DYNAMAC
CORPORATION

ACIFLUORFEN

ENVIRONMENTAL FATE AND EXPOSURE ASSESSMENT OF ACIFLUORFEN

REVIEW AND EVALUATION OF DATA SUBMITTED SUBSEQUENT TO THE INITIAL REVIEW

Contract No. 68-01-6679

Final Report

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SUBMITTED TO:

Environmental Protection Agency
Arlington, Virginia 22202

SUBMITTED BY:

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Environmental Fate and Exposure Assessment of Acifluorfen

This review is the fourth assessment of environmental fate and exposure data submitted by Rhone-Poulenc, Inc. for the registration of acifluorfen as a herbicide to control broadleaf weeds in soybeans (previous submissions have Accession No's 071323-071327, 250467 and 252764). It is based on additional data and comments submitted by Rhone-Poulenc, (Accession No's 254534-254536, August 29, 1984) in response to a review (Dynamac Corp., June 22, 1984) and discussion (meeting July 26, 1984) of previously submitted data. Only new data or discussions are reviewed here. The effect of this recent information on the satisfaction of registration requirements is indicated in the recommendation section.

STUDY 1

Gemma, A.A. and J.P. Wargo. August, 1984. Metabolism of ^{14}C-MC-10978 (Tackle) in soil under aerobic and anaerobic conditions. Rhone-Poulenc Inc., Monmouth Junction, New Jersey. ASD Report No. 84/088. Acc. No. 254534.

Procedure

Aerobic Soil Metabolism: A solution (toluene) containing [^{14}C]acifluorfen [uniformly labeled in the nitrophenyl ring, specific activity 15 mCi/mM, 98% radiochemically pure, acid form, Reference No. GF-266056-1 (CCK-266581)] was diluted with unlabeled pesticide (98.5% pure, acid form, also in toluene). The resulting solution was taken to dryness, and 0.01N NaOH (to convert the acid to the Na salt) was added to the residue, which was then diluted with water. Aliquots (2.5 ml supplying 50.32 µg acifluorfen) of this solution (specific activity 0.020 µCi/µg) were added to the surface of samples (50g) of sieved (2mm) loam soil (35.6% sand, 49.6% silt, 14.8% clay, 1.4% organic matter, pH 5.4, CEC 9.4 meq/100 g) in Erlenmeyer flasks. The flasks were incubated in the dark at 22-24°C. Humidified air was drawn through the flasks; air leaving the last flask was scrubbed sequentially by XAD-4 resin, activated charcoal and 0.1N NaOH. Soil moisture content was maintanied at 75% of the moisture content at 0.33 bar. Duplicate flasks were taken for analysis 0, 1, 3, 7, 14 days and 1, 2, 3, 4, and 6 months posttreatment.

Anaerobic Soil Metabolism: Four aliquots of the loam soil were treated and incubated as described above (Aerobic Soil Metabolism) for 30 days. Distilled water (100 ml) and glucose (2 g) were then added to each flask, which was then purged (purified nitrogen for 30 minutes), stoppered, sealed, and incubated in the dark at 22-24°C. Duplicate flasks were taken for analysis 30 and 60 days after anaerobic conditions were established.

Volatility Study: A single flask containing 500 g soil was treated with 446 µg acifluorfen in aqueous solution (presumably that used to treat the other flasks). The flask was then treated and incubated as described above (Aerobic Soil Metabolism) for three months. Unlabeled acifluorfen (4.5 mg), 5 g of glucose, and 500 ml of distilled water were added and the system purged (N_2). The flask was incubated for 1 month before analysis.

Methodology

Quantification of ^{14}C in the gas traps (volatility study only) was by LSC. Flood water was decanted from the anaerobic samples. ^{14}C in the filtered water was quantified by LSC. Aliquots of the flood water were acidified and extracted three times with dichloromethane. The combined extracts were evaporated to dryness. Residues were taken up in methanol, assayed for ^{14}C activity (LSC), and characterized by TLC.

All soil samples were extracted by refluxing with H_2O:methanol (1:1) for 1 hour. Prior to extraction, subsamples (three per sample) of the aerobic soils were combusted to quantify (LSC) ^{14}C activity. All the filtered soil extracts were also counted (LSC) to determine ^{14}C activity, then acidified. The methanol was evaporated off and the remaining water partitioned three times with dichloromethane. The (presumably combined) dichloromethane extracts were concentrated, then assayed for ^{14}C activity (LSC). The dichloromethane was then

evaporated off and residues taken up in methanol. Residues were characterized by TLC. A subsample was counted (LSC).

