EEE BRANCH REVIEW

| DATE: | IN | OUT | IN | OUT | IN | OUT |
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| | FISH & WILDLIFE | | ENVIRONMENTAL CHEMISTRY | | EFFICACY | |
| | | | 2/18/77 | 10/18/77 | | |

FILE OR REG. NO. 21137-4

PETITION OR EXP. PERMIT NO. 7F1921

DATE DIV. RECEIVED 2/8/77

DATE OF SUBMISSION

DATE SUBMISSION ACCEPTED 2/16/77 3CID-2A&2B-yes

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

PRODUCT MGR. NO. 21 (E. Wilson)

PRODUCT NAME(S) FUNGINEX

COMPANY NAME EM Laboratories Inc.

SUBMISSION PURPOSE new uses on blueberries and peaches

CHEMICAL & FORMULATION Triforine [N, N$^1$-(1, 4-piperazinediyl)bis[2, 2, 2-trichloroethylidene])bis(formamide)]

1.0 Introduction

1.1 Note:

On may 5, 1977, work on the registration submission of Triforine was halted in order to complete the reregistration package of chloropicrin. Work on Triforine resumed on June 17, 1977.

Work on Triforine was again halted on June 17, 1977, to work on EUP's. Work resumed on July 29, 1977.

Work was halted again on August 23, 1977, to work on an EUP and was resumed later that day.

There were also other assignments which delayed completion of this review along with directives to comply with "change in review format."

1.2 The registrant, EM Laboratories Inc., requests registration of the fungicide product Funginex for use on blueberries and peaches.

1.3 Funginex is an EC containing 18.2% triforine as the active ingredient (1.6 lb. a.i./gallon). The accession number is 095812.

2.0 Directions for Use

2.1 Highbush Blueberry

Apply 0.3 lb.a.i./A in 20 to 50 gallons water by ground or in five gallons water by air. Make first application at leaf bud break and repeat in seven to ten days. Make third application at pink bud stage and repeat in seven to ten days at 25 percent to 50 percent bloom. For final spray, apply 0.2 lb.a.i./A between full bloom and early petal fall. Do not apply more than five applications between leaf bud break and early petal fall. (These directions are for mummyberry disease.)

2.2 Peach (for brownrot)

For ground application only. Apply three preharvest sprays at 0.15 to 0.2 lb.a.i./A in 100 gallons water or 0.45 to 0.6 lb.a.i./A at seven to ten day intervals. Make the first application two to three weeks before harvest and the last application just prior to harvest.

In California Only:

Apply two preharvest sprays each at 0.15 lb.a.i./A in 100 gallons water or 0.6 lb.a.i./A. Make the first application three weeks before harvest, followed by a second application seven to ten days later.

2.3 Pesticide Disposal:

Pesticide or rinse liquid that cannot be used or chemically reprocessed should be disposed of in a landfill approved for pesticides or buried in a safe place away from water supplies.

2.4 Container Disposal:

Dispose of in an incinerator or landfill approved for pesticide containers or bury in a safe place. Consult federal, state or local disposal authorities for approved alternative procedures such as limited open burning.

3.0 Discussion of Data

3.1 The following data was submitted or referenced with this submission and have been previously reviewed. They will not be validated per Rogoff's memo to Campt of August 12, 1977.

Soil Studies

1. Degradation of Cela W 524 (Triforine) in Various Soil Types. Dr. D. C. A. Eichler, Plant Protection Department, Analytical Chemistry, C. H. Boehringer Sohn, Ingelheim/Rhein, West Germany, November 5, 1971. Triforine 20% EC.

2. Soil Degradation of Triforine, D. M. Munger, FMC Agricultural Chemical Division, Middleport, New York. May 10, 1974. Technical Triforine ($^{14}C/^{3H}$-Labeled).

3. Leaching Studies on Cela W 524 (Triforine) in Various Soil Types, Dr. D. C. A. Eichler, Plant Protection Department, Analytical Chemistry, C. H. Boehringer Sohn, Ingelheim/Rhein, West Germany. August 15, 1972. Triforine 20% EC.

