Versar inc.

4

MEMORANDUM

TO: Catherine Joseph

cc: 3771.101
S. Anderson
J. Becker

FROM: Mike Huang
Diane Baxter

DATE: April 23, 1999

SUBJECT: Review of *Determination of Dislodgeable Foliar Residues in Succulent Beans Treated with Acephate* (MRID No. 447639-02)

This report reviews *Determination of Dislodgeable Foliar Residues in Succulent Beans Treated with Acephate*, submitted in support of the registration requirements for the pesticide, ORTHENE® 75 Soluble Powder. Requirements for this study are specified by the U.S. Environmental Protection Agency's (US-EPA) OPPTS Series 875, Occupational and Residential Exposure Test Guidelines, Group B: Postapplication Exposure Monitoring Test Guidelines, 875.2100, Dislodgeable Foliar Residue Dissipation: Agricultural, [formerly, EPA Assessment Guidelines Subpart K, Reentry Exposure Series 132-1]. Information which may be used to identify the study includes:

Title:	*Determination of Dislodgeable Foliar Residues in Succulent Beans Treated with Acephate*, 274 pages
Sponsor:	Joseph L. Powell Valent U.S.A. Corporation 6560 Trinity Court Dublin, CA 94568
Performing Laboratory: (Field Study)	Ag Solutions, Inc. 5757 NE Highway 20 Corvallis, OR 97330
Analytical Laboratory:	Valent U.S.A. Corporation Valent Technical Center 6560 Trinity Court Dublin, CA 94568
Author & Study Director:	J.C. Lai
Report Date:	February 11, 1999
Identifying Codes:	MRID # 447639-02; Lab Project Id. No. V11984

Executive Summary

The purpose of this study was to quantify dislodgeable foliar residues (DFRs) of the active ingredient in ORTHENE® 75 SP, acephate, and its metabolite methamidophos over time on succulent beans. The data were intended to assist in determination of worker re-entry intervals. The usage scenario profiled acephate use on a smooth leaf crop in a cool climate.

The study met most of the OPPTS 875.2100 guideline criteria, with the following exceptions: (1) The study was conducted only in one location. The guideline specifies DFR studies be conducted in three geographically different locations; (2) It is unclear whether DFR data were corrected for either laboratory or field fortification recovery; (3) Predicted foliar residues according to a first-order kinetics equation deviated significantly from the actual measured DFR values obtained.

The study was conducted near Corvallis, in Benton County, Oregon. The highest foliar acephate residue (i.e., 3.63 $\mu g/cm^{2)}$ was found immediately after the first application, while the highest methamidophos residue (i.e., 0.063 $\mu g/cm^{2)}$ occurred 1 day after the second application. After the second application, the acephate residue dissipation appeared to be bi-phasic (i.e., an initial fast dissipation from 0 day to 10 days after the second application, followed by the slower dissipation from day 10 to day 35). It appears that there may be two types of residues whose bonding to leaf surfaces were distinctively different.

The registrant analyzed DFR data for acephate and methamidophos collected after the second application using the linear regression technique, assuming first-order kinetics. Half-lives of 3.18 days ($R^2 = 0.79$) for acephate and 5.99 days ($R^2 = 0.88$) for methamidophos were calculated.

Versar re-analyzed the same data-sets using Microsoft EXCEL 97® linear regression function, and calculated very similar half-life values: 3.45 days ($R^2 = 0.83$) for acephate and 5.95 days for methamidophos ($R^2 = 0.88$). Versar also calculated a half-life value for the combined residues of acephate and methamidophos. The half-life for combined residues was estimated to be 3.665 days ($R^2 = 0.83$). "Predicted" residues were found to deviate significantly from actual DFR values measured. An alternative approach might be needed to provide a better description of the DFR dissipation data.

The field portion of the study involved a treated plot, divided into three replicate subplots, and a control plot situated at least 100 feet away. Two applications of ORTHENE® 75 SP were made, seven days apart, at a rate of 1.0 lb a.i. per acre (maximum label rate) in 20 gallons/acre (minimum volume) with a tractor-mounted boom sprayer. Leaf punch samples were collected at the following intervals: just prior to application 1, just after application 1 when the spray had dried, 1 day before application 2, just after application 2, and day 1, 2, 3, 5, 7, 10, 14, 21, 28, 35 after the second application. At each interval, three replicate samples were collected from the treated plot and one sample was collected from the control plot. At intervals, when

field fortification samples were prepared, six more samples were collected from the control plot.

Sample replicates each consisted of forty 1- inch (2.54 cm) diameter leaf punches collected at each interval, representing a total of 405 cm^2 surface area. (Leaf punches were collected only from leaves which had also been present at the first application). Insecticide residues were dislodged by extracting twice with 100 mL of 0.01% Triton X-100 solution. The extraction was performed by mechanically shaking the leaf punches in the Triton solution for ten minutes. All the samples were dislodged within 1.5 hours of collection. The dislodged samples were stored frozen until shipment.

The proprietary analytical method used was validated prior to initiation of the study. It involved extraction of residues with ethyl acetate and analysis by gas chromatography with flame photometric detection. The laboratory fortification recoveries averaged 84.9 percent for acephate and 98.0 percent for methamidophos. For this study, the limit of detection (LOD) was 0.125 µg (0.0003 µg /cm^2) for acephate and 0.05 µg (0.0001 µg /cm^2) for methamidophos. The limit of quantification (LOQ) for both acephate and methamidophos was 0.0025 µg /cm^2.

