Shaughnessy Number: 080804

Date Out of EAB: 06/09/88

TO: G. Werdig/B. Briscoe
Product Manager 50
Registration Division (TS-767C)

FROM: Patrick W. Holden, Team Leader PWH
Ground-Water Team
Exposure Assessment Branch/HED (TS-769C)

THRU: Paul F. Schuda, Chief
Exposure Assessment Branch/HED (TS-769C)

Attached, please find the EAB review of:

Reg./File #: _____

Chemical Name: Prometon

Type Product: Herbicide

Company Name: Ciba-Geigy Corp.

Purpose: Ground-Water Data Call-In Review

Date Received: 06/08/87 Action Code: 495

Date Completed: 06/01/88 EAB #(s): 70730, 70747

Monitoring study requested: x Total Reviewing Time: 8d

Monitoring study volunteered: __

Deferrals to: _____ Ecological Effects Branch

_____ Residue Chemistry Branch

_____ Toxicology Branch

1

1

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REGISTRATION DIVISION DATA REVIEW RECORD

Confidential Business Information — Does Not Contain National Security Information (E.O. 12065)

6/18/87
36425 Hed

CHEMICAL NAME: PROMETON

2. IDENTIFYING NUMBER	3. ACTION CODE	4. ACCESSION NUMBER
080804	495	401455-01

TO BE COMPLETED BY PM

5. RECORD NUMBER: 197,203
6. REFERENCE NUMBER:
7. DATE RECEIVED (EPA): 4/3/87
8. STATUTORY DUE DATE:
9. PRODUCT MANAGER (PM): G. Werdig
10. PM TEAM NUMBER: 50

TO BE COMPLETED BY PCB

11. DATE SENT TO HED/TSS: 6-8-87
12. PRIORITY NUMBER: 29
13. PROJECTED RETURN DATE: 7-8-87

14. CHECK IF APPLICABLE AH

- ☐ Public Health/Quarantine
- ☐ Minor Use
- ☐ Substitute Chemical
- ☐ Part of IPM
- ☐ Seasonal Concern
- ☐ Review Requires Less Than 4 Hours

15. INSTRUCTIONS TO REVIEWER

A. HED
- ☐ Total Assessment - 3(c)(5)
- ☐ Incremental Risk Assessment - 3(c)(7) and/or E.L. Johnson memo of May 12, 1977.

B. SPRD (Send Copy of Form to SPRD PM)
- ☐ Chemical Undergoing Active RPAR Review
- ☐ Chemical Undergoing Active Registration Standards Review

C. ☐ BFSD
D. ☐ TSS/RD
E. ☐ Other

F. INSTRUCTIONS

Screen and review data

16. RELATED ACTIONS

17. 3(c)(1)(D)
- ☐ Use Any or All Available Information
- ☐ Use Only Attached Data
- ☐ Use Only the Attached Data for Formulation and Any or All Available Information on the Technical or Manufacturing Chemical.

18. REVIEWS SENT TO
- ☐ TB
- ☐ EEB
- ☐ EF
- ☐ PL
- ☐ RCB
- ☐ EFB
- ☐ CH
- ☐ BFSD

19.	To	TYPE OF REVIEW	NUMBER OF ACTIONS: Registration	Petition	EUP	SLN	Sec. 18	Inert	MNR. USE	Other
HED		TOXICOLOGY								
		ECOLOGICAL EFFECTS								
		RESIDUE CHEMISTRY								
	X	ENVIRONMENTAL DATE								
TSS		CHEMISTRY								
		EFFICACY								
		PRECAUTIONARY LABELING								
BFS		ECONOMIC ANALYSIS								(2)

20. ☐ Label Submitted with Application Attached	21. ☐ Confidential Statement of Formula	22. ☐ Representative Labels Showing Accepted Uses Attached	23. Date Returned to RD (to be completed by HED)	24. Include an Original and 4 (four) Copies of This Completed Form for Each Branch Checked for Review.

EPA Form 8570-13 (Rev. 11-81) PREVIOUS EDITIONS ARE OBSOLETE.

6/17/87

REGISTRATION DIVISION DATA REVIEW RECORD

Confidential Business Information – Does Not Contain National Security Information (E.O. 12065) 36483 Hed

1. CHEMICAL NAME: PROMETON

2. IDENTIFYING NUMBER	3. ACTION CODE	4. ACCESSION NUMBER	TO BE COMPLETED BY PM
080804	495	40[illegible]-01, 02, 03	5. RECORD NUMBER: 197,731
			6. REFERENCE NUMBER:
			7. DATE RECEIVED (EPA): 6/8/87
			8. STATUTORY DUE DATE:
			9. PRODUCT MANAGER (PM): G Werdig / B Brosius
			10. PM TEAM NUMBER: 50

14. CHECK IF APPLICABLE

- ☐ Public Health/Quarantine
- ☐ Minor Use
- ☐ Substitute Chemical
- ☐ Part of IPM
- ☐ Seasonal Concern
- ☐ Review Requires Less Than 4 Hours

N/A

TO BE COMPLETED BY PCB

11. DATE SENT TO HED/TSS: 6-17-87

12. PRIORITY NUMBER: 20

13. PROJECTED RETURN DATE: 7-1-87

15. INSTRUCTIONS TO REVIEWER

A. HED
- ☐ Total Assessment - 3(c)(5)
- ☐ Incremental Risk Assessment - 3(c)(7) and/or E.L. Johnson memo of May 12, 1977.

B. SPRD (Send Copy of Form to SPRD PM)
- ☐ Chemical Undergoing Active RPAR Review
- ☐ Chemical Undergoing Active Registration Standards Review

C. ☐ BFSD
D. ☐ TSS/RD
E. ☐ Other

F. INSTRUCTIONS

Screen Leaching 163-1
photolysis aqueous 161-2 &
photodecomposition soil 161-3

Cite Carey, Spencer

16. RELATED ACTIONS

17. 3(c)(1)(D)
- ☐ Use Any or All Available Information
- ☐ Use Only Attached Data
- ☐ Use Only the Attached Data for Formulation and Any or All Available Information on the Technical or Manufacturing Chemical.

18. REVIEWS SENT TO
- ☐ TB
- ☐ EEB
- ☐ EF
- ☐ PL
- ☐ RCB
- ☐ EFB
- ☐ CH
- ☐ BFSD

19. To	TYPE OF REVIEW	NUMBER OF ACTIONS: Registration	Petition	EUP	SLN	Sec. 18	Inert	MNR. USE	Other
HED	TOXICOLOGY								
HED	ECOLOGICAL EFFECTS								
HED	RESIDUE CHEMISTRY								
HED	ENVIRONMENTAL DATE								
RD/TSS	CHEMISTRY								
RD/TSS	EFFICACY								
RD/TSS	PRECAUTIONARY LABELING								
BFSD	ECONOMIC ANALYSIS								(3)

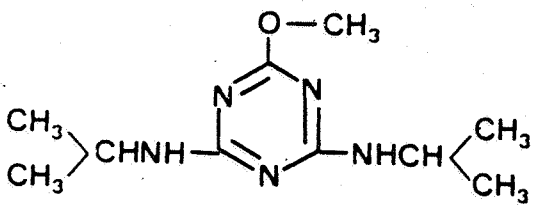
20.	21.	22.	23.	24.
☐ Label Submitted with Application Attached	☐ Confidential Statement of Formula	☐ Representative Labels Showing Accepted Uses Attached	Date Returned to RD (to be completed by HED)	Include an Original and 4 (four) Copies of This Completed Form for Each Branch Checked for Review.

1. Chemical: Common name - Prometon

Chemical name - 2,4-bis(isopropylamino)-6-methoxy-s-triazine

Trade name - Pramitol, Conquer

Structure -



2. Test Material: See reviews of individual studies.

3. Study/Action Type:

Ciba-Geigy Corporation has submitted environmental fate studies (hydrolysis, photolysis, soil metabolism, leaching, adsorption, and field dissipation) studies in response to a Ground-Water Data Call-In for prometon.

4. Study ID: See reviews of individual studies.

5. Reviewed By: Michael R. Barrett
Chemist
Ground-Water Team
Signature: Michael R Barrett
Date: 6/9/88

6. Approved By: Patrick Holden
Team Leader
Ground-Water Team
Signature: Patrick Holden
Date: 6/3/88

7. Conclusion:

In general, the submitted studies indicate that prometon has significant leaching potential. The submitted hydrolysis report (Study No. 1) is unacceptable and cannot be used to make any conclusions regarding the hydrolytic stability. Prometon, however, is likely to be resistant to hydrolysis as has been found for other structurally related s-triazine herbicides (Catherine Eiden, Ground-Water Team/EAB/HED/OPP, personal communication, 1988). A marginally acceptable aqueous photolysis report (Study No. 2) indicates photodegradation is not an important dissipation mode for prometon in water. The submitted soil photolysis report (Study No. 3), however, is inconclusive as the amount of

exposure of the test soil to artificial sunlight was insufficient. The submitted aerobic and anaerobic soil metabolism report (Study No. 4) demonstrates that prometon is extremely persistent (t 1/2 > 1 year at 25 'C and soil water content 75 percent of the 0.33 bar level) in a sandy loam; therefore, significant leaching is a possibility. Soil adsorption coefficients (K_d values) calculated from Freundlich adsorption isotherms were 0.4 to 2.9 in five test soils, which is indicative of only moderate adsorption to soil colloids. In a soil column leaching experiment (Study No. 6) appreciable leaching of prometon occurred in each of four test soils after application of sufficient water to collect leachate equivalent to 20 inches of precipitation. Prometon was determined to have similar leachability to atrazine, a known ground-water contaminant in many areas of the United States, by soil thin-layer chromatography in five test soils. In the field, prometon was found to have a "half-life" (calculated by the authors ignoring the effect of seasonal changes in weather) of 139 to 2227 days for tests conducted in California, Nebraska, and New York. All of these data are indicative of a pesticide with significant leaching potential (table 1). Given especially the very slow degradation rate of prometon in soil, the leaching potential to ground water of prometon is expected to be very high. Refer to the individual study reviews for more detailed conclusions.

8. Recommendations:

The following deficiencies still exist regarding the environmental fate studies required under the Pesticide Assessment Guidelines - Subdivision N:

(a) A new hydrolysis study is required.

(b) A new soil photolysis study is required unless the registrant can demonstrate that no significant absorption of prometon occurs over the spectral energy range of sunlight, and that "sensitizing" of photoenergy absorption properties does not occur in soil.

(c) A ground-water monitoring study as defined in the draft Small-Scale Retrospective Ground-Water Monitoring Guidelines is required, which must include tests in three geographically and hydrogeologically diverse locations representative of the areas in the United States where prometon is used. (This study is requested in lieu of field dissipation studies at this time since the primary deficiency of the submitted field dissipation studies, lack of definition of the depth of leaching, will be addressed through the ground-water monitoring studies and the available data already indicate a strong potential for prometon to leach to ground water.)

9. Background:

Prometon is a nonselective herbicide used for weed control on noncropland at rates of 10 to 60 lb ai/A. Prometon is an s-triazine compound and is chemically related to atrazine, a pesticide which has been found to leach to ground water in many locations.

10. Discussion: Refer to the reviews of individual studies.

11. Completion of One-Liner:

Prometon is a persistent herbicide with a soil half-life frequently > 1 year. Adsorption of prometon is low to moderate with K_d values of 0.4 to 2.9 in five soils. Prometon leaches in sandy or loamy soils. See also table 1.

12. CBI Appendix: N/A

Table 1. Related environmental fate characteristics for atrazine compared with those of some pesticides that have been found to leach

Name of Characteristic	Prometon Characteristics	Charact. of some pesticides known to leach (S. Cohen et al, 1984)
K_d	0.4 to 2.9 in 5 soils from sand to silty clay loam in texture and containing 0.8 to 5.0% O.M.	< 5, usually less than 1 or 2
K_{oc}	48 to 100	< 300 to 500
Water solubility, ug/mL	750	> 30
Henry's law constant (atmos-L/mol)	9.10×10^{-7}	< 10-5
Photolysis, half-life, days	In water, >> 30	> 7
Soil persistence, half-life, days	> 365 days in a sandy loam at 25 °C	> 14 or 21
Hydrolysis rate, half-life, days	No valid test completed, but presumed to be slow based upon data for structurally similar pesticides	> 175

PROMETON

GROUND-WATER DATA CALL-IN REVIEW

Table of Contents

Study No. 1: Aqueous Hydrolysis

Ciba-Geigy Corporation, 1985. Hydrolysis of prometon. Study No. 6015-165 prepared by Hazleton Laboratories America, Inc., Madison, WI; and submitted by Ciba-Geigy Corporation, Greensboro, NC.

