109702
SHAUGHNESSEY NO.

109702

5
REVIEW NO.

EEB BRANCH REVIEW

DATE: IN 1/11/82 OUT 4/27/82

FILE OR REG. NO. 10182-A1,-Au

PETITION OR EXP. PERMIT NO. 2F2623, 245334

DATE OF SUBMISSION 12/28/81

DATE RECEIVED BY HED 1/11/82

RD REQUESTED COMPLETION DATE 4/28/82

EEB ESTIMATED COMPLETION DATE

RD ACTION CODE/TYPE OF REVIEW 105/New Chemical - Food/Feed Use

TYPE PRODUCT(S): I, D, H, F, N, R, S Insecticide

DATA ACCESSION NO(S). 070561, 070562, 070558

PRODUCT MANAGER NO. A. Heyward (17)

PRODUCT NAME(S) Cymbush 2E and Cymbush 3E

COMPANY NAME ICI Americas, INc.

SUBMISSION PURPOSE Proposed full registration of cotton use

SHAUGHNESSEY NO.	CHEMICAL, & FORMULATION	% A.I.
109702	Alpha-cyano-(3-phenoxyphenyl) methyl (±) cis trans-3-(2,2-dichlorophenyl)-2,2-dimethylcyclopropanecarboxylate	35.6 (3E)
		22.9 (2E)

1

Cypermethrin

100 Pesticide Label Information

100.1 Pesticde Use

Insecticide for use on cotton

100.2 Formulation Information

Cymbush 3E contains 35.6% cypermethrin and 64.4% inert ingredients. Cymbush 2E contains 22.86 % cypermethrin and 77.14% inert ingredients.

100.3 Application Methods, Directions, Rates

Apply cymbush as shown in the following chart, using sufficient water to obtain full coverage of foliage. Apply every 5 to 7 days or as needed. Timing and frequency of applications should be based upon insect populations reaching locally determined economic thresholds.

Cotton Spray Recommendations

Dosage Per acre	Minimum Spray Volume	Spray Interval
Cymbush 3E-0.16-0.32 pints	1.5 gal/A aerial, or 5 gal/A ground	5-7 days or as indicated by scouting
Cymbush 2E-0,24-0.48 pints		

Remarks: Do not graze livestock in treated areas. Do not apply within 14 days of harvest. Do not apply more than 5 pints Cymbush 3E or 7.5 pints Cymbush 2E per season.

Rate Conversion Charts
Cymbush 3E

Lb. Active/A	Fluid Ozs./A	Pints/ Acre	Milliters/ Acre	Acres treated/ Gal.
0.06	2.56	0.16	75.71	50.0
0.08	3.41	0.21	100.94	37.5
0.10	4.27	0.27	126.18	30.0
0.12	5.12	0.32	151.41	25.0

Cymbush 2E

Lb. Active/A	Fluid Ozs./A	Pints/ Acre	Milliters/ Acre	Acres treated/ Gal.
0.06	3.84	0.24	113.56	33.33
0.08	5.12	0.32	151.41	25.0
0.10	6.40	0.40	189.27	20.0
0.12	7.68	0.48	227.12	16.67

100.4 Target Organisms

Cotton Ball Weevil, Cotton Ballworm, Tobacco Budworm, Pink Ballworm, Lugus Bug, Whitefly, Cotton Aphid, Cabbage Looper, Thrips, Cotton Leafperforator, Beet Armyworm, Flea Beetle, Fleahopper.

100.5 Precautionary Labeling

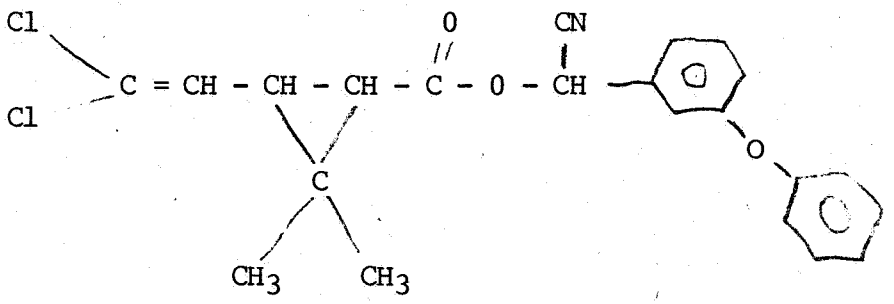
Environmental Hazards: This pesticide is extremely toxic to fish. Use with care when applying in areas adjacent to any body of water. Keep out of lakes, streams, ponds, tidal marshes or estuaries. Do not apply when weather conditions favor drift from treated areas. Do not contaminate water by cleaning of equipment or disposal of wastes. This product is highly toxic to bees exposed to direct treatment or residues on crops or weeds. Do not apply AMBUSH or allow it to drift to crops or weeds on which bees are actively foraging. Additional information may be obtained from your Cooperative Extension Service. Apply their product only as specified on the label.

