

US EPA ARCHIVE DOCUMENT

DATA EVALUATION RECORD

STUDY 8

CHEM 061601

Paraquat dichloride

§164-5

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

DP Barcode D191550

STUDY ID 42738702

Anderson, L, R.E. Hoag, C.W. Anders, and M. Earl. 1992. Paraquat: field soil dissipation under in-use conditions in the USA during 1987-89 (Leland, Mississippi). Laboratory Report No. PP148BD05/Report No. RJ1206B.

Unpublished study performed by ICI Agrochemicals, Berkshire, UK, and submitted by ICI Americas, Inc., Wilmington, DE.

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CONCLUSIONS:

Dissipation -- Long-term field

1. This study can be used towards the fulfillment of data requirements.
2. Paraquat is inactivated (dissipates) by 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 (see Comment 1).

Paraquat residues did not appreciably degrade when applied in three single annual applications of 1.44 lb ai/A to silt loam soil plots of bare ground and soybeans; the plots were located near Leland, Mississippi. In both plots, paraquat residues in the 0- to 3.5-inch layer were 0.97-1.44 ppm after the first application, 1.6-1.9 ppm after the second application, and 2.9-3.3 ppm after the third application. Paraquat was not recovered from depths >3.5 inches.

METHODOLOGY:

Gramoxone Super (SC/L 1.5 or 2.5 lbs ai/gallon) was applied in a single application at 1.32-1.41 lb ai/A/year to two plots of silt loam soil (15-17% sand, 67-69% silt, 14-16% clay, pH 6.3-7.0, organic matter 0.7-1.3%, CEC 8.0-9.7 meq/100 g) located near Leland,

Mississippi; one plot was planted to soybeans (20 x 55 ft) and the second plot was unvegetated (20 x 20 ft). A control plot (20 x 100 ft) was located near the treated plots. Each treated plot was divided into three subplots. A total of three applications were made: 8/7/1987, 6/7/1988, and 6/21/1989.

Samples were taken with zero contamination corers to 15.5 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. Samples from the subplots were composited to make three replicate samples for the first year's sampling and were composited in a single sample after the second application. Samples were removed prior to and immediately after the first application, at 28, 104, 222, and 304 days after the first application, at 150 and 379 days after the second application, and at 145 days after the third and final application.

Soil samples were extracted by refluxing with 6 M sulfuric acid for 5 hours, filtering refluxate, and pouring the filtrate onto a cation exchange resin column. The sample was 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 and it was measured by UV spectroscopy. The detection limit was 0.05 ug/g soil; mean analytical recoveries ranged from 51 to 88%.

RESULTS:

In Mississippi, paraquat residues did not appreciably degrade over three years when applied in three single annual applications of 1.44 lb ai/A to silt loam soil plots of bare ground and soybeans.

The cropped plot: In the top 0- to 3.5-inches of soil, paraquat was recovered from the cropped plot at 0.53-1.44 ppm at all intervals following the first application (Table III). Paraquat was 1.6-1.9 ppm at 150 and 379 days after the second application, and was 3.3 ppm at 145 days following the third and final application. Data showing paraquat residues in the 0- to 3.5-inch depth throughout the study are in Figure 4. No residues were recovered from below the 3.5-inch depth.

The bare soil plot: In the top 0- to 3.5-inches of soil, paraquat was recovered from the bare soil plot at 0.48 to 1.4 ppm at 0-304 days after the initial application (Table IV). Paraquat was 1.8 ppm at 150 and 379 days after the second application, and was 2.9 ppm at 145 days following the third and final application. Data showing paraquat residues in the 0- to 3.5-inch depth throughout the study are in Figure 5. No residues were recovered from below the 3.5-inch depth.

Total rainfall was 119.7 inches which was 99% of the 30 year average; 4.33 inches of irrigation water was applied. Temperatures varied seasonally and generally followed the 30-year average. The water table at this site is >6 feet; the slope is 0.2%.

COMMENTS AND DISCUSSION:

1. As shown in laboratory and 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 does not appear to reflect the environmental activity of paraquat.
2. For this study, only three applications were made and three years of samples were taken because the site was sold and was not available for further sampling. Three other studies were included in this submission which contain data from four years of paraquat application and sampling.
3. This study would have been stronger if samples had been taken immediately after the second and third applications to verify the application rate. However, this information would not change the overall pattern of persistence of paraquat at this site.
4. In 1987 and 1988, aliquots of the application solutions removed for analysis were 92% of calculated values in 1987 and 90% in 1988.
5. 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 represented a worst case scenario for annual application.
6. The registrant cited studies which reported an environmental half-life of approximately 10 years for paraquat.

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