CHEMICAL: Metolachlor (108801)

FORMULATION: Technical

CITATION: Sumner, D.D.; Cassidy, J. E. (1975) The Degradation of CGA-24705 in a Field Soil: GAAC-75022. Received March 26, 1975 under 5F1606 (Unpublished report prepared by CIBA-GEIGY Corp., Greensboro, N. C., CDL: 94385-M).

TRADE SECRET CLAIM: Yes

REASON FOR REVIEW: Generic Standards for Metolachlor

REVIEWED BY: Carroll W. Collier, Supervisory Chemist, Criteria and Evaluation Division, Office of Pesticide Programs, EPA, Washington, D. C.

DATE OF REVIEW: January 23, 1978

TEST TYPE: Aerobic Soil Metabolism

OBJECTIVE:

1. To establish the persistence of metolachlor under field conditions in a Mississippi silt loam soil over a one year period.

2. To establish the relative quantities of extractable and unextractable products associated with soil degradation of metolachlor under field conditions.

3. To fractionate the non-extractable residues into mineral, fulvic acid, humic acid and water associated fractions at an intermediate time and at termination of the dissipation/degradation test.

EXPERIMENTAL:

Following a normal growing season in the Greenville, Mississippi area a 3 x 6 foot plot of Basket silt loam was treated with 2 lbs/acre of ring labeled ^{14}C-metolachlor having a specific activity of 5.08 mC/mM. Details of application are given in (CDL:94385-C). The soil had the following characteristics: pH 5.6, CEC 9.6, organic matter 0.9%, sand 26.0%, silt 62.0% and clay 12.0%. Soil was extracted by method described in (CDL:94385V) to give a methanol water extract and a non-extractable fraction. Non-extractables were determined by total combustion (CDL:94385R) and fractionation of the non-extractables was performed as described in (CDL:94385Z). Liquid scintillation was used for radioassay (CDL:94385W) and counting efficiencies were established by external standardization.

RESULTS:

As can be seen in Table I a pronounced decrease in total residues occurred in the upper 3 inches (treated layer) of soil over the 52 week period. A step-wise decline from a 0 time reading of 1.29 ppm metolachlor equivalent, to .22 ppm at 52 weeks post-treatment was observed. Residues between the 4th and 8th week appeared to stablize at about 0.7 ppm and then declined to another plateau of about 0.3 ppm during the 16-30 week period.

As can be seen from Table 2 non-extractable residues rose rapidly and by the 16th week and represented 81% of the total radioactivity. For the next 36 weeks a steady-state condition apparently persisted with non-extractables at the 30th and 52nd week hovering at the 80-90% level (81% and 84% for the 30th and 52nd week respectively).

Considerable variation in the nature of the non-extractable residues was noted between the 30th and 52nd week. While the percent non-extractable barely changed 81% to 84% in 22 weeks the relative amounts in the various fractions changed significantly. Substantial decreases in the fulvic acid and humic acid fractions occurred between the 30th and 52nd week whereas similar increases in the water soluble and mineral fraction occurred.

2

CONCLUSIONS:

1. The data shown in Table I suggest a gradual albeit stepwise decline in total residues expressed as metolachlor over the entire course of the 52 week study. This is especially noteworthy in the 0-3 inch layer. The pattern of total residues with time in the 3-6 and 6-9 inch layers over the 52 week period suggests an active leaching process may be the major source of dissipation. The bimodality of the data (peak maximum at 8 weeks observation and another pronounced upward trend between the 30th and 52nd week is likely to be due to irregularities in the rainfall pattern during the 52 week period under study.

2. Unextractable residues attain a steady state ranging between 81% and 84% during the last 36 weeks of the 52 week study (Table 2).

3. In spite of the steady state levels of unextractable residues during the last 36 weeks (16th thru 52nd) the relative amounts in the organic matter fractions (fulvic and humic acid positions) declined significantly during this period, the combined percentage of these two fractions decreased from 31.0% to 12.6%. During the same period the H_2O soluble and mineral fractions increased a corresponding amount (Table 3).

4. The high "steady state" levels of non-extractables coupled with the pronounced time related decreases in radioactivity levels of the soil organic fractions suggests: a) the degradation products of metolachlor are not directly incorporated into the soil organic matter matrix and b) a dynamic equillibrium between bound and free residues exists with leaching of certain degradation product(s) causing a continuous disequilibrium.

5. The objective of establishing the persistence of metolachlor under field conditions, in a Mississippi soil, with growing corn, was met. This partially fulfills Guideline Requirement .

6. The relative quantities of extractable and unextractable products associated with soil degradation of metolachlor under field conditions were established. This partially meets Guideline requirement .

7. Important information was gained relative to leaching of aged soil residues. Due to the positive leaching findings, the study is considered adequate to satisfy the requirement in the Guidelines ( ) related to leaching of aged residues.

8. Although not explicity discussed in the current version of the Guidelines the exact nature of the products which leach are of definite regulatory concern. Unless the data from the soil metabolism studies reveals insight into the specific nature of the product(s) additional testing should be performed.

3

DISCUSSION:

1. The protocol used in this study is generally acceptable and experimental details are adequately described. Exceptions to this are noted below:

   a. The study only involved ring labeled ^{14}C pesticide and therefore, the fate of the monochloroacetaldehyde moiety could not be followed.

   b. None of the degradation products were characterized except for empirical fractionations to determine relative amounts of extractable, non-extractables and organosolubles and further classification of the bound residues as fulvic acid, humic acid, mineral or water soluble fractions.

2. Although the results of the study yield important data on leaching, formation of bound residues and persistence in the upper layers the lack of characterization of individual molecular species essentially disqualifies the study as an anaerobic metabolism study.

Table 1: Persistence of Radioactive ^{14}C in Soil Following Treatment with ^{14}C-Metolachlor 2 lbs/acre, Expressed as ppm of Parent Compound

Total ppm at 0-3 inch soil depth	Total ppm at 3-6 inch soil depth	Total ppm at 6-9 inch soil depth
1.29	-	-
0.73	0.14	0.01
0.75	0.31	0.08
0.31	0.10	0.06
0.32	0.05	0.04
0.22	0.07	0.08

Table 2: Solubility Fractionation of Soil Degradation Products Following Treatment with Ring Labeled ^{14}C- Metolachlor at 2 lbs/A.

	Amount of Residue in 0-3 Soil Layer		
Weeks After Application	Extractable	Non-extractable	Metolachlor
4	60	32	35
8	48	45	
16	-	81	
30	22	81	
52	10	84	

Table 3: Fractionation of Soil Treated with Ring Labeled ^{14}C-Metolachlor at 2 lbs/acre and Aged for 30 and 52 Weeks (0-3 inch depth sampled)

Weeks after Application	30	52
Total ppm expressed as ^{14}C-metolachlor	0.32	0.22
Extractable	.064 (22%)	0.044 (20%)
Nonextractable	.256 (81%)	0.176 (84%)
Fractionation		
H_2O	.056 (17.5%)	0.052 (29%)
Fulvic acid	.059 (18.3%)	0.017 (9.8%)
Humic acid	.041 (12.7%)	0.006 (2.8%)
Mineral fraction	.076 (23.6%)	0.077 (43.1%)