Extracted soils were air dried. Subsamples were combusted and ^{14}C activity quantified by LSC. Aliquots were extracted with acidified methanol by refluxing for 1 hour. The filtered extracts were then processed as described previously for the initial soil extracts.

A number of TLC systems were utilized to characterize residues. In all cases, samples were co-chromatographed with one or more of the reference standards (see Figure 1). Three solvent systems were used for the soil samples: system A (chloroform:acetic acid, 9:1), system B (toluene:tetrahydrofuran:acetic acid, 45:30:1) and a reverse-phase system (0.5 M NaCl:ethanol, 2:3). Extracts of soil were chromatographed on either nonactivated silica gel or reverse phase TLC plates. The flood water extracts were chromatographed with solvent system A (presumably on silica gel plates). Reference standards were located on the plates under UV light. Radioactive spots were located by autoradiography and were quantified by zonal scraping [followed by LSC either directly (in water) or after methanol elution].

The soil from the volatility study was extracted, fractionated, and subjected to TLC as described above. Three bands, which co-chromatographed with MC-10879, MC-14621, and the acetamide, respectively, were scraped and extracted. After a repeated TLC clean up (solvent system A) the bands were scraped, extracted (methanol) and derivatized. Further purification of all derivatives (via TLC, solvent system A), was reported before final determination. The postulated acetamide and MC-10879 (together with a reference standard) were methylated (diazomethane) and subjected to GC (EC detector). The suspected acetamide (methylated) was also subjected to GC/MS. The compound co-chromatographing with MC-14621 was methylated [refluxing with HCl:methanol (1:1)], derivatized at the amino group (with heptafluorobutyric anhydride), then purified (florisil). It is not clear that this purification preceeded the TLC procedure reported above. GC analysis (EC detector), with comparison to an analytical standard, was then performed.

Results

Aerobic Soil Metabolism: Reported total ^{14}C recoveries ranged from 83-103% of that theoretically applied. Although the total percent of ^{14}C residues extracted decreased with time, a proportionately greater amount was released by the second extraction at each interval (Table 1). Fractionations of the extractable residues are also summarized in Table 1. The ^{14}C activity in the first extract was almost wholly (>90%) organosoluble, whereas that in the second extract was up to ~30% water soluble. The parent was the largest residue component, comprising ~90% of the recovered activity at the start of the incubation, and >40% after 6 months. Other identified metabolites formed only a very small proportion of extracted activity. At 6 months the amino and desnitro derivatives reportedly comprised 2.4% and 3.1%, respectively, of the ^{14}C recovered (Table 2).

Anaerobic Soil Metabolism: Reported total ^{14}C recoveries were >95% of that applied. Results are summarized in Table 3. The proportion of total ^{14}C recovered that was removed in the initial extraction was similar for the 1- and 2-month samples (51 and 54%, respectively). However the amount released by the second extraction varied (~28 and ~8% for the 1- and 2-month samples, respectively). In both cases, a smaller proportion (76 and 88%) of the residues removed in the second extraction partitioned into dichloromethane. The figure for the first extraction was >97%. The major metabolite extractable from anaerobically incubated soil was the acetamide of the amino analog of acifluorfen. This formed 9.8 and 12.1% of the recovered residue at 1 and 2 months, respectively; the amino analog (MC-14621) comprised 7.3 and 5.7% at the same times. Other major residue components were the parent and the desnitro derivative. According to the registrant, reanalysis of the unidentified polar material demonstrated that only small amounts of all previously identified compounds in the extract plus metabolite MC-14620 (see Figure 1) were present. Trace amounts of the acetamide and other metabolites (Table 3) were identified in the dichloromethane extracts of the flood water.

Volatility Study: Less than 1% of the ^{14}C applied to the volatility sample was recovered in the gas traps within 3 months of aerobic incubation.

