UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
WASHINGTON, D.C. 20460

OFFICE OF
PREVENTION, PESTICIDES AND
TOXIC SUBSTANCES

11/05/98

MEMORANDUM

SUBJECT: Malathion: PC Code 057701, Registration Case 0248. Magnitude of Residues in Alfalfa, Clover and Cottonseed (OPPTS 860.1500); Processing Studies in Grapes, Cottonseed, Rice and Field Corn (OPPTS 860.1520), DP Barcode Nos. D213105, D213929

FROM: Manying Xue, Chemist
Chemistry and Exposure Branch 1
Health Effects Division (7509C)

THROUGH: Francis B. Suhre, Branch Senior Scientist
Chemistry and Exposure Branch 1
Health Effects Division (7509C)

TO: Diana Locke, Chemist
Reregistration Branch 2
Health Effects Division (7509C)

Attached is a review of the field trial data depicting the magnitude of residues of malathion and malaoxon in/on alfalfa forage and hay (1995, MRID 43546101), clover forage and hay (1995, MRID 43545201), cottonseed (1995, MRID 43596601), field corn processed commodities (1995, MRID 43577401), cottonseed processed commodities (1995, MRID 43585301), grape processed commodities (1995, MRID 43548401), and rice processed commodities (1995, MRID 43562301).

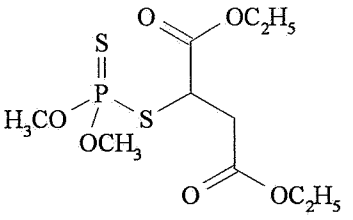
The review was prepared by Dynamac Corporation under contract to the HED. The adequacy in fulfilling residue chemistry data requirements was evaluated for malathion reregistration. This information has undergone secondary review in CEB1 and has been revised to reflect Agency's policy.

The data demonstrated that combined residues of malathion and malaoxon did not exceed the established tolerances in/on most submitted commodities; the exceptions are alfalfa hay and cottonseed. Based on the residue data in these studies, CEB1 recommends that tolerances should be 115 ppm for alfalfa forage, 185 ppm for alfalfa hay, 125 ppm for clover forage and hay, and 20 ppm for cottonseed.

(1)

cc: Xue, Malathion List A File, SF, RF, Lan, D. Lateulere (SRRD)
RDI: ResChemTeam: 10/29/98 :FBSuhre 11/05/98
7509C: CEBI: Mxue :CM-2: RM 816F: 703 305-6198: 10/29/98

MALATHION



PC No. 057701; Case 0248

(DP Barcodes D213105 and D213929)

REGISTRANT'S RESPONSE TO RESIDUE CHEMISTRY DATA REQUIREMENTS

BACKGROUND

In response to the Malathion Reregistration Standard Guidance Document, dated 2/88, Cheminova Agro A/S, through its authorized representatives Jellinek, Schwartz & Connolly, Inc., submitted field residue data for: alfalfa forage and hay (1995, MRID 43546101), clover forage and hay (1995, MRID 43545201), cottonseed (1995, MRID 43596601), field corn processed commodities (1995, MRID 43577401), cottonseed processed commodities (1995, MRID 43585301), grape processed commodities (1995, MRID 43548401), and rice processed commodities (1995, MRID 43562301).

Tolerances for residues in/on food/feed commodities are currently expressed in terms of malathion *per se* (*O,O*-dimethyl dithiophosphate of diethyl mercaptosuccinate) [40 CFR §180.111, §185.3850, §185.7000, and §186.3850]. The HED Metabolism Assessment Review Committee (7/15/92, R. Perfetti) has determined that the parent compound malathion and the metabolite malaoxon are the compounds to be regulated in plant commodities. Codex MRLs exist for residues of malathion *per se* in/on various raw agricultural and processed commodities. The Codex MRLs and the U.S. tolerances will be incompatible when the U.S. tolerance expression for plant commodities is revised to include both residues of malathion and the metabolite malaoxon.

CONCLUSIONS

Magnitude of the Residue in Non-Grass Animal Feeds

1. The field residue data (MRID 43546101), reflecting the maximum use patterns of the EC and RTU formulations on alfalfa, indicate that the combined residues of malathion

and malaoxon in/on alfalfa hay exceeded the established 135ppm tolerance (presently expressed as malathion *per se*), but that combined residues in/on alfalfa forage will not exceed the established tolerance. The combined residues of malathion and malaoxon ranged from 1.04 - 110.12ppm for alfalfa forage, and 0.31 - 182.2 ppm for alfalfa hay following treatment with the 5 lb/gal EC and 9.79 lb/gal RTU formulations.

2. The field residue data (MRID 43545201), reflecting the maximum use patterns the registrant wishes to support for use of the EC and RTU formulations on clover, indicate that the combined residues of malathion and malaoxon in/on clover forage and hay did not exceed the established 135ppm tolerance (presently expressed as malathion *per se*). The combined residues of malathion and malaoxon ranged from 2.8 - 120.14ppm for clover forage, and 3.3 - 120.50 ppm for clover hay following treatment with the 5 lb/gal EC and 9.79 lb/gal RTU formulations.

Magnitude of the Residue in Cottonseed

3a. The field residue data (MRID 43596601), reflecting the use of the EC and RTU formulations on cotton, indicate that the combined residues of malathion and malaoxon will substantially exceed the established tolerance (presently expressed as malathion *per se*) of 2 ppm for cottonseed. The combined residues of malathion and malaoxon in/on cottonseed harvested immediately (3 hours) following the last of 25 foliar applications, with a 3-day retreatment interval, were: (i) 3.08-19.12 ppm when the 5 lb/gal EC formulation was applied at 2.5 lb ai/A/application (1x) in 30 gal/A using ground equipment; (ii) 1.8-5.47 ppm when the 4.1 lb/gal RTU formulation was applied at 1.15 lb ai/A/application (1x) using aerial ULV equipment; and (iii) 2.1-6.50 ppm when the 9.79 lb/gal RTU formulation was applied at 1.22 lb ai/A/application (1x) using aerial ULV equipment.

3b. Table I of OPPTS 860.1000 requires cotton gin byproducts (gin trash) as a RAC of cotton; therefore, residue data depicting residues of malathion and malaoxon in/on cotton gin byproducts following applications of representative Cheminova-registered EC and RTU formulations according to the maximum registered use patterns must be submitted. A minimum of six field trials are required.

Magnitude of the Residue in Cottonseed Processed Commodities

4. The cottonseed processing study (MRID 43585301) is adequate to satisfy reregistration requirements. The combined residues of malathion and malaoxon did not concentrate in cottonseed hulls, meal, crude oil, refined oil, and bleached and deodorized oil processed from cottonseed bearing detectable residues following treatment with the 5 lb/gal EC formulation at 5x the maximum single application rate.

Magnitude of the Residue in Field Corn Aspirated Grain Fractions

5a. The submitted aspirated grain fractions data (MRID 43577401) for corn indicate that the combined residues of malathion and malaoxon concentrated at least 40x in aspirated corn grain fractions collected from field corn grain samples bearing nondetectable residues of malathion and malaoxon (<0.01 ppm each) following three foliar preharvest treatments at 5x the maximum single application rate.

5b. Aspirated grain fractions data for postharvest-treated corn grain (D216397, 5/26/98, M. Xue) indicate that the combined residues of malathion and malaoxon concentrated up to 98x in aspirated corn grain fractions. Based on this study, a tolerance of 700 ppm has been recommended for the aspirated grain fractions.

Magnitude of the Residue in Field Corn Processed Commodities

6a. The submitted field corn processing study (MRID 43577401) is adequate to satisfy reregistration requirements; the study indicates that the combined residues of malathion and malaoxon did not concentrate above the limit of detection in any processed commodities from field corn grain bearing nondetectable residues of malathion and malaoxon (<0.01 ppm each) following three preharvest foliar treatments at 5x the maximum single application rate.

6b. A processing study of postharvest-treated corn grain (D216397, 5/26/98, M. Xue) has previously been found acceptable. This study indicated that the combined residues of malathion and malaoxon concentrated 1.8x in meal, 2.0x in flour, 4.5x in dry-milled crude oil, 5.8x in wet-milled crude oil, 1.3x in dry-milled refined oil, and 3.5x in wet-milled refined oil processed from field corn grain following a series of postharvest treatments. The combined residues did not concentrate in grits, starch and dry- and wet-milled bleached and deodorized oil.

Magnitude of the Residue in Grape Processed Commodities

7a. The grape processing study (MRID 43548401) is adequate to satisfy reregistration requirements. The combined residues of malathion and malaoxon concentrated 2.5x in wet pomace, 6.5x in raisin waste, and 11.0x in dry pomace processed from grapes following treatment with the 5 lb/gal EC formulation at 5x the maximum single application rate. Residues of malathion and malaoxon did not concentrate in juice and raisins.

7b. Since residues did not concentrate in juice, no tolerance is needed for this processed commodity. The processed grape commodities of wet and dry pomace and raisin waste are no longer considered to be significant feed commodities (OPPTS 860.1000, Table I); therefore, no tolerances are needed for these commodities.

7c. The Malathion Reregistration Standard required data reflecting malathion residues of concern in raisins processed from grapes receiving preharvest treatment at the maximum seasonal rate and dried on trays treated with malathion at the maximum rate. Because the registrant wishes to support only preharvest use of malathion on grapes, the established tolerance for raisins should be revoked since the submitted processing study indicates that malathion residues of concern do not concentrate in raisins processed from preharvest-treated grapes.

Magnitude of the Residue in Rice Processed Commodities

8a. The rice processing study (MRID 43562301) is adequate to satisfy reregistration requirements. The combined residues of malathion and malaoxon concentrated 5.5x in rice hulls processed from rice grain following treatment with the 5 lb/gal EC formulation at 4x the maximum single application rate. Residues of malathion and malaoxon did not concentrate in polished rice and bran. The need for tolerances on rice grain and rice hulls will be determined when the rice field trial data (MRID 43468101) are evaluated.

8b. The registrant does not wish to support postharvest use of malathion on stored rice grain for reregistration. Therefore, postharvest use on rice must be removed from all pertinent product labels. The Agency will determine the need for a tolerance on rice grain and rice hulls based on the residue data from preharvest treatment of malathion.

RECOMMENDATIONS

According to the highest residues found in the submitted commodities, CEB1 recommends that tolerances should be 115 ppm for alfalfa forage, 185 ppm for alfalfa hay, 125 ppm for clover forage and hay, and 20 ppm for cottonseed.

DETAILED CONSIDERATIONS

Residue Analytical Methods

The raw agricultural commodities from the submitted field trials and processing studies were analyzed for residues of malathion and its malaoxon metabolite using a GLC method with flame photometric detection (FPD). The limit of quantitation (LOQ) for each compound was 0.05 ppm for alfalfa forage and hay, clover forage and hay, field corn grain dust, cottonseed, cottonseed hulls, wet and dry grape pomace, raisin waste, and rice grain dust and hulls and was 0.01 ppm for each compound for all remaining commodities. The EN-CAS Method Nos. for the methods used for each commodity are listed in Table 1A. These methods use a DB-5 capillary column and flame photometric detection in the phosphorous mode, and are essentially identical to American Cyanamid Method M-1886 which has been recently proposed for

enforcement purposes. Adequate method descriptions as well as acceptable radio validation data using samples from an alfalfa metabolism study have been submitted and evaluated (DP Barcode D196878, R. Perfetti, 2/28/94) for American Cyanamid Method M-1886.

Method validation and concurrent method recoveries were conducted by EN-CAS Analytical Laboratories, Inc. (Winston-Salem, NC) to determine the suitability of the EN-CAS methods for residue data collection purposes. Untreated samples of RACs from the respective field trials and processed fractions from the processing studies were fortified with malathion and malaoxon at various levels. Apparent residues of malathion and malaoxon were nondetectable (<0.01 ppm or <0.05 ppm each) in/on all samples of untreated RACs and processed fractions. Representative chromatograms, sample calculations, and standard curves were provided. The recovery data are presented in Tables 1B. These data suggest that the EN-CAS methods are adequate for malathion and malaoxon data collection for alfalfa forage and hay, clover forage and hay, field corn grain and corn processed commodities, cottonseed and cottonseed processed commodities, grapes and grape processed commodities, and rice and rice processed commodities.

Table 1A. EN-CAS methods used for the analysis of residues of malathion and malaoxon in/on raw agricultural commodities from the submitted field trials.

Commodity	MRID	EN-CAS Method No.
Alfalfa forage and hay	43546101	ENC-19/94
Clover forage and hay	43545201	ENC-20/94
Field corn and processed corn fractions	43577401	ENC-28/94
Cottonseed	43596601	ENC-22/94
Cottonseed and processed cottonseed fractions	43585301	ENC-3/95
Grapes and processed grape fractions	43548401	ENC-30/94
Rice and processed rice fractions	43562301	ENC-1/95

Table 1B. Concurrent method recoveries of EN-CAS Method Nos. ENC-19/94, ENC-20/94, ENC-22/94, ENC-28/94, ENC-30/94, ENC-1/95, and ENC-3/95 from various matrices fortified with malathion and malaoxon.