Field fortification samples were prepared in three replicates at two spiking levels at six sampling intervals. The field spike samples were analyzed with field DFR samples collected at the same interval to assure the quality of the samples. The overall average recovery was 88.4 percent ± 12 percent CV for acephate and 86.4 percent ± 15 percent CV for methamidophos. A storage stability study was also conducted and results suggested that the residues were stable during the period of sample storage.

STUDY REVIEW

Study Background

ORTHENE® 75 SP is an organophosphate insecticide used on a wide variety of crops, including: certain vegetables (e.g. head lettuce, dry and succulent beans, celery, cole crops, etc.), cranberries, cotton, mint, peanuts, tobacco, non-bearing citrus, and non-crop areas (e.g. wasteland and rights-of-way). ORTHENE® 75 SP is a soluble powder formulation containing the active ingredient (a.i.) acephate at 75 percent. The study presents DFR data for acephate and methamidophos residues before and after two spray applications of ORTHENE® 75 SP. The data were submitted in response to a Data Call-in Notice issued by EPA, and are intended to assist in determination of worker re-entry intervals.

Test Plot

This study profiled a single usage scenario (i.e., acephate use on a smooth leaf crop in a cool climate). It was conducted using a test-plot of green podded bush beans near Corvallis, Benton County, Oregon. The test plot consisted of a treated plot (subdivided into three subplots) and a control plot, situated at least 100 feet apart. The beans in the plots were cultivated and maintained according to normal agricultural practices. No pesticides containing acephate were applied to the beans before the study began.

Materials and Applications

Two applications of ORTHENE® 75 SP were made at a rate of 1.0 lb acephate per acre (maximum label rate) by a tractor mounted sprayer with nine nozzles. The volume of solution applied was around 20 gallons per acre (minimum recommended volume). Two applications were made, seven days apart. Table 3 of the study report (see pg. 26) tabulates environmental conditions during acephate application.

Meteorology

During the study, recorded ambient air temperatures were higher than normal and rainfall was less than normal. These conditions might be expected to be representative of worst-case conditions and slower residue dissipation rates. Sprinkler and flood irrigation were required to avoid retarding plant growth. Table 1, below, summarizes rain and irrigation events with regard to pesticide applications. No rain and irrigation events occurred within 24 hours after the applications of ORTHENE® 75 SP.

Sample Collection

Leaf punch samples were collected at the following intervals: just prior to the first application, just after the first application (when sprays had dried), one day before the second

application, just after the second application, and at day 1, 2, 3, 5, 7, 10, 14, 21, 28, 35 following the second application. At each sampling interval, one leaf punch sample was collected from the control plot, and three samples were collected from the treated plot. Six more samples were collected from the control plots at sampling intervals when the field fortification samples were prepared.

Forty 2.54 cm diameter leaf punches were collected per sample at each interval (from those plant leaves also present at the first application). Each sample represented 405 cm^2 of surface area counting both sides of the leaf punches. Residues were dislodged by extracting twice in 100 mL of 0.01% Triton X-100 solution, and mechanically shaking for ten minutes. All samples were dislodged within 1.5 hours of collection and stored frozen until shipment.

At six sampling intervals, field fortified samples were prepared. An additional six leaf punch samples collected from the control plot were dislodged and the dislodged samples were then fortified with mixed solution of acephate and methamidophos at two concentrations, in triplicate. Field fortified samples were stored frozen and treated in exactly the same way as the DFR samples.

Sample Storage & Handling

All dislodged samples were shipped by overnight delivery service on dry ice to the analytical laboratory. Samples were kept at - 20 °C until analysis.

QA/QC

Analytical methodology

The analytical methodology used was validated prior to initiation of the DFR study. The method involved salting of the samples with anhydrous sodium sulfate, extraction with ethyl acetate, and analysis via gas chromatography with flame photometric detection. The methodology was available for review in Appendix II of the study report.

Sample History

The study commenced about 45 days prior to normal harvest, and samples were collected between June 30 and August 4, 1998. Analyses were completed by September 23, 1998. The study author provided a sample history table (see page 23) indicating the interval between sample collection and extraction ranged between 2 and 78 days.

Limit of Detection (LOD) & Limit of Quantitation (LOQ)

The LOD was 0.125 µg (0.0003 µg /cm^2) for acephate and 0.05 µg (0.0001 µg /cm^2) for methamidophos. The LOQ for both acephate and methamidophos was 0.0025 µg /cm^2.

Laboratory Recovery

Laboratory fortification samples (i.e., 1, 10, 200, and 800 µg acephate per 100 mL of detergent solution and at 1, 10, and 40 µg methamidophos per 100 mL of detergent solution) were analyzed concurrently with each set of DFR samples. Average laboratory spike recovery was 84.9 ± 11 percent for acephate and 98.0 ± 18 percent for methamidophos. See Table 2, below. (Individual recovery values are provided in Table 6 of the study report.)

Storage Stability Recovery

The stability of acephate and methamidophos during sample storage was studied by periodically analyzing laboratory fortified samples stored either under refrigeration or frozen. Results suggested that the residues of acephate and methamidophos were stable during storage. The recoveries of acephate and methamidophos at periodic intervals are provided in Table 7 of the study report.

