

(8-26-93)

DATA EVALUATION RECORD

STUDY 5

CHEM 061601 Paraquat dichloride §164-1

FORMULATION--15--SOLUBLE CONCENTRATE (SC/L)

DP Barcode D164623.

STUDY ID 41293202

Earl, M., L. Anderson, and G.T. Muir. 1989. Paraquat short term field soil dissipation under in-use conditions in the USA (Sussex County, Delaware) during 1987-89; analytical report. Unpublished study performed and submitted by ICI Americas, Inc., Wilmington, DE.

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26 AUG 1993

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CONCLUSIONS:

Dissipation -- Terrestrial field

1. This study can be used towards the fulfillment of data requirements.
2. Paraquat is inactivated (dissipates) by rapidly binding to soil but is resistant to degradation; although bound paraquat does not appear to be available under environmental conditions, it can be extracted by reflux with strong acid. Paraquat degraded very slowly from a plot of loamy sand soil in Delaware; the plot was planted to soybeans. Residues decreased from an average of 1.1 mg/kg soil immediately posttreatment to 0.76 mg/kg at 86 days posttreatment and remained at 0.42-0.50 mg/kg from 296 to 657 days posttreatment. Paraquat did not leach below the 0- to 3.5-inch soil depth and was only recovered at the detection limit of 0.05 mg/kg in the 4.5- to 10-inch soil segment from one subplot at 296 days posttreatment.
3. This study is acceptable and fulfills EPA Data Requirements for Registering Pesticides by providing information on the terrestrial field dissipation of the SC/L formulation of paraquat (Gramoxone Super) at one site.

METHODOLOGY:

Paraquat (Gramoxone Super; 1.5 lbs ai/gallon; SC/L) was applied in a single application at 1.44 lb ai/A to a plot of loamy sand soil (83% sand, 10% silt, 7% clay, pH 4.5-5.2, organic matter 2.1-2.8%, CEC 4.0-6.0 meq/100 g) located near Delmar, Delaware. The plot was planted to soybeans and the control plot was separated from the treated plot by two buffer rows of soybeans.

Soil samples were taken with zero contamination corers to 33.5 inches. The top 0- to 3.5-inch samples were taken with a 2 inch diameter corer and the deeper samples were taken with a 1 inch diameter corer. The treated plot was divided into three subplots and samples were composited to make three replicate samples; for this composite, seven cores were taken per subplot for the 0- to 15-inch depths and five cores were taken per subplot for the 15- to 33.5-inch depths. Samples were removed prior to and immediately after paraquat application, at 29, 86, 296, 392, and 657 days posttreatment.

Soil samples (25 g) were extracted by refluxing with 6 M sulfuric acid for 5 hours; the refluxate was filtered and poured onto a cation exchange resin column. The sample on the column was sequentially washed with water, HCl, 2.5% ammonium chloride solution, and water. The paraquat was removed with saturated ammonium chloride solution. An aliquot of the ammonium chloride solution was treated with sodium dithionite "in alkali" to reduce paraquat to a free radical which was measured by UV spectroscopy. The detection limit was 0.05 ug/g soil; mean analytical recoveries ranged from 82-88%. Duplicate subsamples were extracted and analyzed for each composited sample; data in Table III was the mean of the two samples.

RESULTS:

Paraquat (Gramoxone Super; 1.5 lbs ai/gallon; SC/L) degraded very slowly when applied at 1.44 lb ai/A to a loamy sand soil in Delaware planted to soybeans. The paraquat was applied in a single application on August 26, 1987. Paraquat residues were 1.0-1.2 mg/kg immediately posttreatment, 0.66-0.92 mg/kg at 86 days, and ranged from 0.20-0.84 mg/kg at 296-657 days posttreatment (Table III). Paraquat did not leach from the 0- to 3.5-inch soil depth; paraquat residues were only recovered at the detection limit of 0.05 mg/kg in the 4.5- to 10-inch soil segment from one subplot at 296 days posttreatment. No paraquat was recovered from the control plot.

During the study, the total rainfall was 69.1 inches from August 1987-June 1989. The air temperatures ranged from 21-90 F; the soil temperature at a depth of 6 inches ranged from 35-84 F. These weather data were reported to be normal relative to the 30-year average values except that precipitation was 18% below normal. At

this site the depth to the water table was 3-8 ft, the slope was 0.5-1.0%.

COMMENTS AND DISCUSSION:

1. As shown in laboratory and previous field studies, paraquat is resistant to hydrolytic and microbial degradation. Paraquat is inactivated by adsorption to clay particles and even soils with low clay contents can adsorb very high rates of the compound. In the batch equilibrium adsorption/desorption studies included in this submission, paraquat showed no desorption (ie: once bound to the soil, paraquat will not exchange with Ca^{2+} in the soil solution). Paraquat can be extracted from the soil clays by refluxing with 6 M HCL or H_2SO_4 . While the compound persists on soil clays for several years, this persistence apparently does not reflect the environmental activity of paraquat since it is inactivated (dissipated) by adsorption.

The registrant did not attempt to provide a degradation half-life for these data but cited studies which reported an environmental half-life of approximately 10 years for paraquat. The Agency calculated degradation half-life was 491 days with an R-squared value of 0.390 (including all data points). The provided data were obtained by strong acid reflux which does not differentiate between loosely and tightly bound paraquat; therefore it was not possible to determine a dissipation half-life (binding half-life).

2. Analysis of the application solution taken from the spray tank showed 108% of expected recovery.
3. The registrant stated that the single application of 1.44 lb ai/A represented a pre-emergence application of 0.94 lb ai/A, two directed post-emergence applications of 0.125 lb ai/A and a "harvest aid" application of 0.25 lb ai/A. The single large application presented the "worst case" situation.

MRW # 41293202 (PARAQUAT DICHLORIDE)

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