036101

(10)

EEE BRANCH REVIEW

DATE: IN 10/11/79 OUT 10/22/79 IN _____ OUT _____ IN _____ OUT _____
FISH & WILDLIFE ° ENVIRONMENTAL CHEMISTRY EFFICACY

FILE OR REG. NO. 1471-35-AA

PETITION OR (EXP. PERMIT NO.) _____

DATE DIV. RECEIVED 08-30-79

DATE OF SUBMISSION 08-28-79

DATE SUBMISSION ACCEPTED _____

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

DATA ACCESSION NO(S). _____

PRODUCT MGR. NO. _____

PRODUCT NAME(S) TREFLAN E. C.

COMPANY NAME Elanco Products Company

SUBMISSION PURPOSE Section 18 request from the State of California for use of Trifluralin on Asparagus

CHEMICAL FORMULATION a,a,a-trifluoro-2,6-dinitro-N,N-dipropyl-p-toluidine 44.5% Emulsifiable Concentrate

Trifluralin

100.0 Section 18 Application

100.1 Nature and Scope of the Emergency

The California Department of Food and Agriculture has determined that Russian thistle and field bindweed pose a significant threat to the asparagus crop (approximately 34,000 acres).

100.2 Target Organism(s)

Russian thistle
Field bindweed

100.3 Date, Duration

Effective Date: November 1, 1979
Expiration Date: October 31, 1980

100.4 Application Methods, Directions, Rates

Dosage: Apply TREFLAN according to the following broadcast rates per acre:

	Pints TREFLAN per Acre[a/]					
	Split Application			Split Application		
Soil Texture	Before Harvest	and	After Harvest	Before Harvest	or	After Harvest
Coarse (sand, loamy sand, sandy loam)	1	and	1	2	or	2
Medium (loam, silt loam, silt, sandy clay loam[b/], silty clay loam[b/])	1-1/2	and	1-1/2	3	or	3
Fine (clay, clay loam, silty clay, sandy clay, sandy clay loam[b/], silty clay loam[b/])	2	and	2	4	or	4

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a/ In any single calendar year the maximum TREFLAN per acre to be applied is 2 pints on coarse soils, 3 pints on medium soils and, 4 pints on fine soils.

b/ Sandy clay loam and silty clay loam are transitional soils which may be classified either as medium or fine textured soils.

NOTE: Soils containing up to 10% organic matter may be treated at the "fine" soil texture dosage rate. Do not use TREFLAN on soils containing more than 10% organic matter.

Dilution Rate: 5 to 40 gallons of water per acre
Method of Application: Soil incorporation
Frequency/Timing of Application: a. From fern cutting to 30 days BEFORE HARVEST and/or
b. AFTER HARVEST, but before fern emergence

Field Reentry Interval: 24 hours
Preharvest Interval: 30 days
Effective Date: November 1, 1979
Expiration Date: October 31, 1980

Other Requirements: All applicable directions and precautions will be followed.

DIRECTIONS FOR USE

Chop and thoroughly mix crop and/or weed residue into the soil before an application of TREFLAN. The soil surface should be well prepared and free of trash and clods.

Apply TREFLAN uniformly, using any properly calibrated, low-pressure herbicide sprayer. Avoid skips or overlaps. As the spray volume decreases, the accuracy of calibration and uniform application becomes more important. Check the sprayer daily to ensure proper calibration and uniform application.

INCORPORATION DIRECTIONS

Apply TREFLAN to the soil surface and incorporate twice into the top 2-3 inches of soil. Make the first incorporation within eight hours after application. The second incorporation can be made within a few days after the first incorporation. Variable weed control may result from delayed incorporation if TREFLAN is applied to a wet warm soil surface if the wind velocity is 10 miles per hour or higher.

INCORPORATION EQUIPMENT

Use machinery that breaks up large clods and mixes TREFLAN thoroughly with the soil.

Recommended equipment includes:

1. P.T.O.-driven equipment (tillers, cultivators, hoes, etc.) set to cut 2 to 3 inches deep and space rotors to provide a clean sweep of the soil. PTO-driven equipment should not be operated at a speed greater than 4 miles per hour.

2. Rolling cultivator set to cut 2 to 4 inches deep and operate twice at 6 to 8 miles per hour.

3. Disc set to cut 3 to 4 inches deep, operated twice at a speed of 4 to 6 miles per hour. Do not set the disc so deep as to injure the asparagus crowns.

