, no disulfoton was detected (detection limit not reported) in silty clay soil (pH 5 and 8) treated with [^{14}C]disulfoton at 2 ppm. Disulfoton sulfoxide and disulfoton sulfone were found at maximum concentrations of 36.8% (pH 5, day 7) and 63% (pH 8, day 14), respectively. Disulfoton thiol sulfoxide and disulfoton thiol sulfone were found at <4.5% in silty clay soil at pH 8, but were not detected at pH 5.

Experiment 3

Disulfoton was not detected at any sampling interval in silty clay soil treated with [^{14}C]disulfoton at 2 ppm and incubated at 20 or 40 C. Disulfoton sulfoxide and disulfoton sulfone were the major degradates formed under both incubation conditions, accounting for up to 35.4% (40 C, day 7) and 63.1% (20 C, day 7) of the applied radioactivity, respectively. Disulfoton thiol sulfoxide, disulfoton thiol sulfone, and one unknown degradate were identified.

Metabolism - Anaerobic Soil

The degradation of [^{14}C]disulfoton under anaerobic conditions was not appreciably different from that under aerobic conditions, although disulfoton thiol sulfoxide and two unidentified degradates were found (<3.5% of applied) only in anaerobically incubated soil samples (Table 4).

DISCUSSION:

General (All Experiments)

1. The test substance was formulated as a 6 lb/gal EC prior to use.

2. Method detection limits and recovery values for disulfoton and its degradates were not reported.

3. Two of the test soils used were reported to be sandy loam and silty loam soils; however, according to the USDA soil texture classification system these soils are a sandy clay loam and silty clay, respectively, and have been reported as such in this review.

4. Sampling intervals were inadequate to provide data for an accurate assessment of disulfoton degradation because a half-life was reached by the time the first sample was taken for analysis. Therefore, application rates were not confirmed, and the formation of degradates could not be quantified.

Degradation - Hydrolysis

1. The method used for extraction and quantification of residues was not reported.

2. The experiment was not conducted in buffered solutions, and the incubation temperature was not specified.

Degradation - Photodegradation in Water

1. The method used for extraction and quantification of residues was not reported.

2. The experiment was not conducted in buffered solutions.

Metabolism - Aerobic Soil

1. With the exception of the experiment conducted at 20 C, incubation temperatures were either unspecified or not maintained at constant temperature between 18 and 30 C.

2. Results of Experiments 2 and 3 were reported only for the silty clay soil samples.

Table 1. Soil characteristics.

Soil	Sand	Silt	Clay	Organic matter	pH
	%				
Sandy clay loam[a]	48.0	26.0	26.0	2.0	7.3
Silty clay[a]	4.0	45.0	51.0	1.7	6.5
Canadian muck	8.1	70.3	21.6	81.5	5.0

[a] See Discussion No. 3 (General).

Table 2. Distribution of radioactivity (% of applied) in irradiated and dark control silty clay soil.

Component	Days posttreatment						
	1	3	7	14	28	56	126
	Irradiated						
Disulfoton	38.6	ND[a]	ND	ND	ND	ND	ND
Disulfoton sulfoxide	57.5	48.0	33.0	12.2	6.8	2.6	1.4
Disulfoton sulfone	ND	36.8	48.0	63.7	52.6	45.2	25.4
Disulfoton thiol sulfoxide	ND	ND	ND	ND	1.8	1.6	0.4
Disulfoton thiol sulfone	ND	ND	ND	ND	2.3	5.7	3.4
	Dark Control						
Disulfoton		0.7	ND		ND	ND	ND
Disulfoton sulfoxide		49.0	40.5		11.3	6.5	ND
Disulfoton sulfone		40.8	47.5		63.0	66.0	45.0
Disulfoton thiol sulfoxide		0.4	ND		ND	ND	ND
Disulfoton thiol sulfone		ND	ND		ND	ND	ND

[a] Nondetectable; detection limit not reported.

Table 3. Distribution of radioactivity (% of applied) in sterile and nonsterile sandy clay loam, silty clay, and muck soils.

Component	Days posttreatment 3	7	14	28	56	126
Nonsterile sandy clay loam						
Disulfoton	1.3	ND[a]	ND	ND	--	ND
Disulfoton sulfoxide	54.5	41.5	21.9	7.8	--	9.2
Disulfoton sulfone	25.0	31.6	45.5	36.3	--	5.6
Disulfoton thiol sulfoxide	2.9	ND	ND	1.3	--	0.4
Disulfoton thiol sulfone	ND	ND	ND	ND	--	ND
Nonsterile silty clay						
Disulfoton	1.7	ND	ND	ND	--	ND
Disulfoton sulfoxide	52.5	34.3	21.2	9.7	--	ND
Disulfoton sulfone	35.3	49.0	61.5	60.80	--	47.2
Disulfoton thiol sulfoxide	1.9	2.5	0.4	ND	--	ND
Disulfoton thiol sulfone	ND	ND	1.1	1.5	--	0.2
Nonsterile muck						
Disulfoton	0.6	ND	ND	ND	--	ND
Disulfoton sulfoxide	50.7	45.6	17.9	5.9	--	ND
Disulfoton sulfone	21.7	40.2	65.9	74.0	--	47.7
Disulfoton thiol sulfoxide	1.1	ND	ND	ND	--	ND
Disulfoton thiol sulfone	ND	2.7	ND	0.6	--	ND
Sterile sandy clay loam						
Disulfoton	--	19.3	--	ND	ND	--
Disulfoton sulfoxide	--	47.5	--	30.8	19.2	--
Disulfoton sulfone	--	9.1	--	37.0	39.7	--
Disulfoton thiol sulfoxide	--	ND	--	ND	ND	--
Disulfoton thiol sulfone	--	ND	--	ND	ND	--
Sterile silty clay						
Disulfoton	--	20.1	--	ND	ND	--
Disulfoton sulfoxide	--	57.9	--	42.6	19.7	--
Disulfoton sulfone	--	10.1	--	36.7	52.5	--
Disulfoton thiol sulfoxide	--	ND	--	ND	2.4	--
Disulfoton thiol sulfone	--	ND	--	ND	1.8	--
Sterile muck						
Disulfoton	--	4.7	--	ND	ND	--
Disulfoton sulfoxide	--	65.7	--	23.5	9.1	--
Disulfoton sulfone	--	23.2	--	63.5	76.7	--
Disulfoton thiol sulfoxide	--	ND	--	ND	ND	--
Disulfoton thiol sulfone	--	ND	--	ND	ND	--

[a] Nondetectable; detection limit not reported.

Table 4. Distribution of radioactivity (% of applied) in silty clay soil incubated under aerobic or anaerobic conditions.

Component	Days posttreatment 60	90
Aerobic		
Disulfoton	ND[a]	ND
Disulfoton sulfoxide	11.6	ND
Disulfoton sulfone	85.0	100
Disulfoton thiol sulfoxide	ND	ND
Disulfoton thiol sulfone	3.3	ND
Anaerobic		
Disulfoton	1.7	ND
Disulfoton sulfoxide	14.0	ND
Disulfoton sulfone	77.2	98.0
Disulfoton thiol sulfoxide	1.7	ND
Disulfoton thiol sulfone	ND	2.0
Unknown 1	2.1	ND
Unknown 2	3.5	ND

[a] Nondetectable; detection limit not reported.

