

a. D171711
DP BARCODE : b. D186400

PC Code No.: 122010

Date Out of EFGWB: OCT 18 1993

TO: Robert Taylor/Vickie Walters
Product Manager #25
Registration Division (H7505C)

FROM: Akiva D. Abramovitch, Ph.D., Section Head
Environmental Chemistry Review Section #3
Environmental Fate and Ground Water Branch, EFED (H7507C)

THRU: Henry M. Jacoby, Chief
Environmental Fate and Ground Water Branch, EFED (H7507C)

Henry M. Jacoby 10/18/93

Attached, please find the EFGWB review of:

Reg./File #: a. 000352-00435; b. 284287

Common Name: Metsulfuron Methyl; DPX-T6376 (Code Name)

Methyl 2-[[[(4-methoxy-6-methyl-1,3,5-triazin-2-yl)-

Chemical Name: amino]carbonyl]amino]sulfonyl] Benzoate

Type product: Sulfonylurea Herbicide (Cereals)

ALLYTM (Cereals); ESCORTTM (Non-food uses)

Product Name: FINESSETM (With Chlorsulfuron; Wheat/Barley)

Company Name: E.I. du Pont de Nemours and Company, Inc.

Purpose: a. Review of anaerobic aquatic metabolism and field dissipation studies and label modification (addition of use as harvest aid); b. Review of solubility in water study.

Action Code: a. 330 b. 400 EFGWB #: a. 92-0290 b. 93-0300 Total Reviewing Time: 3.0 days

EFGWB Guideline/MRID Summary Table: The review in this package contains:

LABEL SUPPLEMENT				
161-1	162-1	164-1 42016507	165-1	166-1
161-2	162-2	164-2	165-2	166-2
161-3	162-3 42016506 (Same as 41395501; 6/27/90)	164-3	165-3	166-3
161-4	162-4	164-4	165-4	167-2
201-1	163-1	164-5	165-5	167-3
202-1	163-2/-3	Other: Solubility in Aqueous Buffers 42545501		

1. CHEMICAL:

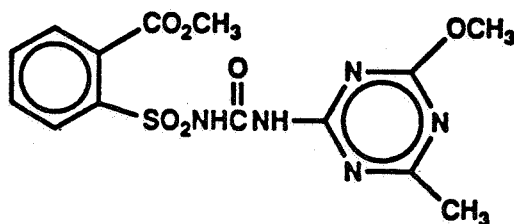
Common Name: Metsulfuron Methyl

Code Name: DPX-T6376

Chemical Name: Methyl 2-[[[(4-methoxy-6-methyl-1,3,5-triazin-2-yl)-amino]carbonyl]amino]sulfonyl] Benzoate

Chemical Abstracts Registry #: 74223-64-6

Chemical Structure:



Physical/Chemical Properties of Active Ingredient:

Molecular formula: $C_{14}H_{15}N_5O_6S$

Molecular weight: 381.37

Physical state: Solid

Color: Off-white

Melting point: 158 C

Specific gravity: 1.74 (25 C)

Vapor pressure: 2.5×10^{-12} mmHg (25 C)*

pK_a : 3.3

Solubility:

In water (25 C; g/L; aqueous buffers; #42545501)

pH 5 0.548

pH 7 2.79

pH 9 213.0

Organic solvents (20 C; mg/L)

Acetone..... 36,000

Methanol..... 7,300

Ethanol..... 2,300

n-Hexane..... 0.79

Methylene chloride..... 121,000

Xylene..... 580

Henry's Law Constant: 2.3×10^{-15} atm-m³/mol (25 C)

Octanol/Water partition coefficient: 0.018 (pH 7; 25 C)

* This value appears in Du Pont's Technical Bulletin "Sulfonylurea Cereal Herbicides". An earlier value on record at EPA is 5.8×10^{-5} mmHg. Therefore, clarification is needed.

Formulation

Dry Flowable; 60% active ingredient

2. STUDY/ACTION TYPE:

- a. Review of Anaerobic Aquatic Metabolism and Terrestrial Field Dissipation studies and new proposed label to include uses of ALLY as a harvest aid for cereals.
- b. Review of solubility in water study.

3. STUDY IDENTIFICATION:

162-3 Anaerobic Aquatic Metabolism

Swanson, M.B. 1988. Anaerobic Aquatic Metabolism of [Triazine-2-¹⁴C] Metsulfuron Methyl. Performed and submitted by E.I. du Pont de Nemours & Company, Inc., Wilmington, DE. Laboratory project # AMR-1140-88; Completed 8/5/88.

MRID #42016506

164-1 Terrestrial Field Dissipation

Rapisarda, C. and Scott, M.T. 1986. Field Soil Dissipation of [Phenyl-(U)-¹⁴C] Metsulfuron Methyl in United States and Canadian Soils. Performed and submitted by E.I. du Pont de Nemours and Company, Wilmington, DE. Laboratory project #AMR-476-84; Completed

MRID #42016507

Barefoot, A.C. and Cooke, L.A. 1990. Water Solubility of DPX-T6376 Using Continuous Sample Agitation. Performed and submitted by E.I. du Pont de Nemours and Company, Inc., Wilmington, DE. Laboratory project #AMR-1661-90; Completed 7/25/90.

MRID #42545501

Other Information:

Proposed Supplemental Labeling ALLY Herbicide, Preharvest Treatment to Aid in Grain Harvesting (Selective Weeding to Aid Grain Harvesting); 8/16/91.

3. REVIEWED BY:

Silvia C. Termes, Chemist
Review Section #3
OPP/EFED/EFGB

Signature: _____

Date: October 5, 1993

4. APPROVED BY:

Akiva D. Abramovitch, Ph.D.
Section Head
Review Section #3
OPP/EFED/EFGB

Signature: Akiva Abramovitch

Date: OCT 14 1993

6. CONCLUSIONS:

A. Administrative

a. Uses of ALLY as a Harvest Aid

i. Supplemental Label for Uses of Ally as Harvest Aid-

The main ALLY label contains the prohibition against using ALLY in soils with a pH greater than 7.9. Since other sulfonylurea herbicides may have been used prior to the use of ALLY as a harvest aid, the "Supplemental label" should re-emphasize the soil pH upper limit as the soil pH upper limit for the other herbicides may differ from the one for ALLY.

ii. Concerns about use of ALLY as a harvest aid

Data are not sufficient to fully assess the impact of the use of ALLY as a harvest aid in a given area, particularly when other sulfonylurea herbicides have been used earlier in the growing season as the primary cereal herbicide. The major concern is the accumulation (carry-over) of phytotoxic residues as the result of usage of a sulfonylurea herbicide as a primary herbicide (including ALLY), plus the addition of ALLY as a harvest aid. This would be a particular concern in areas of short growing seasons, low soil temperatures and low annual rainfall.

In addition, data are still insufficient to determine the extent of leaching of metsulfuron methyl and its degradates in the field (see review of 164-1 study and Table A).