   Shallow incorporation with implements set to cut less than 2 inches deep may result in erratic weed control.

100.5 Treatment Areas

Statewide

100.6 Precautionary Labeling

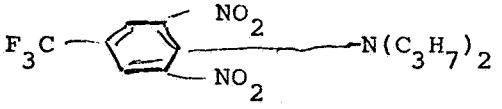
Direct contamination of any body of water with this emulsifiable concentrate may kill fish. Do not contaminate any body of water by direct application, cleaning of equipment or disposal of wastes.

101.0 Physical and Chemical Properties

101.1 Chemical Name

alpha,alpha,alpha-Trifluoro-2,6-dinitro-N,N-dipropyl p-toluidine

101.2 Structural Formula



101.3 Common Name

Trifluralin

101.4 Trade Name

Treflan

101.5 Molecular Weight

335.8

101.6 Physical State (Color, Odor, Taste, etc.)

Orange crystalline solid, no appreciable odor

101.7 Solubility (include temperature)

Readily soluble in organic solvents such as acetone, xylene, and aromatic naphtha.

Water solubility is 0.2-0.4 ppm at 25° C.

101.8 Vapor Pressure

1.14×10^{-5} mm Hg at 17.5° C
2.06×10^{-5} mm Hg at 20° C
1.14×10^{-4} mm Hg at 30° C
2.84×10^{-4} mm Hg at 35° C

102.0 Behavior in the Environment

102.1 Soil (from Substitute Chemical Program review)

A. Persistence

A number of investigators have reported that repeated applications of trifluralin at recommended rates do not result in a buildup of trifluralin residues in soil (Probst et al., 1967: Parkaand Tepe, 1969; Savage, 1973; Burnside, 1974; and Miller et al., 1975)

The degradation of trifluralin has been reported to be rapid in the first two months after application, followed by a period of slower decline. Less than 5% of the applied trifluralin can be recovered two years after application (Golab and Amundson, 1974).

B. Leaching

The results of various investigations demonstrate that trifluralin is not subject to leaching and is relatively immobile in the soil (Helling, 1968; Bardsley et al, 1968; Hollist, 1970; Helling, 1975; and Miller et al, 1975).

C. Volatility

The vapor pressure of trifluralin is very high (1.14×10^{-4} mm Hg at 30° C), and consequently, volatilization is an important mode of loss from soil surfaces.

103.0 Toxicological Properties

103.1 Mammals

Acute Oral

Species	% a.i.	LD_{50}
Rat	97%	>5000 mg/kg
Rat	97%	>2000 mg/kg

(J. P. Edmundson Jr. 12/02/75)

103.2 Minimum Requirements

103.2.1 Avian Acute Oral LD_{50}

Species	Age (months)	Sex	% a.i.	LD_{50}
Mallard	3 to 4	female	96.7%	>2000 mg/kg
Ring-necked pheasant	3 to 4	male	96.7%	>2000 mg/kg

(Tucker and Crabtree, 1970)

103.2.3 Fish Acute LC_{50}'s (Substitute Chemical Review)

SUMMARY OF ALL AQUATIC VERTEBRATE ACUTE TOXICOLOGY DATA ON TRIFLURALIN

Test Species (Common Name)	Formulation[a]	Type of Test	Water Type[b]	pH	Temp C	Lifestage or size	LC_{50} or TL_{50} (in ppb) 24 hr	48 hr	(95% Confidence Intervals in Parentheses) 96 hr	Reference
Rasboro heteromorpha (Harlequin Fish)	EC	Flowing	Soft	7.2	20	30 mm	600	---	---	Alabaster (1969)
Carassius auratus (Goldfish)	EC	Static	Medium	---	22	50-70 mm	---	---	585	Parka & Worth (1965)
Pimephales promelas (Fathead minnow)	EC	Static	Medium	---	22	40-50 mm	---	---	93.8	Parka & Worth (1965)
Lepomis macrochirus (Bluegill sunfish)	EC	Static	Medium	---	22	40-50 mm	---	---	58.2	Parka & Worth (1965)
Lepomis macrochirus (Bluegill sunfish)	Tech	---	---	---	24	0.97g	100	96	68	Cope (1965a)
Lepomis macrochirus (Bluegill)	EC	---	---	---	24	1.2g	23	20	18	Cope (1965a)
Salmo gairdneri (Rainbow trout)	Tech	---	---	---	13	3.52g	210	130	86	Cope (1965a)
Salmo gairdneri (Rainbow trout)	EC	---	---	---	13	1.32g	14	11	10	Cope (1965a)
Lepomis macrochirus (Bluegill sunfish)	Tech	Static	Medium	7.1	13	---	540 (460-640)	---	190 (160-230)	Macek, Hutchison and Cope (1969)
Lepomis macrochirus (Bluegill sunfish)	Tech	Static	Medium	7.1	18.3	---	360 (300-430)	---	120 (100-140)	Macek, Hutchison and Cope (1969)
Lepomis macrochirus (Bluegill sunfish)	Tech	Static	Medium	7.1	24	---	130 (110-150)	---	47 (40-55)	Macek, Hutchison and Cope (1969)

