DATA EVALUATION RECORD

STUDY 4

CHEM 129112 Trifloxystrobin §161-3
CAS No. 141517-21-7
FORMULATION--00--ACTIVE INGREDIENT

STUDY ID 44496729
Cohen, S. 1997. Photodegradation of [phenyl(B)-U-^{14}C]-CGA-279202 on a loamy sand under artificial sunlight irradiation. PERL Study No.: ME 9500196. Novartis Study No.: 31-95. Unpublished study performed by Pittsburgh Environmental Research Laboratory, Inc., Pittsburgh, PA; and submitted by Novartis Crop Protection, Inc., Greensboro, NC.

DIRECT REVIEW TIME = 42 Hours

REVIEWED BY:	M. T. Holdsworth, M.S.	Signature:	Mark Holdsworth
TITLE:	Scientist	Date:	3/23/99
EDITED BY:	C. A. Little, Ph.D.	Signature:	Paul Clothier for C.A.Little
TITLE:	Sr. Scientist/Asst. Project Manager	Date:	3/23/99
APPROVED BY:	P. H. Howard	Signature:	Philip H Howard
TITLE:	Project Manager	Date:	3/22/99
ORG:	Syracuse Research Corp. Arlington, VA 22202		
TEL:	703/413-9369		

APPROVED BY:	Raanan Bloom
TITLE:	Environmental Scientist
ORG:	ERB III/EFED/OPP
TEL:	703/305-6464

SIGNATURE:

CONCLUSIONS

Degradation - Photodegradation on Soil

1. This study is scientifically valid and provides useful information on the photodegradation of trifloxystrobin on soil. However, a photolytic half-life could not be accurately determined because the parent compound degraded rapidly with similar half-lives in the irradiated and dark control soils. Photolytic degradation was indicated by the differences in the degradates and the levels of the degradates observed between the two systems. The major degradate CGA-321113 was observed to be relatively more stable in the dark control soils, indicating that photodegradation of this major degradate may have occurred in the irradiated soils.

2. This study meets Subdivision N Guidelines for the fulfillment of EPA data requirements on photodegradation on soil.

3. Uniformly phenyl ring-labeled [^{14}C]trifloxystrobin, applied at a nominal application rate of 2.8 ppm, degraded rapidly with respective half-lives of 2.1 and 2.3 days (0-2 day data) in irradiated and dark control samples of loamy sand soil maintained at 75% of 0.33 bar moisture content and incubated in darkness at 25 ± 1 °C for up to 30 days. Biphasic degradation was observed in both systems, with the rapid phase occurring through 2 days posttreatment. However, due to similar and rapid rates of degradation observed in the irradiated and dark control soils, the registrant-calculated photolytic half-life of 18.2 days was of questionable worth. Photolytic degradation was indicated by the differences in the degradates and the levels of the degradates observed between the two systems. The major degradate CGA-321113 was observed to be relatively more stable in the dark control soils, indicating that photodegradation of this major degradate may have occurred in the irradiated soils. All data, reported as percentages of the applied radioactivity, represent percentages of the nominal application rate. Based on HPLC analysis, the parent compound was initially present in the irradiated soil at 97.5% of the applied radioactivity, decreased to 49.5% by 2 days posttreatment and to 28.2% by 14 days, and was 12.7% at 30 days. In the dark control soil, the parent compound was initially present at 96.8% of the applied radioactivity, decreased to 53.1% by 2 days posttreatment and to 26.9% by 14 days, and was 11.5% at 30 days. In the irradiated soil, the major degradate CGA-321113 was first detected at a maximum of 17.2% of the applied radioactivity (2 days), decreased to 13.9% by 21 days, and was 16.2% at 30 days. In contrast, in the dark control soil, the major degradate CGA-321113 was first detected at 43.9% of the applied radioactivity (2 days), was a maximum of 72.3% (7 days) and was 56.1% at 30 days. In the irradiated soil, the major degradate CGA-373466 was first detected at 12.3% of the applied radioactivity (2 days) and was a maximum of 24.8% at 30 days. In contrast, in the dark control soil, the minor degradate CGA-373466 was first detected at a maximum of 3.8% (individual replicate) of the applied radioactivity (2 days) and was 0.7% (individual replicate) at 30 days. Radiolabeled residues comprised of CGA-357261 and NOA-

