FILE

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Date Out EFB:
DEC 3 1982

TO: Robert Taylor
Product Manager 25
TS-767

FROM: Emil Regelman,
Acting Chief
Review Section No. 1
Environmental Fate Branch
Hazard Evaluation Division

Attached please find the environmental fate review of:

Reg./File No.: 279-EUP-OG

Chemical: 2-(2-chlorophenyl)methyl-4,4-dimethyl-3-isoxazolidinone

Type Product: Herbicide

Product Name: FMC 57020 4EC

Company Name FMC Co.

Submission Purpose: EUP for use on Soybeans

ZBB Code: Sec 5 ACTION CODE: 700

Date in: 10/13/82 EFB # 15

Date Completed: 12/2/82 TAIS (level II) Days

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Deferrals To:

_____ Ecological Effects Branch

_____ Residue Chemistry Branch

_____ Toxicology Branch

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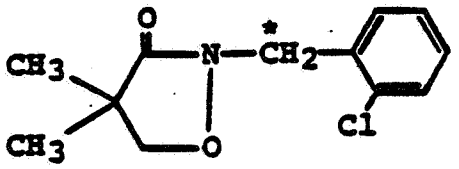
1.0 INTRODUCTION

The FMC Corporation has submitted an application for an experimental use permit (EUP) for the chemical FMC 57020 to evaluate its use as a pre-emergence or preplant herbicide for use on soybeans.

1.1 Chemical

Chemical name: 2-((2-chlorophenyl)-methyl)-4,4-dimethyl-3-isoxazolidinone

Chemical structure:



*denotes position of ^{14}C-label

2.0 DIRECTIONS FOR USE

For use in: Alabama, Arkansas, Delaware, Florida, Georgia, Illinois, Indiana, Iowa, Kansas, Kentucky, Louisiana, Maryland, Michigan, Minnesota, Mississippi, Missouri, Nebraska, New Jersey, New York, North Carolina, Ohio, Oklahoma, Pennsylvania, South Carolina, South Dakota, Tennessee, Texas, Virginia, Wisconsin.

To evaluate control of: foxtails, panicum, barnyard grass, crabgrass, goosegrass, Johnsongrass, shattercane, woolly cupgrass, wild proso millet, velvetleaf, cocklebur, teaweed, spurge, purslane, mallow, lambsquarter, spurred anoda, croton, Pennsylvania smartweed, and common ragweed.

Use FMC 57020 4EC at a rate of 0.5 to 3.0 pounds active ingredient (0.5-3 quarts) per acre in a preplant incorporated, pre-emergent, or post-emergent application. Apply in a minimum of 10 gallons of finished spray per acre with ground equipment or 1 gallon per acre by aircraft, or inject in a uniform manner in a sprinkler irrigation system. All treated crops should be used for research purposes or be destroyed. Do not plant rotational crops within 18 months of last application. Do not graze treated areas or feed crop or crop refuse to livestock.

Do not treat areas while unprotected humans or domestic animals are present in the treatment area.

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3.0 DISCUSSION OF DATA

Note: Only data pertinent to the EUP will be reviewed at this time. Additional studies submitted in the application will be reviewed at the time application for registration is requested.

3.1 FMC 57020 Hydrolysis Study. J. E. Dziedzic, FMC Corp.. June 21, 1982. Reference 29. EPA Acc. no. 248476.

Procedure

Sterile (millipore filtered) aqueous solutions buffered at pH 4.65, 7.00 and 9.25 and an unbuffered solution were fortified to 4.5 and 55 mg/l with unlabeled FMC 57020. Samples were incubated in the dark at constant temperature of 25°C ± 0.5°C for a period of at least 30 days.

Samples were analyzed for FMC 57020 and or hydrolysis products by HPLC.

Results

During the test period (approximately 41 days) very little hydrolysis of FMC 57020 occurred in unbuffered water or solutions buffered at acid or neutral pH. In the basic solution (pH 9.25), 93.3% of the FMC 57020 remained unchanged after 41 days incubation. The hydrolysis product(s) formed were not identified. See Tables I, II, III, and IV.

Conclusions

FMC 57020 is stable to hydrolysis in acidic, neutral and basic solutions maintained at temperature of 25°C ± 0.5°C.

