

US EPA ARCHIVE DOCUMENT

(4-27-95)

**MEMORANDUM**

**SUBJECT:** Response to the Malathion Reregistration Standard: Magnitude of the Residue Studies. Case No. 0248, Chemical I. D. No. 057701, MRID Nos. 43360401, 43372701, 43376801, 43372901, 43370601, 43360001, 43368301, 43362501, 43367201, 43361101, 43468201, 43479601, 43499901, CBRS Nos. 14467, 14863, 14945, 14949, Barcodes: D208047, D210189, D210843, D210294.

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**TO:** Larry Schnaubelt (PM-72)/Susan Jennings  
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Attached is a review of magnitude of the residue studies on beans, lima (1994; MRID 43372701); beans, snap (1994; MRID 43376801); corn, sweet (1994; MRID 43361101); cucumbers (1994; MRID 43370601); lettuce, head (1994; MRID 43362501); lettuce, leaf (1994; MRID 43367201); potatoes (1994; MRID 43360401); sorghum (1994; MRID 43360001); strawberries (1994; MRID 43368301); tomatoes (1994; MRID 43372901); field corn commodities (1994; MRID 43468201); snap bean processed commodities (1994; MRID 43479601); and tomato processed commodities (1994; MRID 43499901) submitted by the Malathion Reregistration Coalition in response to the Malathion Reregistration Standard. This review was completed by Dynamac Corporation under supervision of CBRS, HED. It has undergone secondary review in the branch and has been revised to reflect Agency policies.

**CONCLUSIONS AND RECOMMENDATIONS**

In the absence of supporting storage stability data, all conclusions pertaining to the magnitude of the residue in plants listed below are tentative. Cheminova has indicated

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that a storage stability study is ongoing.

Assuming that the registered uses of malathion on the crops addressed herein are limited to the use patterns employed in the submitted field trials, the currently established tolerances for many raw agricultural commodities may be reduced. However, CBRS recognizes that additional formulations and use patterns are still actively registered by companies other than Cheminova. Issues pertaining to tolerance reassessment will be considered when the reregistration eligibility decisions for malathion are made.

The subject data for sweet corn (K+CWHR), forage, and fodder, potatoes, sorghum grain, field corn commodities, strawberries and processed products of tomatoes are adequate and no additional data are required at this time. Data are required, however, for sorghum forage, fodder, and aspirated grain fractions. Although the subject data are technically acceptable for succulent beans, cucumbers, lettuce, and tomatoes, additional data are required to support additional use patterns and/or formulation classes. A feed additive tolerance for malathion residues in tomato pomace must be proposed once the outstanding tomato field trial data have been submitted and deemed acceptable. Virtually all of the above conclusions are contingent upon tolerance amendments and/or label revisions such that the registered use patterns reflect the available data base. Note that the submitted succulent bean processing study (MRID 43479601; D210294; CBRS No. 14949) was not reviewed because bean processing waste is no longer considered to be a significant feed item.

If you need additional input please advise.

Attachment 1: Malathion Crop Field Trials Review.

cc (With Attachment 1): RBP, circ., Malathion Reregistration Standard File and Malathion Subject File.

cc (Without Attachment): RF, DHRdy.

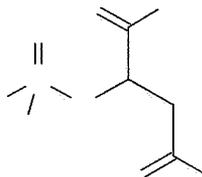
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## MALATHION



Shaughnessy No. 057701; Case 0248

(CBRS Nos. 14467; DP Barcode D208047)

(CBRS Nos. 14863; DP Barcode D210189)

(CBRS Nos. 14945; DP Barcode D210843)

(CBRS Nos. 14949; DP Barcode D210294)

### 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 data pertaining to the magnitude of the residues of malathion and its malaoxon metabolite in/on: beans, lima (1994; MRID 43372701); beans, snap (1994; MRID 43376801); corn, sweet (1994; MRID 43361101); cucumbers (1994; MRID 43370601), lettuce, head (1994; MRID 43362501), lettuce, leaf (1994; MRID 43367201), potatoes (1994; MRID 43360401), sorghum (1994; MRID 43360001), strawberries (1994; MRID 43368301), tomatoes (1994; MRID 43372901), field corn commodities (1994; MRID 43468201); snap bean processed commodities (1994; MRID 43479601); and tomato processed commodities (1994; MRID 43499901). In the transmittal letters for these submissions, the registrant stated that these references are also being submitted in compliance with FIFRA Section 6(a)(2) to report detectable residues of malaoxon in various subject commodities following malathion applications according to use patterns the registrant wishes to support for reregistration. Data from these submissions are evaluated herein for adequacy in fulfilling residue chemistry data requirements for the reregistration of malathion. The Conclusions and Recommendations stated below pertain only to the above submissions. All other

residue chemistry data requirements stated in the Malathion Reregistration Standard Guidance Document are not addressed herein.

The qualitative nature of malathion residues in plants is adequately understood based on acceptable metabolism studies involving alfalfa, lettuce, cotton, and wheat. The residues of concern are malathion and malaoxon. The qualitative nature of the residue resulting from oral dosing of ruminants and poultry is adequately understood; neither malathion nor malaoxon was detected in any tissue. If the direct livestock treatment uses of malathion are removed from all product labels, the tolerances for residues of malathion in animal commodities can be revoked. However, if the direct livestock treatment uses of malathion are supported, then appropriate dermal metabolism and magnitude of the residue in meat, milk, poultry, and egg studies are required.

Tolerances for residues in/on food/feed commodities are expressed in terms of malathion (*O,O*-dimethyl dithiophosphate of diethyl mercaptosuccinate) [40 CFR §180.111, §185.3850, §185.7000, and §186.3850]. The HED Metabolism Committee 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.

Adequate methods are available for the enforcement of tolerances as presently expressed. The Pesticide Analytical Manual (PAM) Vol. II lists a TLC method, a GLC method with KCl thermionic detection, and a spectrophotometric method as Methods I, II, and III, respectively, for the enforcement of malathion tolerances. The Residue Chemistry Science Chapter of the Malathion Reregistration Standard, dated 7/31/87, recommends use of the GLC method for tolerance enforcement. When the tolerance expression is revised to include both malathion and malaoxon, new enforcement methodology may be required.

## CONCLUSIONS AND RECOMMENDATIONS

In the absence of supporting storage stability data, a complete reassessment of established tolerances could not be made; therefore, all conclusions pertaining to the magnitude of the residue in plants listed below are tentative. Cheminova has indicated that a storage stability study is ongoing.

Assuming that the registered uses of malathion on the crops listed below are limited to the use patterns employed in the submitted field trials, the currently established tolerances for many raw agricultural commodities may be reduced. However, CBRS recognizes that additional formulations and use patterns are still actively registered by companies other than Cheminova. Issues pertaining to tolerance reassessment will be considered when the reregistration eligibility decisions for malathion are made.

A snap bean processing study (1994; MRID 43479601) was submitted. However, this study is not reviewed here as the Agency no longer considers bean cannery waste to be a regulated livestock feed item; see the updated Livestock Feeds Table (Table II of the Pesticide Assessment Guidelines, Subdivision O, Residue Chemistry, issued June 1994).

### Beans (Succulent)

- 1a. The submitted field residue data (1994; MRIDs 43372701 and 43376801), reflecting the maximum use pattern the registrant wishes to support for succulent beans, indicate that the combined residues of malathion and malaoxon will not exceed the established tolerance (presently expressed as malathion per se) of 8 ppm for beans. The combined residues of malathion and malaoxon were <0.06-0.92 ppm in/on mature lima beans and <0.02-<0.57 ppm in/on mature snap beans harvested 1 day following the last of three foliar applications, with ~7-day retreatment intervals, of the 9.79 lb/gal RTU formulation at 0.61 lb ai/A/application using aerial ULV equipment.
- 1b. Provided that label revisions are made for the 9.79 lb/gal RTU formulation (EPA Reg. No. 4787-8) to reflect the use pattern used in the current field trials, no additional field residue data for succulent beans will be required for this formulation class. The available data will support a maximum of three foliar applications per growing season to succulent beans at 0.61 lb ai/A/application using ULV aerial equipment, with a 7-day retreatment interval and a 1-day PHI.
- 1c. The reregistration requirements for succulent beans are not yet completely fulfilled. Additional field residue data reflecting use of the Cheminova 5 lb/gal EC formulation (EPA Reg. No. 4787-20) according to the maximum use pattern are required to support malathion uses on succulent beans. Alternatively, the registrant may elect to revise its label for the 5 lb/gal EC formulation to delete uses on succulent beans.

### Beans (Dry)

2. Residue data for dry beans (1994; MRID 43417601) have been submitted and are currently under review (CBRS No. 14065, DP Barcode D208772). It is noted that MRID 43417601 does not contain any residue data on the forage and straw of dry beans.

### Corn, Sweet (K + CWHR)

- 3a. The submitted field residue data (MRID 43361101), reflecting the maximum use patterns the registrant wishes to support for sweet corn, indicate that the combined residues of malathion and malaoxon will not exceed the established tolerance (presently expressed as malathion per se) of 2 ppm for fresh corn. The combined residues of malathion and malaoxon were <0.02-<0.03 ppm in/on sweet corn (K + CWHR) harvested 5 days following the last of five foliar applications, with ~5-day retreatment intervals, of the 5 lb/gal EC formulation at 1.25 lb ai/A/application using ground equipment, and were <0.02 ppm (nondetectable) in/on sweet corn harvested 5 days following the last of five foliar applications, with ~5-day retreatment intervals, of the 9.79 lb/gal RTU formulation at 0.61 lb ai/A/application using aerial ULV equipment.

- 3b. Provided that label revisions are made for the 5 lb/gal EC (EPA Reg. No. 4787-20) and 9.79 lb/gal RTU (EPA Reg. No. 4787-8) formulations to reflect the use patterns used in the current field trials, no additional field residue data for sweet corn (K + CWHR) will be required for reregistration purposes. The available data will support: (i) up to five foliar applications per growing season of the 5 lb/gal EC formulation at 1.25 lb ai/A/application using ground equipment, with a 5-day retreatment interval and a 5-day PHI; and (ii) up to five foliar applications per growing season of the 9.79 lb/gal RTU formulation at 0.61 lb ai/A/application using aerial ULV equipment, with a 5-day retreatment interval and a 5-day PHI.
- 3c. The registrant has indicated in a separate field residue study submission for sorghum (MRID 43360001) that they plan to propose a crop group tolerance for cereal grains. The Branch does not have any objections to the registrant's plan to propose a crop group tolerance for cereal grains, provided that the minimum requirements for the establishment of a crop group tolerance, in accordance with 40 CFR §180.34(f) (further defined in the document entitled; "EPA Guidance on Number and Location of Domestic Crop Fields Trials for Establishment of Pesticide Residue Tolerances", (updated June 1994, E. Saito and E. Zager), are adequately fulfilled.

#### Corn, Sweet, Forage

- 3d. The submitted field residue data, reflecting the maximum use patterns the registrant wishes to support, indicate that the established tolerance of 8 ppm for corn forage is too low. The combined residues of malathion and malaoxon were <0.11-41.19 ppm in/on sweet corn forage harvested 5 days following the last of five foliar applications, with ~5-day retreatment intervals, of the 9.79 lb/gal RTU formulation at 0.61 lb ai/A/application (1X) using aerial ULV equipment, and were <0.10-2.61 ppm in/on sweet corn forage harvested 5 days following the last of five foliar applications, with ~5-day retreatment intervals, of the 5 lb/gal EC formulation at 1.25 lb ai/A/application (1X) using ground equipment.
- 3e. The combined residues of malathion and malaoxon exceeded the established tolerance in/on corn forage treated with the RTU formulation for corn grown in CA (up to 41.19 ppm) and MN (up to 19.05 ppm); trials conducted in other test states using the RTU formulation resulted in combined residue levels below the tolerance (<0.11-0.72 ppm). The registrant may propose a higher tolerance for sweet corn forage. TOX considerations permitting, the available data will support a tolerance of 45 ppm for sweet corn forage assuming label revisions are made to coincide with the use patterns of the subject field trials (see conclusion 3b).

#### Corn, Sweet, Grain and Fodder

- 3f. The updated Livestock Feeds Table (Table II of the Pesticide Assessment Guidelines, Subdivision O, Residue Chemistry, updated June 1994) additionally identifies sweet

corn grain and fodder as raw agricultural commodities of sweet corn and no data have been submitted for these commodities. Table II specifies that a field corn grain tolerance will cover residues in sweet corn grain (dry), provided the use patterns are the same. Field residue data for field corn grain and fodder (MRID 43468201) are discussed below (CBRS No. 14683, DP Barcode D210189). Sweet corn grain (dry) and fodder data reflecting the use patterns used in the current sweet corn field trials must be generated. Alternatively, Cheminova's registered uses on sweet corn may be made identical to those of field corn, in which case the field corn grain tolerance will cover residues in/on sweet corn grain (dry) and the required data for field corn fodder will be used to satisfy the requirements for sweet corn fodder. Note that if the sweet corn use patterns are made identical to the field corn use patterns the suggested 45 ppm sweet corn forage tolerance (see Conclusion 3e) must be reconsidered.

#### Corn, Field, and Grain

- 4a. The submitted field residue data (MRID 43468201), reflecting the maximum use pattern the registrant wishes to support for field corn, indicate that the combined residues of malathion and malaoxon will not exceed the established tolerance (presently expressed as malathion *per se*) of 8 ppm for field corn grain. The combined residues of malathion and malaoxon in/on field corn grain were: (i) <0.02-<0.03 ppm in samples harvested 7 days following the last of three foliar applications, with ~7-day retreatment intervals, of the 5 lb/gal EC formulation at 1.25 lb ai/A/application in 30 gal of water/A using ground equipment; and (ii) <0.02-<0.04 ppm in samples harvested 7 days following the last of three foliar applications, with ~7-day retreatment intervals, of the 9.79 lb/gal RTU formulation at 0.61 lb ai/A/application using aerial ULV equipment.
- 4b. Provided that label revisions are made for the 5 lb/gal EC (EPA Reg. No. 4787-20) and 9.79 lb/gal RTU (EPA Reg. No. 4787-8) formulations to reflect the use patterns used in the current field trials, no additional field residue data for field corn grain will be required for reregistration purposes. The available data will support: (i) up to three foliar applications per growing season of the 5 lb/gal EC formulation at 1.25 lb ai/A/application using ground equipment, with a 7-day retreatment interval and a 7-day PHI; and (ii) up to three foliar applications per growing season of the 9.79 lb/gal RTU formulation at 0.61 lb ai/A/application using aerial ULV equipment, with a 7-day retreatment interval and a 7-day PHI.
- 4c. The registrant has stated that they plan to propose a crop group tolerance for cereal grains. Adequate field residue data for all designated representative members of this crop group, according to 40 CFR §180.34(f) and the recent guidance on conducting crop field trials (EPA Guidance on Number and Location of Domestic Crop Field Trials for Establishment of Pesticide Residue Tolerances, E. Saito and E. Zager, 6/2/94), have now been submitted and are currently under review at CBRS: sweet corn (MRID 43361101; DP Barcode D208047), field corn (this submission), rice (MRID 43468401; DP Barcode D210188); sorghum (MRID 43360001; DP Barcode D208047),

and spring and winter wheat (MRIDs 43350402 and 43414901; DP Barcodes D208233, and D208772). All of these submissions are adequate to support the established individual grain tolerances. When malathion was applied according to the use patterns the registrant wishes to support for these crops, combined residues of malathion and malaoxon were: <0.02-<0.03 ppm in/on sweet corn (K + CWHR); <0.02-<0.04 ppm in/on field corn grain; <0.30-4.71 ppm in/on rice grain; <0.03-2.28 ppm in/on sorghum grain; and <0.02-0.34 ppm in/on spring and winter wheat grain. Pending submission of adequate supporting storage stability data, these data would support a crop group tolerance of 5 ppm for the cereal grains group.

#### Corn, Field, Forage

- 4d. The submitted field residue data (MRID 43468201), reflecting the maximum use pattern the registrant wishes to support for field corn, indicate that the combined residues of malathion and malaoxon will not exceed the established tolerance (presently expressed as malathion *per se*) of 8 ppm for field corn forage. The combined residues of malathion and malaoxon in/on field corn forage were: (i) <0.10-<0.24 ppm in samples harvested 7 days following the last of three foliar applications, with ~7-day retreatment intervals, of the 5 lb/gal EC formulation at 1.25 lb ai/A/application in 30 gal of water/A using ground equipment; and (ii) <0.10-<3.05 ppm in samples harvested 7 days following the last of three foliar applications, with ~7-day retreatment intervals, of the 9.79 lb/gal RTU formulation at 0.61 lb ai/A/application using aerial ULV equipment.
- 4e. Provided that label revisions are made for the 5 lb/gal EC (EPA Reg. No. 4787-20) and 9.79 lb/gal RTU (EPA Reg. No. 4787-8) formulations to reflect the use patterns used in the current field trials (as specified above for field corn grain), no additional field residue data for field corn forage will be required for reregistration purposes.

#### Corn, Field, Fodder

- 4f. The submitted field residue data (MRID 43468201), reflecting the maximum use pattern the registrant wishes to support for field corn, indicate that the combined residues of malathion and malaoxon in/on field corn fodder were: (i) <1.35-13.23 ppm in samples harvested 7 days following the last of three foliar applications, with ~7-day retreatment intervals, of the 5 lb/gal EC formulation at 1.25 lb ai/A/application in 30 gal of water/A using ground equipment; and (ii) <1.45-27.07 ppm in samples harvested 7 days following the last of three foliar applications, with ~7-day retreatment intervals, of the 9.79 lb/gal RTU formulation at 0.61 lb ai/A/application using aerial ULV equipment.
- 4g. There is presently no established tolerance for malathion residues of concern in/on field corn fodder. Since fodder is identified as a raw agricultural commodity of field corn, the registrant must propose a tolerance for this commodity. TOX considerations permitting, the available data will support a tolerance of 30 ppm for the combined

residues of malathion and malaoxon in/on field corn fodder based on residue data from the current submission. The Branch recognizes that the registrant also has the option of proposing a crop group tolerance, if applicable, for the forage, fodder, and straw of cereal grains once adequate residue data from representative members have been submitted and evaluated.

