DATA EVALUATION RECORD

STUDY 7

CHEM 061601 Paraquat dichloride §164-5

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

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Anderson, L, R.E. Hoag, C.W. Anders, and M. Earl. 1992. Paraquat: field soil dissipation under in-use conditions in the USA during 1987-91 (Visalia, California). Laboratory Report No. PP148BD05/Report No. RJ1191B. Unpublished study performed by ICI Agrochemicals, Berkshire, UK, and submitted by ICI Americas, Inc., Wilmington, DE.

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REVIEWED BY: Laura Parsons Laura Parsons
ORG: EFGWB Review Section I 26 AUG 1993

APPROVED BY: Paul Mastradone Paul J Mastradone
ORG: Chief, EFGWB Review Section I 26 AUG 1993

<u>CONCLUSIONS</u>:

<u>Dissipation -- Long term field</u>

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). In laboratory studies, this binding is rapid; therefore, inactivation (dissipation) is rapid although paraquat residues can be extracted by acid reflux.

   Paraquat residues showed a tendency to accumulate when applied in four single annual applications of 2.68-2.87 lb ai/A to loam and sandy loam soil plots of peach trees and bare soil. In the top 0- to 3.5 inches of soil, paraquat was recovered from the bare soil and cropped plots at 0.65-2.4 ppm from 0 to 399 days after the first application, were maximums of 3.8 ppm after the second application, 5.8 ppm after the third application, and 9.1 ppm following the fourth application. There was generally no pattern of leaching. In the 4.5- to 10-inch soil segment, paraquat was recovered at 0.06-0.14 ppm in two sampling intervals for the cropped plot and two different intervals for the bare soil plot. Paraquat residues were recovered at 0.06 ppm from the 15.5- to 33.5-inch depth at 86 days following the fourth application.

METHODOLOGY:

Gramoxone Super (SC/L 1.5 or 2.5 lbs ai/gallon) was applied in a single application at 2.82 lb ai/A/year to two plots located near Visalia, California; the soil was characterized as loam and sandy loam (43-55% sand, 33-45% silt, 12% clay, pH 7.7-8.2, organic matter 0.8-1.1%, CEC 9.5-13.6 meq/100 g). The cropped plot was bordered on two sides by peach trees (20 x 55 ft) and the second plot was unvegetated (20 x 20 ft). A control plot (20 x 20 ft) was located near the treated plots. Each treated plot was divided into three subplots. A total of four annual applications were made in June 1987, July 1988, July 1989, and July 1990.

Samples were taken with zero contamination corers to 15.5 inches or 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. For the 0- to 3.5-inch segments for sampling intervals 0-399 days after the first application, samples from the subplots were composited to make three replicate samples. For the deeper segments and the samples after the second application the samples from the subplots were composited to make a single sample. Samples were removed prior to and immediately after the first application, at 28, 56, 287, and 399 days after the first application, at 99 and 311 days after the second application, at 85 and 361 days after the third application, and at 86 days after the fourth 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 50 to 96%.

RESULTS:

The cropped plot: In the top 0- to 3.5 inches of soil, paraquat was recovered from the cropped plot at 0.65-1.7 ppm from 0 to 399 days after the first application (Table III). Paraquat was 3.5-3.8 ppm at 99 and 311 days after the second application, 3.4-4.97 ppm at 85 and 361 days following the third application and was 6.7 ppm at 86 days following the fourth application. Data showing paraquat residues in the 0- to 3.5-inch depth throughout the study are presented in Figure 4. In the 4.5- to 10-inch soil segment, paraquat was recovered at two sampling intervals, at 0.14 ppm immediately following the first application and at 0.08 ppm at 85 days after the third application.

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Paraquat residues were recovered at 0.06 ppm from the 15.5- to 33.5-inch depth at 86 days following the fourth application.

<u>The bare soil plot</u>: In the top 0- to 3.5 inches of soil, paraquat was recovered from the bare soil plot at 0.67-2.4 ppm from 0 to 399 days after the first application (Table IV). Paraquat was 3.7-3.8 ppm at 99 and 311 days after the second application, 5.2-5.8 ppm at 85 and 361 days following the third application and was 9.1 ppm at 86 days following the fourth application. Data showing paraquat residues in the 0- to 3.5-inch depth throughout the study are in Figure 5. For two sampling intervals, paraquat was recovered from the 4.5- to 10-inch soil segment: at 0.07 ppm 361 days following the third application and at 0.06 ppm 86 days after the fourth application. Paraquat residues were recovered at 0.08 ppm from the 10- to 15.5-inch depth at 287 days following the first application and were not recovered from this depth at any other sampling interval.

Total rainfall was 38.6 inches (98% of the 30 year average); a total of 81.0 inches of water was applied as irrigation. Air temperatures were 27-98 F; soil temperatures at a 2-inch depth were 16-117 F. The water table at this site fluctuates between 12-20 feet; there was 0% slope.

<u>COMMENTS AND DISCUSSION:</u>

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. This study would have been stronger if samples had been taken immediately after the second, third, and fourth applications to confirm the application rate. However, this information would not change the overall pattern of persistence of paraquat at this site.

3. In 1987, tank mix samples were 108% of the calculated values. No other tank mix samples were taken.

4. The registrant stated that the single application of 2.82 lb ai/A represented three applications of 0.94 lb ai/A and therefore represented a "worst case" scenario.

5. The registrant cited studies which reported an environmental half-life of approximately 10 years for paraquat.

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