CONCLUSIONS:

This study is unacceptable because the nature of the residue occurring in the buffer solution at any of the sampling intervals or pH treatments was not unambiguously identified and a mass balance could not be calculated for any of the samples. A new study is required. No conclusions can be made from this study concerning the importance of hydrolysis as a dissipation process for prometon in soil and water.

MATERIALS AND METHODS:

The test material was [U-ring-^{14}C] prometon with a specific activity = 21.9 uCi/mg. Its radiopurity was established to be > 93 percent using thin-layer chromatography (TLC) with ethyl acetate and its structure confirmed using gas chromatography-mass spectrometry.

The test system consisted of buffered solutions prepared as follows: i) 0.01M sodium acetate adjusted to pH 5 with 0.1M acetic acid; ii) 30 mL 0.067M sodium phosphate, monobasic; and 61 mL 0.067M potassium phosphate, dibasic, diluted tenfold to yield pH 7; and iii) 0.025M sodium biborate adjusted to pH 9 with 0.1M acetic acid.

Aliquots were transferred to serum vials and the vials were sealed with septum caps. The vials were sterilized in an autoclave for 4 hours at 120 'C. After cooling, the vials were fortified with an acetone solution of prometon sufficient to bring the concentration of the solution in the vials to 10 ppm. A fresh acetone solution was prepared for the Day-40 pH [sic] vial. The volume of acetone added was less than 0.3 percent of the buffer solution volume. The vials were placed in a covered water bath maintained at 25 $\pm$ 1 'C.

At various times from 0 to 40 days, two vials for each pH treatment were removed for analysis. Aliquots from each vial were analyzed for radioactivity using liquid scintillation counting (LSC) in a suitable cocktail. Separate aliquots were streaked directly on silica gel-coated TLC plates and developed in an unsaturated tank using ethyl acetate as the mobile phase. The profile of the radioactivity was measured using a linear analyzer.

REPORTED RESULTS:

For all samples collected, only one radioactive zone was eluted with the TLC system used. The amount of ^{14}C-activity recovered in this zone was not specified for any sample. The percent of the applied ^{14}C-activity recovered in the buffer solution at pH 5, 7, or 9 ranged from 107 to 165 with recoveries tending to be higher at 29 days posttreatment (123 to 138%) and 40 days posttreatment (126 to 165%). The study authors attributed the high recoveries to evaporation of solvent from the spiking solution before an aliquot was added to the buffer solution in the vials. For selected sample vials it was determined that the final pH was equal to the initial pH.

DISCUSSION

1. The radiopurity of the source material was only 93 percent; the nature of the impurities in the test substance was not discussed.

2. Monitoring of the treated buffer solution to determine whether sterile conditions were maintained was not conducted.

3. The initial concentration of [^{14}C]-prometon in each sample vial was apparently unknown as the author indicated that evaporation of acetone from the spiking solution occurred during the fortification of the vials resulting in apparent recoveries from many samples being much greater than 100 percent of the applied material.

4. It was not determined whether volatile residues formed.

5. Only TLC in one solvent system was used to separate the ^{14}C-residue in treated buffer solution; the identity of a single radioactive zone was assumed by the author to be parent, but no experimental verification of the identity of the residue was provided.

6. The interval between sample collection and analysis for ^{14}C-residues was not specified.

11

Study No. 2: Aqueous Photolysis

Puhl, R. James. 1987. Aqueous solution photolysis of prometon. Study conducted by Hazleton Laboratories America, Inc., Madison, WI; and submitted by Ciba-Geigy Corporation, Greensboro, NC.

CONCLUSIONS:

This study is marginally acceptable as submitted; however, the identity of the ^{14}C-residues at all sampling intervals was not sufficiently documented. Although it was not demonstrated that none of the possible degradation products of prometon eluted at the same rate as the parent compound in the two thin-layer chromatography (TLC) solvent systems used; data from a soil metabolism report (Study No. 4) indicate that the ethyl acetate solvent system is capable of separating prometon from its primary degradation products. This study demonstrates that no photolysis of prometon in aqueous solution occurs after 33 days of exposure to Chroma 50 light at 25 'C (or possibly higher temperature) or after 30 days of exposure to natural sunlight at ambient temperature in May through June in Madison, Wisconsin.

MATERIALS AND METHODS:

Hazleton Laboratories America, Inc. (HLA) conducted a study to investigate the photolysis of prometon, 2,4-bis (isopropylamino)-6-methoxy-s-triazine, in aqueous solutions buffered at pH 7. Spectr cells containing sterile 23.7 ppm solutions of prometon in buffer were prepared. One set of vials was exposed to Chroma 50 artificial sunlight and one set was exposed to natural sunlight. At various times, vials were removed and analyzed for evidence of degradation of prometon. This report describes the procedures used and the results obtained for this study. This study was initiated on May 9, 1985, the first day of test material application, and completed June 11, 1985, the last day of sample collection.

The test substance was [U-ring-^{14}C]-prometon, with specific activity = 21.9 uCi/mg. Radiopurity was established to be greater than 98 percent using TLC with ethyl acetate. Structure was confirmed using gas chromatograpy-mass spectrometry. Nonradioactive prometon (purity not specified) was also used. The solutions to be tested were incubated in screw-cap, flat-faced Spectro-cells with septum caps.

An aqueous solution of K_2HPO_4 (0.0107M) and NaH_2PO_4 (0.0176M), pH 6.95, was prepared, respectively. The dissolved oxygen content of the buffer was 8.7 ppm. This value was the same for water which had been saturated by bubbling air through it.

Aliquots of 3 mL of buffer were added to Spectro-cells, which were capped and sterilized in an autoclave for 4 hours. After cooling, the vials were fortified with an acetonitrile solution of ^{14}C-prometon to a final concentration of 23.7 ppm. This is well below the limits of solubility of prometon, which is 750 ppm. The final concentration of acetonitrile was less than 0.5 percent of the buffer solution volume. One set of Spectro-cells was continually exposed to Chroma 50 light in a temperature-controlled room. Startup of the temperature control equipment in April indicated a temperature range of 23 to 25 'C. On Day 33 of the experiment, the observed temperature range was 25 $\pm$ 1 'C. Another set of Spectro-cells was placed in an unshaded area on a roof and exposed to ambient conditions and natural sunlight starting on May 9, 1985, and continuing until the samples were removed for analysis.

The UV-visible absorbance spectra of prometon and Spectro-cells were determined. A solution of 1.31 x 10^{-3}M nonradio-active prometon in pH 7 buffer was prepared. An absorbance spectrum was obtained from 800 to 290 nm in a 1-cm cell. No absorbance was detected at 0.5 absorbance full-scale deflection. The absorbance of an empty Spectro-cell was measured from 750 to 290 nm. The reference path was air. Absorbance was measured

at 2.0 absorbance full-scale deflection. Beginning at 360 nm, increasing absorbance was detected with a maximum of 2.0 at 290 nm.

At five time points for each type of exposure, a single vial was removed for analysis. Two aliquots from each vial were analyzed for radioactivity using liquid scintillation counting in a suitable cocktail. A separate aliquot was streaked directly onto a silica gel-coated TLC plate and allowed to dry. The plate was predeveloped in methanol, allowed to dry, and then developed in an unsaturated tank using ethyl acetate as the mobile phase. The profile of the radioactivity was measured using a linear analyzer.

The TLC plate for the Day 27 natural sunlight sample was analyzed as described above except that duplicate aliquots were spotted on the TLC plate. The TLC channel of the first replicate (A) was divided into five segments and scraped. Each segment was counted in an Insta-Gel cocktail. This was done to monitor the recovery of ^{14}C for the TLC analysis procedure.

The second replicate (B) of the Day 24 natural sunlight plate was also scraped in five segments; however, the silica region of the TLC plate where the prometon was observed (linear analyzer profile) was eluted with acetone after being scraped. All five scraped regions were then quantitated by liquid scintillation counting (LSC) as previously outlined. The acetone was evaporated from the extract, 50 uL of chloroform were added, and an aliquot was removed for LSC. Two additional aliquots were removed and spotted on TLC plates, along with authentic prometon standard, to provide evidence of co-chromatography in two solvent systems: ethyl acetate (the solvent system used throughout the study) and chloroform:ethyl acetate:formic acid (5:4:1). The prometon standard was visualized by viewing the plates under UV light, while the radioactive zone was located by linear analyzer and autoradiography.

REPORTED RESULTS

A good mass balance was obtained with both the artificial Chroma 50 light and natural sunlight exposed samples as measured by LSC for total ^{14}C-residues. Recovery of the applied ^{14}C-activity was 98 to 110 percent for samples collected after 7, 13, 21, 27, or 33 days of exposure to Chroma 50 light and was 99 to 108 percent for samples collected after 6, 13, 19, 24, or 30 days of exposure to natural sunlight. TLC of all samples with ethyl acetate as the developing solvent resulted in only one radioactive zone eluting; identity of the ^{14}C-residues was not investigated except for the Day 24 natural sunlight sample. For this sample, the ^{14}C-residue was found to co-chromatograph with standard prometon in TLC with two different solvent systems.

For this study, the registrant did not provide evidence that these TLC systems separated prometon from any of its degradation products.

For the natural sunlight treatment the authors did provide local climatological data covering the period of the study, which included temperature at 3-hour intervals, minutes of sunshine per day, percent sky cover each day, etc. Although the initial temperature was 23 to 25 'C and the Day 33 temperature was 25 ± 1 'C in the room where the Chroma 50 light-exposed samples were incubated, there was no indication of the distance between the Chroma 50 lamps and the samples and whether the temperature of the samples was different from the measured room temperature. The Chroma 50 light was shown to have an intensity 7 times less than sunlight on an overcast day and 21 times less than sunlight on a clear day at midafternoon at the distance the samples were set from the light source. The spectral energy distribution was provided and appeared to closely approximate daylight at 5000 'K except for spikes in the radiant power at ca. 360, 400, 430, and 550 nm.

DISCUSSION:

1. The temperature was not continuously monitored for the artificial sunlight portion of this study. There was no determination as to whether the room temperature measured was the same as the temperature under the light where the samples were incubated.

2. Although volatile residues were not determined, this is not required since all of the applied ^{14}C-activity was recovered from the buffer solution at all sampling intervals.

3. No dark controls were included in this study; however, dark controls were included in a hydrolysis study for prometon (Ciba-Geigy Report No. 6015-165).

4. The identity of the ^{14}C-residues in all samples was not sufficiently confirmed. Only TLC was used to identify the ^{14}C-residue, with only one sample being co-chromatographed with prometon in two solvent systems, but not with any of its degradates. It is preferable to confirm identity with another analytical technique. Although the registrant has demonstrated in separate studies that the primary degradates of prometon do not elute at the same rate in the TLC system used; no standards of these degradates were co-eluted with the samples in this experiment.

5. Although climatological data from a nearby weather station were supplied, these data were not summarized by the registrant for the purposes of the submitted study.

Study No. 3: Soil Photolysis

Puhl, R. James. 1987. Artificial sunlight photodecomposition of prometon on soil. Study conducted by Hazleton Laboratories America, Inc., Madison, WI; and submitted by Ciba Geigy Corporation, Greensboro, NC.

CONCLUSIONS:

This study is unacceptable because the prometon-treated soil was not exposed to the equivalent of 30 days of sunlight and the identity of the primary ^{14}C-residue was not confirmed to be prometon *per se* by gas-chromatography-mass spectrometry (GC-MS) or other analytical techniques. Unless the registrant can demonstrate that prometon does not absorb light energy over the spectral energy range of sunlight and that such absorption is not "sensitized" when prometon is present on soil, a new soil photodegradation study is required with sunlight as the energy source.