4. Leaching of $^{3}H$-Triforine Residues in Closed Sandy Loam Soil, Dr. R. A. Robinson, FMC Agricultural Chemical Division, Middleport, New York, May 13, 1974. Triforine Technical ($^{3}H$-Labeled).

5. Influence of Cela W 524 (Triforine) on the Aerobic Activity in the Soil, Dr. G. Muacevic, Pharma Research Biology, Department of Pharmacology, C. H. Boehringer Sohn, Ingelheim/Rhein, West Germany. August 28, 1972. Triforine Technical and Triforine 20% EC.

6. Investigations into the Effects of Saprol (Triforine 20% EC) on Soil Organisms, Dr. K. H. Domsch, Institute of Soil Biology, Braunschweigh, West Germany, May 22, 1973. Triforine 20% EC.

Hydrolysis Studies

1. Stability of Cela W 524 in Solution at Room Temperature, Dr. W. Ost, Pesticide Research Chemical Section, C. H. Boehringer Sohn, Ingelheim/Rhein, West Germany, August 12, 1971. Triforine Technical. EPA Registration Number 21137-4, Submitted December 30, 1975, Accession Number 224103.

2. The Decomposition of Triforine in Aqueous Solution by U.V. Radiation, Dr. W. Ost, Chemical Research, Celamerck, Ingelheim, West Germany. January 3, 1974. Triforine Technical. EPA Registration Number 21137-4, Submitted December 30, 1975, Accession Number 224103.

3. Comparative Radio Thin Layer Chromatographic Investigations of the Decomposition of $^{3}H/^{14}C$ - W 524 (Triforine) in Aqueous Solution, Dr. S. Darda, C. H. Boehringer Sohn, Ingelheim, West Germany. March 1973. Triforine Technical. EPA Registration Number 21137-4, Submitted December 30, 1975, Accession Number 224103.

4. Decomposition Products of Radioactive Triforine (W524) in Aqueous Solution, Dr. S. Darda, C. H. Boehringer Sohn, Ingelheim, West Germany. February 18, 1974. Triforine Technical. EPA Registration Number 21137-4, Submitted December 30, 1975, Accession Number 224103.

5. Rate of Hydrolysis of Triforine in Aqueous Solutions, Dr. D. Eichler, Analytical Laboratory, C. H. Boehringer Sohn, Ingelheim, West Germany. November 1, 1975. Triforine Technical. EPA Registration Number 21137-4, Submitted December 30, 1975, Accession Number 224103.

6. Rate of Hydrolysis of Triforine in Aqueous Solutions at 5°C, Dr. D. Eichler, Analytical Laboratory, C. H. Boehringer Sohn, Ingelheim, West Germany. November 21, 1975. Triforine Technical. EPA Registration Number 21137-4, Submitted December 30, 1975, Accession Number 224103.

7. Correlation Between Various Results of Tests on the Degradation of Triforine in Water, Dr. D. Eichler, Celamerck, Ingelheim, West Germany. November 4, 1975. EPA Registration Number 21137-4, Submitted December 30, 1975, Accession Number 224103.

Photodegradation Effects

1. Investigations Into the Decomposition of Triforine on Exposure to Light, Dr. D. Eichler, Celamerck, Ingelheim, West Germany. January 30, 1974. Triforine Technical.

2. Studies of the Influence of Light on the Degradation of Cela W 524 (Triforine), Dr. D. C. A. Eichler, Plant Protection Department, Analytical Chemistry, C. H. Beohringer Sohn, Ingelheim/Rhein, West Germany. September 6, 1972. Triforine 20% EC.

3.2 This is a new study.

Investigations Into the Effects of Saprol (Triforine 20% EC) on Soil Organisms, Dr. K. H. Domsch, Institute of Soil Biology, Braunschweigh, West Germany, May 22, 1973. Triforine 20% EC.