Fortified Field Recovery

Field fortification samples were prepared in triplicate at four concentrations and six sampling intervals. The field fortified samples were analyzed concomitantly with the DFR samples. The overall average (all fortification levels) recovery was 88.4 ± 12 percent for acephate and 86.4 ± 15 percent for methamidophos. Table 3, below, summarizes field spike recoveries for both analytes. (Individual recovery values are provided in Table 5 of the study report).

Results

The DFR data for each sampling interval are summarized in Table 4. The highest foliar acephate residue level (i.e., 3.63 µg/cm^2) was found immediately after the first application, while the highest methamidophos residue level (i.e., 0.063 µg/cm^2) was found 1 day after the second application. After the second application, the acephate residue dissipation appeared to be bi-phasic, i.e., an initial fast dissipation from 0 day to 10 days after the second application, followed by slower dissipation from day 10 to day 35.

The registrant analyzed the DFR dissipation data collected after the second application using the linear regression technique, assuming first-order kinetics. The calculated acephate half-life was 3.18 days (R^2 = 0.7882), and the calculated methamidophos half-life was 5.99 days (R^2 = 0.8786).

Versar re-analyzed the same data-sets using the Microsoft EXCEL 97® linear regression function, and calculated very similar half-life values: 3.45 days (R^2 = 0.83) for acephate and 5.95 days for methamidophos (R^2 = 0.88). Versar also calculated a half-life value for the combined residues of acephate and methamidophos. The half-life for combined residues was estimated to be 3.665 days (R^2 = 0.83). Table 5, below, presents a comparison of half-lives calculated by

Versar and those calculated by the registrant. Appendices A, B, and C of this review contain the regression analyses for acephate DFRs, methamidophos DFRs, and combined DFRs.

"Predicted" residues were found to deviate significantly from actual DFR values measured, especially for acephate. The registrant used two approaches in an attempt to provide a better description of the residue dissipation data. The first approach was to estimate the half-life using DFR data from Day 0 through Day 10. The calculated half-life was then 1.37 days (R^2 = 0.9673). The second approach used by the registrant involved using a curve-fitting program to generate an empirical exponential equation, from which was calculated the time required for 50% of residue to dissipate, estimated to be 0.98 days. Comparison between the predicted and actual residue values suggests that these approaches do significantly improve pesticide residue dissipation estimates, at least for the period from 0 to 10 days after the second application. However, these approaches significantly underestimate or simply cannot predict residue dissipation for the period from 10 days to 35 days after the second application.

In conclusion, an alternative model other than the simple first-order kinetics model is needed to describe the whole range of the DFR data.

Data Variability

Versar examined data variability as part of the linear regression exercise and found that coefficients of variance for replicate samples ranged from 6.5 to 50% for acephate and from 0% to 36% for methamidophos. There are no specific requirements concerning the variability of replicate samples in the Pesticide Assessment Guidelines.

Table 1. Rain and Irrigation Events

Event Date	Event Description
June 29, 1998	Sprinkler irrigation 1"
June 30, 1998	**Application 1**
July 6, 1998	Sprinkler irrigation 1"
July 7, 1998	**Application 2**
July 10, 1998	Rainfall 0.05"
July 11, 1998	Rainfall 0.01"
July 24, 1998	Flood irrigation 1-1.25"
July 29, 1998	Flood irrigation 1-1.25"
July 30, 1998	Rainfall 0.04"

Table 2. Average Laboratory Fortification Recoveries for Acephate and Methamidophos in the Dislodging Solutions

	Acephate			Methamidophos		
µg Fortified in 100 mL	n	Mean Recovery (%)	Coefficient of Variation (CV) (%)	n	Mean Recovery (%)	Coefficient of Variation (CV) (%)
800	1	83.7	--	--	--	--
200	1	93.6	--	--	--	--
40	0	--	--	1	97.6	--
10	2	82.0	--	2	95.2	--
1.0	4	84.5	± 14.5	5	99.2	± 23.9
Overall Average	8	84.9	± 11	8	98.0	± 18

Table 3. Average Field Fortification Recoveries for Acephate and Methamidophos in Dislodging Solution

	Acephate			Methamidophos		
µg Fortified in 200 mL	n	Mean Recovery (%)	Coefficient of Variation (CV) (%)	n	Mean Recovery (%)	Coefficient of Variation (CV) (%)
400	4	83.1	± 10			
40	1	103	--			
20	10	90.4	± 14	9	90.0	±16
2.0	7	85.7	± 7.3	12	83.6	±14
Overall Average	21	88.4	± 12	21	86.4	±15

Table 4. Dislodgeable Foliar Residues of Acephate and Methamidophos on Succulent Bean Leaves after the Two Broadcast Applications of ORTHENE® 75 SP

