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

DATA ACCESSION NO(S).

PRODUCT MANAGER NO. D. Stubbs (41)

PRODUCT NAME(S) Baythroid

COMPANY NAME State of Washington

SUBMISSION PURPOSE Proposed §18 for use on pears and interplanted apples

SHAUGHNESSEY NO.	CHEMICAL, & FORMULATION	% A.I.
	Cyfluthrin	

Ecological Effects Branch

Baythroid 2

100.0 Submission Purpose and Label Information

100.1 Submission Purpose and Pesticide Use

The State of Washington Department of Agriculture has applied Baythroid (cyfluthrin) once and in the some areas twice this year already under an crisis exemption. The State is now applying for a section 18 emergency exemption to use Baythroid (cyfluthrin) to control pear psylla in pears and a minor acreage of pear/apple interplants one more time in the following counties: Chelan, Douglas, Okanogan, Grant, Franklin, Klickitat, Kittitas, Yakima, and Benton.

100.2 Formulation Information

Active Ingredient:	
Cyano(4-fluoro-3-phenoxyphenyl)methyl 3-(2,2-dichloroethenyl)-2,2-dimethyl-cyclopropane-carboxylate	25%
Inert Ingredients:	75%
(2 lb ai/gal)	100%

100.3 Application Methods, Directions, Rates

Cyfluthrin will be applied twice by aerial or ground equipment on a maximum of 15,500 acres of pears and 1,500 acres of apple/pear interplants. A total of 850 gallons of formulation or 1700 lb ai is expected to be applied within the nine counties of Washington.

100.4 Target Organisms

The pear psylla (Psylla pyricola Foerster) is a serious pest of the pear. The adults overwinter in crevices in the bark and on the ground. The adults may become active at any time when the temperature is above 40 °F. The eggs are deposited in March and hatch in 10 to 30 days. After the foliage is out many eggs are deposited on the leaves. There are 3 to 5 generations per year, with the first one lasting about 45 days and the later one 30 days (Pear Production Agriculture Handbook No. 330, Washington, DC, August 1978).

100.5 Precautionary Labeling

No labeling was submitted.

101.0 Hazard Assessment

101.1 Discussion

Over 746,850 tons of pears were harvested in 1985. Of that 225,000 tons (30%) were harvested in Washington in 1985 (Agricultural Statistics, 1986). Other States that produce pears are California, Colorado, Connecticut, Michigan, New York, Oregon, Pennsylvania, and Utah.

Pears tolerate a wide range of climatic conditions; however, it is preferable to grow commercial pear varieties where the winter temperature is below 45 °F for 1200 hours. All major pear areas of the Pacific coast are dependent on irrigation for moisture. In other pear areas where natural rainfall is depended on for soil moisture, an average of at least 35 inches per year is desirable. Pears have an earlier blooming season than apples and therefore spring frosts are a greater hazard to pears.

Pears orchards are frequently located in lowlands since pears have adapted to fairly heavy soils (Pear Production, USDA Agriculture Handbook No. 526, August 1978).

101.2 Likelihood of Adverse Effects to Nontarget Organisms

Terrestrial Organism Toxicity

Cyfluthrin is practically nontoxic to upland game birds on an acute oral basis, with a reported LD_{50} > 2000 mg/kg for bobwhite quail.

Cyfluthrin is practically nontoxic to both upland game birds and waterfowl on a subacute dietary basis (bobwhite LC_{50} > 5000 ppm and mallard LC_{50} > 5000 ppm).

A mallard duck reproduction study indicated the NOEL $\leq$ 250 ppm, which was the highest level tested. Another supplemental mallard duck reproduction study showed statistically significant reduction in production of normal hatchlings at all levels tested (250, 1000, and 4000 ppm).

A supplemental bobwhite quail reproduction study showed statistically significant impairment of reproduction at 4000 ppm but not at the 1000 ppm. Eggshell thinning was statistically significant at all levels tested (250, 1000, and 4000 ppm). A NOEL was not established for eggshell thinning. Another supplemental study was submitted to address the eggshell thinning concern. The NOEL for effects to eggshell thickness was determined to be $\geq$ 4000 ppm.