### Tomatoes

- 5a. The submitted field residue data (1994; MRID 43372901), reflecting the maximum use patterns the registrant wishes to support for tomatoes, indicate that the combined residues of malathion and malaoxon will not exceed the established tolerance (presently expressed as malathion *per se*) of 8 ppm for tomatoes. The combined residues of malathion and malaoxon were <0.11- <0.42 ppm in/on mature tomatoes harvested 1 day following the last of five foliar applications, with a 5-day retreatment interval, of the 5 lb/gal EC formulation at 1.56 lb ai/A/application using ground equipment, and were <0.14-1.54 ppm in/on mature tomatoes harvested 3 days following the last of 5 foliar applications, with a 5-day retreatment interval, of the 5 lb/gal EC formulation at 3.43 lb ai/A/application using ground equipment.
- 5b. Provided that label revisions are made for the 5 lb/gal EC formulation (EPA Reg. No. 4787-20) to reflect the use patterns used in the current field trials, no additional field residue data for tomatoes will be required. The available data will support: (i) up to five foliar applications to tomatoes per growing season at 3.43 lb ai/A/application using ground equipment, with a 5-day retreatment interval and a 3-day PHI; or (ii) up to five foliar applications per growing season at 1.56 lb ai/A/application using ground equipment, with a 5-day retreatment interval and a 1-day PHI.
- 5c. The reregistration requirements for tomatoes are not yet completely fulfilled. Additional field residue data reflecting use of the Cheminova 9.79 lb/gal RTU formulation (EPA Reg. No. 4787-8) according to the maximum use pattern for tomatoes, and use of the 5 lb/gal EC formulation (EPA Reg. No. 4787-20) according to the maximum use pattern for commercial greenhouse-grown tomatoes are required to support malathion uses on tomatoes. Alternatively, the registrant may elect to revise its label to delete uses on tomatoes from the label for the 9.79 lb/gal RTU formulation and to delete uses on greenhouse-grown tomatoes from the label for the 5 lb/gal EC formulation.

### Tomato Processed Commodities

- 6a. The submitted tomato processing study (MRID 43499901) is adequate to satisfy reregistration requirements for magnitude of the residue in tomato processed commodities. The data indicate that the combined residues of malathion and malaoxon concentrated in dry pomace (13x) and wet pomace (1.7x) processed from whole tomatoes bearing detectable residues. The combined residues of malathion and malaoxon reduced in juice (<0.03x), puree (0.6x), and catsup (0.8x).

- 6b. The available processing data suggest that a feed additive tolerance is needed for the combined residues of malathion and malaoxon in tomato dried pomace based on a combined concentration factor of 13x. The need for a feed additive tolerance for tomato wet pomace, based on a marginal concentration factor of 1.7x, will be determined once the established tolerance for tomatoes has been completely reassessed. Although acceptable tomato field residue data (MRID 43372901), reflecting use patterns the registrant wishes to support for EC formulation, have been submitted and evaluated (DP Barcode D208047, currently under review), the established tolerance cannot be reassessed until additional field residue data reflecting use of the RTU formulation and use of malathion on greenhouse-grown tomatoes have been submitted.

### Cucumbers

- 7a. The submitted field residue data (1994; MRID 43370601), reflecting the maximum use pattern the registrant wishes to support for cucumbers, indicate that the combined residues of malathion and malaoxon will not exceed the established tolerance (presently expressed as malathion *per se*) of 8 ppm for cucumbers. The combined residues of malathion and malaoxon ranged from <0.02 to <0.11 ppm in/on mature cucumbers harvested 1 day following the last of three foliar applications, with a 7-day retreatment interval, of the 5 lb/gal EC formulation at 1.88 lb ai/A/application using ground equipment.
- 7b. Provided that label revisions are made for the 5 lb/gal EC formulation (EPA Reg. No. 4787-20) to reflect the use pattern used in the current field trials, no additional field residue data for cucumbers will be required. The available data will support up to three foliar applications per growing season at 1.88 lb ai/A/application using ground equipment, with a 7-day retreatment interval and a 1-day PHI.
- 7c. The reregistration requirements for cucumbers are not yet completely fulfilled. Additional residue data reflecting use of the Cheminova 5 lb/gal EC formulation (EPA Reg. No. 4787-20) according to the maximum use pattern for commercial greenhouse-grown cucumbers are required. Alternatively, the registrant may elect to delete uses on greenhouse-grown cucumbers from the label for the 5 lb/gal EC formulation.

### Lettuce

- 8a. The submitted field residue data (MRIDs 43362501 and 43367201), reflecting the maximum use pattern the registrant wishes to support for head and leaf lettuce, indicate that the combined residues of malathion and malaoxon will not exceed the established tolerance (presently expressed as malathion *per se*) of 8 ppm for leafy vegetables (except brassica). The combined residues of malathion and malaoxon ranged from <0.02 to 0.22 ppm in/on mature head lettuce and from <0.02 to <3.2 ppm in/on

mature leaf lettuce harvested 14 days following the last of six foliar applications, with ~5-day retreatment intervals, of the 5 lb/gal EC formulation at 1.88 lb ai/A/application using ground equipment.

- 8b. Provided that label revisions are made for the 5 lb/gal EC formulation (EPA Reg. No. 4787-20) to reflect the use patterns used in the current field trials, no additional field residue data for lettuce will be required. The available data will support up to six foliar applications per growing season to head and leaf lettuce at 1.88 lb ai/A/application using ground equipment, with a 5-day retreatment interval and a 14-day PHI.
- 8c. The reregistration requirements for lettuce are not yet completely fulfilled. Additional field residue data reflecting use of the Cheminova 5 lb/gal EC formulation (EPA Reg. No. 4787-20) according to the maximum use patterns for commercial greenhouse-grown lettuce are required. Alternatively, the registrant may elect to delete uses on greenhouse-grown lettuce from the label for the 5 lb/gal EC formulation.

#### Potatoes

- 9a. The submitted field residue data (1994; MRID 43360401), reflecting the maximum use patterns the registrant wishes to support for potatoes, indicate that the combined residues of malathion and malaoxon will not exceed the established tolerance (presently expressed as malathion *per se*) of 8 ppm for potatoes. The combined residues of malathion and malaoxon ranged from <0.02 to 0.05 ppm in/on mature potatoes harvested 3 hours following the last of two foliar applications, with a 7-day retreatment interval, of the 5 lb/gal EC formulation at 1.56 lb ai/A/application using ground equipment.
- 9b. Provided that label revisions are made for the 5 lb/gal EC formulation (EPA Reg. No. 4787-20) to reflect the use patterns used in the current field trials, no additional field residue data for potatoes will be required for reregistration purposes. The available data will support up to two foliar applications per growing season at 1.56 lb ai/A/application using ground equipment, with a 7-day retreatment interval and a 0-day PHI.

#### Sorghum Grain

- 10a. The submitted field residue data (MRID 43360001), reflecting the maximum use patterns the registrant wishes to support for sorghum, indicate that the combined residues of malathion and malaoxon will not exceed the established tolerance (presently expressed as malathion *per se*) of 8 ppm for sorghum grain. The combined residues of malathion and malaoxon were <0.03-0.57 ppm in/on sorghum grain harvested 7 days following the last of three foliar applications, with a 7-day retreatment interval, of the 5 lb/gal EC formulation at 1.25 lb ai/A/application using ground equipment, and were <0.11-2.28 ppm in/on sorghum grain harvested 7 days following the last of three

foliar applications, with a 7-day retreatment interval, of the 9.79 lb/gal RTU formulation at 0.61 lb ai/A/application using aerial ULV equipment.

- 10b. Provided that label revisions are made for the 5 lb/gal EC formulation (EPA Reg. No. 4787-20) and 9.79 lb/gal RTU formulation (EPA Reg. No. 4787-8) to reflect the use patterns used in the current field trials, no additional field residue data for sorghum grain will be required for reregistration purposes. The available data will support: (i) up to three foliar applications per growing season of the 5 lb/gal EC formulation at 1.25 lb ai/A/application using ground equipment, with a 7-day retreatment interval and a 7-day PHI; and (ii) up to three foliar applications per growing season of the 9.79 lb/gal RTU formulation at 0.61 lb ai/A/application using aerial ULV equipment, with a 7-day retreatment interval and a 7-day PHI.
- 10c. The Branch recognizes that the registrant plans to propose a crop group tolerance for cereal grains following submission and evaluation of studies involving representative members of this crop group (see Conclusion No. 3c).

#### Sorghum Forage and Fodder

- 10d. The registrant's intention to include label restrictions against the feeding and grazing of malathion-treated sorghum forage and fodder to livestock is inappropriate. The Agency has recently updated the Livestock Feeds Table (Table II of the Pesticide Assessment Guidelines, Subdivision O, Residue Chemistry, updated 6/94), and restrictions against the feeding of treated sorghum forage and fodder to livestock are now considered impractical. Therefore, field residue data and tolerance proposals are required for sorghum forage and fodder. A minimum of 16 field trials are required. For additional guidance on sampling and geographic locations for field trials, the registrant should consult "EPA Guidance on Number and Location of Domestic Crop Field Trials for Establishment of Pesticide Residue Tolerances" updated 6/2/94. It may be in the registrant's best interest to propose a crop group tolerance for the forage, fodder, and straw of cereal grains thereby allowing them to reduce the number of required field trials.

#### Aspirated Grain Fractions

- 10e. The Agency has recently revised its policy on grain dust (or aspirated grain fractions), and has determined that grain dust should be considered a raw agricultural commodity; see "Aspirated Grain Fractions (Grain Dust): A Tolerance Perspective" (E. Saito and E. Zager, 6/2/94)." This guidance specifies that residue data on aspirated grain fractions of corn, wheat, sorghum, and soybeans are required; malathion is presently registered for postemergence as well as postharvest uses on these crops. If the combined residues of concern in/on aspirated grain fractions exceed the established individual tolerances for cereal grains (or the proposed crop group tolerance) or soybeans, then a tolerance for aspirated grain fractions will be required.

## Strawberries

- 11a. The submitted field residue data (1994; MRID 43368301), reflecting the maximum use pattern the registrant wishes to support for strawberries, indicate that the combined residues of malathion and malaoxon will not exceed the established tolerance (presently expressed as malathion *per se*) of 8 ppm for strawberries. The combined residues of malathion and malaoxon were <0.10-0.45 ppm in/on mature strawberries harvested 3 days following the last of six foliar applications, with a 7-day retreatment interval, of the 5 lb/gal EC formulation at 1.88 lb ai/A/application using ground equipment.
- 11b. Provided that label revisions are made for the 5 lb/gal EC formulation (EPA Reg. No. 4787-20) to reflect the use pattern used in the current field trials, no additional field residue data for strawberries will be required for reregistration purposes. The available data will support up to six foliar applications per growing season at 1.88 lb ai/A/application using ground equipment, with a 7-day retreatment interval and a 3-day PHI.

## DETAILED CONSIDERATIONS

### Residue Analytical Methods

The raw agricultural commodities from the submitted field trials 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 0.01 ppm, except for sweet corn forage where the LOQ was 0.05 ppm. The limit of quantitation (LOQ) for field corn grain, whole tomatoes, and tomato juice and catsup was 0.01 ppm. The LOQ was 0.05 ppm for field corn forage and fodder, and tomato wet pomace. 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 phosphorus mode, and are essentially identical to the American Cyanamid Method M-1886 which has been recently proposed for enforcement purposes. Adequate method descriptions as well as acceptable radiovalidation data using samples from an alfalfa metabolism study have been submitted and evaluated (DP Barcode D196878, CBRS No. 12855, R. Perfetti, 2/28/94) for the American Cyanamid Method M-1886. The registrant has been required to conduct an independent laboratory validation, in accordance with PR Notice 88-5 dated 7/15/88, before the proposed method can undergo an Agency method validation, and be considered suitable for enforcement purposes.

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 were fortified with malathion and malaoxon at various levels. Apparent residues of malathion and malaoxon were nondetectable (<0.01 ppm each) in/on all untreated samples of

RACs. Representative chromatograms, sample calculations, and standard curves were provided. The recovery data are presented in Tables 1B, 1C, 1D, and 1E. These data suggest that the EN-CAS methods are adequate for malathion and malaoxon data collection for beans, sweet corn and sweet corn forage, cucumbers, lettuce, potatoes, sorghum grain, strawberries, tomatoes, field corn fodder, field corn grain, and processed tomato commodities (tomato juice, dry tomato pomace, and catsup).

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

Raw Agricultural Commodity	MRID	EN-CAS Method No.
Beans, lima	43372701	ENC-13/94
Beans, snap	43376801	ENC-5/94
Corn, sweet (K + CWHR) and Corn, sweet, forage	43361101	ENC-3/94
Cucumbers	43370601	ENC-4/94
Lettuce, head	43362501	ENC-9/94
Lettuce, leaf	43367201	ENC-10/94
Potatoes	43360401	ENC-1/94
Sorghum	43360001	ENC-10/93
Strawberries	43368301	ENC-6/94
Tomatoes	43372901	ENC-11/94
Tomatoes and tomato processed commodities	43499901	ENC-25-94
Field Corn Commodities	43468201	ENC-17/94

Table 1B. Method validation of EN-CAS Methods Nos. ENC-10/93, ENC-1/94, ENC-3/94, ENC-4/94, ENC-5/94, ENC-6/94, ENC-9/94, ENC-10/94, ENC-11/94, and ENC-13/94 using various matrices fortified with malathion and malaoxon.

Raw Agricultural Commodity	Fortification Level (ppm)	Analyte Fortified	Percent Recovery	
			Malathion	Malaoxon
Beans, lima	0.01	Both analytes	99, 113, 119	98, 100, 107
	0.05	Both analytes	81, 83, 85	78, 83, 84
	0.50	Both analytes	88, 88, 89	85, 90, 95
	0.50	Malathion only	85	<0.01 ppm
	0.50	Malaoxon only	0.03 ppm	88
Beans, snap	0.01	Both analytes	96, 101, 101	89, 97, 101
	0.05	Both analytes	80, 95, 95	76, 85, 89
	0.50	Both analytes	73, 79, 83	70, 71, 81
	0.50	Malathion only	81	<0.01 ppm
	0.50	Malaoxon only	<0.01 ppm	84
Corn, sweet <sup>a</sup>	0.01	Both analytes	98, 100, 103	93, 94, 97
	0.05	Both analytes	79, 87, 91	84, 88, 90
	0.50	Both analytes	88, 93, 97	93, 95, 101
	0.50	Malathion only	86	<0.01 ppm
	0.50	Malaoxon only	<0.01 ppm	97
Corn, sweet, forage	0.01	Both analytes	81, 131	90, 90
	0.05	Both analytes	94, 104	89, 90
	0.10	Both analytes	88, 97	88, 97
	0.50	Both analytes	94	88
	0.50	Malathion only	86	<0.05 ppm
	0.50	Malaoxon only	<0.05 ppm	90
Cucumbers	0.01	Both analytes	82, 90, 98	84, 93, 100
	0.05	Both analytes	85, 85, 87	84, 84, 85
	0.50	Both analytes	82, 82, 86	80, 81, 82
	0.50	Malathion only	79	<0.01 ppm
	0.50	Malaoxon only	<0.01 ppm	81
Lettuce, head	0.01	Both analytes	77, 82, 111	85, 85, 89
	0.05	Both analytes	84, 88, 93	79, 87, 88
	0.50	Both analytes	85, 91	85, 90
	0.50	Malathion only	68	<0.01 ppm
	0.50	Malaoxon only	<0.01 ppm	84
Lettuce, leaf	0.01	Both analytes	76, 85, 116	70, 74, 91
	0.05	Both analytes	69, 84, 85	84, 86, 87
	0.50	Both analytes	78, 80, 84	79, 80, 88
	0.50	Malathion only	78	<0.01 ppm
	0.50	Malaoxon only	<0.01 ppm	88

Potatoes	0.01	Both analytes	83, 87, 92	80, 91, 92
	0.05	Both analytes	91, 92, 96	85, 88, 90
	0.50	Both analytes	79, 81, 93	84, 85, 89
	0.50	Malathion only	76	<0.01 ppm
	0.50	Malaoxon only	<0.01 ppm	82
Sorghum grain	0.01	Both analytes	81, 88, 101	71, 76, 80
	0.05	Both analytes	82, 85, 85	73, 74, 75
	0.50	Both analytes	76, 77, 82	67, 69, 74
	0.50	Malathion only	81	<0.01 ppm
	0.50	Malaoxon only	<0.01 ppm	74
Strawberries	0.01	Both analytes	79, 88, 98	78, 82, 86
	0.05	Both analytes	79, 80, 84	67, 70, 81
	0.50	Both analytes	74, 76, 82	69, 78, 80
	0.50	Malathion only	80	<0.01 ppm
	0.50	Malaoxon only	<0.01 ppm	74
Tomatoes	0.01	Both analytes	99, 103, 105	92, 105, 106
	0.05	Both analytes	87, 91, 101	89, 89, 91
	0.50	Both analytes	76, 84, 88	82, 85, 88
	0.50	Malathion only	84	<0.01 ppm
	0.50	Malaoxon only	<0.01 ppm	77

<sup>a</sup> Sweet corn samples used for method validation included ears with husks and silk.

Table 1C. Concurrent method recoveries of EN-CAS Method Nos. ENC-10/93, ENC-1/94, ENC-3/94, ENC-4/94, ENC-5/94, ENC-6/94, ENC-9/94, ENC-10/94, ENC-11/94, and ENC-13/94 from various matrices fortified with malathion and malaoxon.

