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Chemical Code:128501
DP Barcode:D201516

ENVIRONMENTAL FATE AND GROUND WATER BRANCH

Review Action

To: Robert Taylor, PM #25
Registration Division (H7505C)

From: Akiva Abramovitch, Section Head
Chemistry Review Section 3
Environmental Fate & Ground Water Branch/EFED (H7507C)

Thru: Henry Jacoby, Chief
Environmental Fate & Ground Water Branch/EFED (H7507C) 10/13/94

Attached, please find the EFGWB review of...

Common Name:	Glyphosate Trimesium (sulfosate)	Trade name:	Touchdown
Company Name:	Zeneca Inc.		
ID #:	010182-00324		
Purpose:	To review data to support the proposed new registration for use of sulfosate on nuts (except almonds).		

Type Product:	Action Code:	EFGWB #(s):	Review Time:
Herbicide	330		2.0day

STATUS OF STUDIES IN THIS PACKAGE:

Guideline #	MRID	Status[1]

STATUS OF DATAREQUIREMENTS ADDRESSED IN THIS PACKAGE:

Guideline #	Status[2]

[1]Study Status Codes: A=Acceptable U=Upgradeable C=Ancillary I=Invalid.
[2]Data Requirement Status Codes: S=Satisfied P=Partially satisfied N=Not satisfied R=Reserved W=Waived.

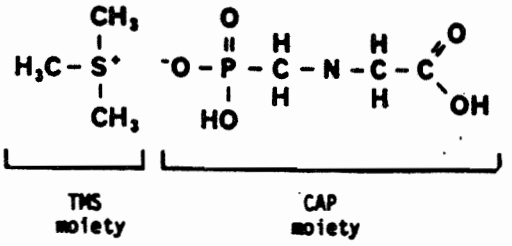
1. CHEMICAL:

Common Name: Sulfosate

Chemical Name: Trimethylsulfonium carboxymethyl aminomethylphosphonate;

Type of product: Herbicide

Chemical Structure:



Physical/Chemical Properties
Molecular formula: $C_6H_{15}NO_5PS$.
Molecular weight: 244.23.
Physical state: Liquid.
Specific gravity: 1.27 g/cm^3.
Boiling point: 110 C at 760 Torr.
Vapor pressure: <4 x 10^{-7} Torr at 25 C.
Molar water solubility: (pure active) 17.6 X 10^6g

2. TEST MATERIAL:

N/A

3. STUDY/ACTION TYPE:

To review data to support the proposed new registration for use of sulfosate on nuts (except almonds).

4. STUDY IDENTIFICATION:

1) Sulfosate label, conditions of sale and directions for use.

5. REVIEWED BY:

Kevin L. Poff, Chemist
Environmental Chemistry Review Section #3 Date: OCT 11 1994
Environmental Fate and Groundwater Branch/EFED

6. APPROVED BY:

Akiva Abramovitch, Ph.D., Chemist
Environmental Chemistry Review Section #3 Date: OCT 11 1994
Environmental Fate and Groundwater Branch/EFED

7. CONCLUSIONS:

1) The EFGWB has previously evaluated (EFGWB #70760-61 (9/22/87) the potential for off site exposure of sulfosate (now called Glyphosate-trimesium) and has determined that there is a low potential for impact to non-target plants or water resources under

most conditions. Therefore the addition of the use of glyphosate trimesium on nut crops (except almonds) presents an incrementally low risk to the environment. The proposed use rate for TOUCHDOWN herbicide on nut crops (except almonds) is 4 lbs/ai/acre; the amended label reads: Nonselective foliar systemic herbicide for weed control in noncrop areas around the farm, in nonbearing trees and vines, and in bearing nut trees.

ENVIRONMENTAL FATE ASSESSMENT

Sulfosate is comprised of two moieties: trimethylsulfonium cation (TMS) and carboxymethlaminomethylphosphate anion (CAP). In general, the available field data indicate sulfosate (TMS, CAP and the AMPA metabolite formed from CAP) adsorbs fairly strongly to soil and would not be expected to move vertically below the 6 inch soil layer.

