2/2/93

D172853
DPBARCODE (Record No.)

Review No.

109702
Shaughnessey No.

EEB REVIEW

DATE: IN 5/01/92 OUT 02/02/93

CASE #: 037992 RE-REG CASE #:
SUBMISSION #: S409326 LIST A B C D
ID #: 000279-03027

DATE OF SUBMISSION 01/03/92

DATE RECEIVED BY EFED 01/07/92

SRRD/RD REQUESTED COMPLETION DATA 02/01/93

EEB ESTIMATED COMPLETION DATE 02/02/93

SRRD/RD ACTION CODE/TYPE OF REVIEW 575 CON REG FLW-UP DAT REQ HE

MRID NO(S). MRID NO. 421482-01 VOLUMES 1-5

DP TYPE 001 SUBMISSION RELATED DATA PACKAGE

PRODUCT MANAGER NO. PM 13

PRODUCT NAME(S) AMMO 2.5 EC

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

COMPANY NAME FMC CORPORATION

SUBMISSION PURPOSE REVIEW OF CYPERMETHRIN MESOCOSM STUDY
INCLUDE USE (S) COTTON, PECANS, LETTUCE

COMMON CHEMICAL NAME CYPERMETHRIN

\ 3

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
WASHINGTON, D.C. 20460

FEB 2 1993

OFFICE OF
PESTICIDES AND TOXIC
SUBSTANCES

SUBJECT: EXECUTIVE SUMMARY OF CYPERMETHRIN MESOCOSM STUDY REVIEW

FROM: Anthony F. Maciorowski, Chief
Ecological Effects Branch
Environmental Fate and Effects Division

TO: George T. LaRocca, Product Manager 13
Insecticide-Rodenticide Branch
Registration Division

Cypermethrin, a synthetic pyrethroid insecticide registered for use on cotton, pecans, and lettuce, is produced and marketed under a variety of trade names by the FMC Corporation. On the basis of laboratory data and a farm pond study, the Agency required an Aquatic Mesocosm Study for cypermethrin. The purpose of the mesocosm study was to assess by means of comparison between treatments and controls the effects of cypermethrin on biological, chemical, and physical variables. The mesocosm study was conducted between 1989 and 1991 by Wildlife International at their Auburn, Alabama test site. The mesocosm study was reviewed by EEB and a summary of study results are presented below.

Twelve 0.25 acre (0.1 ha) randomly selected mesocosm ponds were used in this study. Six mesocosm ponds were designated as control ponds and six were treated with cypermethrin at one dosage level. This dosage approximated the measured environmental concentration (MEC) determined from a previously completed farm pond study. The mesocosm ponds were filled from a predesignated reservoir to establish uniformity among the ponds as well as establish respective populations of phyto- and zooplankton populations. The source water was circulated continuously through all mesocosm ponds prior to commencement of chemical application to achieve uniformity. Each mesocosm was also inoculated with known species of macrophytes and macroinvertebrates. All mesocosm ponds were allowed to age for one year until they had been allowed to reach as close as possible a mesotrophic stage of development. During the second year of the study (pesticide application year) juvenile bluegill, adult bass and bluegill, and grass carp were stocked into each mesocosm pond. In order to assess growth and mortality of the fish populations, adult bass and bluegill were tagged. The mesocosm study was designed to simulate exposure via spray drift and runoff. Six applications of spray drift (290 mg/pond) and soil slurry (105 mg/pond) containing cypermethrin were loaded into six of the twelve mesocosm ponds at seven day intervals.

Three general categories of variables were assessed: physical, chemical, and biological. The physical variables measured included weather data and water quality parameters (i.e. alkalinity, hardness, pH, etc.). Chemical variables included the measurement of residue levels in delivery mixtures, water, hydrosoil, and fish. Biological measurements were taken from several trophic levels, specifically phytoplankton, zooplankton, macroinvertebrates, and fish. Diversity, abundance, growth, and reproduction were key endpoints by which specific taxa within the trophic categories listed above were individually assessed.

Only three of 12 physical parameters exhibited clear influence on the effects of cypermethrin, pH, Total Organic Carbon, and secchi disk results. The degradation rate of pyrethroids is pH dependent. The somewhat high pH of the water during pesticide application probably accelerated the degradation of cypermethrin. Conjunctively, high TOC and low secchi disk readings in the treatment ponds indicated the presence of high particulate matter to which pyrethroids readily bind. Consequently due to the combination of high particulate and pH, the test organisms possibly received a less than typical exposure to the pesticide.

Residues in hydrosoil, water, and slurry ranged from 2000 to 3500 ng/L. Residues apparently dissipated from the water column within 96h, but were measurable in the hydrosoil up to day 174. It was evident that the association of cypermethrin with sediment and particulate was rather rapid. Residues in the water column reached levels of concern for invertebrates, but were considerably lower than levels of concern for fish. EEB has concern that because of missed and/or erratic residue measurements cross-contamination detection was inadequate.