409480 were present in the irradiated soils at a maximum of 18.5% of the applied radioactivity (21 days). In contrast, CGA-357261 and NOA-409480 were detected in the dark control soil at a maximum of 2.5% (individual replicate) of the applied radioactivity (2 days). In the irradiated soil, the minor degradates CGA-357262 and CGA-331409 were maximums of 4.1% (21 days) and 3.4% (14 days) of the applied radioactivity, respectively. In the dark control soil, the minor degradate CGA-357276 was a maximum of 1.9% (individual replicate) of the applied radioactivity (30 days). In the dark control soil, an unidentified major degradate was a maximum of 13.6% of the applied at 30 days. In the irradiated soil, $^{14}CO_2$ accounted for 1.3% of the applied radioactivity at 30 days; [^{14}C]organic volatiles were 9.4% of the applied at 30 days. In the dark control soil, $^{14}CO_2$ accounted for 2.7% of the applied radioactivity at 30 days; [^{14}C]organic volatiles were 0.6% of the applied at 30 days.

METHODOLOGY

This study was conducted using uniformly phenyl ring-labeled [^{14}C]trifloxystrobin labeled on the β-ring. An additional study (MRID 44496728) was conducted using the α-labeled parent compound.

Subsamples (8 g wet weight) of preincubated (10 days in darkness at 75% of 0.33 bar soil moisture content; p. 16), sieved (2 mm) loamy sand soil (81% sand, 10% silt, 9% clay; 0.5% organic matter; pH 7.3; CEC 3.9 meq/100 g; Table II, p. 37) were weighed onto individual stainless steel plates to form a 2-mm thick layer (p. 18). Soils were treated by syringe with uniformly phenyl ring-labeled [^{14}C]trifloxystrobin {CGA-279202; (E,E)-α-(methoxyimino)-2-[[[[1-[3-(trifluoromethyl)phenyl]ethylidene]amino]oxy]methyl] benzeneacetate; radiochemical purity 97.9%, specific activity 46.0 μCi/mg; pp. 14, 53}, dissolved in acetonitrile, at a nominal application rate of 2.8 ppm (pp. 18, 27). The samples were placed in an incubation chamber covered with a quartz glass plate and equipped with a cooling jacket connected to a circulating water bath to maintain the temperature at 25 ± 1 °C (p. 16; Figure 4, p. 62). The moisture content of the soil was continuously monitored by a computer which would automatically trigger a water spray cycle when the soil moisture content fell below 75% FMC at 0.33 bar (p. 16). Soil temperature was monitored by a computer and maintained by a temperature controller and a water circulator. Dark control samples were covered with a stainless steel cover and incubated in a similar manner, but without the addition of moisture during the incubation period (pp. 17, 27). To capture volatiles, humidified air was pumped through the chamber into two toluene traps, two ethylene glycol traps, two 2 *N* KOH traps, polyurethane plugs, and activated charcoal (pp. 19, 28). Volatiles were collected for analysis and replaced with fresh traps at each sampling interval. Samples were irradiated for up to 30 days on a 12-hour light/dark cycle using a xenon arc lamp equipped with a filter to remove wavelengths of <290 nm (p. 17; Figure 4, p. 62). The light intensity of the artificial light source (measured only at 280 nm, 365 nm and 440 nm at 0 and 30 days

posttreatment) was similar at the initiation and termination of the study and was a mean of 2.6-2.8 x 10^{-2} W/m^2 at each measured wavelength over the incubation period (Table III, p. 38). The nominal intensity of the artificial light source was 765 W/m^2. Total radiation was not reported. A comparison graph of the artificial light with natural sunlight (at noon in June in Phoenix, AZ) was presented in Figure 5 (p. 63); plotted data indicated similar total irradiance (across the visible light range) between the two light sources. Duplicate subsamples of irradiated and dark control soil were removed for analysis at 0, 2, 7, 14, 21 and 30 days posttreatment (p. 19).