	Acephate Residues on leaves (µg/cm²)				Methamidophos Residues on leaves (µg/cm²)			
Sampling interval	Repli. 1	Repli. 2	Repli. 3	Average	Repli. 1	Repli. 2	Repli. 3	Average
Pre-Application 1	<0.0025	<0.0025	<0.0025	<0.0025	<0.0025	<0.0025	<0.0025	<0.0025
Post-Application 1	3.610	3.480	3.630	3.5733	0.0140	0.0116	0.0105	0.0120
Pre-Application 2	0.217	0.131	0.244	0.1973	0.0152	0.0120	0.0162	0.1447
Post-Application 2	3.150	2.76	2.690	2.8667	0.0212	0.0196	0.0185	0.0198
1 day after appln 2	1.190	1.84	1.440	1.4900	0.0628	0.0595	0.0485	0.0569
2	0.635	0.672	0.794	0.7003	0.0403	0.0343	0.0368	0.0371
3	0.296	0.260	0.282	0.2793	0.0180	0.0170	0.0160	0.0170
5	0.105	0.129	0.172	0.1353	0.0100	0.0110	0.0160	0.0123
7	0.058	0.039	0.076	0.0577	0.0120	0.0080	0.0120	0.0107
10	0.016	0.016	0.019	0.0170	0.0040	0.0050	0.005	0.0047
14	0.013	0.010	0.009	0.0107	0.0030	0.0030	0.003	0.0030
21	0.007	0.007	0.012	0.0087	0.0020	0.0020	0.003	0.0023
28	0.006	0.006	0.004	0.0053	0.0017	0.0018	0.0015	0.0017
35	0.001	0.0005	0.0015	0.0010	0.0005	0.0005	0.0007	0.0006

Table 5. Half-life for Acephate and Methamidophos as Estimated by the Registrant and Versar

	Acephate		Methamidophos		Combined Residues	
	Half-life (days)	Correlation Coeffi. (R^2)	Half-life (days)	Correlation Coeffi. (R^2)	Half-life (days)	Correlation Coeffi. (R^2)
Calculated by Registrant	3.18	0.7882	5.99	0.8786	--	--
Calculated by Versar	3.45	0.8345	5.95	0.8799	3.67	0.8294

Compliance Checklist

Compliance with OPPTS Series 875, Occupational and Residential Exposure Test Guidelines, Group B: Postapplication Exposure Monitoring Test Guidelines, 875.2100, Dislodgeable Foliar Residue Dissipation: Agricultural, [formerly, EPA Assessment Guidelines Subpart K, Reentry Exposure Series 132-1] is critical. The itemized checklist below describes compliance with the major technical aspects of OPPTS 875.2100, and is based on the "Checklist for Residue Dissipation Data" used for study review by the U.S. EPA/OPP/HED. Additional data gaps identified in the study (not covered by the checklist) are also presented below:

- *Typical end use product of the active ingredient used.* This criterion was met. The product label was provided with the study report.

- *Site(s) treated representative of reasonable worst-case climatic conditions expected in intended use areas.* This criterion was partially met. The site represents a cool climatic zone where the application of pesticide is a normal agricultural practice. Whether or not reasonable "worst-case" climatic conditions were captured is not known.

- *End use product applied by application method recommended for the crop. Application rate given and should be at the least dilution and highest, label permitted, application rate.* This criterion was met. Only one application rate was used. The application rate was the maximum rate permitted by the product label (i.e., 1.0 lb a.i./A). The application volume was the minimum permitted by the product label (i.e., 20 gallons/A).

- *Applications occurred at time of season that the end-use product is normally to achieve intended pest control.* This criterion was met. The applications in this study were made at 45 days prior to normal harvest, which is accepted as part of the typical management season.

- *If multiple applications are made, the minimum allowable interval between applications should be used.* This criterion was met. Two applications were made 7 days apart. The label directs: "repeat at 7 to 10 day spray intervals as necessary to maintain control."

- *Meteorological conditions including temperature, wind speed, daily rainfall, and humidity provided for the duration of the study.* This criterion was met. Meteorological conditions for the duration of the study are provided in Tables 1 and 3 and Appendix III of the study report.

- *Reported residue dissipation data in conjunction with toxicity data must be sufficient to support the determination of a reentry interval.* This criterion was

partially met. Residue dissipation data were provided, however toxicity data were not included in the study report.

- *Residue storage stability, method efficiency (residue recovery), and limit of quantitation provided.* This criterion was met. The storage stability recoveries, laboratory method recoveries, and limits of quantification were provided in the report. The limit of quantification was 0.0025 $\mu g/cm^2$ for acephate and methamidophos.

- *Duplicate foliar and/or soil samples collected at each collection period.* This criterion was met. Triplicate samples were collected at each sampling interval.

- *Control and baseline foliar or soil samples collected.* The criterion was met. Control samples were collected from the control plot at each sampling interval. Blank detergent solution samples were also analyzed. No soil samples were collected.

- *Sufficient collection times to establish dissipation curve.* This criterion was met. Samples were collected just before and just after both applications, and 1, 2, 3, 5, 7, 10, 14, 21, 28, and 35 days after the second application. By day 35, residues were below the limit of quantification.

- *A minimum of 400 cm^2 foliar material was collected per DFR sample.* The criterion was met.

- *Foliar residue data expressed as $\mu g/cm^2$ leaf surface area.* This criterion was met. All residue data were reported in $\mu g/cm^2$.

Pertinent data gaps and other issues critical to the scientific validity and regulatory acceptability of the study (i.e., Subdivision K compliance), not already addressed, are presented below. The following issues were identified:

- OPPTS 875.2100 (an Update to Subdivision K) specifically requires that the DFR samples be typically collected from at least three geographically distinct locations for each crop. In this study, DFR samples were collected only from one location.