[b] Soil samples maintained aerobically for 30 days and then converted to anaerobic conditions by purging with CO_2 and hydrogen.

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CASE GS0102 DISULFOTON STUDY 4 PM 100 10/04/82

CHEM 032501 Disulfoton

BRANCH EFB DISC 30 TOPIC 050525 GUIDELINE 40 CFR 163.62-9b/c/d

FORMULATION 00 - ACTIVE INGREDIENT

FICHE/MASTER ID 00065859 CONTENT CAT 01

Helling, C.S., D.G. Dennison, and D.D. Kaufman. 1974. Fungicide movement in soils. Phytopathology. 64(Aug):1091-1100. Also In unpublished submission received Mar. 5, 1976 under 6G1754; submitted by Kalo Laboratories, Inc., Kansas City, MO; CDL:095981-G.

SUBST. CLASS = S. OTHER SUBJECT DESCRIPTORS PRIM: RCBP-05-1005

DIRECT RVW TIME = 4 (MH) START-DATE END DATE

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CONCLUSION:

Mobility - Leaching and Adsorption/Desorption

This study is scientifically invalid because it was not demonstrated that the bioassays used (fungal and algal) could detect the insecticide disulfoton. Had a valid bioassay been used, this study would not have fulfilled EPA Data Requirements for Registering Pesticides (1983) because bioassays are unable to distinquish between the parent compound and its degradates.

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MATERIALS AND METHODS:

Soil TLC was conducted with a Hagerstown silty clay loam soil (39.5% clay, pH 6.8, 2.5% organic matter, 34.1% water). The soil was sieved to 250 µm, moistened with water until moderately fluid, and applied to glass TLC plates. Disulfoton (98% pure, Mobay Chemical Corp.) was applied to the plates, which were then leached with water in a closed chamber.

Ten soil fungi and an alga were used as visualizing agents for R_f determinations. The air-dried plates were sprayed with a liquid nutrient agar suspension of the organisms and incubated at 100% humidity and ~28 C in the dark (alga incubated in light) until zones of inhibition or stimulation appeared. Fungi used in the study were *Aspergillus fumigatus*, *Diplodia zeae*, *Fusarium roseum*, *Helminthosporium sativum*, *Penicillium chrysogenum*, *P. rugulosum*, *Rhizoctonia solani*, *Trichoderma viride*, and two isolates of *Fusarium moniliforme*. The alga used was *Chlorella sorokiniana*.

REPORTED RESULTS:

Disulfoton was immobile on the soil TLC plates, with an average R_f value of 0.01.

DISCUSSION:

1. The objective of this study was to investigate the fungal and algal bioassay visualization method for its general usefulness and accuracy for numerous pesticides. Autoradiography R_f values, determined for 3 of the 38 tested pesticides showed good agreement between the autoradiograph and bioassay results in terms of relative mobilities of the pesticides. However, disulfoton was not one of the three compounds tested.

2. It was not demonstrated that the fungal and algal bioassays used could detect the insecticide disulfoton. In addition, bioassays are nonspecific and cannot distinguish between the parent compound and its degradates.

(TDR03B) DATA EVALUATION RECORD PAGE 1 OF 2

CASE GS0102 DISULFOTON STUDY 5 PM 100 10/04/82

CHEM 032501 Disulfoton

BRANCH EFB DISC 30 TOPIC 1005

FORMULATION 90 - FORMULATION NOT IDENTIFIED

FICHE/MASTER ID 00094227 CONTENT CAT 01
Mobay Chemical Corporation. 1972. Dasanit - Di-syston: analytical and residue information on tobacco. Includes methods dated Mar. 5, 1964; Mar. 28, 1966; Oct. 27, 1967; and others. Compilation; unpublished study, including published data, received Aug. 21, 1972 under 3125-279; CDL:007221-A.

SUBST. CLASS = M; OTHER CHEMS: 032701 OTHER SUBJECT DESCRIPTORS SEC: EFB -30-050530

DIRECT RVW TIME = 4 (MH) START-DATE END DATE

REVIEWED BY: L. Lewis
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Report No. 29915 was included under 00094227 but was reviewed separately as Study 1 (00095651).

CONCLUSIONS:

Mobility - Leaching and Adsorption/Desorption

1. This study is scientifically valid.

2. Disulfoton, applied to subirrigated soil columns at 20 lb ai/A, exhibited slight upward mobility in a Hagerstown silty clay loam and a Lakeland sandy loam soil.

3. This study does not fulfill EPA Data Requirements for Registering Pesticides (1983) because the experimental method was not one of the three specified for use in predicting pesticide mobility in soil.

MATERIALS AND METHODS:

Air-dried Hagerstown silty clay loam (4.3% organic matter, 30% clay, CEC 12.5, pH 5.5, bulk density in columns = 1.2 g/cc) and Lakeland sandy loam soil (3.3% organic matter, 10% clay, CEC 2.9, pH 6.2, bulk density in columns = 1.4 g/cc) were uniformly packed in replicate aluminum columns to a depth of 4.4 cm). The columns were constructed of aluminum rings (2.5-cm high, 7.6-cm inside diameter). Disulfoton (technical grade, purity and source unspecified) in ethanol solution was applied at 20 lb ai/A (10.2 mg/column) and the ethanol was evaporated overnight. Additional air-dried soil was then packed in the columns to a depth of 17.8 cm, and the columns were placed in 2-liter plastic containers to allow for subirrigation at a depth not exceeding 2.5 cm of water. After 3 days, the columns were sectioned into 1-inch segments and the segments were dried, sieved (2 mm), and individually mixed.

Soil samples were extracted twice with hexane:2-propanol (3:1), and the two extracts were combined, filtered, concentrated, and quantified by using electron-capture GC. Recovery values for the silty clay loam and sandy loam soils were 43% and 61%, respectively.

The range of possible mobility factor values was from 1.0 (no movement) to 6.0 (maximum movement), and were calculated as described by Harris (1967. Weeds 15:214).

REPORTED RESULTS:

Disulfoton was found to be slightly mobile in the two soils tested after upward movement of water (quantity unspecified). For the silty clay loam and sandy loam soils, respectively, 3.7 and 5.7 mg of disulfoton was recovered from the treated soil segment, and 0.77 and 0.61 mg from the adjacent untreated soil segment. These values represented total disulfoton recovered. The mobility factors for disulfoton in the silty clay loam and the sandy loam soils were 1.2 and 1.1, respectively.

DISCUSSION:

The experimental method used (subirrigated soil columns to determine upward mobility) was not one of the three specified for use in predicting pesticide mobility in soil.

CASE GS0102 DISULFOTON STUDY 6 PM 100 10/04/82

CHEM 032501 Disulfoton

BRANCH EFB DISC 30 TOPIC 050525 GUIDELINE 40 CFR 163.62-9b/c/d

FORMULATION 00 - ACTIVE INGREDIENT

FICHE/MASTER ID 00052094 CONTENT CAT 01
Kawamori, I., T. Saito, and K. Iyatomi. 1971. Fate of organophosphorus insecticides in soils. Part I. Botyu-Kagaku 36(?):7-12. Also In unpublished submission received Dec. 4, 1974 under 5F1531; submitted by American Cyanamid Co., Princeton, NJ; CDL: 094151-Q.