At each sampling interval, humidified air was pumped at an increased flow rate for 10 minutes through individual test systems and into volatile traps to purge the systems of volatiles. Soil samples were extracted three times by sonicating with acetonitrile: acidified water (glacial acetic acid, pH 4; 80:20, v:v) and centrifuged (p. 21). The supernatants were decanted and combined, and duplicate aliquots were analyzed for total radioactivity by LSC; the limit of detection was 75 dpm (p. 22). Soil samples collected after 2 days posttreatment were further extracted by sonicating with acetone:2 M acetic acid (80:20, v:v) and centrifuged. Duplicate aliquots of the supernatant were analyzed for total radioactivity by LSC. Aliquots of both extracts were filtered, concentrated by rotary evaporation, and analyzed by LSC. Aliquots of the concentrated extracts were analyzed by HPLC (Alltech Lichrosorb RP-18 column) using a mobile phase gradient of aqueous 1% formic acid:acetonitrile (100:0 to 35:60 to 0:100, v:v) with UV (250 nm) and radioactive flow detection; the limit of detection was 500 dpm (p. 20; Table V, p. 40). Samples were co-chromatographed with nonradiolabeled reference standards. Eluate fractions were collected at one-minute intervals and analyzed for total radioactivity by LSC; mean column recovery was 102.3 ± 5.2% (p. 20). To confirm compound identities, the extracts were further analyzed by two-dimensional TLC on silica gel plates developed sequentially with in toluene:chloroform:ethyl ether:formic acid (60:34:5:1, v:v:v:v) and toluene:ethyl acetate:acetic acid (70:30:1.5, v:v:v); radioactive areas on the TLC plates were quantified by radioimage scanning (p. 21). Samples were co-chromatographed with nonradiolabeled reference standards which were visualized with UV (254 nm) light. The concentrated soil extracts were analyzed by TLC as previously described; radioactive areas were scraped from the plates, mixed with water, and analyzed by LSC; mean column recovery was 111.1 ± 5.6%. Post-extracted soil subsamples were analyzed for total radioactivity by LSC following combustion; combustion efficiency was 94.7% (p. 20).

At each sampling interval, duplicate aliquots of the toluene, ethylene glycol and KOH volatile trapping solutions were analyzed for total radioactivity by LSC (p. 21). An aliquot from the toluene trap at 12 days posttreatment was analyzed by TLC as previously described. The sample was further analyzed by HPLC and a degradate (CGA-107170) was identified in the solution (p. 31). The analytical methods utilized for analysis of the polyurethane plugs and activated charcoal were not specified.

To confirm the viability of the soil, selected irradiated (days 0 and 30) and dark control (day 30) soil subsamples were extracted by vortexing with sterile 0.1 M $CaCl_2$ solution (p. 18). The supernatants were decanted, serially diluted, and plated on agar for approximately 48 hours at 25°C. Viability was evaluated by enumerating total colony forming units (CFU) of bacteria and actinomycetes; microbial data indicated that the soils were viable at the initiation and termination of the study (Table VII, p. 42).

DATA SUMMARY

Uniformly phenyl ring-labeled [^{14}C]trifloxystrobin (radiochemical purity 97.9%), applied at a nominal application rate of 2.8 ppm, degraded rapidly with respective half-lives of 2.1 and 2.3 days (0-2 day data) in irradiated and dark control samples of loamy sand soil maintained at 75% of 0.33 bar moisture content and incubated at 25 ± 1°C for up to 30 days (Figures 10, 11; pp. 68, 69). Biphasic degradation was observed in both systems, with the rapid phase occurring through 2 days posttreatment. However, due to similar and rapid rates of degradation observed in the irradiated and dark control soils, the registrant-calculated photolytic half-life of 18.2 days was of questionable worth. Photolytic degradation was indicated by the differences in the degradates and the levels of the degradates observed between the two systems. The major degradate CGA-321113 was observed to be relatively more stable in the dark control soils, indicating that photodegradation of this major degradate may have occurred in the irradiated soils. All data, reported as percentages of the applied radioactivity, represent percentages of the nominal application rate. Based on HPLC analysis, the parent compound was initially present in the irradiated soil at 97.5% of the applied radioactivity, decreased to 49.5% by 2 days posttreatment and to 28.2% by 14 days, and was 12.7% at 30 days (Table XI, p. 46). In the dark control soil, the parent compound was initially present at 96.8% of the applied radioactivity, decreased to 53.1% of the applied by 2 days posttreatment and to 26.9% by 14 days, and was 11.5% at 30 days (Table XIII, p. 48). In the irradiated soil, the major degradate