Key biological effects included reduced diversity of phytoplankton, stimulated periphyton metabolism, decreased abundance of crustaceans, ostracods, and rotifers, reduced macroinvertebrate diversity, a substantial decrease of emergent insects, and poor fish survival.

Overall phytoplankton diversity was reduced slightly. Cypermethrin also influenced only a marginal decrease in phytoplankton abundance. Primary productivity was not effected by cypermethrin. Although marginal, it was generally concluded by EEB that the presumption of risk to phytoplankton was not negated.

Total Periphyton abundance and diversity were not effected by cypermethrin. However when evaluated individually, several algal divisions were marginally effected by cypermethrin. In addition, the hypothesis for increased chlorophyll a content, autotrophic index, gross photosynthesis, and P/R ratio could not be rejected. Likewise the hypothesis for decreased biomass could not be rejected. Therefore while not overwhelming, the investigator failed to refute the presumption of risk to periphyton.

38

The zooplankton community was predominantly microzooplankton (<200 µm) and included protozoa, copepod (nauplii), and rotifers. Smaller numbers of macrozooplankton (>200 µm) were present and were represented by cladocerans and copedpods (copepodids and adults). Cypermethrin had no effect on diversity or littoral zone populations of crustaceans. The hypothesis of decreased Abundance for crustaceans (open water only), copepod nauplii, ostracods, and rotifers could not be rejected. The hypothesis of an increase in protozoan abundance was also not rejected. Several species of zooplankton were present in too few numbers to be adequately analyzed. It was concluded by EEB that the presumption of risk to zooplankton was not negated.

The macroinvertebrate community consisted primarily of ephemeroptera, trichoptera, diptera, and gastropoda. The diversity and total abundance of macroinvertebrates declined during the treatment phase of the study. Specifically, substantial declines were observed in the abundance of tanypodinae and chaoboridae, but only marginal decreases were noted for ephemeroptera and trichoptera. In contrast, the dipterans, ceratopogonidae and chironominae increased substantially, while the odonates and oligochaetes increased only marginally. The hypotheses for either increased or decreased abundance could not be rejected. Gastropods were not effected.

Three of five functional feeding groups were effected by exposure to cypermethrin. The abundance of "collectors" increased (related to increased abundance of oligochaetes) and the number of "predators" (reduction of predatory Diptera and Trichoptera) and "macrophyte piercers" decreased (related to decreased trichopteran abundance).

The mayfly Caenis was selected for life history analysis. It was determined that cypermethrin retarded egg development, effected overall community structure, was toxic to all size classes, and reduced abundance and biomass of mayfly larvae.

Effects on fish were primarily limited to growth, survival, and reproduction. However in this study condition factor and liver condition were also assessed. Water column residues (200 to 300 ng/L) were less than laboratory derived levels of concern.

EEB's presumption of risk to bluegill survival was not negated when tested using b = 0.85. The data failed to reject the hypothesis of either a decrease or increase in number for fish 0 to 4 cm or 5 to 9 cm. Fish Survival was very poor in this study (<50%). EEB separated the fish into three categories based on food size preference. The hypothesis of decreased survival could not be rejected (b=0.85). Survival was twice as high in the juveniles as in adult bluegill. Despite the paucity and indeterminableness of this data, the presumption of risk was not negated.

Bluegill biomass data was inconclusive.

Young-of-the-year (Y-O-Y) fish (viz. 0 to 4 cm) exhibited significantly smaller condition factor values than control groups. Since the immediate availability of preferred food organisms is critical for Y-O-Y fish, the effect on the condition factor of this size class may be linked to direct effects on zooplankton.

Liver condition factor was greater in treated fish than in control fish. The increase in treated fish was considered to be adaptive rather than a toxic response. The livers of analyzed bluegill were otherwise healthy and free of gross abnormalities.

Bluegill reproduction was not determinable, and therefore did not negate the presumption of risk to the reproductive capacity of bluegill.

Bass abundance decreased and may be treatment related. The survival of bass was markedly lower than for bluegill. In contrast, the biomass of the bass population was greater than for bluegill. The increase in biomass of treated bass may have been cypermethrin related.

Due to the inadequacy of the data, bass condition factor could not be assessed at this time. Similarly to the bluegill, bass experienced an increase in liver condition factor. Again this phenomenon is attributed to an adaptive response not a toxic response.

Since bass only spawned in one pond and only a total of 17 Y-O-Y were found, EEB could not adequately analyze bass reproduction. EEB questions the adequacy of this test system to successfully support fish populations. EEB considered the entire study to be suspect since inferences on the health, growth, survival, and reproduction of the top predator were obfuscated.

In summary, due to direct or indirect chemical effects as determined by the testing of the null hypothesis, or to the lack of adequate data for analysis, EEB concluded that the Investigator failed to unquestionably refute the presumption of adverse effect due to typical exposures to the cotton pyrethroid insecticide, cypermethrin.

5 x