3.3 Investigation into the Effect of Saprol (Triforine EC 20 on Soil Organisms (from PP7F1921, page 73-83)

The effects of Triforine on cellulose degrading soil microbes was investigated by adding dried, finely macerated bean plants containing 181 ppm triforine (dry wt. basis) to four different soils until the soil:bean plant weight ratio was 200:1. Carbon dioxide production was monitored for up to 160 hours.

Analysis of the test soils.

| | I | II | III | IV |
|---|---|---|---|---|
| Type | | Silt | Silty Loam | Clay loam |
| Origin | USA | Jerxheim | Volkenrode | Salzdahlum |
| Organic matter % | 4.5 | 3.6 | 2.1 | 1.9 |
| pH | 4.3 | 7.6 (KCl) | 5.4 (KCl) | 7.4 (KCl) |
| Coarse sand % | 37.2 | 0.6 | 6.7 | |
| Fine sand % | 37.4 | 6.0 | 35.0 | |
| Silt % | 12.9 | 88.0 | 48.5 | |
| Clay % | 12.6 | 5.4 | 9.8 | |

The same soils were used to investigate the effects of triforine on nitrification. Concentrations of 0, 5, and 50 ppm triforine were studied at 20°C incubation.

Also, effects on the population of soil fungi in soils I and III, effects on the microbial spore content of bacteria streptomycetes and fungi in soils I and III and effects on the weight gain of young earthworms fed triforine (147 ppm) fortified feed were investigated.

Results

1. In soils II, III and IV, there was a slight increase in released $CO_2$ from the triforine treated bean leaves than from the untreated bean leaves for the first 15 to 20 hours. This situation reversed during the next 15 to 20 hours showing slightly more $CO_2$ liberated from the untreated bean leaves for the next 20 hours followed by a generally equivalent release of $CO_2$ from the treated and untreated leaves for the remainder of the experiment. In soil I, there was a slight preliminary inhibition in $CO_2$ production for the first 15 hours in the treated sample, but this was followed by a small increase in $CO_2$ production over the untreated sample for the remaining 40 to 45 hours of the experiment.

2. Nitrification was not altered at the 5 ppm level or the 50 ppm level except for soil III which exhibited a slight increase in nitrification over the 240 hour long experiment. No nitrification was observed in soil I because $NH_4^+$-$NO_2^-$ is inhibited by acid pH. (The pH of soil I is 4.3.) The presence of this first step of nitrification was determined by measuring the loss of $NH_4^+$ in the soils. However, when analyzing the soils for $NO_2^-$ ions, only soils II and IV gave positive results.

   Also when analyzing the soils for $NO_3^-$ ions, no significant difference was found between the control and fortified samples of soils II, III and IV. Soil I gave no evidence of $NO_3$ nitrification.

3. The effects of triforine on soil fungi were observed on soils I and III and 0, 5 and 50 ppm triforine. No significant effects were seen on day 0, 10 and 30 except on fungi adhering to soil mineral particles of soil I at 50 ppm. Some inhibition is noted.

4. The content of spores of bacteria, streptomycetes and fungi in soils I and III was not significantly altered by triforine in the soil at concentrations of 0, 5, and 50 ppm.

5. An earthworm feeding study was included. It showed a slightly lower weight gain for the treated worms.

Conclusions

1. At the dosages tested, triforine did not affect soil $CO_2$ production, nitrification, soil fungi populations or the content of spores of bacteria, streptomycetes and fungi in soils.

2. Effects on nitrogen fixation, and starch and protein degradation were not addressed.

3. The earthworm study employed only four worms and only gave the final weight readings of the four week study. We will inform the Environmental Safety Section of this study.

5.0 Recommendations

5.1 We do not concur with the proposed new uses because we have no data assessing the fate of Triforine under actual use conditions.

5.2 We note the following data gaps with this submission and include sample protocol for those gaps. Per Dr. Rogoff's memo of August 12, 1977, to Mr. Campt, the data is not validated.