MATERIALS AND METHODS:

The test substance was [U-ring-^{14}C] prometon with a specific activity = 21.9 uCi/mg. Its radiopurity was established to be greater than 98.7 percent using Thin-Layer Chromatography (TLC) with ethyl acetate and 99.7 percent with toluene:chloroform:ethyl acetate (40:40:20). The structure was confirmed using GC-MS.

The test soil was California sandy loam [58 percent sand, 32 percent silt, 10 percent clay; pH 6.1; CEC "6" (meq/100 g ?)].

The TLC plates were prepared by scraping a 0.5 cm band of silica from the TLC plates about 1.5 cm from the bottom. Three channels were cut in the plate perpendicular to the scraped zone. A slurry was made from the California sandy loam and water. The slurry was painted into the 0.5-cm band and allowed to dry. The channels were extended through the soil, thus separating the soil into three strips. The three soil strips were spotted with a methanol solution of ^{14}C-prometon.

Six plates prepared as described above were placed in an enclosed chamber 6 cm below two Chroma 50 lamps. Exposure to the lamps was continuous. A separate set of plates was maintained as a control group. The control samples were stored in a drawer at room temperature. Although no 0 time samples were analyzed in the original experiment, two 0 time samples (Day 0 dark control) were analyzed at a later date.

The chamber was connected in series to two traps: one containing charcoal for trapping volatile organic compounds and one containing 2-ethoxyethanol:ethanolamine (1:1) for trapping carbon dioxide. Air was pulled through the system at a rate of 188 mL/minute. The chamber was constructed of tinted material to exclude extraneous light. The temperature in the chamber was monitored each time a plate was removed. It remained in the range of 25 to 26 'C.

At the times indicated in table 1, one irradiated plate and one dark control plate was removed and analyzed as described below. Each time an exposed plate was removed, the carbon dioxide trapping solution and the charcoal were replaced. Radioactivity in the carbon dioxide trap was measured by LSC in Insta-Gel. The charcoal traps were oxidized in a biological oxidizer, the carbon dioxide was trapped in Carbo-Sorb, and the radioactivity was determined by LSC counting in PermaFluor cocktail. At the start of each day's sample oxidation, the performance of the sample oxidizer was verified by oxidizing known amounts of Spec-Chec-^{14}C.

The carbon dioxide trapping efficiency of 2-ethoxyethanol: ethanolamine (1:1) in a gas washing bottle was measured. A gas line from the Harvey biological oxidizer was used to successively oxidize five measured quantities of Spec-Chec-^{14}C. The carbon dioxide combustion product was bubbled through the washing bottle; cumulative recoveries averaged 92.7 percent with a coefficient of variation of 5.3 percent.

All TLC plates were developed with methanol until the solvent passed to the upper edge of the soil layer. The plates were removed from the solvent and dried. They were then developed with ethyl acetate, dried, and a profile of their radioactivity made with the linear analyzer.

The following discussion refers to the processing of the stored digital data acquired using the linear analyzer. Although each silica strip is 1.5 cm wide, the resulting profile is presented as radioactivity counts per unit of length. For each silica strip, the full length (0 to 20 cm) of the TLC plate was included in the quantitative analysis as follows: The region of interest (ROI) in the profile corresponding to the silica strip above the solvent front (18 to 20 cm) was designated as a background. The average counts per unit of length in this ROI was then automatically subtracted from other ROIs. The remainder of the silica strip (0 to 18 cm) was manually divided into ROIs. The ROIs associated with the soil and with prometon were designated in each profile. For silica strips where the photoproduct (R_f = 0.4) was observed in the profile, this ROI was also designated. ROIs between the designated ROIs were considered to correspond to diffuse radioactivity. Where the photoproduct was not observed in the profile, the photoproduct was assumed to be absent (0%), and any radioactivity present in this section of the TLC plate was also considered to be diffuse. The resulting quantitation represents the sum of counts in each ROI. Prior to summation a peak smoothing function was executed. Peak smoothing mitigates the spike effect resulting from the statistical nature of radioactivity. Plates were not scraped for quantitation.

The definition of an R_f value in this system is complicated by the procedure of predevelopment of the samples in methanol. The R_f value of each peak of the linear analyzer profile was calculated with respect to the peak of radioactivity observed near the soil band.

REPORTED RESULTS:

No volatile ^{14}C-residues were detected in either the charcoal or 2-ethoxyethanol:ethanolamine traps (the detection limit was not specified). For all thin-layer chromatography (TLC) plates, development in ethyl acetate resulted in up to

three distinct radioactive zones with most of the ^{14}C-residue co-eluting with prometon (table 1). Prometon had an R_f of ca. 0.7 and the photodegradates remained at the origin or had an R_f of ca. 0.3. The identity of the ^{14}C-residue co-eluting with prometon standards in ethyl acetate was not confirmed. No attempt was made to identify the other ^{14}C-residues. No half-life was calculated from these data, which, if prometon was correctly identified, indicate that photodegradation was very slow.

DISCUSSION:

1. The initial concentration of prometon in the soil and the thickness of the treated soil layer were not specified.

2. This experiment was conducted under nonsterile conditions.

3. The intensity of light of the treated soil was exposed to from the artificial light source was 10 to 20 less than sunlight. Therefore, the treated soil was only exposed to the equivalent of ca. 2 to 4 days of sunlight.

4. No absorption spectrum for prometon was submitted.

5. Some of the residues remain at the origin after TLC development may have been bound residues and were possibly still present as prometon *per se*.

6. No statistical analysis of the data was conducted to determine whether prometon degradation in the soil exposed to the Chroma 50 light source was significantly more rapid than in the soil kept in the dark.

7. It is not clear whether the reported study temperature was the actual temperature of the soil, which was only 6 cm away from the light source.

Table 1. Distribution of radioactivity on developed TLC plates

Exposure Time (Days)	Total Radioactivity (cpm)[a]	Percent Radioactivity			
		Origin	R_f 0.3	R_f 0.7	Total[b]
	Not Exposed to Light (Dark Controls)				
0[c]	1120	0.8	0.0	97.6	98.4
4	727	6.4	0.5	91.7	98.6
18	935	2.4	2.3	94.6	99.3
25	1000	6.7	0.0	92.9	99.6
32	718	2.4	2.9	94.0	99.3
	Exposed to Chroma 50 Lamp				
1	808	2.5	1.2	92.9	96.6
4	1310	11.8	1.7	82.7	96.2
11[d]	1140	9.2	3.6	78.4	91.2
18	1010	7.7	5.3	83.0	96.0
25	972	14.0	4.8	78.6	97.4
32	1160	9.5	6.0	83.6	99.1

[a] Linear analyzer data (not identical to dpm as determined by liquid scintillation counting [LSC]).
[b] The balance of radioactivity was assumed to be associated with diffuse radioactivity.
[c] This plate was prepared 63 days after study initiation and was developed immediately after fortification to yield Day 0 data.
[d] This sample was not quantitated exactly as described in the procedures. However, the values presented here represent the percent of total radioactivity detected on the plate. Therefore, the values are similar. The footnote with regard to the total is valid.

Study No. 4: Aerobic and Anaerobic Soil Metabolism

Obrist, J.J. 1987. Aerobic/anaerobic and sterile soil metabolism of prometon. Study No. 6015-309 conducted by Hazleton Laboratories, Inc., Madison, WI; and submitted by Ciba-Geigy Corporation, Greensboro, NC.

CONCLUSIONS:

The submitted study is adequate to describe the aerobic and anaerobic degradation of prometon in the single test soil that was used. The study demonstrates that prometon degrades very slowly in a California sandy loam with a half-life of over a year at 25 'C even under soil water conditions that should optimize soil microbial activity. Under anaerobic conditions prometon was even more persistent with virtually no loss of parent compound after 90 days, given its very slow degradation rate, it is expected that if prometon is found to leach to any appreciable extent in a particular soil, the possibility of significant contamination of ground water would exist. In the absence of any metabolism/degradation studies for other soils, EPA must presume that prometon is similarly persistent in all soils. If the registrant wishes to establish whether prometon is significantly less persistent in other soils, then additional soil metabolism studies must be submitted.

MATERIALS AND METHODS:

The test material was [universal ring-^{14}C] prometon with a specific activity of 21.9 uCi/mg. The radiopurity was established to be greater than 98 percent using thin-layer chromatography (TLC) with 100 percent ethyl acetate. Four nonradioactive analytical standards were used (refer to the Appendix for the structures of those compounds): i) prometon analytical standard, 98.7 percent pure; ii) hydroxy prometon, 2-hydroxy-4,6-bis(isopropylamino)-s-triazine, 99 percent pure; iii) dideisopropylated prometon, 2,4-diamino-6-methoxy-s-triazine, no purity provided; and iv) monodeisopropylated prometon, 2-amino-4-(isopropylamino)-6-methoxy-s-triazine, 99 percent pure.

The test soil was a California sandy loam (58 percent sand, 32 percent silt, 10 percent clay, 3.0 percent organic matter; pH 6.1; and 6 meq/100 g cation exchange capacity (CEC)). The 0.33-bar field moisture capacity (FMC) of this soil was 30.0 percent and its bulk density was 1.37 g/mL.

Before study initiation, a soil sample for the active aerobic soil incubation was assayed for microbial activity. The remainder of the soil used was air-dried to approximately 6 percent moisture and sieved through a 2-mm mesh screen to ensure uniformity. Portions of 20 g of sieved soil (dry-soil basis) were placed into 27 jars. A methanol solution was prepared that contained the appropriate quantities of radio-labeled and nonradiolabeled prometon to ensure that the soil solution ratio during fortification would not be less than 100:1 (w:v). On December 30, 1985, a 45-uL aliquot of the solution containing 8.59 x 10^6 dpm (based on aliquots taken from the fortification solution before, during, and after the December 30, 1985 sample fortification and before the January 3, 1986 Day 0 dosing) and a total of 218 ug prometon was added to the soil in each of 25 jars, resulting in a 10.9 ppm (dry-weight basis) concentration of prometon. The solvent was evaporated and the jars were capped and tumbled for approximately 2 minutes to homogenize the soil. Enough water was added to each soil sample to achieve a moisture content of approximately 75 percent of the 0.33 bar FMC of the soil. The weights of the jars and contents were recorded.

The soil used for the sterile aerobic soil incubation was air-dried to approximately 2 percent moisture and sieved through a 2-mm mesh screen. There were 20 soil samples weighed and each placed in a jar. The soil in these jars was adjusted to approximately 75 percent of 0.33-bar FMC. The jars were then capped with silicone sponge lids and autoclaved at 120 'C for 22 hours to sterilize the soil. On December 30, 1985, 14 soil samples were fortified by injection through the silicone lid. The soil samples were homogenized by tumbling for about 2 minutes. Four

unfortified sterile soil samples were used to monitor the microbial activity throughout the sterile soil incubation.

Because of the time involved in study initiation procedures for both the sterile and active aerobic portions of the metabolism study, the two remaining soil samples for each group were dosed and extracted on January 3, 1986 to serve as Day 0 samples for the study. The samples were fortified with 45 uL of the same dosing solution. After fortification, the samples were treated as described for each sample type.

The fortified biologically active and sterile soil samples (except those extracted immediately as Day 0 samples) were placed in their respective incubating chambers. Each chamber had humid air continuously drawn through it and was kept in the dark at 25 ± 2 'C. An ethylene glycol trap and a 2-ethoxyethanol: ethanolamine (1:1, v/v) trap were set in series with each chamber to collect organic volatiles and carbon dioxide, respectively. The moisture content of the biologically active aerobic samples was maintained at 75 percent of 0.33-bar FMC by replenishing any water lost by evaporation. Water loss was determined by weighing the jars periodically. The biologically active soil was sampled in duplicate at 0, 1, 3, 7, 14, 30, 63, 92, 199, 284, and 374 days. The carbon dioxide and organic volatile traps were sampled and replaced at 1, 3, 7, 14, 30, 63, 92, 122, 155, 199, 232, 267, 284, 326, and 374 days. The sterile aerobic soil was sampled in duplicate at 0, 1, 3, 14, 30, 63, 122, and 199 days. The carbon dioxide and organic volatiles traps were sampled and replaced at 1, 3, 14, 30, 63, 92, 122, 155, and 199 days.