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Honey Bee Toxicity

An acute contact LD_{50} study indicated cyfluthrin was highly toxic to the honey bee with an LD_{50} = 0.037 ug/bee. The residual toxicity persisted for up to 10 days, indicating cyfluthrin is highly toxic to honey bees.

Toxicity to Mammalian Species

Cyfluthrin is highly toxic to slightly toxic to rats on an acute oral basis with reported LD_{50} values ranging from 16.2 to 1000 mg/kg. Cyfluthrin is moderately toxic to mice on an acute oral basis (mice LD_{50} < 100 mg/kg) and is slightly toxic to rabbits and sheep (LD_{50} > 1000 mg/kg and LD_{50} = 1000 mg/kg, respectively).

A three-generation reproduction study in the rat indicated a reproductive NOEL = 50 ppm, and an LOEL = 150 ppm, where a decrease in body weight of the pups was seen.

A 2-year feeding/oncogenic study indicated a systemic NOEL = 50 ppm, and systemic LOEL = 150 ppm, where a decrease in body weights and inflammatory foci in kidneys of the females was seen.

A preliminary study (not yet validated) on subchronic inhalation using rats, reported adverse effects as low as 0.00009 mg/L.

Metabolism Data

Cyfluthrin is the only pyrethroid under review by RCB whereby the highest tissue levels were not found in fat. The highest tissue activity was found in the liver and kidney. Important degradative routes include hydrolysis and hydroxylation, but in most cases the terminal residue, even 3 months or more after application, consists of parent compound.

This chemical is the same as cypermethrin, except it has a flourine attached to the structure, which is expected to delay degradation (Arne, K.H., et al. 1978).

Aquatic Organism Toxicity

Freshwater Fish Toxicity

Cyfluthrin is very highly toxic to both warmwater and coldwater species on an acute basis (rainbow trout LC_{50} = 0.68 ppb, and bluegill sunfish LC_{50} = 1.5 ppb). A fish early

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life stage study, which was classifed as supplemental indicates that the NOEL for rainbow trout exposed to cyfluthrin is 10 ng/L (pptr) and the LOEL is 17.7 ng/L.

Freshwater Invertebrate Toxicity

Cyfluthrin is very highly toxic to Daphnia magna, with a reported LC_{50} = 0.141 ppb.

A Daphnia magna invertebrate life cycle study indicates that the MATC was > 7 < 15 pptr when daphnids were exposed to cyfluthrin.

Marine Fish Toxicity

Cyfluthrin is very highly toxic to sheepshead minnow on an acute basis, with a reported LC_{50} = 1.3 ppb. One supplemental sheepshead minnow early life stage study indicated an MATC $\geq$ 270 and $\leq$ 620 pptr for percent survivability and weight. Another supplemental sheepshead minnow early life stage study indicated an MATC > 24.7 and < 84 pptr, based on juvenile survival.

Marine Invertebrate Toxicity

Cyfluthrin is very highly toxic to the eastern oyster on an acute basis, with reported EC_{50} = 3.2 ppb in a flow-through shell deposition study.

Cyfluthrin is also very highly toxic to mysid shrimp on an acute basis, with a reported LC_{50} = 2.42 pptr. A supplemental mysid shrimp life cycle revealed an MATC of > 0.17 pptr and $\leq$ 0.40 pptr. The NOEL = 0.17 pptr for percent survival and dry weight. Reproductive success was affected at $\geq$ 1.25 pptr with the NOEL = 0.64 pptr; therefore, the MATC was > 0.64 pptr < 1.25 pptr.

Environmental Fate and Residues

Cyfluthrin is stable to hydrolysis at pH 5 and has a half-life of 193 days at pH 7, and a half-life of < 2 days at pH 9.

Cyfluthrin is soluble in water at 2 ppb (20 °C). The octanol/water partition coefficient (Kow) is 420,000 and K_d value is 546. This chemical is determined to have a maximum bioconcentration factor of 858X. Photodegradation studies indicate the half-life of [^{14}C]cyfluthrin ranged from 2 to 4 days.