101 Physical and Chemical Properties

101.1 Chemical Name

(+) a-cyano-3-(phenoxyphenyl)methyl (+) cis, trans 3-(2,2-dichloroethenyl)-2,2-dimethyl cyclopropanecarboxylate

101.2 Structural Formula



$C_{22}H_{19}O_3NCl_2$

101.3 Common Names

Cypermethrin, PP383, NRDC 149, WL43467

101.4 Trade Name

"CYMBUSH" Pyrethroid Insecticide

101.5 Molecular Weight : 416

101.6 Physical State : Dark brown viscous liquid

101.7 Solubility

Miscible with alcohols, ketones, chlorinated hydrocarbons and substituted aromatic hydrocarbons (xylene). Sparingly soluble in aliphatic hydrocarbons.

102 Behavior in the Environment

According to the Registration Division PM for cypermethrin, the report the Environmental Fate Branch has not been completed at this time.

103 Toxicological Properties

103.1 References from Toxicology Branch

Technical Material

Species	Method of Administration	Acute Oral LD_{50} (mg/kg)
Rat	Aqueous suspension	4123
Rat	Solution in corn oil	*1741
Mouse	Aqueous suspension	779
Guinea Pig	Aqueous suspension	>4000
Rabbit	Technical material	>2400

CYMBUSH 2E

Species, sex	Method of Administration	Acute Oral LD_{50} (mg/kg)
Rat (M)	10% Aqueous dilution	170 (42.5 cypermethrin)
Rat (F)	10% Aqueous dilution	180 (45 cypermethrin
Rat (Repeat test)	10% Aqueous dilution	250 (60 cypermethrin

*This value is numerically higher than those recorded in later, unreported studies. Retrospecive checking of the study data provides no basis for believing the result to be suspect, although the later values, which are in the range 499 to 891 mg/kg, are considered to be more representative of the acute oral LD_{50} value for the material administered to rats in corn oil.

103.2 Minimum Requirements

Test	Species	Result	Status	EEB Validation Date
Acute Oral LD_{50}	Mallard Duck	10,248 mg/kg	Core	5/2/80
8-day Dietary LC_{50}	Mallard Duck	>20,000 ppm	Core	This report
8-day Dietary LC_{50}	Bobwhite Quail	>20,000 ppm	Core	This report
96-hr LC_{50}	Sheepshead Minnow	0.95 ppb	Core	This report
96-hr EC_{50}	Gammarus pulex	0.00[illegible] ppb 4/23/84	Core	This report
96-hr LC_{50}	Gammarus pulex	0.009 ppb	Core	This report
96-hr EC_{50}	Cleon dipterum	0.004 ppb	Core	This report
96-hr LC_{50}	Cleon dipterum	0.020 ppb	Core	This report
48-hr LC_{50}	Orconectes sp.	0.068 ppb	Core	This report
48-hr LC_{50}	Pink Shrimp	0.043 ppb	Core	This report
96-hr LC_{50}	Mysid Shrimp	4.75 pptr	Core	This report
96-hr LC_{50}	Fiddler Crabs	0.197 ppb	Suppl.	This report
96-hr EC_{50}	Baetis rhodani	5.7 pptr	Suppl.	This report
96-hr LC_{50}	Baetis rhodani	12.3 pptr	Suppl.	This report
102-hr LC_{50}	Rainbow trout	0.82 ppb	Core	5/2/80

96-hr LC_{50}	Bluegill	1.78 ppb	Core	2/26/81
48-hr LC_{50}	Daphnia magna	1.25 ppb	Core	2/26/81
96-hr LC_{50}	Rainbow Trout	0.92 ppb	Core	2/26/81
96-hr LC_{50}*	Rainbow Trout	4.7 ppb	Suppl.	2/26/81
96-hr LC_{50}*	Bluegill	5.96 ppb	Suppl.	2/26/81
48-hr LC_{50}*	Daphnia magna	3.14 ppb	Suppl.	2/26/81
48-hr EC_{50}**	Daphnia magna	21.6 ppb	Suppl.	This report

