Shaugh. No. 109702

JUN 19 1984

EAB Log Out Date: JUN 19 1984

Init.: CKO

To: Tim Gardner
Product Manager 17
Registration Division (TS-767)

From: Carolyn K. Offutt
Head, Environmental Processes and Guidelines Section
Exposure Assessment Branch, HED (TS-769)

Attached, please find the estimated environmental concentration review of:

Reg./File No.: 10182-AL

Chemical: Cypermethrin

Type Product: Insecticide

Product Name: Cymbush 3E

Company Name: ICI

Submission Purposes: EEC Aquatic Exposure for Ecological Effects Banch

ZBB Code: Other

Action Code: 106

Date In: 28FEB84

EFB#: 4217

Date Completed:

TAIS (Level II)	Days
63	2.0

Deferrals To:

X Ecological Effects Branch

____ Residue Chemistry Branch

____ Toxicology Branch

Cypermethrin

I. INTRODUCTION

Ecological Effects Branch (memo of 27 January 1984) has requested that an estimated environmental concentration be determined for cypermethrin (CYMBUSH 3E) as it would be used in pecans. Lentic and lotic situations were requested to be especially considered.

II. CHEMICAL/PHYSICAL PROPERTIES

Common Name: Cypermethrin

Chemical Name: (±)a-cyano-3-(phenoxyphenyl)methyl (±) cis,trans-3-(2,2-dichloroethenyl)-2,2-dimethyl-cyclopropane carboxylate

Other chemical and physical properties may be found on the attached "one-liner".

III. DISCUSSION

The estimated environmental concentration was determined for pecans grown in Georgia and Mississippi. Two watersheds from the Simulator for Water Resources in Rural Basins (SWRRB) model system were chosen and modified to reflect pecans grown on those sites. The two sites, Yazoo MS (MISS) and Tifton GA (TIFTON), had been modified to reflect grass or turf growth with a root depth of 8 inches. The leaf area index (LAI) was changed accordingly to reflect the LAI for pecan trees:

TIFTON		MISS	
DAY	LAI	DAY	LAI
1	0.100	1	0.100
70	0.100	100	0.100
100	2.000	130	2.000
290	2.000	280	2.000
320	0.100	300	0.100
366	0.100	366	0.100

The application dates and rates are given in Table 2.

Though the pesticide was applied eight (8) times during the growing season in conjunction with various rain patterns, the runoff of the pesticide never exceeded 0.001 lb/acre. The most that was ever transported from the field was 0.003 lb/acre per year. The pesticide runoff was only associated with runoff events where the peak runoff rate exceeded 0.1 cfs combined with a total runoff greater than 0.1 inches.

In a runoff study performed using CYMBUSH in a cotton field in Alabama, CYMBUSH was applied at a rate of 0.125 lb/acre, 16 times at a 5 day interval (Ussary, 1981). The residues on the cotton were 3 to 15 ppm one day after application and declined to less than 5 ppm 7 days after the last application. Of the 0.125 lb/acre applied, about 7 percent reached the soil (0.0088 lb/acre). In the runoff from the field, the concentration of cypermethrin in the water ranged from 1 to 13 ppb with the sediment concentration about 2 ppb. After the material reached the stream the concentration dissipated to 0.014 to 0.019 ppb in the water. The sediment concentration was less than 2 ppb, the limit of detection.

These water concentrations were compared to an Exposure Analysis Modeling System (EXAMS) estimation using the pond scenario (Table 3 data input). EXAMS predicted about 50 pptr material to be present in the stream or pond (see Table 4). The values of this table are related to a 0.0011 kg runoff input as from a one hectare field loading a one hectare pond. There is an initial surge of chemical concentration for the first day only which then dissipates into the sediments by the second day. If 100 hectares were entering the pond the values can be multiplied by 100 to get a "worst case" situation.

If EXAMS is used to predict the quantity of material in a pond using the runoff values from the cotton field study above, the prediction is quite accurate. Assuming a 0.25 inch runoff (based on actual runoff data) and using the 13 ppb quantity found in the runoff waters, there would be approximately 0.360 kg of material from 100 hectares entering the pond for every 24 hours of runoff. This is based on a 100 acre field, the approximate size of this cotton field watershed, feeding a 1 acre pond. This scenerio was entered into EXAMS. The quantity found in the water was 17 ppb which again lasted only for that day (Table 5).