Raw Agricultural Commodity	Fortification Level (ppm)		Percent Recovery	
	Malathion	Malaoxon	Malathion	Malaoxon
Beans, lima	0.01	0.01	76, 104	89, 118
	0.25	0.02	87	98
	0.50	0.05	84	78
	1.0	0.05	87	80
	1.0	0.10	83	82
Beans, snap	0.01	0.01	67, 123, 125	92, 99, 116
	0.02	0.01	86	105
	0.05	0.05	85	90
	0.20	0.02	89	86
	0.50	0.02	73	83
	0.50	0.05	78, 81	89, 72
	1.0	0.10	75	87
Corn, sweet (K + CWHR)	0.01	0.01	88	84
	0.02	--	102	--
	0.02	0.02	88, 112	90, 93
	0.05	0.05	86, 100	85, 95
	0.10	0.01	91	105
	0.10	0.10	98	86
	1.0	0.10	94	94
Corn, sweet, forage	0.05	0.05	55, 95	84, 100
	0.25	--	88	--
	0.5	0.05	85	77
	0.50	0.50	93	86
	1.0	0.10	82, 82	66, 73
	5.0	0.20	99	96
	10	0.05	90	96
	10	1.0	86	82
	20	0.50	83	91
	50	2.0	92	85
	100	0.50	82	77

Cucumbers	0.01	0.01	78, 89, 91, 96	85, 96, 98, 109
	0.05	0.05	93	97
	0.10	0.05	91	97
	0.20	0.05	83	81
	0.25	0.02	72	91
	0.50	0.05	93	97
	1.0	0.10	85	93
	Lettuce, head	0.01	0.01	100, 109
0.05		0.01	88	89
0.10		0.02	74	81
0.50		0.05	88, 111	82, 97
Lettuce, leaf	0.01	0.01	97, 103	102, 112
	0.25	0.05	100	109
	0.50	0.01	80	107
	1.0	0.10	81	88
	5.0	0.50	81	91
	5.0	1.0	86	89
	20	0.50	97	101
	Potatoes	0.01	--	71, 114
0.01		0.01	66, 76, 78, 96	75, 75, 81, 85
0.02		0.02	84, 89	84, 92
0.05		0.05	82	83
0.10		0.05	99	106
Sorghum grain	0.01	0.01	88	96
	0.05	0.01	91	83
	0.10	0.01	82	80
	0.50	0.05	99	81
	1.0	0.10	92, 95	93, 103
	2.0	0.02	82	81
	5.0	0.20	84	83

Strawberries	0.01	0.01	80, 88	79, 86
	0.02	0.02	86	99
	0.10	0.10	82	72
	0.20	0.01	85	102
	0.50	0.05	85	88
	1.0	0.10	84	77
	Tomatoes	0.01	0.01	79, 97, 101, 108
0.05		0.01	83	89
0.05		0.05	85	85
0.20		0.20	83	83
0.25		0.02	97	88
0.50		0.05	84	81
1.0		0.02	87	90
1.0		0.10	84, 85, 85, 87	91, 92, 93, 97
2.0		0.05	80, 92	78, 94

The limit of quantitation (LOQ) for field corn grain, whole tomatoes, and tomato juice and catsup was 0.01 ppm. The LOQ was 0.05 ppm for field corn forage and fodder, and tomato wet pomace.

Table 1D. Method validation of EN-CAS Method Nos. ENC-17/94 and ENC-25/94 using various matrices fortified with malathion and malaoxon.

Commodity	Fortification Level (ppm)	Analyte Fortified	Percent Recovery	
			Malathion	Malaoxon
Corn, field, fodder	0.01	Both analytes	101, 103, 107	78, 79, 84
	0.05	Both analytes	90, 91, 92	85, 86, 86
	0.50	Both analytes	85, 86, 90	87, 89, 89
	0.50	Malathion only	95	<0.05 ppm
	0.50	Malaoxon only	<0.05 ppm	84
Corn, field, forage	0.01	Both analytes	107, 115, 120	65, 67, 70
	0.05	Both analytes	93, 94, 106	81, 84, 85
	0.50	Both analytes	88, 88, 88	87, 90, 91
	0.50	Malathion only	89	<0.05 ppm
	0.50	Malaoxon only	<0.05 ppm	88
Corn, field, grain	0.01	Both analytes	93, 101, 103	88, 91, 91
	0.05	Both analytes	84, 86, 88	88, 89, 90
	0.50	Both analytes	83, 85, 90	85, 86, 92
	0.50	Malathion only	87	<0.01 ppm
	0.50	Malaoxon only	<0.01 ppm	71
Tomatoes	0.01	Both analytes	99, 103, 105	92, 105, 106
	0.05	Both analytes	87, 91, 101	89, 89, 91
	0.50	Both analytes	76, 84, 88	82, 85, 88
	0.50	Malathion only	84	<0.01 ppm
	0.50	Malaoxon only	<0.01 ppm	77
Tomatoes, juice	0.01	Both analytes	77, 78	106, 114
	0.05	Both analytes	79, 82	88, 98
	0.50	Both analytes	72, 80	97, 101
	0.50	Malathion only	64, 84	<0.01 ppm
	0.50	Malaoxon only	<0.01 ppm	92, 98
Tomatoes, dry pomace	0.01	Both analytes	97, 119	94, 98
	0.05	Both analytes	91, 96	90, 96
	0.50	Both analytes	91, 95	92, 95
	0.50	Malathion only	96	<0.05 ppm
	0.50	Malaoxon only	<0.05 ppm	100
Tomatoes, catsup	0.01	Both analytes	94, 116	123, 123
	0.05	Both analytes	88, 90	89, 102
	0.50	Both analytes	80, 93	89, 100
	0.50	Malathion only	67, 84	<0.01 ppm
	0.50	Malaoxon only	<0.01 ppm	98

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Table 1E. Concurrent method recoveries of malathion and malaoxon from various fortified matrices analyzed using EN-CAS Method Nos. ENC-17/94 and ENC-25/94.

Commodity	Fortification Level (ppm)		Percent Recovery	
	Malathion	Malaoxon	Malathion	Malaoxon
Corn, field, fodder	0.05	0.05	73, 77, 84, 103, 126	73, 91, 94, 96, 108, 128
	0.50	0.05	88, 97	85, 102
	1.0	0.10	77, 80	84, 104
	20	0.50	70, 124	98, 111
	25	0.20	109	94
	50	1.0	90, 90	107, 112
	75	5.0	75	91
Corn, field, forage	--	0.05	--	77
	--	0.10	--	78
	0.05	0.05	77, 78, 81, 83, 90, 96, 100, 115	78, 91, 91, 92, 97, 106, 112, 122
	0.10	0.10	87, 90	88, 96
	0.20	0.20	79	87
	0.50	--	88	--
	0.50	0.05	90	79
	0.50	0.50	93	92
	1.0	--	87	--
	1.0	0.10	85	76
	1.0	0.20	108	118
	2.0	0.10	84	113
	5.0	0.10	86, 91	104, 112
Corn, field, grain	0.01	0.01	70, 95, 109, 116, 133, 138	103, 104, 105, 105, 107, 120
	0.03	0.025	116	121
	0.05	0.05	99	105
	0.20	0.05	96	120
	0.50	0.025	98	117
	0.50	0.05	88, 96, 97	96, 98, 104
	0.50	0.25	88	90
	1.0	0.10	80, 88	95, 98
1.0	0.50	98, 107	109, 114	
Tomatoes	0.01	0.01	113	90
	50	0.50	81	81
Tomatoes, wet pomace	0.05	0.05	82	91
	75	2.0	85	91
Tomatoes, juice	0.01	0.01	82	85
	50	2.0	92	95
Tomatoes, puree	0.01	0.01	26 <sup>a</sup>	90
	100	4.0	94	94
Tomatoes, dry pomace	0.05	0.05	164 <sup>a</sup>	106
	300	10	86	89
Tomatoes, catsup	0.01	0.01	107	133
	100	4.0	90	99

<sup>a</sup> The registrant explained that these recovery values were probably due to low-level contamination which may have occurred due to high-level residue

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samples concurrently analyzed in the set.

### Storage Stability Data

All samples from the submitted field trials were transferred to frozen storage within 5.5 hours of sample collection and then shipped via freezer truck to the analytical laboratory where they were stored frozen until residue analysis. Samples from the field corn trials were transferred to frozen storage within 2 hours of sample collection and then shipped via freezer truck to the analytical laboratory where they were stored frozen prior to analysis. The tomatoes collected for the processing study were shipped the day of harvest to the processing facility where they were stored at 16-18°C for no more than 5 days until processing. Processed samples were stored and shipped frozen to the analytical laboratory where they were stored frozen prior to analysis. The maximum storage intervals prior to residue analysis of commodities collected from various field trials are presented in Table 2. There are no available data depicting the frozen storage stability of malathion and its metabolite malaoxon in/on the commodities of concern. Therefore, the conclusions regarding the adequacy of the submitted field trials are considered tentative until adequate supporting storage stability data have been submitted and evaluated. The registrant has indicated that a storage stability study is ongoing.

According to the Residue Chemistry Science Chapter of the Malathion Reregistration Standard dated 7/31/87, residues of malathion *per se* are stable in/on frozen plant commodities for up to 6.2 months.

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

Commodity	MRID	Storage Condition	Storage Interval
Beans, lima	43372701	-32 to 6 °C	5-9 months
Beans, snap	43376801	-30 to -3 °C	3-19 months
Corn, sweet	43361101	-32 to -2 °C	2-10 months
Cucumbers	43370601	-38 to 0 °C	1-9 months
Lettuce, head	43362501	-29 to -3 °C	2-10 months <sup>a</sup>
Lettuce, leaf	43367201	-32 to 0 °C	1-16 months
Potatoes	43360401	-29 to 6 °C	2-14 months
Sorghum	43360001	-30 to 2 °C	1-7 months
Strawberries	43368301	-29 to -2 °C	2-10 months
Tomatoes	43372901	-36 to 0 °C	4-19 months
Corn, field, grain, forage, and fodder	42468201	-32 to -3 °C	~2-15 months
Tomatoes and processed tomato fractions	43499901	-27 to 18 °C	~7-14 months

<sup>a</sup> One sample was analyzed 16 months after collection.

### Magnitude of the Residue in Plants

#### Beans (Succulent)

*Established tolerance:* A tolerance of 8 ppm has been established for residues of malathion *per se* in/on beans [40 CFR §180.111].

*Use patterns registered to Cheminova :* A REFS search, conducted 7/6/94, identified two Cheminova malathion end-use products, a 57% or 5 lb/gal EC formulation (EPA Reg. No. 4787-20, accepted 2/2/89, transferred from EPA Reg. No. 241-47) and a 95% or 9.79 lb/gal

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RTU formulation (EPA Reg. No. 4787-8, accepted 1/25/91), registered for use on succulent and dried varieties of beans (including blackeyed beans, green beans, lima beans, navy beans, red kidney beans, snap beans, and wax beans).

The 5 lb/gal EC formulation is registered for multiple foliar applications to succulent and dried beans at 0.94-1.25 lb ai/A/application in a minimum of 30 gal of water/A using ground equipment or in 5 gal of water/A using aerial equipment (except in CA and the Northwest, where the maximum application rate is 0.94 lb ai/10 gal/A). The 9.79 lb/gal RTU formulation is registered for multiple foliar applications to succulent and dried beans at 0.15-0.61 lb ai/A/application using ground or aerial ULV equipment. A 1-day PHI is in effect. Neither label specifies a maximum seasonal rate or maximum number of applications that may be made per growing season.

*Discussion of the data (lima beans):* Cheminova submitted data (1994; MRID 43372701) from five trials conducted in CA(2), NC(1), PA(1), and WI(1) depicting the magnitude of the residue of malathion and its metabolite malaoxon in/on lima beans. Mature lima beans were harvested 1, 4, 7, and 14 days following the last of three foliar applications, with ~7-day retreatment intervals, of the 9.79 lb/gal RTU formulation using aerial ULV equipment at 0.61 lb ai/A/application (1x the maximum registered single application rate for this formulation).

Intervals from sampling to shipment, homogenization, extraction, and analysis were provided for each test. The harvested treated and untreated lima beans were frozen (-32 to 6 C) within 4 hours of collection and shipped frozen (<-3 C) to the analytical laboratory (EN-CAS Laboratory, Winston-Salem, NC). At the analytical laboratory, samples were stored frozen (-27 to -12 C) prior to analysis. The intervals between harvest and residue analysis were 160-283 days (~5-9 months). Residues in/on treated and untreated lima beans were determined using EN-CAS Method No. ENC-13/94. The results of the lima bean field trials are presented in Table 3. Apparent residues of malathion and malaoxon were nondetectable (<0.01 ppm each) in/on five untreated samples.

No production statistics were available for lima beans (1992 USDA Agricultural Statistics); however, lima bean field trials were conducted in Regions 1, 2, 5, and 10 which collectively represent 86% of U.S. lima bean production ("EPA Guidance on Number and Location of Domestic Crop Field Trials for Establishment of Pesticide Residue Tolerances," E. Saito and E. Zager, 6/2/94).

*Discussion of the data (snap beans):* Cheminova submitted data (1994; MRID 43376801) from five trials conducted in FL(1), NY(1), OR(1), and WI(2) depicting the magnitude of the residue of malathion and its metabolite malaoxon in/on snap beans. Mature snap beans were harvested 1, 4, 7, and 14 days following the last of three foliar applications, with ~7-day retreatment intervals, of the 9.79 lb/gal RTU formulation using aerial ULV equipment at 0.61 lb ai/A/application (1x the maximum registered single application rate for this formulation).

Intervals from sampling to shipment, homogenization, extraction, and analysis were provided for each test. The harvested treated and untreated snap beans were frozen (-30 to -4 C) within 2.5 hours of collection and shipped frozen (<-3 C) to the analytical laboratory (EN-CAS Laboratory, Winston-Salem, NC). At the analytical laboratory, samples were stored frozen

(-27 to -12 C) prior to analysis. The intervals between harvest and residue analysis were 88-588 days (~3-19 months). Residues in/on treated and untreated snap beans were determined using EN-CAS Method No. ENC-5/94. The results of the snap bean field trials are presented in Table 4. Apparent residues of malathion and malaoxon were nondetectable (<0.01 ppm each) in/on five untreated samples.

Geographic representation is adequate since the test states of FL(<0.5%), NY(10%), OR(10%), and WI (33%) plus the neighboring states of IL(10%) and MI(11%) accounted for 74% of the 1991 U.S. production of snap beans for processing (1992 USDA Agricultural Statistics).

Table 3. Residues of malathion and its metabolite malaoxon in/on lima beans following multiple foliar applications of the 9.79 lb/gal RTU formulation.

Formulation	Application Parameters	Trial Site	Uncorrected Residues (ppm) <sup>a</sup>		
			Malathion	Malaoxon	Combined
9.79 lb/gal RTU	3 foliar applications, with ~7-day retreatment intervals, at 0.61 lb ai/A/application (1x) using aerial ULV equipment.	<b>1-Day PTI</b>			
		CA-1	0.9	0.02	0.92
		CA-2	0.05	<0.01	<0.06
		NC	0.71	<0.01	<0.72
		PA	0.49	<0.01	<0.50
		WI	(0.28, 0.54) <sup>b</sup>	(<0.01, <0.01) <sup>b</sup>	<0.29, <0.55
		<b>4-Day PTI</b>			
		CA-1	0.44	<0.01	<0.45
		CA-2	<0.01	<0.01	<0.02
		NC	0.52	<0.01	<0.53
		PA	0.16	<0.01	<0.17
		WI	0.03	<0.01	<0.04
		<b>7-Day PTI</b>			
		CA-1	0.08	<0.01	<0.09
		CA-2	<0.01	<0.01	<0.02
		NC	0.02	<0.01	<0.03
		PA	0.13	<0.01	<0.14
		WI	0.02	<0.01	<0.03
		<b>14-Day PTI</b>			
		CA-1	0.01	<0.01	<0.02
		CA-2	<0.01	<0.01	<0.02
		NC	<0.01	<0.01	<0.02
		PA	<0.01	<0.01	<0.02
		WI	<0.01	<0.01	<0.02

<sup>a</sup> Each residue value represents one sample unless otherwise indicated.

<sup>b</sup> Residue values in parentheses represent multiple analyses of a single sample.

Table 4. Residues of malathion and its metabolite malaoxon in/on snap beans following multiple foliar applications of the 9.79 lb/gal RTU formulation.

Formulation	Application Parameters	Trial Site	Uncorrected Residues (ppm) <sup>a</sup>		
			Malathion	Malaoxon	Combined
9.79 lb/gal RTU	3 foliar applications, with ~7-day retreatment intervals, at 0.61 lb ai/A/application (1x) using aerial ULV equipment.	<b>1-Day PHI</b>			
		FL	<0.01, (<0.01, 0.01) <sup>b</sup>	<0.01, (<0.01, <0.01) <sup>b</sup>	<0.02, <0.02, <0.02
		NY	0.13	<0.01	<0.14
		OR	(0.05, 0.08) <sup>b</sup> , 0.56	(<0.01, <0.01) <sup>b</sup> , <0.01	<0.06, <0.09, <0.57
		WI-1	0.07, (0.10, 0.13) <sup>b</sup>	<0.01, (<0.01, <0.01) <sup>b</sup>	<0.08, <0.11, <0.14
		WI-2	0.21	<0.01	<0.22
		<b>4-Day PHI</b>			
		FL	<0.01	<0.01	<0.02
		NY	<0.01	<0.01	<0.02
		OR	0.07	<0.01	<0.08
		WI-1	0.01	<0.01	<0.02
		WI-2	<0.01	<0.01	<0.02
		<b>7-Day PHI</b>			
		FL	<0.01	<0.01	<0.02
		NY	0.03	<0.01	<0.04
		OR	0.01	<0.01	<0.02
		WI-1	<0.01	<0.01	<0.02
		WI-2	<0.01	<0.01	<0.02
		<b>14-Day PHI</b>			
		FL	<0.01	<0.01	<0.02
		NY	<0.01	<0.01	<0.02
		OR	0.01, (0.15, 0.16, 0.41) <sup>b</sup>	<0.01, (<0.01, <0.01, <0.01) <sup>b</sup>	<0.02, <0.16, <0.17, <0.42
		WI-1	<0.01	<0.01	<0.02
		WI-2	<0.01	<0.01	<0.02

<sup>a</sup> Each residue value represents one sample unless otherwise indicated.

<sup>b</sup> Residue values in parentheses represent multiple analyses of a single sample.

A snap bean processing study (1994; MRID 43479601) was submitted. However, this study is not reviewed here as the Agency no longer considers bean cannery waste to be a regulated livestock feed item; see the updated Livestock Feeds Table (Table II of the Pesticide Assessment Guidelines, Subdivision O, Residue Chemistry, issued June 1994).

The submitted field residue data (1994; MRIDs 43372701 and 43376801), reflecting the maximum use pattern the registrant wishes to support for succulent beans, indicate that the combined residues of malathion and malaoxon will not exceed the established tolerance (presently expressed as malathion *per se*) of 8 ppm for beans. The combined residues of malathion and malaoxon were <0.06-0.92 ppm in/on mature lima beans and <0.02-<0.57 ppm in/on mature snap beans harvested 1 day following the last of three foliar applications, with ~7-day retreatment intervals, of the 9.79 lb/gal RTU formulation at 0.61 lb ai/A/application using aerial ULV equipment.

Provided that label revisions are made for the 9.79 lb/gal RTU formulation (EPA Reg. No. 4787-8) to reflect the use pattern used in the current field trials, no additional field residue data for succulent beans will be required for this formulation class. The available data will support a maximum of three foliar applications per growing season to succulent beans at 0.61 lb ai/A/application using ULV aerial equipment, with a 7-day retreatment interval and a 1-day PHI.

