7-6-90

265185
Record No.

Review No.

081901
Shaughnessey No.

# EEB REVIEW

DATE: IN June 4, 1990 OUT July 6, 1990

FILE OR REG. NO. 90-MI-07

PETITION OR EXP. NO.

DATE OF SUBMISSION June 1, 1990

DATE RECEIVED BY EFED June 4, 1990

RD REQUESTED COMPLETION DATA June 16, 1990

EEB ESTIMATED COMPLETION DATE June 16, 1990

RD ACTION CODE/TYPE OF REVIEW 510

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

MRID NO(S).

PRODUCT MANAGER NO. Stanton PM #41, Rebecca Cool 557-4360

PRODUCT NAME(S) Bravo 720

COMPANY NAME Michigan Department of Agriculture

SUBMISSION PURPOSE To obtain a section 18 permit to control purple spot on asparagus.

| SHAUGHNESSEY NO. | CHEMICAL AND FORMULATION | % A.I. |
|---|---|---|
| 081901 | Chlorothalonil EC | 54% |
| | | |
| | | |

1

265185
Record No.

081901
Shaughnessy No.

Emergency Use Application
Section 18

# CHLOROTHALONIL

Bravo 720

Control of Purple Spot on Asparagus in Michigan
Ecological Effects Branch Review

## 100. REASON FOR APPLICATION:

### 100.1 NATURE AND SCOPE OF THE EMERGENCY:

*Applicant and Request:*

David R. Wade, Ph.D
Michigan Department of Agriculture
P.O. Box 30017
Lansing, Michigan 48909
517-373-1087

*Description of the Pesticide Problem:*

The State of Michigan requests the use of Bravo 720 (a 54% emulsifiable concentrate of Chlorothalonil) to control Purple spot in asparagus, which causes lesions in the ferns. The spores of the disease overwinter in field debris and reinfect the asparagus in the spring.

*Alternatives:*

The farmers have been using EBDCs to control this fungus, but processors have refused to accept EBDC treated asparagus.

### 100.2 TARGET ORGANISMS- Purple spot fungus *Stemphyllium vesicarium*

### 100.3 DATE AND DURATION OF THE TREATMENT:

"Begin applications after harvest of spears, when conditions favor disease development on ferns, generally when leaf wetness occurs. Repeat application at 2 to 4 week intervals until ferns are no longer productive. Use the high rate and shortest interval when conditions favor disease. Do not apply within **100 days** of anticipated harvest of spears during the subsequent growing season."

### 100.4 APPLICATION METHODS, DIRECTIONS AND RATES:

Bravo 720 is a 54% emulsifiable concentrate of Chlorothalonil. From 1.69 to 2.25 lbs ai/A (wt/wt) would be applied by ground equipment only.

## 100.5 TREATMENT AREAS:

Asparagus is grown in the counties that border Lakes Michigan and Superior and along the State's southern border. The soil is generally sandy or a sandy loam and the topography is flat to rolling.

## 100.6 PRECAUTIONARY LABELING:

"This product is toxic to fish, aquatic invertebrates, and marine/estuarine organisms. Runoff from treated areas may be hazardous to aquatic organisms in neighboring areas. Do not apply when weather conditions favor drift from treated areas."

# 101. PHYSICAL AND CHEMICAL PROPERTIES:

## 101.1 NAMES- Bravo 720.

## 101.2 FORMULATION- 54% emulsifiable concentrate.

## 101.3 BEHAVIOR IN THE ENVIRONMENT:

In most soils, Chlorothalonil breakdown is moderate. It has a half-life of about 30 days. The presence of water favors the breakdown procedure as do temperatures from 21 to 39° C. Its half-life in water is 30 days at moderate acidity (pH 5 to pH 7). Its half-life in sediment is five to 15 days.

# 102. HAZARD ASSESSMENT:

Asparagus is a perennial plant that may be harvested every spring for up to 20 years. The edible portions are the spears that grow from the base. The spears that appear in late spring are not harvested because they are "tough." They continue growing into "ferns" (leaf-like structures that bare seeds).

The label directions allow applications every other week "until the ferns are no longer productive" but not "within 100 days of harvest." EEB has contacted Dr. David Wade at the Michigan Department of Agriculture and Dr. Hugh Price, Department of Agronomy, Michigan State University. Under the present label, it is possible that application would continue until the 100 days PHI (17 applications), but it is difficult to imagine a farmer spraying a snowed-in, asparagus field. Application might continue until the fall (13 applications) or the ferns might die during the summer (four applications). Dr. Price says that the number of applications depends upon the seriousness of the disease, but three to five applications are the most likely. EEB has looked at several of these scenarios.