It should be noted that on 6/22/90 (EFGWB #90-0600), the Branch reviewed an Emergency Exemption petition from the State of Texas for use of ALLY as a pre-harvest use on winter wheat. In the review, the Branch expressed its concerns about aerial applications in areas where sensitive crops may grow (for example, sugarbeets). In addition, the Branch presented an analysis of soil vulnerability to leaching in the areas for which the use of ALLY as a harvest aid was intended (the High Plains, the Rolling Plains and the Blackland Prairies).

- b. The Anaerobic Aquatic Metabolism study (42016506) was reviewed by EFGWB on 6/27/90 under MRID 41395501. Additional information was requested from the registrant to upgrade the study. Copy of the 6/27/90 (EFGWB #90-0467/-0468/-0469) is attached to this review and should be made available to the registrant.
- c. The Terrestrial Field Dissipation study (42016507) provides ANCILLARY information only. Although this study (conducted with the phenyl-¹⁴C-labelled material) provides some useful information on the rate of dissipation of metsulfuron methyl in eight different sites (four in the USA and four in Canada), the study fails to provide any information on the pattern of formation/decline of degradates in the field. No degradate identification was reported and, in addition, the 35-cm pipes used in the study may have not been sufficiently deep to assess the movement of residues as a function of time.

- d. The solubility in water studies should have been reviewed by the pertinent Chemistry Branch. However, the EFGWB is using the reported data since no major deficiencies were noted in the study.
- e. The current status of data requirements for metsulfuron methyl (including MRID #s/Review dates) is shown on Table A. The footnotes include the deficiencies identified in the presently available database for metsulfuron methyl. Most of the environmental fate studies for metsulfuron methyl were performed prior to 1986 and were not designed to address current concerns about sulfonylurea herbicides.
- f. There is an apparent discrepancy between the value of the vapor pressure recorded in EPA's files (5.8×10^{-5} mmHg; 25 C) and that reported in DuPont's Technical Bulletin "Sulfonylurea Cereal Herbicides" (2.5×10^{-12} mmHg; 25 C). This discrepancy should be clarified.

B. Scientific

Anaerobic Aquatic Metabolism- Refer to the attached earlier review of 6/27/90.

Terrestrial Field Dissipation- This study, conducted with the phenyl-labelled material at a rate of 100 g ai/ha, showed dissipation rates (as first half-lives) of:

	<u>Fall Application</u>	<u>Spring Application</u>
Akron, CO (Site I) Silt loam; pH 6.9; 1% OM	2 months 96.5 ¹	1.0 month 75.1 ¹
Akron, CO (Site II) Silt loam; pH 8.2; 1.2% OM	3 months 96.5 ¹	1.5 months 75.1 ¹
Fargo, ND Silty clay loam; pH 7.6; 5.3% OM	10.5 months 103.0 ¹	1.5 months 73.5 ¹
Kimberly, ID Silt loam; pH 8.0; 1.3% OM	7 months 72.4 ¹	7 months 53.3 ¹
Stettler, Alberta Sandy loam; pH 6.9; 4.4% OM	-	2.5 months 58.3 ¹
Swift Current, Saskatchewan Silt loam; pH 6.1; 1% OM	-	1 months 43.7 ¹
Saskatoon, Saskatchewan Silty clay loam; pH 6.2; 1% OM	-	1 month 53.6 ¹
Fisher Branch, Manitoba Silty clay loam; pH 7.8; 6.4% OM	-	1.5 month 92.2 ¹

¹ Total cumulative rainfall (cm)

In general, dissipation was faster in more acidic soils and when the product was applied in the spring. In most cases movement of radioactivity to lower depths was observed as a function of time.

No attempts were made to characterize residues moving through the soil profile. Since the depth of the steel pipes was only 35 cm, the study did not provide information of residue movement beyond 35-cm. However, it is feasible that residues could move beyond 35-cm depth. The study did not present data on site temperatures (including soil temperature). The depth of the water tables was not indicated.

An earlier study conducted at a rate of 1 lb [ai]/acre of phenyl-labelled material in Delaware, North Dakota, Florida and Mississippi indicated breakdown within 1-4 weeks; the metabolites identified in soil were methyl 2-(aminosulfonyl) benzoate, saccharin and 2-(aminosulfonyl) benzoic acid. Cylinder depth was 38 cm. Accession #072767.

7. RECOMMENDATIONS:

- a. Inform the registrant of EFGWB's recommendation about re-emphasizing soil pH requirements for use of ALLY as a harvest aid. The Branch also has concerns of potential carry-over of phytotoxic residues when ALLY is used as a harvest aid after usage of other sulfonylurea herbicides as primary weed control treatment. This is of particular concern in areas of short growing seasons, low soil temperatures and low annual rainfall.
- b. The review of the Anaerobic Aquatic Metabolism study (dated 6/27/90; EFGWB #90-0467/-0468/-0469) should be made available to the registrant.
- c. The registrant should be informed that the submitted 164-1 study provides only ANCILLARY information for the reasons indicated in the CONCLUSIONS section. In addition, there are no 164-1 studies conducted with the triazine-labelled material.
- d. The registrant should be informed of the status of the environmental fate database for metsulfuron methyl, as indicated in Table A.
- e. The apparent discrepancy in vapor pressure values should be clarified.
- f. The Branch requests from the registrant an update on analytical methodology (including immunoassay methods and bioassays) for identifying/quantifying "cold" residues of metsulfuron methyl/degradates in field samples (soil/water/plant material) at low levels at which phytotoxicity is still of concern.
- g. The Product Manager should be aware that the evaluation of spray drift data submitted in support of aerial application was completed on 12/14/92 (DP BARCODE D169054; EFGWB #90-0996). A copy of the review is attached to this review.

- h. In reviewing the latest label for ALLY (Accepted 7/29/93), it is said that ALLY is to be used in CO, ID, KS, MN, MT, NE, NM, ND, OK, SD, TX, UT and WY. The label reads that aerial application of ALLY is restricted to those states and to "MO, OR and WA". Since these states do not appear as the "recommended states for use of ALLY", it is unclear the inclusion of MO, OR and WA in the aerial application restrictions. This apparent discrepancy should be clarified.

8. BACKGROUND:

Metsulfuron methyl is the active ingredient in the herbicides ALLY (uses in cereals) and ESCORT (non-crop areas). Both herbicides were registered on 3/28/1986. The first application for EUP was reviewed by the Branch on 5/20/83; multiple deficiencies were noted in the submitted database. The registrant re-submitted new data for the EUP, which was reviewed and accepted by the Branch on 7/12/84. The review of Section 3 data submitted was completed on 12/17/84, but not all data requirements were satisfied. On 10/2/85, the Branch completed the review of the registrant's response to the 12/17/84 review and concluded that still the data requirements were not satisfied. New data (mostly surrogate data) were reviewed on 2/28/86; the Branch concluded then that all data requirements were satisfied.