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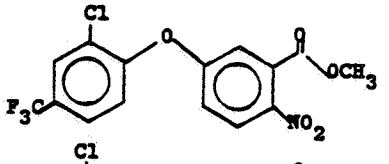
MC-10108



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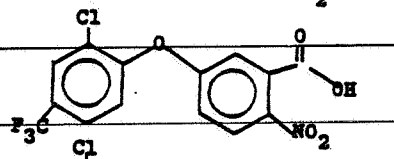

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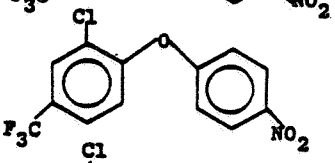
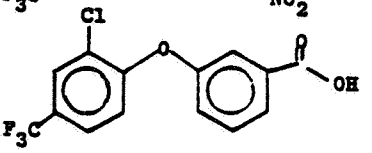
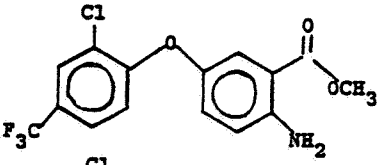


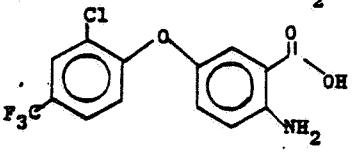
MC-10879



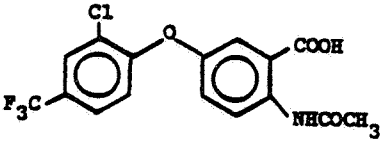
MC-14620



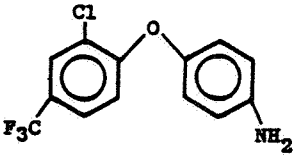
MC-14621



Acetamide



MC-15412



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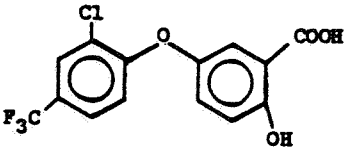

AgRT-1106

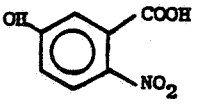

Figure 1. Structures of metabolism study reference compounds.

Table 1. Distribution of ^{14}C residues in aerobically incubated soil treated with nitrophenyl ring-labeled [^{14}C]acifluorfen.[a]

Sample	^{14}C Extracted from soil	Unextracted	Partitioning of extracted residues DCM[b]	Aqueous[c]
0 Day				
Initial extraction[d]	97.5	--	92.1	5.4
Second extraction[e]	ND[f]	2.5	ND	ND
1 Day				
Initial extraction	96.6	--	91.8	4.8
Second extraction	ND	3.4	ND	ND
3 Days				
Initial extraction	93.3	--	92.4	0.9
Second extraction	ND	6.7	ND	ND
7 Days				
Initial extraction	88.6	--	88.4	0.2
Second extraction	6.5	4.9	4.3	2.2
14 Days				
Initial extraction	83.9	--	83.5	0.4
Second extraction	8.6	7.5	5.8	2.8
28 Days				
Initial extraction	79.4	--	79.0	0.4
Second extraction	11.5	9.1	7.7	3.8
2 Months				
Initial extraction	71.4	--	70.7	0.7
Second extraction	15.6	13.0	12.5	3.1
3 Months				
Initial extraction	69.9	--	69.7	0.2
Second extraction	5.5	24.6	1.9	3.6
4 Months				
Initial extraction	60.9	--	60.5	0.4
Second extraction	20.2	18.9	13.7	6.5
6 Months				
Initial extraction	52.2	--	50.4	1.8
Second extraction	24.1	23.7	16.0	8.1

[a] All results are the mean of two replicates and are expressed as percent of total ^{14}C recovered.
[b] Dichloromethane-soluble ^{14}C residues extracted from soil.
[c] Water-soluble ^{14}C residues extracted from soil.
[d] Methanol:water (1:1).
[e] 2% HCl in methanol.
[f] Not determined.

Table 2. Identification of ^{14}C residues extracted[a] from aerobically incubated soil treated with nitrophenyl ring-labeled [^{14}C]acifluorfen.[b]

Incubation interval	Unidentified		MC-10109[c]	MC-14621[c]	MC-10879[c]	MC-10108[c]
	TLC Origin	Other				
0 Day	0.34	1.06	89.7	0.07	0.21	0.40
1 Day	0.63	1.19	85.4	0.22	0.16	0.49
3 Days	1.38	1.65	87.1	0.27	0.29	1.39
7 Days	1.73	1.95	81.5	0.42	0.47	1.41
14 Days	1.88	2.19	77.9	0.67	0.63	1.96
28 Days	2.62	5.27	71.2	0.57	0.77	4.39
2 Months	4.20	4.84	66.1	2.17	1.55	2.75
3 Months	2.05	3.44	59.8	1.93	1.44	2.44
4 Months	6.29	6.45	52.5	3.13	2.26	3.97
6 Months	4.79	6.86	43.0	2.39	3.11	3.09

[a] By initial and second extraction where performed.
[b] Expressed as a percent of total ^{14}C recovered. Presumed to be mean of two replicates.
[c] See Figure 1 for metabolite identification.