For anaerobic studies, four jars were removed from the biologically active aerobic study 30 days after study initiation. A 1 percent (dry-soil basis) glucose supplement was added to each jar, and the soil was covered with 2 to 3 cm of water that had nitrogen bubbled through it to remove dissolved oxygen. The jars were placed in an incubating chamber that had nitrogen continuously passed through it. The chamber itself was kept in the dark at 25 ± 2 'C in series with ethylene glycol and 2-ethoxyethanol: ethanolamine (1:1, v/v) traps to collect volatiles. Duplicate samples from the anaerobic system were assayed 30 and 61 days after being flooded (i.e., 60 and 91 days after fortification), as were the volatiles traps.

For analysis of aerobic soil samples, extraction was accomplished by stirring successively with acetonitrile:water, acetonitrile, and dichloromethane. The samples were filtered, the filtrate collected in a round-bottom flask, and then transferred to a separatory funnel. The filtrate was partitioned with dichloromethane, and the aqueous and organic phases were separated. Duplicate aliquots of the filtrate and of each phase

were quantified by liquid scintillation counting (LSC). Because the aqueous phases contained less than 10 percent of the applied radioactivity, only the organosoluble fraction was further analyzed by TLC.

Anaerobic samples were centrifuged; the water layer was decanted into a separatory funnel and partitioned with approximately 50 mL of dichloromethane, thus generating aqueous and organic phases. Duplicate aliquots of each phase were quantified by LSC. The soil of the anaerobic samples was extracted in the same fashion as the aerobic soil samples.

Radioactivity in the traps for volatile products was determined by LSC of duplicate aliquots. For determination of nonextractable residues, duplicate aliquots of each extracted soil sample were oxidized, the resulting carbon dioxide was trapped in Carbo-sorb, and the radioactivity content was determined by LSC.

To determine the nature of extractable residues for each sample, the organic phase was concentrated and an aliquot was applied to a TLC plate along with nonradioactive prometon standard. These plates were developed in 100 percent ethyl acetate (Solvent System I). The distribution of radioactivity on each plate was determined using a linear analyzer. For each radioactivity profile, the equivalent of the entire TLC plate (from bottom edge to solvent front) was divided into sections and each section was quantitated separately using the manual peak search routine of the linear analyzer to yield the percent activity present in the corresponding area of the plate. Identification work was done for at least one extract from each experimental group. A single active aerobic extract from Day 284, a sterile aerobic extract from Day 199, and both organic extracts from anaerobic Day 30 were spotted on separate two-dimensional (2-D) TLC plates along with all available standards. The plates were developed in the first direction with ethyl acetate (100%) (Solvent System I) and in the second direction with chloroform:methanol (9:1) (Solvent System II). These 2-D plates were autoradiographed to visualize the radioactive zones that were present. Degradates on the TLC plate were identified by matching the fluorescent quench of the nonradioactive standards with the zones that were revealed by autoradiography. A 1-D TLC plate spotted with active aerobic extracts from Day 374, sterile aerobic extracts from Day 199, and all available standards, was developed in Solvent System I and autoradiographed to insure that the radioactive zones were resolvable using the linear analyzer. A 1-D plate spotted with active aerobic extracts from Day 374 and developed in Solvent System I was scraped and the radioactivity was quantitated using LSC to obtain a material balance for the TLC procedure.

For determination of FMC, oven-dried soil was weighed into a Buchner funnel. The soil was saturated with water and allowed to drain. The water-saturated soil was weighed, and the filter was then attached to a vacuum filtration flask drawing a pressure of approximately 0.3 atmosphere. The soil was reweighed, and the weight difference between aspirated soil and oven-dried soil, divided by the oven-dried soil weight, multiplied by 100, was the 0.33-bar FMC.

REPORTED RESULTS:

Biologically Active Aerobic Soil:

The author presented plate count data indicating an active microbial population was present in the soil (details of the method of calculation of microbes/g were not presented). At least 91 percent of the ^{14}C-activity from applied prometon was recovered from the soil extract, combusted soil, and volatile residue traps for samples collected at intervals from 0 to 374 days after treatment (representative data given in table 1). Residues extractable with the solvent system used decreased to 72 percent of the ^{14}C-activity from applied prometon by the termination of the experiment at 374 days posttreatment. For all samples for which both prometon and degradates were quantified, 100 percent of the ^{14}C-activity extracted in the organic fraction was identifiable as prometon, monodeisopropylated prometon, or hydroxyprometon (compare table 1 with table 2). Using a first-order rate model for prometon degradation, the half-life was calculated to be 431 days in California sandy loam with a water content at 75 percent of the 0.33-bar level and incubated at 25 'C.

Sterilized Aerobic Soil

Initially no soil microorganisms were detected in the sterilized soil, but at 30 days after sterilization evidence of a very small microbial population with 20 bacteria or bacteria-like and 140 mold colonies forming from culture of 1 g of soil was detected. A material balance of at least 92 percent of the ^{14}C-residue was obtained for all except the 1-day posttreatment samples, and the distribution of residues was similar to that obtained for the microbially active aerobic soil treatment (table 1). Prometon *per se* detected in the organic fraction of the soil extract declined to 78 percent of the applied ^{14}C-activity by the termination of the experiment at 199 days posttreatment; the degradates monodeisopropylated prometon, dideisopropylated prometon, and hydroxyprometon collectively represented 5 percent of the ^{14}C-activity from applied prometon at this time (the maximum levels for these degradates over the course of the experiment).

Anaerobic Soil Metabolism

At least 95 percent of the ^{14}C-activity from applied prometon was recovered from samples collected after 30 days of incubation under aerobic conditions plus 30, 60, or 91 days under anaerobic conditions. There was no change in the amount of prometon *per se* recovered from organic extracts of the decanted soil water or soil over the 61 days of anaerobic, flooded conditions, (86 to 87 percent of the ^{14}C-activity from applied prometon). The deisopropylated and hydroxy degradates accounted for only ca. 1 to 2 percent of the ^{14}C-activity.

DISCUSSION:

1. The degradation of prometon was studied in only one type of soil even though the use of this herbicide is not restricted geographically or to certain soil types.

2. The duration and conditions of sample storage prior to residue analysis were not detailed.

3. For both the aerobic and anaerobic soil metabolism studies, sampling for residue determinations was halted before 50 percent of the applied prometon had disappeared. However, the data were sufficient to calculate a half-life for prometon in aerobic soil, with minimal extrapolation and to determine that degradation is extremely slow in anaerobic, flooded soil.

Table 1. Material balance for microbially active California sandy loam treated with 10.9 ppm prometon and incubated at 25 °C and 75% of 0.33-bar soil water tension[a]

Incubation Time (Days)	Organic Fraction	Aqueous Fraction	Soil Fraction	Carbon Dioxide Trap	Organic Volatiles Trap	Total Recovered
0	106.8	0.1	0.9	NA[b]	NA	107.8
1	94.2	0.1	4.7	ND[c]	ND	99.0
7	88.5	0.2	5.9	ND	ND	94.6
30	87.4	0.6	6.9	ND	ND	94.8
92	82.6	1.5	9.6	ND	0.1	93.7
199	76.1	1.3	15.6	ND	0.1	93.0
374	69.9	1.7	19.9	ND	0.1	91.6

[a] The data presented are mean values based on the percent of total radioactivity applied at fortification.
[b] NA = Not applicable.
[c] ND = Nondetectable.

Table 2. Distribution of metabolites for the biologically active aerobic samples[a]

Incubation Time (Days)	Prometon	GS-14626[b]	GS-11526[c]	Total
0	106.2	NA[d]	NA	106.2
1	93.6	NA	NA	93.6
7	88.3	NA	NA	88.3
30	85.9	0.8	0.4	87.1
92	77.1	3.5	2.0	82.6
199	68.4	4.1	3.7	76.2
374	55.0	6.4	8.5	69.9

[a] The data presented are the percent of ^{14}C-activity of applied prometon recovered as determined by TLC of the organic fraction of the soil extract.
[b] Monodeisopropylated prometon.
[c] Hydroxyprometon.
[d] NA = Not applicable; the area of the plate where the material was expected to migrate was not specifically quantitated.

Study No. 5: Soil Adsorption/Desorption

Hazleton Laboratories America, Inc. 1985. The adsorption/desorption of radiolabeled prometon on representative agricultural soils. Study No. 6015-164 submitted by Ciba-Geigy Corporation, Greensboro, NC.

CONCLUSIONS:

Although this study should have been conducted with lower concentrations of prometon and with major degradates of prometon, this study is acceptable to describe prometon adsorption/desorption. Prometon appears to be relatively weakly adsorbed to all five of the test soils (of sandy or loamy textures) with Freundich K_d values of 0.4 to 2.9. The significant reversibility of adsorption was demonstrated for all test soils (usually 20 to 50% desorption occurred). Therefore, presuming it is persistent, leaching of prometon is likely to be a significant dissipation process in these soils.

MATERIALS AND METHODS:

The test substance was [U-ring-^{14}C] prometon with a specific activity of 21.9 uCi/mg. The radiopurity was established to be > 93 percent using thin-layer chromatography (TLC) with ethyl acetate and its structure verified using gas chromatography-mass spectrometry (GC-MS).

The physical properties of the five test soils are given in table 1.

Two aqueous prometon solutions were prepared that were used for both preliminary work and the definitive study. The first solution was prepared with labeled material at a level of 0.2 ppm prometon in 0.01M calcium nitrate. The concentration was calculated using the specific activity after determining the radiocarbon level in an aliquot of the solution by liquid scintillation counting (LSC). Radiopurity of this solution was measured by TLC in ethyl acetate.

The second aqueous solution was prepared with labeled and nonlabeled material to contain 10 ppm prometon in 0.01M calcium nitrate resulting in 50,000 dpm/mL. The concentration of this solution was verified using GC. This 10 ppm solution and dilutions in 0.01M calcium nitrate were used for both the definitive study and some preliminary work. The accuracy of the dilutions was verified by measuring radioactivity with LSC.

To test for adsorption to glass, two test tubes containing 10 mL of the 0.2 ppm solution were shaken in the incubator at 25 'C for over 48 hours. From each test tube, duplicate 1 mL aliquots were taken for radiocarbon level determination by LSC.

Centrifugation time was determined for 1 g of Kewaunee silty clay loam and 10 mL of the 10 ppm solution in test tubes equilibrated in the shaking incubator for 2 hours at 25 'C. Kewaunee soil was used because it has a relatively high percent of the smaller particles, organic matter and clay. Eight test tubes were prepared. Two test tubes were removed after 15 minutes of centifuging at 2000 rpm. Duplicate 1 mL aliquots were removed from each test tube. This was repeated three times, taking care not to disrupt the packed soil, to detect a possible decrease in prometon concentration in solution.

Five test tubes, each containing 1 g of Plainfield sand and 10 mL of the 0.2 ppm solution, were placed in the 25 'C incubator. At five times for up to 48 hours, a test tube was removed from the incubator and duplicate 1 mL aliquots were removed for LSC to detect a possible decrease in the concentration of prometon in solution.

For soil adsorption studies, five solutions, having concentrations ranging from 0.2 to 10 ppm, were prepared as described above. Each of the five soils was equilibrated with each solution in duplicate at 25 'C. A total of 50 test tubes, five concentrates times five soils, in duplicate, were prepared, each containing 1 g of soil and 10 mL of solution. After 2 hours of equilibration and 15 minutes of centrifuging, duplicate 1 mL aliquots were removed from each test tube and the radiocarbon level determined by LSC.

For soil desorption studies, after removing an additional 5 mL of solution, 7 mL of 0.01M calcium nitrate solution were added to each test tube to reestablish a 10 mL volume. The test tubes were mixed on a vortex mixer. Following 2 hours of shaking at 25 'C, the tubes were centrifuged and duplicate 1 mL aliquots were removed and the radiocarbon level determined by LSC.