Commodity	Fortification Level (ppm)		Percent Recovery	
	Malathion	Malaoxon	Malathion	Malaoxon
Alfalfa forage	0.05	0.05	70, 74, 93, 95, 96, 97, 103, 103	106, 114, 121, 121, 125, 116, 118, 128
	0.10	0.05	84, 93	87, 101
	0.10	0.10	86, 95	93, 115
	0.50	0.05	71, 83, 88, 96, 97	90, 96, 117, 123, 127
	0.50	0.10	--	86
	0.50	0.50	77, 80	N/A, 84
	1.0	0.05	76, 84, 94, 110	73, 93, 98, 105
	1.0	0.10	89, 89, 89	96, 100, 123
	1.0	1.0	91, 98	99, 103
	2.0	0.25	--	87
	2.0	2.0	83	87
	5.0	1.0	86	94
	10	0.05	74, 76, 82, 86	101, 109, 122, 130
	10	1.0	83, 87	84, 112
	10	10	97	90
	50	0.10	101	107
	50	0.20	82, 94, 102, 104	104, 113, 117, 122
	70	0.10	104	123
	70	0.50	122	111
	75	0.20	88	134
	80	1.0	83	116
	100	0.20	73, 93	98, 112
	100	0.25	84, 97	102, 114
	100	0.50	78	102
	100	10	72	90
	200	1.0	91	87
	200	5.0	89, 114, 131	78, 88, 93
	300	0.20	70, 82, 99, 133	102, 110, 112, 116
	--	0.10	--	88
	--	0.25	--	92
Alfalfa hay	0.05	0.05	68, 71, 88, 92, 93, 96, 100, 106, 109, 109	92, 93, 96, 96, 97,102, 104, 107, 107, 110, 111
	0.10	0.10	76, 84, 92, 93, 106	81, 85, 93, 98, 104, 110
	1.0	0.05	82, 92, 107	104, 113, 127
	1.0	0.10	84	124
Alfalfa hay (cont.)	1.0	1.0	75, 78, 79, 83	87, 87, 88, 89

(continued)

Commodity	Fortification Level (ppm)		Percent Recovery	
	Malathion	Malaoxon	Malathion	Malaoxon
	2.0	0.05	94	106
	2.0	0.20	82, 88	81, 105
	2.5	0.10	89	101
	2.5	0.20	98	124
	5.0	0.05	100	122
	5.0	0.10	90	102
	5.0	0.50	92	82
	10	0.20	79	109
	10	1.0	87, 92	86, 89
	10	10	93	94
	20	0.10	84, 92, 107	98, 111, 123
	20	0.20	72	81
	25	0.50	83, 90	98, 103
	30	0.25	104, 128	110, 121
	30	0.50	87	120
	40	0.25	86	108
	50	0.25	79	81
	50	0.50	80, 81, 91	97, 98, 106
	50	1.0	87	82
	80	10	90	92
	100	1.0	85	102
	100	2.5	96	106
	100	5.0	86	87
	100	10	83	88
	150	4.0	74, 89, 94	90, 97, 97
	200	1.0	93	114
	200	5.0	71, 124	83, 109
Clover forage	0.05	0.05	86, 87, 89, 92, 95, 98, 101, 113, 120	88, 96, 97, 100, 101, 105, 108, 112, 115
	0.10	0.10	122	103
	0.50	0.05	76, 87	97, 97
	1.0	0.05	84, 91	97, 101
	1.0	0.10	85, 93	102, 110
	2.0	0.50	83	93
	5.0	0.10	82, 88, 96, 107	101, 102, 110, 126
	20	0.10	92	133
Clover forage (cont.)	20	0.50	84, 86	91, 101

(continued)

Commodity	Fortification Level (ppm)		Percent Recovery	
	Malathion	Malaoxon	Malathion	Malaoxon
	50	0.10	77, 88, 92	120, 124, 132
	50	0.50	91	97
	200	1.0	91, 107	89, 95
Clover hay	0.05	0.05	85, 131	93, 108
	0.10	0.10	107	113
	0.20	0.20	122	104
	0.25	0.25	97	106
	0.50	0.05	81, 87, 92, 97, 101	97, 113, 113, 117, 119
	1.0	0.05	85, 91, 104, 142	100, 105, 123, 136
	1.0	0.10	74, 80, 81, 91, 101	94, 96, 102, 103, 110
	1.0	0.50	78	85
	5.0	0.05	70	124
	5.0	0.10	84	94
	5.0	0.50	88	93
	10	1.0	89	82
	20	0.10	72	107
	30	0.10	100	117
	30	0.25	86	102
	30	0.50	90	88
	50	0.40	89	102
	50	0.50	87	80
	80	0.25	73	122
	100	0.50	92	110
	150	0.50	90	112
	200	1.0	80, 82, 117	95, 103, 110
Field corn grain	0.01	0.1	82	103
	2.0	0.05	93	98
Field corn grain dust (<2540 μm)	0.05	0.05	70	112
	100	10	99	108
Corn grits	0.01	0.01	78	118
	10	1.0	93	106
Corn meal	0.01	0.01	93	123
	10	1.0	82	101
Corn flour	0.01	0.01	122	130
	10	1.0	80	110

(continued)

Commodity	Fortification Level (ppm)		Percent Recovery	
	Malathion	Malaoxon	Malathion	Malaoxon
Corn crude oil (dry milling)	0.01	0.01	81	128
	25	2.0	88	99
Corn refined oil (dry milling)	0.01	0.01	83	93
	25	2.0	91	82
Corn B&D oil (dry milling)	0.01	0.01	79	
	25	2.0	77	98
Corn starch	0.01	0.01	117	85
	10	1.0	95	122
Cottonseed	0.01	0.01	54, 65, 79, 82, 85, 93, 94, 102	66, 78, 84, 102, 104, 104, 131, 131
	0.025	0.025	70, 104, 124	82, 113, 123
	0.05	0.05	71, 71, 73, 73, 86, 87, 103, 123	86, 86, 97, 101, 101, 103, 110, 113, 113
	10	0.50	74, 75, 76, 78, 79, 90, 81, 88, 90, 91, 92, 98	86, 91, 95, 95, 97, 99, 102, 102, 103, 105, 108, 109
	20	0.50	74, 75, 77, 79, 82, 83, 83, 86	82, 86, 92, 97, 97, 101, 105, 106
Cottonseed (for processing)	0.05	0.05	91	110
	0.50	0.10	91	108
	50	1.0	87	96
	300	5.0	88	98
Cottonseed hulls	0.05	0.05	89	85
	1000	10	89	106
Cottonseed meal	0.01	0.01	84	122
	0.05	0.05	120	99
	500	5.0	75	101
Cottonseed crude oil	0.01	0.01	64	105
	0.05	0.05	106	121
	300	1.0	68	100
Cottonseed refined oil	0.01	0.01	79	107
	0.05	0.05	96	106
	20	0.50	68	85
Cottonseed B&D oil	0.01	0.01	85, 98	86, 107
	0.05	0.05	85, 107	95, 102
	0.50	0.50	76, 91	95, 99
Grapes	0.01	0.01	108	87
	50	1.0	95	95

(continued)

Commodity	Fortification Level (ppm)		Percent Recovery	
	Malathion	Malaoxon	Malathion	Malaoxon
Grape juice	0.01	0.01	90	97
	10	0.50	87	93
Grape wet pomace	0.05	0.05	89	102
	10	0.50	88	96
Grape dry pomace	0.05	0.05	90	109
	50	2.0	92	108
Raisin waste	0.05	0.05	88	93
	50	2.0	98	88
Raisins	0.01	0.01	131	102
	50	2.0	77	95
Rice grain	0.01	0.01	100, 101	89, 107
	20	0.50	95	97
	50	0.50	97	107
Rice hulls	0.05	0.05	90	88
	300	10	89	87
Rice bran	0.01	0.01	78	143
	50	2.0	107	122
	300	10	99	107
Rice, white milled	0.01	0.01	81	106
	50	0.50	98	100
Rice grain dust (>2540 μm)	1.0	0.50	88	102
	10	5.0	95	104
	100	10	90	98
	2500	25	66, 96	93, 142

Storage Stability Data

Samples from the submitted field trial studies were transferred to frozen storage within 6 hours of sample collection and then shipped via freezer truck to the analytical laboratory where they were stored frozen prior to residue analysis. Samples collected for the processing studies, with the exception of grape samples, were transferred to frozen storage within 6 hours of harvest and then shipped frozen to the processing facilities, where samples were stored frozen until processing. Grape samples for processing were shipped to the processor at ambient temperature on the day of harvest and then stored at 0-7 C for one day until processing. All samples of processed commodities were stored frozen and shipped via freezer truck to the analytical laboratory where they were stored frozen prior to residue analysis. The maximum storage intervals prior to residue analysis of commodities collected from various field trials are

presented in Table 2.

Table 2. Storage intervals prior to residue analysis of commodities collected from various field trials and processing studies.

Commodity	MRID	Storage Condition	Storage Interval (months)
Alfalfa forage and hay	43546101	-36 to -2.8 C	~2-18
Clover forage and hay	43545201	-35.6 to -3.3 C	~2-26
Field corn and processed corn fractions	43577401	-27 to -2.8 C	RAC: ~8 RAC to be processed: 0.5 Processed commodities: ~15-18 Total: ~8-18
Cottonseed	43596601	-34.4 to -2.2 C	~11-26
Cottonseed and processed cottonseed fractions	43585301	-27 to -6.7 C	RAC: ~14 RAC to be processed: ~3 Processed commodities: ~11-12 Total: ~14-15
Grapes and processed grape fractions	43548401	-27 to 7 C	RAC: ~9 RAC to be processed: 2 days [a] Processed commodities: ~13-15 Total: ~9-15
Rice and processed rice fractions	43562301	-27 to -6.7 C	RAC: ~6 RAC to be processed: ~1 Processed commodities: ~8-15 Total: ~6-16

[a] Grape RAC samples were shipped at ambient temperature on the day of harvest to the processing facility and then stored at 0-7 C for one day until processing was initiated.

The Cheminova Agro A/S has previously submitted storage stability data representing all types of raw agricultural and processed commodities for which malathion is registered (D223392, 9/23/97, W. Smith). The available storage stability data indicate that residues of malathion and malaoxon are relatively stable under frozen storage conditions (-5 C) for at least 12 months in/on: cottonseed and cottonseed meal, hulls, and bleached and deodorized oils; wheat straw, bran, flour, middlings, and shorts; leaf lettuce; potato tubers; tomatoes and tomato catsup, juice, and dried pomace. The only significant decline in residue was observed in/on wheat grain and forage when compared to day-0 recovery values; residues of malathion *per se* declined ~33-36% in/on wheat grain and ~15-17% in/on wheat forage following 12 months of storage.

The samples from the submitted alfalfa, clover, field corn, cottonseed, grapes, rice and their processed fractions were stored in frozen condition up to 26 months. The storage stability data are available only for 1 year. However, no additional storage stability data are required. CEB1 has previously concluded that one year storage stability data would be extrapolated to assess the stability of samples stored for 2-3 years (D. Miller, 10/12/95, D213229).

Magnitude of the Residue in Plants

Alfalfa Forage and Hay

Established tolerance: A tolerance of 135 ppm has been established for residues of malathion *per se* in/on alfalfa [40 CFR §180.111]. No tolerance has been established for alfalfa hay and forage.

Discussion of the data: Cheminova submitted data (1995; MRID 43546101) from 22 trials conducted in CA(2), IA(2), ID(2), MI(2), MN(2), NE(2), PA(2), SD(4), WA(2), and WI(2) depicting the magnitude of the residue of malathion and its metabolite malaoxon in/on alfalfa forage and hay. Alfalfa forage was harvested 3 hours to 14 days following the last of: (i) two foliar applications per cutting, with a 12- to 16-day retreatment interval, using the Platte 5 lb/gal EC formulation at 1.25 lb ai/A/application (0.8x the maximum registered single application rate for the Cheminova EC formulation) in 30 gal/A using ground equipment; and (ii) two foliar applications per cutting, with a 12- to 16-day retreatment interval, of the 9.79 lb/gal RTU formulation at 0.61 lb ai/A/application (0.5x the maximum registered single application rate for this formulation) using aerial ULV equipment. Trials conducted in CA, IA, MI, NE, PA, and WA produced three cuttings of alfalfa. Other sites produced one or two cuttings due to a delay in initiating the 1992 trials (SD-1 and WI) or due to weather conditions (cool or wet). Trial SD-2 produced one cutting, and ID, MN, and WI trials produced two cuttings of alfalfa forage and hay. Subsamples of the harvested forage from each trial field were either field- or barn-dried for 2-10 days at 107-120 C to produce hay. The moisture content (as percentage of fresh weight of untreated samples) was determined to be 71-85% (mean=78.3%) for forage and 15-79% (mean=39.2%) for hay.

Residues in/on treated and untreated alfalfa forage and hay were determined using EN-CAS Method No. ENC-19/94. The results of the alfalfa forage and hay field trials are presented in Tables 3 and 4, respectively. Apparent residues of malathion and malaoxon were below the limit of quantitation (LOQ = 0.05 ppm each) in/on 25 untreated forage and 23 untreated hay samples. One untreated forage sample (third cutting) analyzed twice bore malathion residues of 0.05 and 0.06 ppm and nondetectable (<0.05 ppm) residues of malaoxon. Two untreated hay samples (second and third cuttings) bore malathion residues of 0.10 and 0.08 ppm, respectively, and nondetectable (<0.05 ppm) residues of malaoxon. Adequate raw data pertaining to the field and analytical portions of the study were provided.