3.2 Degradation of FMC 57020 ^{14}C-Methylene in Clay Loam, Silt Loam and Sandy Loam Soil under Aerobic Conditions. L. W. French, FMC Corp.. June 7, 1982. Reference 30.

Procedure

Three soil types were fortified to 3 ppm with ^{14}C-FMC 57020 labeled in the methylene carbon. Soil moisture was adjusted to 65% field moisture capacity. Soil Flasks were incubated at room temperature (21-23°C) in the dark. Soil samples were taken at 0, 7, 14, 28, and 56 days. CO_2 was trapped in 0.1N KOH solution and assayed at 0, 1, 3, 7, 14, 28, and 56 days.

TABLE I

Summary of HPLC Results for Hydrolysis of FMC 57020 at 25°±0.5°C, pH 9.25, 55 mg/l

TIME (hrs.)	% FMC 57020 Remaining[a] SOLUTION A	SOLUTION B
0	100.0	100.0
164	98.9	99.5
306	98.4	98.8
475	97.4	98.0
645	95.0	95.4
741	94.8	95.3
811	94.5	95.1
979	93.6	93.6

a) At the end of the study, the pH of the test solution was 9.28.

TABLE II

Summary of HPLC Results for Hydrolysis of FMC 57020 at 25°±0.5°C, pH 9.25, 4.5 mg/l

TIME (hrs.)	% FMC 57020 Remaining[a] SOLUTION A	SOLUTION B
0	100.0	100.0
143	100.2	99.8
312	98.3	99.0
478	96.2	97.2
647	94.9	95.2
815	93.3	93.3

a) At the end of the study, the pH of the test solution was 9.28.

TABLE III

Summary of HPLC Results for Hydrolysis of FMC 57020 at 25°±0.5°C, pH 7.00, 50 mg/l

TIME (hrs.)	% FMC 57020 Remaining[a] SOLUTION A	SOLUTION B
0	100.0	100.0
163	99.8	100.0
332	99.8	100.0
501	98.4	98.8
667	98.9	98.8
835	98.7	98.9

a) At the end of the study, the pH of the test solution was 7.04.

TABLE IV

Summary of HPLC Results for Hydrolysis of FMC 57020 at 25°±0.5°C, Millipore (Super Q/Organex Q) Water, 55 mg/l

TIME (hrs.)	% FMC 57020 Remaining[a] SOLUTION A	SOLUTION B
0	100.0	100.0
164	100.0	100.3
306	100.7	100.3
475	100.5	100.7
645	99.3	99.3
741	99.7	99.1
811	99.0	98.8
979	99.6	99.5

a) The pH of the test solution was 6.80 initially and the pH of the test solution at the end of the study was 4.54.

Soil Characteristics

Soil Type	% Composition			% Organic Matter	CDEC*	pH
	Silt	Clay	Sand			
Hagarstown clay loam	41.0	35.0	24.0	2.5	7.7	6.9
Dunkirk Silt loam	60.0	15.2	24.8	2.1	10.9	4.8
Cosad sandy loam	32.8	10.8	56.4	3.2	17.1	6.8

* mequiv/100 gm.

Recovery of total radioactivity was determined by LSC analysis of $^{14}CO_2$ trap and combustion of soil samples. Extractable radioactivity was determined by blending soil with methanol/water (9:1/v:v). Extracted radioactivity was analyzed by HPLC and LSC.

Results

The registrant reported overall recovery ranged from 75.3% to 102.3% of the applied radioactivty.

The half-life of FMC 57020 in sandy loam soil was < 28 days. 43.3% of applied ^{14}C was unchanged FMC 57020 after 28 days incubation. Half-life was > 56 days (termination of study) in the silt loam and clay loam soils. 53.3% and 51.2% of the applied ^{14}C was unchanged FMC 57020 in silt loam and clay loam soils after 56 days incubation. See Tables 2, 3, and 4.

FMC 57020 ^{14}C-methylene-labeled degraded in the soils releasing $^{14}CO_2$. After 56 days incubation, 34.4%, 4.9%, and 12.4% of the applied radioactivity was released as $^{14}CO_2$ from the sandy loam, silty loam and clay loam soils, respectively.