5.2.1 Field Dissipation

A field dissipation study under actual use conditions is required to define the duration of potential hazards. Dissipation may decrease potential hazard of reentry into the treated area, residues in rotational crops, residues in the food web and loss of usable land and water resources through degradation processes in the treated area, or may increase potential hazards in non-treated areas through mobility. Continue analyses until a ninety percent loss of the pesticide occurs or until patterns of formation and decline of degradation products are established, or to the maximum time specified below. Sampling times include preapplication, day of application, and shortly post-application for each single or multiple application. Succeeding samples are dependent upon degradation and metabolism characteristics and potential for reentry. Identification of residues comprising more than ten percent of initial application or 0.01 ppm is needed for the registrant to construct decline curves or residues in soil.

Soil samples are taken in increments to a depth of 12 inches from sites in four agricultural use areas for a maximum test duration of 12 months. Include a soil profile and characteristics of each soil (percent sand, percent silt, percent clay, percent organic matter, pH, field moisture capacity, cation exchange capacity and bulk density).

This protocol satisfies the requirement for fruit and nut crop uses but not for field and vegetable crop uses.

5.2.2 Fish residue accumulation data using radioisotopic or comparable technique are required. Two exposure systems are required: flow-through (with constant concentration of aqueous solution of pesticide) and static (with ambient concentration of residues). Sunfish are preferred in flow-through system and catfish required in the static system. For the static system treat water overlayering a sandy loam soil at the proposed application rate and allow system to "age" for two to four weeks prior to initiation of fish exposure.

Exposure duration is 30 days with suggested sampling times at 0, 1, 3, 7, 10, 14, 22, and 30 days of exposure; while fish and water samples are taken on 0, 1, 3, 7, 10 and 14 days of withdrawal of exposure. Obtain soil and water samples prior to fish exposure intervals. Determine the amount and identity of the residue in water, soil, whole body fish, edible tissue, and viscera or carcass at each sample interval.

Characteristics of water must be reported including pH, temperature, and oxygen content.

We note that a fish residue accumulation study on Triforine was submitted and reviewed with a previous submission but was not referenced with this submission.

5.3 Comments on the new data follow.

5.3.1 The study titled Investigations Into the Effects of Saprol (Triforine 20% EC) on Soil Organisms did not address Triforine effects on nitrogen fixation and starch and protein degradation.

A sample of acceptable protocol to satisfy our requirement for a study on the effects of the pesticide on microbes is below.

Effects of Pesticides on Microbes

Data on effects on microbes are obtained from studies of effects on microbial functions or microbial populations. Studies of effects on microbial functions constitute a more direct approach and are preferred to studies of effects on populations. Some effects cannot be measured directly and population studies may be the only recourse. When the functional approach is chosen, the effects on nitrogen fixation, nitrification, cellulose, starch and protein degradation are required. When the population approach is chosen, effects on pure or mixed culture populations of representative microorganisms from soil or water or obtained from culture collections are required. Appropriate organisms include free-living nitrogen-fixing bacteria and blue-green algae such as Azotobacter, Colostridium and Nostoc, and nitrifiers such as Nitrosomonas and Nitrobacter.

For cellulose, starch, pectin, protein and similar degradation include at least one each of soil bacteria, actinomycetes, and molds such as Bacillus, Pseudomonas, Arthrobacter, Cellulomas, Cytopaga, Streptomyces, Penicillium, Flavobacterium, Trichoderma, Aspergillus, Chaetomium, and Fusarium.

Animal or plant pathogens and indicators of fecal pollution are unsuitable.

Information on organism identity and media must be supplied. Organisms used as indicator must be identified by Linnaean name as well as common name. Cultures of microorganisms obtained from collections must also be identified by collection code numbers; other sources of microorganisms must be described. Photographic evidence for claimed pure cultures not derived from collections must be submitted. Standard maintenance and test media must be identified and other media identified and described.

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