Geographic representation of the submitted residue data is adequate. The test states of CA(8%), IA(7%), ID(5%), MI(6%), MN(8%), NE(6%), PA(2%), SD(6%), WA(3%), and WI(10%) accounted for 61% of the 1991 U.S. alfalfa hay and alfalfa-mixtures hay production *(1992 USDA Agricultural Statistics)*.

Table 3. Residues of malathion and its metabolite malaoxon in/on alfalfa forage following multiple foliar applications of the 5 lb/gal EC and 9.79 lb/gal RTU formulations.

Form.	Trial Site	Residues (ppm) [a]														
		3-Hour PTI			1-Day PTI			4-Day PTI			7-Day PTI			14-Day PTI		
		Mthion	Moxon	Combined	Mthion	Moxon	Combined	Mthion	Moxon	Combined	Mthion	Moxon	Combined	Mthion	Moxon	Combined
EC [c]	**Forage - 1st Cutting**															
	CA	51	0.13	51.13	16	0.07	16.07	2.9	0.11	3.01	N/A [b]	N/A	N/A	N/A	N/A	N/A
	IA	51	0.08	51.08	6.5	<0.05	6.5	0.16	<0.05	<0.21	N/A	N/A	N/A	N/A	N/A	N/A
	ID	53	0.08	53.08	24	<0.05	24	1.4	<0.05	1.4	N/A	N/A	N/A	N/A	N/A	N/A
	MI	(27, 30)	(<0.05, 0.06)	(27, 30.06)	(0.39, 0.42)	(<0.05, <0.05)	(<0.44, <0.47)	(0.11, 0.16)	(<0.05, <0.05)	(<0.16, <0.21)	N/A	N/A	N/A	N/A	N/A	N/A
	MN	35	0.06	35.06	1.0	<0.05	<1.05	0.20	<0.05	<0.25	N/A	N/A	N/A	N/A	N/A	N/A
	NE	23	<0.05	23	11	<0.05	11	0.33	<0.05	<0.38	N/A	N/A	N/A	N/A	N/A	N/A
	PA	(84, 100), (94, 100, 109)	(0.07, 0.08), (0.12, 0.13, 0.09)	(84.07, 100.08), (94.12, 100.13, 109.09)	53	0.16	53.16	4.7	0.13	4.83	N/A	N/A	N/A	N/A	N/A	N/A
	SD-1	47	0.13	47.13	2.0	<0.05	2.0	0.33	<0.05	<0.38	0.07	<0.05	<0.12	0.07	<0.05	<0.12
	SD-2	70	0.15	70.15	31	0.10	31.10	1.3, 4.0	<0.05, <0.05	1.3, 4.0	N/A	N/A	N/A	N/A	N/A	N/A
	WA	22	<0.05	22	1.7	0.07	1.77	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	WI	42	0.05	42.05	12	<0.05	12	0.89	<0.05	<0.94	0.54	<0.05	<0.59	0.16	<0.05	<0.21
	Forage - 2nd Cutting															
	CA	34	0.14	34.14	12	0.13	12.13	1.1	0.10	1.20	N/A	N/A	N/A	N/A	N/A	N/A
	IA	60	0.10	60.10	(1.4, 1.6)	(<0.05, <0.05)	(1.4, 1.6)	0.42	<0.05	<0.47	N/A	N/A	N/A	N/A	N/A	N/A
	ID	(89, 97, 110), (89, 99)	(0.10, 0.11, 0.12), (0.11, 0.12)	(89.10, 97.11, 110.12), (89.11, 99.12)	(71, 91, 91), (92, 98)	(0.11, 0.11, 0.12), (0.13, 0.14)	(71.11, 91.11, 91.12), (92.13, 98.14)	(27, 30)	(0.11, 0.13)	(27.11, 30.13)	N/A	N/A	N/A	N/A	N/A	N/A
	MI	37	0.10	37.10	0.55	<0.05	<0.60	0.05	<0.05	<0.10	N/A	N/A	N/A	N/A	N/A	N/A
	MN	29	0.06	29.06	20	<0.05	20	(0.92, 1.0)	(<0.05, <0.05)	(<0.97, <1.05)	N/A	N/A	N/A	N/A	N/A	N/A
	NE	45	0.08	45.08	2.5	<0.05	2.5	0.57	<0.05	<0.62	N/A	N/A	N/A	N/A	N/A	N/A
	PA	19	0.06	19.06	(0.97, 1.0)	(<0.05, <0.05)	(<1.02, <1.05)	0.27	<0.05	<0.32	N/A	N/A	N/A	N/A	N/A	N/A
	WA	68	0.07	68.07	11	<0.05	11	0.24	<0.05	<0.29	N/A	N/A	N/A	N/A	N/A	N/A
	WI	32	<0.05	32	46	<0.05	46	6.6	<0.05	6.6	1.4	<0.05	1.4	0.32	<0.05	<0.37

(continued; footnotes follow)

Table 3 *(continued)*.

Form.	Trial Site	Residues (ppm) [a]														
		3-Hour PTI			1-Day PTI			4-Day PTI			7-Day PTI			14-Day PTI		
		Mthion	Moxon	Combined	Mthion	Moxon	Combined	Mthion	Moxon	Combined	Mthion	Moxon	Combined	Mthion	Moxon	Combined
EC (cont.)	**Forage - 3rd Cutting**															
	CA	64	0.26	64.26	8.1	0.07	8.17	2.1	0.16	2.26	N/A	N/A	N/A	N/A	N/A	N/A
	IA	(91, 94)	(0.06, 0.06)	(91.06, 94.06)	2.5	<0.05	2.5	1.2	<0.05	1.2	N/A	N/A	N/A	N/A	N/A	N/A
	MI	54	0.13	54.13	11	<0.05	11	0.73	<0.05	<0.78	N/A	N/A	N/A	N/A	N/A	N/A
	NE	28	0.09	28.09	5.4	<0.05	5.4	0.41	<0.05	<0.46	N/A	N/A	N/A	N/A	N/A	N/A
	PA	65	0.15	65.15	19	0.07	19.07	0.94	<0.05	<0.99	N/A	N/A	N/A	N/A	N/A	N/A
	WA	81	0.10	81.10	12	<0.05	12	0.20	<0.05	<0.25	N/A	N/A	N/A	N/A	N/A	N/A
RTU [d]	**Forage - 1st Cutting**															
	CA	72	0.09	72.09	34	0.07	34.07	(8.1, 11)	(<0.05, 0.06)	(8.1, 11.06)	N/A	N/A	N/A	N/A	N/A	N/A
	IA	(22, 24)	(<0.05, <0.05)	(22, 24)	9.8	<0.05	9.8	2.1	<0.05	2.1	N/A	N/A	N/A	N/A	N/A	N/A
	ID	20	<0.05	20	16	<0.05	16	1.1	<0.05	1.1	N/A	N/A	N/A	N/A	N/A	N/A
	MI	(8.8, 9.2)	(<0.05, <0.05)	(8.8, 9.2)	(0.06, 0.09)	<0.05, <0.05)	(<0.11, <0.14)	(0.06, 0.09)	<0.05, <0.05)	(<0.11, <0.14)	N/A	N/A	N/A	N/A	N/A	N/A
	MN	5.7	<0.05	5.7	5.5	<0.05	5.5	3.8	<0.05	3.8	N/A	N/A	N/A	N/A	N/A	N/A
	NE	17	<0.05	17	15	<0.05	15	0.79	<0.05	<0.84	N/A	N/A	N/A	N/A	N/A	N/A
	PA	22	<0.05	22	20	0.06	20.06	5.3	<0.05	5.3	N/A	N/A	N/A	N/A	N/A	N/A
	SD-1	1.8	<0.05	1.8	0.30	<0.05	<0.35	0.09	<0.05	<0.14	<0.05	<0.05	<0.10	<0.05	<0.05	<0.10
	SD-2	29	<0.05	29	(18, 18)	(<0.05, <0.05)	(18, 18)	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	WA	0.99	<0.05	<1.04	(0.24, 0.31)	(<0.05, <0.05)	(<0.29, <0.36)	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	WI	5.2	<0.05	5.2	2.1	<0.05	2.1	1.6	<0.05	1.6	1.0	<0.05	<1.05	1.0	<0.05	<1.05
	Forage - 2nd Cutting															
	CA	43	<0.05	43	19	<0.05	19	8.7	<0.05	8.7	N/A	N/A	N/A	N/A	N/A	N/A
	IA	36	<0.05	36	5.3	<0.05	5.3	0.53	<0.05	<0.58	N/A	N/A	N/A	N/A	N/A	N/A
	ID	25	<0.05	25	48	<0.05	48	21	0.06	21.06	N/A	N/A	N/A	N/A	N/A	N/A
	MI	9.7	<0.05	9.7	0.27	<0.05	<0.32	0.18	<0.05	<0.23	N/A	N/A	N/A	N/A	N/A	N/A
	MN	21	<0.05	21	2.2	<0.05	2.2	2.0	<0.05	2.0	N/A	N/A	N/A	N/A	N/A	N/A
	NE	32	<0.05	32	11	<0.05	11	2.6	<0.05	2.6	N/A	N/A	N/A	N/A	N/A	N/A
	PA	10	<0.05	10	10	<0.05	10	7.1	<0.05	7.1	N/A	N/A	N/A	N/A	N/A	N/A
	WA	4.5	<0.05	4.5	0.84	<0.05	<0.89	<0.05	<0.05	<0.10	N/A	N/A	N/A	N/A	N/A	N/A
	WI	21	<0.05	21	22	<0.05	22	18	<0.05	18	6.8	<0.05	6.8	1.5	<0.05	1.5

(continued; footnotes follow)

Table 3 *(continued)*.

Form.	Trial Site	Residues (ppm) [a]														
		3-Hour PTI			1-Day PTI			4-Day PTI			7-Day PTI			14-Day PTI		
		Mthion	Moxon	Combined	Mthion	Moxon	Combined	Mthion	Moxon	Combined	Mthion	Moxon	Combined	Mthion	Moxon	Combined
RTU		**Forage - 3rd Cutting**														
(cont.)	CA	(36, 46)	(0.07, 0.09)	(36.07, 46.09)	49	0.08	49.08	16	0.07	16.07	N/A	N/A	N/A	N/A	N/A	N/A
	IA	(49, 68, 110), (90, 100)	(<0.05, <0.05, <0.05), (<0.05, <0.05)	(49, 68, 110), (90, 100)	6.3	<0.05	6.3	7.8	<0.05	7.8	N/A	N/A	N/A	N/A	N/A	N/A
	MI	8.7	<0.05	8.7	3.2	<0.05	3.2	0.70	<0.05	<0.75	N/A	N/A	N/A	N/A	N/A	N/A
	NE	22	0.06	22.06	9.4	<0.05	9.4	1.7	<0.05	1.7	N/A	N/A	N/A	N/A	N/A	N/A
	PA	19	<0.05	19	38	0.06	38.06	14	<0.05	14	N/A	N/A	N/A	N/A	N/A	N/A
	WA	12	<0.05	12	0.33	<0.05	<0.38	0.06	<0.05	<0.11	N/A	N/A	N/A	N/A	N/A	N/A

[a] Each residue value represents one sample except that residue values in parentheses represent multiple extractions and/or analyses of a single sample. "Mthion" = malathion and "Moxon" = malaoxon. When calculating combined residues, nondetectable residues of malaoxon were not included in the total when residues of malathion were greater than 1.0 ppm.

[b] N/A = Not analyzed.

[c] Application parameters for the 5 lb/gal EC formulation: two foliar applications per cutting, with a 12- to 16-day retreatment interval, at 1.25 lb ai/A/application (0.8x) in 30 gal/A using ground equipment.

[d] Application parameters for the 9.79 lb/gal RTU formulation: two foliar applications per cutting, with a 12- to 16-day retreatment interval, at 0.61 lb ai/A/application (0.5x) using aerial ULV equipment.

Table 4. Residues of malathion and its metabolite malaoxon in/on alfalfa hay following multiple foliar applications of the 5 lb/gal EC and 9.79 lb/gal RTU formulations.