SUMMARY OF ALL AQUATIC VERTEBRATE ACUTE TOXICOLOGY DATA ON TRIFLURALIN
(CONTINUED)

Test Species (Common Name)	Formulation[a]	Type of Test	Water Type[b]	pH	Temp C	Lifestage or size	LC_{50} or TL_{50} (in ppb) (95% Confidence Intervals in Parentheses) 24 hr	48 hr	96 hr	Reference
Lepomis macrochirus (Bluegill sunfish)	---	---	---	---	7.2	38 mm	1,300	590	280	Cope (1965a)
Lepomis macrochirus (Bluegill sunfish)	---	---	---	---	13	38 mm	530	380	210	Cope (1965a)
Lepomis macrochirus (Bluegill sunfish)	---	---	---	---	18	38 mm	360	200	135	Cope (1965a)
Lepomis macrochirus (Bluegill sunfish)	---	---	---	---	24	38 mm	120	66	47	Cope (1965a)
Lepomis macrochirus (Bluegill sunfish)	---	---	---	---	29.5	38 mm	10	8.4	8.4	Cope (1965a)
Salmo gairdneri (Rainbow trout)	Tech	Static	Medium	7.1	1.6	---	318 (270-375)	---	210 (180-240)	Macek, Hutchison, Cope (1969)
Salmo gairdneri (Rainbow trout)	Tech	Static	Medium	7.1	7.2	---	239 (196-267)	---	152 (132-175)	Macek, Hutchison, Cope (1969)
Salmo gairdneri (Rainbow trout)	Tech	Static	Medium	7.1	13	---	98 (85-113)	---	42 (38-46)	Macek, Hutchison, Cope (1969)

a. EC = emulsifiable concentrate
Tech = technical grade

b. $Ca^{++} + Mg^{++}$
<35 mg/l = soft
35-85 mg/l = medium
>85 mg/l = hard

c. LC = lethal concentration
d. TL = tolerance limit

STATIC SOIL WATER ACUTE TEST LC_{50}[a] - (EMULSIFIABLE CONCENTRATE)

Test Species (Common Name)	Water Type[b]	Temp C	Size	Static Water LC_{50} (ppb)	Static Soil Water LC_{50} (ppb) Princeton/Brookston Fine Sand	Silty Clam Loam
Lepomis macrochirus (Bluegill sunfish)	Medium	22	40-50 mm	58.2	2,800	13,200
Pimephales cromelas (Fathead minnow)	Medium	22	40-50 mm	93.8 (± 8)	3,900 (± 300)	17,200 (± 2,100)
Carassius auratus (Goldfish)	Medium	22	50-70 mm	585	15,700 (± 1,000)	>32,000

a. LC - lethal concentration

b. $\frac{Ca^{++} + Mg^{++}}{35\text{-}85 \text{ mg/l}} = \text{medium}$

Source: Parka and Worth (1965)

(Adapted from Parka & Worth, 1965)

ACUTE TOXICITIES OF TRIFLURALIN AND SOME METABOLITES ON FISH

(96-hr. LC_{50} [a] in ppb)

	Lepomis macrochirus (Bluegill sunfish)	Pimephales promelas (Fathead minnow)
Metabolite No. 1 [b] Trifluralin	89	
Metabolite No. 2 (Mono-Oxidized)		225
Metabolite No. 3 (Di-Oxidized)		162 (± 95)
Metabolite No. 4 (Mono-Oxidized) (Mono-Reduced)		>900
Metabolite No. 5 (Di-Oxidized) (Mono-Reduced)		>900
Metabolite No. 6 (Mono-Reduced)		525 (± 212)

[a] LC_{50} = lethal concentration

[b] See Table 6 for names of trifluralin metabolites.