The only new submissions after the 2/28/86 review were an Aquatic Metabolism study (reviewed on 6/27/90), spray drift data (12/14/92) and a field dissipation study with the phenyl-ring labelled material (this review).

On 6/22/90, the Branch reviewed (EFGWB #90-0600) an Emergency Exemption petition for pre-harvest use of ALLY on winter wheat in the State of Texas (The High Plains, the Rolling Plains and the Blackland Prairies).

Table A identifies the status of data requirements at the time of registration. The Branch has re-evaluated the database and indicated the deficiencies in the database based on current concerns about sulfonylurea herbicides.

Uses of ALLY:

ALLY is recommended for use on wheat (including durum) and barley in CO, ID, KS, MN, MT, NE, NM, ND, OK, SD, TX, UT and WY. In Colorado, ALLY is not to be used in the counties of Alamosa, Conejos, Costilla, Rio Grande and Saguache.

Rotation options are provided for oats, proso millet, dryland grain sorghum, dryland corn, soybeans, flax, sunflower, safflower, alfalfa, hay and dry beans.

Application to wheat and barley is made post-emergence to actively growing broadleaf weeds. Tank mixtures with other herbicides may be needed.

The upper soil pH limit for using ALLY is 7.9, since above that pH residual phytotoxicity could cause injury.

The maximum recommended use rates are:

- 1/10 ounce ALLY per acre in a 22-month period in CO, ID, Western KS, Western NE (West of Highway 183), MN, NM, ND, OK Panhandle, TX Panhandle, SD, UT, and WY.
- 1/10 ounce of ALLY per acre in a 10-month period in Central KS, Central NE, Central OK, and North Central TX.

ALLY is applied by ground equipment or aurally. Aerial applications are restricted to the states of CO, ID, KS, MN, MO (?), MT, NE, NM, OK, OR (?), SD, TX, UT, WA (?) and WY.

9. DISCUSSION OF INDIVIDUAL STUDIES: Refer to DER of 164-1 study and to copy of 6/27/90 review for DER of 162-3 study.
10. COMPLETION OF ONE-LINER: The One-Liner has been updated.
11. CBI APPENDIX: No CBI.

Uses on Terrestrial FOOD/FEED CROPS

Uses on WHEAT/BARLEY

Common Name

Product Name/Registrant:

Date of Registration:

Metsulfuron Methyl

ALLY (du Pont)

3/86

Ph= Phenyl-labelled Material

Tr= Triazine-labelled Material

Environmental Fate Data Requirements

At Req.

Current

Study ID/Review Date

161-1 Hydrolysis	S	S	071434 (ph); 5/20/83	0252492; 7/12/84 ¹
161-2 Photodegradation in Water	S	S ²	072767 (ph); 10/2/85	074003 (tr); 2/28/86
161-3 Photodegradation on Soil	S	PS ³	072767 (ph); 10/2/85	074003 (tr); 2/28/86
161-4 Photodegradation in Air	N/R ⁴	Clarification of vapor pressure needed ⁴		
162-1 Aerobic Soil Metabolism	S	PS ⁵	071434 (ph); 5/20/83	260974 (tr); 2/28/86 ⁵
162-2 Anaerobic Soil Metabolism	PS ⁶	PS ⁶	See anaerobic aquatic metabolism	
162-3 Anaerobic Aquatic Metabolism	PS ⁶	PS ⁶	072767 (ph) 2/28/86; 41395501 (tr); 6/27/90 ⁶	
162-4 Aerobic Aquatic Metabolism	N/A	N/A		
163-1 Mobility in Soil (Batch-equilibrium adsorption/desorption; soil column leaching)	S ⁷	PS ⁷	072767 (ph) 12/17/84 ⁷	
163-2 Volatility from Soil (Laboratory) [*]	N/R ⁴	Clarification of vapor pressure value needed ⁴		
163-3 Volatility from Soil (Field)	N/R ⁴			
<u>Field Dissipation Studies</u>				
164-1 Terrestrial (Short-term)	PS ⁸	NS ⁸ (A)	072767 (ph); 10/2/85	42016507 (ph) 10/93
164-2 Aquatic (Sediment)	N/A	N/A		
164-3 Forestry	N/A	N/A		
164-3 Combination/Tank Mixes	N/A	N/A		
164-5 Terrestrial (Long-term)	R	R		
<u>Accumulation Studies</u>				
165-1 In Confined Rotational Crops	PS ⁹	PS ⁹	072767 (ph); 10/2/85 ⁹	
165-2 In Field Rotational Crops	N/R	See footnote 9		
165-3 In Irrigated Crops	N/A	N/A		
165-4 In Fish	S	S	256626; 6/5/85 (see 7/12/84; 2/28/86)	
165-5 In Aquatic Non-target organisms	N/R	N/R		

Status of Data:

S= Satisfied; PS= Partially Satisfied; NS= Not Satisfied; A= Ancillary;
R= Reserved; N/A= Not Applicable; N/R= Not Required

(Continued)

Uses on WHEAT/BARLEY

Common Name:

Metsulfuron Methyl

Product Name/Registrant:

ALLY (du Pont)

Date of Registration:

3/86

Environmental Fate Data Requirements

At Reg. Current

Ground Water Monitoring Studies

Not Requested R¹⁰

166-1 Prospective (Small-scale)

166-2 Retrospective (Small-scale)

166-3 Retrospective (Large-scale)

167-1 Field Run-off

R¹⁰

176-2 Surface Water Monitoring

R¹⁰

Spray Drift Studies

201-1 Droplet Size Spectrum

Not Requested

See footnote 11

202-1 Field Drift Evaluation

Not Requested

See footnote 11

FOOTNOTES

Metsulfuron Methyl (Uses on Wheat and Barley):

- 1 The study conducted with the phenyl-labelled material showed that the stability of metsulfuron methyl increase with increasing pH and decreasing temperature. At 25 C, the half-lives were 3-weeks (pH 5) and greater than 30 days at pHs 7 and 9. The hydrolysis reaction involves cleavage of the sulfonylurea bridge. The major degradate was saccharin, formed via the intermediate methyl-2-(aminosulfonyl) benzoate.