Form.	Trial Site	Residues (ppm) [a]														
		3-Hour PTI			1-Day PTI			4-Day PTI			7-Day PTI			14-Day PTI		
		Mthion	Moxon	Combined	Mthion	Moxon	Combined	Mthion	Moxon	Combined	Mthion	Moxon	Combined	Mthion	Moxon	Combined
EC [c]	**Hay - 1st Cutting**															
	CA	43	0.40	43.40	18	0.32	18.32	5.5	0.27	5.77	N/A [b]	N/A	N/A	N/A	N/A	N/A
	IA	20	0.19	20.19	6.7	0.08	6.78	1.7	<0.05	1.7	N/A	N/A	N/A	N/A	N/A	N/A
	ID	8.0	0.09	8.09	13	0.14	13.14	0.68	<0.05	<0.73	N/A	N/A	N/A	N/A	N/A	N/A
	MI	(13, 14)	(0.07. 0.08)	(13.07, 14.08)	(0.63, 0.81)	(<0.05, <0.05)	(<0.68, <0.86)	(0.46, 0.63)	(<0.05, <0.05)	(<0.51, <0.68)	N/A	N/A	N/A	N/A	N/A	N/A
	MN	0.26	<0.05	<0.31	0.21	<0.05	<0.26	0.20	<0.05	<0.25	N/A	N/A	N/A	N/A	N/A	N/A
	NE	6.1	<0.05	6.1	3.8	<0.05	3.8	0.93	<0.05	<0.98	N/A	N/A	N/A	N/A	N/A	N/A
	PA	46	0.27	46.27	33	0.25	33.25	5.5	0.15	5.65	N/A	N/A	N/A	N/A	N/A	N/A
	SD-1	11	0.08	11.08	0.89	<0.05	<0.94	0.28	<0.05	<0.33	0.22	<0.05	<0.27	<0.05	<0.05	<0.10
	SD-2	(130, 140), (170, 180)	(1.7, 1.9), (2.0, 2.2)	(131.7, 141.9), (172.0, 182.2)	(64, 65)	(0.86, 0.89)	(64.86, 65.89)	(5.1, 6.4)	(0.09, 0.10)	(5.19, 6.50)	N/A	N/A	N/A	N/A	N/A	N/A
	WA	16	0.10	16.10	3.7	0.07	3.77	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	WI	52	0.33	52.33	17	0.09	17.09	3.4	<0.05	3.4	2.6	<0.05	2.6	0.27	<0.05	<0.32
	Hay - 2nd Cutting															
	CA	43	0.46	43.46	12	0.48	12.48	4.4	0.28	4.68	N/A	N/A	N/A	N/A	N/A	N/A
	IA	17	0.30	17.30	(2.0, 2.1)	(<0.05, <0.05)	(2.0, 2.1)	1.5	<0.05	1.5	N/A	N/A	N/A	N/A	N/A	N/A
	ID	(91, 110), (130, 150)	(0.31, 0.54), (0.65, 0.63)	(91.31, 110.54), (130.65, 150.63)	(84, 87, 90, 96)	(0.40, 0.42, 0.66, 0.64)	(84.40, 87.42, 90.66, 96.64)	(30, 38)	(0.43, 0.71)	(30.43, 38.71)	N/A	N/A	N/A	N/A	N/A	N/A
	MI	20	0.20	20.20	0.96	<0.05	<1.01	0.26	<0.05	<0.31	N/A	N/A	N/A	N/A	N/A	N/A
	MN	2.0	<0.05	2.0	3.1	<0.05	3.1	(0.98, 1.2)	(<0.05, <0.05)	(<1.03, 1.2)	N/A	N/A	N/A	N/A	N/A	N/A
	NE	20	0.16	20.16	1.8	<0.05	1.8	0.57	<0.05	<0.62	N/A	N/A	N/A	N/A	N/A	N/A
	PA	3.9	<0.05	3.9	(1.5, 1.6)	(<0.05, <0.05)	(1.5, 1.6)	0.75	<0.05	<0.80	N/A	N/A	N/A	N/A	N/A	N/A
	WA	28	0.27	28.27	5.7	<0.05	5.7	0.85	<0.05	<0.90	N/A	N/A	N/A	N/A	N/A	N/A
	WI	85	0.59	85.59	83	0.54	83.54	6.7	0.07	6.77	N/A	N/A	N/A	N/A	N/A	N/A

(continued; footnotes follow)

Table 4 *(continued)*.

Form.	Trial Site	Residues (ppm) [a]														
		3-Hour PTI			1-Day PTI			4-Day PTI			7-Day PTI			14-Day PTI		
		Mthion	Moxon	Combined	Mthion	Moxon	Combined	Mthion	Moxon	Combined	Mthion	Moxon	Combined	Mthion	Moxon	Combined
EC (cont.)	**Hay - 3rd Cutting**															
	CA	27	0.39	27.39	12	0.30	12.30	2.2	0.16	2.36	N/A	N/A	N/A	N/A	N/A	N/A
	IA	17	0.20	17.20	3.1	0.07	3.17	1.3	<0.05	1.3	N/A	N/A	N/A	N/A	N/A	N/A
	MI	7.7	0.06	7.76	6.5	0.08	6.58	0.06	<0.05	<0.11	N/A	N/A	N/A	N/A	N/A	N/A
	NE	1.5	<0.05	1.5	0.20	<0.05	<0.25	0.29	<0.05	<0.34	N/A	N/A	N/A	N/A	N/A	N/A
	PA	3.2	<0.05	3.2	3.1	<0.05	3.1	0.10	<0.05	<0.15	N/A	N/A	N/A	N/A	N/A	N/A
	WA	6.7	0.05	6.75	1.8	<0.05	1.8	0.26	<0.05	<0.31	N/A	N/A	N/A	N/A	N/A	N/A
RTU [d]	**Hay - 1st Cutting**															
	CA	52	0.31	52.31	79	0.43	79.43	(17, 21)	(0.14, 0.14)	(17.14, 21.14)	N/A	N/A	N/A	N/A	N/A	N/A
	IA	(16, 25)	(<0.05, 0.07)	(16, 25.07)	19	0.07	19.07	8.8	<0.05	8.8	N/A	N/A	N/A	N/A	N/A	N/A
	ID	12	<0.05	12	30	0.07	30.07	3.5	<0.05	3.5	N/A	N/A	N/A	N/A	N/A	N/A
	MI	(5.2, 6.1)	(<0.05, <0.05)	(5.2, 6.1)	(0.37, 0.46)	(<0.05, <0.05)	(<0.42, <0.51)	(0.12, 0.16)	(<0.05, <0.05)	(<0.17, <0.21)	N/A	N/A	N/A	N/A	N/A	N/A
	MN	8.6	<0.05	8.6	3.3	<0.05	3.3	2.3	<0.05	2.3	N/A	N/A	N/A	N/A	N/A	N/A
	NE	19	<0.05	19	7.7	<0.05	7.7	1.7	<0.05	1.7	N/A	N/A	N/A	N/A	N/A	N/A
	PA	33	0.10	33.10	24	0.12	24.12	6.8	<0.05	6.8	N/A	N/A	N/A	N/A	N/A	N/A
	SD-1	3.5	<0.05	3.5	0.43	<0.05	<0.48	0.23	<0.05	<0.28	0.05	<0.05	<0.10	0.08	<0.05	<0.13
	SD-2	(120, 150), (89, 110)	(0.37, 0.49), (0.31, 0.43)	(120.37, 150.49), (89.31, 110.43)	(76, 77, 80, 89)	(0.33, 0.34, 0.34, 0.40)	(76.33, 77.34, 80.34, 89.40)	(35, 39)	(0.08, 0.09)	(35.08, 39.09)	N/A	N/A	N/A	N/A	N/A	N/A
	WA	2.8	<0.05	2.8	(0.39, 0.50)	(<0.05, <0.05)	(<0.44, <0.55)	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	WI	3.3	<0.05	3.3	1.6	<0.05	1.6	0.47	<0.05	<0.52	0.32	<0.05	<0.37	0.08	<0.05	<0.13
	Hay - 2nd Cutting															
	CA	26	0.14	26.14	8.1	0.22	8.32	(24, 25, 28)	(0.15, 0.16, 0.16)	(24.15, 25.16, 28.16)	N/A	N/A	N/A	N/A	N/A	N/A
	IA	14	<0.05	14	4.3	<0.05	4.3	1.6	<0.05	1.6	N/A	N/A	N/A	N/A	N/A	N/A
	ID	(60, 74)	(0.07, 0.14)	(60.07, 74.14)	(63, 85)	(0.20, 0.37)	(63.20, 85.37)	(51, 82)	(0.27, 0.65)	(51.27, 82.65)	N/A	N/A	N/A	N/A	N/A	N/A
	MI	6.2	<0.05	6.2	0.24	<0.05	<0.29	<0.05	<0.05	<0.10	N/A	N/A	N/A	N/A	N/A	N/A
	MN	9.7	<0.05	9.7	8.5	<0.05	8.5	0.43	<0.05	<0.48	N/A	N/A	N/A	N/A	N/A	N/A
	NE	38	0.08	.38.08	13	<0.05	13	7.0	<0.05	7.0	N/A	N/A	N/A	N/A	N/A	N/A
RTU	PA	21	<0.05	21	10	<0.05	10	11	<0.05	11	N/A	N/A	N/A	N/A	N/A	N/A

(continued; footnotes follow)

Form.	Trial Site	Residues (ppm) [a]														
		3-Hour PTI			1-Day PTI			4-Day PTI			7-Day PTI			14-Day PTI		
		Mthion	Moxon	Combined	Mthion	Moxon	Combined	Mthion	Moxon	Combined	Mthion	Moxon	Combined	Mthion	Moxon	Combined
(cont.)	WA	2.9	<0.05	2.9	0.22	<0.05	<0.27	0.06	<0.05	<0.11	N/A	N/A	N/A	N/A	N/A	N/A
	WI	45	0.21	45.21	46	0.24	46.24	13	0.05	13.05	N/A	N/A	N/A	N/A	N/A	N/A
	Hay - 3rd Cutting															
	CA	(55, 56)	(0.42, 0.40)	(55.42, 56.40)	34	0.39	34.39	11	0.18	11.18	N/A	N/A	N/A	N/A	N/A	N/A
	IA	(23, 27)	(0.05, 0.05)	(23.05, 27.05)	7.5	<0.05	7.5	10	<0.05	10	N/A	N/A	N/A	N/A	N/A	N/A
	MI	2.1	<0.05	2.1	3.1	<0.05	3.1	0.05	0.05	0.10	N/A	N/A	N/A	N/A	N/A	N/A
	NE	4.6	<0.05	4.6	1.9	<0.05	1.9	1.8	<0.05	1.8	N/A	N/A	N/A	N/A	N/A	N/A
	PA	26	0.05	26.05	20	<0.05	20	8.7	<0.05	8.7	N/A	N/A	N/A	N/A	N/A	N/A
	WA	2.1	<0.05	2.1	0.10	<0.05	<0.15	<0.05	<0.05	<0.10	N/A	N/A	N/A	N/A	N/A	N/A

[a] Each residue value represents one sample except that residue values in parentheses represent multiple extractions and/or analyses of a single sample. "Mthion" = malathion and "Moxon" = malaoxon. When calculating combined residues, nondetectable residues of malaoxon were not included in the total when residues of malathion were greater than 1.0 ppm.

[b] N/A = Not analyzed.

[c] Application parameters for the 5 lb/gal EC formulation: two foliar applications per cutting, with a 12- to 16-day retreatment interval, at 1.25 lb ai/A/application (0.8x) in 30 gal/A using ground equipment.

[d] Application parameters for the 9.79 lb/gal RTU formulation: two foliar applications per cutting, with a 12- to 16-day retreatment interval, at 0.61 lb ai/A/application (0.5x) using aerial ULV equipment.

The field residue data (MRID 43546101), reflecting the maximum use patterns the registrant wishes to support for use of the EC and RTU formulations on alfalfa, indicate that the combined residues of malathion and malaoxon in/on alfalfa hay exceeded the established 135-ppm tolerance (presently expressed as malathion *per se*), but that combined residues in/on alfalfa forage did not exceed the established tolerance. The combined residues of malathion and malaoxon in/on alfalfa forage and hay following treatment with the 5 lb/gal EC and 9.79 lb/gal RTU formulations according to the use patterns the registrant wishes to support for reregistration are summarized below:

Alfalfa Commodity	Formulation	Combined Residues (ppm)		
		First Cutting	Second Cutting	Third Cutting
Forage	EC	22-109.09	19.06-110.12	28.09-94.06
	RTU	<1.04-72.09	4.5-43	8.7-110
Hay	EC	<0.31-182.2	2.0-150.63	1.5-27.39
	RTU	2.8-150.49	2.9-74.14	2.1-56.40

If the registrant wishes to rely on the submitted data to fulfill reregistration requirements for magnitude of the residue in alfalfa forage and hay, then product labels for the 5 lb/gal EC (EPA Reg. No. 4787-20) and 9.79 lb/gal RTU (EPA Reg. No. 4787-8) formulations must be revised to reflect the use patterns depicted in the current field trials. The available data will support the following use patterns: (i) two foliar applications per cutting, with a 14-day retreatment interval, of the 5 lb/gal EC formulation at 1.25 lb ai/A/application in 30 gal/A using ground equipment; and (ii) two foliar applications per cutting, with a 14-day retreatment interval, of the 9.79 lb/gal RTU formulation at 0.61 lb ai/A/application using aerial ULV equipment.

Clover Forage and Hay

Established tolerance: A tolerance of 135 ppm has been established for residues of malathion *per se* in/on clover [40 CFR §180.111]. No tolerance has been established for clover hay and forage, respectively.