Table 3. Distribution and identification of ^{14}C residues in anaerobically incubated[a] soil treated with nitrophenyl ring-labeled [^{14}C]acifluorfen.[b]

Sample	^{14}C Extracted	^{14}C Not extracted	Partitioning of extracted residues		Characterization of extracted residues						
			DCM[c]	Aqueous[d]	Unidentified TLC Origin	Unidentified Other	MC-10109[e]	Acetamide[e]	MC-14621[e]	MC-10879[e]	MC-10108[e]
One month											
Initial extraction[f]	51.3	--	49.8	1.5	--	--	--	--	--	--	--
Second extraction[g]	27.6	15.5	20.9	6.7	16.70[h]	16.80[h]	9.03[h]	9.84[h]	7.32[h]	6.59[h]	1.22[h]
Flood Water	5.6	--	4.0	1.6	1.05	2.50	0.02	0.27	0.09	0.06	NR[i]
Two months											
Initial extraction[f]	53.6	--	53.6	0.0	--	--	--	--	--	--	--
Second extraction[g]	8.5	35.3	7.5	1.0	12.67[h]	14.24[h]	4.01[h]	12.09[h]	5.73[h]	7.77[h]	2.99[h]
Flood Water	2.6	--	1.7	0.9	0.33	0.62	0.02	0.40	0.05	0.15	0.02

[a] Subjected to a prior (30 day) aerobic incubation.
[b] Results are expressed as a percent of total ^{14}C recovered and are presumed to be means of two replicates.
[c] Dichloromethane-soluble ^{14}C residues extracted from soil or flood water.
[d] Water-soluble residues extracted from soil or flood water.
[e] See Figure 1 for metabolite identification.
[f] Extracted with methanol:water (1:1).
[g] Extracted wtih 2% HCl in methanol.
[h] Indicates residues removed by both extractions.
[i] Not reported.

Conclusions

The half-life of acifluorfen (calculated assuming first order kinetics, $r^2 = 0.979$) in an aerobically incubated loam soil was found to be ~170 days; degradation was more rapid under anaerobic conditions. Loss of ^{14}C by volatilization was very low under aerobic conditions (<1% of that applied within 3 months) and was not measured under anaerobic conditions. The parent (MC-10109) was the major residue component in aerobically aged soil, comprising 43% of recovered ^{14}C activity after 6 months. Bound residues accounted for ~24% of the activity at the same time. Three minor degradates were reported: amino, and desnitro acifluorfen and its methyl ester (MC-14621, MC-10879, MC-10108, respectively in Figure 1). However, it does not appear from the autoradiograms provided that MC-10074 (decarboxylated acifluorfen) MC10108, MC-14620 (the methyl ester of the amino analog), and MC-10879 can be resolved by TLC using solvent system A. A second normal phase system ("solvent system B") was described but no autoradiograms were included. If these compounds were resolved using this TLC system then this should have been indicated and sample autoradiograms presented.

The presence of three degradates, desnitro acifluorfen (MC-10879), the amino analog (MC-14621) and the acetamide of the amino analog, in an anaerobically incubated sample was confirmed using GC (MC-10879, MC-14621) or GC/MS (acetamide). These metabolites accounted for ~25% of the ^{14}C activity after 2 months anaerobic incubation (the parent was 4%); 35% of total ^{14}C could not be extracted. Autoradiograms of anaerobically incubated samples did not confirm that the TLC procedures used were adequate to obtain all the required separations. In the examples provided, MC-10879 and MC-14620 were not clearly resolved.

Thus, this study provides useful information about the rate of decline of acifluorfen and the nature of the residue under aerobic and anaerobic conditions. However, due to apparent poor TLC separations some metabolite identifications must be regarded as tentative; this affects <7% (aerobic) and <11% (anaerobic) of the total ^{14}C recovered.