REPORTED RESULTS:

From preliminary studies it was determined that adsorption of aqueous prometon to the test tubes was negligible. Centrifugation for 15 minutes at 2000 rpm was found to effect complete separation of the soil and liquid phases. Adsorption equilibrium was reached in 2 hours. Prometon was stable in aqueous solutions with less than 5 percent degradation occurring over the course of the study as determined by TLC.

Representative soil and solution concentration data for the California sandy loam are given in table 2. Adsorption data for the other test soils showed similarly good precision. Desorption data, however, were more variable. For example, for the Plainfield sand the percent desorbed ranged from 6 to 53. The Freundlich constant 1/n varied from 0.74 to 0.91 for the five test soils (table 3). Therefore, there was a nonlinear relationship between solution concentration and adsorption over the range of prometon concentrations used in these tests: as more prometon was added to the soil solution an increasing proportion was adsorbed to the soil. The K_d coefficients ranged from 0.4 to 2.9 for the five test soils (table 3). Only for the Plainfield sand was there an apparently significant deviation from linearity of the relationship of the logarithm of the amount of prometon adsorbed to the logarithm of the amount remaining in solution with an obtuse S-shaped curve appearing to fit these data better than a straight line (the author presented no statistical data for the significance of the deviation from linearity for the Plainfield sand). This curve is more pronounced on an arithmetic scale and according to Weed and Weber (1974, Pesticides in Soil and Water, edited by W.D. Guenzi, SSSA, Madison, WI) "indicates 'cooperative adsorption'; i.e., adsorption occurs with increasing ease as solute concentration increases in the initial part of the isotherm, suggesting that

adsorbed molecules encourage the retention of additional like-molecules." For the other test soils, 30 to 50 percent desorption typically occurred except for Kewaunee silty clay loam, for which 14 to 26 percent desorption occurred except 38 percent desorption occurred for one sample.

DISCUSSION:

1. Adsorption/desorption studies were not conducted for any of the degradates of prometon.

2. There were some deviations from the experimental procedures indicated in the draft Standard Evaluation Procedure; calcium nitrate rather than calcium chloride solution was used, no control samples were used, and the samples were incubated for only 2 hours rather than allowing a minimum of 24 hours for equilibrium to be reached (however, the registrant experimentally verified that equilibrium was reached within 2 hours).

3. The minimum initial solution concentration used in this study was 0.18 ug/mL rather than 0.001 to 0.01 ug/mL.

4. Adsorption of prometon to the Plainfield sand was particularly weak, as indicated by the S-shaped curve that could be fitted to the adsorption isotherm and the high but variable rate of desorption to this soil.

Table 1. Soil physical properties

Soil	Sand (%)	Silt (%)	Clay (%)	Organic Matter (%)[a]	pH	Cation Exchange Capacity (meq/100 g)[b]	FMC[c] (%)	Bulk Density
Dubuque silt loam	2	80	18	2.9	6.9	10	36.0	1.14
Plainfield sand	90	8	2	0.8	5.6	1.01	20.3	1.62
California sandy loam	58	32	10	3.0	6.1	6	30.0	1.37
Kewaunee silty clay loam	2	70	29	5.0	44.3	7.0	17.0	1.24
Mississippi silt loam	13	64	23	2.1	7.0	15	20.1	1.34

[a] Percent organic matter is assumed to be 0.1 times the organic matter expressed as tons per acre.

[b] Cation exchange capacity for Plainfield sand was calculated from:

$$CEC = 0.75 \left[\frac{Ca\ (lb/acre)}{400} + \frac{Mg\ (lb/acre)}{243} + \frac{K\ (lb/acre)}{780}\right]$$

[c] FMC = field moisture capacity.

Table 2. Adsorption and desorption results for aqueous prometon and California sandy loam

Initial Solution Concentration (ppm)	Replicate	Adsorption		Percent Desorbed
		Soil Concentration (ppm)	Solution Concentration (ppm)[a]	
0.182	A	0.425	0.139	41.5
	B	0.433	0.135	104
0.460	A	1.06	0.353	44.8
	B	1.02	0.350	42.8
0.912	A	1.96	0.713	47.6
	B	2.09	0.691	47.0
4.57	A	7.80	3.77	52.1
	B	7.95	3.75	50.3
9.29	A	16.4	7.59	49.1
	B	16.9	7.62	46.4

[a] Mean of duplicate LSC analysis for each replicate.

Table 3. Linear regression analysis for each soil[a]

Soil	Freundlich Constant K_d	Freundlich Constant 1/n	Organic Content (%)	Correlation Coefficient
California sandy loam	2.61	0.893	3.0	0.9991
Dubuque silt loam	2.90	0.895	2.9	0.9987
Kewaunee silty clay loam	2.40	0.868	5.0	0.9985
Mississippi silt loam	1.20	0.911	2.1	0.9982
Plainfield sand	0.398	0.738	0.8	0.9530

[a] Abscissa = logarithm of final solution concentration of prometon in ug/mL; ordinate = logarithm of final soil concentrating in ug/g. K_d = y-intercept, 1/n = slope.

Study No. 6: Soil Column Leaching

Blair, J. 1986. Leaching characteristics of parent prometon. Study No. 6015-201 conducted by Hazleton Laboratories America, Inc., Madison, WI; and submitted by Ciba Geigy Corporation, Greensboro, NC.

CONCLUSIONS:

Although none of the ^{14}C-residues found in the soil or leachate were identified, nor were experiments with aged prometon residues conducted for this soil column leaching study; this study is marginally acceptable. Since aerobic and anaerobic soil metabolism studies have demonstrated high persistence of prometon and the test material was [U-ring-^{14}C] prometon, it is presumed that either prometon or its primary degradates (see Appendix for chemical structures) constituted the vast majority of the leaching ^{14}C-residues in this study. Prometon and/or its primary degradates leached appreciably in four test soils with textures ranging from a sand to silt or silty clay loams. Given the high persistence of prometon it is concluded that there is a potential for eventual leaching to ground water with any of these soils.

MATERIALS AND METHODS:

Three of the four test soils, Plainfield sand, California sandy loam, and Kewaunee silty clay loam--were the same as used in Study No. 5 (refer to table 1 of that study review for the physical properties of these soils). The fourth soil, Plano silt loam, had 6 percent sand, 74 percent silt, and 20 percent clay; 5.9 percent organic matter; 29.3 percent field moisture capacity (FMC), pH 6.8; and a cation exchange capacity of 13 meq/100 g.

The test substance was [U-ring^{14}C] prometon with a specific activity = 21.9 uCi/mg. Its radiopurity was established to be > 93 percent using thin-layer chromatography with ethyl acetate, and its structure confirmed using gas chromatography-mass spectrometry.

For each soil type, 40 g of dried and sieved soil were placed in a brown glass bottle.. The soil was fortified with 0.015 mL of a methanol solution of prometon containing 14.6 x 10^6 dpm and 0.30 mg of prometon. A stream of nitrogen was passed into the bottle to evaporate the solvent and purge the atmosphere of nitrogen. The bottle was capped and mixed overnight on a rolling mixer. Aliquots of treated soil were oxidized and analyzed for carbon-14 content by liquid scintillation counting (LSC).

Three columns were prepared using PVC plastic 3-inch diameter tubes cut into eleven 1-inch segments with a 4-inch top segment. A screen was clamped over the bottom segment, and the segments were sealed together with silicone rubber adhesive. A filter paper disk was placed on the screen in the bottom of each PVC column, and the empty column was weighed. Each soil was dried in a 90 'C oven, sieved through a 2-mm mesh screen, and poured into the columns to a depth of 12 inches. After the dry soil was put in the columns, the columns were weighed, immersed in water until saturated, and weighed again. Wet and dry bulk densities were calculated for each column. Ten g of fortified soil (prepared as described above) were added to the top of each column and covered with a thin layer of unfortified soil, on top of which was placed a filter paper disk.

Water was added to the top of the saturated columns and leachate was collected in Erlenmeyer flasks. In the case of Plainfield sand, the water passed through the column rapidly so 1 inch of water (116 mL) was added each hour for 20 hours over a period of 3 days. For the other three soils, sufficient amounts of water were added to keep the top of the column constantly immersed, until 20 inches (2320 mL) had passed through the column. This took from 8 to 40 days depending on the soil type and the particular column; the California sandy loam columns were the slowest. The volume of each leachate was measured.

The soil columns were separated into 1-inch segments and the soil removed. Each soil type was prepared for oxidation differently, depending on its texture. Plainfield sand was air dried, comminuted, and thoroughly mixed. Aliquots were mixed with an equal volume of cellulose prior to oxidation. California sandy loam was air dried and thoroughly mixed. Plano silt loam and Kewaunee silty clay loam were mixed with water to produce a slurry, aliquots of which were weighed onto combustion boats for oxidation.

Duplicate 1-mL aliquots of each leachate were shaken with 15 mL of Insta-Gel, and the radioactivity was determined by LSC. The Kewaunee soil was oxidized in the Packard oxidizer, the other soils in the Harvey oxidizer. The resulting carbon dioxide was trapped in Carbo-sorb, and the radioactivity content was determined by LSC. Triplicate aliquots of fortified soil were oxidized and duplicate aliquots of soil from each column section were oxidized. If the results differed by more than 15 percent, the sample was remixed and fresh aliquots were analyzed (only if samples contained more than 100 dpm/aliquot).

The FMC of each soil was determined by saturating a portion with water, placing it in a Buchner funnel attached to a vacuum filtration flask, and drawing a pressure of 0.3 atmosphere. The wet soil was then weighed, dried in a 90 'C oven overnight, and weighed again. Weight loss divided by dry weight is equal to the FMC.

REPORTED RESULTS:

Prometon was found to leach through the soil in each of the test soils (table 1), although it appeared in the leachate water collected at the base of the soil columns in only Plainfield sand and Kewaunee silty clay loam by the end of the experiment (i.e., when 20 inches of leachate was collected from the test soil) (table 2). For most columns, a good mass balance was obtained with between 75 and 100 percent recovery (table 2).

DISCUSSION:

1. The identities of the ^{14}C-residues in the soil and leachate were not determined.

2. Experiments were not conducted with aged prometon soil residues.

Table 1. Distribution by depth of applied radioactivity in soil columns after leaching of 20 inches of water

Soil depth, inches	SOIL TYPE			
	Plainfield sand	California sandy loam	Kewaunee silty clay loam	Plano silt loam
0 to 3	28.6	47.2	41.3	69.3
3 to 6	20.8	33.7	24.2	11.7
6 to 9	13.6	10.8	24.7	0.9
9 to 12	11.9	1.4	9.6	ND[a]
Total	74.9	93.1	99.8	81.9

[a] ND = Nondetectable; the detection limit was not specified.

Table 2. Summary of radioactivity recovered for each soil column

Column Number	Soil Type	Leaching Time (Days)	Percent of Applied Radioactivity Recovered		
			In Column	In Leachate	Total
1	Plainfield sand	3	62.6	8.4	71.0
2		3	76.5	12.3	88.8
3		3	85.3	4.7	90.0
4	California sandy	24	97.1	ND[a]	97.1
5	loam	24	94.0	ND	94.0
6		40	88.3	ND	88.3
7	Kewaunee silty	12	118.6	2.1	120.7
8	clay loam	12	92.5	ND	92.5
9		12	88.7	9.8	98.5
10	Plano silt	8	89.2	ND	89.2
11	loam	9	78.6	ND	78.6
12		8	77.8	ND	77.8

[a] ND = Nondetectable, the detection limit was not specified.

Study No. 7: Soil Column Leaching

Guth, J.A. 1976. Leaching model study with the herbicide prometon in four standard soils. Study No. 31/76 submitted by Ciba-Geigy Corporation, Greensboro, NC.