(E,E)-α-(methoxyimino)-2-[[[[1-[3(trifluoromethyl)phenyl]ethylidene]amino] oxy]methyl]benzeneacetic acid (CGA-321113)

was first detected at a maximum of 17.2% of the applied radioactivity at 2 days posttreatment, was 13.9% at 21 days, and was 16.2% at 30 days; data were variable between replicates from 2 to 30 days posttreatment. The major degradate

(Z,E-)-α-(methoxyimino)-2-[[[[1-[3-(trifluoromethyl)phenyl]ethylidene]amino] oxy]methyl]benzeneacetic acid (CGA-373466)

was first detected at 12.3% of the applied radioactivity at 2 days posttreatment, was 15.8-16.9% at 7-21 days, and was a maximum of 24.8% at 30 days. Radiolabeled residues

comprised of CGA-357261 and NOA-409480 were first detected at 13.6% of the applied radioactivity at 2 days posttreatment, were a maximum of 18.5% at 21 days, and were 9.4% at 30 days. The minor degradate (Z,Z)-α-(methoxyimino)-2-[[[[1-[3-(trifluoromethyl)phenyl]ethylidene]amino]oxy]methyl]benzeneacetic acid, methyl ester (CGA-357262) was first detected at 2.1% of the applied radioactivity at 2 days posttreatment, was a maximum of 4.1% at 21 days, and was 3.2% at 30 days. The minor degradate (E,Z)-α-(methoxyimino)-2-[[[[1-[3-(trifluoromethyl)phenyl]ethylidene]amino]oxy]methyl]benzeneacetic acid, methyl ester (CGA-331409) was first detected at 1.7% of the applied radioactivity at 2 days posttreatment, was a maximum of 3.4% at 14 days, and was 1.6% at 30 days. Nonextractable [^{14}C]residues were a maximum of 2.2% of the applied radioactivity at 14 days posttreatment (Table VIII, p. 43). Evolved $^{14}CO_2$ accounted for 1.3% of the applied radioactivity at 30 days posttreatment (Table X, p. 45). Cumulative [^{14}C]organic volatiles accounted for 9.4% of the applied radioactivity at 30 days posttreatment.

In the dark control soil, the major degradate

CGA-321113

was first detected at 43.9% of the applied radioactivity at 2 days posttreatment, was a maximum of 72.3% at 7 days and was 56.1% at 30 days (the next and final sampling interval). An unidentified major degradate, designated Unknown No. 4, was first detected at 1.1% of the applied radioactivity at 14 days posttreatment, was 1.3% at 21 days, and was a maximum of 13.6% at 30 days. The minor degradate CGA-373466 was first detected at a maximum of 3.8% (individual replicate) of the applied radioactivity at 2 days posttreatment and was 0.7% (individual replicate) at 30 days. Radiolabeled residues comprised of CGA-357261 and NOA-409480 were first detected at a maximum of 2.5% (individual replicate) of the applied radioactivity at 2 days posttreatment and were detected only at one other sampling interval (21 days), at 1.1%. The minor degradate CGA-357276 was detected once, at 1.9% (individual replicate) of the applied radioactivity at 30 days posttreatment. An unidentified minor degradate was detected once at 2.1% (individual replicate) at 30 days posttreatment. Nonextractable [^{14}C]residues were a maximum of 6.2% at 30 days (Table IX, p. 44). Evolved $^{14}CO_2$ accounted for 2.7% of the applied radioactivity at 30 days posttreatment; [^{14}C]organic volatiles were 0.6% of the applied at 30 days.

Material balances were 82.1-99.4% and 97.3-103.8% of the applied radioactivity for the irradiated and dark control soils, respectively (Tables VIII, IX; pp. 43, 44). The reviewer noted that there was a pattern of loss of material balance throughout the incubation period in the irradiated samples (see Comment #2). Material balances were initially at 99.2% of the applied radioactivity, decreased to 96.6% by 7 days, and was 85.8% by 30 days.