It must be remembered that the pulse into the EXAMS is instantaneous, not spread out over the time period involved. Therefore, the quantity in the water and suspended sediments will be much less (one or two orders of magnitude by initial estimates) than indicated by the model.

In all cases, as soon as the input of stopped, the concentration in both the water and suspended sediments drops drastically as the cypermethrin is adsorbed on to the bottom sediments.

Degradates

The principle degradates of cypermethrin are DCVAs (dichlorovinyl acids), 3-phenoxybenzaldehyde, and 3-phenoxybenzoic acid; the latter being the primary degradate. Cypermethrin is degraded relatively rapidly; however, 3-phenoxybenzoic acid has a long half-life in sediments as do the other degradates. It can be found in the sediments up to one year later. It can also move in the sediments, water, and soils due to its higher water solubility and lower Kd (10). Up to about 20 percent of the total cypermethrin applied can be found in sediments as 3-phenoxybenzoic acid during degradation of the parent.

IV. CONCLUSION

Cypermethrin may be found in quantities of 0.02 ppb or more in waters flowing past fields and less than 2 ppb (limit of detection) in the associated sediments. Cypermethrin will rapidly dissipate in the water and suspended sediments through adsorption to bottom sediemnts as soon as the input is halted. Desorption from the sediments will be very slow (Kd=2000).

V. REFERENCES

Ussary, J.P. 1981. Cypermethrin residues in samples from a 1980 Alabama Run-off study. [Submitted by ICI Americas Inc. Report No. TMU 0541/B (Revised) February 1981]. [EAB review 29 April 1982, EFB # 130,131]

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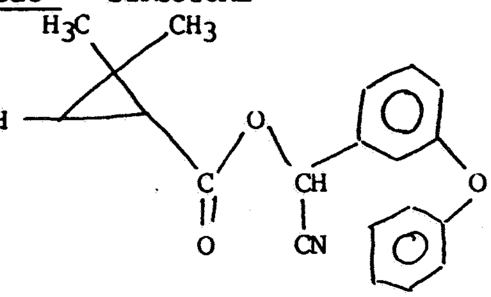
Plant Physiologist
Exposure Assessment Branch (TS-769C)

15 May 1984

EXPOSURE ASSESSMENT BRANCH ONE LINER

SHAUGH. NO. 109702 TYPE PESTICIDE: Insecticide STRUCTURE



COMMON NAME: Cypermethrin

CHEMICAL NAME: (±)a-cyano-3-(phenoxyphenyl) methyl (±)cis,trans -3-(2,2-dichloroethenyl)-2,2-dimethyl-cyclopropanecarboxylate

TYPICAL USES foliar applications cotton, pecans

CHEMICAL PROPERTIES:

Molecular Wt	Aqueous Solubility	Vapor Pressure	K_{ow}	K_{oc}
416.3	0.2 (ppm)	10-22 (?) (torr)		

Soil Adsorption Coefficient

Soil Type	% Soil O.M.	K	K_{om}	Soil TLC R_f	Mobility Class
Loamy sand (pH 5.4)	2.1	1911			(1) Immobile
Silty clay				0.08-0.10	(2) Low
Silty clay loam				0.13	(3) Low to Mod.
Loamy sand				0.12-0.16	(4) Moderate
					(5) Mobile

Degradation

Lab Half-life		Field Half-life		Hydrolysis (23°) pH	$T^1/2$	Photolysis $T^1/2$
Soil Aerobic:	(OVER)	Soil	4-12 days	4	"slow" (>50 days)	Soil: (OVER)
Anaerobic:				7	"slow"	Water: (OVER)
Aquatic Aerobic:	<2 wks	Aquatic:	<2 wks	9	"rapid"	
Anaerobic:						

ENVIRONMENTAL EXPOSURE

Found in Ground Water (Y/N)? ______

Site(s) ND Level: ______

Rotational Crop Restrictions

ND

Reentry Interval Established

ND

Leaching Potential (For parent)

Lab: Yes ____ No X

Field: Yes ____ No X

EAB Chemical One-Liner

Chemical Cypermethrin

Fish Bioaccumulation Factors

Species	Tissue Edible	Tissue Viscera	Whole Fish	Duration (Half-life)
Trout	X	X	1200 X	8 days
Catfish	9 X	X	14 X	70-80% depurated in 14 days.
	X	X	X	

DEGRADATION SUMMARY:

Soil metabolism shows that degradation is faster in soils with low cation exchange capacity and organic matter. Major soil degradation products are cis,trans cyclopropane carboxylic acids, 3-phenoxybenzaldehyde, and 3-phenoxybenzoic acid. Water showed same degradation products as found in soil.