Unchanged FMC 57020 was the primary soil extracted residue. Unidentified polar and non-polar products accounted for up to 2.3% (day 14, Cosad sandy loam soil) or less of the applied radioactivity during the incubation period.

Radioactivity associated with the "post extracted solids" (bound residues) accounted for 30.7%, 40.9% and 35.7% of the applied radioactivity in the sandy loam, silty loam and clay loam soils, respectively, after 56 days incubation.

Conclusions

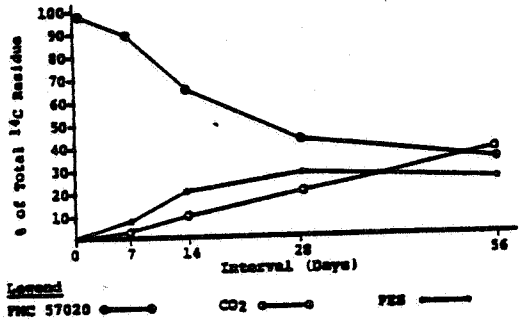
FMC 57020 degrades in soils maintained under aerobic conditions

Table 2
^{14}C-methylene FMC 57020
Cosad Sandy Loam
Material Balance1/

	0 Days	7 Days	14 Days	28 Days	56 Days
FMC 57020	98.0	88.0	68.0	43.3	33.3
Unidentified Products	1.7	1.3	1.5	1.3	0.9
Total Nonpolar Products	99.7	90.3	66.5	44.6	34.2
Polar	0.1	0.8	0.8	0.4	0.7
$^{14}CO_2$		0.5	10.0	23.4	34.4
PES	0.2	8.4	22.7	31.6	30.7
Total	100.0	100.0	100.0	100.0	100.0

1/ Represents a normalized percent distribution of total recovered ^{14}C. Recoveries based on applied radioactivity ranged from 75.3% to 102.3%.

Figure 3
Material Balance Summary
Cosad Sandy Loam



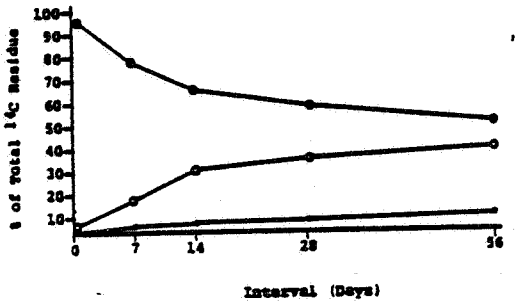
Legend
FMC 57020 —●— CO_2 —○— PES ——

Table 3
^{14}C-methylene FMC 57020
Dunkirk Silt Loam
Material Balance1/

	0 Days	7 Days	14 Days	28 Days	56 Days
FMC 57020	96.1	79.6	64.3	38.7	33.5
Unidentified Products	1.8	0.6	0.6	0.6	0.6
Total Nonpolar Products	97.9	80.2	64.9	39.3	34.1
Polar	0.3	0.2	0.2	0.1	0.1
$^{14}CO_2$		0.1	1.4	2.6	4.9
PES	1.8	19.5	33.5	58.0	60.9
Total	100.0	100.0	100.0	100.0	100.0

1/ Represents a normalized percent distribution of total recovered ^{14}C. Recoveries based on applied radioactivity ranged from 75.3% to 102.3%.

Figure 4
Material Balance Summary
Dunkirk Silt Loam



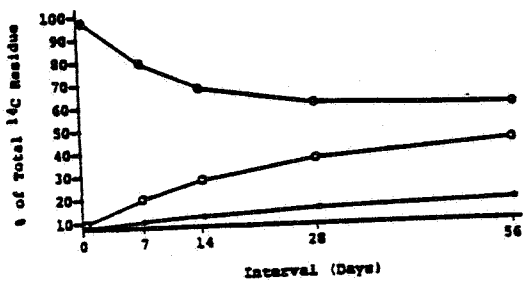
Legend
FMC 57020 —●— PES —○— CO_2 ——

Table 4
^{14}C-methylene FMC 57020
Hagerstown Clay Loam
Material Balance1/

	0 Days	7 Days	14 Days	28 Days	56 Days
FMC 57020	97.5	78.6	68.4	54.9	51.2
Unidentified Products	1.9	1.0	0.7	0.5	0.6
Total Nonpolar Products	99.4	79.6	69.1	55.4	51.8
Polar	0.1	0.3	0.4	0.1	0.1
$^{14}CO_2$		0.2	2.0	10.0	12.4
PES	0.5	19.9	28.5	34.4	35.7
Total	100.0	100.0	100.0	100.0	100.0

1/ Represents a normalized percent distribution of total recovered ^{14}C. Recoveries based on applied radioactivity ranged from 75.3% to 102.3%.