## 102.1 TOXICOLOGY:

Chlorothalonil is categorized as "Practically Nontoxic" to birds (Mallard oral acute $LD_{50}$>4,540 mg/kg and Bobwhite and Mallard dietary $LC_{50}$> 10,000). There were no adverse

effects in the avian reproduction studies at 5,000 ppm for both Bobwhite quail and Mallard ducks.

Chlorothalonil is categorized as "Practically Nontoxic" to mammals (rat $LD_{50}$> 10,000 mg/kg and the dog $LD_{50}$> 5,000 mg/kg). The rat reproductive NOEL in two generation study was 1,500 ppm.

Chlorothalonil is categorized as "Very Highly Toxic" to fish and aquatic invertebrates:

| ACUTE TOXICITY | $LC_{50}$ |
|---|---|
| Rainbow trout | 47 ppb |
| Bluegill sunfish | 62 ppb |
| Channel catfish | 43 ppb |
| Fathead minnow | 23 ppb |
| *Daphnia magna* | 70 ppb |

| CHRONIC EFFECTS TESTS | MATC |
|---|---|
| Invertebrate life cycle- *Daphnia magna* | >39<79 ppb |
| Fish reproductive Fathead minnow | >3<6.5 ppb |

## 102.2 NON-TARGET TERRESTRIAL ORGANISMS:

Gussey and Maturgo (1973) found that wildlife, specifically pheasants and rabbits, used asparagus fields from March through October for food and cover. EEB used Hoerger and Kenaga's (1972) nomograph to predict the following residues on various forms of plants at an application rate of 2.25 lbs ai/A.

RESIDUES ON TERRESTRIAL FOOD ITEMS IN PPM

| | SHORT GRASS | LONG GRASS | LEAFY CROPS | FORAGE CROPS | SEED PODS | FRUIT |
|---|---|---|---|---|---|---|
| MAXIMUM | 540 | 248 | 281 | 139 | 27 | 16 |
| TYPICAL | 281 | 207 | 79 | 74 | 79 | 35 |

The best approximation of residues after a single application that can be made from the above chart is the entry for "Long Grass" (248 ppm).

EEB used the Environmental Fate computer simulation to estimate the change in residue levels during a period of multiple applications. It starts with a given initial concentration then calculates the daily expected residue of a pesticide by subtracting the daily degradation (based on the chemical's half-life) from the previous day's level and adding the residue from additional applications (if any). A worst case scenario for multiple applications would usually require the use of the "Maximum" residue, but, since the number of applications is so great and since an increased number of "samples" leads to stability of the variation about the mean, EEB used the "Typical" estimation. The terrestrial model used the maxi-

mum rate (2.25 lbs/A) applied every 14 days until November (13 applications). The half-life on the plants was assumed to be the same for water as for soil (30 days). The estimated residues (Maximum = 746 ppb and Average = 543 ppb) do not exceed the avian or mammalian reproductive $LC_{50}$s.

## 102.3 NONTARGET AQUATIC ORGANISMS:

We used a simple runoff model to evaluate the runoff's effect on aquatic environments. This model assumes that a treated, ten acre basin drains into a one acre, six foot deep pond. The model considers the change in the concentration of a pesticide in a pond due to runoff to be:

$$\textit{Application rate} \times \textit{Size of treated area} \times \textit{Per cent runoff} \times \textit{Conversion factor}$$

Where:

Application rate = the pounds of active ingredient applied to an acre.

Size of the treated area is 10 acres in the standard model.

Per cent runoff is an estimated based partly upon empirical evidence and is related to the water solubility of the pesticide.

Conversion factor is the concentration of a pesticide in a one acre, six foot deep "standard pond" if one pound of active ingredient was put into it. It is 61 ppb per lb ai.

We calculated the expected runoff from a single application using the 2.25 lbs ai/A rate. "Per Cent Runoff" was assumed to be 2% because of Chlorothalonil's solubility (6 ppm).

$$\frac{2.25\ \textit{lbs ai}}{A} \times 10\ A \times .02 \times \frac{61\ \textit{ppb}}{\textit{lbs ai}} = 27\ \textit{ppb application}$$

To determine the average amount of Bravo on the field, EEB used the Environmental Fate model (see the description in the "Nontarget Terrestrial Organisms" section). See the attached sheets for an example of this calculation. The application rate (2.25 lbs ai/A) was the "Initial Concentration." The simulation output called "Average Residue" was the average amount of chemical in the field. This figure was used as the "Application Rate" in the runoff model, which then was used to predict the average amount of runoff from a typical treated field after every runoff event (rain, snow, etc.). The average runoff was the "Initial Concentration" in the Environmental Fate model that estimated the daily, average and maximum EECs of Bravo in the pond during the application period.