A number of additional shortcomings were noted. No comment was made on the presence of other peaks in the GC traces for the soil extracts (when compared with those for the standards). These may be due to either the work-up procedure or to the presence of additional metabolites (indicating poor separation by TLC). Reverse-phase TLC revealed the presence of the parent and five metabolites in the "origin and polar materials" from the TLC (solvent system A) plates of the anaerobic samples. The data on metabolite distribution do not appear to have been corrected using this information. Finally, the moisture content of the soil at 0.33 bar was not reported.

STUDY 2

Guyton, G.L. August, 1984. Addendum to Report: Soil Dissipation data on Tackle® under field conditions. Rhone-Poulenc, Inc., Monmouth Junction, New Jersey, ASD Report No. 84/100. Acc. No. 254535.

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The registrant has submitted additional site and climatic data, which are necessary to fulfill data requirements as stated in the initial review [Dynamac Corp., June 1984, (Study 16)] of the field dissipation study (ASD Report No. 83/025, Acc. No. 252764).

Terrestrial Field Dissipation: The appropriate temperature and site information have now been submitted. A description of cultural practices (requested in the initial review) was not included.

Dissipation studies for combination products and tank mixes: This portion of the study is considered ancillary since such information is not currently required. For these data to fulfill any future requirements, the following deficiencies must be addressed: day zero residue recoveries should be provided for the Fugua Varina site, cultural practices should be described for all sites, and the reported possibility of run-off losses at the Fugua Varina site should be addressed.

STUDY 3

Norris, F.A., J.P. Wargo, E.G. Jordon and S.S. Eng. August, 1984. Mobility and dissipation rates of Tackle® herbicide as determined from field experiments. ASD Report No. 84/099. Acc. No. 254536.

In a previous review (Dynamac Corp., June 1984) concern was expressed over apparent contradictions in data obtained from field and laboratory studies on acifluorfen mobility and persistence. The registrant has submitted a discussion that attempts to rationalize these differences.

Mobility studies: The registrant states that significant leaching was observed in the laboratory study [Norris and Miller, 1980, Acc. No. 071325; Study 8 in earlier reviews, (Dynamac Corp., March and August 1983)] in contrast to the field study [Guyton, 1983, Acc. No. 252764; Study 16 in earlier review (Dynamac Corp., June, 1984)] because the simulated rainfall application in the laboratory far exceeded the daily rainfall encountered in the field. It should be noted that the pesticide loading in the columns used in the leaching study was excessive (682 lb ai/A).

The field dissipation study [Guyton, 1983, Acc. No. 252764; Study 16 in previous review, field dissipation study (Dynamac Corp., June 1984)] indicated that acifluorfen applied to a silt loam soil in Mississippi at 0.75 lb ai/A did not significantly leach below 3 inches during the 179 days of the study. However, climatic data indicate that rainfall was low (<2 inches) during the first 30 days after application. Ancillary information, available from three sites (two silt loam soils, one sandy loam soil) receiving multi-pesticide treatments, show that some leaching of acifluorfen (from a treatment of 0.75 lb ai/A) occurred below 3 inches. Significant leaching below 3 inches was observed at two of three sites from a treatment of 1.5 lb ai/A. All three sites received significantly more rain (between 3 and 4 times as much) than the Mississippi site immediately (30 days) post application.

The high leaching potential of acifluorfen indicated by laboratory studies may indeed be a consequence of high water fluxes and excessive pesticide loading. However, the absence of leaching below 3 inches in the field is demonstrated only under dry conditions. Significant rainfall immediately post-application may result in acifluorfen leaching.

~~Field Dissipation: The registrant has submitted a discussion of previously~~ reviewed laboratory and field studies, including studies determined to be invalid (Wargo, July 1982, Acc. No. 071324), or providing only supplementary information (Gemma and Wargo, October 1982, ASD Report No. 82/051. Acc. No. 071324).

Available information on acifluorfen metabolism may be summarized briefly as follows. Half-lives reported from laboratory studies have been variable but indicate that under aerobic conditions acifluorfen may be persistent. The new study reports a lower half-life (~170 days) than some previous aerobic studies and suggests that under anaerobic conditions degradation is more rapid (half-life <1 month). The reported half-life at one field site was ~2 months.

Also submitted here is a general discussion of the effect of moisture content on the metabolism of acifluorfen and other pesticides. This discussion was not clear due to the presence of extraneous material, the relevance of which was not evident to the reviewer. For example, the reported dependence of the degradation of the herbicide EPTC [S-ethyl dipropyl(thiocarbamate)] on soil moisture content below 3% (at which soils will typically be air dry) does not aid the interpretation of laboratory or field data on acifluorfen. Also the registrant states that bacteria require a "continuous film of water for movement and metabolism." However, bacteria are normally associated with clays and humic acids and are rarely free in the soil solution; the significance of bacterial movement is not obvious to the reviewer.