*Test run with the formulated product GFM 061.
**Test run with the formulated product GFU 061

103.3 Additional Terrestrial Laboratory Tests

103.3.1 Avian Reproduction Studies

Species	Result	Status	EEB Validation Date
Mallard Ducks	NOEL >50 ppm	Core	This report
Bobwhite Quail	NOEL >50 ppm	Core	This report

103.4 Additional Aquatic Laboratory Tests

103.4.2 Embryo-Larvae and Life-Cycle Studies

Test Type	Species	Result	Status	EEB Validation Date
Embryo-larvae	Fathead Minnow	0.14<MATC<0.33 ppb	Core	This Report
Life-cycle	Mysid Shrimp	0.44<MATC<0.64 pptr	Core	This Report
Life-cycle	Daphnia magna	9<MATC<60 pptr	Core	This Report
Embryo-larvae	Pacific oyster	48-hr EC_{50} >2.27 ppm	Core	This Report

103.4.3 Oyster Shell Deposition Studies

For eastern oysters, the 96-hr EC_{50} value for shell deposition (the concentration at which shell deposition was reduced by 50%) was 370 ppb. .The status of the study, which is reviewed in this report, is Core.

103.4.4 Toxicity and Residue Studies

The following acute toxicity tests were run on 3-phenoxybenzoic acid, a major degradation product of cypermethrin:

Test Type	Species	Result	Status	EEB Validation Date
96-hr LC_{50}	Bluegill	36.3 ppm	Core	This Report
96-hr LC_{50}	Rainbow Trout	13.3 ppm	Core	This Report
48-hr LC_{50}	Daphnia magna	111 ppm	Core	This Report

104 Hazard Assessment

104.1 Discussion

The application of cypermethrin to cotton at the proposed maximum rate of 0.125 a.i./acre will result in residue levels of 13 ppm (on leaves and leafy crops). Repeat applications will result in higher residues.

104.2 Likelihood of Adverse Effects to Non-Target Organisms

Mammals-

Antelope, deer, rabbits, and racoons are all known to utilize cotton fields. Several types of rodents may also be found in areas immediately adjacent to cotton fields. All of these mammals are likely to be exposed to cypermethrin under the proposed use pattern. However, cypermethrin is not sufficiently toxic to mammals to pose a threat to exposed populations. The rat acute oral LD_{50} is 45 mg/kg, and conversion of this value to parts per million results in a lethal residue level of 900 ppm. The expected residue levels are much lower.

Birds-

As reported by Natella (EEB review 5/2/80), at least six species of birds (plus an unknown number of songbirds) are known to feed in cotton fields and adjacent areas. Bobwhite quail and ring-necked pheasant make extensive use of cotton fields for nesting and brooding. All these bird species are likely to be exposed under the proposed use pattern. However, cypermethrin is practically non-toxic to birds, and dietary concentrations of up to 50 ppm have no effect on reproduction in mallards or quail. Therefore, no adverse effects on local populations are expected.

Aquatic Organisms-

Cypermethrin is very highly toxic to a wide variety of aquatic organisms. Prolonged exposure to virtually any amount will result in the acute poisoning of aquatic invertebrates. Fish are only slightly less sensitive, with several species showing acute LC_{50}s of around one part per billion.

With such high toxicities to a wide variety of aquatic organisms, cypermethrin poses a substantial threat to fish and invertebrate populations whenever it reaches their habitat in appreciable amounts. Therefore, the key to this hazard assessment is the amounts of cypermethrin that reach aquatic habitats from applications on cotton.

The registrant has contended that only negligible amounts of cypermethrin reach aquatic systems after applications to cotton. Field monitoring studies show otherwise. In one runoff study (EPA Access. No. 070558, Section J12), detectable amounts of cypermethrin were found as far as 8 miles downstream from the cotton field where the pesticide was applied.

According to the study in question, most of the cypermethrin found in water samples was adsorbed to suspended sediment. Sediment samples from the stream bottom typically contained much higher levels than the water flowing just above it. This is to be expected, because cypermethrin binds very readily to soil particles, and is relatively insoluble in water.