Figure 5
Material Balance Summary
Hagerstown Clay Loam



Legend
FMC 57020 —●— PES —○— CO_2 ——

in the laboratory. The half-life in sandy loam soil was < 28 days. Degradation to CO_2 and soil binding appear to be the primary mechanisms for dissipation in the soil. Formation of CO_2 and binding to soil increased with time during the study.

The half-life in silt loam or clay loam soils is > 56 days. While the study was not conducted long enough to determine half-life, the pattern of degradation can be seen . CO_2 formation and soil binding increased with time during the study.

Note: A study using ^{14}C-FMC 57020 labeled in other positions of the molecule would be beneficial in determining the soil metabolism of FMC 57020.

3.3 Crop Rotation

The registrant submitted no data on rotational crop uptake of FMC 57020 residues. However, the proposed labeling bears the restriction prohibiting planting rotational crops within 18 months of last application.

3.4 Additional Studies

The registrant submitted additional studies that are not required for the EUP. EFB, at this time, will briefly comment on these studies. A thorough review will be completed upon application for registration.

3.4.1 Soil Mobility of FMC 57020. L. P. Kinne, FMC Corp. June 9, 1982. Reference 31. EPA Acc. no. 248476.

Soil TLC indicated that FMC 57020 has a low potential to leach in Cosad sandy loam, Dunkirk silty loam or Hagarstown clay loam soils and has moderate potential to leach in Leon fine sand soil. In leon fine sand soil column leaching study with 20 inches water applied, 34.9% of the applied ^{14}C-methylene FMC 57020 was found in the leachate. The remaining ^{14}C (62.3%) had difused through the 30 cm column.

3.4.1 Soil Adsorption/Desorption Characteristics of FMC 57020. L. W. Froelich, FMC Corp.. June 7, 1982. Reference 32. EPA Acc. no. 248476.

FMC 57020 has a low potential for soil binding (conversely, has high potential for leaching). The average adsorption coefficient in four soils was K = 3.4 after 24 hour equilibration period and K = 3.6 after 48 hour equilibration period.

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Sorption Coefficients

Soil Type	Coefficient			
	Adsorption (K)		Desorption (K')	
	24 hours	48 hours	24 hours	48 hours
Sandy loam	2.82	2.58	3.24	4.52
Silt loam	6.85	7.42	12.13	17.06
Silty clay loam	2.57	2.84	4.10	6.50
Fine sand	1.54	1.54	4.21	15.99

4.0 EXECUTIVE SUMMARY

4.1 FMC 57020 is stable to hydrolysis over the pH range of 4.64 to 9.25 at temperature of 25°C ± 0.5°C.

4.2 The aerobic half-life of ^{14}C-methylene labeled FMC 57020 is < 28 days in a sandy loam soil and > 56 days (last sampling date) in a silt loam and a clay loam soil. Degradation to CO_2 and soil binding appear to be the primary route of dissipation in soil maintained under aerobic conditions in the laboratory. Unchanged FMC 57020 was the primary residue extracted from the soils. Unidentified polar and/or nonpolar metabolites accounted for not more than 2.3% of the applied radioactivity.

4.3 A brief review of the leaching and adsorption data indicate that FMC 57020 has a potential to leach in the soil environment.

4.4 The proposed labeling contains a restriction prohibitng planting rotational crops within 18 months of last application of the experimental program.

5.0 RECOMMENDATION

5.1 The data submitted is adequate to support the experimental use permit. EFB concurs with the proposed experimental program.

5.2 EFB notes that, based on lab data, FMC 57020 has a potential to leach into groundwater. EFB recommends that the field dissipation study include monitoring for leaching and for potential groundwater contamination in sandy soils low in organic matter.

Clinton Fletcher

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