The data indicate that although there is some photochemical decomposition, chemical decomposition in general is not a significant pathway of degradation of sulfosate. However, sulfosate (CAP moiety) appears to be readily degraded by soil microbes (t1/2= 48 to 72 hrs.) to aminomethyl phosphonic acid (AMPA), which is degraded further to CO_2, although at a slower rate than for parent sulfosate. In addition, the TMS moiety appears to biodegrade fairly rapidly (t1/2= 72 hrs.) to CO_2 as well.

Even though sulfosate is highly water soluble it appears that parent sulfosate (TMS, CAP) and the AMPA degradate have a low potential to move to ground water due to fairly fast microbial degradation and the adsorptive characteristics as demonstrated in the laboratory and field studies. Laboratory batch equilibrium studies of parent sulfosate in four separate soils indicated a moderate adsorption giving Freundlich K (ads) values of 9-21, desorption values were 4-9. In a soil column (aged 3 day) residues applied to 2 separate soils did not move below 6 cm. Parent sulfosate also showed low mobility in a supplemental soil TLC study. However, sulfosate does have a limited potential to contaminate surface waters. If a runoff event were to occur shortly after application, parent sulfosate would readily wash from the application area and could be transported to local surface waters. In surface water, sulfosate may either photodegrade or persist for sometime, depending on light sensitization and water pH.

Based on the low vapor pressure of sulfosate, volatilization from soils will not be an important dissipation mechanism. The low octanol/water coefficient suggests that sulfosate will have a low tendency to accumulate in fish.

8. RECOMMENDATIONS:

Based on the available data the new registration for use on the nut crop group (except almonds) of glyphosate-trimesium would not present a risk to ground and surface water.

SUMMARY OF DATA REQUIREMENTS: (sulfosate)

The summary of data requirements to support uses of glyphosate-trimesium (sulfosate) on terrestrial food crop and terrestrial nonfood sites is as follows:

Satisfied:

-Hydrolysis (161-1). Stable at pH 5, 7, and 9 at 25°C; EFGWB #4119, 4120 3/1/84 (originally reviewed 8/18/83).

-Photodegradation in water (161-2). Carboxymethylaminomethylphosphonate (CAP) anion; 14.6 days, 77.9 and 41.6 days at pH 5, 7, and 9 respectively. Photoproducts were phosphoric acid and aminomethylphosphonic acid. The trimethylsulfonium (TMS) cation was stable at pH 5 and 7, but degraded in 31.7 days at pH 9; EFGWB #4119, 4120 3/1/84.

-Photodegradation in soil (161-3). The (CAP) anion degraded with an initial rapid phase of 12 days in which 34% of applied degraded followed by a slower phase in which only 6% degraded. The degradate isolated was aminomethylphosphonic acid (AMPA). The TMS cation was stable; EFGWB # 6147, 6148, 1/21/86 Acc #258400, EFGWB # 60707-60708,70214-70215, 3/27/87 (no MRID).

-Aerobic Soil Metabolism (162-1). The TMS moiety has a half-life of 3 days in soil with CO_2 being the major degradate. The CAP portion of the molecule degraded with a half-life of 2 to 3 days with CO_2 as the major degradate. EFGWB # 6483-6486, Acc #260670, 6/30/86, EFGWB # 70716-17, 6/26/87. However, the calculated half-life was based on parent TMS and not total extractable TMS as well so a more realistic half-life for the TMS moiety may be on the order of 2 to 3 weeks. (EFGWB review of 6/30/86 indicated that 66% of the radiolabeled TMS was converted to CO_2 within 28 days; also see 70760-61, 9/22/87).

-Anaerobic Soil Metabolism (162-2). The CAP moiety degraded with 43% of the applied being converted to CO_2 at day 66. EFGWB #70716-17, Acc #40214008-9. Half-life of cation is 2 months based on CO_2 evolution. Anion exhibited a half-life similar to that of the aerobic metabolism study of 2-3 wks. EFGWB #70760-61 9/22/87.

-Leaching/Adsorption/Desorption (163-1). Freundlich K ads values for parent in four separate soils were 9-21, desorption values were 4-9. In a soil column (aged 3 day) residues applied to 2 soils did not move below 6 cm. EFGWB # 70760-61, 9/22/87. The parent also showed low mobility in a soil TLC study (1/17/86).