| Application Period | Number of Applications | Average Amount of Chemical on the Field | Average Increase of the Concentration in the Pond After Runoff | Average/Maximum EEC in Pond from Runoff |
|---|---|---|---|---|
| 100 day PHI | 17 | 5.9 lbs ai/A | 72 ppb | 189/259 ppb |
| November | 13 | 5.6 lbs ai/A | 68 ppb | 171/242 ppb |
| Summer | 4 | 3.2 lbs ai/A | 40 ppb | 58/105 ppb |
| Spring II | 3 | 2.7 lbs ai/A | 33 ppb | 40/75 ppb |
| Spring I | 2 | 2.1 lbs ai/A | 25 ppb | 23/44 ppb |

For the worst case scenario, the model assumed that the runoff events occur every 14 days, but not immediately after the application. This later method is a much more complicated model that would yield a higher average EEC. The average EEC (58 ppb) of the four time application regime exceeds the low figure of the *Daphnia magna* life cycle study (>39<79 ppb). The lowest estimated average EEC exceeds the acute $LC_{50}$ for Rainbow trout and Channel catfish. The maximum EEC exceeds the acute $LC_{50}$ for Bluegill sunfish.

## 102.4 ENDANGERED SPECIES:

There are no endangered species in the asparagus growing counties of Michigan that would be affected by this use pattern.

## 102.5 ADEQUACY OF LABELING:

EEB recommends that, if EPA issues the § 18 permit in spite of EEB concerns, the label should limit the number of applications to a maximum of three at two week intervals to reduce potential hazards to nontarget aquatic organisms.

The standard aquatic warning label should be a part of the labeling. Do not apply directly to water or wetlands (swamp, bogs, marshes, and potholes). Do not contaminate water when disposing of equipment washwaters.

## 102.6 DISCUSSION:

EEB uses "triggers" or "levels or concern" to warn of expected danger from a pesticide. The triggers for nonendangered, nontarget aquatic animals are an EEC ≥ 0.5 $LC_{50}$ for acute exposure and an EEC ≥ Chronic Effect Levels (including reproductive effects). The lowest aquatic $LC_{50}$ is 23 ppb for the Fathead minnow; the $LC_{50}$ for the Rainbow trout is 47 ppb. A single application exceeds EEB's level of concern for the Rainbow trout, Channel catfish, and Fathead minnow. Two applications exceed the level of concern for the Bluegill sunfish and *Daphnia magna*.

The Fathead minnow Chronic Effect level of concern (MATC >3<6.5 ppb) was exceeded by a single application. Two applications exceed the *Daphnia magna* life cycle MATC (>39<79 ppb).

The maximum EEC (75 ppb) from three applications (the least number expected by Dr. Price) would exceed the acute $LC_{50}$s of the Fathead minnow (23 ppb), the Rainbow trout (47 ppb), the Channel catfish (43 ppb), the Bluegill sunfish (62 ppb), and *Daphnia magna* (70 ppb).

Chlorothalonil has a toxic degradation product, DS-3701, that has not been considered in this analysis.

Rieder (1988) wrote the EEB chapter for the Registration Standard for Chlorothalonil. He used two modelling programs to assess the aquatic hazard; SWRRB was used to estimate runoff and EXAMS II was used to simulate its fate in the adjacent ponds and streams. Two scenarios were examined: 1) two applications, 14 days apart, in July and August of 1.8 lbs ai/A on soybeans and 2) nine applications, 14 days apart, from March to July with 3.15 lbs ai/A on pecans. The program used actual rainfall data. The soybean model found maximum concentrations of 2.6 ppb in pond water and 49.6 ppb is the pond sediment. The pecan model found maximum concentrations of 30 ppb in the water and 466 ppb in the sediment.

Rieder concluded that, "The majority of the use patterns of chlorothalonil is not expected to have a severe adverse effect on aquatic organisms. However, the use of chlorothalonil on orchards would be expected to cause acute and chronic effects to fish but not aquatic invertebrates." His results predict much lower concentrations of the active ingredient in ponds than do the results in this analysis, but the "bottom line" conclusion on hazard does not contradict the conclusions (below) of this analysis.

His models differed greatly from the ones used here in complexity and sophistication, but they cannot necessarily be said to be better predictors of expected pollution in an asparagus use pattern since they were based upon different application rates, crops and rainfall patterns. Chlorothalonil would be applied to asparagus in the spring when rain is at a maximum, not during the winter or summer. SWRRB and EXAMS II attempt to accurately model typical conditions, whereas this analysis attempts to model a "worst case scenario." Suskanke (February 1990 and March 1990) used similar methods and came to conclusions of aquatic hazard for § 18 applications for hazelnuts and mangos.