- It is unclear whether the registrants corrected raw DFR data for laboratory or field recovery losses before running their regression analysis.

- "Predicted" residues calculated based on first-order kinetics deviated significantly from the actual DFR data. An alternative approach might be needed to provide a better description of the residue dissipation data.

Appendix A

Versar's Regression Analysis for DFR Acephate Data

Regression Analysis: Summary Output for Acephate

Regression Statistics	
Multiple R	0.91637
R Square	0.839735
Adjusted R^2	0.834565
Standard Error	1.016782
Observations	33

ANOVA

	df	*SS*	*MS*	*F*	*Signif. F*
Regression	1	167.927	167.927	162.42945	7.29816E-14
Residual	31	32.04921	1.033846		
Total	32	199.9762			

	Coeff.	*Std. Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*
Intercept	-0.50032	0.252668	-1.980152	0.056622	-1.015640017	0.014999101
Slope	-0.200622	0.015742	-12.74478	7.298E-14	-0.232727057	-0.168517002

Half Life = 3.45499 Days

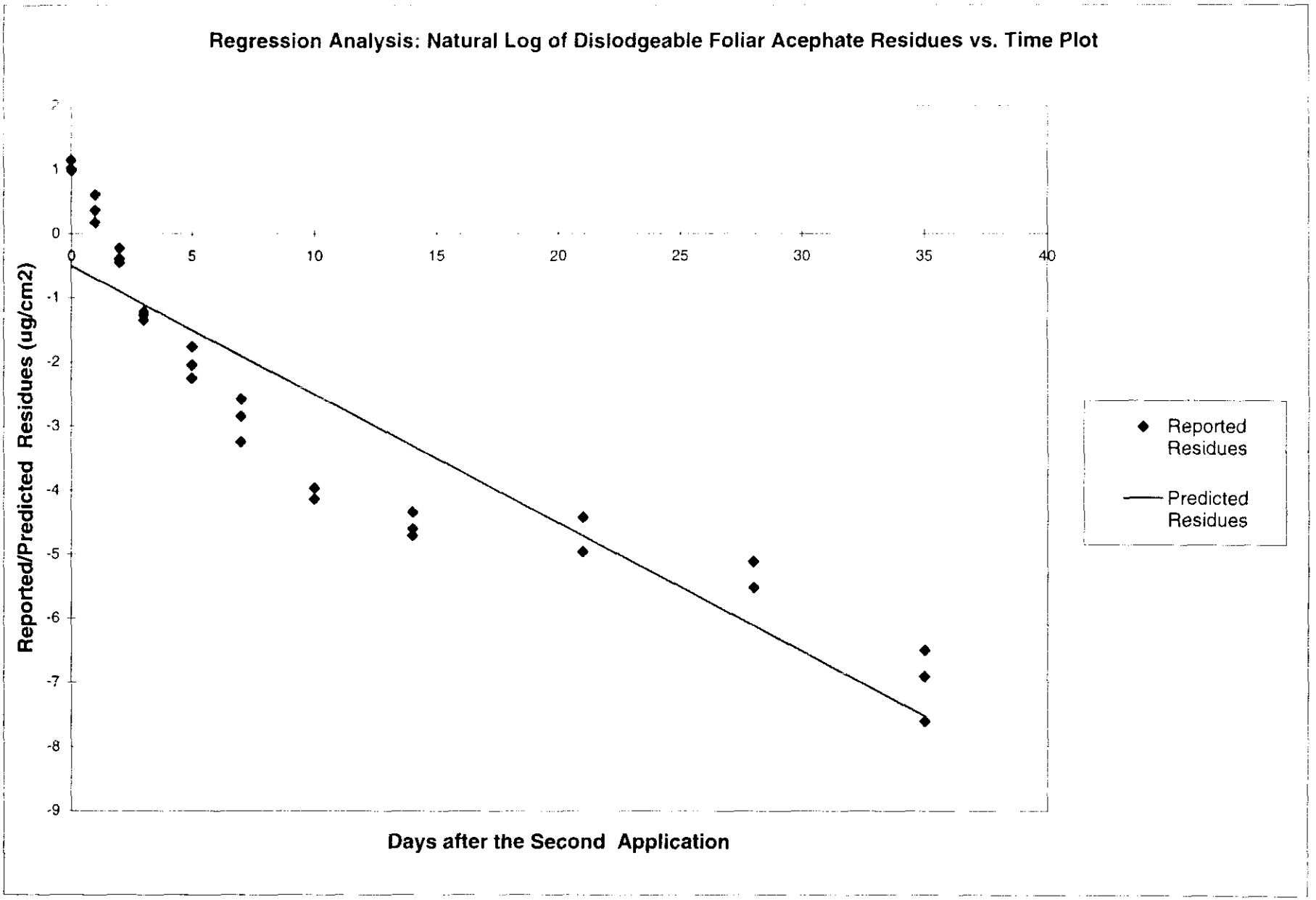
Predicted DFR Levels

Time (Days)	Residue (ug/cm2)
0	0.606336
1	0.496117
2	0.405934
3	0.332144
4	0.271767
5	0.222366
6	0.181945
7	0.148871
8	0.12181
9	0.099667
10	0.08155
11	0.066726
12	0.054597
13	0.044672
14	0.036552
15	0.029907
16	0.024471
17	0.020023
18	0.016383
19	0.013405
20	0.010968