Discussion of the data: Cheminova submitted data (1995; MRID 43545201) from 14 trials conducted in GA(2), ID(2), MI(2), MN(2), NY(2), OK(2), and WI(2) depicting the magnitude of the residue of malathion and its metabolite malaoxon in/on clover forage and hay. Clover forage was harvested 3 hours to 14 days following the last of: (i) two foliar applications per cutting, with a 14-day retreatment interval, using the Platte 5 lb/gal EC formulation at 1.25 lb ai/A/application (1x the maximum registered single application rate for the Cheminova EC formulation) in 30 gal/A using ground equipment; and (ii) two foliar applications per cutting, with a 14-day retreatment interval, of the 9.79 lb/gal RTU formulation at 0.61 lb ai/A/application (0.7x the maximum registered single application rate for this formulation) using aerial ULV equipment. Subsamples of the harvested forage from each field trial were either field- or barn-dried for 1-11 days at 107-120 C to produce hay. The moisture content (as percentage of fresh weight of

untreated samples) was determined to be 71-87% (mean=81%) for forage and 17-73% (mean=39%) for hay.

Residues in/on treated and untreated clover forage and hay were determined using EN-CAS Method No. ENC-20/94. The results of the clover forage and hay field trials are presented in Tables 5 and 6, respectively. Apparent residues of malathion and malaoxon were below the limit of quantitation (LOQ = 0.05 ppm each) in/on 13 untreated forage and 12 untreated hay samples. One untreated hay sample (second cutting) bore detectable malathion residues of 0.36 ppm and nondetectable malaoxon residues. Adequate raw data pertaining to the field and analytical portions of the study were provided.

Geographic representation is adequate for clover field trials. Field trials were conducted in the states required by the Malathion Guidance Document.

Table 5. Residues of malathion and its metabolite malaoxon in/on clover forage following multiple foliar applications of the 5 lb/gal EC and 9.79 lb/gal RTU formulations.

Form.	Trial Site	Residues (ppm) [a]														
		3-Hour PTI			1-Day PTI			4-Day PTI			7-Day PTI			14-Day PTI		
		Mthion	Moxon	Combined	Mthion	Moxon	Combined	Mthion	Moxon	Combined	Mthion	Moxon	Combined	Mthion	Moxon	Combined
EC [c]	**Forage - 1st Cutting**															
	GA	17	0.08	17.08	8.4	0.08	8.48	8.0	0.11	8.11	6.5	0.08	6.58	N/A [b]	N/A	N/A
	ID	71	0.10	71.10	7.5	<0.05	7.5	2.5	<0.05	2.5	2.4	<0.05	2.4	0.68	<0.05	<0.73
	MI	20	<0.05	20	2.2	<0.05	2.2	2.0	<0.05	2.0	2.0	<0.05	2.0	1.1	<0.05	1.1
	MN	57	0.11	57.11	(21, 23)	(<0.05, <0.05)	(21, 23)	12	<0.05	12	5.6	<0.05	5.6	4.9	<0.05	4.9
	NY	(35, 36)	(<0.05, <0.05)	(35, 36)	39	0.05	39.05	2.5	<0.05	2.5	3.9	<0.05	3.9	2.8	<0.05	2.8
	OK	31	0.10	31.10	9.4	<0.05	9.4	(1.2, 1.3)	(<0.05, <0.05)	(1.2, 1.3)	0.71	<0.05	<0.76	0.20	<0.05	<0.25
	WI	14	<0.05	14	7.8	<0.05	7.8	2.0	<0.05	2.0	0.74	<0.05	<0.79	0.37	<0.05	<0.42
	Forage - 2nd Cutting															
	ID	88	0.11	88.11	44	0.11	44.11	21	0.19	21.19	4.3	<0.05	4.3	2.8	<0.05	2.8
	MI	37	0.12	37.12	9.4	<0.05	9.4	3.1	<0.05	3.1	2.6	<0.05	2.6	2.5	<0.05	2.5
	NY	(83, 83, 120), (83, 83)	(0.09, 0.10, 0.14), (0.10, 0.10)	(83.09, 83.10, 120.14), (83.10, 83.10)	51	0.11	51.11	11	0.05	11.05	4.7	<0.05	4.7	2.9	<0.05	2.9
	OK	18	0.07	18.07	7.7	0.05	7.75	1.5	0.05	1.55	0.79	<0.05	<0.84	0.47 .	<0.05	<0.52
	WI	40	<0.05	40	27	<0.05	27	7.1	<0.05	7.1	6.4	<0.05	6.4	3.1	<0.05	3.1
	Forage - 3rd Cutting															
	MI	73	0.13	73.13	32	0.10	32.10	10	<0.05	10	3.1	<0.05	3.1	1.3	<0.05	1.3
RTU [d]	**Forage - 1st Cutting**															
	GA	33	0.06	33.06	28	0.09	28.09	8.5	<0.05	8.5	6.3	0.06	6.36	N/A	N/A	N/A
	ID	46	<0.05	46	11	<0.05	11	7.0	<0.05	7.0	5.5	<0.05	5.5	1.9	<0.05	1.9
	MI	3.2	<0.05	3.2	0.39	<0.05	<0.44	0.19	<0.05	<0.24	0.10	<0.05	<0.15	0.12	<0.05	<0.17
	MN	(57, 62)	(<0.05, <0.05)	(57, 62)	(52, 52)	(<0.05, <0.05)	(52, 52)	(54, 57)	(0.19, 0.12)	(54.19, 57.12)	(34, 47)	(0.16, 0.14)	(34.16, 47.14)	(44, 48)	(<0.05, 0.14)	(44, 48.14)
	NY	9.5	<0.05	9.5	4.8	<0.05	4.8	3.9	<0.05	3.9	1.2	<0.05	1.2	1.8	<0.05	1.8
	OK	25	<0.05	25	24	<0.05	24	11	<0.05	11	7.2	<0.05	7.2	0.83	<0.05	<0.88
	WI	2.8	<0.05	2.8	1.2	<0.05	1.2	0.95	<0.05	<1.00	1.6	<0.05	1.6	0.48	<0.05	<0.53

(continued; footnotes follow)

Table 5 *(continued)*.

Form.	Trial Site	Residues (ppm) [a]														
		3-Hour PTI			1-Day PTI			4-Day PTI			7-Day PTI			14-Day PTI		
		Mthion	Moxon	Combined	Mthion	Moxon	Combined	Mthion	Moxon	Combined	Mthion	Moxon	Combined	Mthion	Moxon	Combined
RTU (cont.)		**Forage - 2nd Cutting**														
	ID	56	0.05	56.05	51	0.06	51.06	45	0.11	45.11	18	<0.05	18	8.5	<0.05	8.5
	MI	8.7	<0.05	8.7	0.20	<0.05	<0.25	0.09	<0.05	<0.14	0.15	<0.05	<0.20	0.12	<0.05	<0.17
	NY	16	<0.05	16	20	<0.05	20	7.7	<0.05	7.7	4.4	<0.05	4.4	(3.0, 3.7)	(<0.05, <0.05)	(3.0, 3.7)
	OK	(2.5, 2.6, 3.7)	(<0.05, <0.05, <0.05)	(2.5, 2.6, 3.7)	(31, 41, 46)	(<0.05, <0.05, <0.05)	(31, 41, 46)	5.6	<0.05	5.6	5.2	<0.05	5.2	1.4	<0.05	1.4
	WI	38	<0.05	38	26	<0.05	26	13	<0.05	13	11	0.05	11.05	8.5	0.05	8.55
		Forage - 3rd Cutting														
	MI	14	<0.05	14	8.3	<0.05	8.3	3.3	<0.05	3.3	0.69	<0.05	<0.74	0.66	<0.05	<0.71

[a] Each residue value represents one sample except that residue values in parentheses represent multiple extractions and/or analyses of a single sample. "Mthion" = malathion and "Moxon" = malaoxon. When calculating combined residues, nondetectable residues of malaoxon were not included in the total when residues of malathion were greater than 1.0 ppm.

[b] N/A = Not analyzed.

[c] Application parameters for the 5 lb/gal EC formulation: two foliar applications per cutting, with a 14-day retreatment interval, at 1.25 lb ai/A/application in 30 gal/A using ground equipment.

[d] Application parameters for the 9.79 lb/gal RTU formulation: two foliar applications per cutting, with a 14-day retreatment interval, at 0.61 lb ai/A/application using aerial ULV equipment.

42

Table 6. Residues of malathion and its metabolite malaoxon in/on clover hay following multiple foliar applications of the 5 lb/gal EC and 9.79 lb/gal RTU formulations.

Form.	Trial Site	Residues (ppm) [a]														
		3-Hour PTI			1-Day PTI			4-Day PTI			7-Day PTI			14-Day PTI		
		Mthion	Moxon	Combined	Mthion	Moxon	Combined	Mthion	Moxon	Combined	Mthion	Moxon	Combined	Mthion	Moxon	Combined
EC [c]	**Hay - 1st Cutting**															
	GA	35	0.25	35.25	24	0.18	24.18	14	0.14	14.14	11	0.16	11.16	N/A [b]	N/A	N/A
	ID	21	0.22	21.22	10	0.11	10.11	7.0	0.09	7.09	6.6	0.07	6.67	2.9	<0.05	2.9
	MI	16	<0.05	16	8.9	<0.05	8.9	7.1	<0.05	7.1	3.0	<0.05	3.0	3.4	<0.05	3.4
	MN	13	0.05	13.05	15	0.06	15.06	18	0.11	18.11	13	0.07	13.07	5.0	<0.05	5.0
	NY	5.7	<0.05	5.7	9.7	<0.05	9.7	6.6	<0.05	6.6	(16, 23, 23)	(0.11, 0.14, 0.15)	(16.11, 23.14, 23.15)	7.5	0.07	7.57
	OK	53	0.22	53.22	20	<0.05	20	4.7	<0.05	4.7	2.1	<0.05	2.1	1.4	<0.05	1.4
	WI	5.4	<0.05	5.4	9.2	0.06	9.26	12	0.06	12.06	25	<0.05	25	1.1	<0.05	1.1
	Hay - 2nd Cutting															
	ID	(89, 97), (120, 120, 120)	(0.32, 0.34), (0.44, 0.46, 0.50)	(89.32, 97.34), (120.44, 120.46, 120.50)	74	0.30	74.30	12	<0.05	12	16	0.07	16.07	13	0.06	13.06
	MI	64	0.50	64.50	30	0.24	30.24	11	0.07	11.07	4.3	<0.05	4.3	4.8	<0.05	4.8
	NY	86	0.32	86.32	25	0.34	25.34	15	0.12	15.12	12	0.09	12.09	4.4	0.07	4.47
	OK	36	0.21	36.21	10	0.10	10.10	2.6	0.10	2.70	(1.3, 1.3)	(<0.05, <0.05)	(1.3, 1.3)	0.97	<0.05	<1.02
	WI	(73, 87)	(0.25, 0.50)	(73.25, 87.50)	(86, 93)	(0.32, 0.50)	(86.32, 93.50)	13	0.07	13.07	20	0.14	20.14	8.7	0.05	8.75
	Hay - 3rd Cutting															
	MI	34	0.25	34.25	49	0.45	49.45	4.7	<0.05	4.7	7.2	0.05	7.25	1.6	<0.05	1.6
RTU [d]	**Hay - 1st Cutting**															
	GA	34	0.17	34.17	24	0.18	24.18	9.2	0.07	9.27	13	0.09	13.09	N/A	N/A	N/A
	ID	58	0.35	58.35	22	0.18	22.18	14	0.11	14.11	14	0.09	14.09	7.6	<0.05	7.6
	MI	4.4	<0.05	4.4	0.48	<0.05	<0.53	0.32	<0.05	<0.37	0.32	<0.05	<0.37	0.14	<0.05	<0.19
	MN	11	<0.05	11	(11, 13)	(<0.05, <0.05)	(11, 13)	(24, 26), (79, 99, 120)	(0.06, 0.06), (0.27, 0.29, 0.32)	(24.06, 26.06), (79.27, 99.29, 120.32)	8.6	<0.05	8.6	13	<0.05	13
	NY	26	0.11	26.11	22	0.06	22.06	9.7	0.06	9.76	5.8	<0.05	5.8	4.9	<0.05	4.9
RTU (cont.)	OK	(83, 92, 94)	(0.23, 0.33, 0.34)	(83.23, 92.33, 94.34)	55	0.09	55.09	22	0.06	22.06	(14, 17)	(<0.05, 0.05)	(14, 17.05)	5.3	<0.05	5.3
	WI	3.3	<0.05	3.3	(4.3, 5.7)	(<0.05, <0.05)	(4.3, 5.7)	3.9	<0.05	3.9	4.0	<0.05	4.0	1.9	<0.05	1.9

(continued; footnotes follow)

Table 6 *(continued)*.