Two field dissipation studies indicate cyfluthrin at 1.0 kg ai/ha would dissipate with a half-life of < 31 days in the upper 6 inches of a sandy clay loam soil/sandy soil.

A photodecomposition study in aqueous solutions (pH 5.0) showed cyfluthrin to degrade with a half-life of < 1 day. A study that partially fulfills data requirements for leaching and adsorption/desorption showed that aged (36 days) cyfluthrin residues were immobile (Rf < 0.04) in sand, sandy loam, sandy clay loam, silt loam, and two silty clay soils.

Terrestrial Residues

Cyfluthrin can be applied at a maximum rat of 0.05 lb ai/acre. The following residues would be expected immediately after a single application to cotton (based on EEB's nomograph, Urban, D.J.; Cook, N.J. (1986) Hazard Evaluation Division, Standard Evaluation Procedure, Ecological Risk Assessment):

Substrate	Residues (ppm)
Short range grasses	12
Long grasses	6
Leaves and leafy crops	7
Forage (alfalfa and clover, exposed seeds, small insects)	3
Pods containing seeds	.6
Fruit	.4
Soil (top 0.1 inch) (after direct application)	1.1

Aquatic Residues

Using the EEB scenario of a 10-acre field supplying and draining into a one-acre pond 6 feet deep, EEB estimated the highest EEC would be from aerial application, 335 pptr. See Attachment A.

Risk Assessment

A. Effects on Terrestrial Organisms

Avian Wildlife

Cyfluthrin is practically nontoxic to upland game birds and waterfowl on a subacute dietary basis, and practically nontoxic to upland game birds on an acute oral basis. Avian reproduction studies indicate the NOELs are $\geq$ 250 ppm and $\geq$ 1000 ppm for the mallard duck and bobwhite quail, respectively.

Based on the maximum estimated residues on short range grass, 12 p$_{p}$ s well below both the estimated triggers for Restricted Use Classification (1/5 LC_{50} = 1000 ppm) and endangered species (1/0 LC_{50} = 500 ppm).

In addition, the maximum expected residues are well below the NOELs for both bobwhite and the mallard ($\geq$ 250 and $\geq$ 1000 ppm, respectively).

Mammals

Cyfluthrin is highly toxic on an acute oral basis to rats with LD_{50} values as low as 16.2 mg/kg.

To convert the LD_{50} to LC_{50}, the following formula was used:

$$\frac{LD_{50}\ (Rat)}{\text{Food consumption/day (\% body weight)}} = \frac{16.2\ mg/kg}{0.10} = 162\ ppm$$

The LC_{50} for rats exposed to cyfluthrin is estimated to be 162 ppm. The short range grass residue of 12 ppm is well below this value.

B. Effects on Aquatic Organisms

Cyfluthrin is very highly toxic to freshwater fish, freshwater invertebrates, marine/estuarine fish, and marine invertebrates. The aquatic EEC, 335 pptr, greatly exceeds the triggers for both Restricted Use Classification (1/10 LC_{50} values ranging from 0.24 to 400 pptr) and endangered species (1/20 LC_{50} with values ranging from 0.12 to 200 pptr). In addition, all the NOELs were well exceeded with values ranging from 0.17 to 270 pptr.

Of all the aquatic organism studies, it appears that the aquatic invertebrates are the most sensitive, and the least sensitive are the marine fish - sheepshead minnow.

Using the species that would be most likely to be affected from cyfluthrin use, the toxicity data indicate that cyfluthrin would adversely affect the freshwater fish, bluegill sunfish.

Other warmwater fish species that may be adversely affected from the use of cyfluthrin are as follows: smallmouth bass, largemouth bass, white crappie, yellow perch, carp, goldfish, several species of shiners, minnows, chubs, bullheads, catfish, and madtoms.

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Endangered Species Consideration

This compound does pose a hazard to endangered aquatic species; however, the U.S. Fish and Wildlife Service has determined that with this use pattern, no endangered aquatic organisms are in jeopardy in Washington.

Additional Information

The State of Washington indicated that piperonyl butoxide was added to the synthetic pyrethroids permethrin and fenvalerate to enhance the pesticidal activity.