Field monitoring study indicated that cypermethrin will be transported via runoff of sediments to adjacent aquatic sites. Leaching potential of the parent compound, cypermethrin, is low but may be higher for the degradates.

Cypermethrin is stable to hydrolysis and photolysis in water.

REFERENCES: EAB Review Files

DEGRADATION INFORMATION (Continued)

Soil, Aerobic Half-life

Clay loam	1-3 wks	pH 7.5	12.2% OM
Loamy Sand	2 wks	pH 6.1	1.8% OM
Peat	3 wks	pH 9.4	72.0% OM

Photolysis, Soil
Sandy loam 8-16 days pH 7.25

Photolysis, Water
Sterile 100-120 days pH 5.3 26°C

6

Table 2. SWRRB Input Information for cypermethrin in pecans in Tifton GA and Yazoo MS

Adsorption coefficient	1000.0
Soil Half-life	.0165 /day
Foliar half-life	100.0 days
Application efficiency	.90 (90%)
Initial pesticide on foliage	0.0 lb/A
Initial pesticide on soil	0.0 lb/A
Enrichment ratio or pesticide	1.5

Application Dates and Rates (lb ai./acre)

Tifton GA

1970			1973		
	130	.10		130	.10
	144	.10		145	.10
	160	.10		161	.10
	175	.10		175	.10
	191	.10		191	.10
	206	.10		205	.10
	232	.10		220	.10
	236	.10		235	.10
1971			1974		
	130	.10		130	.10
	145	.10		145	.10
	160	.10		161	.10
	175	.10		175	.10
	190	.10		190	.10
	205	.10		204	.10
	220	.10		220	.10
	235	.10		235	.10
1972			1975		
	130	.10		130	.10
	145	.10		145	.10
	160	.10		159	.10
	175	.10		175	.10
	191	.10		191	.10
	205	.10		205	.10
	221	.10		221	.10
	235	.10		235	.10

Yazoo MS

1971			1974		
	128	.10		130	.10
	145	.10		144	.10
	160	.10		160	.10
	175	.10		175	.10
	190	.10		189	.10
	204	.10		205	.10
	220	.10		220	.10
	236	.10		235	.10
1972			1975		
	130	.10		130	.10
	145	.10		145	.10
	160	.10		159	.10
	174	.10		175	.10
	190	.10		190	.10
	205	.10		206	.10
	220	.10		220	.10
	235	.10		235	.10
1973			1976		
	130	.10		130	.10
	146	.10		145	.10
	160	.10		160	.10
	175	.10		176	.10
	190	.10		190	.10
	205	.10		205	.10
	220	.10		220	.10
	235	.10		235	.10

TABLE 3. EXAMS -- EXPOSURE ANALYSIS MODELING SYSTEM -- V2.0: MODE 2
ECOSYSTEM: POND, AERL DEVELOPMENT PHASE TEST DEFINITION
CHEMICAL: CYPERMETHRIN

SH2 (NEUTRAL MOLECULE, SPECIES #1) INPUT DATA.