- Terrestrial Field Dissipation (164-1). TMS and CAP dissipated with calculated half-lives of 6 and 12 days, respectively, in the 0- to 3-inch depth of unvegetated sandy loam soil in California treated with a single application of sulfosate at 4 lb ai/A. TMS and CMP did leach to the 3- to 6-inch soil depth, but were not detected below the 6-inch soil depth. (MRID #41235906)

TMS and CAP dissipated with half-lives of 5 and 6 days, respectively, in the 0- to 3-inch depth of unvegetated sandy loam soil in Mississippi treated with a single application of sulfosate at 4 lb ai/A. TMS and CAP were not detected below the 3-inch soil depth, except for one sampling interval in which TMS was near the detection limit. (MRID #41235907)

TMS and CAP dissipated with calculated half-lives of 10 and 4 days, respectively, from the 0- to 3-inch depth of unvegetated loamy sand soil in Georgia that was treated with a single application of sulfosate at 4 lb ai/A. In general, TMS and CMP were not detected below the 3-inch soil depth. EFGWB #'s 90-0680-0681,-0594-0595,-0784,91-0755,-0361 (9/25/91).

Frozen storage stability (MRID #42937702) studies were reviewed and indicate Sulfosate (Trimethylsulfonium carboxymethyl aminomethylphosphonate) residues were stable in soil stored frozen (-20 C) for 2 years.

Waived:

Fish Accumulation (165-3). (EFGWB #4119, 4120, 3/1/84) based on sulfosates high water sol./low kow.

9. BACKGROUND :

Touchdown is a nonselective foliar systemic herbicide used to control a broad spectrum of emerged weeds. Touchdown controls most grass and broadleaf weeds - both annual and perennial Touchdown may be used in bearing pecan, walnut, beech nut, Brazil nut, butternut, cashew, chestnut, chinquapin, filbert, hickory nut and Macadamia nut groves; in certain noncrop areas around the farm, and in nonbearing groves, orchards, or vineyards up to 1 year of harvest to control unwanted vegetation. Touchdown in formulated as a liquid concentrate which contains 6 pounds of ai per gallon. Touchdown requires a 6-hour rain-free period after application. Rain occurring within 6 hours of application may reduce weed control.

In general, glyphosate trimesium (sulfosate) is a nonselective systemic herbicide developed for postemergence weed control on terrestrial food crop and terrestrial nonfood sites. Sulfosate is comprised of two moieties: trimethylsulfonium cation (TMS) and carboxymethlaminomethylphosphate anion (CMP). Sulfosate is applied at 0.44 to 4.1 lb ai/A using either spray, wiper, or hand-directed spot application procedures. It is generally applied with a surfactant.

10. DISCUSSION:
See recommendations above.

11. COMPLETION OF ONE-LINER:
N/A

12. CBI INDEX:
N/A

Environmental Fate & Effects Division
PESTICIDE ENVIRONMENTAL FATE ONE LINE SUMMARY
SULFOSATE
Last Update on October 12, 1994
[V] = Validated Study [S] = Supplemental Study [U] = USDA Data

LOGOUT	Reviewer:	Section Head:	Date:

Common Name:SULFOSATE
Smiles Code:
PC Code # :128501 CAS #:81591-81-3 Caswell #:

Chem. Name :TRIMETHYLSULFONIUM CARBOXYMETHYLAMINOMETHYL-PHOSPHONATE

Action Type:Herbicide

Trade Names:TOUCHDOWN
(Formul'tn):
Physical State:

Use :NONSELECTIVE SYSTEMIC HERBICIDE FOR POSTEMERGENCE WEED
Patterns :CONTROL
(% Usage) :
:

Empirical Form: $C_3H_7NPO_5^- + SC_3H_9$
Molecular Wgt.: 245.23 Vapor Pressure: 4.00E -7 Torr
Melting Point : °C Boiling Point: 110C@1Atm°C
Log Kow : -5 pKa: @ °C
Henry's : E Atm. M3/Mol (Measured)

Solubility in ...				Comments
Water	E	ppm	@20.0 °C	very soluble
Acetone	E	ppm	@ °C	
Acetonitrile	E	ppm	@ °C	
Benzene	E	ppm	@ °C	
Chloroform	E	ppm	@ °C	
Ethanol	E	ppm	@ °C	
Methanol	E	ppm	@ °C	
Toluene	E	ppm	@ °C	
Xylene	E	ppm	@ °C	
	E	ppm	@ °C	
	E	ppm	@ °C	