FICHE/MASTER ID 00052095 CONTENT CAT 01
Kawamori, I., T. Saito, and K. Iyatomi. 1971. Fate of organophosphorus insecticides in soils. Part II. Botyu-Kagaku 36(?):12-17. Also In unpublished submission received Dec. 4, 1974 under 5F1531; submitted by American Cyanamid Co., Princeton, NJ; CDL: 094151-R.

SUBST. CLASS = S. OTHER SUBJECT DESCRIPTORS SEC: EFB -30-050525

DIRECT RVW TIME = 7 1/2 (MH) START-DATE END DATE

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CONCLUSIONS:

Mobility - Leaching and Adsorption/Desorption

1. This study is scientifically valid.

2. More than 92% of the applied [^{32}P]disulfoton was eluted from 2.5-cm deep columns (sandy loam, clay loam, and silty clay loam soils) after the application of ~50 inches of water. Results of alkali treatment of disulfoton indicated that disulfoton sulfoxide and disulfoton sulfone were more mobile in these soils than was the parent compound. Aging [^{32}P]-disulfoton prior to elution increased adsorption 10-20 times that of unaged [^{32}P]disulfoton. Mobility of disulfoton in soil appears to decrease as organic matter content and CEC increase.

3. This study does not fulfill EPA Data Requirements for Registering Pesticides (1983) because the column lengths were insufficient (2.5 cm) to fully assess the leaching characteristics of disulfoton in soil.

MATERIALS AND METHODS:

Experiment 1

[^{32}P]Disulfoton (>90% purity; 400 cpm/µg specific activity) was synthesized by using the methods of Metcalf et al. (1957. J. Econ. Entomol. 50:338) and O'Brien (1960. Toxic Phosphorus Esters. Academic Press, NY 345). The radioactive disulfoton was stored as an EC (containing 47.5% benzene-acetone (1:1, w/w) and 2.5% Newcol 863) at 5 C for 3 weeks.

Sandy loam, clay loam, and silty clay loam soils (Table 1) were air dried, passed through a 2-mm sieve, and 12, 9.2, and 5.6-g fractions, respectively, were packed directly into columns (2-cm diameter x 2.5-cm deep) and treated with 10 mg of [^{32}P]disulfoton in 10 ml of water. The columns (unaged) were eluted with 400 ml of water (equivalent to 50 inches). Other soil fractions were treated with [^{32}P]disulfoton and incubated (aged) in beakers at 25 ± 3 C and 70% relative humidity for 2, 6, or 10 days prior to being packed into columns and eluted with water. Eluate was collected from each column, concentrated to 10 ml at 40 C, and extracted three times in chloroform. An aliquot of the combined extracts was dried on a planchet. Radioactivity was measured by using an Aloka thin window par-flow automatic counter. Another aliquot (eluate) was concentrated, separated by paper chromatography, and radioactivity measured by using an Aloka 4π low-background gas flow scanner. Soil from the columns was mixed and dried, and then the radioactivity in the soil was counted by using an Aloka thin window par-flow automatic counter. The clay fraction of additional soil aliquots was also counted for radioactivity.

Extraction of soil organic matter by water was compared with extraction by a 1:1 mixture of NaOH (0.1 N) and $Na_4P_3O_7$ (0.1 M).

Experiment 2

In a separate experiment, 10 mg [^{32}P]disulfoton (specific activity 400 cpm/µg, >90% purity) was prepared in 10 ml water and adjusted to pH >10 with 6 N potassium hydroxide. The solution was allowed to stand at 25 C for 3 days after which time disulfoton was >90% degraded. The pH was then adjusted to the initial pH with 6 N hydrochloric acid and the disulfoton residues (degradation products) were applied to soil columns and their mobility analyzed by the same procedure as described above.

REPORTED RESULTS:

Experiment 1

Approximately 7.8%, 3.1% and 1.2% of the applied [^{32}P]disulfoton was retained in silty clay loam, clay loam, and loamy sand soils, respectively, after elution with 400 ml of water. Aging [^{32}P]disulfoton in soil for 2-10 days prior to elution with 200 ml of water increased soil adsorption over that of unaged (0 day) samples (Table 2). Chromatography analysis of the eluate from samples aged 2 or 10 days prior to leaching found the sulfoxide and sulfone degradates of disulfoton to be present 10 days post-treatment and the amount of the parent compound to be decreasing (Table 3). Adsorption of disulfoton was directly related to organic matter and clay content.

Experiment 2

Results of alkali treatment of disulfoton indicated that degradates of [^{32}P]disulfoton were more mobile in soil than was the parent compound. In loamy sand, clay loam, and silty clay loam soils, [^{32}P]disulfoton degradates were found at 16.6, 20.3, and 32.4 µg/g of air-dried soil, respectively; [^{32}P]disulfoton was found in respective soils at 120.0, 310.0, and 780.0 µg/g of air-dried soil.

DISCUSSION:

1. Although disulfoton leached rapidly under the test conditions, the columns were too short (2.5-cm tall) to fully assess the leaching characteristics of disulfoton.

2. Degradates may have been present which could not be isolated and identified from the chloroform extracts by using paper chromatography. Method sensitivity and recovery values were not reported.

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Table 1. Soil characteristics.

Soil type	Organic matter (%)	CEC (meq/100 g)	pH	Soil moisture (%)
Loamy sand	1.1	5.4	4.7	1.6
Clay loam	3.6	12.3	4.9	2.5
Silty clay loam	15.5	33.2	5.3	7.3

Table 2. [^{32}P]Disulfoton adsorption (μg/g soil) by three soils.[a,b]

	Incubation period (days)			
Soil type	0	2	6	10
Loamy sand	0.6	0.7	1.0	1.3
Clay loam	1.2	1.3	1.6	2.5
Silty clay loam	3.6	3.8	4.4	5.3

[a] Estimated values from Figure 1 in 00052095.

[b] Soil column eluted with 200 ml of water (~25 inches).

Table 3. Relative amounts of chloroform extractable materials in the water eluate obtained at the indicated periods after soil application of [^{32}P]disulfoton.

Soils	Days posttreatment	Disulfoton residues (% of applied radioactivity)[a]					
		PC	PSO	PSO_2	POA	POAO	$POAO_2$
Loamy sand	2	50.5	0	0	0	23.7	26.8
	10	22.2	TRACE[b]	0	0	19.1	58.7
Clay loam	2	18.7	0	0	0	69.8	11.5
	10	2.9	7.5	TRACE	0	10.5	79.1
Silty clay loam	2	17.7	0	0	0	71.5	10.8
	10	1.9	6.9	5.8	0	22.6	62.8
Soil free[c]	10	21.6	24.8	12.0	TRACE	23.8	17.8

[a] Abbreviations: PC, parent compound; PSO, sulfoxide degradates; POA, thiol types; POAO, sulfoxide degradate of thiol type; $POAO_2$, sulfone degradate of thiol type.

[b] Trace, undefined; no detection or sensitivity limits given.