The submitted description of acifluorfen metabolism is incomplete because the registrant appears to envisage acifluorfen metabolism as occurring only under anaerobic conditions. Degradation of acifluorfen is discussed as being a reductive process, the rate of which is controlled by the degree of soil anaerobicity. This in turn is controlled by soil moisture content and texture, which affect the number of "anaerobic sites" in a soil. Degradation in the registrant's view requires such sites and their number controls degradation rate. This thesis does not adequately explain the decompostion observed in an aerobically incubated loam (only ~43% of the ^{14}C recovered was extracted as parent after 6 months and ~24% was non-extractable) in Study 1 of this submission. The soil was incubated at 75% of the moisture content at 0.33 bar, which is within the optimum range for aerobic bacterial activity. Furthermore, aerobic and anaerobic soil metabolism take place in very different environments and have not conventionally been expected to produce the same products at the same rate.

Nevertheless, it is clear that soil moisture content affects aerobic degradation rates of pesticides. Generally, it is the moisture requirement (and hence response) of the soil biomass that is used to explain variations in degradation rates with increasing moisture.

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EXECUTIVE SUMMARY

Only additions to or alterations of the conclusions in previous reviews (Dynamac Corp., March 1983 - Accession No. 071323-071327, August 1983 - Accession No. 250467 and June 1984 - Accession No. 252764) are discussed here.

The half-life of acifluorfen in an aerobically incubated soil was found to be ~170 days; anaerobic degradation was more rapid (half-life <1 month). The dominant residue components after 6 months aerobic incubation were the parent and bound materials. After 2 months under anaerobic conditions the acetamide of amino acifluorfen was the major degradate extracted from soil, the amino analog itself was also significant, and desnitro acifluorfen was also formed.

The tentative half-life of 59 days reported in the last review (Dynamac Corp., June 1984) for acifluorfen applied at 0.75 lb ai/A to a silt loam soil in Mississippi can now be confirmed. Leaching of the parent below 3 inches was negligible under the climatic conditions prevailing during the study (<2 inches of rain were recorded during the first 30 days posttreatment). Information from three sites (two silt loam and one sandy loam soil) receiving multi-pesticide treatments (including 0.75-1.50 lb ai/A acifluorfen), and higher rainfall posttreatment than the Mississippi site, suggests that leaching of acifluorfen is possible under wetter conditions.

General conclusions from laboratory and field dissipation studies are that degradation rates in soil are variable, breakdown may be slow under aerobic conditions but is rapid under flooded or anaerobic conditions.

Recommendations:

The submission of data to fulfill registration requirements (Subparts N and K) are summarized below:

Hydrolysis studies: One study (Norris and Hassell, November, 1980, Acc. No. 071323) was submitted and reviewed. The study was scientifically valid and satisfied all data requirements. No further data are required.

Photodegradation studies in water: One study (Somma et al., September, 1982, Acc. No. 071324) was submitted and reviewed. The study is scientifically valid and is in compliance with data requirements. No further data are required.

Photodegradation studies in air: No studies were submitted, but these data are not required at this time.

Aerobic soil metabolism studies: Five studies were submitted and reviewed. One study (Gemma and Wargo, October, 1982, ASD Report No. 82/053, Acc. No. 071324) is scientifically invalid because of improper sample storage and erratic recovery of soil residues. A second study (Piznik and Wargo, September,

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In conclusion, it would appear that anaerobic metabolism of acifluorfen is more rapid than aerobic metabolism. The results obtained under aerobic conditions are not inconsistent with the expected influence of soil moisture content on pesticide degradation rates, particularly in dry soils where moisture may be the factor limiting biological activity.

1982, Acc. No. 071324) is scientifically invalid because it could not be demonstrated that the study was conducted under aerobic conditions. Estimates of half-lives from the third study (Wargo, July, 1982, Acc. No. 071-324) were too variable to be useful in fulfilling registration requirements. The fourth study (Gemma and Wargo, October, 1982, ASD Report No. 82/053, Acc. No. 071324) was not adequately designed to provide the required data. This study is considered to be supplemental information. The fifth study (Gemma and Wargo, August, 1984, Acc. No. 254534) was found to be scientifically valid and to satisfy data requirements. No further data are required.