The study 252492 was not conducted with metsulfuron methyl radiolabelled in the triazine ring, but with 4-methoxy-6-methyl-1,3,5-triazine-2-amine. Although not mentioned in the report or discussed in the review, this is presumably the bridge-cleavage product containing the triazine ring. The study showed that this degradate was stable to hydrolysis. Greater than 96% remained after 30 days; the minor degradate 4-amino-6-methyl-1,3,5-triazine-2-ol was detected at less than 2%.
- 2 An earlier study conducted with the phenyl-labeled metsulfuron methyl was unacceptable (072767). The registrant submitted at a later day a study conducted with the triazine-labeled material showing that photolysis was not an important degradation pathway for metsulfuron methyl at pH 5, 7, and 9 (074003). Although an acceptable study conducted with the phenyl-labelled material should have been submitted, the results of the study conducted with the triazine-labelled material (which showed that direct photolysis is not an important degradative pathway for metsulfuron methyl under the experimental conditions of the study) can be used to satisfy the 161-2 data requirement. The earlier study with the phenyl-labelled material, conducted with river water, appears to indicate that indirect photolysis may contribute to the degradation of metsulfuron methyl.
- 3 EFGWB noticed that the relatively fast "photodegradation" of metsulfuron methyl in the Keyport silt loam soil (pH 4.3) is likely due to hydrolysis (favored at low pHs) rather than to photolysis (074003). In addition, this low pH soil is atypical of most soils where wheat and barley are cultivated. The study conducted with the phenyl-labeled metsulfuron-methyl (072767) was deemed unacceptable.
- 4 The reported vapor pressure of 10^{-5} mmHg at 25 C is above the 10^{-6} mmHg trigger value. This value for metsulfuron methyl is considerably higher than for most sulfonylureas and therefore, must be verified. The value appearing in DuPont's Technical Bulletin is 2.5×10^{-12} mmHg, which more in line with other sulfonylurea herbicides.

5 The early 1982 study (071434) conducted with the phenyl-labelled material was considered acceptable. The study, conducted with a Keyport silt loam (pH 6.4; 2.75% OM), estimated a half-life of 3 to 4 weeks. Degradation involved cleavage of the sulfonylurea bridge to produce saccharin and 2-(aminosulfonyl) benzoic acid as the major non-volatile metabolites, accompanied by mineralization (36% $^{14}\text{CO}_2$ after 24 weeks). In sterile samples, no mineralization was observed, but metsulfuron methyl hydrolyzed to methyl 2-(aminosulfonyl) benzoate. This study was considered acceptable.

To address the fate of the triazine moiety, the registrant submitted an aerobic soil metabolism conducted with chlorsulfuron (which has identical substituents in the triazine ring as metsulfuron methyl). Although the Branch accepted this surrogate data (260974; 2/28/86), a surrogate study with chlorsulfuron should not have been used to address the kinetics of triazine-containing moieties. The rate of bridge cleavage for metsulfuron methyl and chlorsulfuron to yield degradates containing solely the triazine moiety differ. Thus, the rate of formation (and subsequent decline) of these triazine-containing products would be expected to differ for metsulfuron methyl and chlorsulfuron. In addition, the experimental conditions (soil type, analytical methods, etc) may have been different for the two parent sulfonylureas. Unlike photodegradation or abiotic hydrolysis at pH 7 and 9 (which indicate that these are not major degradative pathways), biodegradation constitutes the most significant route of degradation. Therefore, the Branch believes that biodegradation studies should have been conducted with both phenyl- and triazine-labelled metsulfuron methyl under identical experimental conditions.

6 At the time of registration the anaerobic aquatic metabolism study conducted with the phenyl-labeled parent was considered acceptable, but no data were available for the triazine-label parent. The registrant submitted a study conducted with the triazine radiolabel (41395501), which was reviewed on 6/27/90. Several deficiencies were noted in the study. The anaerobic aquatic metabolism study submitted in conjunction with the application for new use (42016506) is the same as the study reviewed on 6/27/90.

7 Batch-equilibrium adsorption/desorption, soil column leaching and soil TLC studies conducted with unaged parent and soil column leaching studies conducted with aged metsulfuron methyl were used to fulfill this requirement at the time of registration. (072767). However, there are no sorption coefficients (K_d values) available for each, individual major degrade.

2

8 An earlier study conducted with the phenyl-labelled unformulated material (072767) was reviewed (the study was conducted in DE, NC, FL and MS); it showed that residues moved down through the soil profile. Another study (42016507) conducted with the phenyl-labelled material (this review) was considered to be ANCILLARY. It provide information on the rate of dissipation in four USA sites and four Canadian sites. However, no attempts were made to identify degradation products. In none of the studies submitted, the depth of sampling (35 to 38 cm) was considered insufficient to define the extent of leaching, although movement of radioactive residues through the soil profile was observed as a function of time.

A surrogate study conducted with chlorsulfuron radiolabelled in the triazine ring was used to "partially fulfill data requirements" (based that the triazine moiety common to both sulfonyleureas could address the triazine fate). However, since the formation of the triazine-containing degradate(s) in both chemicals is dependent on the cleavage of the sulfonyleurea bridge, the rate of formation of these degradate(s) and the subsequent rate of decline are likely to differ for both chemicals. In addition, field conditions may have been different for the chlorsulfuron studies to allow comparison with the metsulfuron methyl studies conducted with the phenyl-labelled material. Studies with both radiolabels should have been conducted at the same sites and during the same period of time.

9 A study conducted with the phenyl-labelled material (072767) was considered "acceptable and to partially satisfy data requirements". The study indicate that residues tend to accumulate. However, according to the 10/2/85 review, data were still missing for the triazine-labelled material. Even the study considered as "acceptable" has some deficiencies. The Chemistry Branch(es) should be informed of the problems with the available database for confined rotational crops.

10 The depth of sampling in the field dissipation studies (radiolabelled) was insufficient to assess the extent of leaching at this time. However, metsulfuron methyl has characteristics (persistence/mobility) in common with other pesticides known as leachers. The low tendency of metsulfuron methyl to bind to soils makes this herbicide a candidate for dissolved run-off. In addition, the persistence of metsulfuron methyl in cold/dry could cause transport of contaminated soil particulates by wind erosion.

11 There are no records in EFGWB files that these studies were requested at the time of registration. A review of spray drift data (40767017) was completed on 12/14/92. Refer to that review for CONCLUSIONS/RECOMMENDATIONS.

13

Environmental Fate & Effects Division
PESTICIDE ENVIRONMENTAL FATE ONE LINE SUMMARY
METSULFURON METHYL

Last Update on October 3, 1993

[V] = Validated Study [S] = Supplemental Study [U] = USDA Data

LOGOUT	Reviewer: <i>[Signature]</i>	Section Head: <i>[Signature]</i>	Date: OCT 13 1993
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Common Name:METSULFURON METHYL

Smiles Code:

PC Code # :122010

CAS #:74223-64-6

Caswell #:

Chem. Name :METHYL-2[[[(4-METHOXY-6-METHYL-1,3,5-TRIAZIN-2-YL)
AMINO]CARBONYL]AMINO]SULFONYL]BENZOATE

Action Type:HERBICIDE

Trade Names:ALLY HERBICIDE; ALLIE; GROPPER

(Formul'tn):DRY FLOWABLE

Physical State:

Use :WHEAT, BARLEY, FALLOW OR NONCROPLAND
Patterns :
(% Usage) :
:

Empirical Form: $C_{14}H_{15}N_5SO_6$
Molecular Wgt.: 381.37 Vapor Pressure: 2.50E-12 Torr
Melting Point : °C Boiling Point: °C
Log Kow : -1.74 pKa: 3.30 @ °C
Henry's : E Atm. M3/Mol (Measured)

Solubility in ...