[c] [^{32}P]Disulfoton was incubated without adding the soils.

(TDR03B) DATA EVALUATION RECORD PAGE 1 OF 3

CASE GS0102 DISULFOTON STUDY 7 PM 100 10/04/82

CHEM 032501 Disulfoton

BRANCH EFB DISC 30 TOPIC 050525 GUIDELINE 40 CFR 163.62-9b/c/d

FORMULATION 00 - ACTIVE INGREDIENT

FICHE/MASTER ID 00052092 CONTENT CAT 01
Graham-Bryce, L.J. 1969. Diffusion of organophosphorus insecticides in soils. J. Sci. Food Agric. 20(?/Aug):489-494. Also In unpublished submission received Dec. 4, 1974 under 5F1531; submitted by American Cyanamid Co., Princeton, NJ; CDL:094151-N.

SUBST. CLASS = S.

DIRECT RVW TIME = 4 1/2 (MH) START-DATE END DATE

REVIEWED BY: G. Bartels
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<u>CONCLUSIONS</u>:

Most of this study dealt with an experimental measurement of disulfoton diffusion in soil. Since this work would have no bearing on the development of a registration standard, only the data pertaining to actual soil adsorption measurements have been reviewed.

Mobility - Leaching and Adsorption/Desorption

This portion of the study cannot be validated because insufficient information on the procedures and protocol was provided; and, there appears to be an error in the units used to describe the amount of disulfoton adsorbed. In addition, this study would not fulfill EPA Data Requirements for Registering Pesticides (1983) because the test substance was not characterized, and an adsorption coefficient (i.e., K_d or Freundlich K) was not calculated.

MATERIALS AND METHODS:

Two-gram aliquots of a silt loam soil (18% clay, CEC of 19.8 meq/100 g, pH of 7.8, and 2.7% organic carbon) were equilibrated with 100-ml portions of disulfoton (source unspecified, test substance uncharacterized) solutions. The disulfoton concentrations ranged from 2 to 14 ppm in 0.01 M $CaCl_2$. Following equilibration, the soil was extracted with an acetone:hexane (3:2) solution, dried with anhydrous sodium sulfate, and analyzed for disulfoton by using GLC equipped with a thermionic phosphorus detector.

REPORTED RESULTS:

The adsorption isotherm for disulfoton is shown in Figure 1 and illustrates a linear relationship over the wide concentration range.

DISCUSSION:

1. The units (mg/g) used in Figure 1 to indicate the amount of disulfoton adsorbed should probably be µg/g.

2. No information was given on the experimental incubation times or temperature. Thus, degradation of disulfoton may have occured during the experiment.

3. No information was given about the adsorption constant (K_d) for this soil or which adsorption equation the authors believe best represent the data.

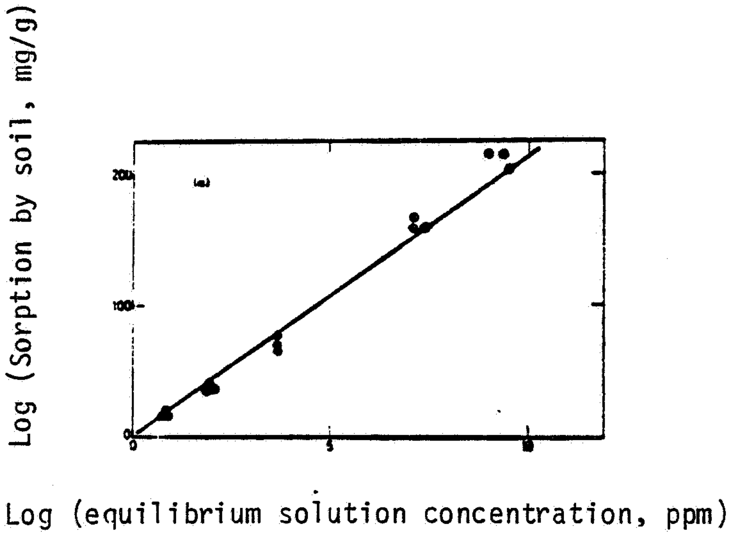

Figure 1. Adsorption isotherm for disulfoton.

(TDR03B) DATA EVALUATION RECORD PAGE 1 OF 3

CASE GS0102 DISULFOTON STUDY 8 PM 100 10/04/82

CHEM 032501 Disulfoton

BRANCH EFB DISC 30 TOPIC 0505

FORMULATION 00 - ACTIVE INGREDIENT

FICHE/MASTER ID 00073113 CONTENT CAT 01
McCarty, P.L. and P.H. King. 1966. The movement of pesticides in soils. Pages 156-171, In proceedings of the 21st Industrial Waste Conference: Part One: May 3-5, 1966. Lafayette, Ind.: Purdue Univ. Engineering extension series no. 121; also In unpublished submission received Aug. 28, 1972 under 279-2280, submitted by FMC Corp., Philadelphia, PA; CDL:120619-B.

SUBST. CLASS = S. OTHER SUBJECT DESCRIPTORS SEC: EFB-30-050515 EFB-30-050525 EFB-30-050520

DIRECT RVW TIME = 3 1/2 (MH) START-DATE END DATE

REVIEWED BY: T. Opeka
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CONCLUSIONS:

Mobility - Leaching and Adsorption/Desorption

1. The column leaching portions of this study in which columns were leached immediately after treatment are scientifically valid. However, the portions of this study pertaining to mobility of disulfoton degradates and adsorption are invalid because the experimental procedures were either inadequate or incompletely presented.

2. Disulfoton has a low mobility in Hugo sandy loam soil; 28% of the pesticide applied to a 6-inch high column was eluted with a total of 110 feet of dilute buffer.

3. This study does not fulfill EPA Data Requirements for Registering Pesticides (1983) because the test substance used was uncharacterized, and adsorption constants such as Freundlich K values were not calculated in the adsorption portion of the study.

MATERIALS AND METHODS:

Mobility - Adsorption

Aqueous disulfoton (source unspecified, test substance uncharacterized) solutions at 1, 10, 100, and 1,000 ppb were mixed with Hugo sandy loam soil (71% sand, 24% silt, 5% clay, 0.22% organic matter; pH and CEC not provided) for 65 minutes. After centrifugation, supernatants were extracted with hexane (70-80% recovery) and the hexane extracts were analyzed for disulfoton using electron-capture GC.

Mobility - Column Leaching

Disulfoton (source unspecified, test substance uncharacterized) was applied to 1.5- or 6.0-inch high columns of Hugo sandy loam soil at 1.0 or 10.0 lb ai/A, respectively. The respective columns were eluted with a total of 25 and 110 feet of distilled water (buffered to pH 7 with 0.01 M phosphate salts). In another experiment, elution (volume unspecified) of 6-inch columns treated with disulfoton at 1 lb ai/A was begun 1, 7, 28, or 112 days after treatment (the moisture level in soil prior to leaching was unspecified). In an additional experiment, applications at 1.0 lb ai/A were made to 6-inch columns at 20 unspecified intervals over a 1-year period; each application was followed by elution with 3.5 feet of 0.01 M phosphate buffer. At various intervals, aliquots of leachate were extracted and analyzed as for the adsorption experiment.

