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DATA EVALUATION RECORD

STUDY 3

CHEM 060101 | Thiabendazole | §164-1, -5

FORMULATION--14--FLOWABLE CONCENTRATE (F1C)

STUDY ID 43187203

Jacobson, B. 1994b. Terrestrial field dissipation for thiabendazole in soybeans. Laboratory ID No. 618-360-92678. Merck Study No. 92678. Unpublished study performed by Research Options, Inc., Montezuma, GA, and ABC Laboratories, Inc., Columbia, MO; and submitted by Merck & Company, Inc., Three Bridges, NJ.

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CONCLUSIONS:

Field Dissipation - Terrestrial
Field Dissipation - Long Term

1. This study can be used toward the fulfillment of data requirements.

2. Thiabendazole [2-(thiazol-4-yl)benzimidazole] dissipated with calculated half-lives of 833 days from the upper 6 inches of vegetated (soybeans) plots and 1093 days from bareground plots of sandy loam soil following a single application of thiabendazole (Mertect 340-F; 3.8 lb ai/gallon flowable concentrate) at 0.96 lb ai/A in August 1989. In the 0- to 6-inch soil depth of the vegetated

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plot, thiabendazole was $\leq$0.04 ppm immediately posttreatment, increased to 0.05-0.26 ppm (average 0.11-0.16 ppm) at 84 through 182 days, and averaged 0.06 ppm at 362 and 543 days, 0.12 ppm at 721 days, and 0.05-0.06 ppm at 906 through 1082 days. In the 0- to 6-inch soil depth of the bareground plot, thiabendazole was 0.16-0.20 ppm immediately posttreatment, ranged from 0.06 to 0.26 ppm between 7 and 721 days (average 0.13-0.17 ppm) with no clear pattern of decline, and averaged 0.08-0.10 ppm at 906 and 992 days, and 0.16 ppm at 1082 days. Thiabendazole was not detected below the 6-inch soil depth in either plot. The degradate, benzimidazole was not detected (0.01 ppm) at any sampling interval at any depth.

3. This study is acceptable and contributes toward the fulfillment of EPA Data Requirements for Registering Pesticides by providing information on the dissipation of the flowable concentrate formulation of thiabendazole in vegetated (soybeans) and bareground plots of sandy loam soil in Georgia that were treated with thiabendazole [2-(thiazol-4-yl)benzimidazole; Mertect 340-F; 3.8 lb ai/gallon flowable concentrate] at 0.96 lb ai/A.

4. This study may be used to support the registration of the flowable concentrate formulation of thiabendazole at an application rate of 0.96 lb ai/A. Acceptable data have been provided on the dissipation of the flowable concentrate formulation of thiabendazole on wheat in Washington and soybeans in Illinois (MRIDs 43187201 and 43187202, Studies 1 and 2 of this submission, respectively). For complete fulfillment of the terrestrial field dissipation requirement, acceptable data are required for each <u>additional</u> formulation type at two typical use sites.

<u>Ancillary Study - Freezer Storage Stability</u>

1. Freezer storage stability studies are not specifically required by Subdivision N guidelines.

2. Thiabendazole [2-(thiazol-4-yl)benzimidazole] did not degrade in sandy loam soil during 1171 days of incubation in polyethylene bottles at -20 C. Thiabendazole averaged 106% of the applied immediately posttreatment, and 86.3-99.1% of the applied at 28 through 1171 days with no discernable pattern of decline. In contrast, the degradate benzimidazole (1,3-benzodiazole) degraded slowly under similar conditions, averaging 89.5-100% of the applied through 180 days posttreatment with no discernable pattern of decline, and 85.2-90.3% at 364 through 1171 days.

3. This study is scientifically sound and provides information on the stability of thiabendazole and benzimidazole in soil stored for up to 1171 days at -20 C.

4. No additional information on the stability of thiabendazole and benzimidazole in soil during 3.2 years of frozen storage is required at this time. Additional data on the stability of these compounds in

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frozen soil have been provided (MRIDs 43187201 and 43187202, Studies 1 and 2 of this submission, respectively).