					Comments
Water	E	3	ppm	@25.0 °C	pH 5 0.548 g/L
Acetone	36.00E	3	ppm	@25.0 °C	pH 7 2.79 "
Acetonitrile	E		ppm	@ °C	pH 9 213 "
Benzene	E		ppm	@ °C	Above values for
Chloroform	E		ppm	@ °C	buffered water
Ethanol	2.30E	3	ppm	@25.0 °C	?
Methanol	7.30E	3	ppm	@25.0 °C	
Toluene	E		ppm	@ °C	
Xylene	5.80E	2	ppm	@25.0 °C	
methylene chloride	12.10E	3	ppm	@25.0 °C	
	E		ppm	@ °C	

Hydrolysis (161-1)

[V] pH 5.0:3 WEEKS(25 C), >30DA (15C)
[V] pH 7.0:STABLE
[V] pH 9.0:STABLE
[] pH :
[] pH :
[] pH :

Environmental Fate & Effects Division
PESTICIDE ENVIRONMENTAL FATE ONE LINE SUMMARY
METSULFURON METHYL

Last Update on October 3, 1993

[V] = Validated Study [S] = Supplemental Study [U] = USDA Data

Photolysis (161-2, -3, -4)

[V] Water:STABLE

[] :
[] :
[] :

[V] Soil :STABLE ON KEYPORT SiLm

[] Air :

Aerobic Soil Metabolism (162-1)

[S] 120-180 DAYS IN SiLm

[S] PHENYL-LABELLED PARENT COMPD.

[] T_{1/2} = 2-3 WEEKS IN SiLm.

[]
[]
[]
[]

Anaerobic Soil Metabolism (162-2)

[]
[]
[]
[]
[]
[]
[]

Anaerobic Aquatic Metabolism (162-3)

[S] 16-52 WEEKS IN STERILE SiLm

[] AND >52 WEEKS IN NONSTERILE

[] (PERFORMED WITH CHLORSULFURON

[] TO SIMULATE TRIAZINE MOIETY)

[] Chlorsulfuron data should not have been accepted for metsulfuron

[] methyl. Deficiencies in studies for met.met.

[]

Aerobic Aquatic Metabolism (162-4)

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[]
[]

Environmental Fate & Effects Division
PESTICIDE ENVIRONMENTAL FATE ONE LINE SUMMARY
METSULFURON METHYL

Last Update on October 3, 1993

[V] = Validated Study [S] = Supplemental Study [U] = USDA Data

Soil Partition Coefficient (Kad, Freun) (163-1)

[]	Soil	pH	%OM	Kad	Kom	1/n
[V]	Cecil sand	6.1	0.3	0.36	120	1.14
[V]	Fallingston sd lm	5.6	1.40	0.41	29	0.57
[V]	Keyport slt lm	6.4	2.75	0.84	31	0.85
[V]	Flanagan slt cl lm	6.5	4.02	1.40	35	0.97
[]	See comments for soil column leaching					

Soil Rf Factors (163-1)

[]	Metsulfuron methyl	Terbacil	Diuron	
[V]	1.0	0.87	0.42	Cecil sand
[V]	0.98	0.72	0.26	Fallingston
[V]	0.90	0.62	0.20	Keyport
[V]	0.64	0.40	0.14	Flanagan
[]	See soils above			

Laboratory Volatility (163-2)

[]
[]

Field Volatility (163-3)

[]
[]

Terrestrial Field Dissipation (164-1)

[A] Application rate 100 g ai/ha
 [] Fall application (CO, ND, ID) t1/2 ranged from 2 mo to 10.5 mo
 [] Spring application (CO, ND, ID) t1/2 from 1 to 7 mo
 []
 [] Canada (four sites)
 [] Spring application, t1/2 ranged from 1 to 2.5 mo
 []
 [] These sites are contained in same study. Study was done with
 [] phenyl-C14. No attempts were made to ident. residues (except
 [] parent). Depth of sampling insufficient, but movement observed.

Aquatic Dissipation (164-2)

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[]

Forestry Dissipation (164-3)

[]
[]

16

Environmental Fate & Effects Division
PESTICIDE ENVIRONMENTAL FATE ONE LINE SUMMARY
METSULFURON METHYL

Last Update on October 3, 1993

[V] = Validated Study [S] = Supplemental Study [U] = USDA Data

Long-Term Soil Dissipation (164-5)

[]
[]

Accumulation in Rotational Crops, Confined (165-1)

[S] RESIDUES ACCUMULATED IN SUGARBEET, SOYBEAN THAT
[] WERE PLANTED IN SdLm 120 DAYS AFTER APP. 15.6 G/HA

Accumulation in Rotational Crops, Field (165-2)

[S] RESIDUES IN SOILS WERE 2 PPB PREPLANTING AND 1 PPB
[] IN WINTER WHEAT POSTHARVEST

Accumulation in Irrigated Crops (165-3)

[]
[]

Bioaccumulation in Fish (165-4)

[] DOES NOT ACCUMULATE
[]

Bioaccumulation in Non-Target Organisms (165-5)

[]
[]

Ground Water Monitoring, Prospective (166-1)

[]
[]
[]
[]

Ground Water Monitoring, Small Scale Retrospective (166-2)

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[]
[]
[]

Ground Water Monitoring, Large Scale Retrospective (166-3)

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[]

Ground Water Monitoring, Miscellaneous Data (158.75)

[]
[]
[]

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PESTICIDE ENVIRONMENTAL FATE ONE LINE SUMMARY
METSULFURON METHYL

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Field Runoff (167-1)

[]
[]
[]
[]

Surface Water Monitoring (167-2)

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[]
[]
[]

Spray Drift, Droplet Spectrum (201-1)

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[]

Spray Drift, Field Evaluation (202-1)

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[]
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Degradation Products

Cleavage of the sulfonylurea is the major mechanism of degradation.
It produces products containing a single ring

Aged soil column leaching showed that saccharin is the most
mobile of the degradates (formed from the phenyl ring moiety).
No data for triazine containing degradates.

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Comments

Metsulfuro methyl degraded under anaerobic conditions in simulated pond/sediment systems with T_{1/2}= 4-11 weeks; degradate 2-(Aminosulfonyl)-benzoic acid gradually accumulated during the 54-week study.

In a column leaching study, with Fallsington SdIm, 84% of the unaged residues were found in 20" of leachate; with Flanagan SiIm it was 99%,

Phenyl-labelled parent compd. decomposed in anaerobic aquatic system with T_{1/2} range of 5 to 20 weeks.

References: FARM CHEMICALS HANDBOK; EPA REVIEWS
Writer : SCT

METSULFURON-METHYL

Page ____ is not included in this copy.

Pages 20 through 36 are not included.