The reregistration requirements for succulent beans are not yet completely fulfilled. Additional field residue data reflecting use of the Cheminova 5 lb/gal EC formulation (EPA

Reg. No. 4787-20) according to the maximum use pattern are required to support malathion uses on succulent beans. Alternatively, the registrant may elect to revise its label for the 5 lb/gal EC formulation to delete uses on succulent beans.

Residue data for dry beans (1994; MRID 43417601) have been submitted and are currently under review (CBRS No. 14065, DP Barcode D208772). It is noted that MRID 43417601 does not contain any residue data on the forage and straw of dry beans.

### Corn (Sweet)

*Established tolerances:* A tolerance of 2 ppm has been established for residues of malathion *per se* in/on fresh corn (including sweet kernels plus cobs with husks removed; K + CWHR) [40 CFR §180.111]. 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 residues of malathion in/on sweet corn fodder.

*Use patterns registered to Cheminova :* A REFS search, conducted 7/6/94, identified two Cheminova malathion end-use products, a 57% or 5 lb/gal EC formulation (EPA Reg. No. 4787-20, accepted 2/2/89, transferred from EPA Reg. No. 241-47) and a 95% or 9.79 lb/gal RTU formulation (EPA Reg. No. 4787-8, accepted 1/25/91), registered for use on field and sweet corn.

The 5 lb/gal EC formulation is registered for multiple foliar applications to sweet corn at 1.25 lb ai/A/application, and up to five applications to field corn at 0.94-1.25 lb ai/A/application with a 3- to 5-day retreatment interval. Applications are to be made in a minimum of 30 gal of water/A using ground equipment or in 5 gal of water/A using aerial equipment. A maximum seasonal rate or maximum number of applications per growing season has not been established for sweet corn. A 5-day PHI has been established for field/sweet corn grain and forage.

The 9.79 lb/gal RTU formulation is registered for multiple foliar applications to corn (type or variety of corn was unspecified) at 0.15-0.61 lb ai/A/application using ground or aerial ULV equipment. A 5-day PHI is in effect. A maximum seasonal rate or maximum number of applications per growing season has not been established.

*Other registered use patterns:* The submission contained a specimen label for a 57% or 5 lb/gal EC formulation registered to Platte Chemical Company (EPA Reg. No. 34704-108). The 5 lb/gal EC formulation is registered for multiple foliar applications to sweet corn with 3- to 5-day retreatment intervals at 0.94 lb ai/A/application in a minimum of 10 gal of water/A using ground equipment or in 2 gal of water/A using aerial equipment. A 5-day PHI is in effect, and a maximum of five applications per growing season is specified. This formulation was used as one of the test substances in the sweet corn field trials.

*Discussion of the data:* Cheminova submitted data (1994; MRID 43361101) from twelve trials conducted in CA(2), FL(2), MN(2), NY(2), WA(2), and WI(2) depicting the magnitude of the residue of malathion and its metabolite malaoxon in/on sweet corn (K + CWHR) and sweet

corn forage. These commodities were harvested 5 and 14 days following the last of: (i) five foliar applications, with ~5-day retreatment intervals, of 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 of water/A using ground equipment; or (ii) five foliar applications, with ~5-day retreatment intervals, of the 9.79 lb/gal RTU formulation at 0.61 lb ai/A/application (1x the maximum registered single application rate for the Cheminova RTU formulation) using aerial ULV equipment. Adequate raw data pertaining to field trial information, application of the test substances, and sample handling procedures were provided.

Intervals from sampling to shipment, homogenization, extraction, and analysis were provided for each test. The harvested treated and untreated sweet corn (K + CWHR) and sweet corn forage were frozen (-32 to -7 C) within 3 hours of collection and shipped frozen (<-2 C) to the analytical laboratory (EN-CAS Laboratory, Winston-Salem, NC). At the analytical laboratory, samples were stored frozen (-27 to -12 C) prior to analysis. The intervals between harvest and residue analysis were 73-290 days (~2-10 months). Residues in/on treated and untreated samples were determined using EN-CAS Method No. ENC-3/94.

The results of the field trials are presented in Table 5 for sweet corn (K + CWHR) and Table 6 for sweet corn forage. Residues of malathion were detected at 0.16 ppm in/on one sample of untreated sweet corn forage; however, residues were nondetectable (<0.05) in duplicate reanalyses of the sample. Apparent residues of malathion and malaoxon were nondetectable (<0.01 ppm and <0.05 ppm, respectively) in/on the remaining six untreated samples of sweet corn (K + CWHR) and five untreated samples of sweet corn forage.

Geographic representation is adequate since the test states of CA(2%), FL(6%), MN(19%), NY(5%), WA(12%), and WI(24%) accounted for 68% of the 1991 U.S. sweet corn production (1992 USDA Agricultural Statistics).

Table 5. Residues of malathion and its metabolite malaoxon in/on sweet corn (K + CWHR) following multiple foliar applications of the 5 lb/gal EC or 9.79 lb/gal RTU formulations.

Formulation	Application Parameters	Trial Site	Uncorrected Residues (ppm) <sup>a</sup>		
			Malathion	Malaoxon	Combined
5 lb/gal EC	5 foliar applications, with ~5-day retreatment intervals, at 1.25 lb ai/A/application (1x) in 30 gal of water/A using ground equipment.	<b>5-Day PTI</b>			
		CA	<0.01	<0.01	<0.02
		FL	<0.01	<0.01	<0.02
		MN	<0.01	<0.01	<0.02
		NY	(<0.01, <0.01) <sup>b</sup>	(<0.01, <0.01) <sub>b</sub>	<0.02, <0.02
		WA	(<0.01, <0.01, 0.02) <sup>b</sup>	<0.01	<0.02, <0.02, <0.03
		WI	<0.01	<0.01	<0.02
		<b>14-Day PTI</b>			
		CA	<0.01	<0.01	<0.02
		FL	<0.01	<0.01	<0.02
		MN	<0.01	<0.01	<0.02
		NY	<0.01	<0.01	<0.02
		WA	<0.01	<0.01	<0.02
		WI	<0.01	<0.01	<0.02
9.79 lb/gal RTU	5 foliar applications, with ~5-day retreatment intervals, at 0.61 lb ai/A/application (1x) using aerial ULV equipment.	<b>5-Day PTI</b>			
		CA	<0.01	<0.01	<0.02
		FL	<0.01	<0.01	<0.02
		MN	<0.01	<0.01	<0.02
		NY	<0.01	<0.01	<0.02
		WA	<0.01	<0.01	<0.02
		WI	<0.01	<0.01	<0.02
		<b>14-Day PTI</b>			
		CA	<0.01	<0.01	<0.02
		FL	<0.01	<0.01	<0.02
		MN	<0.01	<0.01	<0.02
		NY	<0.01	<0.01	<0.02
		WA	<0.01	<0.01	<0.02
		WI	<0.01	<0.01	<0.02

<sup>a</sup> Each residue value represents one sample unless otherwise indicated.

<sup>b</sup> Residue values in parentheses represent multiple analyses of a single sample.

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

Formulation	Application Parameters	Trial Site	Uncorrected Residues (ppm) <sup>a</sup>		
			Malathion	Malaoxon	Combined
5 lb/gal EC	5 foliar applications, with ~5-day retreatment intervals, at 1.25 lb ai/A/application (1x) in 30 gal of water/A using ground equipment.	<b>5-Day PTI</b>			
		CA	(1.9, 2.0, 2.4) <sup>b</sup>	(0.16, 0.17, 0.21) <sup>b</sup>	2.06, 2.17, 2.61
		FL	0.20	<0.05	<0.25
		MN	1.7	<0.05	<1.75
		NY	(0.32, 0.34) <sup>b</sup>	(<0.05, <0.05) <sup>b</sup>	<0.37, <0.39
		WA	<0.05	<0.05	<0.10
		WI	<0.05	<0.05	<0.10
		<b>14-Day PTI</b>			
		CA	(0.72, 0.76, 1.3) <sup>b</sup>	(0.09, 0.10, 0.14) <sup>b</sup>	0.81, 0.86, 1.44
		FL	<0.05	<0.05	<0.10
		MN	0.09	<0.05	<0.14
		NY	<0.05	<0.05	<0.10
		WA	<0.05	<0.05	<0.10
		WI	<0.05	<0.05	<0.10
9.79 lb/gal RTU	5 foliar applications, with ~5-day retreatment intervals, at 0.61 lb ai/A/application (1x) using aerial ULV equipment.	<b>5-Day PTI</b>			
		CA	(35.0, 41.0) <sup>b</sup>	(0.13, 0.19) <sup>b</sup>	35.13, 41.19
		FL	0.12	<0.05	<0.17
		MN	(12.0, 19.0) <sup>b</sup>	(<0.05, <0.05) <sup>b</sup>	<12.05, 19.05
		NY	6.9	<0.05	<6.95
		WA	0.06	<0.05	<0.11
		WI	0.67	<0.05	<0.72
		<b>14-Day PTI</b>			
		CA	(4.0, 4.3) <sup>b</sup> (15.0, 17.0, 20.0) <sup>b</sup>	(0.06, <0.05) <sup>b</sup> (0.11, 0.10, 0.12) <sup>b</sup>	4.06, <4.35, 15.11, 17.10, 20.12
		FL	<0.05	<0.05	<0.10
		MN	(1.4, 1.7) <sup>b</sup>	(<0.05, <0.05) <sup>b</sup>	<1.45, <1.75
		NY	1.3	<0.05	<1.35
		WA	<0.05	<0.05	<0.10
		WI	<0.05	<0.05	<0.10

<sup>a</sup> Each residue value represents one sample unless otherwise indicated.

<sup>b</sup> Residue values in parentheses represent multiple analyses of a single sample.

The submitted field residue data (MRID 43361101), reflecting the maximum use patterns the registrant wishes to support for sweet corn, indicate that the combined residues of malathion and malaoxon will not exceed the established tolerance (presently expressed as malathion *per se*) of 2 ppm for fresh corn. The combined residues of malathion and malaoxon were <0.02- <0.03 ppm in/on sweet corn (K + CWHR) harvested 5 days following the last of five foliar applications, with ~5-day retreatment intervals, of the 5 lb/gal EC formulation at 1.25 lb ai/A/application using ground equipment, and were <0.02 ppm (nondetectable) in/on sweet corn harvested 5 days following the last of five foliar applications, with ~5-day retreatment intervals, of the 9.79 lb/gal RTU formulation at 0.61 lb ai/A/application using aerial ULV equipment.

Provided that label revisions are made for the 5 lb/gal EC (EPA Reg. No. 4787-20) and 9.79 lb/gal RTU (EPA Reg. No. 4787-8) formulations to reflect the use patterns used in the current field trials, no additional field residue data for sweet corn (K + CWHR) will be required for reregistration purposes. The available data will support: (i) up to five foliar applications per growing season of the 5 lb/gal EC formulation at 1.25 lb ai/A/application using ground equipment, with a 5-day retreatment interval and a 5-day PHI; and (ii) up to five foliar applications per growing season of the 9.79 lb/gal RTU formulation at 0.61 lb ai/A/application using aerial ULV equipment, with a 5-day retreatment interval and a 5-day PHI.

The registrant has indicated in a separate field residue study submission for sorghum (MRID 43360001) that they plan to propose a crop group tolerance for cereal grains. The Branch does not have any objections to the registrant's plan to propose a crop group tolerance for cereal grains, provided that the minimum requirements for the establishment of a crop group tolerance, in accordance with 40 CFR §180.34 (and as defined further in the document entitled "EPA Guidance on Number and Location of Domestic Crop Field Trials for Establishment of Pesticide Residue Tolerances.", 6/2/94, E. Saito, and E. Zager), are adequately fulfilled.

The submitted field residue data, reflecting the maximum use patterns the registrant wishes to support, indicate that the established tolerance of 8 ppm for corn forage is too low. The combined residues of malathion and malaoxon were <0.11-41.19 ppm in/on sweet corn forage harvested 5 days following the last of five foliar applications, with ~5-day retreatment intervals, of the 9.79 lb/gal RTU formulation at 0.61 lb ai/A/application (1X) using aerial ULV equipment, and were <0.10-2.61 ppm in/on sweet corn forage harvested 5 days following the last of five foliar applications, with ~5-day retreatment intervals, of the 5 lb/gal EC formulation at 1.25 lb ai/A/application (1X) using ground equipment.

The combined residues of malathion and malaoxon exceeded the established tolerance in/on corn forage treated with the RTU formulation for corn grown in CA (up to 41.19 ppm) and MN (up to 19.05 ppm); trials conducted in other test states using the RTU formulation resulted in combined residue levels below the tolerance (<0.11-0.72 ppm). The registrant may propose a higher tolerance for sweet corn forage. TOX considerations permitting, the available data will support a tolerance of 45 ppm for sweet corn forage assuming label revisions are made to coincide with the use patterns of the subject field trials (see Conclusion 3b).

The updated Livestock Feeds Table (Table II of the Pesticide Assessment Guidelines, Subdivision O, Residue Chemistry, updated June 1994) additionally identifies sweet corn grain and fodder as raw agricultural commodities of sweet corn and no data have been submitted for these commodities. Table II specifies that a field corn grain tolerance will cover residues in sweet corn grain (dry), provided the use patterns are the same. Field residue data for field corn grain and fodder (MRID 43468201) are discussed below (CBRS No. 14683, DP Barcode D210189). Sweet corn grain (dry) and fodder data reflecting the use patterns used in the current sweet corn field trials must be generated. Alternatively, Cheminova's registered uses on sweet corn may be made identical to those of field corn, in which case the field corn grain tolerance will cover residues in/on sweet corn grain (dry) and the required data for field corn fodder will be used to satisfy the requirements for sweet corn fodder. Note that if the sweet corn use patterns are made identical to the field corn use patterns the suggested 45 ppm sweet corn forage tolerance (see Conclusion 3e) must be reconsidered.

### Field Corn

*Established tolerances:* 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 residues of malathion in/on field corn fodder.

*Use patterns registered to Cheminova:* A REFS search, conducted 1/23/95, identified two Cheminova malathion end-use products, a 57% or 5 lb/gal EC formulation (EPA Reg. No. 4787-20, accepted 2/2/89, transferred from EPA Reg. No. 241-47) and a 95% or 9.79 lb/gal RTU formulation (EPA Reg. No. 4787-8, accepted 1/25/91), registered for use on field corn.

The 5 lb/gal EC formulation is registered for up to five applications to field corn at 0.94-1.25 lb ai/A/application with a 3- to 5-day retreatment interval. Applications are to be made in a minimum of 30 gal of water/A using ground equipment or in 5 gal of water/A using aerial equipment. A 5-day PHI/PGI has been established for field corn grain and forage.

The 9.79 lb/gal RTU formulation is registered for multiple foliar applications to corn (type or variety of corn was unspecified) at 0.15-0.61 lb ai/A/application using ground or aerial ULV equipment. A 5-day PHI is in effect. A maximum seasonal rate or maximum number of applications per growing season has not been established.

*Other registered use patterns:* The submission contained a specimen label for a 57% or 5 lb/gal EC formulation registered to Platte Chemical Company (EPA Reg. No. 34704-108). The 5 lb/gal EC formulation is registered for multiple foliar applications to field corn at 0.94 lb ai/A/application in a minimum of 10 gal of water/A using ground equipment or in 2 gal of water/A using aerial equipment. No PHI or maximum number of applications per season is specified. This formulation was used as one of the test substances in the field corn trials.

*Discussion of the data:* Cheminova submitted data (1994; MRID 43468201) from a total of 42 trials (21 forage trials and 21 grain/fodder trials) conducted in IA(14) IL(10), NE(6), OH(4), TX(4), and WI(4) depicting the magnitude of the residue of malathion and its metabolite malaoxon in/on field corn grain, forage, and fodder. Separate trials were designated for forage and grain/fodder because of differences in the application timing. Field corn commodities were harvested 7 and 14 days following the last of: (i) three foliar applications,

with ~7-day retreatment intervals, of 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 of water/A using ground equipment; or (ii) three foliar applications, with ~7-day retreatment intervals, of the 9.79 lb/gal RTU formulation at 0.61 lb ai/A/application (1x the maximum registered single application rate for this formulation) using aerial ULV equipment. For forage samples, immature green corn plants, with no plant parts removed, were collected. The grain samples were collected by harvesting the ears by hand, removing husk and silk, and removing the grain from the cob with a stationary sheller. The fodder samples consisted of dried plant material without the ear. Adequate raw data pertaining to field trial information, application of the test substances, and sample-handling procedures were provided.

Intervals from sampling to shipment, homogenization, extraction, and analysis were also provided for each test. The harvested treated and untreated corn commodities were frozen (-32 to -3 C) within 2 hours of collection and shipped frozen (-3 C) to the analytical laboratory (EN-CAS Laboratory, Winston-Salem, NC). At the analytical laboratory, samples were stored frozen (-27 to -12 C) prior to analysis. The intervals between harvest and analysis for most samples were 68-465 days (~2-15 months). Residues in/on field corn commodities were determined using EN-CAS Method No. ENC-17/94. The results of the field corn trials are presented in Tables 7 (grain), 8 (forage), and 9 (fodder). Apparent residues of malathion and malaoxon were nondetectable (<0.01 ppm each) in/on 11 untreated grain samples; one grain sample from NE, analyzed in triplicate, bore detectable malathion residues (0.02-0.06 ppm) and nondetectable (<0.01 ppm) malaoxon residues. Apparent residues of malathion and malaoxon were nondetectable (<0.05 ppm each) in/on 12 untreated forage samples. Apparent residues of malathion and malaoxon were nondetectable (<0.05 ppm each) in/on 11 untreated fodder samples; one fodder sample from IA bore detectable malathion residues of 0.16 ppm and nondetectable (<0.05 ppm) malaoxon residues.

Geographic representation is adequate since the test states of IA(19%) IL(16%), NE(13%), OH(4%), TX(2%), and WI(5%) along with the neighboring states of MN(10%) and IN(7%) accounted for 76% of the 1991 U.S. field corn production (1992 *USDA Agricultural Statistics*).

Table 7. Residues of malathion and its metabolite malaoxon in/on field corn grain following multiple foliar applications of the 5 lb/gal EC or 9.79 lb/gal RTU formulations.