METHODOLOGY:

Field Dissipation - Terrestrial
Field Dissipation - Long Term

Thiabendazole [2-(thiazol-4-yl)benzimidazole; Mertect 340-F; 3.8 lb ai/gallon flowable concentrate, Merck & Company] was applied once, at 0.96 lb ai/A, to two plots of sandy loam soil (0- to 12-inch depth; 77% sand, 6% silt, 17% clay, 0.78% organic matter, pH 6.7, CEC 6.1 meq/100 g) located near Pinehurst, Georgia. One plot (105 x 60 feet) had been planted to soybeans on May 30, 1989; the second plot (45 x 60 feet) was unvegetated. The plots were treated on August 4, 1989, when the soybeans were in the early pod-fill growth stage, using a tractor-mounted boom spray applicator. An untreated plot (35 x 60 feet) of soybeans located 50 feet west of the nearest treated plot was maintained as a control. The soybeans in both the treated and control plots were mowed to the soil surface on October 17, 1989; the plots were left fallow and untilled for the remainder of the study. The plots were sprinkler-irrigated as needed to maintain the crop.

For sampling purposes, the treated and control plots were divided into 3- x 7- or 3- x 3-foot subplots. Soil samples were collected prior to and immediately after treatment, and at 1, 7, 14, 28, 56, 84, 129, 182, 272, 362, 452, 543, 633, 721, 812, 906, 992, and 1082 days. At each sampling interval, fifteen and five soil cores were randomly collected from the treated and control plots, respectively. Cores were collected to a depth of 48 inches in the treated soybean and control plots, and 12 inches in the treated bareground plot. For the treated soybean plot, soil from the 0- to 6-inch depth was collected from within an excavation template (4-inch id) using a zero-contamination hand-held soil probe (0.9-inch id). The remaining soil within the template was excavated to the 6-inch depth, and a 6- to 48-inch soil core was collected through the surface excavation using a zero-contamination hydraulic probe (2-inch id). For the treated unvegetated plot, the 0- to 12-inch soil layer was collected using a zero-contamination hand-held probe (0.9-inch id). For the control plot, the 0- to 48-inch cores were collected in their entirety using a zero-contamination hydraulic probe (2-inch id). Following sampling, the sample holes were filled with uncontaminated soil and marked to prevent resampling. The soil cores were stored in an insulated box in the field, then frozen at the field cooperator facilities, and were shipped to and stored frozen (approximately -20 C) at the analytical laboratory until analysis.

At the analytical laboratory, the soil cores were divided into 0- to 6-, 6- to 12-, 12- to 18-, 18- to 24-, 24- to 30-, 30- to 36-, and 36- to 48-inch segments. The fifteen soil cores from each treated plot were composited by sampling interval and soil depth into a three samples (5 cores/sample); the five cores collected from the control plot at each sampling interval were composited into a single sample. The soil samples were finely ground and homogenized with dry ice in a grinding mill, then returned to the freezer until analysis.

Subsamples (20 g) of the composited soil samples were extracted with 1 N methanolic KOH by shaking for 1 hour; the samples were centrifuged, the supernatants were decanted, and the extracted soils were further extracted with 6 N HCl:dimethylformamide (1:1) by shaking for 1 hour. After the second extraction, the samples were filtered, and the extraction bottle and soil marc were rinsed with additional solvent. The KOH and HCl:dimethylformamide extracts were combined, diluted sequentially with 4 N NaOH and 2 N Na_2CO_3 (approximate ratio 2:1:1, v:v:v), and then partitioned twice with ethyl acetate. The ethyl acetate extracts were filtered and combined, and the combined solution was evaporated to near dryness on a rotoevaporator at 30-40 C. The concentrate was diluted with 10% acetic acid in water, and analyzed for thiabendazole and its degradate benzimidazole by reverse-phase HPLC using a Supelco LC-8-DB column eluted with water:methanol (60:40 for thiabendazole, 70:30 for benzimidazole); the column was equipped with fluorometric detection. Recovery efficiencies from soil samples fortified during analysis of the field samples at 0.01-1.0 ppm with either thiabendazole or benzimidazole ranged from 58-107 and 64-115% of the applied, respectively (average recoveries 83 ± 11% and 84 ± 11%, respectively; Table M-2). Recovery efficiencies from soil samples fortified during analysis of the field spike samples were 79-83% of the applied for thiabendazole and 64-85% for benzimidazole (Table S-1). The method detection limit was 0.01 ppm.