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DATA EVALUATION RECORD

STUDY 1

CHEM 122010

Metsulfuron methyl

§164-1

FORMULATION--00--ACTIVE INGREDIENT

STUDY ID 42016507

Rapisarda, C., and Scott, M.T. 1986. Field soil dissipation of [phenyl (U) ¹⁴C]metsulfuron methyl on United States and Canadian soils. Document No. AMR-476-86. Unpublished study performed and submitted by E.I. du Pont de Nemours & Company, Inc., Wilmington, DE.

DIRECT REVIEW TIME = 18

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CONCLUSIONS:

a. Administrative

This study can be considered ANCILLARY. Although the study provides some information on the dissipation half-lives at different sites, the depth of sampling (35-cm maximum depth) was insufficient to define the extent of leaching of metsulfuron methyl. In addition, the soil was analyzed solely for parent metsulfuron methyl and total residues; degradates were not isolated/identified. Data to support storage stability of frozen soil samples were not provided.

Four of the test sites were in Canada. Although the sites were not in within the United States territory, they are in areas adjacent to

states in which metsulfuron methyl (ALLY) is used to control weeds in wheat and barley. In such a case, the registrant should have provided a comparison of the Canadian sites with typical use areas within the United States (soils, climate, agricultural practices, etc.).

b. Scientific

Terrestrial Field Dissipation- This study, conducted with the phenyl-labelled material at a rate of 100 g ai/ha, showed dissipation rates (as first half-lives) of:

<u>Application</u>	<u>Fall Application</u>	<u>Spring</u>
Akron, CO (Site I) Silt loam; pH 6.9; 1% CM	2 months 96.5 ¹	1.0 month 75.1 ¹
Akron, CO (Site II) Silt loam pH 8.2; 1.2% CM	3 months 96.5 ¹	1.5 months 75.1 ¹
Fargo, ND Silty clay loam; pH 7.6; 5.3% OM	10.5 months 103.0 ¹	1.5 months 73.5 ¹
Kimberly, ID Silt loam; pH	7 months 72.4 ¹	7 months 53.3 ¹
Stettler, Alberta Sandy loam; pH 6.9; 4.4% OM	-	2.5 months 58.3 ¹
Swift Current, Saskatchewan Silt loam; pH 6.1; 1% OM	-	1 months 43.7 ¹
Saskatoon, Saskatchewan Silty clay loam; pH 6.2; 1% OM	-	1 month 53.6 ¹
Fisher Branch, Manitoba Silty clay loam; pH 7.8; 6.4% OM	-	1.5 month 92.2 ¹

¹ Total cumulative precipitation (cm)

In general, dissipation was faster in more acidic soils and when the product was applied in the spring. In most cases movement of radioactivity to lower depths was observed as a function of time. No attempts were made to characterize residues moving through the soil profile. Since the depth of the steel pipes was only 35 cm, the study did not provide information of residue movement beyond 35-cm. However, it is feasible that residues could move beyond 35-cm depth. The study did not present data on site temperatures (including soil temperature). The depth of the water tables was not indicated.

An earlier study conducted at a rate of 1 lb [ai]/acre of phenyl-labelled material in Delaware, North Dakota, Florida and Mississippi indicated breakdown within 1-4 weeks; the metabolites identified in soil were methyl 2-(aminosulfonyl) benzoate, saccharin and 2-(amino-sulfonyl) benzoic acid. Cylinder depth was 38 cm. Accession #072767.

METHODOLOGY

Eight test sites, four in the United States and four in Canada, were selected for study. The U.S. test sites were located at Akron, Colorado (sites I and II); Kimberly, Idaho; and Fargo, North Dakota. The Canadian sites were located at Stettler, Alberta; Swift Current and Saskatoon, Saskatchewan; and Fisher Branch, Manitoba (Table 1). At each test site, ten stainless steel cylinders (10-cm diameter, 38-cm length) were driven into the ground in a bareground plot (3 x 4 m); the rim of each metal tube protruded approximately 3 cm above ground level.

Uniformly phenyl ring-labeled [^{14}C]metsulfuron methyl (radiochemical purity 98%, specific activity 8.62 $\mu\text{Ci}/\text{mg}$, du Pont), dissolved in acetone (containing 0.1 M ammonium carbonate at 0.5%) was uniformly applied at 100 g ai/ha (83 $\mu\text{g}/78.5\text{ cm}^2$) to the surface of the soil within the cylinders. The test sites in the U.S. were treated twice, one set of cylinders was treated in early November 1982, and a second set was treated in May-June 1983; the Canadian test sites were treated only in June 1983 (Table A). At the time of treatment, 5.0 mL of the test solution was applied by pipette to the surface of each soil column; after the acetone had evaporated, the soil surface was wetted with 50 mL of water and covered with approximately 1 cm of fresh soil. Entire soil columns were collected for analysis at various sampling intervals as outlined in Table B. Each soil tube was dug out of the ground, capped at both ends, labeled, frozen, and shipped on dry ice to the analytical laboratory where they were "either analyzed immediately or stored frozen at -25 C until analysis".

At the analytical laboratory, each cylinder was thawed to room temperature, and the soil column was extruded and divided into 0- to 5-, 5- to 12-, 12- to 22-, and 22- to 35-cm segments. The soil segments were air-dried at room temperature for 2-4 days, then ground and homogenized in an electric grinding mill. Duplicate portions (2.5 g) of the air-dried, homogenized soil segments were analyzed by LSC following combustion. Soil segments determined to contain significant levels of radioactivity were retained and frozen; those with only background levels of radioactivity were discarded. Aliquots of the soil segments or the total segments (200-1200 g, depending on the total ^{14}C analyses) containing $\geq 10\%$ of the total radioactivity in the soil tube were transferred to glass columns (5-cm id, 30-cm length). For the soil samples from the immediately posttreatment to 1 year posttreatment sampling intervals only, acetone:0.1 M ammonium carbonate (90:10, v:v) was percolated through

the soil overnight at room temperature at a soil:solvent ratio of 1:2 (w:v). These acetone:0.1 M ammonium carbonate-extracted soil samples, plus all other soil samples from subsequent intervals, were then extracted with 0.1 M ammonium carbonate (soil:solvent ratio of 1:2, w:v) for 1 hour at 45-50 C using sonication. The soil slurries were centrifuged for 15 minutes, and the supernatants were decanted and combined by soil segment and sampling interval. The extracted soils were further extracted by sonicating with acetone for 30 minutes at 45-50 C, followed by centrifugation. The acetone and ammonium carbonate extracts were combined by soil segment and sampling interval, then centrifuged. These extracts were combined with the corresponding acetone:ammonium carbonate extracts; all extract solutions were concentrated using rotary evaporation and a nitrogen blower. Aliquots of the concentrated extracts were analyzed by one-dimensional TLC on silica gel plates developed in methylene chloride:methanol:1 M ammonium hydroxide (170:27:3, v:v:v). Phenyl ring-labeled [^{14}C]metsulfuron methyl was cochromatographed as a reference standard. Radioactive areas were located using autoradiography; these areas were scraped from the plates and analyzed for total radioactivity using LSC. To determine unextracted radioactivity, the extracted soil samples were dried in a vacuum oven for 2-3 days at 50 C, homogenized by grinding, and analyzed by LSC following combustion.