REPORTED RESULTS:

Mobility - Adsorption

The relationship between the concentration of disulfoton in solution and the amount adsorbed to Hugo sandy loam was linear at the solution concentrations tested. A ratio of ~1:5 was found for the concentration of disulfoton in solution to that adsorbed.

Mobility - Column Leaching

Of the disulfoton applied to Hugo sandy loam columns, 22 or 28% was eluted after leaching with 4-25 feet (1.5-inch column) or 12-110 feet (6-inch column) of buffer. After aging disulfoton in 6-inch columns for 1, 7, 28, or 112 days, ~35, 15, 3, and 1.5% of the applied disulfoton, respectively, was eluted with an unspecified volume of buffer.

DISCUSSION:

1. For one column leaching experiment, treated columns were aged for various periods prior to leaching. Neither the moisture condition of the treated soil during aging nor the volume of applied buffer were specified.

2. There was no indication that equilibrium had been attained within 65 minutes of soil-disulfoton solution contact in the adsorption experiment. Also, no Freundlich K values were calculated.

3. No soil samples were analyzed for disulfoton and/or its degradates in the soil column or adsorption experiments.

4. The procedural portion of the study indicated that four soils were used (Hugo sandy loam, Elkorn sandy loam, Sweeney sandy clay loam, and Tierra heavy clay loam); however, results were presented only for disulfoton mobility in Hugo sandy loam soil.

(TDR03B) DATA EVALUATION RECORD PAGE 1 OF 3

CASE GS0102 DISULFOTON STUDY 9 PM 100 10/04/82

CHEM 032501 Disulfoton

BRANCH EFB DISC 30 TOPIC 050525 GUIDELINE 40 CFR 163.62-9b/c/d

FORMULATION 00 - ACTIVE INGREDIENT

FICHE/MASTER ID 00068214 CONTENT CAT 01

Thornton, J.S., J.B. Hurley, and J.J. Obrist. 1976. Soil thin-layer mobility of twenty four pesticide chemicals: Report No. 51016. Unpublished study received July 11, 1977 under 3125-315; submitted by Mobay Chemical Corp., Kansas City, MO; CDL:230908-I.

SUBST. CLASS = S.

DIRECT RVW TIME = 2 (MH) START-DATE END DATE

REVIEWED BY: T. Opeka
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CONCLUSIONS:

Mobility - Leaching and Adsorption/Desorption

1. This study is scientifically valid.

2. Based on soil TLC tests, disulfoton has low mobility in sand (R_f 0.18), sandy loam (R_f 0.16), silt loam (R_f 0.23), and two silty clay soils (R_f 0.11 and 0.33), and intermediate mobility in a sandy clay loam soil (R_f 0.39)

3. This study partially fulfills EPA Data Requirements for Registering Pesticides (1983 by providing information on the mobility of disulfoton in sand, sandy loam, sandy clay loam, silt loam, and silty clay soils.

MATERIALS AND METHODS:

Six soils (Table 1) were air dried and sieved to <250 or <420 µm. Each dried soil was mixed with water to form a slurry and spread evenly in a thin layer on glass TLC plates. The soil TLC plates were air dried for 24 hours. About 0.014 µCi of [^{14}C]disulfoton (Mobay Chemical Corp.; "pure compound" dissolved in benzene or methanol) was spotted on triplicate soil TLC plates. The plates were developed in distilled water, air dried, and exposed to X-ray film for 5 days.

REPORTED RESULTS:

The average R_f values for disulfoton on sand, sandy loam, sandy clay loam, silt loam, and two silty clay soils were 0.18, 0.16, 0.39, 0.23, 0.11, and 0.33, respectively.

DISCUSSION:

Acceptable standard procedures were used.

Table 1. Characteristics of soils used in leaching studies.

Soil type	Origin	Sand (%)	Silt (%)	Clay (%)	Organic matter (%)	pH
Agricultural sand[a]	Vero Beach, FL	92	1	7	0.8	5.9
Sandy loam[a]	Merrill, OR	74	14	13	2.8	6.6
Sandy clay loam[a]	Howe, IN	56	21	23	0.6	5.5
Silt loam[b]	Concord, NH	18	57	25	5.1	7.9
Silty clay[b]	Hagerstown, MD	4	53	43	2.1	6.7
Silty clay[b]	Stanley, KS	0	41	59	0.5	6.0

[a] Passed through a 420 µm screen.

[b] Passed through a 250 µm screen.

(TDR03B) DATA EVALUATION RECORD PAGE 1 OF 2

CASE GS0102 DISULFOTON STUDY 10 PM 100 10/04/82

CHEM 032501 Disulfoton

BRANCH EFB DISC 30 TOPIC 101050

FORMULATION 90 - FORMULATION NOT IDENTIFIED

FICHE/MASTER ID 00079801 CONTENT CAT 01
Kadoum, A.M., and D.E. Mock. 1978. Herbicide and insecticide residues in tailwater pits: water and pit bottom soil from irrigated corn and sorghum fields. J. Agric. Food Chem. 26(1):45-50. Also In unpublished submission received on unknown date under 352-338; submitted by E.I. du Pont de Nemours & Co., Wilmington, DE; CDL:236741-R.

SUBST. CLASS = S.

DIRECT RVW TIME = 4 1/2 (MH) START-DATE END DATE

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CONCLUSIONS:

Field Dissipation - Terrestrial

1. This monitoring study is scientifically valid.

2. Disulfoton is likely to be found in runoff water and sediment from treated and cultivated fields. Disulfoton was found at average concentrations of 13.8 ppb in sediment samples taken from tailwater pits receiving irrigation and rainfall runoff water from cultivated corn silt loam fields. The maximum concentration in sediment samples was 32.7 ppb. The compound was also detected in soil samples from a tailwater pit draining corn and sorghum silt loam fields at an average concentration of 11 ppb. Sediment samples in tailwater pits draining sorghum fields contained disulfoton at a concentration of 117.2 ppb.

3. This study does not fulfill EPA Data Requirements for Registering Pesticides (1983) because submission of monitoring data is currently not required.

MATERIALS AND METHODS:

Water and sediment samples were collected from 36 tailwater pits in Haskell County, Kansas, each receiving irrigation and rainfall runoff from one or more fields of corn, grain, or sorghum. The surface soils of all fields were silt loams (characteristics not provided) and all fields had 0-3% slopes. The fields received typical cultural treatments for the crops mentioned. Information about pesticide use in drained fields was obtained in June or July of 1973 and 1974 and after known applications by survey.

In 1973, sampling of each pit was attempted prior to and immediately after the first runoff of the growing season, at mid-season, in late summer, and during autumn. However, irregular rainfall and irrigation patterns upset the timing of the first two samplings. In 1974, each pit was sampled in May, June, July, August, and November without regard to runoff dates.

Water samples (1 gal) were collected in clean glass jars from the edges of the pits near their inlets. At each sampling, bottom soil (primarily sediment) samples (1 qt) were also taken. Many of the 1973 samples were stored 2 weeks or longer at ~22 C before extraction and analysis. Extraction of 1974 samples was performed within ~3 ± 2 days of collection.