Ancillary Study - Freezer Storage Stability

Samples (20 g) of soil from the control plot were treated with either 0.20 ppm of thiabendazole [2-(thiazol-4-yl)benzimidazole; purity 99.8%, Merck & Company], 0.20 ppm of benzimidazole (1,3-benzodiazole, purity 98%, Aldrich Chemical Company), or 0.20 ppm each of thiabendazole and benzimidazole. The treated soils were stored frozen at -20 C in polyethylene bottles for up to 1171 days posttreatment; samples were collected at 0, 28, 90, 180, 364, 730, and 1171 days posttreatment. The soils were extracted and analyzed for thiabendazole and benzimidazole as previously described.

DATA SUMMARY:

Field Dissipation - Terrestrial
Field Dissipation - Long Term

Thiabendazole [2-(thiazol-4-yl)benzimidazole] dissipated with registrant-calculated half-lives of 833 days from the upper 6 inches of vegetated (soybeans) plots and 1093 days from bareground plots of sandy loam soil following a single application of thiabendazole

(Mertect 340-F, 3.8 lb ai/gallon flowable concentrate) at 0.96 lb ai/A in August 1989, when the soybeans were in the early pod-fill growth stage (Tables 8 and 9). Thiabendazole was not detected below the 6-inch soil depth in either plot. The degradate, benzimidazole, was not detected (0.01 ppm) at any sampling interval at any depth.

In the 0- to 6-inch soil depth of the vegetated plot, thiabendazole was ≤0.04 ppm immediately posttreatment, increased to 0.05-0.26 ppm (average 0.11-0.16 ppm) at 84 through 182 days, and averaged 0.06 ppm at 362 and 543 days, 0.12 ppm at 721 days, and 0.05-0.06 ppm at 906 through 1082 days (Tables A-1 and A-3). Thiabendazole was not detected (0.01 ppm) below the 6-inch soil depth at any sampling interval. Benzimidazole was not detected (0.01 ppm) at any sampling interval at any depth.

In the 0- to 6-inch soil depth of the bareground plot, thiabendazole was 0.16-0.20 ppm immediately posttreatment, ranged from 0.06 to 0.26 ppm between 7 and 721 days (average 0.13-0.17 ppm) with no clear pattern of decline, and averaged 0.08-0.10 ppm at 906 and 992 days, and 0.16 ppm at 1082 days (Tables A-2 and A-4). Thiabendazole was not detected (0.01 ppm) below the 6-inch soil depth at any sampling interval. Benzimidazole was not detected (0.01 ppm) at any sampling interval at any depth.

During the study, the air temperatures ranged from 19 to 102 F; average soil temperatures (4-inch depth) ranged from 38 to 106 C. Rainfall plus irrigation totaled 1.20 inches by day 13 and 5.25 inches by day 27. During the 1082-day study, precipitation totaled 138.7 inches, and irrigation totaled 27.0 inches. The elevation of the test plot was 380 feet, the slope of the test plot was ≤2%, and the depth to the water table was 100-150 feet. There was no subsurface drainage.

Ancillary Study - Freezer Storage Stability

Thiabendazole [2-(thiazol-4-yl)benzimidazole] did not degrade in sandy loam soil that was treated with thiabendazole (purity 99.8%) at 0.20 ppm and incubated in polyethylene bottles at -20 C for up to 1171 days. Thiabendazole averaged 106% of the applied immediately posttreatment, and 86.3-99.1% of the applied at 28 through 1171 days with no discernable pattern of decline (Table S-2).