CONCLUSIONS:

This study is of the same general design as Study 6, which is more in compliance with current EPA Pesticide Assessment Guidelines-Subdivision N, and has been reviewed in detail. Therefore, this study is not subject to the same detailed review here. Leaching occurred in each of the test soils: Vetroz sandy loam (pH 6.7, 5.6% O.M.), les Evoutes silty loam (pH 6.1, 36% O.M.), Lakeland sand (pH 6.6, 0.4% O.M.), and Collombey sand (pH 7.8, 2.2% O.M.); with more rapid leaching in the sands. The applied prometon included radiolabeled material (the type of radiolabel was not specified), and soil residues were determined by liquid scintillation counting (LSC) of ^{14}C-activity of acetone extracts and water residues were determined directly by LSC. These data, in so far as can be determined, are consistent with the results of Study 6.

Study No. 8: Soil Thin-Layer Chromatography

Hazleton Laboratories America, Inc. 1985. Mobility determination of prometon in soils by soil thin-layer chromatography (TLC). Study No. 6015-167 submitted by Ciba-Geigy Corporation, Greensboro, NC.

CONCLUSIONS:

Prometon exhibited some mobility, as determined by the soil TLC technique, in all five of the test soils. Prometon exhibited roughly similar mobility in these soils to atrazine, a pesticide which is an established contaminant of ground water in many areas of the United States, often from presumed nonpoint sources (agricultural applications). Prometon, therefore, with its high persistence, may have the potential to leach to ground water in many soils.

MATERIALS AND METHODS:

The test substance was [U-ring-labeled ^{14}C] prometon with a specific activity = 21.9 uCi/mg. Its radiopurity was established to be > 93% using TLC with ethyl acetate and its structure verified using gas chromatography-mass spectrometry. ^{14}C-radiolabeled standards of ametryn, atrazine, and methidathion were also used. Characteristics of the five test soils are given in table 1.

Each soil was sieved through a 1.18-mm screen. Glass plates (20 cm x 20 cm) had a tape strip placed 17 cm from one edge. For each soil type, a slurry of soil and water was prepared and coated uniformly on a 20 cm x 17 cm area of the plate and dried. Channels were then cut in the soil separating each plate into seven strips, each 17 cm long and about 2.5 cm wide.

A separate strip of each plate was spotted at the origin (about 3 cm from the bottom) with a methanol solution of ametryn, prometon, methidathion, or atrazine (approximately 20,000 dpm of each). Duplicate samples of each compound except atrazine were spotted on each plate. After the methanol evaporated, the glass plate was developed in water at room temperature (23 $\pm$ 1 'C) until the solvent front reached the top of each strip (14 cm beyond the origin). The plate was then dried and the radioactivity distribution in each strip was determined using a linear analyzer.

REPORTED RESULTS:

The frontal relative migration (R_f) of prometon indicated prometon was generally more mobile than methidathion or ametryn in the test soils whereas relative mobilities of prometon and atrazine varied between soils but were generally roughly similar (table 2). As would be expected, prometon was most mobile in Plainfield sand, the soil with the coarsest texture and lowest organic matter content. Prometon was least mobile in California sandy loam, a soil with a coarser texture than the other three test soils but which had the highest organic matter content of any of the five test soils.

DISCUSSION:

1. Although the identity of the ^{14}C-residue detected after development of the soil TLC plates was not reported, this is not required since other submitted studies have indicated that prometon is probably too persistent to degrade to any appreciable extent during the course of this experiment.

2. The development time required for the soil TLC plates was not reported.

3. The percent of the ^{14}C-activity from applied prometon that was detected on the plates after development was not reported.

Table 1. Characteristics of test soils for soil TLC

Soil	Sand (%)	Silt (%)	Clay (%)	Organic Matter (%)	FMC (%)	pH	Cation Exchange Capacity (meq/100 g)
Dubuque silt loam	2	80	18	2.9	36.0	6.9	10
Plainfield sand	90	8	2	0.8	20.3	5.6	1.01
California sandy loam	58	32	10	3.0	30.0	6.1	6
Mississippi silt loam	13	64	23	2.1	20.1	7.0	15
Hagerstown silty clay loam	24	42	34	2.5	31	6.6	14.7

Table 2. Relative mobility (R_f) of prometon and standards in five soil thin-layers[a]

	Prometon	Methidathion	Ametryn	Atrazine
Plainfield sand	0.73	1.00	0.64	1.0
Mississippi silt loam	0.72	0.26	0.36	0.71
Dubuque silt loam	0.44	0.17	0.26	0.32
California sandy loam	0.30	0.21	0.19	0.45
Hagerstown silty clay loam	0.58	0.25	0.36	0.50

[a] Values reported here are averages of two or more replicates except for four soils with atrazine as explained in the text. Replicate values generally did not vary by more than a few hundredths.

Study No. 9: Field Dissipation

Balcomb, R.T. and Honeycutt R.C. 1986. Field dissipation studies on prometon (Pramitol 25E) (Fresno, California). Report EIR-86013 submitted by Ciba-Geigy Corporation, Greensboro, NC.

CONCLUSIONS:

This study demonstrates that prometon was extremely persistent with a dissipation half-life calculated ignoring the influence of changes in environmental conditions to be ca. 200 to 400 days. The amount of prometon and/or its primary degradates leaching below an 18-inch depth was not determined, but is implied by the available data to have been significant. Therefore, the persistence of prometon in the test soil may be longer than indicated by the half-life calculated from the rate of dissipation below a 6-inch depth. These data, although incomplete to comply with the Pesticide Assessment Guidelines-Subdivision N, do indicate that the potential for leaching to ground water does exist for prometon and its degradates.

MATERIALS AND METHODS:

The test plots were located on the Ciba-Geigy research farm in Fresno, California. Control plots were located 6 feet from the test plots. The test plot did not contain a subsurface drainage system. There were no subsurface drainage problems. The test soil was a California (the true soil series name was not specified) sandy loam (57 percent sand, 31 percent silt, 12 percent clay, 0.7 percent organic matter; 6.7 pH; 7.4 meq/100 g CEC). The depth to the water table for the Fresno, California farm is approximately 30 to 75 feet. The slope of the test plots was 0.15 percent. All plots consisted of turf prior to treatment and were bare ground after treatment. No other pesticides were used on the plots before or after treatment with a 25 percent EC formulation of prometon.

On June 15, 1976, three 30 x 30 ft plots were rototilled and disked. The 1X plot was treated on June 15, 1976, with a 25 percent EC formulation of prometon at 10 pounds of active ingredient per acre (lb ai/A) in 40 gal water/A. An AZ plot sprayer was used for the application. The 2X plot was treated at 20 lb ai/A in a similar fashion. On June 15, 1976, the weather was clear, the wind was from the northwest at 2 to 5 mph, and the temperature was 101 'F. The soil was dry (5% moisture) and in good condition for tilling. There was no rain until 31 days after application (0.03 inches).

The following year (June 20, 1977), each of the single plots was rototilled and disked. One-half of the 1X plot was treated as above with 10 lb ai/A of prometon from a 25 percent EC formulation in 40 gal water/Acre. One-half of the 2X plot was treated with 20 lb ai/A in 40 gal water/A. On June 20, 1977, the weather was clear and the temperature was 92 'F. The soil was dry (10% moisture). There was no rain until 108 days from application (0.07 inches).

The third year (June 19, 1978), each of the single and superimposed plots was rototilled and disked. The 1X and 2X superimposed plots were treated again as above at 10 and 20 lb ai/A, respectively. The single treatment halves of each plot were left untreated. On June 19, 1978, the weather was clear and the temperature was 93 'F. The soil was dry (6% moisture). There was no rain until 77 days after the application (0.8 inches).

Soil samples were taken from 0 to 18 inches using a 1-inch diameter soil core sampler. The 0- to 6-inch, 6- to 12-inch, and 12- to 18-inch sections were separated after removal of a 0- to 18-inch core. Four soil sections per replicate were taken randomly, composited in the field, and designated Rep A or Rep B. These samples, at different intervals, were analyzed individually or

composited before analysis in the laboratory. All samples were immediately frozen at the site and shipped to Ciba-Geigy laboratory at Greensboro, NC, without delay.

No crops were grown on the test plots. No weeds grew on the test plots during the study.

For residue analysis, prometon and its degradation products were extracted from soil by reflux in 90/10 acetonitrile/water. The extract was filtered, concentrated, and reconstituted in ethanol. The sample was then submitted to gas chromatography using a 2-foot x 1/4-inch 10 percent DC200 on GCQ 80/100 mesh. A Coulson electrolytic conductivity detector was used for prometon. The column temperature was 155 'C. For the degradates, a 2-foot x 1/4-inch 3 percent Carbowax 20M on GCQ (80/100 mesh) was used. The column temperature was 30 'C for the mono- and 155 'C for the dideisopropylated degradates. Untreated soil samples were fortified with prometon and its degradates at levels in the range of 0.05 to 5.0 ppm and analyzed using the above procedure. The reported residue values were corrected for recovery of the analytical method but not for apparent residues in control samples.

REPORTED RESULTS:

The field plots were irrigated once or twice per month with 1 to 2 inches of water during the spring to fall of each of the 3 study years. The weather summary data submitted indicated that the test location was characterized by summers with hot daytime temperatures up to the 100s ('F) and cool nights (50s) and cool winters (daily temperatures from 20s to 70s). By the time of the second sampling interval 69 days after treatment with 10 lb ai/A, about 50 percent of the prometon in the top 6 inches of soil had dissipated (figure 1). Prometon was more persistent after application at 20 lb ai/A, with about 200 days required before 50 percent of the original prometon dissipated from the treated area (figure 2). In terms of a half-life measurement the dissipation rate of prometon remaining after the 50 percent disappearance time was slower. The authors calculated half-lives by assuming a simple first-order dissipation rate over the 3-year period without any correction for the seasonal fluctuation in environmental conditions (temperature differences would be expected to have an especially important influence on degradation rates) were 223 and 321 days after respective applications at 10 and 20 lb ai/A (table 1). Significant carryover of residues of prometon per se occurred from one cropping season to the next (table 2, data for the 20 lb ai/A rate only are shown). The half-life for prometon per se from these data appears to be much shorter than the authors' calculated 243 days for the second application year and equal to the authors' calculation of 1415 days for the third year if the 244-day sample value is discarded

as an outlier (leaving only three time intervals for which residue data are available for use in the half-life calculation). Significant penetration of prometon per se occurred to the lowest depth sampled (table 2). Residues of monodeisopropylated prometon and dideisopropylated prometon also were present at all soil depths sampled (data not presented in this review), but it is not possible to calculate the degradation rate of either of these degradates from the field data. Residues of prometon and its degradates in the top 6 inches had declined to low or nondetectable levels (< 0.05 ppm for prometon and monodeisopropylated degradate and < 0.1 ppm for the dideisopropylated degradate) by the close of the 3-year study period following a single application of prometon (figures 1 and 2, data for 6- to 12- and 12- to 18-inch depths not shown). These data say nothing about the possibility of significant residues remaining at depths greater than 18 inches in the soil profile or leaching to ground water.

DISCUSSION:

1. The depth of leaching of prometon was not determined. The available residue data down to a depth of 12 to 18 inches imply that leaching of detectable residues to a significantly greater depth occurs.

2. The registrant's submitted report was poorly organized with the most relevant data buried in appendices rather than presented in concise tables and discussed in their narrative section.

Figure 1. Field dissipation of prometon from the top 6 inches of a California sandy loam after application at 10 lb ai/A.