Formulation	Application Parameters	Trial Site	Uncorrected Residues (ppm) <sup>a</sup>		
			Malathion	Malaoxon	Combined
5 lb/gal EC	3 foliar applications, with -7-day retreatment intervals, at 1.25 lb ai/A/application (1x) in 30 gal/A of water using ground equipment.	<b>7-Day PTI</b>			
		IA-1	0.01	<0.01	<0.02
		IA-2	(0.02, 0.02)	(<0.01, <0.01)	(<0.03, <0.03)
		IA-3	(0.01, 0.02)	(<0.01, <0.01)	(<0.02, <0.03)
		IL-1	(0.02, 0.02, 0.02)	(<0.01, <0.01, <0.01)	(<0.03, <0.03, <0.03)
		IL-2	<0.01	<0.01	<0.02
		NE	<0.01	<0.01	<0.02
		OH	<0.01	<0.01	<0.02
		TX	<0.01	<0.01	<0.02
		WI	<0.01	<0.01	<0.02
		<b>14-Day PTI</b>			
		IA-1	<0.01	<0.01	<0.02
		IA-2	<0.01	<0.01	<0.02
		IA-3	<0.01	<0.01	<0.02
		IL-1	<0.01	<0.01	<0.02
		IL-2	<0.01	<0.01	<0.02
		NE	<0.01	<0.01	<0.02
		OH	<0.01	<0.01	<0.02
		TX	<0.01	<0.01	<0.02
		WI	<0.01	<0.01	<0.02

9.79  
lb/gal  
RTU

3 foliar  
applications,  
with -7-day  
retreatment  
intervals, at  
0.61 lb  
ai/A/application  
(1x) using  
aerial ULV  
equipment.

7-Day PTI			
IA-1	<0.01	<0.01	<0.02
IA-2	<0.01	<0.01	<0.02
IA-3	<0.01	<0.01	<0.02
IA-4	<0.01	<0.01	<0.02
IL-1	<0.01	<0.01	<0.02
IL-2	(<0.01, <0.01)	(<0.01, <0.01)	(<0.02, <0.02)
IL-3	<0.01	<0.01	<0.02
NE-1	(<0.01, 0.01, 0.01, 0.02, 0.03)	(<0.01, <0.01, <0.01, <0.01, <0.01)	(<0.02, <0.02, <0.02, <0.03, <0.04)
NE-2	<0.01	<0.01	<0.02
OH	(<0.01, <0.01)	(<0.01, <0.01)	(<0.02, <0.02)
TX	<0.01	<0.01	<0.02
WI	<0.01	<0.01	<0.02
14-Day PTI			
IA-1	<0.01	<0.01	<0.02
IA-2	<0.01	<0.01	<0.02
IA-3	<0.01	<0.01	<0.02
IA-4	<0.01	<0.01	<0.02
IL-1	<0.01	<0.01	<0.02
IL-2	<0.01	<0.01	<0.02
IL-3	(<0.01, <0.01, <0.01, 0.02)	(<0.01, <0.01, <0.01, <0.01)	(<0.02, <0.02, <0.02, <0.03)
NE-1	<0.01	<0.01	<0.02
NE-2	<0.01	<0.01	<0.02
OH	0.01	<0.01	<0.02
TX	<0.01	<0.01	<0.02

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	WI	<0.01	<0.01	<0.02
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<sup>a</sup> Each residue value represents one sample unless otherwise indicated. Residue values in parentheses represent multiple analyses of a single sample.

Table 8. Residues of malathion and its metabolite malaoxon in/on field corn forage following multiple foliar applications of the 5 lb/gal EC or 9.79 lb/gal RTU formulations.

Formulation	Application Parameters	Tri al Site	Uncorrected Residues (ppm) <sup>a</sup>		
			Malathion	Malaoxon	Combined
5 lb/gal EC	3 foliar applications, with 7-day retreatment interval, at 1.25 lb ai/A/application (1x) in 30 gal/A of water using ground equipment.	<b>7-Day PTI</b>			
		IA-1	<0.05	<0.05	<0.10
		IA-2	<0.05	<0.05	<0.10
		IA-3	<0.05	<0.05	<0.10
		IL-1	<0.05	<0.05	<0.10
		IL-2	<0.05	<0.05	<0.10
		NE	(0.06, 0.17)	(<0.05, <0.05)	(<0.11, <0.22)
		OH	0.19	<0.05	<0.24
		TX	(<0.05, <0.05)	(<0.05, <0.05)	(<0.10, <0.10)
		WI	<0.05	<0.05	<0.10
		<b>14-Day PTI</b>			
		IA-1	<0.05	<0.05	<0.10
		IA-2	<0.05	<0.05	<0.10
		IA-3	<0.05	<0.05	<0.10
		IL-1	<0.05	<0.05	<0.10
		IL-2	<0.05	<0.05	<0.10
		NE	<0.05	<0.05	<0.10
		OH	<0.05	<0.05	<0.10
		TX	(<0.05, <0.05)	(<0.05, <0.05)	(<0.10, <0.10)
		WI	<0.05	<0.05	<0.10

9.79 lb/gal RTU	3 foliar applications, with -7-day retreatment interval, at 0.61 lb ai/A/application (1x) using aerial ULV equipment.	<b>7-Day PTI</b>			
		IA-1	0.06	<0.05	<0.11
		IA-2	0.09	<0.05	<0.14
		IA-3	(0.26, 0.44, 1.2, 3.0)	(<0.05, <0.05, <0.05, <0.05)	(<0.31, <0.49, <1.25, <3.05)
		IA-4	(<0.05, <0.05)	(<0.05, <0.05)	(<0.10, <0.10)
		IL-1	0.22	<0.05	<0.27
		IL-2	0.15	<0.05	<0.20
		IL-3	0.21	<0.05	<0.26
		NE-1	(0.15, 0.19)	(<0.05, <0.05)	(<0.20, <0.24)
		NE-2	(0.38, 0.42, 0.55, 0.62, 0.69, 1.2, 1.3)	(<0.05, <0.05, <0.05, <0.05, <0.05, <0.05, <0.05)	(<0.43, <0.47, <0.60, <0.067, <0.74, <1.25, <1.35)
		OH	(<0.05, 0.09)	(<0.05, <0.05)	(<0.10, <0.14)
		TX	(0.06, 0.07, 0.09)	(<0.05, <0.05, <0.05)	(<0.11, <0.12, <0.14)
		WI	0.25	<0.05	<0.30
		<b>14-Day PTI</b>			
		IA-1	<0.05	<0.05	<0.10
		IA-2	0.06	<0.05	<0.11
		IA-3	0.16	<0.05	<0.21
		IA-4	<0.05	<0.05	<0.10
		IL-1	<0.05	<0.05	<0.10
		IL-2	<0.05	<0.05	<0.10
		IL-3	(0.10, 0.57)	(<0.05, <0.05)	(<0.15, <0.62)
		NE-1	0.24	<0.05	<0.29
		NE-2	(0.26, 0.29)	(<0.05, <0.05)	(<0.31, <0.34)
		OH	<0.05	<0.05	<0.10
TX	(<0.05, <0.05)	(<0.05, <0.05)	(<0.10, <0.10)		
WI	0.07	<0.05	<0.12		

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<sup>a</sup> Each residue value represents one sample unless otherwise indicated. Residue values in parentheses represent multiple analyses of a single sample.

Table 9. Residues of malathion and its metabolite malaoxon in/on field corn fodder following multiple foliar applications of the 5 lb/gal EC or 9.79 lb/gal RTU formulations.

Formulation	Application Parameters	Trial Site	Uncorrected Residues (ppm) <sup>a</sup>		
			Malathion	Malaoxon	Combined
5 lb/gal EC	3 foliar applications, with -7-day retreatment interval, at 1.25 lb ai/A/application (1x) in 30 gal/A of water using ground equipment.	<b>7-Day PTI</b>			
		IA-1	1.3	<0.05	<1.35
		IA-2	3.4	0.10	3.50
		IA-3	(3.2, 3.3)	(0.07, 0.07)	(3.27, 3.37)
		IL-1	4.7	0.08	4.78
		IL-2	(1.8, 1.9)	(0.06, 0.06)	(1.86, 1.96)
		NE	2.3	0.07	2.37
		OH	9.9	0.13	10.03
		TX	3.1	0.09	3.19
		WI	13	0.23	13.23
		<b>14-Day PTI</b>			
		IA-1	1.2	0.08	1.28
		IA-2	3.0	0.19	3.19
		IA-3	2.5	0.12	2.62
		IL-1	2.3	0.10	2.40
		IL-2	5.2	0.23	5.43
		NE	0.66	<0.05	<0.71
		OH	11.0	0.22	11.22
		TX	4.5	0.13	4.63
		WI	(15, 18, 20)	(0.72, 0.53, 0.93)	(15.72, 18.53, 20.93)

9.79 lb/gal RTU	3 foliar applications, with -7-day retreatment interval, at 0.61 lb ai/A/application (1x) using aerial ULV equipment.	<b>7-Day PTI</b>			
		IA-1	2.0	<0.05	<2.05
		IA-2	4.5	<0.05	<4.55
		IA-3	8.0	<0.05	<8.05
		IA-4	1.4	<0.05	<1.45
		IL-1	(7.0, 21, 26)	(<0.05, 0.06, 0.08)	(<7.05, 21.06, 26.08)
		IL-2	4.8	<0.05	<4.85
		IL-3	(18, 21, 27)	(0.07, 0.07, 0.07)	(18.07, 21.07, 27.07)
		NE-1	(6.5, 13.0)	(<0.05, 0.05)	(<6.55, 13.05)
		NE-2	6.9	<0.05	<6.95
		OH	(8.0, 11.0)	(<0.05, 0.05)	(<8.05, 11.05)
		TX	4.6	<0.05	<4.65
		WI	(11.0, 13.0)	(0.14, 0.16)	(11.14, 13.16)
		<b>14-Day PTI</b>			
		IA-1	5.0	<0.05	<5.05
		IA-2	6.7	<0.05	<6.75
		IA-3	6.5	<0.05	<6.55
		IA-4	0.81	<0.05	<0.86
		IL-1	(17, 19)	(0.11, 0.12)	(17.11, 19.12)
		IL-2	6.6	<0.05	<6.65
		IL-3	12.0	0.06	12.06
		NE-1	3.3	<0.05	<3.35
		NE-2	4.0	<0.05	<4.05
		OH	6.3	0.05	6.35
		TX	12.0	0.11	12.11
		WI	7.3	0.07	7.37

<sup>a</sup> Each residue value represents one sample unless otherwise indicated.

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Residue values in parentheses represent multiple analyses of a single sample.

The submitted field residue data (MRID 43468201), reflecting the maximum use pattern the registrant wishes to support for field corn, indicate that the combined residues of malathion and malaoxon will not exceed the established tolerance (presently expressed as malathion *per se*) of 8 ppm for field corn grain. The combined residues of malathion and malaoxon in/on field corn grain were: (i) <0.02-<0.03 ppm in samples harvested 7 days following the last of three foliar applications, with ~7-day retreatment intervals, of the 5 lb/gal EC formulation at 1.25 lb ai/A/application in 30 gal of water/A using ground equipment; and (ii) <0.02-<0.04 ppm in samples harvested 7 days following the last of three foliar applications, with ~7-day retreatment intervals, of the 9.79 lb/gal RTU formulation at 0.61 lb ai/A/application using aerial ULV equipment.

Provided that label revisions are made for the 5 lb/gal EC (EPA Reg. No. 4787-20) and 9.79 lb/gal RTU (EPA Reg. No. 4787-8) formulations to reflect the use patterns used in the current field trials, no additional field residue data for field corn grain will be required for reregistration purposes. The available data will support: (i) up to three foliar applications per growing season of the 5 lb/gal EC formulation at 1.25 lb ai/A/application using ground equipment, with a 7-day retreatment interval and a 7-day PHI; and (ii) up to three foliar applications per growing season of the 9.79 lb/gal RTU formulation at 0.61 lb ai/A/application using aerial ULV equipment, with a 7-day retreatment interval and a 7-day PHI.

The registrant has stated that they plan to propose a crop group tolerance for cereal grains. Adequate field residue data for all designated representative members of this crop group, according to 40 CFR §180.34(f) and the recent guidance on conducting crop field trials (EPA Guidance on Number and Location of Domestic Crop Field Trials for Establishment of Pesticide Residue Tolerances, E. Saito and E. Zager, 6/2/94), have now been submitted and are currently under review at CBRS: sweet corn (MRID 43361101; DP Barcode D208047), field corn (this submission), rice (MRID 43468401; DP Barcode D210188); sorghum (MRID 43360001; DP Barcode D208047), and spring and winter wheat (MRIDs 43350402 and 43414901; DP Barcodes D208233, and D208772). All of these submissions are adequate to support the established individual grain tolerances. When malathion was applied according to the use patterns the registrant wishes to support for these crops, combined residues of malathion and malaoxon were: <0.02-<0.03 ppm in/on sweet corn (K + CWHR); <0.02-<0.04 ppm in/on field corn grain; <0.30-4.71 ppm in/on rice grain; <0.03-2.28 ppm in/on sorghum grain; and <0.02-0.34 ppm in/on spring and winter wheat grain. Pending submission of adequate supporting storage stability data, these data would support a crop group tolerance of 5 ppm for the cereal grains group.

The submitted field residue data (MRID 43468201), reflecting the maximum use pattern the registrant wishes to support for field corn, indicate that the combined residues of malathion and malaoxon will not exceed the established tolerance (presently expressed as malathion *per se*) of 8 ppm for field corn forage. The combined residues of malathion and malaoxon in/on field corn forage were: (i) <0.10-<0.24 ppm in samples harvested 7 days following the last of three foliar applications, with ~7-day retreatment intervals, of the 5 lb/gal EC formulation at 1.25 lb ai/A/application in 30 gal of water/A using ground equipment; and (ii)

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<0.10- <3.05 ppm in samples harvested 7 days following the last of three foliar applications, with ~7-day retreatment intervals, of the 9.79 lb/gal RTU formulation at 0.61 lb ai/A/application using aerial ULV equipment.

Provided that label revisions are made for the 5 lb/gal EC (EPA Reg. No. 4787-20) and 9.79 lb/gal RTU (EPA Reg. No. 4787-8) formulations to reflect the use patterns used in the current field trials (as specified above for field corn grain), no additional field residue data for field corn forage will be required for reregistration purposes.

The submitted field residue data (MRID 43468201), reflecting the maximum use pattern the registrant wishes to support for field corn, indicate that the combined residues of malathion and malaoxon in/on field corn fodder were: (i) <1.35-13.23 ppm in samples harvested 7 days following the last of three foliar applications, with ~7-day retreatment intervals, of the 5 lb/gal EC formulation at 1.25 lb ai/A/application in 30 gal of water/A using ground equipment; and (ii) <1.45-27.07 ppm in samples harvested 7 days following the last of three foliar applications, with ~7-day retreatment intervals, of the 9.79 lb/gal RTU formulation at 0.61 lb ai/A/application using aerial ULV equipment.

There is presently no established tolerance for malathion residues of concern in/on field corn fodder. Since fodder is identified as a raw agricultural commodity of field corn, the registrant must propose a tolerance for this commodity. TOX considerations permitting, the available data will support a tolerance of 30 ppm for the combined residues of malathion and malaoxon in/on field corn fodder based on residue data from the current submission. The Branch recognizes that the registrant also has the option of proposing a crop group tolerance, if applicable, for the forage, fodder, and straw of cereal grains once adequate residue data from representative members have been submitted and evaluated.

### Cucumbers

*Established tolerance:* A tolerance of 8 ppm has been established for residues of malathion *per se* in/on cucumbers [40 CFR §180.111].

*Use patterns registered to Cheminova :* A REFS search, conducted 7/6/94, identified one Cheminova malathion end-use product, a 57% or 5 lb/gal EC formulation (EPA Reg. No. 4787-20, accepted 2/2/89, transferred from EPA Reg. No. 241-47) registered for use on cucumbers. This formulation is registered for multiple foliar applications to: (i) field-grown cucumbers at 0.94-1.88 lb ai/A/application in a minimum of 30 gal of water/A using ground equipment or in 5 gal of water/A using aerial equipment; and (ii) commercial greenhouse-grown cucumbers at 0.94-1.25 lb ai/100 gal/application. A 1-day PHI is in effect. A maximum seasonal rate or maximum number of applications per growing season has not been established.

*Other registered use patterns:* The submission contained a specimen label for a 57% or 5 lb/gal EC formulation registered to Platte Chemical Company (EPA Reg. No. 34704-108). The 5 lb/gal EC formulation is registered for multiple foliar applications to cucumbers at 0.94 lb ai/A/application in a minimum of 10 gal of water/A using ground equipment or in 2 gal of water/A using aerial equipment. A 1-day PHI is in effect. No maximum seasonal rate or

maximum number of applications per growing season has been established. This formulation was used as the test substance in the cucumber field trials.

*Discussion of the data:* Cheminova submitted data (1994; MRID 43370601) from nine trials conducted in CA(1), FL(1), MI(2), NC(2), NJ(1) and TX(2) depicting the magnitude of the residue of malathion and its metabolite malaoxon in/on cucumbers. Mature cucumbers were harvested 1, 4, 7, and 14 days after the last of three foliar applications, with ~7-day retreatment intervals, of the Platte 5 lb/gal EC formulation at 1.88 lb ai/A (1x the maximum single application rate for the Cheminova EC formulation) in ~30 gal of water/A using tractor-mounted boom or backpack CO<sub>2</sub> equipment. Adequate raw data pertaining to field trial information, application of the test substances, and sample handling procedures were provided.

Intervals from sampling to shipment, homogenization, extraction, and analysis were provided for each test. The harvested treated and untreated cucumbers were frozen (-38 to 0 C) within 3 hours of collection and shipped frozen (<-2 C) to the analytical laboratory (EN-CAS Laboratory, Winston-Salem, NC). At the analytical laboratory, samples were stored frozen (-27 to -12 C) prior to analysis. The intervals between harvest and residue analysis were 43-262 days (~1-9 months). Residues in/on treated and untreated cucumbers were determined using EN-CAS Method No. ENC-4/94. The results of the cucumber field trials are presented in Table 10. Apparent residues of malathion and malaoxon were nondetectable (<0.01 ppm each) in/on nine untreated samples.

Geographic representation is adequate since the test states of CA(4%), FL(2%), MI(22%), NC(21%), NJ(<0.5%), TX(5%), and adjacent states of SC(10%) and WI(6%) accounted for 70% of the 1991 U.S. cucumber (for pickles) production (1992 USDA Agricultural Statistics).

Table 10. Residues of malathion and its metabolite malaoxon in/on cucumbers following multiple foliar applications of the 5 lb/gal EC formulation.