(Adapted from Worth, et al., 1966.)

103.2.4 Aquatic Invertebrate LC_{50} (from Substitute Chemical Review)

SUMMARY OF ALL AQUATIC AND MARINE INVERTEBRATE ACUTE TOXICOLOGIC DATA ON TRIFLURALIN

Test Species (Common Name)	Formulation[a]	Type of Test	Water Type[b]	pH	Temp C	Lifestage	EC_{50}[c] or LC_{50}[d] or TL_{50}[e] (in ppm) 24 hr	48 hr	96 hr	Reference
Orconectes nais (Crayfish)	Tech	Static	Soft	7.4	15.5	1st instar	---	50	---	Sanders (1970)
Cancer magister (Dungeness crab)	Tech	Static	Seawater 25% [h]	7.8	13	adults	---	---	>9.8	Caldwell et al. (1976)
" "	"	"	Salinity	7.5	13	juveniles	---	---	>1.0	" "
Grammarus lacustris (Scud)	EC	Static	Soft	7.1	21	2 months	8.8 (6.6-12)	5.6 (4.2-7.4)	2.2 (1.4-3.4)	Sanders (1969)
Pteronarcy californica (California stonefly)	EC	Static	Medium	7.1	15.5	naiads	13 (9.0-19)	4.2 (3.4-5.2)	3.00 (2.2-4.0	Sanders & Cope (196)
Asellus brevicaudus (Sow bug)	Tech	Static	Soft	7.4	15.5	1st instar	---	2.0	---	Sanders (1970)
G. fasciatus (Scud)	Tech	Static	Soft	7.4	15.5	1st instar	3.2 (1.9-17)	1.8 (1.6-12)	1.0 (0.3-3.6)	Sanders (1970)
Palaemonetes kadiakensis (Glass shrimp)	Tech	Static	Soft	7.4	21	1st instar	---	1.2	---	Sanders (1970)
Daphnia magna (Waterflea)	Tech	Static	Soft	7.4	21	---	---	0.56	---	Sanders (1970)
Dypridopsis vidua (Seed shrimp)	Tech	Static	Soft	7.4	21	---	---	0.25	---	Sanders (1970)

SUMMARY OF ALL AQUATIC AND MARINE INVERTEBRATE ACUTE TOXICOLOGIC DATA ON TRIFLURALIN
(CONTINUED)

Test Species (Common Name)	Formulation[a]	Type of Test	Water Type[b]	pH	Temp C	Lifestage	EC_{50}[c] or LC_{50}[d] or TL_{50}[e] (in ppm) 24 hr	48 hr	96 hr	Reference
Simoccphalus serrulatus (Waterflea)	Tech	Static	Medium	7.4-7.8	16.5	adults	---	0.45 (0.33-0.62)	---	Sanders & Cope (1966)
D. pulex (Waterflea)	Tech	Static	Medium	7.4-7.8	16.5	adults	---	0.24 (0.16-0.36)	---	Sanders & Cope (1966)
Cancer magister Dungeness crab)	Tech	Static	Seawater 25% [h] Salinity	7.8	13	1st stage zoae	---	>EC_{50}[f] = 0.06 LC_{50} >0.11		
Cancer magister (Dungeness crab)	EC	Static	Seawater 25% [h] Salinity	7.8	13	1st stage zoea	---	EC_{50}[f] = 0.14 LC_{50}[g] = 0.25		

a. EC = emulsifiable concentrate
Tech = technical grade

b. $\frac{Ca^{++} + Mg^{++}}{}$
<35 mg/l = soft
35-85 mg/l = medium
>85 mg/l = hard

c. EC = effective concentration
d. LC = lethal concentration
e. TL = tolerance limit
f. EC as non-lethal inhibition of swimming
g. LC as death with acquisition of opaque appearance
h. % = parts per thousand

Note: Data in parenthesis represents 95% confidence limits.

104.0 Hazard Assessment

104.1 Discussion

Trifluralin is highly toxic to aquatic fauna asindicated by data from the Substitute Chemical Review. (See 103 Toxicological Properties.) On the other hand, the acute toxicity data for bees, earthworms, mammals and birds indicates a practically non-toxic chemical.