Stones and other large objects were removed from the bottom soil samples and the samples were thoroughly mixed. Subsamples were extracted with acetone and then extracted several times with ethyl acetate. The extracts were decanted, evaporated, and reconstituted in benzene. Water subsamples were extracted twice with 50% ethyl acetate in hexane and the extracts were combined. Samples were then extracted with chloroform. The extracts were combined, evaporated, and reconstituted in benzene. Soil and water extracts were subjected to column clean-up prior to GC analysis. Recovery of disulfoton from samples fortified with pure standards was 101 ± 2%.

REPORTED RESULTS:

Disulfoton was found in bottom soil samples from pits draining corn fields in 1974 at a mean concentration of 13.8 ppb and a maximum concentration of 32.7 ppb. The compound was also found in bottom soil samples from a pit draining corn and sorghum fields in 1974 at a mean concentration of 11 ppb. Disulfoton concentrations (means of all pits in which the compound was found) over the 1973 and 1974 samplings, were 36 and 11 ppb in sediment samples taken in August and November to December, respectively, and 0 ppb in water samples. Disulfoton was detected at a mean concentration of 117.2 ppb in bottom soil from tailwater pits draining sorghum fields.

DISCUSSION:

It was stated that pesticide use information was obtained through annual surveys; however, the results of these surveys were not presented or related to the concentrations found in water or sediment samples.

(TDR03B) DATA EVALUATION RECORD PAGE 1 OF 3

CASE GS0102 DISULFOTON STUDY 11 PM 100 10/04/82

CHEM 032501 Disulfoton

BRANCH EFB DISC 30 TOPIC 050530 GUIDELINE 40 CFR 163.62-10b

FORMULATION 04 - GRANULAR

FICHE/MASTER ID 00068096 CONTENT CAT 01

Suett, D.L. 1975. Persistence and degradation of chlorfenvinphos, chlormephos, disulfoton, phorate and primiphos-ethyl following spring and late-summer soil application. Also In unpublished submission received Dec. 17, 1976 under 10182-9; submitted by ICI Americas, Inc., Wilmington, DE; CDL:227314-0.

SUBST. CLASS = S. OTHER SUBJECT DESCRIPTORS SEC: EFB -30-050520

DIRECT RVW TIME = 4 (MH) START-DATE END DATE

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CONCLUSIONS:

Field Dissipation - Terrestrial

1. This study is scientifically valid.

2. Disulfoton (G) dissipates rapidly in field plots of sandy loam soil treated at 2 kg/ha (incorporated to a depth of 10 cm), with a half-life of ~1 week, and 90% loss after 5 weeks. Disulfoton sulfoxide has a half-life of 8-10 weeks while disulfoton sulfone once formed remains fairly stable over a 42 week period. Disulfoton sulfone was detected at a depth of 20 cm.

3. This study provides useful information by identifying disulfoton sulfone and and disulfoton sulfoxide as degradates of disulfoton. This study does not fulfill EPA Data Requirements for Registering Pesticides (1983) on the decline of disulfoton and formation and decline of degradates for one site because the test site was not shown to be representative of use sites in the United States, preapplication soil samples were not analyzed, the test soil was not fully characterized, and disulfoton was not applied at the highest recommended label rate.

MATERIALS AND METHODS:

Disulfoton (Disyston, Fe-10, 10% G, Bayer Agrochem Ltd.) was applied at 2 kg ai/ha (1.8 lb ai/A) to duplicate field plots (4 x 2.5 m) of Wick sandy loam soil (characteristics unspecified) in Great Britain during May and September of 1971. Granules were mixed with dry sand, broadcast onto the field plots by hand, and incorporated to a depth of 10 cm. Carrots were planted in field plots treated in May, but all plots treated in September remained fallow. Soil samples (up to 20 cm deep) were taken immediately after treatment and at nine subsequent intervals up to 42 weeks post-treatment.

Soil samples were mixed by sieving, and extracted with chloroform:methanol (9:1). Decane was added to the extract, and 0.5 ml aliquots were concentrated to near dryness and quantified by using alkali flame ionization GLC. Recovery values were between 95 and 101%, with the exception of disulfoton oxygen analog sulfone and disulfoton oxygen analog sulfoxide which ranged between 84 and 97%. Minimum detection limits were 0.05 mg/kg for disulfoton oxygen analog sulfoxide, 0.01 mg/kg for disulfoton oxygen analog sulfone, and 0.001 mg/kg for disulfoton and oxidation products.

REPORTED RESULTS:

Rainfall and soil temperature data for the experimental period are presented in Figure 1. Disulfoton dissipated in sandy loam soil treated at 2 kg/ha with a half-life of 1 week, and declined to <10% of the applied amount after ~5 weeks. Disulfoton sulfoxide levels reached a peak ~1 week after treatment. Declining soil temperatures from 8 to 3.5 C reduced the rates of loss of disulfoton and its oxidation products over the winter, and this period of reduced residue loss continued until the soil temperature rose above 6-7 C in the spring. Disulfoton residues in soil treated in September were 7.2, 13.2, 13.2 and 6.0% of the applied amount at depths of 0-5, 5-10, 10-15, and 15-20 cm, respectively, 10 months after treatment. The majority of the residue was identified as disulfoton sulfone. Soil samples below the depth of incorporation (10 cm) were not taken from plots treated in May.

DISCUSSION:

1. Pretreatment soil samples were not analyzed for disulfoton residues.
2. The test soil was not fully characterized.

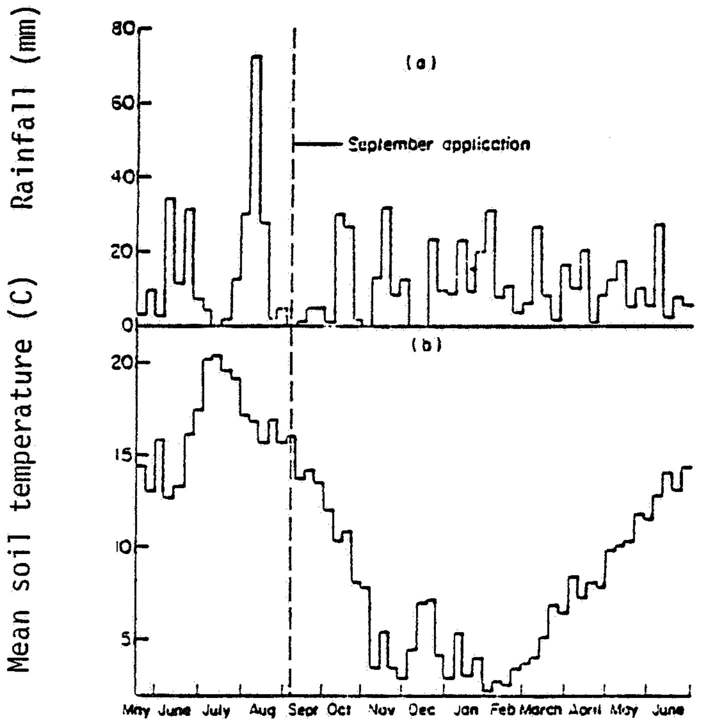

Figure 1. Rainfall (a) and mean weekly soil temperature (b) at 10 cm during the experimental period.