Anaerobic soil metabolism studies: Three studies were submitted and reviewed. One study (Wargo, July, 1982, Acc. No. 071324) was submitted as supplementary information not intended to fulfill data requirements. The second study (Piznik and Wargo, September, 1982, Acc. No. 071324) is not scientifically valid because of the inadequate mass balance. In addition, the validity of the aerobic portion of this study has not been verified. The third study (Gemma and Wargo, August 1984) Acc. No. 254534 was found to be scientifically valid and to satisfy data requirements. No further data are required.

Anaerobic aquatic metabolism studies: No data were submitted, but these studies are not required because acifluorfen does not have forestry, aquatic, or aquatic impact use.

Aerobic aquatic metabolism studies: No data were submitted, but these studies are not required because acifluorfen does not have an aquatic or aquatic impact use.

Leaching and adsorption/desorption studies: Two studies were submitted. One study (Norris and Miller, December, 1980, Acc. No. 071235) is scientifically valid and fulfills all data requirements. The second study (Norris and Guardigli, May, 1982, Acc. No. 071325) supplies supplementary data. No further data are required.

Laboratory and field volatility studies: No data were submitted, but these data are not required at this time.

Terrestrial field dissipation studies: Two studies were submitted and reviewed. One study (Norris and Ku, April, 1981, Acc. No. 071325) is scientifically invalid because the data were variable and inaccurate; samples appeared to be contaminated with acifluorfen. The second study (Guyton, October, 1983, Acc. No. 252764) was scientifically valid. Appropriate plot descriptions and climatic data have now been submitted (Guyton, August, 1984 Acc. No. 254535.) No further data are required.

Aquatic field dissipation studies: No data were submitted, but no data are required because acifluorfen does not have an aquatic or an aquatic impact use.

Forestry dissipation studies: No data were submitted, but no data are required because acifluorfen does not have a forestry use.

Long-term field dissipation studies: No data were submitted, but these data are not required at this time.

Confined accumulation studies on rotational crops: Two studies were submitted, reviewed, and found to be scientifically valid. One (Gemma, et al., September, 1982, ASD Report No. 82/042, Acc. No. 071326 and Spare et al., October, 1982 Acc. No. 071326) does not fulfill data requirements because the application rate was too low. The second study (Gemma et al., September, 1982, ASD Report No. 82/046, Acc. No. 071326) fulfills the data requirements for a maximum application rate of 0.50 lb ai/A with a 12 month rotational crop interval for root crops, leafy vegetable crops, and grain from cereal crops. Data requirements have not been fully satisfied for wheat straw and forage because the metabolite identification has not been confirmed. Additional studies must be submitted to establish rotational crop intervals for application at 0.75 lb ai/A.

Field accumulation studies on rotational crops: No data were submitted. Data may be required if the issues raised in the confined accumulation studies on rotational crops are not satisfactorily addressed.

Accumulation studies on irrigated crops: No data were submitted; however, data are not required because acifluorfen has no aquatic food crop or aquatic noncrop use, is not used in and around holding ponds used for irrigation purposes, and has no uses involving effluents or discharges to water used for crop irrigation.

Laboratory studies of accumluation in fish: One study (Thompson and Cranor, January, 1981, Acc. No. 071327) was submitted and reviewed. The study is scientifically valid and partially fulfills data requirements by providing data on the quantity of acifluorfen residues accumulated in fish. The required characterization of residues in fish may be waived if the levels of residues are sufficiently low to be of no toxicological concern. Judgement is deferred to the Toxicological Branch.

Field accumulation studies on nontarget organisms: No data were submitted; however requirements for these studies depend upon the results from laboratory studies of accumulation in fish and toxicological data.

Reentry studies: One worker exposure study has been submitted, but has not been reviewed by Dynamac.

Ancillary studies reviewed:

Static studies of accumulation in fish (Forbis and Boudreau, March, 1981, Acc. No. 071327).

Methods evaluation studies (Ku and Miller, November, 1980. Acc. No. 071325 and Ku and Norris, May, 1981, Acc. No. 071325).

References

Forbis, A.D., and P. Boudreau. March, 1981. Uptake, depuration and bioconcentration of MC-10978 by channel catfish (Ictalurus punctatus) in a static system with soil. ABC Report No. 26611. Acc. No. 071327.