Formulation	Application Parameters	Trial Site	Uncorrected Residues (ppm) <sup>a</sup>		
			Malathion	Malaoxon	Combined
5 lb/gal EC	3 foliar applications, with ~7-day retreatment intervals, at 1.88 lb ai/A/application (1x) in ~30 gal of water/A using ground equipment.	<b>1-Day PTI</b>			
		CA	0.02	<0.01	<0.03
		FL	<0.01	<0.01	<0.02
		MI-1	(0.09, 0.10) <sup>b</sup>	(<0.01, <0.01) <sup>b</sup>	<0.10, <0.11
		MI-2	0.02	<0.01	<0.03
		NC-1	0.03	<0.01	<0.04
		NC-2	0.01	<0.01	<0.02
		NJ	0.02	<0.01	<0.03
		TX-1	(0.05, 0.08) <sup>b</sup>	(<0.01, <0.01) <sup>b</sup>	<0.06, <0.09
		TX-2	0.03	<0.01	<0.04
		<b>4-Day PTI</b>			
		CA	<0.01	<0.01	<0.02
		FL	<0.01	<0.01	<0.02
		MI-1	0.01	<0.01	<0.02
		MI-2	<0.01	<0.01	<0.02
		NC-1	<0.01	<0.01	<0.02
		NC-2	<0.01	<0.01	<0.02
		NJ	<0.01	<0.01	<0.02
		TX-1	<0.01	<0.01	<0.02
		TX-2	<0.01	<0.01	<0.02
5 lb/gal EC	3 foliar applications, with ~7-day retreatment intervals, at 1.88 lb ai/A/application (1x) in ~30 gal of water/A using ground equipment.	<b>7-Day PTI</b>			
		CA	<0.01	<0.01	<0.02
		FL	0.02	<0.01	<0.03
		MI-1	<0.01	<0.01	<0.02
		MI-2	<0.01	<0.01	<0.02
		NC-1	<0.01	<0.01	<0.02
		NC-2	<0.01	<0.01	<0.02
		NJ	<0.01	<0.01	<0.02
		TX-1	<0.01	<0.01	<0.02
		TX-2	<0.01	<0.01	<0.02

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		14-Day PHI	
CA	<0.01	<0.01	<0.02
FL	<0.01	<0.01	<0.02
MI-1	<0.01	<0.01	<0.02
MI-2	<0.01	<0.01	<0.02
NC-1	<0.01	<0.01	<0.02
NC-2	<0.01	<0.01	<0.02
NJ	<0.01	<0.01	<0.02
TX-1	<0.01	<0.01	<0.02
TX-2	<0.01	<0.01	<0.02

- <sup>a</sup> Each residue value represents one sample unless otherwise indicated.  
<sup>b</sup> Residue values in parentheses represent multiple analyses of a single sample.

The submitted field residue data (1994; MRID 43370601), reflecting the maximum use pattern the registrant wishes to support for cucumbers, indicate that the combined residues of malathion and malaoxon will not exceed the established tolerance (presently expressed as malathion *per se*) of 8 ppm for cucumbers. The combined residues of malathion and malaoxon were <0.02- <0.11 ppm in/on mature cucumbers harvested 1 day following the last of three foliar applications, with a 7-day retreatment interval, of the 5 lb/gal EC formulation at 1.88 lb ai/A/application using ground equipment.

Provided that label revisions are made for the 5 lb/gal EC formulation (EPA Reg. No. 4787-20) to reflect the use pattern used in the current field trials, no additional field residue data for cucumbers will be required. The available data will support up to three foliar applications per growing season at 1.88 lb ai/A/application using ground equipment, with a 7-day retreatment interval and a 1-day PHI.

The reregistration requirements for cucumbers are not yet completely fulfilled. Additional residue data reflecting use of the Cheminova 5 lb/gal EC formulation (EPA Reg. No. 4787-20) according to the maximum use pattern for commercial greenhouse-grown cucumbers are required. Alternatively, the registrant may elect to delete uses on greenhouse-grown cucumbers from the label for the 5 lb/gal EC formulation.

### Lettuce

**Established tolerance:** A tolerance of 8 ppm has been established for residues of malathion *per se* in/on leafy vegetables (except Brassica) [40 CFR §180.111].

**Use patterns registered to Cheminova :** A REFS search, conducted 7/6/94, identified one Cheminova malathion end-use product, a 57% or 5 lb/gal EC formulation (EPA Reg. No. 4787-20, accepted 2/2/89, transferred from EPA Reg. No. 241-47) registered for use on lettuce. This formulation is registered for multiple foliar applications to: (i) field-grown lettuce at 1.25-1.88 lb ai/A/application in a minimum of 30 gal of water/A using ground equipment or in 5 gal of water/A using aerial equipment; and (ii) commercial greenhouse-grown lettuce at 0.94-1.25 lb ai/100 gal/application. The established PHIs are 7 and 14 days for head and leaf lettuce, respectively. A maximum seasonal rate or maximum number of applications per growing season has not been established.

**Other registered use patterns:** The submission contained a specimen label for a 57% or 5 lb/gal EC formulation registered to Platte Chemical Company, Inc. (EPA Reg. No.

34704-108). The 5 lb/gal EC formulation is registered for multiple foliar applications to lettuce at 1.25-1.88 lb ai/A/application in a minimum of 10 gal of water/A using ground equipment or in 2 gal of water/A using aerial equipment. The established PHIs are 7 and 14 days for head and leaf lettuce, respectively. This formulation was used as the test substance in the lettuce field trials.

*Discussion of the data* (head lettuce): Cheminova submitted data (1994; MRID 43362501) from three trials conducted in CA depicting the magnitude of the residue of malathion and its metabolite malaoxon in/on head lettuce. Mature head lettuce was harvested ~14 and 21 days following the last of six foliar applications, with ~5-day retreatment intervals, of the Platte 5 lb/gal EC formulation at 1.88 lb ai/A/application (1x the maximum registered single application rate for this formulation) in ~30 gal of water/A using backpack CO<sub>2</sub> equipment. Adequate raw data pertaining to field trial information, application of the test substances, and sample handling procedures were provided.

Intervals from sampling to shipment, homogenization, extraction, and analysis were provided for each test. The harvested treated and untreated head lettuce was frozen (-29 to -14 C) within less than an hour of collection and shipped frozen (<-3 C) to the analytical laboratory (EN-CAS Laboratory, Winston-Salem, NC). At the analytical laboratory, samples were stored frozen (-27 to -12 C) prior to analysis. The intervals between harvest and residue analysis were 46-292 days (~2-10 months), except for one sample which was analyzed 472 days (~16 months) after harvest. Residues in/on treated and untreated head lettuce were determined using EN-CAS Method No. ENC-9/94. The results of the head lettuce field trials are presented in Table 11. Apparent residues of malathion and malaoxon were nondetectable (<0.01 ppm each) in/on four untreated samples.

Table 11. Residues of malathion and its metabolite malaoxon in/on head lettuce following multiple foliar applications of the 5 lb/gal EC formulation.

Formulation	Application Parameters	Trial Site	Uncorrected Residues (ppm) <sup>a</sup>		
			Malathion	Malaoxon	Combined
5 lb/gal EC	6 foliar applications, with ~5-day retreatment intervals, at 1.88 lb ai/A/application (1x) in ~30 gal of water/A using ground equipment.	<b>14-Day PTI</b>			
		CA-1	(0.05, 0.07) <sup>b</sup>	(<0.01, <0.01) <sub>b</sub>	<0.06, <0.08
		CA-2	0.15 (0.16, 0.17, 0.17) <sup>b</sup>	0.03, (0.04, 0.04, 0.05) <sup>b</sup>	0.18, 0.20, 0.21, 0.22
		CA-3	(<0.01, 0.01) <sup>b</sup>	(<0.01, <0.01) <sub>b</sub>	<0.02, <0.02
		<b>21-Day PTI</b>			
		CA-1	0.04, 0.16	<0.01, <0.01	<0.05, <0.17
		CA-2	0.04, 0.07	<0.01, 0.03	<0.05, 0.10
		CA-3	<0.01	<0.01	<0.02

<sup>a</sup> Each residue value represents one sample unless otherwise indicated.

<sup>b</sup> Residue values in parentheses represent multiple analyses of a single sample.

*Discussion of the data* (leaf lettuce): Cheminova submitted data (1994; MRID 43367201) from six trials conducted in AZ(1), CA(2), FL(1), NJ(1) and WA(1) depicting the magnitude of the residue of malathion and its metabolite malaoxon in/on leaf lettuce. Mature leaf lettuce was harvested 7 and 14 days following the last of six foliar applications, with ~5-day retreatment intervals, of the Platte 5 lb/gal EC formulation at 1.88 lb ai/A/application (1x the maximum registered single application rate for the Cheminova EC formulation) in ~30 gal water/A using tractor-mounted boom or CO<sub>2</sub> backpack equipment. Adequate raw data pertaining to field trial information, application of the test substances, and sample handling procedures were provided.

Intervals from sampling to shipment, homogenization, extraction, and analysis were provided for each test. The harvested treated and untreated leaf lettuce was frozen (-32 to 0 C) within 3 hours of collection and shipped frozen (<-3 C) to the analytical laboratory (EN-CAS Laboratory, Winston-Salem, NC). At the analytical laboratory, samples were stored frozen (-27 to -12 C). The intervals between harvest and residue analysis were 36-482 days (~1-16 months). Residues in/on treated and untreated leaf lettuce were determined using EN-CAS Method No. ENC-10/94. The results of the leaf lettuce field trials are presented in Table 12. Although residues of malathion and malaoxon were detected at 1.3 and 0.03 ppm, respectively in/on one sample of untreated leaf lettuce; residues were nondetectable (<0.01 ppm) in duplicate reanalyses of the sample. Apparent residues of malathion and malaoxon were nondetectable (<0.01 ppm each) in/on the remaining five untreated samples.

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Table 12. Residues of malathion and its metabolite malaoxon in/on leaf lettuce following multiple foliar applications of the 5 lb/gal EC formulation.

Formulation	Application Parameters	Trial Site	Uncorrected Residues (ppm) <sup>a</sup>		
			Malathion	Malaoxon	Combined
5 lb/gal EC	6 foliar applications, with ~5-day retreatment intervals, at 1.88 lb ai/A/application (1x) in ~30 gal of water/A using ground equipment.	<b>7-Day PTI</b>			
		AZ	0.04	<0.01	<0.05
		CA-1	(2.8, 3.8) <sup>b</sup>	(<0.01, 0.01) <sup>b</sup>	<2.81, 3.81
		CA-2	(13, 20) <sup>b</sup> , (16, 16) <sup>b</sup>	(0.24, 0.23) <sup>b</sup> , (0.24, 0.25)	13.24, 20.23, 16.24, 16.25
		FL	<0.01	<0.01	<0.02
		NJ	0.04, (0.03, 0.03, 0.28) <sup>b</sup>	<0.01, (<0.01, <0.01, <0.01) <sup>b</sup>	<0.05, <0.04, <0.04, <0.29
		WA	0.10	<0.01	<0.11
		<b>14-Day PTI</b>			
		AZ	<0.01	<0.01	<0.02
		CA-1	0.99	<0.01	<1.00
		CA-2	2.5, 3.1	0.08, 0.08	2.58, 3.18
		FL	<0.01	<0.01	<0.02
		NJ	(<0.01, <0.01, 16) <sup>b</sup>	(<0.01, <0.01, 0.24) <sup>b</sup>	<0.02, <0.02, 16.24 <sup>c</sup>
		WA	<0.01	<0.01	<0.02

<sup>a</sup> Each residue value represents one sample unless otherwise indicated.

<sup>b</sup> Residue values in parentheses represent multiple analyses of a single sample.

<sup>c</sup> The registrant has determined this value to be an outlier.

Geographic representation is adequate since the test states of AZ(22%), CA(72%), FL(2%), NJ(1%), and WA(<0.5%) accounted for 97% of the 1991 U.S. lettuce production (1992 USDA Agricultural Statistics).

The submitted field residue data (MRIDs 43362501 and 43367201), reflecting the maximum use pattern the registrant wishes to support for head and leaf lettuce, indicate that the combined residues of malathion and malaoxon will not exceed the established tolerance (presently expressed as malathion *per se*) of 8 ppm for leafy vegetables (except brassica). The combined residues of malathion and malaoxon were <0.02-0.22 ppm in/on mature head lettuce and <0.02-3.2 ppm in/on mature leaf lettuce harvested 14 days following the last of six foliar applications, with ~5-day retreatment intervals, of the 5 lb/gal EC formulation at 1.88 lb ai/A/application using ground equipment.

Provided that label revisions are made for the 5 lb/gal EC formulation (EPA Reg. No. 4787-20) to reflect the use patterns used in the current field trials, no additional field residue data for lettuce will be required. The available data will support up to six foliar applications per growing season to head and leaf lettuce at 1.88 lb ai/A/application using ground equipment, with a 5-day retreatment interval and a 14-day PHI.

The reregistration requirements for lettuce are not yet completely fulfilled. Additional field residue data reflecting use of the Cheminova 5 lb/gal EC formulation (EPA Reg. No. 4787-20) according to the maximum use patterns for commercial greenhouse-grown lettuce are required. Alternatively, the registrant may elect to delete uses on greenhouse-grown lettuce from the

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label for the 5 lb/gal EC formulation.

Potatoes

*Established tolerance:* A tolerance of 8 ppm has been established for residues of malathion *per se* in/on potatoes [40 CFR §180.111].

*Use patterns registered to Cheminova :* A REFS search, conducted 7/6/94, identified one Cheminova malathion end-use product, a 57% or 5 lb/gal EC formulation (EPA Reg. No. 4787-20, accepted 2/2/89, transferred from EPA Reg. No. 241-47) registered for use on potatoes. This formulation is registered for multiple foliar applications to potatoes at 0.94-1.56 lb ai/A/application in a minimum of 30 gal of water/A using ground equipment or in 5 gal of water/A using aerial equipment. A 0-day PHI is in effect. A maximum seasonal rate or maximum number of applications per growing season has not been established.

*Other registered use patterns:* The submission contained a specimen label for a 57% or 5 lb/gal EC formulation registered to Platte Chemical Company, Inc. (EPA Reg. No. 34704-108). The 5 lb/gal EC formulation is registered for multiple foliar applications to potatoes at 0.63-0.94 lb ai/A/application in a minimum of 10 gal of water/A using ground equipment or in 2 gal of water/A using aerial equipment. A 0-day PHI is established. This formulation was used as the test substance in the potato field trials.

*Discussion of the data:* Cheminova submitted data (1994; MRID 43360401) from 15 trials conducted in CA(1), ID(8), ME(4), NE(1), and WI(1) depicting the magnitude of the residue of malathion and its metabolite malaoxon in/on potatoes. Mature potatoes were harvested 3 hours following the last of two foliar applications, with a 7-day retreatment interval, of the Platte 5 lb/gal EC formulation at 1.56 lb ai/A/application in 30 gal of water/A using ground equipment (1x the maximum registered single application rate for the Cheminova EC formulation).

Intervals from sampling to shipment, homogenization, extraction, and analysis were provided for each test. The harvested treated and untreated potatoes were frozen (-29 to 6 C) within 3 hours of collection and shipped frozen (<-3 C) to the analytical laboratory (EN-CAS Laboratory, Winston-Salem, NC). At the analytical laboratory, samples were stored frozen (-27 to -12 C) prior to analysis. The intervals between harvest and residue analysis were 57-428 days (~2-14 months). Residues in/on treated and untreated potatoes were determined using EN-CAS Method No. ENC-1/94. The results of the potato field trials are presented in Table 13. Apparent residues of malathion and malaoxon were nondetectable (<0.01 ppm each) in/on 17 untreated samples.

Geographic representation is adequate since the test states of CA(4%), ID(29%), ME(4%), NE(1%), and WI(6%) plus the neighboring states of ND(7%), OR(5%), and WA(18%) accounted for 74% of the 1991 U.S. potato production (1992 USDA Agricultural Statistics).

Table 13. Residues of malathion and its metabolite malaoxon in/on potatoes following multiple foliar applications of the 5 lb/gal EC formulation.

Formulation	Application Parameters	Trial Site	Uncorrected Residues (ppm) <sup>a</sup>		
			Malathion	Malaoxon	Combined

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5 lb/gal EC	2 foliar applications, with a 7-day retreatment interval, at 1.56 lb ai/A/application (1x) in 30 gal of water/A using ground equipment.	0-Day (3-Hour) PTI			
		CA	<0.01	<0.01	<0.02
		ID-1	(<0.01, <0.01) <sup>b</sup>	(<0.01, <0.01) <sup>b</sup>	<0.02, <0.02
		ID-2	<0.01	<0.01	<0.02
		ID-3	<0.01	<0.01	<0.02
		ID-4	<0.01	<0.01	<0.02
		ID-5	<0.01	<0.01	<0.02
		ID-6	<0.01	<0.01	<0.02
		ID-7	<0.01	<0.01	<0.02
		ID-8	<0.01	<0.01	<0.02
		ME-1	<0.01	<0.01	<0.02
		ME-2	<0.01	<0.01	<0.02
		ME-3	<0.01	<0.01	<0.02
		ME-4	<0.01	<0.01	<0.02
		NE	<0.01	<0.01	<0.02
		WI	(<0.01, 0.01, 0.01, 0.01, 0.04) <sup>b</sup>	<0.01, <0.01, <0.01, <0.01, <0.01	<0.02, <0.02, <0.02, <0.02, <0.05

<sup>a</sup> Each residue value represents one sample unless otherwise indicated.

<sup>b</sup> Residue values in parentheses represent multiple analyses of a single sample.

The submitted field residue data (1994; MRID 43360401), reflecting the maximum use patterns the registrant wishes to support for potatoes, indicate that the combined residues of malathion and malaoxon will not exceed the established tolerance (presently expressed as malathion *per se*) of 8 ppm for potatoes. The combined residues of malathion and malaoxon were <0.02-0.05 ppm in/on mature potatoes harvested 3 hours following the last of two foliar applications, with a 7-day retreatment interval, of the 5 lb/gal EC formulation at 1.56 lb ai/A/application using ground equipment.

Provided that label revisions are made for the 5 lb/gal EC formulation (EPA Reg. No. 4787-20) to reflect the use patterns used in the current field trials, no additional field residue data for potatoes will be required for reregistration purposes. The available data will support up to two foliar applications per growing season at 1.56 lb ai/A/application using ground equipment, with a 7-day retreatment interval and a 0-day PHI.

### Sorghum

**Established tolerance:** Tolerances of 8 ppm have been established for residues of malathion *per se* in/on sorghum grain and forage [40 CFR §180.111]. No tolerances have been established for sorghum fodder or aspirated grain fractions.