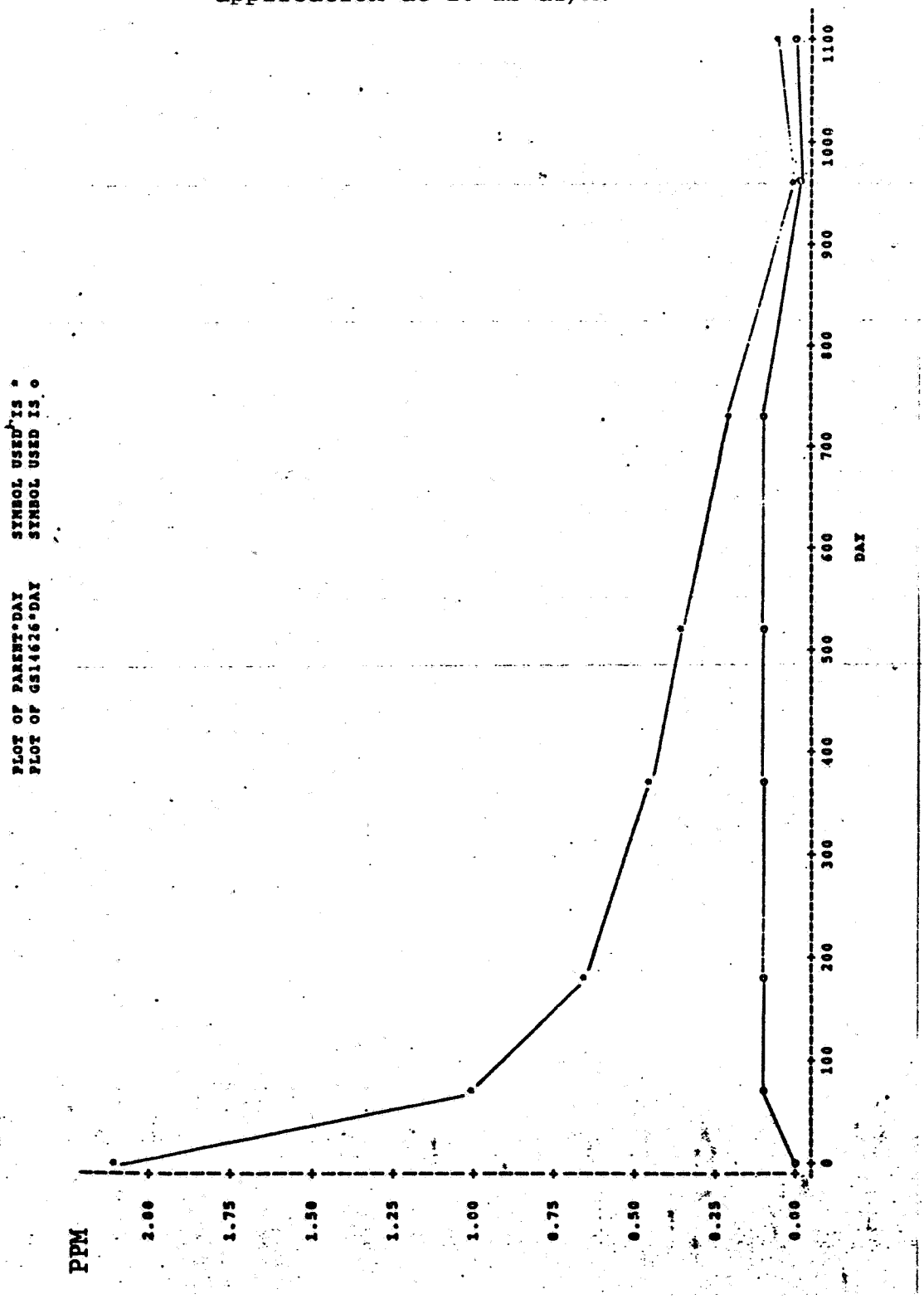


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Figure 2. Field dissipation of prometon from the top 6 inches of a California sandy loam after application at 20 lb ai/A.

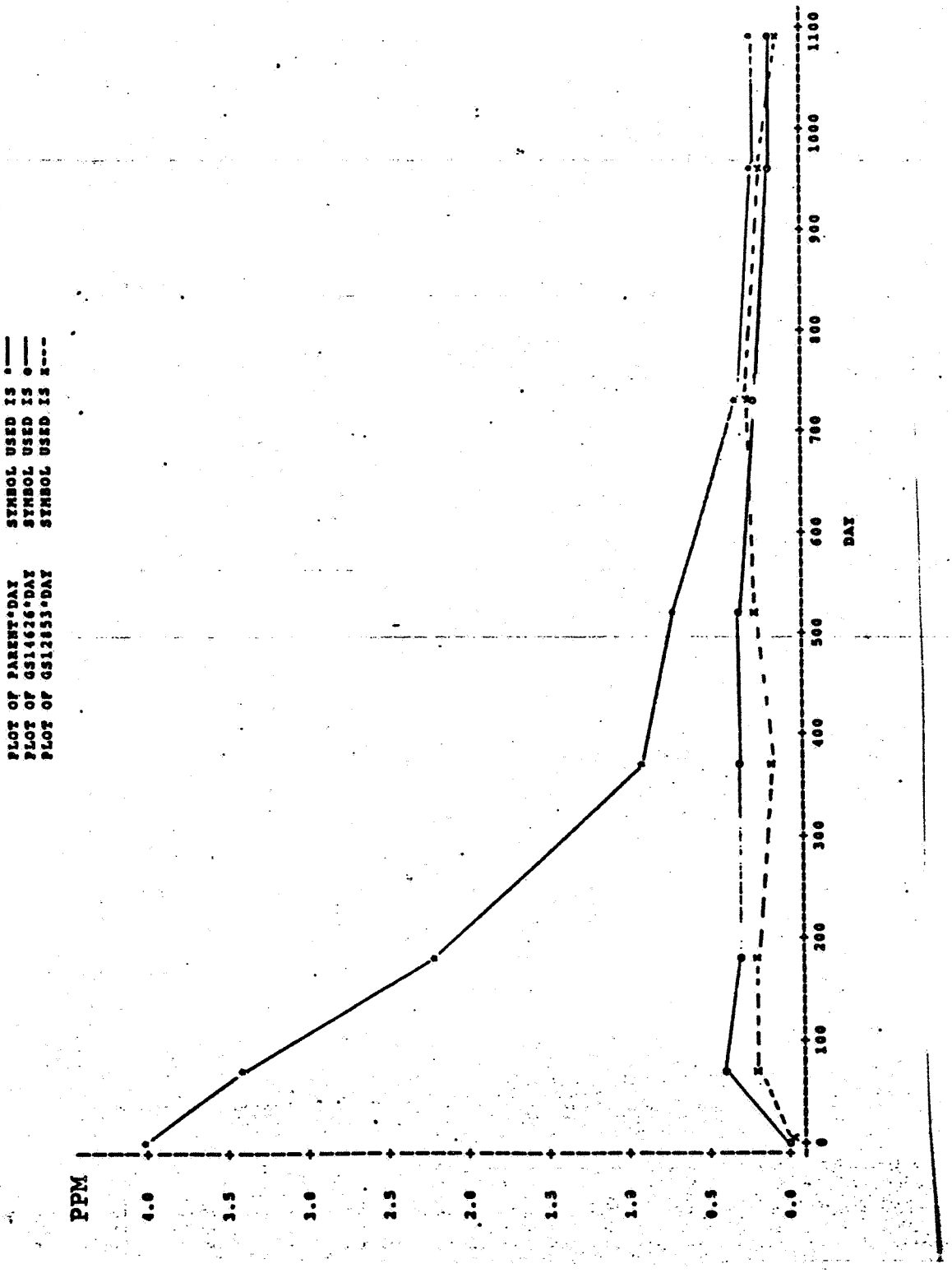

Table 1. Half-life values for prometon in California field soil (0 to 6 inches)

Rate of Application[a] (lb ai/A)	t 1/2 (days)	r
10	223	0.94
10 + 10	352	0.67
10 + 10 + 10	197	0.94
20	321	0.98
20 + 20	243	0.93
20 + 20 + 20	1415	0.28
	Mean 459 days	

[a]Multiple applications were made in successive years.

Table 2. Residues of prometon *per se* in California sandy loam after two or three annual applications at 20 lb ai/A

Second Year	Depth, inches	Days After Treatment				
		Pre	0	64	148	364
	0 to 6	0.83	9.54	4.79	4.22	1.98
	6 to 12	0.23	0.23	1.00	.66	0.54
	12 to 18	0.12	0.12	0.31	.37	0.27
	Total	1.20	9.89	6.10	5.25	2.79
Third Year		Pre	0	61	244	358
	0 to 6	1.98	4.39	4.42	8.02	3.13
	6 to 12	0.54	0.54	0.74	0.76	0.35
	12 to 18	0.27	0.27	0.25	0.45	0.39
	Total	2.79	5.20	5.41	9.23	3.87

Study No. 10: Field Dissipation

Balcomb, R.T. and Honeycutt, R.C. 1986. Field dissipation studies on prometon (Pramitol 25E) (Columbia, New York). Report EIR-86014, submitted by Ciba-Geigy Corporation, Greensboro, NC.

CONCLUSIONS:

This study demonstrates that prometon is extremely persistent in New York silt loam and that carryover of residues from one year to the next would be expected. The depth of leaching of prometon residues was not defined, but was at least 12 to 18 inches in this soil.

MATERIALS AND METHODS:

The field plot design, plot preparation, prometon treatment, methodology, residue sample collection, and residue analytical method were similar to that used for the California field dissipation study (refer to the review of Study 9). The test location was Columbia, New York, and the test soil was a New York silt loam (the true soil series name was not specified) with 35 percent sand, 52 percent silt, and 13 percent clay; pH 6.3; 2.8 percent organic matter; and a CEC of 9.1 meq/100 g.

REPORTED RESULTS:

Prometon was highly persistent in New York silt loam (figures 1 and 2). Monodeisopropylated prometon may also be persistent, although since significant residues of prometon per se remained even 3 years after application at the lower rate (figure 1), it is not possible to determine the dissipation rate of this degradate. Prometon residues were found down to the lowest sampling depth of 12 to 18 inches (table 1). The authors calculated half-lives of 531 to 2058 days for the six treatments (one, two, or three applications at 10 or at 20 lb ai/A each).

DISCUSSION:

1. Deficiencies for this field dissipation study are the same as for the study in California sandy loam (cf. review of Study 9).

Figure 1. Field dissipation of prometon from the top 6 inches of a New York silt loam after application at 10 lb ai/A.

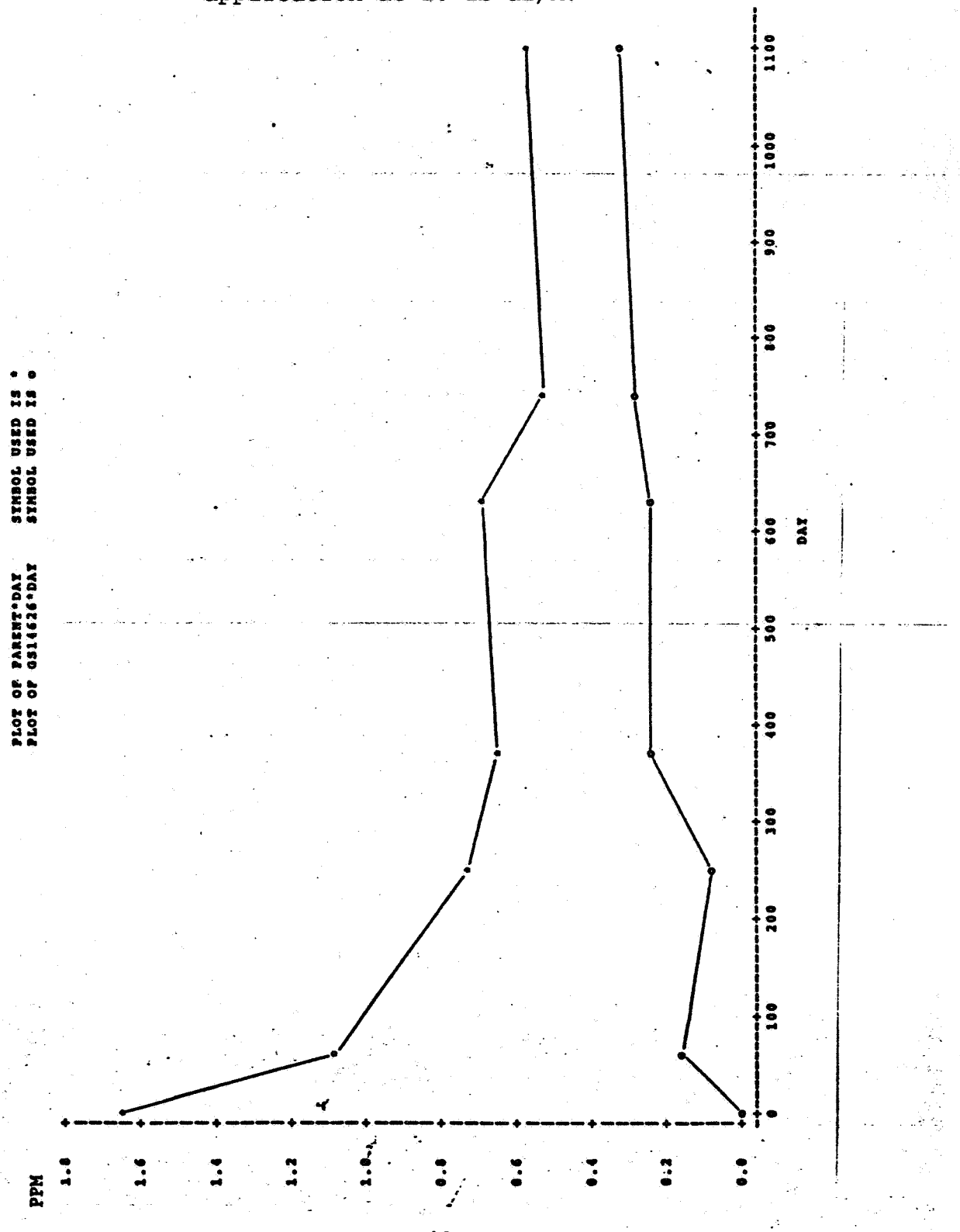

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Figure 2. Field dissipation of prometon from the top 6 inches of a New York silt loam after application at 20 lb ai/A.