Form.	Trial Site	Residues (ppm) [a]														
		3-Hour PTI			1-Day PTI			4-Day PTI			7-Day PTI			14-Day PTI		
		Mthion	Moxon	Combined	Mthion	Moxon	Combined	Mthion	Moxon	Combined	Mthion	Moxon	Combined	Mthion	Moxon	Combined
	Hay - 2nd Cutting															
	ID	(98, 99)	(0.27, 0.27)	(98.27, 99.27)	96	0.29	96.29	15, 30	<0.05, 0.07	15, 30.07	26	0.06	26.06	13	0.06	13.06
	MI	20	0.16	20.16	2.7	<0.05	2.7	1.7	<0.05	1.7	0.54	<0.05	<0.59	0.20	<0.05	<0.25
	NY	18	<0.05	18	24	0.09	24.09	26	0.15	26.15	10	0.07	10.07	4.7	<0.05	4.7
	OK	33	0.16	33.16	32	0.10	32.10	19	0.15	19.15	15	0.07	15.07	1.9	<0.05	1.9
	WI	(82, 104)	(0.17, 0.27)	(82.17, 104.27)	(70, 86, 95)	(0.20, 0.25, 0.27)	(70.20, 86.25, 95.27)	(31, 39)	(0.11, 0.16)	(31.11, 39.16)	(41, 43)	(0.21, 0.25)	(41.21, 43.25)	(21, 24)	(0.09, 0.11)	(21.09, 24.11)
	Hay - 3rd Cutting															
	MI	9.4	0.08	9.48	19	0.20	19.20	0.41	<0.05	<0.46	1.7	<0.05	1.7	0.35	<0.05	<0.40

[a] Each residue value represents one sample except that residue values in parentheses represent multiple extractions and/or analyses of a single sample. "Mthion" = malathion and "Moxon" = malaoxon. When calculating combined residues, nondetectable residues of malaoxon were not included in the total when residues of malathion were greater than 1.0 ppm.

[b] N/A = Not analyzed.

[c] Application parameters for the 5 lb/gal EC formulation: two foliar applications per cutting, with a 14-day retreatment interval, at 1.25 lb ai/A/application in 30 gal/A using ground equipment.

[d] Application parameters for the 9.79 lb/gal RTU formulation: two foliar applications per cutting, with a 14-day retreatment interval, at 0.61 lb ai/A/application using aerial ULV equipment.

26

The field residue data (MRID 43545201), reflecting the maximum use patterns the registrant wishes to support for use of the EC and RTU formulations on clover, indicate that the combined residues of malathion and malaoxon in/on clover forage and hay did not exceed the established 135-ppm tolerance (presently expressed as malathion *per se*). The combined residues of malathion and malaoxon in/on clover forage and hay following treatment with the 5 lb/gal EC and 9.79 lb/gal RTU formulations according to the use patterns the registrant wishes to support for reregistration are summarized below.

Clover Commodity	Formulation	Combined Residues (ppm)		
		First Cutting	Second Cutting	Third Cutting
Forage	EC	14-71.10	18.07-120.14	73.13
	RTU	2.8-62	3.75-56.05	14
Hay	EC	5.4-53.22	36.21-120.50	34.25
	RTU	3.3-94.34	18-104.27	9.48

If the registrant wishes to rely on the submitted data to fulfill reregistration requirements for magnitude of the residue in clover forage and hay, then product labels for the 5 lb/gal EC (EPA Reg. No. 4787-20) and 9.79 lb/gal RTU (EPA Reg. No. 4787-8) formulations must be revised to reflect the use patterns depicted in the current field trials. The available data will support the following use patterns: (i) two foliar applications per cutting, with a 14-day retreatment interval, of the 5 lb/gal EC formulation at 1.25 lb ai/A/application in 30 gal/A using ground equipment; and (ii) two foliar applications per cutting, with a 14-day retreatment interval, of the 9.79 lb/gal RTU formulation at 0.61 lb ai/A/application using aerial ULV equipment.

Cottonseed and Cotton Gin Byproduct

Established tolerance: A tolerance of 2 ppm has been established for residues of malathion *per se* in/on cottonseed [40 CFR §180.111]. No tolerance has been established for malathion residues of concern in/on cotton gin byproducts.

Discussion of the data: Cheminova submitted data (1995; MRID 43596601) from 18 trials conducted in AZ(2), CA(6), LA(4), and TX(6) depicting the magnitude of the residue of malathion and its metabolite malaoxon in/on cottonseed. Ginned and undelinted cottonseed was harvested 3 hours to 14 days following the last of: (i) 25 foliar applications, with 3-day retreatment intervals, of the Platte 5 lb/gal EC formulation at 2.5 lb ai/A/application (1x the maximum registered single application rate for the Cheminova EC formulation) in 30 gal/A using ground equipment; (ii) 25 foliar applications, with 3-day retreatment intervals, of the 4.1 lb/gal RTU formulation at 1.15 lb ai/A/application (1x the maximum registered single application rate) using aerial ULV equipment; and (iii) 25 foliar applications, with 3-day retreatment intervals, of the 9.79 lb/gal RTU formulation at 1.22 lb ai/A/application (1x the maximum registered single application rate) using aerial ULV equipment. Cottonseed samples were ginned using research-type ginning equipment.

Residues in/on treated and untreated cottonseed were determined using EN-CAS Method No. ENC-22/94. The results of the cottonseed field trials are presented in Table 7. Apparent residues of malathion and malaoxon were nondetectable (LOQ = 0.05 ppm each) in/on four untreated cottonseed samples. Additional untreated samples from AZ, TX-1, and TX-2 bore detectable malathion residues of 0.09, 0.17, and 0.09 ppm, respectively, and nondetectable residues (<0.05 ppm) of malaoxon; reanalysis of the untreated sample from AZ yielded residues below the LOQ. Adequate raw data pertaining to the field and analytical portions of the study were provided.

Geographic representation is adequate since the test states of AZ(6%), CA(15%), LA(8%), and TX(27%) along with the neighboring states of AR(9%) and MS(13%) accounted for ~80% of the 1991 U.S. cotton production *(1992 USDA Agricultural Statistics)*.

Table 7. Residues of malathion and its metabolite malaoxon in/on cottonseed following multiple foliar applications of the 5 lb/gal EC, 4.1 lb/gal RTU, and 9.79 lb/gal RTU formulations.

Formulation	Application Parameters	Trial Site	Residues (ppm) [a]		
			Malathion	Malaoxon	Combined
5 lb/gal EC	25 foliar applications, with 3-day retreatment intervals, at 2.5 lb ai/A/application (1x) in 30 gal/A using ground equipment.	**3-Hour PTI**			
		AZ	4.1	0.06	4.16
		CA-1	5.6	0.06	5.66
		CA-2	(11, 12), (14, 19)	(0.10, 0.11), (0.14, 0.12)	(11.10, 12.11), (14.14, 19.12)
		LA-1	7.8	<0.05	7.8
		LA-2	6.0	<0.05	6.0
		TX-1	3.8	0.07	3.87
		TX-2	3.0	0.08	3.08
		1-Day PTI			
		AZ	3.9	0.06	3.96
		CA-1	5.9	0.06	5.96
		CA-2	(4.9, 9.3)	(0.05, 0.09)	(4.95, 9.39)
		LA-1	7.4	0.05	7.45
		LA-2	4.7	<0.05	4.7
		TX-1	3.1	0.07	3.17
		TX-2	2.9	0.09	2.99
		4-Day PTI			
		AZ	2.4	<0.05	2.4
		CA-1	5.2	0.06	5.26
		CA-2	(6.9, 7.3), (7.4, 7.8)	(0.10, 0.09), (0.10, 0.10)	(7.00, 7.39), (7.50, 7.90)
		LA-1	2.3	<0.05	2.3
		LA-2	2.3	<0.05	2.3
		TX-1	2.1	0.10	2.20
		TX-2	2.4	0.09	2.49
		7-Day PTI			
		AZ	1.8	0.13	1.93
		CA-1	1.8	<0.05	1.8
		CA-2	(3.9, 4.7)	(0.06, 0.06)	(3.96, 4.76)
		LA-1	1.4	<0.05	1.4
		LA-2	1.2	<0.05	1.2
		TX-1	0.66	<0.05	<0.71
		TX-2	2.9	0.12	3.02

Formulation	Application Parameters	Trial Site	Residues (ppm) [a]		
			Malathion	Malaoxon	Combined
5 lb/gal EC (cont.)		**14-Day PTI**			
		AZ	3.0	0.37	3.37
		CA-1	0.23	<0.05	<0.28
		CA-2	(2.4, 4.4), (3.8, 4.6)	(0.05, 0.05), (0.05, 0.07)	(2.45, 4.45), (3.85, 4.67)
		LA-1	1.4	<0.05	1.4
		LA-2	0.65	<0.05	<0.70
		TX-1	0.73	0.07	0.80
		TX-2	2.1	0.12	2.22
4.1 lb/gal RTU	25 foliar applications, with 3-day retreatment intervals, at 1.15 lb ai/A/application (1x) using aerial ULV equipment.	**3-Hour PTI**			
		AZ	4.2	0.10	4.30
		CA-1	4.3	0.06	4.36
		CA-2	4.7	0.05	4.75
		LA-2	5.4	0.07	5.47
		TX-1	4.9	0.12	5.02
		TX-2	1.8	<0.05	1.8
		1-Day PTI			
		AZ	1.5	0.07	1.57
		CA-1	4.8	0.07	4.87
		CA-2	3.5	0.05	3.55
		LA-2	1.9	0.07	1.97
		TX-1	2.6	0.09	2.69
		TX-2	2.3	0.07	2.37
		4-Day PTI			
		AZ	2.1	0.11	2.21
		CA-1	2.4	<0.05	2.4
		CA-2	2.1	<0.05	2.1
		LA-2	0.50	<0.05	<0.55
		TX-1	1.9	0.11	2.01
		TX-2	0.92	<0.05	<0.97
		7-Day PTI			
		AZ	1.3	0.14	1.44
		CA-1	1.8	<0.05	1.8
		CA-2	1.7	<0.05	1.7
		LA-2	0.74	<0.05	<0.79

Formulation	Application Parameters	Trial Site	Residues (ppm) [a]		
			Malathion	Malaoxon	Combined
4.1 lb/gal RTU (cont.)		TX-1	0.67	0.07	0.74
		TX-2	0.87	0.05	0.92
		14-Day PTI			
		AZ	3.3	0.34	3.64
		CA-1	1.1	<0.05	1.1
		CA-2	0.90	<0.05	<0.95
		LA-2	0.25	<0.05	<0.30
		TX-1	0.57	0.06	0.63
		TX-2	(0.31, 0.42)	(<0.05, 0.05)	(<0.36, 0.47)
9.79 lb/gal RTU	25 foliar applications, with 3-day retreatment intervals, at 1.22 lb ai/A/application (1x) using aerial ULV equipment.	**3-Hour PTI**			
		CA-1	5.4	<0.05	5.4
		CA-2	(5.2, 5.9)	(<0.05, 0.05)	(5.2, 5.95)
		LA-1	2.1	<0.05	2.1
		TX-1	6.4	0.10	6.50
		TX-2	(2.4, 3.0)	(<0.05, <0.05)	(2.4, 3.0)
		1-Day PTI			
		CA-1	5.4	<0.05	5.4
		CA-2	7.1	0.07	7.17
		LA-1	2.1	<0.05	2.1
		TX-1	3.2	0.06	3.26
		TX-2	1.5	<0.05	1.5
		4-Day PTI			
		CA-1	2.1	<0.05	2.1
		CA-2	4.0	<0.05	4.0
		LA-1	(0.30, 0.66)	(<0.05, <0.05)	(<0.35, <0.71)
		TX-1	2.0	0.07	2.07
		TX-2	1.8	<0.05	1.8
		7-Day PTI			
		CA-1	2.0	<0.05	2.0
		CA-2	2.0	<0.05	2.0
		LA-1	0.40	<0.05	<0.45
		TX-1	2.1	0.06	2.16
		TX-2	1.6	0.06	1.66
		14-Day PTI			
		CA-1	1.2	<0.05	1.2
		CA-2	1.3	<0.05	1.3
		LA-1	0.14	<0.05	<0.19

Formulation	Application Parameters	Trial Site	Residues (ppm) [a]		
			Malathion	Malaoxon	Combined
9.79 lb/gal RTU (cont.)		TX-1	1.4	0.07	1.47
		TX-2	0.45	0.06	0.51

[a] Each residue value represents one sample, except that residue values in parentheses represent multiple extractions and/or analyses of a single sample. When calculating combined residues, nondetectable residues of malaoxon were not included in the total when residues of malathion were greater than 1.0 ppm.

The field residue data (MRID 43596601), reflecting the use of the EC and RTU formulations on cotton, indicate that the combined residues of malathion and malaoxon substantially exceeded the established tolerance (presently expressed as malathion *per se*) of 2 ppm for cottonseed. The combined residues of malathion and malaoxon in/on cottonseed harvested immediately (3 hours) following the last of 25 foliar applications, with 3-day retreatment intervals, were: (i) 3.08-19.12 ppm when the 5 lb/gal EC formulation was applied at 2.5 lb ai/A/application (1x) in 30 gal/A using ground equipment; (ii) 1.8-5.47 ppm when the 4.1 lb/gal RTU formulation was applied at 1.15 lb ai/A/application (1x) using aerial ULV equipment; and (iii) 2.1-6.50 ppm when the 9.79 lb/gal RTU formulation was applied at 1.22 lb ai/A/application (1x) using aerial ULV equipment.