Modeling with SWRRB and EXAMS II requires much more ecological information about the use pattern, some of which must be obtained empirically. The modeling process itself is done by the Environmental Fate and Groundwater Branch of EFED. It might take a few months to gather all of the information about an asparagus use pattern for Chlorothalonil, but the result might be a more accurate assessment of the aquatic pollution problem that might predict a lesser hazard than the simple, worst case method used in this review.

## 103. CONCLUSIONS:

Chlorothalonil, as Bravo 54% EC, is Very Highly Toxic to freshwater fish and invertebrates. EEB projects acute and chronic adverse effects to nontarget, aquatic species through runoff if Bravo is used as proposed to control purple spot on asparagus in Michigan.

## 104. REVIEWED BY:

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Signature: James J Goodyear
Date: July 10, 1990

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## LITERATURE CITATIONS

Gussey, W.F. and Z.D. Maturgo. 1973. Wildlife utilization of cropland. Environmental affairs, Shell Oil Company, Houston, Texas. 278 pp.

Hoerger, F.D. and E.E. Kenaga. 1972. Pesticide residues on plants: Correlation of representative data as a basis for estimation of their magnitude in the environment. *in*, Environmental Quality. F. Coulston and F. Korte, Eds. Academic Press, New York. Vol. I, pp. 9-28.

DAILY ACCUMULATED PESTICIDE RESIDUES---MULTP. APPL.

| | |
|---|---|
| Chemical name | Bravo |
| Initial concentration [redacted] | 2.25 lbs ai / A APPLICATION RATE |
| Half-life | 30 |
| A number of application | 3 |
| Application interval | 14 |
| Length of simulation (day) | 28 |

| DAY | RESIDUE (PPM) |
|---|---|
| 0 | 2.25 |
| 1 | 2.19861 |
| 2 | 2.148394 |
| 3 | 2.099324 |
| 4 | 2.051376 |
| 5 | 2.004522 |
| 6 | 1.958739 |
| 7 | 1.914001 |
| 8 | 1.870285 |
| 9 | 1.827568 |
| 10 | 1.785826 |
| 11 | 1.745038 |
| 12 | 1.705181 |
| 13 | 1.666235 |
| 14 | 3.878178 |
| 15 | 3.7896 |
| 16 | 3.703046 |
| 17 | 3.618468 |
| 18 | 3.535822 |
| 19 | 3.455064 |
| 20 | 3.37615 |
| 21 | 3.299039 |
| 22 | 3.223688 |
| 23 | 3.150059 |
| 24 | 3.078112 |
| 25 | 3.007808 |
| 26 | 2.939109 |
| 27 | 2.87198 |
| 28 | 5.056384 |

Maximum [redacted] lbs ai/A

Average [redacted] lbs ai/A

5.056384 MAXIMUM POUNDS AND
2.731296 AVERAGE POUNDS ON THE FIELD DURING THE APPLICAT PERIOD

RUNOFF EQUATION:

2.73 x .02 x 10 x 61ppb = 33.32 ppb OF ai ADDE TO THE POND AFTER EVERY RAINFALL

DAILY ACCUMULATED PESTICIDE RESIDUES---MULTP. APPL.

| | | |
|---|---|---|
| Chemical name ---------- | Bravo | |
| Initial concentration ([redacted]) ----- | 33.32181 | ppb IN POND AFTER |
| Half-life ---------- | 30 | |
| A number of [redacted] RUNOFFS | 3 | EVERY RAIN FALL |
| [redacted] interval OF RUNOFFS | 14 | (RUNOFFS) |
| Length of simulation (day) ----- | 28 | |

| DAY | RESIDUE (PPM) |
|---|---|
| 0 | 33.32181 |
| 1 | 32.56074 |
| 2 | 31.81705 |
| 3 | 31.09035 |
| 4 | 30.38025 |
| 5 | 29.68636 |
| 6 | 29.00832 |
| 7 | 28.34577 |
| 8 | 27.69835 |
| 9 | 27.06572 |
| 10 | 26.44754 |
| 11 | 25.84348 |
| 12 | 25.25321 |
| 13 | 24.67643 |
| 14 | 57.43463 |
| 15 | 56.12282 |
| 16 | 54.84098 |
| 17 | 53.5884 |
| 18 | 52.36444 |
| 19 | 51.16844 |
| 20 | 49.99975 |
| 21 | 48.85775 |
| 22 | 47.74184 |
| 23 | 46.65142 |
| 24 | 45.58589 |
| 25 | 44.54471 |
| 26 | 43.52731 |
| 27 | 42.53314 |
| 28 | 74.8835 |

| | | | |
|---|---|---|---|
| Maximum [redacted] | PPB IN POND | 74.8835 | DURING THE APPLICATION |
| Average [redacted] | PPB IN POND | 40.44967 | PERIOD |