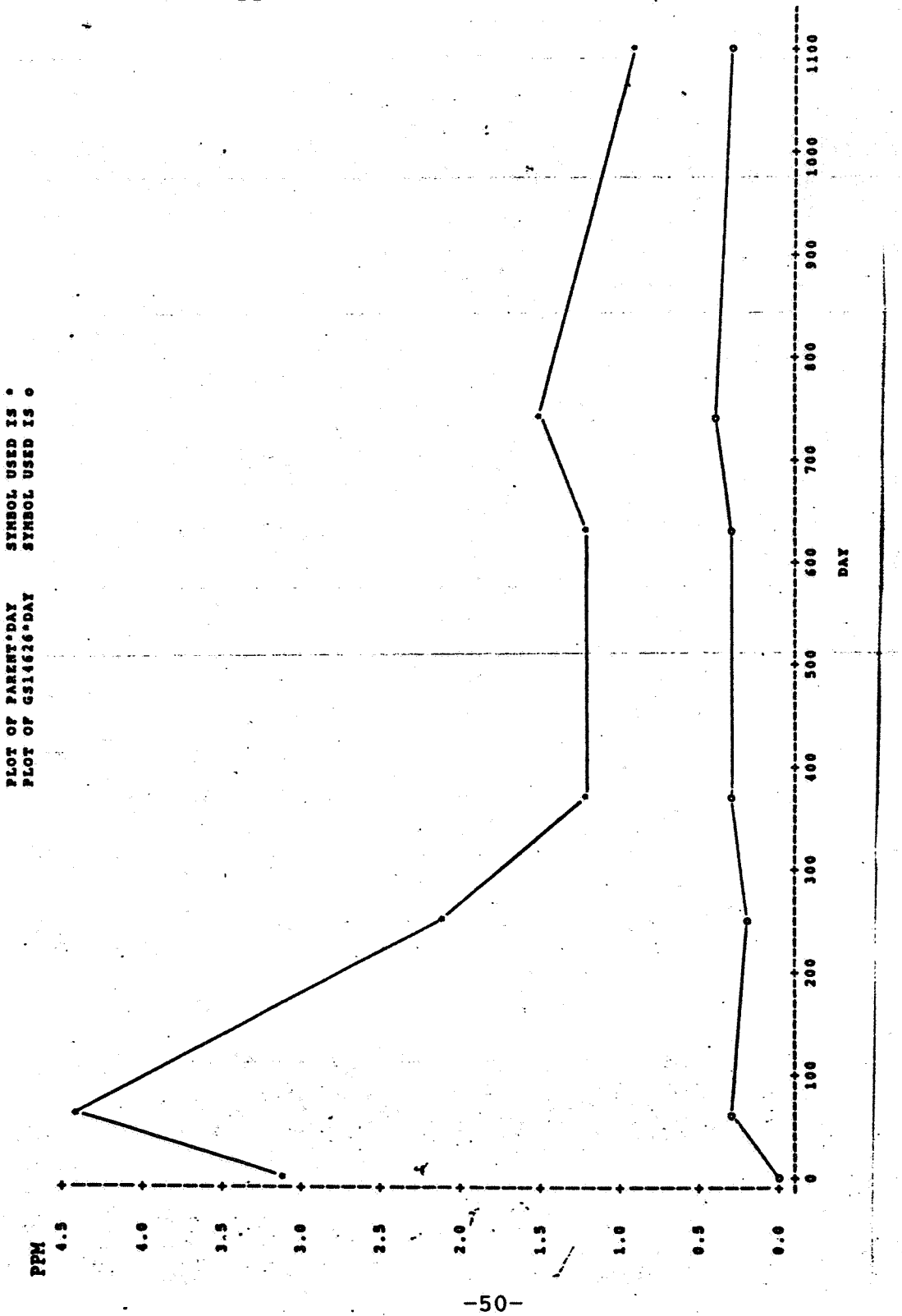

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Table 1. Residues of prometon and its degradates in New York silt loam after single or double application.

No. of Applications	Interval After Last Application, Days	Parts per Million Found						
		Prometon			GS-14626[a]			GS-12853[b]
		0-6"	6-12"	12-18"	0-6"	6-12"	12-18"	0-6"
1	0	1.65	-[c]	-	<0.05	-	-	<0.10
	63	1.09	0.20	0.15	0.15	<0.05	<0.05	<0.10
	251	0.72	0.08	0.10	0.09	<0.05	<0.05	<0.10
	365	0.63	0.12	<0.05	0.25	<0.05	<0.05	<0.10
	626	0.66	0.09	<0.05	0.23	<0.05	<0.05	<0.10
	740	0.51	0.08	<0.05	0.26	<0.05	<0.05	0.11
	1095	0.57	0.23	<0.05	0.31	0.13	<0.05	0.12
2	0[d]	3.94	-	-	0.56	-	-	0.15
		1.86	-	-	0.26	-	-	<0.10
	60	3.10	0.34	0.11	0.51	0.09	<0.05	0.12
	255	2.14	0.13	0.30	0.49	0.05	0.09	0.15
	365	1.52	0.28	<0.05	0.53	0.11	<0.05	0.16

[a] GS-14626 = monodeisopropylated prometon.

[b] GS-12853 = dideisopropylated atrazine; 6 to 12 inches and 12 to 18 inches samples contained < 0.10 ppm GS-12853 at all samplings.

[c] Not analyzed.

[d] Results of analyses of replicate samples are given.

Study No. 11: Field Dissipation

Balcomb, R.T. and Honeycutt, R.C. 1986. Field dissipation studies on prometon (Pramitol 25E) (York, Nebraska) Report EIR-860018 submitted by Ciba-Geigy Corporation, Greensboro, NC.

CONCLUSIONS:

This study demonstrates that prometon is extremely persistent in a Nebraska silt loam and that residue carry-over from one year to the next would be expected. The depth of leaching of prometon residues was not defined, but it was at least 12 to 18 inches in this soil. Significant residues of monodeisopropylated prometon formed, but were less than the amount of prometon per se remaining at all sampling intervals. The data indicate monodeisopropylated prometon is persistent, but are insufficient to calculate its dissipation rate.

MATERIALS AND METHODS:

The field plot design, plot preparation, prometon treatment, methodology, residue sample collection, and residue analytical method were similar to that used for the California field dissipation study (refer to the review of Study 9). The test location was York, Nebraska, and the test soil was a Nebraska (the true soil series name was not specified) silt loam with 20 percent sand, 59 percent silt, and 21 percent clay; pH 6.4; 2.9 percent organic matter; and a CEC of 14.0 meq/100 g.

REPORTED RESULTS:

In this test soil, as with the field studies in California and New York, prometon was found to be extremely persistent (table 1, data shown only for the lower application rate). Residues of monodeisopropylated prometon detected at all sampling intervals after each combination of applications were: 0.30 to 0.66 ppm 61 to 1093 days after one application at 10 lb ai/A, 0.54 to 1.3 ppm 0 to 361 days after the last of two applications at 10 lb ai/A, and 0.53 to 1.1 ppm 0 to 365 days after the last of three applications at 10 lb ai/A (table 1). Lower residue levels of dideisopropylated prometon were also detected in some samples, up to a maximum of 0.36 ppm 0 days after the last of two applications at 10 lb ai/A. The authors' calculated half-lives were 139 to 2227 days for the six treatments with one, two, or three annual applications each at 10 or at 20 lb ai/A. Prometon leached to at least the 12- to 18-inch sampling depth, being consistently detected at this lowest sampling depth. Monodeisopropylated prometon was sometimes detected at this depth at up to a maximum of 0.12 ppm after the 10 lb ai/A treatments (table 1). Results for the 20 lb ai/A treatments were similar to results for the 10 lb ai/A, except residue levels were higher.

DISCUSSION:

1. Deficiencies for this field dissipation study are the same as for the study in California sandy loam (cf. review of Study 9).

Table 1. Residues of prometon and its monodeisopropylated degradate in Nebraska silt loam after one to three applications at 10 lb ai/A

No. of Applications	Days After Last Application	Parts per Million Found					
		Prometon			Monodeisopropylated Prometon		
		Depth, Inches			Depth, Inches		
		0-6	6-12	12-18	0-6	6-12	12-18
1	0	3.9	-[a]	-	<0.05	-	-
	61	3.0	0.20	0.15	0.23	<0.06	<0.06
	183	3.4	0.37	0.22	0.30	0.07	<0.06
	365	4.8	0.36	0.22	0.55	<0.06	<0.06
	542	1.6	0.20	0.25	0.43	<0.06	<0.06
	727	2.3	0.29	0.19	0.66	<0.06	<0.06
	888	2.4	0.49	0.12	0.49	0.10	<0.06
	1093	1.7	0.52	0.27	0.43	0.14	<0.06
2	0	13.5	-	-	1.3	-	-
	60	9.6	1.2	0.20	1.3	0.19	<0.06
	176	3.2	0.19	0.23	0.80	0.08	0.07
	361	1.9	0.61	0.31	0.54	0.21	0.10
3	0	9.7	-	-	0.69	-	-
	61	3.8	0.60	0.29	0.53	0.16	<0.06
	159	3.8	0.63	0.21	0.81	0.19	0.08
	365	5.5	1.8	0.66	1.1	0.35	0.12

[a]Not analyzed.

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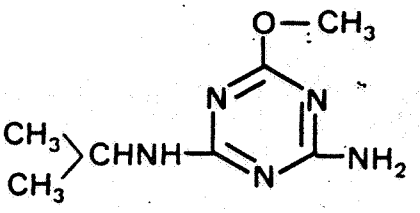
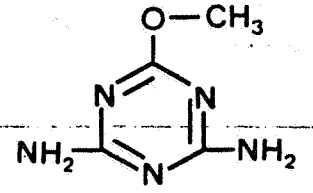
APPENDIX

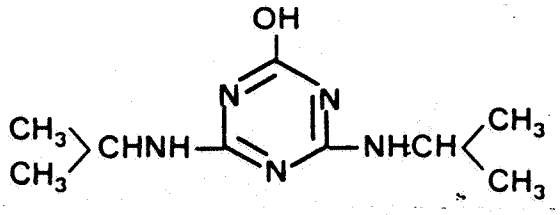
Structures of Prometon Metabolites



Monodeisopropylated prometon
(GS-14626)
2-amino-4-(isopropylamino)-6-methoxy-s-triazine



Dideisopropylated prometon
(GS-12853)
2,4-diamino-6-methoxy-s-triazine



Hydroxy prometon
(GS-11526)
2-hydroxy-4,6 bis (isopropylamino)-s-triazine