Time (Days)	Residue (ug/cm2)
21	0.0089744
22	0.007343
23	0.0060082
24	0.0049161
25	0.0040224
26	0.0032912
27	0.002693
28	0.0022034
29	0.0018029
30	0.0014752
31	0.001207
32	0.0009876
33	0.0008081
34	0.0006612
35	0.000541

Regression Analysis: Means and CVs for Acephate

Days after Last Treatment	Residues (ug/cm2)	Mean (ug/cm2)	Standard Deviation (ug/cm2)	Coefficient of Variation (%)
0	3.15	2.87	0.248	8.64
	2.76			
	2.69			
1	1.19	1.49	0.328	22
	1.84			
	1.44			
2	0.635	0.7	0.0832	11.9
	0.672			
	0.794			
3	0.296	0.279	0.0181	6.5
	0.26			
	0.282			
5	0.105	0.135	0.0339	25.1
	0.129			
	0.172			
7	0.058	0.0577	0.0185	32.1
	0.039			
	0.076			
10	0.016	0.017	0.00173	10.2
	0.016			
	0.019			
14	0.013	0.0107	0.00208	19.5
	0.01			
	0.009			
21	0.007	0.00867	0.00289	33.3
	0.007			
	0.012			
28	0.006	0.00533	0.00115	21.7
	0.006			
	0.004			
35	0.001	0.001	0.0005	50
	0.0005			
	0.0015			


Regression Analysis: Natural Log of Dislodgeable Foliar Acephate Residues vs. Time Plot
Reported/Predicted Residues (ug/cm2)
Days after the Second Application
Reported Residues
Predicted Residues
0
5
10
15
20
25
30
35
40
1
0
-1
-2
-3
-4
-5
-6
-7
-8
-9

Appendix B

Versar's Regression Analysis for DFR Methamidophos Data

Regression Analysis: Summary Output for Methamidophos

Regression Statistics	
Multiple R	0.940282
R Square	0.884131
Adjusted R^2	0.879993
Standard Error	0.486923
Observations	30

ANOVA

	df	*SS*	*MS*	*F*	*Signif. F*
Regression	1	50.65562	50.65562	213.65243	1.24418E-14
Residual	28	6.638621	0.237094		
Total	29	57.29424			

	Coeff.	*Std. Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*
Intercept	-3.570218	0.134051	-26.63325	1.974E-21	-3.844809381	-3.295626161
Slope	-0.116392	0.007963	-14.61685	1.244E-14	-0.132703617	-0.100081109