104.2 Likelihood of Adverse Effects to Non-Target Organisms

The principal concern of this Section 18 request is the irrigation system aquatic fauna. The Department of Commerce 1974 Census of Agriculture indicates that out of 41,819 acres of asparagus only 272 acres were not irrigated. However, the hazards resulting from toxicity to aquatic organisms appear to be mitigated by the following:

1. Trifluralin is not subject to leaching and is relatively immobile. (Substitute Chemical Review)

2. Three static soil water tests develop 96-hour LC_{50} for the formulation. The results were 585, 93.8, and 58.2 ppb. The lowest LC_{50} value was estimated to be equivalent to an application rate of 22.8 lbs/acre, assuming that all of the applied trifluralin would wash into the pond. (Substitute Chemical Review)

3. In a field study trifluralin was incorporated into soils in the bottom of swimming pools at 0.5 lb/A. and 16 lb/A. Seven days later the pools were flooded, and 20 fathead minnows were stocked in each pool within another 7 days, 5 species of aquatic weeds were also introduced. No fish mortalities or evidence of herbicidal activity were observed at the end of 4 weeks. (Substitute Chemical Review)

4. No fish kills have been reported in California where trifluralin is used on several different crops. (See table 1).[1/]

5. The vapor pressure of trifluralin is very high (1.14×10^{-4} mm Hg at 30^{o} C), and consequently, volatilization is an important mode of loss from soil surfaces. Hence, the trifluralin left at the soil surface would be expected to evaporate and not run off. (Substitute Chemical Review)

6. Repeat applications of trifluralin at recommended rates do not result in a buildup of residues in soil. (Substitute Chemical Review)

Therefore, minimal hazard is expected for the use on asparagus.

1/ Ed Biernacki, EPA Monitoring and Data Support Division.

Table 1. Usage of trifluralin in California, 1971 and 1973

Use	1971 Pounds	1971 Acres	1973 Pounds	1973 Acres
Alfalfa	1,352	1,403	2,403	3,015
Beans, Dry Edible	456	623	9,296	15,159
Cotton	29,363	24,746	95,114	108,309
Grape	154	226	2,365	2,140
Sugarbeets	12,598	8,978	4,531	6,472
Tomato	7,679	20,713	8,878	22,847
Other Crops	1,071	1,445	11,708	16,553
Non-Crop Uses	2,560	2,687	60,267	53,255
Total	55,233	60,821	194,562	227,750

Sources: State of California Department of Food and Agriculture (1971, 1973).

104.3 Endangered Species Considerations

A. Use Patterns

The product is intended for use in an area inhabited by endangered species.

B. Identification of Endangered Species

The USDI lists the following species for California counties where asparagus is grown and endangered species are found:

1. California Condor (Gymnogyps californianus)

2. Southern Bald Eagle
(Haliaectus leucocephalus leucocephalus)

3. American Peregrine Falcon
(Falco peregrinus anatum)

4. Light-footed Clapper Rail
(Rallus longirostris levipes)

5. California Least Tern
(Sterna albifrons browni)

6. Belding's Savannah Sparrow
(Passerculus sandwishensis)

7. Blunt-Nosed Leopard Lizard
(Crotaphytus silus)

8. Santa Cruz Long-Toed Salamander
(Ambystoma macrodactylum croceum)

9. Thicktail Chub (Gila crassicauda)

10. Colorado Squawfish
(Ptychocheilus lucius)

11. Bonytail (Gila elegans)

12. Humpback Sucker
(Xyrauchen texanus)

C. Likelihood of Exposure

With respect to the bird species, soil incorporation, dissipation of soil residues, and volatility of the herbicide limit concentrations available to below the LC_{50} value (>2000 ppm) for birds.

The lizard [1/] or salamander are not found in existing asparagus-growing areas of their county (California Dept. of Fish and Game, 1978).

Concerning fish, the thicktail chub, according to California Dept. of Fish and Game, 1978, may be extinct; the last known specimen was collected in 1957. The remaining fish are found in the Colorado River. As previously mentioned in the hazard assessment, the danger to fish has been mitigated by dissipation of soil residues, soil incorporation, immobility in the soil and volatilization.

It is also likely that the registered product is presently used on alfalfa, sugarbeets, tomatoes, and grapes (See Table). All these crops are grown in Riverside or Imperial County or both. Hence, minimal hazard is expected for fish as well as birds, lizards and salamanders.

105.0 Conclusions

105.5 Recommendations

The Ecological Effects Branch concurs with the proposed Section 18 for the application of trifluralin to asparagus in California.

1/ Per communication with Mr. John Brode, California Dept. of Fish and Game.

Dennis J. McLane Dennis J. McLane
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