Hydrolysis (161-1)
[V] pH 5.0:STABLE 25C
[V] pH 7.0:STABLE 25C
[V] pH 9.0:STABLE 25C
[ ] pH :
[ ] pH :
[ ] pH :

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Photolysis (161-2, -3, -4)
[V] Water:pH5 CAT. STABLE; AN. 14.6DA
[V] :pH7 CAT. STABLE; AN. 77.9DA
[V] :pH9 CAT. 31.7DA; AN. 41.6DA
[ ] :

[V] Soil :+ STABLE; ANION 382 HR
[ ] Air :

Aerobic Soil Metabolism (162-1)

	SOIL	pH	%OM	(+)	(-)
[V]	SOIL	pH	%OM	(+)	(-)
[ ]	SdLm	5.6	1.1	49 HRS	13HR
[ ]	LOAM	6.9	1.9	300 "	16 "
[ ]	SAND	6.7	2.5	29 "	33 "
[ ]	LOAM	5.7	6.2		19 "
[ ]					
[ ]					

Anaerobic Soil Metabolism (162-2)
[V] T1/2 FOR (+) MOIETY=2 MONTHS
[ ] BASED ON CO2 EVOLUTION
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Anaerobic Aquatic Metabolism (162-3)
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Aerobic Aquatic Metabolism (162-4)
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Environmental Fate & Effects Division
PESTICIDE ENVIRONMENTAL FATE ONE LINE SUMMARY
SULFOSATE
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Soil Partition Coefficient (Kd) (163-1)

[ ] Kd VALUES FOR TMS MOIETY:

	Sd	Si	Cl	%OM	pH	Kd
[V]	88	9	3	0.6	7.9	6.72
[V]	44	43	13	1.4	6.6	3.67
[V]	14	56	30	4.4	5.3	8.08
[V]			52	2.1	5.1	8.96

Soil Rf Factors (163-1)

		CATION	ANION
[V]			
[ ]	SdLm	.06	.20
[ ]	Lm	.01	.16
[ ]	Sd	.09	.08
[ ]	Lm	0.0	.16
[ ]			

Laboratory Volatility (163-2)
[ ]
[ ]

Field Volatility (163-3)
[ ]
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Terrestrial Field Dissipation (164-1)

[V] FIELD STUDIES CONDUCTED IN VA, CA, IO, FL; APPL 6 LBS AIA:

	STATE	CAP(-)	TMS(+)	AMPA (CAP DEGRADATE)
[ ]	VA	<7 DAYS	NON-DETECT.	VARIABLE
[ ]	CA, IO, FL	23-26 DAYS	30-50 DAYS	83-92 DAYS

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Aquatic Dissipation (164-2)
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Forestry Dissipation (164-3)
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Long-Term Soil Dissipation (164-5)
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Accumulation in Rotational Crops, Confined (165-1)
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Accumulation in Rotational Crops, Field (165-2)
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Accumulation in Irrigated Crops (165-3)
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Bioaccumulation in Fish (165-4)
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Bioaccumulation in Non-Target Organisms (165-5)
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Ground Water Monitoring, Prospective (166-1)
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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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Environmental Fate & Effects Division
PESTICIDE ENVIRONMENTAL FATE ONE LINE SUMMARY
SULFOSATE
Last Update on October 12, 1994
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Field Runoff (167-1)
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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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Degradation Products

Aminomethylphosphonic acid (anion deg. from photolysis)

CO2 is major degradate of TMS moiety in aerobic soil study.

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Comments

Sulfosate consists of an N-(Phosphonomethyl) glycine anion and a trimethylsulfonium cation. The anion degrades to aminomethylphosphonic acid (AMPA) via photolysis (aqueous and soil).
There are discrepancies in the aerobic metabolism data; in addn. to that shown, T1/2 for (+) in loam was 192 days in one study but in another was < 1 month based on CO2 evolution.
T1/2 for (-) on soil was 382 hours, but (+) was stable.
In an anaerobic soil study, in 66 days 43% of radioactive (-) moiety was recovered as CO2.
Frozen storage stability studies indicate sulfosate residues were stable in soil stored frozen (-20C) for up to 2 years.

References: EPA REVIEWS
Writer : PJH