**Use patterns registered to Cheminova :** A REFS search, conducted 7/6/94, identified two Cheminova malathion end-use products, a 57% or 5 lb/gal EC formulation (EPA Reg. No. 4787-20, accepted 2/2/89, transferred from EPA Reg. No. 241-47) and a 95% or 9.79 lb/gal

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RTU formulation (EPA Reg. No. 4787-8, accepted 1/25/91), registered for use on sorghum.

The 5 lb/gal EC formulation is registered for multiple foliar applications to sorghum at 0.94 lb ai/A/application in a minimum of 30 gal of water/A using ground equipment or in 5 gal of water/A using aerial equipment. The 9.79 lb/gal RTU formulation is registered for multiple foliar (prebloom stage) applications to sorghum at 0.16-0.92 lb ai/A/application using ground or aerial ULV equipment. A 7-day PHI has been established for sorghum grain and forage. Neither label specifies a maximum seasonal rate or maximum number of applications that may be made per growing season.

*Other registered use patterns:* The submission contained a specimen label for a 57% or 5 lb/gal EC formulation registered to Platte Chemical Company (EPA Reg. No. 34704-108). The 5 lb/gal EC formulation is registered for multiple foliar applications to grain sorghum at 0.94 lb ai/A/application in a minimum of 10 gal of water/A using ground equipment or in 2 gal of water/A using aerial equipment. A 7-day PHI is in effect. This formulation was used as one of the test substances in the sorghum field trials.

*Discussion of the data:* Cheminova submitted data (1994; MRID 43360001) from eight trials conducted in NE(4) and TX(4) depicting the magnitude of the residue of malathion and its metabolite malaoxon in/on sorghum grain. In the "Introduction" section of this submission, the registrant states that product labels will be amended to: (i) include a feeding/grazing restriction for sorghum forage and fodder; and (ii) harmonize the application rate, number of applications, and PHI for all cereal grains. The registrant intends to support a crop group tolerance for cereal grains.

Mature sorghum grain was harvested 7 and 14 days following the last of: (i) three foliar applications, with a 7-day retreatment interval, of the Platte 5 lb/gal EC formulation at 1.25 lb ai/A/application (1.3x the maximum registered single application rate for the Cheminova EC formulation) in 30 gal of water/A using ground equipment; or (ii) three foliar applications, with a 7-day retreatment interval, of the 9.79 lb/gal RTU formulation at 0.61 lb ai/A/application (0.66x the maximum registered single application rate for this formulation) using aerial ULV equipment. Adequate raw data pertaining to field trial information, application of the test substances, and sample handling procedures were provided.

Intervals from sampling to shipment, homogenization, extraction, and analysis were provided for each test. The harvested treated and untreated sorghum grain samples were frozen (-30 to 2 C) within 2 hours of collection and shipped frozen (<-3 C) to the analytical laboratory (EN-CAS Laboratory, Winston-Salem, NC). At the analytical laboratory, samples were stored frozen (-27 to -12 C) prior to analysis. The intervals between harvest and residue analysis were 35-221 days (~1-7 months). Residues in/on treated and untreated sorghum grain were determined using EN-CAS Method No. ENC-10/93. The results of the sorghum grain field trials are presented in Table 14. Apparent residues of malathion and malaoxon were nondetectable (<0.01 ppm each) in/on four untreated samples.

Table 14. Residues of malathion and its metabolite malaoxon in/on sorghum grain following multiple foliar applications of the 5 lb/gal EC or 9.79 lb/gal RTU formulations.

	Application	Uncorrected Residues (ppm) <sup>a</sup>
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Formulation	Parameters	Trial Site	Malathion	Malaoxon	Combined
5 lb/gal EC	3 foliar applications, with a 7-day retreatment interval, at 1.25 lb ai/A/application (1.3x) in 30 gal of water/A using ground equipment.	<b>7-Day PTI</b>			
		NE-1	0.07	<0.01	<0.08
		NE-2	0.02	<0.01	<0.03
		TX-1	(0.49, 0.49) <sup>b</sup>	(0.07, 0.08) <sup>b</sup>	0.56, 0.57
		TX-2	0.12	<0.01	<0.13
		<b>14-Day PTI</b>			
		NE-1	<0.01	<0.01	<0.02
		NE-2	0.01	<0.01	<0.02
		TX-1	0.36	0.06	0.42
		TX-2	0.04	<0.01	<0.05
9.79 lb/gal RTU	3 foliar applications, with a 7-day retreatment interval, at 0.61 lb ai/A/application (0.66x) using aerial ULV equipment.	<b>7-Day PTI</b>			
		NE-1	0.34	<0.01	<0.35
		NE-2	0.10	<0.01	<0.11
		TX-1	2.2	0.08	2.28
		TX-2	2.0	<0.01	<2.01
		<b>14-Day PTI</b>			
		NE-1	0.30	<0.01	<0.31
		NE-2	0.13	<0.01	<0.14
		TX-1	1.5	0.06	1.56
		TX-2	0.79	<0.01	<0.80

<sup>a</sup> Each residue value represents one sample unless otherwise indicated.

<sup>b</sup> Residue values in parentheses represent multiple analyses of a single sample.

Geographic representation is adequate since the test states of NE(15%) and TX(31%) along with the neighboring states of AR(3%), KS(30%), LA(2%), and NM(2%) accounted for 83% of the 1991 U.S. sorghum grain production (1992 USDA Agricultural Statistics).

The submitted field residue data (MRID 43360001), reflecting the maximum use patterns the registrant wishes to support for sorghum, indicate that the combined residues of malathion and malaoxon will not exceed the established tolerance (presently expressed as malathion *per se*) of 8 ppm for sorghum grain. The combined residues of malathion and malaoxon were <0.03-0.57 ppm in/on sorghum grain harvested 7 days following the last of three foliar applications, with a 7-day retreatment interval, of the 5 lb/gal EC formulation at 1.25 lb ai/A/application using ground equipment, and were <0.11-2.28 ppm in/on sorghum grain harvested 7 days following the last of three foliar applications, with a 7-day retreatment interval, of the 9.79 lb/gal RTU formulation at 0.61 lb ai/A/application using aerial ULV equipment.

Provided that label revisions are made for the 5 lb/gal EC formulation (EPA Reg. No. 4787-20) and 9.79 lb/gal RTU formulation (EPA Reg. No. 4787-8) to reflect the use patterns used in the current field trials, no additional field residue data for sorghum grain will be required for reregistration purposes. The available data will support: (i) up to three foliar

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applications per growing season of the 5 lb/gal EC formulation at 1.25 lb ai/A/application using ground equipment, with a 7-day retreatment interval and a 7-day PHI; and (ii) up to three foliar applications per growing season of the 9.79 lb/gal RTU formulation at 0.61 lb ai/A/application using aerial ULV equipment, with a 7-day retreatment interval and a 7-day PHI.

The Branch recognizes that the registrant plans to propose a crop group tolerance for cereal grains following submission and evaluation of studies involving representative members of this crop group. The Branch does not have any objections to the registrant's plan to propose a crop group tolerance for cereal grains, provided that the minimum requirements for the establishment of a crop group tolerance, in accordance with 40 CFR §180.34(f) (and as further defined in the document entitled "EPA Guidance on number and location of domestic crop field trials for establishment of pesticide residue tolerances", updated 6/2/94, E. Saito and E. Zager), are adequately fulfilled.

The registrant's intention to include label restrictions against the feeding and grazing of malathion-treated sorghum forage and fodder to livestock is inappropriate. The Agency has recently updated the Livestock Feeds Table (Table II of the Pesticide Assessment Guidelines, Subdivision O, Residue Chemistry, updated 6/94), and restrictions against the feeding of treated sorghum forage and fodder to livestock are now considered impractical. Therefore, field residue data and tolerance proposals are required for sorghum forage and fodder. A minimum of 16 field trials are required. For additional guidance on sampling and geographic locations for field trials, the registrant should consult "EPA Guidance on Number and Location of Domestic Crop Field Trials for Establishment of Pesticide Residue Tolerances" updated 6/2/94. It may be in the registrant's best interest to propose a crop group tolerance for the forage, fodder, and straw of cereal grains thereby allowing them to reduce the number of required field trials.

The Agency has recently revised its policy on grain dust (or aspirated grain fractions) and has determined that grain dust should be considered a raw agricultural commodity; see "Aspirated Grain Fractions (Grain Dust): A Tolerance Perspective (E. Saito and E. Zager, 6/2/94)." The guidelines specify that residue data on aspirated grain fractions of corn, wheat, sorghum, and soybeans are required; the Branch recognizes that malathion is presently registered for postemergence as well as postharvest uses on these crops. If the combined residues of concern in/on aspirated grain fractions exceed the established individual tolerances for cereal grains (or the proposed crop group tolerance) or soybeans, then a tolerance for aspirated grain fractions will be required.

### Strawberries

*Established tolerance:* A tolerance of 8 ppm has been established for residues of malathion *per se* in/on strawberries [40 CFR §180.111].

*Use patterns registered to Cheminova :* A REFS search, conducted 7/6/94, identified one Cheminova malathion end-use product, a 57% or 5 lb/gal EC formulation (EPA Reg. No. 4787-20, accepted 2/2/89, transferred from EPA Reg. No. 241-47) registered for use on strawberries. This formulation is registered for multiple foliar applications to strawberries at

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0.94-1.88 lb ai/A/application in a minimum of 30 gal of water/A using ground equipment or in 5 gal of water/A using aerial equipment. A 3-day PHI is in effect. A maximum seasonal rate or maximum number of applications per growing season has not been established.

*Other registered use patterns:* The submission contained a specimen label for a 57% or 5 lb/gal EC formulation registered to Platte Chemical Company, Inc. (EPA Reg. No. 34704-108). The 5 lb/gal EC is registered for multiple applications and preplant soil incorporated application at 0.94-1.88 lb ai/A/application. This formulation was used as the test substance in the strawberry field trials.

*Discussion of the data:* Cheminova submitted data (1994; MRID 43368301) from five trials conducted in CA(2), FL(1), OR(1), and PA(1) depicting the magnitude of the residue of malathion and its metabolite malaoxon in/on strawberries. Mature strawberries were harvested 3, 7, and 14 days after the last of six foliar applications, with a ~7-day retreatment interval, of the Platte 5 lb/gal EC formulation at 1.88 lb ai/A (1x the maximum single application rate for the Cheminova EC formulation) in ~30 gal of water/A using tractor-mounted boom or backpack CO<sub>2</sub> ground equipment. Adequate raw data pertaining to field trial information, application of the test substance, and sample handling procedures were provided.

Intervals from sampling to shipment, homogenization, extraction, and analysis were provided for each test. The harvested treated and untreated strawberries were frozen (-29 to -2 C) within 5.5 hours of collection and shipped frozen (<-3 C) to the analytical laboratory (EN-CAS Laboratory, Winston-Salem, NC). At the analytical laboratory, samples were stored frozen (-27 to -12 C) prior to analysis. The intervals between harvest and residue analysis were 46-315 days (~2-10 months); samples were analyzed within 13 days of extraction. Residues in/on treated and untreated strawberries were determined using EN-CAS Method No. ENC-6/94. The results of the strawberry field trials are presented in Table 15. Apparent residues of malathion and malaoxon were nondetectable (<0.01 ppm each) in/on five untreated samples. Geographic representation is adequate since the test states of CA(80%), FL(10%), OR(4%), and PA(<0.5%) accounted for 94% of the 1991 U.S. strawberry production (1992 USDA Agricultural Statistics).

Table 15. Residues of malathion and its metabolite malaoxon in/on strawberries following multiple foliar applications of the 5 lb/gal EC formulation.

Formulation	Application Parameters	Trial Site	Uncorrected Residues (ppm) <sup>a</sup>		
			Malathion	Malaoxon	Combined
5 lb/gal EC	6 foliar applications, with ~7-day retreatment intervals, at 1.88 lb ai/A/application (1x) in ~ 30 gal of water/A using ground equipment.	<b>3-Day PTI</b>			
		CA-1	0.19, (0.19, 0.31) <sup>b</sup>	0.02, (0.01, 0.05) <sup>b</sup>	0.21, 0.20, 0.36
		CA-2	0.32, (0.34, 0.44) <sup>b</sup>	0.01, (0.01, 0.01) <sup>b</sup>	0.33, 0.35, 0.45
		FL	(0.19, 0.19) <sup>b</sup>	(<0.01, <0.01) <sup>b</sup>	<0.20, <0.20
		OR	0.16	<0.01	<0.17
		PA	0.09	<0.01	<0.10
		<b>7-Day PTI</b>			
		CA-1	0.07	<0.01	<0.08
		CA-2	0.20, (0.38, 0.62) <sup>b</sup>	<0.01, (0.02, 0.03) <sup>b</sup>	<0.21, 0.40, 0.65
		FL	0.02	<0.01	<0.03
		OR	0.05	<0.01	<0.06
		PA	(<0.01, 0.01) <sup>b</sup>	(<0.01, <0.01) <sup>b</sup>	<0.02, <0.02
		<b>14-Day PTI</b>			
		CA-1	0.05	<0.01	<0.06
		CA-2	(0.06, 0.12) <sup>b</sup>	(<0.01, <0.01) <sup>b</sup>	<0.07, <0.13
		FL	0.01	<0.01	<0.02
		OR	0.04	<0.01	<0.05
		PA	0.02	<0.01	<0.03

<sup>a</sup> Each residue value represents one sample unless otherwise indicated.

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<sup>b</sup> Residue values in parentheses represent multiple analyses of a single sample.

The submitted field residue data (1994; MRID 43368301), reflecting the maximum use pattern the registrant wishes to support, indicate that the combined residues of malathion and malaoxon will not exceed the established tolerance (presently expressed as malathion *per se*) of 8 ppm for strawberries. The combined residues of malathion and malaoxon were <0.10-0.45 ppm in/on mature strawberries harvested 3 days following the last of six foliar applications, with a 7-day retreatment interval, of the 5 lb/gal EC formulation at 1.88 lb ai/A/application using ground equipment.

Provided that label revisions are made for the 5 lb/gal EC formulation (EPA Reg. No. 4787-20) to reflect the use pattern used in the current field trials, no additional field residue data for strawberries will be required for reregistration purposes. The available data will support up to six foliar applications to strawberries per growing season at 1.88 lb ai/A/application using ground equipment, with a 7-day retreatment interval and a 3-day PHI.

### Tomatoes

*Established tolerance:* A tolerance of 8 ppm has been established for residues of malathion *per se* in/on tomatoes [40 CFR §180.111].

*Use patterns registered to Cheminova :* A REFS search, conducted 7/6/94, identified two Cheminova malathion end-use products, a 57% or 5 lb/gal EC formulation (EPA Reg. No. 4787-20, accepted 2/2/89, transferred from EPA Reg. No. 241-47) and a 95% or 9.79 lb/gal RTU formulation (EPA Reg. No. 4787-8, accepted 1/25/91), registered for use on tomatoes.

The 5 lb/gal EC formulation is registered for multiple foliar applications to: (i) field-grown tomatoes at 0.94-1.56 lb ai/A/application in a minimum of 30 gal of water/A using ground equipment or in 5 gal of water/A using aerial equipment; in CA, up to 3.44 lb ai/A/application may be applied; and (ii) commercial greenhouse-grown tomatoes at 0.94-1.25 lb ai/100 gal/application. The established PHIs are: 1 day when maximum single rates of 1.56 lb ai/A or 1.25 lb ai/100 gal are used, and 3 days when a maximum single rate of 3.44 lb ai/A is used. A maximum seasonal rate or maximum number of applications per growing season has not been established.

The 9.79 lb/gal RTU formulation is registered for multiple foliar applications to tomatoes at 0.15-0.61 lb ai/A/application using ground or aerial ULV equipment. A 1-day PHI has been established. A maximum seasonal rate or maximum number of applications per growing season has not been established.

*Other registered use patterns:* The submission contained a specimen label for a 57% or 5 lb/gal EC formulation registered to Platte Chemical Company (EPA Reg. No. 34704-108). The 5 lb/gal EC formulation is registered for multiple foliar applications to tomatoes at 0.63-1.88 lb ai/A/application in a minimum of 10 gal of water/A using ground equipment or in 2 gal of water/A using aerial equipment. In CA multiple applications may be made at 3.44 lb ai/A/application. A 1-day PHI is in effect; a 3-day PHI is in effect for CA. No maximum seasonal rate or maximum number of applications per growing season has been established.

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This formulation was used as the test substance in the tomato field trials.

*Discussion of the data:* Cheminova submitted data (1994; MRID 43372901) from 14 trials conducted in CA(6), FL(2), MI(4), and NJ(2) depicting the magnitude of the residue of malathion and its metabolite malaoxon in/on tomatoes. Mature tomatoes were harvested 1, 3, 7, and 14 days or 3, 7, and 14 days after the last of 5 foliar applications, with a ~5-day retreatment interval, of the 5 lb/gal EC formulation at 1.56 lb ai/A (1x the maximum single application rate for the Cheminova EC formulation in states other than CA) or at 3.43 lb ai/A (1x the maximum single application rate for the Cheminova EC formulation in CA) in ~30 gal of water/A using backpack CO<sub>2</sub> equipment. Adequate raw data pertaining to field trial information, application of the test substances, and sample handling procedures were provided.

Intervals from sampling to shipment, homogenization, extraction, and analysis were provided for each test. The harvested treated and untreated tomatoes were frozen (-36 to 0 C) within 2.5 hours of collection and shipped frozen (<-3 C) to the analytical laboratory (EN-CAS Laboratory, Winston-Salem, NC). At the analytical laboratory, samples were stored frozen (-27 to -12 C) prior to analysis. The intervals between harvest and residue analysis were 117-580 days (~4-19 months); samples were analyzed within 7 days of extraction. Residues in/on treated and untreated tomatoes were determined using EN-CAS Method No. ENC-11/94. The results of the tomato field trials are presented in Table 16. Apparent residues of malathion and malaoxon were nondetectable (<0.01 ppm each) in/on seven untreated samples.

Geographic representation is adequate since the test states of CA(83%), FL(6%), MI(1%), and NJ(1%) accounted for 91% of the 1991 U.S. tomato production (1992 *USDA Agricultural Statistics*).

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Table 16. Residues of malathion and its metabolite malaoxon in/on tomatoes following multiple foliar applications of the 5 lb/gal EC formulation.