Half Life = 5.955263 Days

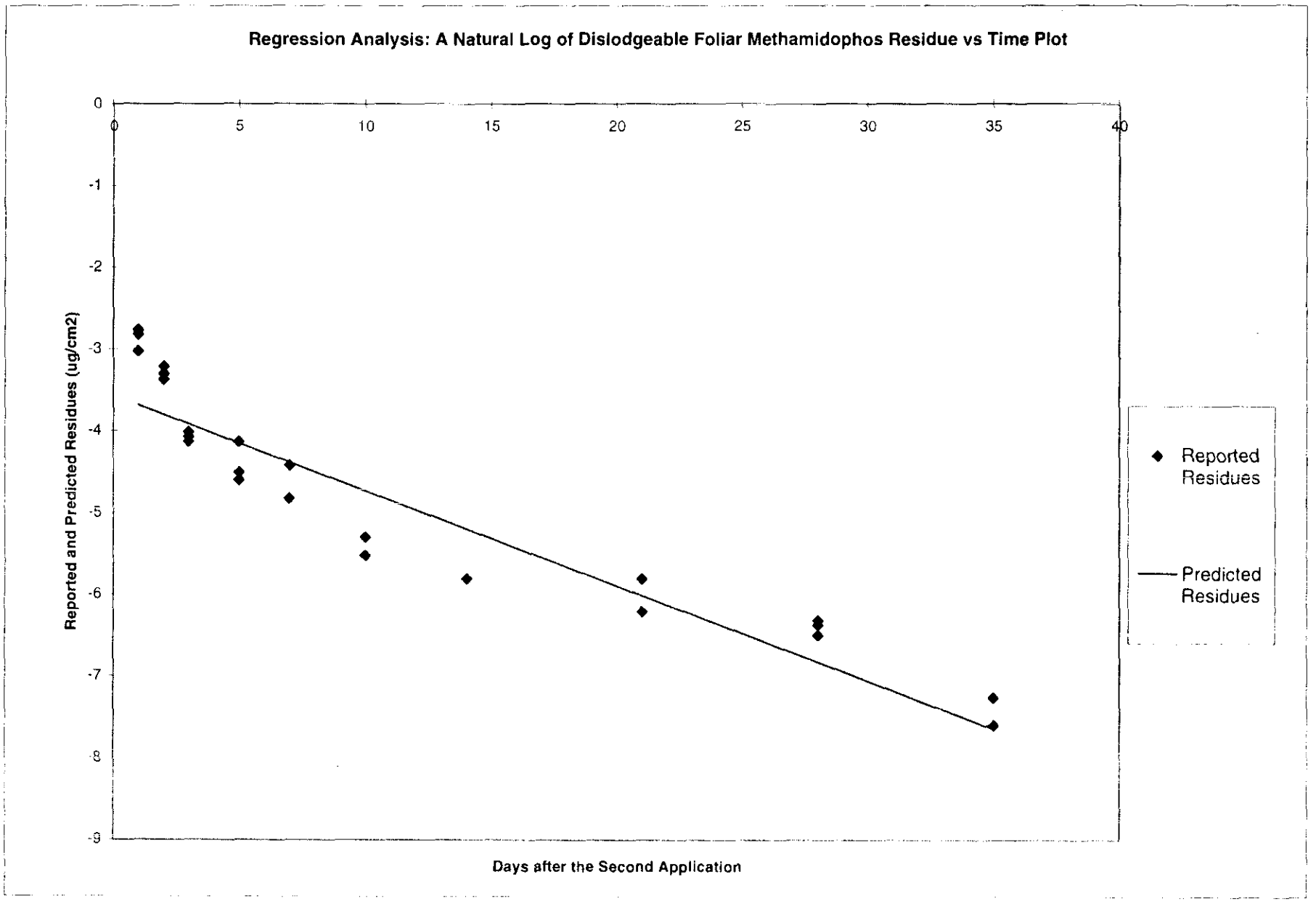
Predicted DFR Levels

Time (Days)	Residue (ug/cm2)
0	0.02815
1	0.025057
2	0.022304
3	0.019853
4	0.017672
5	0.01573
6	0.014002
7	0.012463
8	0.011094
9	0.009875
10	0.00879
11	0.007824
12	0.006965
13	0.006199
14	0.005518
15	0.004912
16	0.004372
17	0.003892
18	0.003464
19	0.003084
20	0.002745

Time (Days)	Residue (ug/cm2)
21	0.0024432
22	0.0021747
23	0.0019358
24	0.0017231
25	0.0015338
26	0.0013652
27	0.0012152
28	0.0010817
29	0.0009629
30	0.0008571
31	0.0007629
32	0.0006791
33	0.0006045
34	0.0005381
35	0.0004789

Regression Analysis: Means and CVs for Methamidophos

Days after Last Treatment	Residues (ug/cm2)	Mean (ug/cm2)	Standard Deviation (ug/cm2)	Coefficient of Variation (%)
1	0.0628	0.0569	0.00749	13.2
	0.0595			
	0.0485			
2	0.0403	0.0371	0.00301	8.12
	0.0343			
	0.0368			
3	0.018	0.017	0.001	5.88
	0.017			
	0.016			
5	0.01	0.0123	0.00321	26.1
	0.011			
	0.016			
7	0.012	0.0107	0.00231	21.6
	0.008			
	0.012			
10	0.004	0.00467	0.000577	12.4
	0.005			
	0.005			
14	0.003	0.003	0	0
	0.003			
	0.003			
21	0.002	0.00233	0.000577	24.8
	0.002			
	0.003			
28	0.0017	0.00167	0.000153	9.15
	0.0018			
	0.0015			
35	0.0005	0.000567	0.000115	20.4
	0.0005			
	0.0007			


Regression Analysis: A Natural Log of Dislodgeable Foliar Methamidophos Residue vs Time Plot
Reported and Predicted Residues (ug/cm2)
0
-1
-2
-3
-4
-5
-6
-7
-8
-9
0
5
10
15
20
25
30
35
40
Days after the Second Application
Reported Residues
Predicted Residues

Appendix C

Versar's Regression Analysis for Combined Residues Acephate and Methamidophos

Regression Analysis: Summary Output for Combined Residues of Acephate and Methamidophos

Regression Statistics	
Multiple R	0.913672
R Square	0.834797
Adjusted R^2	0.829468
Standard Error	0.976034
Observations	33

ANOVA

	df	*SS*	*MS*	*F*	*Signif. F*
Regression	1	149.2299	149.2299	156.6482	1.17129E-13
Residual	31	29.53194	0.952643		
Total	32	178.7618			

	Coeff.	*Std. Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*
Intercept	-0.45693	0.242542	-1.883919	0.0689851	-0.951597825	0.037738463
Slope	-0.189124	0.015111	-12.51592	1.171E-13	-0.219942247	-0.158305408