Piperonyl butoxide is a known synergist for pyrethrins and some of the synthetic pyrethroids (Pesticides, Theory and Application, George Ware 1983). The use of mixtures of pyrethroids and synergists or other pesticides may, however, increase toxic effects in nontarget as well as target organisms (Pyrethroids: Their Effects on Aquatic and Terrestrial Ecosystems, National Research Council, Canada, 1986).

101.4 Adequacy of Toxicity Data

No data were submitted with this application. There are data gaps that the registrant is required to satisfy. The data are adequate to estimate the potential hazard to aquatic organisms for this section 18 emergency exemption.

101.5 Adequacy of Labeling

The following labeling is required:

> This pesticide is extremely toxic to fish and wildlife. Do not apply directly to water or wetlands (swamps, bogs, marshes, and potholes). Consult your State Fish and Game Agency before applying this product to public waters to determine if a permit is needed for such application. Drift and runoff from treated areas may be hazardous to aquatic organisms in neighboring areas. Do not contaminate water when disposing of equipment washwaters.

102.0 Classification

Based on the aquatic toxicity data, this pesticide is required to be classified as a "Restricted Use Pesticide."

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103.0 Conclusions

Based on the current toxicity data, and the current agricultural practices associated with pears, EEB concludes that the use of this pesticide on pears, pears/apples interplants will undoubtedly pose a hazard to both freshwater and marine fish and invertebrates.

The EEC clearly exceeds both the NOELs and the LOELs for freshwater and marine fish and invertebrates. The Restricted Use Classification trigger has been exceeded for all aquatic organisms.

In addition, the EEC clearly exceeds the Special Review Criteria (1/2 LC_{50}) for freshwater and marine invertebrates. The EEC is approximately the same as the Special Review criteria for freshwater fish.

Under an 1988 crisis/emergency exemption, cyfluthrin was applied once to a total of 10,970 acres and twice to half of those acres. It was reported that no adverse effects were noted after application.

However, given the environmental fate characteristics, the level of exposure, and the toxicity to aquatic organisms, EEB expects that the use of this chemical on pears and apples/pear interplants may still pose a serious hazard to aquatic organisms. The registered alternatives (permethrin and fenvalerate) are not expected to be nearly as persistent, therefore, are not expected to pose as great a hazard. EPA should inform the Washington Department of Agriculture that the use of piperonyl butoxide, a known synthetic pyrethroid synergist, is expected to enhance the toxicity, therefore pose an even greater hazard to aquatic organisms.

Attachment

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Attachment A

EEC CALCULATION SHEET

I. FOR FOLIAR APPLICATION

- Runoff

$$0.05 \text{ lb} \times \frac{0.01}{(1\% \text{ runoff})} \times \frac{10 \text{ (A)}}{\begin{array}{l}\text{(from 10 A}\\ \text{drainage}\\ \text{basin)}\end{array}} = \frac{0.005 \text{ lb}}{\text{(tot. runoff)}}$$

EEC of 1 lb ai direct application to 1 A pond 6-foot deep = 61 ppb.

Therefore, EEC = 61 ppb x 0.005 (lb) = 0.305 ppm (305 pptr)

II. FOR AERIAL APPLICATION

A. Runoff

$$0.05 \text{ lb} \times \frac{0.6}{\begin{array}{l}\text{(appl.}\\ \text{efficiency)}\end{array}} \times \frac{0.01}{(1\% \text{ runoff})} \times \frac{10 \text{ (A)}}{\begin{array}{l}\text{(10 A}\\ \text{drainage}\\ \text{basin)}\end{array}} = \frac{0.003 \text{ lb}}{\text{(tot. runoff)}}$$

B. Drift

$$0.05 \text{ lb} \times \frac{0.05}{(5\% \text{ drift})} = 0.0025 \text{ lb (tot. drift)}$$

Tot. loading = 0.0025 lb + 0.003 lb = 0.0055 lb.

Therefore, EEC = 61 ppb x 0.0055 (lb) = 0.3355 ppb (335 pptr)