Formulation	Application Parameters	Trial Site	Uncorrected Residues (ppm) <sup>a</sup>		
			Malathion	Malaoxon	Combined
5 lb/gal EC	5 foliar applications, with ~5-day retreatment intervals, at 1.56 lb ai/A/application (1x for states other than CA; 0.5x for CA) in ~30 gal of water/A using ground equipment.	<b>1-Day PTI</b>			
		CA-1	0.21	<0.01	<0.22
		CA-2	0.10	<0.01	<0.11
		CA-3	0.33	<0.01	<0.34
		FL	0.14	<0.01	<0.15
		MI-1	(0.23, 0.31) <sup>b</sup>	(<0.01, <0.01) <sup>b</sup>	<0.24, <0.32
		MI-2	0.17	<0.01	<0.18
		NJ	0.41	<0.01	<0.42
		<b>3-Day PTI</b>			
		CA-1	(0.11, 0.21) <sup>b</sup>	(<0.01, <0.01) <sup>b</sup>	<0.12, <0.22
		CA-2	0.07	<0.01	<0.08
		CA-3	0.13	<0.01	<0.14
		FL	0.12	<0.01	<0.13
		MI-1	0.05	<0.01	<0.06
		MI-2	0.08	<0.01	<0.09
		NJ	(0.12, 0.26) <sup>b</sup>	(<0.01, 0.01) <sup>b</sup>	<0.13, 0.27
		<b>7-Day PTI</b>			
		CA-1	0.04	<0.01	<0.05
		CA-2	<0.01	<0.01	<0.02
		CA-3	0.06	<0.01	<0.07
		FL	0.02	<0.01	<0.03
		MI-1	<0.01	<0.01	<0.02
		MI-2	<0.01	<0.01	<0.02
		NJ	0.05	<0.01	<0.06
		<b>14-Day PTI</b>			
		CA-1	0.01	<0.01	<0.02
		CA-2	<0.01	<0.01	<0.02
		CA-3	0.02	<0.01	<0.03
		FL	<0.01	<0.01	<0.02
		MI-1	<0.01	<0.01	<0.02
MI-2	<0.01	<0.01	<0.02		
NJ	<0.01	<0.01	<0.02		
5 lb/gal EC	5 foliar applications, with ~5-day retreatment intervals, at 3.43 lb ai/A/application (2x for states other than CA; 1x for CA) in ~30 gal of water/A using ground equipment.	<b>3-Day PTI</b>			
		CA-1	0.70	<0.01	<0.71
		CA-2	0.13	<0.01	<0.14
		CA-3	0.30, (0.79, 1.1) <sup>b</sup>	<0.01 (<0.01, <0.01) <sup>b</sup>	<0.31, <0.80, <1.11
		FL	0.73	<0.01	<0.74
		MI-1	0.23	<0.01	<0.24
		MI-2	0.54	<0.01	<0.55
		NJ	(1.0, 1.5) <sup>b</sup> , 1.1	(0.04, 0.04) <sup>b</sup> , 0.05	1.04, 1.54, 1.15
		<b>7-Day PTI</b>			
		CA1	0.16	<0.01	<0.17
		CA2	(0.01, 0.02) <sup>b</sup>	(<0.01, <0.01) <sup>b</sup>	<0.02, <0.03
		CA3	0.15	<0.01	<0.16
		FL1	0.10	<0.01	<0.11
		MI1	0.05	<0.01	<0.06
		MI2	0.03	<0.01	<0.04
		NJ1	0.15	<0.01	<0.16
		<b>14-Day PTI</b>			
		CA1	0.03	<0.01	<0.04
		CA2	<0.01	<0.01	<0.02
		CA3	0.03	<0.01	<0.04
		FL1	0.04	<0.01	<0.05
		MI1	<0.01	<0.01	<0.02
		MI2	<0.01	<0.01	<0.02
		NJ1	0.01	<0.01	<0.02

<sup>a</sup> Each residue value represents one sample unless otherwise indicated.

<sup>b</sup> Residue values in parentheses represent multiple analyses of a single sample.

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The submitted field residue data (1994; MRID 43372901), reflecting the maximum use

patterns the registrant wishes to support, indicate that the combined residues of malathion and malaoxon will not exceed the established tolerance (presently expressed as malathion *per se*) of 8 ppm for tomatoes. The combined residues of malathion and malaoxon were <0.11- <0.42 ppm in/on mature tomatoes harvested 1 day following the last of five foliar applications, with a 5-day retreatment interval, of the 5 lb/gal EC formulation at 1.56 lb ai/A/application using ground equipment, and were <0.14-1.54 ppm in/on mature tomatoes harvested 3 days following the last of 5 foliar applications, with a 5-day retreatment interval, of the 5 lb/gal EC formulation at 3.43 lb ai/A/application using ground equipment.

Provided that label revisions are made for the 5 lb/gal EC formulation (EPA Reg. No. 4787-20) to reflect the use patterns used in the current field trials, no additional field residue data for tomatoes will be required. The available data will support: (i) up to five foliar applications to tomatoes per growing season at 3.43 lb ai/A/application using ground equipment, with a 5-day retreatment interval and a 3-day PHI; or (ii) up to five foliar applications per growing season at 1.56 lb ai/A/application using ground equipment, with a 5-day retreatment interval and a 1-day PHI.

The reregistration requirements for tomatoes are not yet completely fulfilled. Additional field residue data reflecting use of the Cheminova 9.79 lb/gal RTU formulation (EPA Reg. No. 4787-8) according to the maximum use pattern for tomatoes, and use of the 5 lb/gal EC formulation (EPA Reg. No. 4787-20) according to the maximum use pattern for commercial greenhouse-grown tomatoes are required to support malathion uses on tomatoes. Alternatively, the registrant may elect to revise its label to delete uses on tomatoes from the label for the 9.79 lb/gal RTU formulation and to delete uses on greenhouse-grown tomatoes from the label for the 5 lb/gal EC formulation.

### Magnitude of the Residue in Processed Food/Feed

#### Tomato Processed Commodities

*Established tolerance:* A tolerance of 8 ppm has been established for residues of malathion *per se* in/on tomatoes [40 CFR §180.111]. No food/feed additive tolerances have been established for malathion residues of concern in tomato processed commodities.

*Use patterns registered to Cheminova:* A REFS search, conducted 1/23/95, identified two Cheminova malathion end-use products, a 57% or 5 lb/gal EC formulation (EPA Reg. No. 4787-20, accepted 2/2/89, transferred from EPA Reg. No. 241-47) and a 95% or 9.79 lb/gal RTU formulation (EPA Reg. No. 4787-8, accepted 1/25/91), registered for use on tomatoes.

The 5 lb/gal EC formulation is registered for multiple foliar applications to: (i) field-grown tomatoes at 0.94-1.56 lb ai/A/application in a minimum of 30 gal of water/A using ground equipment or in 5 gal of water/A using aerial equipment; in CA, up to 3.44 lb ai/A/application may be applied; and (ii) commercial greenhouse-grown tomatoes at 0.94-1.25 lb ai/100 gal/application. The established PHIs are: 1 day when maximum single rates of 1.56 lb ai/A or 1.25 lb ai/100 gal are used, and 3 days when a maximum single rate of 3.44 lb ai/A is used. A maximum seasonal rate or maximum number of applications per growing season has not been established.

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The 9.79 lb/gal RTU formulation is registered for multiple foliar applications to tomatoes at 0.15-0.61 lb ai/A/application using ground or aerial ULV equipment. A 1-day PHI has been established. A maximum seasonal rate or maximum number of applications per growing season has not been established.

*Other registered use patterns:* The submission contained a specimen label for a 57% or 5 lb/gal EC formulation registered to Platte Chemical Company (EPA Reg. No. 34704-108). The 5 lb/gal EC formulation is registered for multiple foliar applications to tomatoes at 0.63-1.88 lb ai/A/application in a minimum of 10 gal of water/A using ground equipment or in 2 gal of water/A using aerial equipment. In CA multiple applications may be made at 3.44 lb ai/A/application. A 1-day PHI is in effect; a 3-day PHI is in effect for CA. No maximum seasonal rate or maximum number of applications per growing season has been established. This formulation was used as the test substance in the tomato processing study.

*Discussion of the data:* Cheminova submitted data (1994; MRID 43499901) pertaining to the potential for concentration of residues of malathion and its malaoxon metabolite in the processed commodities of tomatoes. In one test conducted in CA, mature tomatoes were harvested 1 day following the last of five foliar applications, with ~5-day retreatment intervals, of the Platte 5 lb/gal EC formulation at 17.15 lb ai/A/application (5x the maximum registered single application rate for the Cheminova EC formulation). [Note: Additional tests were also conducted in CA using the test formulation at 1x and 2x rates; however, samples from these tests were not used for processing.] The harvested samples were boxed with "blue ice" packages, and shipped within 4 hours of harvest to the National Food Laboratory, Inc. (NFL; Dublin, CA) for processing. At NFL, the tomatoes were stored for 5 days at 16-18 C before processing. The registrant reported that some tomatoes deteriorated during storage and some fruits were overripe and broken.

Tomatoes were processed according to simulated commercial procedures. Briefly, the tomatoes were washed twice, first with municipal water, then with chlorinated water. The washed tomatoes were crushed, heated to 91 C, and passed through a 0.033-inch screen. The materials that did not pass through the screen, designated as **wet pomace**, were collected and frozen. Subsamples of wet pomace were spread on trays, dehydrated, bagged and frozen as **dry pomace**. The **juice** that passed through the screen was collected and refrigerated. A sample was weighed, heated in a steam-jacketed kettle to 66 C, and collected into cans. The filled cans were sealed, heated for a minimum of 50 minutes at  $\geq 116$  C, cooled, labeled, and frozen. The remaining juice was concentrated by vacuum evaporation to produce **puree**; a sample of which was collected, weighed, heated to 90 C, canned, cooled, and frozen. An additional sample of puree was vacuum-condensed to paste. A portion of the paste was mixed with additional ingredients in a steam-jacketed kettle, heated to 92-96 C, canned, cooled, and frozen as **catsup**. The registrant submitted adequate descriptions and material balance sheets for the processing procedures.

The processed fractions were shipped frozen (-11 to 4 C) to the analytical laboratory (EN-CAS Laboratory, Winston-Salem, NC). At the analytical laboratory, samples were stored frozen (-27 to -12 C) prior to analysis. The intervals between harvest and residue analysis were 208-443 days (~7-14 months). The results of the tomato processing study are presented in Table 17. Apparent residues of malathion and malaoxon were each nondetectable in/on one

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untreated sample of whole tomatoes (<0.01 ppm) and in one sample each of wet pomace (<0.05 ppm), juice (<0.01 ppm), dry pomace (<0.05 ppm), and catsup (<0.01 ppm) processed from untreated whole tomatoes. One sample of puree processed from untreated whole tomatoes bore detectable malathion residues of 0.02 ppm and nondetectable (<0.01 ppm) residues of malaoxon.

Table 17. Residues of malathion and malaoxon in/on tomatoes and tomato processed commodities treated with five foliar applications, with -5-day retreatment intervals, of the 5 lb/gal EC formulation at 17.15 lb ai/A/application (5x).

Tomato Commodities	Residues (ppm) <sup>a</sup>			Concentration/Reduction Factor <sup>b</sup>		
	Malathion n	Malaoxon	Combined	Malathion	Malaoxon	Combined
Whole tomatoes	22, 25 (23.5)	0.14, 0.20 (0.17)	22.14, 25.20 (23.67)	--	--	--
Wet pomace	41, 41 (41)	0.22, 0.24 (0.23)	41.22, 41.24 (41.23)	1.7	1.4	1.7
Juice	0.66, 0.71 (0.69)	<0.01, <0.01 (<0.01)	<0.67, <0.72 (<0.70)	0.03	<0.06	<0.03
Puree	12, 16 (14)	0.08, 0.12 (0.10)	12.08, 16.12 (14.10)	0.6	0.6	0.6
Dry pomace	310, 320 (315)	2.7, 2.3 (2.5)	312.7, 322.3 (317.5)	13	15	13
Catsup	17, 19 (18)	0.14, 0.14 (0.14)	17.14, 19.14 (18.14)	0.8	0.8	0.8

<sup>a</sup> Average residues are listed in parentheses.

<sup>b</sup> Calculated by dividing average residues in processed fraction by the average residues found in whole tomatoes.

The submitted tomato processing study (MRID 43499901) is adequate to satisfy reregistration requirements for magnitude of the residue in tomato processed commodities. The data indicate that the combined residues of malathion and malaoxon concentrated in dry pomace (13x) and wet pomace (1.7x) processed from whole tomatoes bearing detectable residues. The combined residues of malathion and malaoxon reduced in juice (<0.03x), puree (0.6x), and catsup (0.8x). The updated Livestock Feeds Table (Table II of the Pesticide Assessment Guidelines, Subdivision O, Residue Chemistry, issued June 1994) has added paste and deleted catsup as processed commodities of tomatoes. The potential for residue concentration or reduction in paste was not investigated in the current study. For malathion reregistration requirements only, no paste data will be required since the current tomato processing study was initiated before issuance of the updated Table II, Subdivision O; the data for puree and catsup may also suffice the need for paste data, for this purpose only. However, the Branch will require data for all recognized processed fractions in future tomato processing studies.

The available processing data suggest that a feed additive tolerance is needed for the combined

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residues of malathion and malaoxon in tomato dried pomace based on a combined concentration factor of 13x. The need for a feed additive tolerance for tomato wet pomace, based on a marginal concentration factor of 1.7x, will be determined once the established tolerance for tomatoes has been completely reassessed. Although acceptable tomato field residue data (MRID 43372901), reflecting use patterns the registrant wishes to support for EC formulation, have been submitted and evaluated (DP Barcode D208047) the established tolerance cannot be reassessed until additional field residue data reflecting use of the RTU formulation and use of malathion on greenhouse-grown tomatoes have been submitted.

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EPA MEMORANDA CITED IN THIS REVIEW

CBRS No.: 12855  
DP Barcode: D196878  
Subject: Response to the Malathion Reregistration Standard: Radiovalidation of method in plants.  
From: R. Perfetti  
To: L. Rossi  
Dated: 2/28/94  
MRID(s): 42894601

MASTER RECORD IDENTIFICATION NUMBERS

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

43360001 Bookbinder, M. (1994) Magnitude of the Residue of Malathion and its Metabolite Malaoxon in/on Sorghum Grain Harvested After Ground and Aerial Treatment: Lab Project Number: AA920121: 92-0032. Unpublished study prepared by American Agricultural Services, Inc. and EN-CAS Analytical Labs. 467 p.

43360401 Bookbinder, M. (1994) Magnitude of the Residues of Malathion and its Metabolite Malaoxon in/on Potatoes Harvested after Ground Treatment: Lab Project Number: AA920119: 92-0050. Unpublished study prepared by American Agriculture Services, Inc. and EN-CAS Analytical Labs. 671 p.

43361101 Bookbinder, M. (1994) Magnitude of the Residue of Malathion and its Metabolite Malaoxon in/on Sweet Corn Raw Agricultural Commodities Harvested After Ground and Aerial Treatment: Lab Project Number: AA920109: 92-0052. Unpublished study prepared by American Agricultural Services, Inc. and EN-CAS Analytical Labs. 1336 p.

43362501 Bookbinder, M. (1994) Magnitude of the Residue of Malathion and its Metabolite Malaoxon in/on Head Lettuce Harvested After Ground Treatment: Lab Project Number: AA920126: 92-0048. Unpublished study prepared by American Agricultural Services, Inc. and EN-CAS Analytical Labs. 371 p.

43367201 Bookbinder, M. (1994) Magnitude of the Residue of Malathion and Its Metabolite Malaoxon in/on Leaf Lettuce Harvested after Ground Treatment: Lab Project Number: AA920114: 92/0050. Unpublished study prepared by EN-CAS Analytical Laboratories. 554 p.

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43368301 Bookbinder, M. (1994) Magnitude of the Residue of Malathion and Its Metabolite Malaoxon in/on Strawberries Harvested after Ground Treatment: Lab Project Number: AA920122: 92/0059. Unpublished study prepared by EN-CAS Analytical Laboratories. 521 p.

43370601 Bookbinder, M. (1994) Magnitude of the Residue of Malathion and its Metabolite Malaoxon in/on Cucumbers Harvested after Ground Treatment: Lab Project Number: AA920111: 92/0045. Unpublished study prepared by EN-CAS Analytical Lab., American Agricultural Services, Inc. 663 p.

43372701 Bookbinder, M. (1994) Magnitude of the Residue of Malathion and Its Metabolite Malaoxon in/on Lima Beans Harvested after Aerial Treatment: Lab Project Number: AA920125: 92/0037. Unpublished study prepared by EN-CAS Analytical Laboratories and American Agricultural Services, Inc. 451 p.

43372901 Bookbinder, M. (1994) Magnitude of the Residue of Malathion and Its Metabolite Malaoxon in/on Tomatoes Harvested after Ground Treatment: Lab Project Number: AA920123: 92/0042. Unpublished study prepared by EN-CAS Analytical Laboratories, Inc. and American Agricultural Services, Inc. 932 p.

43376801 Bookbinder, M. (1994) Magnitude of the Residue of Malathion and its Metabolite Malaoxon in/on Snap Beans Harvested After Aerial Treatment: Lab Project Number: AA920103: 92-0035. Unpublished study prepared by American Agricultural Services, Inc. and EN-CAS Analytical Labs. 475 p.

43468201 Bookbinder, M. (1994) Magnitude of the Residue of Malathion and Its Metabolite Malaoxon in/on Field Corn Raw Agricultural Commodities Harvested After Ground and Aerial Treatment: Lab Project Numbers: AA920108: 92-0046. Unpublished study prepared by American Agricultural Services, Inc. and EN-CAS Analytical Labs. 1778 p.

43499901 Bookbinder, M. (1994) Magnitude of the Residue of Malathion and Its Metabolite Malaoxon in/on Tomato Processed Commodities: Lab Project Number: AA920135: 92-0079. Unpublished study prepared by American Agricultural Services, Inc.; The National Food Lab, Inc.; and EN-CAS Analytical Labs. 370 p.

Reference Not Used: The MRID cited below was not reviewed since it pertains to a commodity which is no longer considered to be a livestock feed item according to Table II of the Pesticide Assessment Guidelines, Subdivision O, Residue Chemistry, issued June 1994.

43479601 Bookbinder, M. (1994) Magnitude of the Residue of Malathion and Its Metabolite Malaoxon in Snap Bean Processed Commodities: Lab Project Number: AA920130: 92-0076. Unpublished study prepared by American Agricultural Services, Inc.; Englar and Associates, Inc.; and EN-CAS Analytical Labs. 377 p.

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