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MWT=  416.0       SOL = 0.2000       VAPR= 0.0000E+00 HENRY= 0.0000E+00
KVO= 0.0000E+00 ESOL= 0.0000E+00 EVPR= 0.0000E+00 EHEN = 0.0000E+00
KPS=  2000.       KPB = 0.0000E+00 KOC = 0.0000E+00 KOW  = 0.0000E+00
KAH1= 0.0000E+00 EAH1= 0.0000E+00  KNH1= 0.0000E+00 ENH1= 0.0000E+00
KAH2= 0.0000E+00 EAH2= 0.0000E+00  KNH2= 0.0000E+00 ENH2= 0.0000E+00
KAH3= 0.0000E+00 EAH3= 0.0000E+00  KNH3= 0.0000E+00 ENH3= 0.0000E+00
KBH1= 0.0000E+00 EBH1= 0.0000E+00  KOX1= 0.0000E+00 EOX1= 0.0000E+00
KBH2= 0.0000E+00 EBH2= 0.0000E+00  KOX2= 0.0000E+00 EOX2= 0.0000E+00
KBH3= 0.0000E+00 EBH3= 0.0000E+00  KOX3= 0.0000E+00 EOX3= 0.0000E+00
KBACW1= 2.1000E-03 QTW1= 0.0000E+00  KBACS1= 0.0000E+00 QTS1= 0.0000E+00
KBACW2= 0.0000E+00 QTW2= 0.0000E+00  KBACS2= 0.0000E+00 QTS2= 0.0000E+00
KBACW3= 0.0000E+00 QTW3= 0.0000E+00  KBACS3= 0.0000E+00 QTS3= 0.0000E+00
KDP= 2.4000E-04 RFLAT=  40.00      LAMAX=      0.00
QUANT1=  1.000       QUANT2= 0.0000E+00 QUANT3= 0.0000E+00
ABSORPTION SPECTRUM (ABS):    0.0000E+00    0.0000E+00    0.0000E+00
 0.0000E+00  0.0000E+00  0.0000E+00  0.0000E+00  0.0000E+00  0.0000E+00
 0.0000E+00  0.0000E+00  0.0000E+00  0.0000E+00  0.0000E+00  0.0000E+00
 0.0000E+00  0.0000E+00  0.0000E+00  0.0000E+00  0.0000E+00  0.0000E+00
 0.0000E+00  0.0000E+00  0.0000E+00  0.0000E+00  0.0000E+00  0.0000E+00
 0.0000E+00  0.0000E+00  0.0000E+00  0.0000E+00  0.0000E+00  0.0000E+00
 0.0000E+00  0.0000E+00  0.0000E+00  0.0000E+00  0.0000E+00  0.0000E+00
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TABLE 4. EXAMS -- EXPOSURE ANALYSIS MODELING SYSTEM — V2.0: MODE 2
ECOSYSTEM: POND, AERL DEVELOPMENT PHASE TEST DEFINITION
CHEMICAL: CYPERMETHRIN

TABLE 16. SIMULATION RESULTS -- TIME-TRACE OF CHEMICAL CONCENTRATIONS.

TIME	AVERAGE CHEMICAL CONCENTRATIONS				MASS OF CHEMICAL	
DAYS	WATER COLUMN		BOTTOM SEDIMENTS		WATER COL	SEDIMENTS
	FREE(MG/L)	SED(MG/KG)	PORE(MG/L)	SED(MG/KG)	TOTAL KG	TOTAL KG
Runoff Input .0011 kg from 1 hectare						
0.	5.189E-05	0.104	0.000E+00	0.000E+00	1.1000E-03	0.000E+00
1.	2.569E-14	5.137E-11	1.435E-10	2.871E-07	5.4457E-13	1.939E-07
2.	2.535E-14	5.069E-11	1.416E-10	2.833E-07	5.3735E-13	1.913E-07
3.	2.501E-14	5.002E-11	1.398E-10	2.795E-07	5.3022E-13	1.888E-07
4.	2.468E-14	4.936E-11	1.379E-10	2.758E-07	5.2318E-13	1.862E-07
5.	2.435E-14	4.870E-11	1.361E-10	2.721E-07	5.1624E-13	1.838E-07
6.	2.403E-14	4.806E-11	1.343E-10	2.685E-07	5.0939E-13	1.813E-07
7.	2.371E-14	4.742E-11	1.325E-10	2.650E-07	5.0263E-13	1.789E-07
8.	2.339E-14	4.679E-11	1.307E-10	2.614E-07	4.9596E-13	1.766E-07
9.	2.308E-14	4.617E-11	1.290E-10	2.580E-07	4.8938E-13	1.742E-07
10.	2.278E-14	4.556E-11	1.273E-10	2.546E-07	4.8289E-13	1.719E-07
15.	2.131E-14	4.261E-11	1.190E-10	2.381E-07	4.5168E-13	1.608E-07
20.	1.993E-14	3.986E-11	1.114E-10	2.227E-07	4.2246E-13	1.504E-07
25.	1.864E-14	3.728E-11	1.041E-10	2.083E-07	3.9513E-13	1.407E-07
30.	1.743E-14	3.487E-11	9.741E-11	1.948E-07	3.6958E-13	1.316E-07
35.	1.630E-14	3.261E-11	9.110E-11	1.822E-07	3.4564E-13	1.230E-07
40.	1.525E-14	3.050E-11	8.521E-11	1.704E-07	3.2329E-13	1.151E-07
45.	1.426E-14	2.853E-11	7.971E-11	1.594E-07	3.0241E-13	1.077E-07
50.	1.334E-14	2.669E-11	7.457E-11	1.491E-07	2.8291E-13	1.007E-07

Table 5.