Half Life = 3.665044 Days

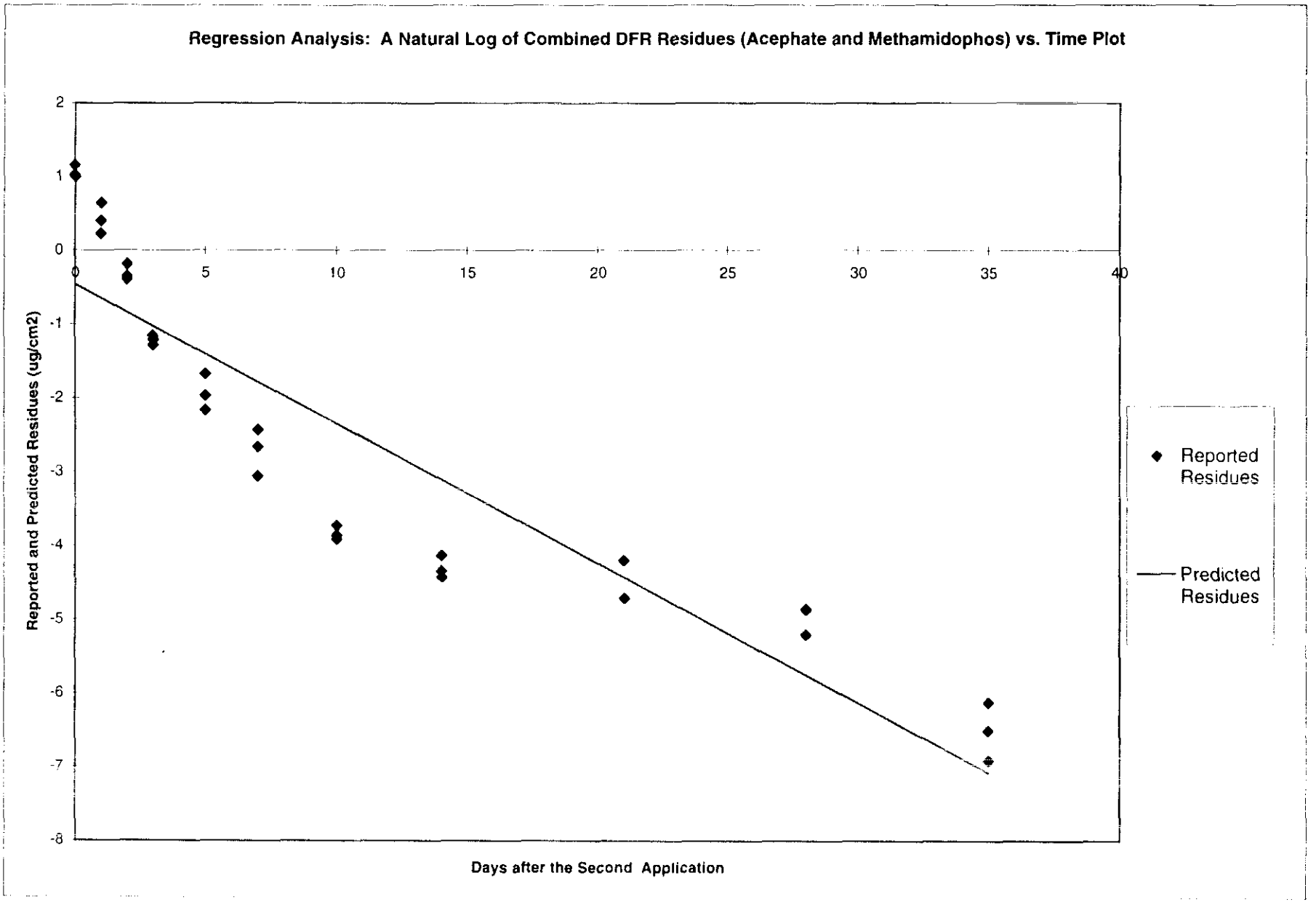
Predicted DFR Levels

Time (Days)	Residue (ug/cm2)
0	0.633225
1	0.52411
2	0.433798
3	0.359047
4	0.297178
5	0.245969
6	0.203585
7	0.168504
8	0.139468
9	0.115435
10	0.095544
11	0.07908
12	0.065453
13	0.054175
14	0.04484
15	0.037113
16	0.030718
17	0.025425
18	0.021044
19	0.017417
20	0.014416

Time (Days)	Residue (ug/cm2)
21	0.011932
22	0.0098759
23	0.0081742
24	0.0067656
25	0.0055998
26	0.0046349
27	0.0038362
28	0.0031752
29	0.002628
30	0.0021752
31	0.0018004
32	0.0014901
33	0.0012334
34	0.0010208
35	0.0008449

Regression Analysis: Means and CVs for Combined Residue

Days after Last Treatment	Residues (ug/cm2)	Mean (ug/cm2)	Standard Deviation (ug/cm2)	Coefficient of Variation (%)
0	3.1712	2.89	0.249	8.62
	2.7796			
	2.7085			
1	1.2528	1.55	0.327	21.1
	1.8995			
	1.4885			
2	0.6753	0.737	0.0823	11.2
	0.7063			
	0.8308			
3	0.314	0.296	0.0186	6.27
	0.277			
	0.298			
5	0.115	0.148	0.0371	25.1
	0.14			
	0.188			
7	0.07	0.0683	0.0206	30.1
	0.047			
	0.088			
10	0.02	0.0217	0.00208	9.59
	0.021			
	0.024			
14	0.016	0.0137	0.00208	15.2
	0.013			
	0.012			
21	0.009	0.011	0.00346	31.5
	0.009			
	0.015			
28	0.0077	0.007	0.0013	18.6
	0.0078			
	0.0055			
35	0.0015	0.00157	0.000603	38.4
	0.001			
	0.0022			


Regression Analysis: A Natural Log of Combined DFR Residues (Acephate and Methamidophos) vs. Time Plot
Reported and Predicted Residues (ug/cm2)
2
1
0
-1
-2
-3
-4
-5
-6
-7
-8
0
5
10
15
20
25
30
35
40
Days after the Second Application
Reported Residues
Predicted Residues

13544

R132697

Chemical: Acephate

PC Code:
103301

HED File Code: 19050 Versar DER Warning: May not have been QAed by EPA--
CONTRACTOR DRAFT DOCUMENT

Memo Date: 4/23/1999

File ID: 00000000

Accession #: 412-07-0024

HED Records Reference Center
11/9/2006