COMMENTS

1. It could not be determined whether photodegradation of the parent compound actually occurred because the parent degraded rapidly (≤53.1% remained as parent at 2 days posttreatment in both systems) and with similar half-lives in the irradiated and dark control soils. Therefore, the registrant-calculated photolytic half-life of 18.2 days was of questionable worth. Photolytic degradation was indicated by the differences in the degradates and the levels of the degradates observed between the two systems. The major degradate CGA-321113 was observed to be relatively more stable in the dark control soils, indicating that photodegradation of this major degradate may have occurred in the irradiated soils.

2. The reviewer notes that material balances for the irradiated soils declined throughout the incubation period from an initial maximum of 99.2% of the applied radioactivity to 93.1-93.2% of the applied by 7-14 days posttreatment and to a minimum of 85.8% by 30 days (Table VIII, p. 43). A decline was not observed in the dark control soils.

3. The reviewer notes that the parent compound (labeled on the β-ring) degraded less rapidly in the current study than was observed in an additional photodegradation on soil study (MRID 44496728) which was conducted using the α-labeled parent compound; soil characterization data indicated that the same soil type was utilized in the studies. In the current study (β-label), the parent compound was present in the irradiated and dark control soils at 49.5% and 53.1% of the applied radioactivity, respectively, at 2 days posttreatment and decreased to 12.7% and 11.5%, respectively, by 30 days. In the α-label study, the parent compound was present in the irradiated and dark control soils at 19.0% and 18.9% of the applied radioactivity, respectively, at 2 days posttreatment and decreased to 1.1% (21 days) and 2.9% (30 days), respectively, by the last sampling interval in which it was detected. Additionally, the major degradate CGA-321113 (which was more stable in each dark control compared with the irradiated soils) was present in the dark control samples of the α-label study at a greater percentage (80.4%) of the applied radioactivity at 30 days posttreatment compared with the percentage (56.1%) observed in the β-label study at that sampling interval. It was unclear to the reviewer why the rate and pattern of degradation would be dissimilar between the two studies which utilized similar experimental methods and differed only in the location of the radiolabel on the parent compound. Clarification by the registrant is necessary.

4. A major unidentified degradate was detected in the dark control soils at 13.6% of the applied radioactivity at 30 days posttreatment (Table XIII, p. 48). Subdivision N Guidelines require that degradates present at ≥10% of the applied radioactivity be identified.

5. The soil utilized in this study was a loamy sand soil collected from North Carolina. The reviewer notes that a loamy sand soil from North Carolina, with generally similar

characteristics, was also utilized in an aerobic soil metabolism study (MRID 44496732). The soil utilized in another aerobic soil metabolism study (MRID 44496731) was a loam soil collected from North Dakota. The soil utilized in a third aerobic soil metabolism study (MRID 44496730) was a sandy loam soil collected from North Carolina. Since soil series names were not reported in the studies, the reviewer could not confirm that the soil utilized in the current study was the same type of soil used in one of the metabolism studies. Clarification by the registrant is necessary.

6. Only chemical structure diagrams with 'CGA' names were provided in this study. Full chemical names associated with the chemical structures were obtained from a previously submitted terrestrial field dissipation study (MRID 44496808). In future studies submitted to the EPA, chemical names of all confirmed degradates should be reported.

7. The reviewer notes that r^2 values of 1 (for both the irradiated and dark control soils) were reported for the regressions depicted in Figure 11 (p. 69). However, the data used to determine the registrant-calculated half-lives consisted of only two points, thereby ensuring r^2 values of 1. Generally, a minimum of four data points is necessary for the valid determination of a half-life.

8. The proposed metabolic pathway for the degradation of trifloxystrobin is presented in Figure 32 (p. 90).

Page _____ is not included in this copy.

Pages 9 through 135 are not included.

The material not included contains the following type of information:

_____ Identity of product inert ingredients.

_____ Identity of product impurities.

_____ Description of the product manufacturing process.

_____ Description of quality control procedures.

_____ Identity of the source of product ingredients.

_____ Sales or other commercial/financial information.

_____ A draft product label.

_____ The product confidential statement of formula.

_____ Information about a pending registration action.

✓ FIFRA registration data.

_____ The document is a duplicate of page(s) _____.

_____ The document is not responsive to the request.

The information not included is generally considered confidential by product registrants. If you have any questions, please contact the individual who prepared the response to your request.