If the registrant wishes to rely on the submitted data and retain a 0-day PHI, then a higher tolerance for cottonseed must be proposed and product labels for the 5 lb/gal EC (EPA Reg. No. 4787-20), 4.1 lb/gal RTU (EPA Reg. No. 4787-21), and 9.79 lb/gal RTU (EPA Reg. No. 4787-8) formulations must be revised to reflect the use patterns depicted in the current field trials. TOX considerations permitting, the available data will support a tolerance of 20 ppm for the combined residues of malathion and malaoxon in/on cottonseed. The available data will also support the following use patterns: (i) 25 foliar applications, with 3-day retreatment intervals, of the 5 lb/gal EC formulation at 2.5 lb ai/A/application in 30 gal/A using ground equipment; (ii) 25 foliar applications, with 3-day retreatment intervals, of the 4.1 lb/gal RTU formulation at 1.15 lb ai/A/application using aerial ULV equipment; and (iii) 25 foliar applications, with 3-day retreatment intervals, of the 9.79 lb/gal RTU formulation at 1.22 lb ai/A/application using aerial ULV equipment.

Table I of OPPTS 860.1000 requires cotton gin byproduct (gin trash) as a RAC of cotton; therefore, residue data depicting residues of malathion and malaoxon in/on cotton gin byproducts following applications of representative Cheminova-registered EC and RTU formulations according to the maximum registered use patterns must be submitted. A minimum of six field trials are required.

Magnitude of the Residue in Processed Food/Feed

Field Corn Processed Commodities

Established tolerance: A tolerance of 8 ppm has been established for residues of malathion *per se* in/on corn grain and forage [40 CFR §180.111]. No tolerance has been established for any field corn processed commodity.

Discussion of the data: Cheminova submitted data (1995; MRID 43577401) pertaining to the potential for concentration of residues of malathion and its malaoxon metabolite in the processed commodities of field corn. In one test conducted in TX, field corn was harvested 7 days following the last of three foliar applications, with 7- and 8-day retreatment intervals, of the Platte 5 lb/gal EC formulation at 6.25 lb ai/A/application (5x the maximum registered single application rate for the Cheminova EC formulation). In other tests in TX, three foliar applications were made to field corn, with 7- and 8-day retreatment intervals, of the Platte 5 lb/gal EC formulation at 1.25 and 2.50 lb ai/A/application (1x and 2x, respectively); however, samples from these studies were not harvested for processing.

Field corn was processed at the Engineering Biosciences Research Center of Texas A&M University (Bryan, TX) according to simulated commercial procedures. Briefly, unprocessed grain samples were cleaned by aspiration and mechanical screening. The aspirated fractions were processed into **grain dust** by further mechanical sifting and air-jet sieving.

The cleaned grain sample was **dry-milled** as follows: grain was steeped in water, cracked by an impact mill, dried by forced air, cooled and put through a shaker screen. Material collected on the screens was aspirated to separate hull + germ material from grits and detached germ. To separate germ from hulls, the hull + germ material was re-milled and re-aspirated. The grits/detached germ material was gravity-separated into germ and large grits. The germ was oven-dried and frozen for oil extraction. The large grits were mechanically sieved through a series of screens. **Medium grits** were collected off the 0.08-inch screen, **small grits** were collected off the 0.054-inch screen, **coarse meal** was collected off the 0.0204-inch screen, **meal** was collected off the 0.0098-inch screen, and **flour** was collected from the materials which passed through all screens.

Another portion of the cleaned grain sample was **wet-milled** as follows: grain was steeped and heated in water and sulfurous acid, the steepwater was drained, and the wet grain was disc-milled to separate the germ from hulls and endosperm. The germ fractions were combined after re-milling and washed with water to remove starch. The germ fractions were then oven-dried and frozen for oil extraction. **Starch** was collected from the other fraction after screening, water-washing, refrigeration, and centrifugation.

Both the wet- and dry-milled germ fractions were moistened, heated, flaked, and processed in an expeller to produce **crude oil** and presscake. The crude oil was filtered. The residual oil in

the presscake was extracted with hot hexane three times. The hexane/oil fractions were combined and heated to remove hexane. Crude oil fractions were combined, and a portion was combined with NaOH and heated in a refining machine, refrigerated, and the **refined oil** was decanted. A portion of the refined oil was heated with "bleaching earth", and mixed under vacuum. The bleached oil was filtered. Another portion of the refined oil was heated under vacuum in a steam bath, cooled, mixed with citric acid solution, and cooled to produce **bleached and deodorized oil**.

The registrant submitted adequate descriptions and material balance sheets for the processing procedures. Residues in/on treated and untreated field corn and its processed commodities were determined using EN-CAS Method No. ENC-28/94. The results of the field corn processing study are presented in Table 8. Apparent residues of malathion and malaoxon were nondetectable in/on one untreated sample of whole grain (<0.01 ppm each), and in one sample each of grain dust ≥2540 μm and <2540 μm (<0.05 ppm), starch (<0.01 ppm), grits (<0.01 ppm), meal (<0.01 ppm), flour (<0.01 ppm), and dry-milled crude, refined, and bleached and deodorized oil (<0.01 ppm) processed from untreated field corn grain.

Table 8. Residues of malathion and malaoxon in/on field corn grain and field corn processed commodities treated with three foliar applications, with 7- and 8-day retreatment intervals, of the 5 lb/gal EC formulation at 6.25 lb ai/A/application (5x).

Field Corn	Residues (ppm) [a]			Concentration/Reduction Factors [b]
Commodity	Malathion	Malaoxon	Combined	Combined
Whole grain	<0.01, <0.01 [<0.01]	<0.01, <0.01 [<0.01]	<0.02, <0.02 [<0.02]	--
Grain dust ≥2540 μm	0.98, 0.99 [0.99]	<0.05, <0.05 [<0.05]	<1.03, <1.04 [<1.04]	>52
Grain dust <2540 μm	0.84, 0.63 [0.74]	<0.05, <0.05 [<0.05]	<0.89, <0.68 [<0.79]	>40
Grits	<0.01, <0.01 [<0.01]	<0.01, <0.01 [<0.01]	<0.02, <0.02 [<0.02]	--
Meal	<0.01, <0.01 [<0.01]	<0.01, <0.01 [<0.01]	<0.02, <0.02 [<0.02]	--
Flour	<0.01, <0.01 [<0.01]	<0.01, <0.01 [<0.01]	<0.02, <0.02 [<0.02]	--
Crude oil (dry milling)	<0.01, <0.01 [<0.01]	<0.01, <0.01 [<0.01]	<0.02, <0.02 [<0.02]	--
Crude oil (wet milling)	<0.01, <0.01 [<0.01]	<0.01, <0.01 [<0.01]	<0.02, <0.02 [<0.02]	--
Refined oil (dry milling)	<0.01, <0.01 [<0.01]	<0.01, <0.01 [<0.01]	<0.02, <0.02 [<0.02]	--
Refined oil (wet milling)	<0.01, <0.01 [<0.01]	<0.01, <0.01 [<0.01]	<0.02, <0.02 [<0.02]	--
Bleached and deodorized oil (dry milling)	<0.01, <0.01 [<0.01]	<0.01, <0.01 [<0.01]	<0.02, <0.02 [<0.02]	--
Bleached and deodorized oil (wet milling)	<0.01, <0.01 [<0.01]	<0.01, <0.01 [<0.01]	<0.02, <0.02 [<0.02]	--
Starch	<0.01, <0.01 [<0.01]	<0.01, <0.01 [<0.01]	<0.02, <0.02 [<0.02]	--

[a] Bracketed values represent average residues.
[b] Calculated by dividing average residues found in processed fraction by the average residues found in whole grain.

The submitted field corn processing study (MRID 43577401) indicates that the combined residues of malathion and malaoxon did not concentrate above the limit of detection in starch, grits, meal, flour, dry- and wet-milled crude oil, dry- and wet-milled refined oil, and dry- and wet-milled bleached and deodorized oil processed from field corn grain bearing nondetectable residues of malathion and malaoxon (<0.01 ppm each) following three preharvest foliar treatments at 5x the maximum single application rate.

A study depicting the residues of malathion and malaoxon in the processed commodities of postharvest-treated corn grain (D216397, 5/26/98, M. Xue) has previously been reviewed. The combined residues of malathion and malaoxon concentrated 1.8x in meal, 2.0x in flour, 4.5x in dry-milled crude oil, 5.8x in wet-milled crude oil, 1.3x in dry-milled refined oil, and 3.5x in wet-milled refined oil processed from field corn grain following a series of postharvest treatments. Residues did not concentrate in grits, starch and dry- and wet-milled bleached and deodorized oil.

The submitted aspirated grain fractions data for corn indicate that the combined residues of malathion and malaoxon concentrated at least 40x in aspirated corn grain fractions collected from field corn grain samples bearing nondetectable residues of malathion and malaoxon (<0.01 ppm each) following three foliar preharvest treatments at 5x the maximum single application rate.

Postharvest-treated corn grain produced the highest residue levels in grain fractions (D216397, 5/26/98, M. Xue). These data indicate that the combined residues of malathion and malaoxon concentrated up to 98x in aspirated corn grain fractions collected. A tolerance of 700ppm has been recommended based on this study.

Malathion is presently registered for postemergence as well as postharvest uses on corn, sorghum, soybeans, and wheat; these are the crops for which aspirated grain fractions data are required. Adequate aspirated grain fractions data have been submitted for preharvest-treated field corn grain (MRID 43577401; this review), postharvest-treated field corn grain (D216397, 5/26/98, M. Xue), preharvest-treated wheat grain (D211260,07/13/98, M. Xue), and postharvest-treated wheat grain (D216397, 5/26/98, M. Xue). Data for postharvest-treated field corn grain may be translated to sorghum aspirated grain fractions (D187727, D. McNeilly, 4/15/93).

Cottonseed Processed Commodities

Established tolerance: A tolerance of 2 ppm has been established for residues of malathion *per se* in/on cottonseed [40 CFR §180.111]. No tolerance has been established for residues of malathion in any cottonseed processed commodity.

Discussion of the data: Cheminova submitted data (1995; MRID 43585301) pertaining to the potential for concentration of residues of malathion and its malaoxon metabolite in the processed commodities of cottonseed. In one test conducted in MS, cottonseed was harvested on the day (within 3 hours) of the last of 25 foliar applications, with 2- to 12-day retreatment intervals, of the Platte 5 lb/gal EC formulation at 12.5 lb ai/A/application (5x the maximum registered single application rate for the Cheminova EC formulation; see page 35 for use pattern information). In other tests in MS, 22 to 25 foliar applications were made to cottonseed, with 2- to 12-day retreatment intervals, of the Platte 5 lb/gal EC formulation at 2.50 and 5.0 lb ai/A/application (1x and 2x the maximum single application rate for the Cheminova EC formulation, respectively); however, cottonseed samples treated at 1x or 2x were not used for processing.

Cottonseed was processed at the Food Protein Research and Development Center of Texas A&M

University (Bryan, TX) according to simulated commercial procedures. Briefly, unprocessed cottonseed samples were mechanically delinted; the delinted seed was mechanically hulled and shaker-screened to produce kernels and **hulls**. A kernel sample was heated to 73.3 C, flaked in a roll mill and fed through an expander/extruder. The expander was injected with steam and collets were collected through a 3/8-inch die. **Crude oil** was extracted from the collets in a steam-jacketed extractor with hot hexane. The extracted collets were collected for **cottonseed meal**. The crude oil content of the miscella was determined, and the oil:hexane ratio was reduced to 60:40 by rotary evaporation at 90 C. The crude oil was refined by the addition of NaOH with heating and cooling, and finally centrifugation to separate the miscella from the remaining solids. The remaining hexane was extracted from the miscella with heat leaving **refined oil**. A fraction of the refined oil was treated with "bleaching earth" and heated under vacuum. The bleached oil was filtered, heated in a steam bath under vacuum, cooled, and mixed with citric acid solution yielding **bleached and deodorized oil**.

The registrant submitted adequate descriptions and material balance sheets for the processing procedures. Residues in/on treated and untreated cottonseed and its processed commodities were determined using EN-CAS Method No. ENC-3/95. The results of the cottonseed processing study are presented in Table 9. Apparent residues of malathion and malaoxon were nondetectable in/on one untreated sample of cottonseed (<0.05 ppm each), and in one sample each of hulls (<0.05 ppm), meal (<0.01 ppm), crude oil (<0.01 ppm), and bleached and deodorized oil (<0.01 ppm) processed from untreated cottonseed. Apparent residues of malathion were detectable in one refined oil sample (0.01 ppm) processed from untreated cottonseed; apparent residues of malaoxon were nondetectable (<0.01 ppm) in that sample.

Table 9. Residues of malathion and malaoxon in/on cottonseed and cottonseed processed commodities treated with 25 foliar applications, with 2- to 12-day retreatment intervals, of the 5 lb/gal EC formulation at 12.5 lb ai/A/application (5x).

Cottonseed Commodity	Residues (ppm) [a]			Concentration/Reduction Factors [b]
	Malathion	Malaoxon	Combined	Combined
Cottonseed	310, 350 [330]	0.60, 0.78 [0.69]	310.60, 350.78 [330.69]	--
Hulls	250, 260 [255]	0.77, 0.95 [0.86]	250.77, 260.95 [255.86]	0.77
Meal	22, 24 [23]	0.16, 0.14 [0.15]	22.16, 24.14 [23.15]	0.07
Crude oil	220, 220 [220]	0.29, 0.30 [0.30]	220.29, 220.30 [220.30]	0.67
Refined oil	210, 220 [215]	0.03, 0.03 [0.03]	210.03, 220.03 [215.03]	0.65
Bleached and deodorized oil	(2.3, 2.6), (2.4, 2.5) [2.5]	(<0.01, <0.01), (<0.01, <0.01) [<0.01]	(2.3, 2.6), (2.4, 2.5) [2.5]	0.01

[a] Duplicate analyses of a single sample are reported in parentheses; bracketed values represent the average of all samples and analyses. When calculating combined residues, nondetectable residues of malaoxon were not included in the total when residues of malathion were greater than 1.0 ppm.