Benzimidazole (1,3-benzodiazole) degraded slowly in sandy loam soil that was treated with benzimidazole (purity 98%) at 0.20 ppm and incubated in polyethylene bottles at -20 C for up to 1171 days. Benzimidazole averaged 89.5-100% of the applied through 180 days posttreatment with no discernable pattern of decline, and 85.2-90.3% at 364 through 1171 days (Table S-2).

COMMENTS:

1. Many of the soil samples were analyzed several times during the course of the study. The length of storage prior to analysis ranged from 29 to approximately 1141 days (Tables A-6 and A-7).

2. To determine the stability of thiabendazole and benzimidazole during shipping and handling, on 1/12/92 two 20-g samples of control soil were treated with 4 ug of thiabendazole, and two additional samples were treated with 4 ug of benzimidazole. The treated soil samples were capped and frozen, then shipped in a freezer truck and stored frozen until analysis on 1/14/93 (370 days posttreatment). Recoveries from the duplicate samples were 90 and 97% of the applied for thiabendazole, and 94 and 102% for benzimidazole.

   All soil samples were shipped to the analytical laboratory in a freezer truck.

3. To confirm the application rate, five filter paper discs (15-cm diameter) were placed in each treated plot prior to application. The filter paper was collected and frozen immediately posttreatment. The five filter paper discs in the vegetated treated plot contained 66, 75, 82, 88, and 91% of the theoretical application (average 80 ± 10%). The five filter paper discs in the bareground treated plot contained 54, 56, 62, 67, and 113% of the theoretical application (average 70 ± 24%). Also prior to application, five aliquots of the spray solution were collected. The spray solution contained 66-72% of the theoretical concentration (average 69 ± 2%).

4. In the 3 years prior to the initiation of the study, the test plots were treated with chlorothalonil, metribuzin + chlorimuron-ethyl, ethalfluralin, alachlor, paraquat, dichlorprop, and 2,4-DB. The test plots were planted to watermelon in 1986, wheat/soybeans in 1987, and peanuts in 1988.

5. To control grass and broadleaf weeds during the study, the test plots were treated with paraquat and glyphosate.

6. For the freezer storage stability study, all samples were not treated on the same date. Samples collected between 0 and 6 months posttreatment were treated on 12/13/90, and samples collected between 12 and 40 months were treated on 9/26/89. The study author did not provide a reason why all samples were not treated on the same date.

7. Additional data have been provided on the stability of these compounds in frozen soil (MRIDs 43187201 and 43187202, Studies 1 and 2 of this submission, respectively). In MRID 43187201, thiabendazole was stable and benzimidazole degraded slowly in loamy sand soil that was treated with thiabendazole or benzimidazole at 0.2 ppm and incubated in polyethylene bottles at -20 C for up to 1120 days. Thiabendazole averaged 97-102% of the applied through 3 months posttreatment, 89-91% at 6 through 18 months, and 102% at 3 years.

Benzimidazole averaged 102% of the applied immediately posttreatment, 93% at 0.5 months, 90% at 1 month, 78-80% at 3 through 12 months, 72% at 18 months, and 54% at 3 years. In MRID 43187202, thiabendazole was stable and benzimidazole degraded slowly in sandy loam soil that was incubated at -20 C for up to 1219 days. Thiabendazole averaged 93-99% of the applied through 730 days posttreatment, and 101% at 1219 days. Benzimidazole averaged 100-103% of the applied through 90 days posttreatment, 89-95% at 180 through 730 days with no discernable pattern of decline, and 90% at 1219 days.

8. Based on the textural analysis of the 0- to 12-inch soil depth, the soil described as a Dothan loamy sand soil (77% sand, 6% silt, 17% clay) in this study is, in fact, a sandy loam soil according to the USDA soil textural classification system.

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