DATA SUMMARY

Uniformly phenyl ring-labeled [^{14}C]metsulfuron methyl (radiochemical purity 98%), at 100 g ai/ha, dissipated with half-lives of 1 to 10.5 months in the upper 0- to 5-cm of bareground plots of silt loam and silty clay loam soils that were located in Colorado, Idaho, and North Dakota and treated with [^{14}C]metsulfuron methyl in the fall of 1982 and the spring of 1983 (Table 22). [^{14}C]Metsulfuron methyl dissipated with half-lives of 1 to 2.5 months in the upper 0- to 5-cm of plots of sandy loam, silt loam, and silty clay loam soils located in Canada that were treated in the spring of 1983. In general, dissipation was considerably more rapid following the spring applications. At all sites, [^{14}C]metsulfuron methyl residues were detected to a depth of 22- to 35-cm (maximum sampling depth). Cumulative rainfall at the eight sites during the 16- to 24-month sampling periods was 43.7-103.0 cm; no relation between total rainfall and degradation rates was apparent (Tables 2-13, 22). No other meteorological data were provided.

Akron, Colorado (Site I): [^{14}C]Metsulfuron methyl dissipated in the upper 0- to 5-cm of silt loam soil that had been treated with uniformly phenyl ring-labeled [^{14}C]metsulfuron methyl at 100 g ai/ha with registrant-calculated half-lives of approximately 2 months following a fall application and 1 month following a spring application (Table 22).

Following the fall application, in the 0- to 35-cm depth, [¹⁴C]metsulfuron methyl was 92% of the recovered radioactivity immediately posttreatment, 61% at 1 month, 27% at 5 months, and 0.7% at 24 months. Total [¹⁴C]residues recovered were 96.4% immediately posttreatment, 85.4% at 1 month, 45.3% at 5 months, and 32.1% at 24 months (Tables 2 and 14). [¹⁴C]Metsulfuron methyl residues were detected in the 22- to 35-cm sampling depth at 5 through 24 months posttreatment; the maximum concentration was 9.5% of the recovered at 5 months (Table 2).

Following the spring application, in the 0- to 35-cm depth, [¹⁴C]metsulfuron methyl was 96% of the recovered radioactivity immediately posttreatment, 36% at 1.3 months, 13% at 2.8 months, and 1.9% at 18 months. Total [¹⁴C]residues recovered were 103.6% immediately posttreatment, 63.4% at 1.3 months, 57.9% at 2.8 months, 46.8% at 4 months, and 32.5% at 18 months (Tables 3 and 14). [¹⁴C]Metsulfuron methyl residues were detected in the 22- to 35-cm sampling depth at 2.8 through 18 months posttreatment; the maximum concentration was 3.6% of the recovered at 18 months (Table 3).

Akron, Colorado (Site II): [¹⁴C]Metsulfuron methyl dissipated in the upper 0- to 5-cm of silt loam soil that had been treated with uniformly phenyl ring-labeled [¹⁴C]metsulfuron methyl at 100 g ai/ha with registrant-calculated half-lives of approximately 3 months following a fall application and 1.5 months following a spring application (Table 22).

Following the fall application, in the 0- to 35-cm depth, [¹⁴C]metsulfuron methyl was 97% of the recovered radioactivity immediately posttreatment, 87% at 0.8 months, 29% at 5 months, 42% at 7.3 months, 2.3-3.8% at 9.3 and 12 months, and 0.4% at 23.8 months. Total [¹⁴C]residues recovered were 100.3% immediately posttreatment, 93.8% at 0.8 months, 38.1% at 5 months, 69.0% at 7.3 months, 9.6-11.8% at 9.3 through 19.5 months, and 5.2% at 23.8 months (Tables 4 and 15). [¹⁴C]Metsulfuron methyl residues were detected in the 22- to 35-cm sampling depth at 5 through 23.8 months posttreatment; the maximum concentration was 24.1% of the recovered at 7.3 months (Table 4).

Following the spring application, in the 0- to 35-cm depth, [¹⁴C]metsulfuron methyl was 99% of the recovered radioactivity immediately posttreatment, 54% at 1.3 months posttreatment, 38% at 2.8 months, and 3.1% at 18 months. Total [¹⁴C]residues recovered were 102.8% immediately posttreatment, 85.6% at 1.3 months, 64.7% at 2.8 months, and 26.2% at 18 months (Tables 5 and 15). [¹⁴C]Metsulfuron methyl residues were detected in the 22- to 35-cm sampling depth at 1.3 through 18 months posttreatment; the maximum concentration was 13.7% of the recovered at 5.8 months (Table 5).

Kimberly, Idaho: [¹⁴C]Metsulfuron methyl dissipated in the upper 0- to 5-cm of silt loam soil that had been treated with uniformly phenyl ring-labeled [¹⁴C]metsulfuron methyl at 100 g ai/ha with registrant-

calculated half-lives of approximately 7 months following both fall and spring applications (Table 22).

Following the fall application, in the 0- to 35-cm depth, [^{14}C]metsulfuron methyl was 96% of the recovered radioactivity immediately posttreatment, 85% at 1 and 4 months, 31.6% at 8 months, and 1.4% at 19 months. Total [^{14}C]residues recovered were 95.5% immediately posttreatment, 97.1% at 4 months, 48.0% at 8 months, and 16.6% at 24 months (Tables 6 and 16). [^{14}C]Metsulfuron methyl residues were detected in the 22- to 35-cm sampling depth at 4 through 24 months posttreatment; the maximum concentration was 37.8% of the recovered at 4 months (Table 6).

Following the spring application, in the 0- to 35-cm depth, [^{14}C]metsulfuron methyl was 98% of the recovered radioactivity immediately posttreatment, 56.1% at 6 months, 21.4% at 13 months, and 9.1% at 18 months. Total [^{14}C]residues recovered were 88.0% immediately posttreatment, 87.3-97.0% between 0.7 and 4 months, 82.2% at 6 months, 38.5% at 13 months, and 16.6% at 24 months (Tables 7 and 16). [^{14}C]Metsulfuron methyl residues were detected in the 22- to 35-cm sampling depth at 13 through 24 months posttreatment; the maximum concentration was 6.3% of the recovered at 13 months (Table 7).

Fargo, North Dakota: [^{14}C]Metsulfuron methyl dissipated in the upper 0- to 5-cm of silty clay loam soil that had been treated with uniformly phenyl ring-labeled [^{14}C]metsulfuron methyl at 100 g ai/ha with registrant-calculated half-lives of approximately 10.5 months following a fall application and 1.5 months following a spring application (Table 22).