EXAMS -- EXPOSURE ANALYSIS MODELING SYSTEM -- V2.0: MODE 2
ECOSYSTEM: POND, AERL DEVELOPMENT PHASE TEST DEFINITION
CHEMICAL: CYPERMETHRIN

TABLE 16. SIMULATION RESULTS -- TIME-TRACE OF CHEMICAL CONCENTRATIONS.

TIME	AVERAGE CHEMICAL CONCENTRATIONS				MASS OF CHEMICAL	
DAYS	WATER COLUMN		BOTTOM SEDIMENTS		WATER COL	SEDIMENTS
	FREE(MG/L)	SED(MG/KG)	PORE(MG/L)	SED(MG/KG)	TOTAL KG	TOTAL KG
Runoff input 0.364 kg from 0.25 inch runoff, 13 ppb from 100 hectares						
0.	1.717E-02	34.3	0.000E+00	0.000E+00	0.3640	0.000E+00
Runoff input 0.364 kg from 0.25 inch runoff, 13 ppb from 100 hectares						
1.	1.717E-02	34.3	4.750E-08	9.499E-05	0.3640	6.415E-05
2.	1.689E-11	3.378E-08	9.436E-08	1.887E-04	3.5802E-10	1.274E-04
3.	1.666E-11	3.333E-08	9.311E-08	1.862E-04	3.5327E-10	1.258E-04
4.	1.644E-11	3.288E-08	9.188E-08	1.838E-04	3.4858E-10	1.241E-04
5.	1.622E-11	3.245E-08	9.066E-08	1.813E-04	3.4396E-10	1.224E-04
6.	1.601E-11	3.202E-08	8.945E-08	1.789E-04	3.3939E-10	1.208E-04
7.	1.580E-11	3.159E-08	8.827E-08	1.765E-04	3.3489E-10	1.192E-04
8.	1.559E-11	3.117E-08	8.710E-08	1.742E-04	3.3045E-10	1.176E-04
9.	1.538E-11	3.076E-08	8.594E-08	1.719E-04	3.2606E-10	1.161E-04
10.	1.518E-11	3.035E-08	8.480E-08	1.696E-04	3.2174E-10	1.145E-04
11.	1.497E-11	2.995E-08	8.368E-08	1.674E-04	3.1747E-10	1.130E-04
12.	1.478E-11	2.955E-08	8.257E-08	1.651E-04	3.1325E-10	1.115E-04
13.	1.458E-11	2.916E-08	8.147E-08	1.629E-04	3.0910E-10	1.100E-04
14.	1.439E-11	2.877E-08	8.039E-08	1.608E-04	3.0500E-10	1.086E-04
15.	1.420E-11	2.839E-08	7.932E-08	1.586E-04	3.0095E-10	1.071E-04
16.	1.401E-11	2.801E-08	7.827E-08	1.565E-04	2.9696E-10	1.057E-04
17.	1.382E-11	2.764E-08	7.723E-08	1.545E-04	2.9302E-10	1.043E-04
18.	1.364E-11	2.728E-08	7.621E-08	1.524E-04	2.8913E-10	1.029E-04
19.	1.346E-11	2.691E-08	7.520E-08	1.504E-04	2.8529E-10	1.016E-04
20.	1.328E-11	2.656E-08	7.420E-08	1.484E-04	2.8151E-10	1.002E-04
21.	1.310E-11	2.621E-08	7.321E-08	1.464E-04	2.7777E-10	9.888E-05
22.	1.293E-11	2.586E-08	7.224E-08	1.445E-04	2.7409E-10	9.757E-05
23.	1.276E-11	2.551E-08	7.128E-08	1.426E-04	2.7045E-10	9.628E-05
24.	1.259E-11	2.518E-08	7.034E-08	1.407E-04	2.6686E-10	9.500E-05
25.	1.242E-11	2.484E-08	6.940E-08	1.388E-04	2.6332E-10	9.374E-05
30.	1.162E-11	2.324E-08	6.492E-08	1.298E-04	2.4631E-10	8.768E-05
35.	1.087E-11	2.174E-08	6.073E-08	1.215E-04	2.3040E-10	8.202E-05
40.	1.017E-11	2.033E-08	5.680E-08	1.136E-04	2.1552E-10	7.672E-05
45.	9.509E-12	1.902E-08	5.313E-08	1.063E-04	2.0159E-10	7.176E-05
50.	8.895E-12	1.779E-08	4.970E-08	9.940E-05	1.8857E-10	6.713E-05