CASE GS0102 DISULFOTON STUDY 12 PM 100 10/04/82

CHEM 032501 Disulfoton

BRANCH EFB DISC 30 TOPIC 050530 GUIDELINE 40 CFR 163.62-10b

FORMULATION 04 - GRANULAR

FICHE/MASTER ID 00095652 CONTENT CAT 01
Menzer, R.E., E.L. Fontanilla, and L.P. Ditman. 1969. Degradation of disulfoton and phorate in soil influenced by environmental factors and soil type: submitter 25682. Unpublished study received Apr. 2, 1971 under 3125-119; prepared by Univ. of Maryland, Dept. of Entomology, submitted by Mobay Chemical Corp., Kansas City, MO; CDL:119684-C.

SUBST. CLASS = S.

DIRECT RVW TIME = 5 (MH) START-DATE END DATE

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CONCLUSION:

Field Dissipation - Terrestrial

This study is scientifically invalid because insufficient sampling was performed to allow generation of a decline curve, and no pretreatment soil samples were analyzed. In addition, this study would not fulfill EPA Data Requirements for Registering Pesticides (1983) because soil was sampled only to a depth of 4 inches, soil characteristics and rainfall amounts were unspecified and the pattern of formation and decline of degradates was not quantified. However, this study does provide some useful information by identifying the following degradates: disulfoton oxygen analog, disulfoton sulfone, disulfoton oxygen analog sulfone, disulfoton sulfoxide, and disulfoton oxygen analog sulfoxide.

MATERIALS AND METHODS:

Disulfoton (10% G, Mobay Chemical Corp.) was applied at 2 lb ai/A by broadcast to replicate Evesboro loamy sand plots (4 ft. width, soil not further characterized) on October 13, 1964 and disked in prior to seeding with winter spinach. Additional replicate field plots were similarly treated on November 13, 1964, December 22, 1964, and March 12, 1965 at different stages of spinach growth. The fields were watered following treatment with an unspecified amount of water. The field soils were sampled periodically during the ~220 day study period.

To compare soil disulfoton residues after planting to winter and summer spinach crops, Chillum silt loam plots (soil not further characterized) were treated at 2 and 4 lb ai/A on June 18, 1964 and disked in immediately before seeding. On July 21, additional field plots were similarly treated when the seedlings were 2 inches high. Soil samples were collected from the disulfoton treated field on days 0, 3, 10, 22, 27, 41, 43, and 60, posttreatment.

Fifty soil cores (1-inch diameter by 4-inch depth) from each field plot were collected, combined, and mixed. A 200-g aliquot was subsampled and analyzed for disulfoton residues by a nonspecific total phosphorus colorimetric procedure. Recovery rates for disulfoton ranged from 85 to 92% and the results were corroborated by GC analysis using a sodium thermionic detector. TLC was also performed on the samples to characterize the disulfoton residues.

REPORTED RESULTS:

In field plots treated during the winter, disulfoton degradation was minimal regardless of the treatment date following planting. From day 0 to day 220 posttreatment, disulfoton residues in soil treated on October 3, 1964 declined from ~0.6 ppm to ~0.2 ppm, respectively. Applications made at various stages of plant growth indicated similar results with disulfoton residues of ~0.6-1.7 ppm and ~0.8-0.3 ppm at 0 and 220 days following treatment, respectively.

Disulfoton residues in soils treated with disulfoton at 2 and 4 lb ai/A prior to planting during the summer months fluctuated between 0.74 and 1.66 ppm over the 60 day sampling period. When applied after the plants were 2 inches high, disulfoton soil residues also fluctuated with concentrations ranging from 0.80 to 2.06 ppm.

Large amounts of disulfoton sulfone and disulfoton oxygen analog sulfone, and small amounts of disulfoton oxygen analog, disulfoton sulfoxide, and disulfoton oxygen analog sulfoxide were present in soil samples (quantitative data not provided). The parent compound was found in larger quantities in the winter samples than in the summer samples (quantitative data not provided).

DISCUSSION:

1. Complete soil characteristics, rainfall and irrigation data, and method sensitivity and detection limits were not provided.

2. Results of the TLC analyses were reported; however, quantitative data were not included.

3. A nonspecific total phosphorus colorimetric method for determination of disulfoton residues was employed. Results of the colorimetric assay were corroborated with GC determination for some samples (unspecified); however, GC results were not reported.

4. No preapplication sample was taken for analysis.

CASE GS0102 DISULFOTON STUDY 13 PM 100 10/04/82

CHEM 032501 Disulfoton

BRANCH EFB DISC 30 TOPIC 050530 GUIDELINE 40 CFR 163.62-10b

FORMULATION 04 - GRANULAR

FICHE/MASTER ID 00036250 CONTENT CAT 01
Chemagro Corporation. 1969. Di-Syston soil persistence studies. Unpublished study received Aug. 5, 1970 under 0F0945; CDL:091615-C.

FICHE/MASTER ID 00044919 CONTENT CAT 01
Loeffler, W.W. 1969. A summary of Dasanit and Di-Syston soil persistence data: Report No. 25122. Unpublished study received July 20, 1976 under 3125-163; submitted by Mobay Chemical Corp., Kansas City, MO; CDL:095238-J.

FICHE/MASTER ID 00091497 CONTENT CAT 02
Mobay Chemical Corporation. 1964. Synopsis of analytical and residue information on Di-syston (clover). Includes method dated Mar. 5, 1964. Compilation; unpublished study received Dec. 4, 1964 under 6F0480; CDL:090538-A.

SUBST. CLASS = S. OTHER SUBJECT DESCRIPTORS PRIM: RCBR-25-10113010 SEC: RCBR-25-10000505

DIRECT RVW TIME = 9 (MH) START-DATE END DATE

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CONCLUSIONS:

Field Dissipation - Terrestrial

1. This study is scientifically valid.

2. Disulfoton residues dissipate with half-lives of 1-6 months in muck-sand, silt loam, and clay soils treated with disulfoton 10% G or 6 lb/gal EC at 10 ppm. Dissipation (from the upper 6 inches) was enhanced by increasing amounts of rainfall.

3. This study does not fulfill EPA Data Requirements for Registering Pesticides (1983) because a nonspecific colorimetric assay was used to determine disulfoton concentrations in soil and the pattern of formation and decline of degradates was not addressed.

MATERIALS AND METHODS:

Disulfoton (10% G or EC, Mobay Chemical Co.) was applied to muck-sand (pH 5.3), clay (pH 4.9), clay (pH 5.7), and silt loam (pH 5.9) soils. The G and EC formulations were broadcast onto the soil surface and then rototilled or disked into the soil to a 4- to 6-inch depth.

Soil samples (0- to 6-inch depth) were analyzed for disulfoton by a nonspecific colorimetric phosphorus method described in Report 13059 (0009-1497). The samples were extracted with acetone and water, centrifuged, and filtered. Chloroform was added to the filtrate and the solution was evaporated on a steam bath. The soil extracts were further purified by a carbon column clean-up procedure. The resulting effluent was evaporated to 10-15 ml on a steam bath, rinsed with acetone, evaporated to ~0.5 ml and extracted with either nitric or perchloric acid. The samples were heated to boiling and digested until 0.5 ml remained. Aliquots of ammonium molybdate and an isobutyl alcohol:benzene mixture were added to the extract, followed by separation of solvent phases. The aqueous phase was discarded and 2 ml of ethanolic sulfuric acid solution was added to the remainder. Just before colorimetric determination, 300 µl of dilute stannous chloride solution was added.