Gemma, A.A. and J.P. Wargo. August, 1984. Metabolism of ^{14}C-MC-10978 (Tackle) in soil under aerobic and anaerobic conditions. Rhone-Poulenc Inc., Monmouth Junction, New Jersey. ASD Report No. 84/088. Acc. No. 254534.

Gemma, A.A., and J.P. Wargo. October, 1982. The metabolic fate of ^{14}C-MC-10978 in New Jersey loamy sand soil. ASD Report No. 82/051. Acc. No. 071324.

Gemma, A.A., and J.P. Wargo. October, 1982. Tackle soil metabolism: Metabolic fate of ^{14}C-MC-10978 in Maryland silt loam soil. ASD Report No. 82/053. Acc. No. 071324.

Gemma, A.A., J.P. Wargo, and G. Heinzelmann. September, 1982. Tackle field rotational crop study: The potential uptake of ^{14}C-MC 10978 in various crops grown under field conditions in soil treated with ^{14}C-MC 10978. ASD Report No. 82/042. Acc. No. 071326.

Gemma, A.A., J.P. Wargo, Jr., and G. Heinzelman. September, 1982. Tackle greenhouse rotational crop study: The potential uptake of ^{14}C MC 10978 in various crops from soil treated with ^{14}C MC 10978. ASD Report No. 82/046. Acc. No. 071326.

Gerecke, D.R., and J.P. Wargo. August, 1982. Photodegradation of Tackle (MC 10109) on a soil surface. ASD Report No. 82/045. Acc. No. 071323.

Guyton, G.L. August, 1984. Addendum to Report: Soil Dissipation data on Tackle® under field conditions. Rhone-Poulenc, Inc., Monmouth Junction, New Jersey, ASD Report No. 84/100. Acc. No. 254535.

Guyton, C.L. October, 1983. Soil dissipation data on Tackle® under field conditions. ASD Report No. 83/025. Acc. No. 252765.

Ku, C.C., and K.M. Miller. November, 1980. Determination of Mobil 10978 and Mobil 10109 residues in soils. Mobil Chemical Method 157-80. Acc. No. 071325.

Ku, C.C., and F.A. Norris. May, 1981. Validation of Mobil Chemical Method 157-81 "Determination of Mobil 10978 and Mobil 10109 residues in soil" Progress Memorandum PME-81.57. Acc. No. 071325.

Norris, F.A., J.P. Wargo, E.G. Jordon and S.S. Eng. August, 1984. Mobility and dissipation rates of Tackle® herbicide as determined from field experiments. ASD Report 84/099. Acc. No. 254536.

Norris, F.A., and A. Guardigli. May 1982. Adsorption-desorption of acifluorfen sodium (LS-80-1213, MC-10978) from a silt loam soil. PDD Report No. 82/030. Acc. No. 071325.

Norris, F.A., and A.E. Hassell. November, 1980. Hydrolytic stability of MC-10978 in buffered aqueous solutions. Technical Memorandum TME-80.17. Acc. No. 071323.

Norris, F.A., and C.C. Ku. April, 1981. Field dissipation and leaching studies. Progress Memorandum PME-81.48. Acc. No. 071325.

Norris, F.A., and K.M. Miller. December, 1980. Mobility of MC 10978 in four soil types. Technical Memorandum TME-80.24. Acc. No. 071325.

Piznik, M., and J.P. Wargo. September, 1982. Abbreviated aerobic/anaerobic soil metabolism study with radiolabeled Tackle (MC-10978). ASD Report No. 82/047. Acc. No. 071324.

Somma, N., F.A. Norris, and A. Guardigli. September, 1982. Photodegradation of Tackle in aqueous solution. Rhone-Poulenc, Inc., Monmouth Junction, New Jersey. ASD Report No. 82/048. Acc. No. 071323.

Spare, W.C., F. Dillion, and C. Hutchinson. October, 1982. Field metabolism studies with ^{14}C-MC-10978. Report No. 349. Acc. No. 071326.

Thompson, C.M., and W. Cranor. January, 1981. Uptake, depuration and bioconcentration of ^{14}C-MC 10978 by bluegill sunfish (Lepomis macrochirus) ABC Report No. 26610. Acc. No. 071327.

Wargo, J.P. July, 1982. Metabolism of carbon-14 labeled MC-10978 in Kansas, Virginia, Georgia and New Jersey soils under aerobic and anaerobic conditions. ASD Report No. 82/040. Acc. No. 071324.