[b] Calculated by dividing average residues found in processed fraction by the average residues found in cottonseed.

The cottonseed processing study (MRID 43585301) is adequate to satisfy reregistration requirements. The combined residues of malathion and malaoxon did not concentrate in cottonseed hulls, meal, crude oil, refined oil, and bleached and deodorized oil processed from cottonseed bearing detectable residues following treatment with the 5 lb/gal EC formulation at 5x the maximum single application rate.

Grape Processed Commodities

Established tolerance: A tolerance of 8 ppm has been established for residues of malathion *per se* in/on grapes [40 CFR §180.111]. A tolerance of 12 ppm has been established for residues of malathion in raisins as a result of drying grapes on trays treated with malathion and from application of malathion to grapes before harvest [40 CFR §185.3850].

Discussion of the data: Cheminova submitted data (1995; MRID 43548401) pertaining to the potential for concentration of residues of malathion and its malaoxon metabolite in the processed commodities of grapes. In one test conducted in CA, grapes were harvested 3 days following the last of two foliar applications to grape vines, with a 14-day retreatment interval, of the Platte 5 lb/gal EC formulation at 9.40 lb ai/A/application (5x the maximum registered single application rate for the Cheminova EC formulation). In other tests in CA, two foliar applications were made

to grape vines, with a 14-day retreatment interval, of the Platte 5 lb/gal EC formulation at 1.88 and 3.76 lb ai/A/application (1x and 2x the maximum single application rate for the Cheminova EC formulation, respectively); however, grapes treated at 1x or 2x were not used for processing. Following harvest of 5x-treated grapes, the samples were boxed and shipped at ambient temperature on the day of harvest to the National Food Laboratory, Inc. (Dublin, CA) for processing.

Grapes were processed according to simulated commercial procedures. Briefly, grapes were manually de-stemmed, mechanically crushed, and depectinized by commercial enzyme treatment at 54-60 C for 2-3 hours. The crushed fruit was passed through a 0.02-inch mesh screen. Skins (**wet pomace**) were collected, while a separate sample of skins was dehydrated at 54-66 C (**dry pomace**). The juices collected from the mesh screen were heated to 85-88 C, press-filtered, and refrigerated at -3.3 to 2.2 C for 4-6 weeks to allow argol settling. Afterwards, the **juice** was press-filtered again, heated to 91-93 C, canned, sealed, and cooled for sample collection.

A fraction of grapes and stems were sun-dried for 35-36 days. Because of adverse weather conditions, the partially dried grapes were mechanically dried to 12-15%. The dried grapes were re-hydrated to 18-20% moisture and dried again at 53-54 C to produce **raisins**. Stems were dried for 28-29 days and frozen. The stems and cap stems combined with sun-dried stems comprised **raisin waste**. The registrant submitted adequate descriptions and material balance sheets for the processing procedures. Residues in/on treated and untreated grapes and its processed commodities were determined using EN-CAS Method No. ENC-30/94.

The results of the grape processing study are presented in Table 10. Apparent residues of malathion and malaoxon were nondetectable in/on one sample of untreated whole grapes (<0.01 ppm each), and in one sample each of juice (<0.01 ppm), wet and dry pomace (<0.05 ppm), raisin waste (<0.05 ppm) and raisins (<0.01 ppm) processed from untreated grapes.

Table 10. Residues of malathion and malaoxon in/on grapes and grape processed commodities treated with two foliar applications, with a 14-day retreatment interval, of the 5 lb/gal EC formulation at 9.40 lb ai/A/application (5x).

Grape	Residues (ppm) [a]			Concentration/Reduction Factors [b]
Commodity	Malathion	Malaoxon	Combined	Combined
Whole grapes	0.73, 0.84 [0.79]	0.04, 0.04 [0.04]	0.77, 0.88 [0.82]	--
Juice	0.07, 0.07 [0.07]	0.01, 0.01 [0.01]	0.08, 0.08 [0.08]	0.1
Wet Pomace	1.9, 2.1 [2.0]	0.06, 0.07 [0.07]	1.96, 2.17 [2.07]	2.5
Dry Pomace	8.7, 8.9 [8.8]	0.18, 0.17 [0.18]	8.88, 9.07 [8.98]	11.0
Raisin Waste	4.7, 5.0 [4.9]	0.49, 0.47 [0.48]	5.19, 5.47 [5.33]	6.5
Raisins	0.32, 0.36 [0.34]	0.02, 0.02 [0.02]	0.34, 0.38 [0.36]	0.4

[a] Bracketed values represent the average residues.
[b] Calculated by dividing average residues found in processed fraction by the average residues found in whole grapes.

The grape processing study (MRID 43548401) is adequate to satisfy reregistration requirements. The combined residues of malathion and malaoxon concentrated 2.5x in wet pomace, 6.5x in raisin waste, and 11.0x in dry pomace processed from grapes bearing detectable residues following treatment with the 5 lb/gal EC formulation at 5x the maximum single application rate. Residues did not concentrate in juice and raisins.

Since residues did not concentrate in juice, no tolerance is needed for this processed commodity. The processed grape commodities of wet and dry pomace and raisin waste are no longer considered to be significant feed commodities (OPPTS 860.1000); therefore, no tolerances are needed for these commodities.

The Malathion Reregistration Standard required data reflecting malathion residues of concern in raisins processed from grapes receiving preharvest treatment at the maximum seasonal rate and dried on trays treated with malathion at the maximum rate. Because the registrant wishes to support only preharvest use of malathion on grapes, the established tolerance for raisins should be revoked since the submitted processing study indicates that malathion residues of concern do not concentrate in raisins processed from preharvest-treated grapes.

Rice Processed Commodities

Established tolerance: Tolerances of 8 ppm have been established for residues of malathion *per se* in/on rice grain and wild rice [40 CFR §180.111]. No tolerance has been established for any processed rice commodity.

Discussion of the data: Cheminova submitted data (1995; MRID 43562301) pertaining to the potential for concentration of residues of malathion and its malaoxon metabolite in the processed commodities of rice. In one test conducted in LA, rice grain was harvested 7 days following the last of three foliar applications, with 7-day retreatment intervals, of the Platte 5 lb/gal EC formulation at 6.25 lb ai/A/application (4x the maximum registered single application rate for the Cheminova EC formulation). In other tests in LA, three foliar applications were made to rice, with 7-day retreatment intervals, of the Platte 5 lb/gal EC formulation at 1.25 and 2.50 lb ai/A/application (0.8x and 1.6x the maximum single application of the Cheminova EC formulation, respectively); however, rice grain treated at 0.8x and 1.6x were not used for processing.

Rice grain was processed at the Engineering Biosciences Research Center of Texas A&M University (Bryan, TX) according to simulated commercial procedures. Briefly, unprocessed grain samples were cleaned by aspiration and mechanical screening. The aspirated fractions were further processed into **grain dust** by mechanical sifting and air-jet sieving. The cleaned grain sample caught on the 5/8-inch screen was milled two times to produce **hulls**, brown rice, and unhulled grain. The brown rice was processed through a commercial abrasion mill and screened to separate the **polished rice** (collected on the 1410-μm screen) and **bran**.

The registrant submitted adequate descriptions and material balance sheets for the processing procedures. Residues in/on treated and untreated rice grain and its processed commodities were determined using EN-CAS Method No. ENC-1/95. The results of the rice processing study are presented in Table 11. Apparent residues of malathion and malaoxon were nondetectable in/on two untreated samples of whole grain (<0.01 ppm each), and in one sample each of polished rice (<0.01 ppm), hulls (<0.05 ppm), and bran (<0.01 ppm). Untreated samples of grain dust bore detectable malathion residues of 0.07 ppm (grain dust ≥2540 μm), and 0.06 and 0.07 ppm (grain dust <2540 μm) and nondetectable residues (<0.05 ppm) of malaoxon; duplicate reanalyses of the untreated grain dust ≥2540 μm sample yielded residues below the LOQ (<0.05 ppm).

Table 11. Residues of malathion and malaoxon in/on rice grain and its processed commodities treated with three foliar applications, with 7-day retreatment intervals, of the 5 lb/gal EC formulation at 6.25 lb ai/A/application (4x).

Rice Commodities	Residues (ppm) [a]			Concentration/Reduction Factor[b]
	Malathion	Malaoxon	Combined	Combined
Whole grain	(20, 25), (26, 27) [25]	(0.43, 0.51), (0.57, 0.55) [0.52]	(20.43, 25.51), (26.57, 27.55) [25.02]	--
Polished rice	0.51, 0.56 [0.54]	<0.01, <0.01 [<0.01]	<0.52, <0.57 [<0.55]	<0.02
Hulls	130, 140 [135]	2.4, 2.6 [2.5]	132.4, 142.6 [137.5]	5.5
Bran	15, 18 [17]	0.19, 0.25 [0.22]	15.19, 18.25 [16.72]	0.7
Grain dust ≥2540 μm	(37, 49), (39, 44) [42]	(0.83, 0.86), (0.80, 0.82) [0.82]	(37.83, 49.86), (39.80, 44.82) [43.08]	1.7
Grain dust <2540 μm	(58, 64), (60, 64) [62]	(1.6, 1.5), (1.5, 1.5) [1.5]	(59.6, 65.5), (61.5, 65.5) [63.0]	2.5

[a] Duplicate analyses of a single sample are reported in parentheses; bracketed values represent the average of all samples and analyses.

[b] Calculated by dividing average residues found in processed fraction by the average residues found in whole grain.

The rice processing study (MRID 43562301) is adequate to satisfy reregistration requirements. The combined residues of malathion and malaoxon concentrated 5.5x in rice hulls processed from rice grain bearing detectable residues following treatment with the 5 lb/gal EC formulation at 4x the maximum single application rate. The combined residues of malathion and malaoxon did not concentrate in polished rice and bran. The needs for tolerances of rice grain and rice hulls will be determined when the rice field trial data (MRID 43468101) are evaluated.

Postharvest use of malathion on rice grain currently exist on Cheminova product labels. However, the registrant does not wish to support postharvest use of malathion on stored rice grain for reregistration. Therefore, postharvest use on rice must be removed from all pertinent product labels. The Agency will determine the need for tolerances on rice grain and hulls based on the residue data from preharvest use of malathion.

MASTER RECORD IDENTIFICATION NUMBERS

The citations for the MRID documents referred to in this review are presented below.

43545201 Bookbinder, M. (1995) Magnitude of the Residue of Malathion and its Metabolite Malaoxon in/on Clover Raw Agricultural Commodities Harvested after Ground and Aerial Treatment: Lab Project Number: AA920107: 94-0044. Unpublished study prepared by American

Agricultural Services, Inc. and EN-CAS Analytical Labs. 1274 p.

43546101 Bookbinder, M. (1995) Magnitude of the Residue of Malathion and Its Metabolite Malaoxon in/on Alfalfa Raw Agricultural Commodities Harvested after Ground and Aerial Treatment: Lab Project Number: AA920101: 92-0031: AA920101.CA1. Unpublished study prepared by American Agricultural Services, Inc. and EN-CAS Analytical Labs. 2252 p.

43548401 Bookbinder, M. (1995) Magnitude of the Residue of Malathion and Its Metabolite Malaoxon in/on Grape Processed Commodities: Lab Project Number: 92-0073: AA920133: AA920133.CA1. Unpublished study prepared by American Agricultural Services,Inc.; The National Food Lab, Inc.; and EN-CAS Analytical Labs. 405 p.

43562301 Bookbinder, M. (1995) Magnitude of the Residue of Malathion and Its Metabolite Malaoxon in/on Rice Processed Commodities: Lab Project Numbers: AA920137: 92-0077: AA920137.LA1. Unpublished study prepared by American Agricultural Services, Inc.; Texas A&M University; and EN-CAS Analytical Labs. 416 p.

43577401 Bookbinder, M. (1995) Magnitude of the Residue of Malathion and its Metabolite Malaoxon in/on Field Corn Processed Commodities: Lab Project Number: AA920132: 92-0072: AA920132.TX1. Unpublished study prepared by American Agricultural Service, Inc.; Texas A&M University; and EN-CAS Analytical Labs. 544 p.

43585301 Bookbinder, R. (1995) Magnitude of the Residue of Malathion and Its Metabolite Malaoxon in/on Cottonseed Processed Commodities: Lab Project Number: AA920131: 92-0071: AA920131.MS1. Unpublished study prepared by American Agricultural Services,Inc.; EN-CAS Analytical Labs; and Texas A&M University. 555 p.

43596601 Bookbinder, M. (1995) Magnitude of the Residue of Malathion and Its Metabolite Malaoxon in/on Cottonseed Harvested after Ground and Aerial Treatment: Lab Project Number: 92-0033: AA920110: AA920110.AZ1. Unpublished study prepared by American Agricultural Services, Inc. and EN-CAS Analytical Labs. 3327 p.