This affinity of cypermethrin for soil particles does reduce the amounts left in the water, reducing the hazards to free-swimming organisms such as fish. However, the concentration of cypermethrin in bottom sediments increases the hazards to benthic organisms, and several benthic organisms (i.e. crayfish, mayfly larvae, and isopods) have shown exceptional vulnerability to cypermethrin in laboratory tests. The 96-hr LC_{50}s for these organisms were only a few parts per trillion. In the runoff study cited above, levels of 2 ppb were found in sediment samples as far as 165 meters downstream from the treated field.

The soil-binding properties of cypermethrin should reduce the concentrations in water to levels too low to create acute or chronic poisoning of fish. Cypermethrin has shown some tendency to bioaccumulate in fish (EPA Access. No. 070558, Section J13), but secondary poisoning of piscivorous predators is not likely because of the low toxicity of cypermethrin to the most likely predator species. Therefore, cypermethrin applications to cotton under the proposed use pattern are not likely to cause direct harm to fish populations. The primary threat to fish populations posed by this use pattern is the destruction of important fish food sources, e.g. benthic invertebrates.

The proposed use pattern will probably result in severe acute poisonings of aquatic invertebrates, particularly benthic invertebrates such as crayfish, insect larvae, and crustaceans. The effects on these organisms will be most severe in areas immediately downstream from the cotton fields, but populations up to several hundred yards aways will probably also be severely depleted. If the water concentration/:/sediment concentration ratio is the same at distant downstream sites as it has been shown to be at sites near the application area, some poisonings of benthic invertebrates will occur up to several miles downstream.

Estuarine and Marine Organisms-

It is difficult to evaluate the hazards to estuarine and marine species. Both vertebrates and invertebrates from estuarine and marine systems are very vulnerable to cypermethrin in the laboratory, but the likelihood of exposure in natural environments is difficult to assess without complete data on the environmental fate of cypermethrin and its effects on benthic organisms. An evaluation of the hazards posed to estuarine and marine organisms must therefore be postponed until EEB has received and evaluated the study requested in Section 106 and the final report from the Environmental Fate Branch.

104.3 Endangered Species Considerations

As mentioned in an earlier EEB review (Natella 5/2/80), 13 endangered or threatened aquatic species live in areas where cotton is grown. Informal consulations with the Office of Endangered Species (USDI) were recently undertaken by Dennis McLane of EEB during a review of another pesticide's use on cotton. Based on the findings of those consultations, the number of aquatic species likely to be impacted by use of cypermethrin on cotton can be reduced to three: the Gila topminnow, the Commanche Springs pupfish, and Pecos gambusia.

According to the Endangered Species Coordinator of the Arizona Game and Fish Department, there is a Gila topminnow population approximately 5 miles from some cotton fields in Arizona. However, the topminnows are located upstream from the cotton, and are also usually upwind, according to the local wind patterns. Therefore, neither runoff nor spray drift should endanger the topminnow population.

The Commanche Springs pupfish and Pecos gambusia are found in drainage ditches in several areas of Reeves County, Texas. If cypermethrin were applied to the cotton that grows around these ditches, a considerable amount would reach the critical habitats of these two species. Some damage to the populations would almost surely result.

Additional hazards to endangered species could arise if cypermethrin is applied to cotton in the vicinity of the Dexter National Fish Hatchery in Dexter, New Mexico. Populations of several endangered species are maintained there, and cotton is grown very close to the holding ponds. The hatchery managers believe that there is little or no runoff from the fields to the ponds, but the ponds could be contaminated because of spray drift.

The hazards to endangered fish in Reeves County, Texas and in the vicinity of the Dexter National Fish Hatchery cannot be eliminated by changes in the application methods. The only apparent way to eliminate the hazards is to require a label statement prohibiting the use of CYMBUSH in Reeves County and within one mile of the Dexter National Fish Hatchery.