Following the fall application, in the 0- to 35-cm depth, [^{14}C]metsulfuron methyl was 98% of the recovered radioactivity immediately posttreatment, 67% at 8 months, 34.7% at 12 months, and 21.4% at 24.3 months. Total [^{14}C]residues recovered were 95.2% immediately posttreatment, 78.7% at 19 months, and 55.5% at 24.3 months (Tables 8 and 17). [^{14}C]Metsulfuron methyl residues were detected in the 22- to 35-cm sampling depth at 5.4 through 24.3 months posttreatment; the maximum concentration was 10.9% of the recovered at 19 months (Table 8).

Following the spring application, in the 0- to 35-cm depth, [^{14}C]metsulfuron methyl was 95% of the recovered radioactivity immediately posttreatment, 61% at 1.3 months, 42% at 2 months, and 24.2-26.3% at 4.3 to 16 months. Total [^{14}C]residues recovered were 101.9% immediately posttreatment and 65.2-72.4%, with no discernable pattern between 2 and 16 months (Tables 9 and 17). [^{14}C]Metsulfuron methyl residues were detected in the 22- to 35-cm sampling depth at 13 and 16 months posttreatment; the maximum concentration was 1.5% of the recovered at 16 months (Table 9).

Stettler, Alberta: Uniformly phenyl ring-labeled [^{14}C]metsulfuron methyl, at 100 g ai/ha, dissipated with a registrant-calculated half-life of 2.5 months from the upper 0- to 5-cm of sandy loam soil that had been treated with [^{14}C]metsulfuron methyl in June 1983 (Table 22). Following the spring application, in the 0- to 35-cm depth, [^{14}C]metsulfuron methyl was 97% of the recovered radioactivity immediately posttreatment, 59% at 2 months, 38% at 4 months, 45% at 13.5 months, and 32.1% at 16 months. Total [^{14}C]residues were 100.8% immediately posttreatment and ranged from 54.9 to 84.7% with no discernable pattern between 2 and 16 months (Tables 10 and 18). [^{14}C]Metsulfuron methyl residues were detected in the 22- to 35-cm sampling depth at 0.5 through 16 months posttreatment; the maximum concentration was 12.0% of the recovered at 1 month (Table 10).

Swift Current, Saskatchewan: Uniformly phenyl ring-labeled [^{14}C]metsulfuron methyl, at 100 g ai/ha, dissipated with a registrant-calculated half-life of 1 month from the upper 0- to 5-cm of silt loam soil that had been treated with [^{14}C]metsulfuron methyl in June 1983 (Table 22). Following the spring application, in the 0- to 35-cm depth, [^{14}C]metsulfuron methyl was 91% of the recovered radioactivity immediately posttreatment, 43% at 1 month, 16% at 2 months, and 2.7% at 16 months. Total [^{14}C]residues were 91.0% immediately posttreatment, 61.8-70.1% between 2 and 10 months, 59.3% at 13.5 months, and 49.0% at 16 months (Tables 11 and 19). [^{14}C]Metsulfuron methyl residues were detected in the 22- to 35-cm sampling depth at 0.3% of the recovered at 10 months posttreatment; it was not detected at that depth at any other sampling interval (Table 11).

Saskatoon, Saskatchewan: Uniformly phenyl ring-labeled [^{14}C]metsulfuron methyl, at 100 g ai/ha, dissipated with a registrant-calculated half-life of 1 month from the upper 0- to 5-cm of silty clay loam soil that had been treated with [^{14}C]metsulfuron methyl in June 1983 (Table 22). Following the spring application, in the 0- to 35-cm depth, [^{14}C]metsulfuron methyl was 90% of the recovered radioactivity immediately posttreatment, 51% at 1 month, 39% at 2 months, and 10.2% at 16.5 months. Total [^{14}C]residues were 96.4% immediately posttreatment, 58.6% at 13.5 months, and 55.0% at 16.5 months (Tables 12 and 20). [^{14}C]Metsulfuron methyl residues were detected in the 22- to 35-cm sampling depth at 4, 13.5, and 16.5 months posttreatment; the maximum concentration was 0.8% of the recovered at 16.5 months (Table 12).

Fisher Branch, Manitoba: Uniformly phenyl ring-labeled [^{14}C]metsulfuron methyl, at 100 g ai/ha, dissipated with a registrant-calculated half-life of 1.5 months from the upper 0- to 5-cm of silty clay loam soil that had been treated with [^{14}C]metsulfuron methyl in June 1983 (Table 22). Following the spring application, in the 0- to 35-cm depth, [^{14}C]metsulfuron methyl was 90% of the recovered radioactivity immediately posttreatment, 58% at 1 month, 44% at 2 months, and 14.1% at 16.5 months. Total [^{14}C]residues were 100.2% immediately posttreatment, 68.0% at

13.5 months, and 58.0% at 16.5 months (Tables 13 and 21). [¹⁴C]Metsulfuron methyl residues were detected in the 22- to 35-cm sampling depth at 1 through 16.5 months posttreatment; the maximum concentration was 3.4% of the recovered at 4 months (Table 13).

COMMENTS:

1. The test sites were sampled infrequently; the second sampling generally did not occur until 1 month posttreatment (the first sampling was immediately posttreatment) and there was a maximum of 7.5 months between samplings (Table B). This made it difficult to accurately determine the half-life of [¹⁴C]metsulfuron methyl and total [¹⁴C]residues. At the Colorado (spring, Site I; fall, Site II) and Idaho (fall) sites, >50% of the applied metsulfuron methyl degraded between subsequent sampling intervals. Data from several sites (Colorado Site I, North Dakota, Alberta) were variable; if the soil had been sampled more frequently, the significance of individual sampling dates would have been lessened.
2. The formation and decline of degradates in the treated soils were not addressed; the soil samples were analyzed only for [¹⁴C]metsulfuron methyl and total [¹⁴C]residues, although in some cases <50% of the recovered radioactivity was metsulfuron methyl. In this field dissipation study, the authors stated, "The soil metabolites of metsulfuron methyl were identified and quantitated in previous aerobic soil metabolism and field soil dissipation studies", apparently as justification for the limited soil analyses. Saccharin, 2-(aminosulfonyl)benzoic acid, and methyl-2-(aminosulfonyl)benzoate have been identified as the major degradates of metsulfuron methyl.
3. The soil was not sampled deep enough to define the extent of leaching. At all sites, [¹⁴C]residues were detected in the deepest soil depth sampled.
4. No storage stability data were provided.
5. Four of the test sites were in Canada and may not be typical of growing areas in the United States where metsulfuron methyl is used. Since the meteorological data from all test sites were incomplete (air and soil temperature data were not provided), and information on the depth to the water table and pesticide history of the site were not provided, comparisons between environmental conditions at the Canadian and United States sites could not be made.
6. Sample calculations were not provided; it was uncertain which data were used by the study authors to calculate the half-lives of parent metsulfuron methyl at the eight sites.
7. It was stated that ammonium carbonate was added to the treatment solution to neutralize acidic impurities in the acetone which could decompose metsulfuron methyl.

METSULFURON-METHYL

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