Recovery and detection limit values for clay and muck-sand samples fortified with 0.5 ppm ranged from 81-104% and 0.1 to 0.15 ppm, respectively.

REPORTED RESULTS:

Soil persistence data for disulfoton residues are presented in Table 1. In clay soils the half-life of disulfoton residues is ~30 days for both the G and EC formulations. Disulfoton residues are more persistent in muck-sand soils than in clay soils and the G formulation is ~2.5 times more persistent than the EC formulation (half-lives of ~46 and ~112 days, respectively).

DISCUSSION:

1. No pretreatment samples were collected for analysis.

2. A nonspecific colorimetric phosphorus assay was used to determine disulfoton residues.

Table 1. Disulfoton residues (ppm) and corresponding rainfall data in soils treated with disulfoton at 10 ppm.

Soil type (report no.)	Formulation applied	Days after application	Disulfoton residue (ppm)	Cumulative rainfall (inches)
Louisiana clay[a] (13095)	10% G	0	24.6	--
		30	10.1	0.59
		93	2.9	9.62
		177	0.4	20.44
		202	0.9	26.58
		366	0.4	48.63
Louisiana clay[a] (13171)	EC[b]	0	8.0	--
		30	3.8	0.59
		93	1.1	9.62
		177	0.8	20.44
		202	1.0	26.58
		366	<0.1	48.63
Florida muck-sand[c] (13097)	10% G	1	5.8	--
		32	4.8	2.8
		112	1.1	15.0
		182	0.6	22.9
		424	0.4	52.4
Florida muck-sand[c] (13096)	EC[b]	1	6.1	--
		32	3.8	2.8
		112	1.2	15.0
		182	2.1	22.9
		424	0.1	52.4
Kansas clay[d] (21316)	6 lb/gal EC	1	3.1	0.00
		30	2.2	1.24
		86	1.8	14.47
		176	0.3	30.58
		324	0.6	36.30
Kansas clay[d] (21317)	10% G	1	3.6	0.00
		30	3.6	1.24
		86	2.7	14.47
		176	1.2	30.58
		331	1.3	36.88
Kansas silt loam[e] (22043)	6 lb/gal EC	1	4.1	0.00
		30	3.6	1.24
		84	1.6	14.35
		181	1.2	31.24
Kansas silt loam[e] (22044)	10% G	1	2.0	0.00
		30	3.2	1.24
		84	2.4	14.35
		181	0.8	31.24

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[a] Control samples contained disulfoton residues at 0.2 ppm.

[b] Purity unspecified.

[c] Control samples contained disulfoton residues at 0.1 ppm.

[d] Control samples contained disulfoton residues at 0.5 ppm.

[e] Control samples contained disulfoton residues at 0.3 ppm.

CASE GS0102 DISULFOTON STUDY 14 PM 100 10/04/82

CHEM 032501 Disulfoton

BRANCH EFB DISC 30 TOPIC 050525 GUIDELINE 40 CFR 163.62-9b/c/d

FORMULATION 00 - ACTIVE INGREDIENT

FICHE/MASTER ID 00103661 CONTENT CAT 01
Lichtenstein, E., K. Schulz, R. Skrentny, and Y. Tsukano. 1966. Toxicity and fate of insecticide residues in water: insecticide residues in water after direct application or by leaching of agricultural soil. Arch. Environ. Health 12(Feb):199-212. Also In unpublished submission received Dec. 20, 1968 under 9F8785; submitted by Shell Chemical Co., Washington, DC; CDL:091349-T.

SUBST. CLASS = S.

DIRECT RVW TIME = 6 (MH) START-DATE END DATE

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CONCLUSIONS:

Mobility - Leaching and Adsorption/Desorption

1. This study is scientifically valid.

2. Disulfoton residues are mobile in silt loam soil as determined by a mosquito bioassay method.

3. This study would not fulfill EPA Data Requirements for Registering Pesticides (1983) because a nonspecific mosquito bioassay was used, disulfoton residues in leachate samples were not quantified, the soil column was not segmented and analyzed for disulfoton following leaching, and complete soil characteristics were not specified.

MATERIALS AND METHODS:

A sample of Carrington silt loam soil (characteristics unspecified) was treated with disulfoton (Di-Syston, analytical grade, source unspecified) at 50 ppm (100 lb ai/A) in chloroform. Aliquots (400 g) of the treated soil were placed in each of seven glass containers (7.7 cm in diameter and 60 cm long) onto a previously washed 10-cm long filter of glass wool, silica sand, and gravel. Two pieces of filter paper were placed on top of each soil column to distribute elution water which was applied at one drop of water per 5 seconds. Two soil columns treated with solvent (chloroform) without disulfoton prior to leaching served as controls. Two hundred and fifty milliliters of water were applied before water began eluting from the columns. Eleven 50-ml samples of leachate water were collected. The first leachate sample was discarded and the subsequent ten samples were analyzed for insecticidal disulfoton residues by using a mosquito bioassay. Ten third-instar larvae of Aedes aegyti were exposed directly to the leachate samples and mortality counts were conducted during a 24-hour period.

The soil columns were left undisturbed for 6 days, then leached with an additional 400 ml of water. Disulfoton residues were determined in the leachate samples by using a mosquito bioassay as described previously. Portions of the leachate samples were extracted with redistilled chloroform, dried with anhydrous sodium sulfate and the extracts were spotted on silica-gel TLC plates for characterization. The TLC plates were developed with hexane:chloroform:anhydrous methanol (7:2:1). Quantification of disulfoton residues was based on the size and intensity of the spots isolated on the TLC plates.

Similar studies were performed with disulfoton applied at 200 ppm.

REPORTED RESULTS:

Insecticidal disulfoton residues were detected in the second through the eleventh 50-ml aliquot of eluate collected from the soil columns. The twelfth 50-ml aliquot of leachate, collected following a 6-day aging period, also contained insecticidal residues. No insecticidal residues were detected in leachate samples collected from untreated soil columns.

Results of TLC characterization of disulfoton residues in leachate samples after a 6-day aging period indicated approximate concentrations of 0.5, 1.0, and 0.2 ppm of disulfoton, disulfoton sulfoxide, and disulfoton sulfone, respectively.

When disulfoton was applied at 200 ppm, the mosquito mortality rates were higher in all of the leachate samples; however, no values were provided.

DISCUSSION:

1. Complete soil characteristics were not provided.

2. A nonspecific mosquito bioassay was used.

3. The soil columns were not divided into increments and analyzed for disulfoton; only leachate samples were collected for analysis.

4. Mosquito bioassay data from leachate water collected from soils treated at 200 ppm were not presented.

5. Relative concentrations of disulfoton, disulfoton sulfoxide, and disulfoton sulfone were derived by comparing the size and intensity of corresponding spots isolated on TLC plates; this method of analysis is not quantitative.

6. The first 50-ml leachate sample was discarded and not analyzed for disulfoton residues.