104.5 Adequacy of Toxicity Data

The following USEPA guideline requirements have been filled:

1. Avian acute oral LD_{50}
2. Avian subacute dietary LC_{50}s
3. Avian reproduction studies
4. 96-hr LC_{50} for coldwater and warmwater fish
5. 48-hr EC_{50} for aquatic invertebrate
6. 96-hr LC_{50} for an estuarine vertebrate
7. 48-hr EC_{50} for an estuarine invertebrate
8. Fish embryo-larvae study
9. Invertebrate life-cycle study

(continued next page)

10) Oyster embryo-larvae test
11) Oyster shell-deposition test
12) 96-hr LC_{50}s for a major degradate for fish
13) 48-hr EC_{50} for a major degradate for an aquatic invertebrate

104.5 Additional Data Required

No additional toxicity data is required

105 Classification

No classification scheme will be recommended until the EEB presumption against registration has been rebutted.

106 RPAR Criteria

The proposed use of cypermethrin on cotton will result in exposure of benthic invertebrates to concentrations of toxicant that could severely damage local populations. Therefore the criterion for issuance a rebuttable presumption against registration has been met.

This presumption against registration could be rebutted if the applicant performs a field study of the effects of repeated cypermethrin applications on benthic invertebrates in a pond exposed to direct runoff from the treated field. The results of this pond study must show that benthic organisms are not appreciably affected by repeated cypermethrin applications.

107 Conclusions

The Ecological Effects Branch concludes that the proposed use of cypermethrin on cotton would result in unreasonable risks to aquatic organisms, and possibly to endangered species. Our presumption against registration could be rebutted if a field study shows that populations of benthic invertebrates and other aquatic fauna are not appreciably damaged by repeated cypermethrin applications to adjacent fields.

107.4 Data Adequacy Conclusions

All requested laboratory tests have been completed and are acceptable. Without a field study, the laboratory tests do not provide enough information on which to base a hazard evaluation.

107.5 Data Requests

A field study of the effects of repeated cypermethrin field applications on benthic organisms in an adjacent pond is requested.

Thomas B. Johnston 4/27/82
Ecological Effects Branch

Norman Cook 4/27/82
Norm Cook
Section Head
Ecological Effects Branch

Clayton Bushong 4/27/82
Branch Chief
Ecological Effects Branch

Tom Johnston

EEB Peer Group Report

TITLE: Peer Review Group Review of Proposed Full Registration of Cypermethrin on Cotton.

TO: Clayton Bushong, Chief
Ecological Effects Branch

Meeting Date: 4/22/82
Date of Report: 4/23/82

Peer Group	Reviewer
1. R. Stevens, Chairman	Douglas J. Urban
2. M. Gessner	
3. D. McLane	
4. D. Urban	

Background Information:

Cypermethrin is a synthetic pyrethroid insecticide which is proposed for use on cotton under a full registration. Based on the proposed label, a maximum of 0.125 lbs active ingredient will be applied per acre as many times as needed for insect control. This compares to 0.2 lbs a.i./A for permethrin, to which cypermethrin is structurally very similar [$-CH_2-$ in permethrin is replaced by $-CHCN-$ in cypermethrin]. Based on data submitted with this action, cypermethrin is very highly toxic to aquatic organisms, and significantly more toxic than permethrin. Cypermethrin does not appear to pose a hazard to birds or wild mammals. No environmental fate information was available at the time that the review was completed.

Issues:

A pond field study focusing on the effects of repeat applications of cypermethrin on benthic invertebrates was requested. This study was requested to rebutt the likely hazard to populations of these organisms from the proposed cotton use. The peer group was asked to review this Tier 4 data request.

Findings of the Peer Group with Rationale:

We support the data request based on the following:

(1) The tier 1 and 2 laboratory data submitted by the applicant clearly demonstrate that cypermethrin is very likely to have acute and chronic effects on aquatic organisms in the field;

12

(2) The field monitoring studies referenced in the review indicate that the use of cypermethrin will result in residues in the sediment that are greater than the acute and chronic toxicity levels for aquatic invertebrates established in the laboratory;

(3) This data request is similar to and consistent with the previous branch requests for data on permethrin.

In addition, we made the following observations during the course of the review:

(1) The endangered species considerations should be co-ordinated with a recent review by D. McLane on Curacron 6E for use on cotton;

(2) The hazard statements concerning estuarine and marine organisms (see Section 104.2) should be deferred until adequate environmental fate information is received.

Recommendations:

(1) Let the request for a pond field study stand;

(2) Co-ordinate endangered species concerns with a review by D. McLane on Curacron for use on cotton;

(3) Defer hazard statements on estuarine and marine organisms until receipt of environmental fate information.

cc: N. Cook, Head, Section #2
file